People`s Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Blida 1 «SAAD DAHLAB» University

Institute of Architecture and Urbanism

Environment and Technology for Architecture and Heritage Laboratory

(ETAP)

PHD THESIS

IN ARCHITECTURE, HERITAGE AND ENVIRONMENT

The Architecture of Proximity Mosques Legislation Vs Field: the Contribution of a Digital Platform (Case of El Oued Mosques)

Presented by:

KHOUKHI Imadeddine

Jury members

Pr.ABDESSEMED-FOUFA Amina	**President**	**University of Blida 1**
Dr.SENHADJI Dalila	**Supervisor**	**University of USTO-MB**
Pr.CHERGUI Samia	**Examiner**	**University of Blida 1**
Pr.KACEMI Malika	**Examiner**	**University of USTO-MB**
Pr.BEN-HAMOUCHE Mustapha	**Examiner**	**University of Blida 1**
Dr.BOUKARTA Soufiane	**Examiner**	**University of Blida 1**

Academic Year 2024/2025

ACKNOWLEDGEMENT

At the end of this thesis, I would like to thank all those who have contributed directly or indirectly to its development. First of all, my sincere thanks to my thesis director, Dr SENHADJI Dalila. I would like to thank her for having accompanied me throughout this thesis. Her expert advice, countless remote work sessions and proofreading, knowledge and great rigor contributed greatly the completion of this work.

I would also like to express my gratitude to Professor ABDESSEMED-FOUFA Amina, director of the ETAP laboratory. I thank her for encouraging and supporting me throughout this thesis.

My thanks also go to the members of the jury, Professor ABDESSEMED-FOUFA Amina, Professor CHERGUI Samia, Professor KACEMI Malika, Professor BEN-HAMOUCHE Mustapha and Dr.BOUKARTA Soufiane who have honored me with the pleasure of agreeing to review this research.

Thanks to my parents for their support and love, and to my wife who has endured everything, without her I would not have made it. To my children their love is my source of energy.

I also wish to express my gratitude for the director and architect of Directorate of Religious and Wakfs Affairs of El Oued for the facilities they gave me to do the fieldwork.

My gratitude to Marwane Zineelabidine Helal for his advice, patience and professionalism.

Finally, I would like to express my special thanks to Dr.Adlane MHAMEDI BOUZINA, Dr CHETTAH, Mr.ARBAOUI Noureddine, Mr. Hamidi Mostafa, for their support and encouragement.

It is thanks to the will of God and all these people that this thesis has been able to succeed.

ABSTRACT

This research primarily focuses on legislation regarding mosque construction and the architectural typologies of proximity mosques established by religious associations in Algeria. This study aligns with the latest guidelines and recommendations from the Ministry of Religious Affairs and Wakfs regarding the stylistic and architectural choices for mosques. Notably, an inter- ministerial order was promulgated in 2022 that sets forth national specifications for the construction of all mosques in Algeria. The mosque, as a pivotal space for Muslim worship, has been the subject of extensive scholarly inquiry, including historical, architectural, and anthropological studies. In Algeria, the architectural typology of both national and regional mosques has been meticulously examined by expert architects and design firms. In contrast, many proximity mosques, often constructed by religious associations, exhibit random or even fanciful designs that deviate significantly from the official guidelines provided by the Ministry of Religious Affairs and Wakfs. In light of this context, our fieldwork conducted during the COVID-19 pandemic, focused on mosques in the El Oued Wilaya, an area notable for its domed structures. This research enables us to identify and analyse the architectural components of proximity mosques while shedding light on other significant elements. The extensive field data collected, along with existing inventories that had previously remained underutilized, inspired the development of a flexible analytical platform. The field data were thoroughly studied and analysed using this platform. The digitized data generated through this research can be leveraged to address gaps in the legislations that administer mosque construction in Algeria. This thesis is organized into two primary sections: the first focuses on the legislative framework related to mosques, including diachronic studies, previous inventory efforts, and the design of the analytical platform. The second section concentrates on the field study and digital platform exploitation.

Keywords: Legislation, Proximity mosques, digitalization, platform, Wilaya of El Oued, Algeria.

ملخص

ينصب التركيز الرئيسي لهذا البحث على التشريع الجزائري بخصوص بناء المساجد والتصنيف المعماري للمساجد الجوارية المبنية من طرف الجمعيات الدينية. بحيث أن هذا البحث يتزامن مع أحدث التوصيات الصادرة عن وزارة الشؤون الدينية والأوقاف الجزائرية بشأن الخيارات والتوجهات المعمارية لبناء المساجد. وقد تحقق ذلك بإصدار قرار وزاري مشترك أواخر سنة 2022 يحدد دفتر الشروط النموذجي المتعلق بنمطية بناء المساجد على المستوى الوطني.
لقد تم البحث في المساجد كمكان عبادة إسلامي بشكل كبير في الأبحاث (التاريخية، المعمارية، الأنثروبولوجية...) ، وبالمقابل فان دراسة النمط المعماري للمساجد في الجزائر ذات الطابع الوطني أو الإقليمي تتم بعناية فائقة من قبل المهندسين المعماريين والمختصين في المجال. على عكس من ذلك فان المساجد الجوارية المبنية من قبل الجمعيات الدينية ، فإن بعضها يتسم بهندسة عشوائية أو غريبة و هذا ما يتناقض مع اشتراطات صاحب المشروع و الممثلة بوزارة أو مديريات الشؤون الدينية والأوقاف.

من هذا المنظور، فإن العمل الميداني الذي خص المساجد الجوارية في ولاية الوادي والمعروفة بوجود القباب في المباني، والذي تزامن مع تفشي جائحة كورونا قد سمح لنا بتحديد وتحليل المكونات المعمارية لهذه المساجد وتسليط الضوء على مكونات أخرى. وقد قادتنا وفرة البيانات الميدانية التي لا حصر لها و حصولنا على قائمة جرد غير مستغلة إلى تصميم منصة رقمية بشبكة تحليل مرنة. وبفضل هذه المنصة الرقمية تمت دراسة الجزء الميداني بالكامل وتحليله. كما يمكن ايضا استغلال جميع بياناتها الرقمية لاستخراج النتائج التي ستعمل على «سد» الثغرات في التشريعات المتعلقة ببناء المساجد في الجزائر.

تنقسم هذه الأطروحة إلى جزأين رئيسيين. يتعلق الجزء الأول بجميع التشريعات المتعلقة بالمساجد والدراسات التاريخية ومحاولات الجرد وتصميم المنصة الرقمية . يتعلق الجزء الثاني بالدراسة الميدانية و استغلال المنصة الرقمية .

الكلمات المفتاحية: التشريعات ، المساجد الجوارية ، الرقمنة، المنصة الرقمية ، ولاية الوادي، الجزائر

RÉSUME

L'axe majeur qui a régenté la présente recherche concerne la législation algérienne en matière de construction des mosquées et la typologie architecturale des mosquées de proximité construites par les associations cultuelles.

Cette recherche s'inscrit davantage dans les dernières directives voire recommandations du Ministère des Affaires Religieuses et des Wakfs pour les choix stylistiques et architecturaux des mosquées. Cela s'est concrétisé par la promulgation en 2022 d'un arrêté interministériel fixant un cahier des charges nationale pour la construction de toutes les mosquées en Algérie.

La mosquée en tant qu'espace cultuel musulman est abondamment investie par la recherche (études historiques, architecturales, anthropologiques…). En Algérie, la typologie architecturale des mosquées à caractère national ou régional est étudiée avec beaucoup de minutie par chercheur des architectes et des bureaux d'études de renom. Contrairement aux mosquées de proximité qui confiées aux associations cultuelles pour la construction présentent souvent des architectures aléatoires voire fantaisistes. Celles-ci sont éloignées des prescriptions officielles du principal commanditaire à savoir le Ministère des Affaires Religieuses et des Wakfs.

Dans cette optique, un travail de terrain qui avait coïncidé avec l'épidémie COVID-19 sur des mosquées dans la région spécifique de la wilaya d'El Oued connue par la présence de coupoles dans les constructions, nous a permis d'identifier et d'analyser les composantes architecturales des mosquées de proximité et de mettre en lumière d'autres composantes. La profusion des innombrables données du terrain et l'existence d'inventaire resté vain, nous a incité à concevoir une plateforme avec une grille d'analyse flexible. Toute la partie terrain a été étudiée et analysée grâce à cette plateforme. Toutes les données digitalisées ont permis d'extraire des résultats qui serviront à « combler » les manquements de la législation relative à la construction des mosquées en Algérie.

La présente thèse est scindée en deux parties principales. La première partie concerne toute la législation relative aux mosquées, les études diachroniques, les tentatives d'inventaires restées vaines et la conception de la plateforme. La deuxième partie concerne le terrain d'études et l'exploitation de la plateforme.

Les mots-clés : Législations, mosquées de proximité, digitalisation, plate-forme, wilaya d'El Oued, Algérie.

Glossary

Mihrab	(*Gen*.) Niche used to indicate the direction of prayer in Mosque
Minbar	(*Gen*.) Pulpit
Qibla	(*Gen*.) Wall indicating the direction of Mecca, hence of prayer
Qobba	(*Ar*.) Dome;
Riwaq	(*Ar*.) Arcade or portico, open on one side
Sahn	Courtyard of Mosque
Wakf	(*Ar*.) Pious architectural foundation of public utility (i.e. of Mosques, Hospitals, Baths, Fountains etc.}
T. O. R	Terms of reference

(Ar.) = Arabic; (Gen.) = General usage throughout the Islamic world

Abbreviations

JORADP	Official journal of the People's Democratic Republic of Algeria
MARW	Ministry of Religious Affairs and Wakfs
DARW	Directorate of religious Affairs and Wakfs
CTC	Technical Building Control
RPA	Algerian seismic rules
WHO	World health organization
ONS	National office of statistics
C e s a d a	Centro studi automazione dati dans architettura
UNESCO	United nations educational, scientific and cultural organization
ONDA	National copyright and neighboring rights office
INAPI	Algerian national institute for industrial property
RN	National Road

Table of Contents

LISTS OF ILLUSTRATIONS

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

LIST OF TABLES

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Appendix

GENERAL INTRODUCTION

The mosque serves as the cardinal symbol of Islam, embodying the essence of the Muslim faith and its influence. The Prophet's Mosque (PBUH) in Medina is regarded as the prototype of mosques and is notable for its simplicity and unpretentiousness. It features a closed prayer hall surrounded by an inner courtyard or Sahn. This mosque represents the foundational model for the construction of subsequent mosques established during periods of territorial and spatial expansion.

Over time, however, mosque architecture has evolved significantly, influenced by interactions with new territories and ancient civilizations that predated the advent of Islam. Notably, the Prophet's Mosque (PBUH) was originally constructed without a minaret or dome. The introduction of these elements was prompted by encounters with diverse regions and culture. Consequently, the organization and architectural features of mosques continued to adapt in response to varying cultural contexts, technological advancements, community needs, and local realities.

Mosques constructed throughout history serve as vital sources of typological references and religious architectural heritage. Today, the design of new mosques worldwide is inherently influenced by historical typologies, both in terms of spatial organization and architectural components. Generally, newly built mosques include at least a prayer room and a Mihrab, regardless of their specific location or architectural style. While the fundamental principles of mosque design remained largely unchanged for centuries, innovations in materials, decorations, and elements related to ecological sustainability have emerged. Nevertheless, the historical framework of mosque architecture remains rich and inexhaustible.

The correlation between religious architectural heritage and contemporary mosque construction persists today. Algeria, like many other Muslim nations, is home to numerous historic mosques, many of which are recognized for their authentic and often original characteristics. Therefore, it is both prudent and essential to leverage this religious architectural heritage in the design of newly constructed mosques, particularly in Algeria.

In this context, the Algerian government has been proactive in establishing mosque construction legislations. The texts from 1991 and 2013 respectively stipulate the Islamic and Maghrebian character that should inform the architecture of newly built mosques. However, the interpretation of those character often remains ambiguous for stakeholders involved in mosque construction, including designers and project overseers. There is frequently a disconnect between the expectations of the Ministry of Religious Affairs and Wakfs and the realities observed in practice. While national or regional mosques are closely monitored by the state, local and neighbourhood mosques typically constructed by religious associations. frequently exhibit random or fanciful designs that are loosely categorized as Islamic or Muslim architecture.

This disparity highlights inconsistencies between current legislation and its practical application. Despite the Ministry of Religious Affairs and Wakfs recent efforts to establish

national specifications for mosques by 2022, the architecture of mosques predominantly constructed by religious associations often diverges from the established references of historic Algerian and Maghrebian mosques. This situation is primarily attributed to the failure to capitalize the extensive studies, research and inventories that have been conducted without yielding significant results.

To address this gap, we have developed a dynamic platform designed to analyse a substantial corpus of data, located in the distinctive region of El Oued in southern Algeria, known for its prominent domed structures. Through this analysis, it aims at identifying the architectural components present in the field and faced them with those recommended in the specifications issued by the Ministry of Religious Affairs and Wakfs in 2022. Additionally, we will explore whether the architectural language of local and neighbourhood mosques[1] aligns with the guidelines articulated by the Ministry in 2022.

Our research seeks to employ a dynamic platform to identify potential shortcomings in the current legislative framework for mosque construction. By doing so, we aim to determine whether there is a need for amendments or updates to existing legislative texts. This approach is designed to ensure that the realities faced in the field are effectively communicated to the decision-makers and legislators at the forefront of these initiatives, particularly those within the Ministry of Religious Affairs and Wakfs, the main body responsible for overseeing mosque construction projects.

Research Context

From the period of Muslim territorial conquests to the digital era of the last two centuries, mosque architecture has undergone continuous evolution. While the fundamental components of a Muslim worship space have remained consistent, the integration of new digital technologies, innovative materials, and the pressing challenge of climate change have introduced significant changes. These factors undeniably open up new avenues for research, encouraging further exploration into how modern advancements can be harmonized with traditional architectural principles.

It is evident that numerous researchers have long been captivated by Muslim architecture, particularly the architecture of mosques. This interest is not new; scholars such as Henri Saladin, Jean Sauvaget[2], Lucien Golvin[3], and Georges Marçais[4] are among the most prominent figures in this field, and their contributions remain indispensable.

Recent approaches have begun to analyse mosque architecture by examining the

[1] local and neighbourhood mosques are legislative classification. the two class of mosques will consider as a proximity mosque

[2] Saladin, Henri, Manuel d'art musulman, Paris : A Picard, 1907
Histoire de l'Orient musulman, 1949
Histoire de l'Orient islamique 1948
Notes sur quelques monuments musulmans de Syrie 1944

[4] Marçais, Georges L'Art musulman (1991), les monuments arabes (1903) Marçais Georges, l'Art en Algérie, 1906. Marçais, Georges, *L'Art en Algérie*, *Exposition coloniale de Marseille,* Alger

construction process (Bousmaha et al., 2018; Sekhri, 2018) and the various stakeholders involved, including owners, builders, religious associations, the Ministry of Religious Affairs and Wakfs, and civil society.

In Algeria ,Mosques that do not fall under national or regional categories are typically constructed by religious associations, resulting in mosques situated in neighbourhoods, new housing developments, and emerging towns. According to (Senhadji, 2017), the construction of these mosques presents several challenges due to the diverse interpretations and misunderstandings surrounding the 2013 legislation on mosque construction, as well as the varying styles advocated by different stakeholders across distinct geographical areas.

This study specifically focuses on the architecture of proximity[5] mosques within the wilaya of El Oued. The architectural typology of these mosques reflects the interaction of various actors within a unique context. The choice of El Oued is particularly relevant due to its local specificity, notably the prevalence of domes in its buildings. This characteristic is of significant interest to our research on proximity mosques and the associated legislative framework.

Numerous publications have explored the typology of mosques in Algeria through historical, anthropological, and architectural lenses. These works have drawn the attention of the Ministry of Religious Affairs and Wakfs to the typologies of mosques, prompting the ministry to convene meetings with various stakeholders, including practicing architects and researchers from diverse fields such as sociology, history, anthropology, and architectural history. These discussions aim to address the challenges faced in the field regarding proximity mosques. As a result, the Ministry of Religious Affairs and Wakfs is set to develop national specifications for mosque construction in 2022.

Since 2016, the Ministry of Religious Affairs and Wakfs has undertaken an assessment of the current state of new mosque architecture, which is frequently perceived as disorganized. To address this observation, a diverse group of researchers including historians, sociologists, and practicing architects has been engaged to propose potential solutions. Concurrently, a network of researchers has been mobilized to contribute to this initiative.

For instance, an international symposium on Islamic architecture and architectural practices was organized in 2016 by the University of Constantine 3 at the Faculty of Architecture and Urban Planning[6]. This event highlighted the issues associated with haphazard architecture in the field and underscored the desire to preserve a distinct national or even Maghrebian identity in the architecture of new mosques. The commitment to safeguarding the religious architectural heritage has further motivated the Ministry of Religious Affairs and Wakfs to pursue this agenda. The architecture of mosques constructed by associations has

[5] All mosques that do not fall under national or regional categories. What we are called proximity mosque in the current legislation are classified as local mosque, Neighbourhood mosque and prayer room.
[6] The international symposium entitled: Islamic Architecture: History and architectural practices is organized on 14-16 February 2016 by the University of Constantine 3 at the Faculty of Architecture and Urbanism. https://www.univ-constantine3.dz/pdfs/programme version French.pdf

garnered increasing attention from the Ministry following several public declarations addressing these concerns.

The subject of research

The focus of our research is the architecture of proximity mosques in relation to current legislation on mosque construction, examining specifically the evolution and state of knowledge regarding the architectural typologies of mosques built by religious associations or individual citizens in Algeria.

While the study of mosque architecture in Algeria has been explored for some time, research on proximity mosques constructed by religious associations remains limited. According to (Senhadji, 2017), it is essential to highlight the emergence of new architectural models while analysing the design process of mosques in the city of Oran. This includes identifying all stakeholders involved in mosque construction and the administrative procedures established by the Religious Affairs Department. To better understand the architectural choices associated with the design and construction of mosques, Senhadji advocates for a revision of the legislation through consultations with all relevant parties; jurists, administrators, architects, civil society members, and sociologists.

There exists a scarcity of research addressing mosque topic, with most monographs, dissertations, and theses focusing more on the patrimonial aspects of mosques rather than the architecture of newly local-built mosques. The work (Redjem, 2014) has provided insights into the authentic characteristics of architectural elements that represent the local and traditional architecture of Constantine ,the intention behind these efforts is to establish a framework for future mosque designs and the conservation of historic mosques. Similarly, another work (Menhour, 2012) conducted research in the same wilaya and identified disorder in the design and construction of mosques, particularly focusing on contemporary structures. By examining these two studies, which are situated within a similar context, we recognize that the challenges associated with newly-built mosque architecture are prevalent across various regions.

It is crucial to emphasize that proximity mosques play a significant role in the urban landscape. Given their increasing numbers and central locations within cities, they contribute substantially to the urban image of our communities, often more than national or regional mosques.

Research problem

The mosque, as a place of worship, has been the subject of numerous research projects in Algeria and beyond. The architectural investigations focus on proximity mosques built by religious associations (Baradi, 2018), aiming to understand their typologies in relation to current legislation, particularly the specifications established by the Ministry of Religious Affairs and Wakfs in 2022. We conducted a thorough analysis of the legislative framework surrounding mosque construction as both a place of worship and a public facility, particularly in the El Oued wilaya.

This research is not a historical study of Muslim architecture; as significant work has already been done in that area. However, our theme requires referencing historical architectural precedents when relevant. Algerian legislation seeks to preserve the "authentic" character of Muslim architecture and guide new mosque constructions based on historical references, including those from the Almoravids, Almohads, and Ottomans.

Nonetheless, the often inconsistent architecture of proximity mosques raises significant challenges regarding these architectural references. This issue has been previously highlighted (Senhadji, 2017; Senhadji Khiat, 2010), who noted the ambiguity in the 2013 decree that aimed to define the Islamic character of mosques, recommending revisions to avoid misinterpretations.

In a 2021 address, the Minister of Religious Affairs criticized the construction practices that deviate from the Maghreb character, specifically the trend of building multiple minarets, which he argued could lead to corruption and waste. Despite the intent to clarify the architectural guidelines in the 2013 decree, ambiguities remain, particularly regarding the "Islamic" and "Maghrebian" characteristics of mosque architecture.

Article 26 of the 2013 decree mandated the creation of standard specifications for mosque construction by relevant ministries to address gaps in architectural typology. However, our experience in designing and supervising two mosques in the wilaya of Medea revealed a narrow interpretation of the 2013 legislation, reducing the "Maghrebian" character to a single square minaret.

Since the 2013 decree, there has been no update to the legislation, leaving the architectural landscape of Algeria varied and often arbitrary. The diverse historical, climatic, and social contexts across Algeria suggest that mosques in different regions should not conform to the same specifications.

These observations raise two fundamental questions and several sub-questions:

Fundamental questions:

1. How can we reconcile the architectural typology of proximity mosques with current legislation on mosque construction?
2. Is the current legislation on the construction of mosques adapted to the reality on the ground for mosques?

Sub-questions:

1. Is there any way of exploiting research in architecture of mosques in Algeria to help draft legislation?

2. Are there any inventories or platforms of the architectural components of mosques in Algeria that could be used to set legislations ?

3. Who and which factors are involved in proximity mosques typologies? Who are the real contractors?

Field study: El Oued, a wilaya and an observatory region

To address these questions, we focused on a specific area: The wilaya of El Oued. Our interest lies in the typologies of proximity mosques within their historical, climatic, and cultural contexts, as well as local craftsmanship.

National architecture legislations are implemented across Algeria, thus Wilaya of El Oued has been chosen because it has a unique architectural identity, known as the city of a thousand domes. Also El Oued has historically hosted many mosques; in 1940, the French recorded 113 mosques of varying sizes (Ghenabzia, 2008).

El Oued as a Saharan region, its specific characteristics must be considered in mosque construction legislation .The Decree no. 14-27[7] emphasizes preserving the architectural character of southern Algeria, calling for a blend of traditional forms with contemporary needs. Additionally, the climate significantly influences construction and typological choices within this cultural context. Our subjective motivation stems from a scientific curiosity to explore a region with distinct buildings and traditions, as our architectural practice and training have been based in central Algeria.

Our research led us to formulate the following hypotheses

Hypothesis 01: The policies based on legislative texts for mosque construction are broad and overlook local or regional specificities related to climatic, social, and cultural factors.

Hypothesis 02: Local climatic, social, and cultural factors are often not respected in practice.

Hypothesis 03: Establishing a platform for consolidating previous inventory studies and analyzing architectural elements identified in the field would greatly benefit legislators at the Ministry of Religious Affairs and Wakfs.

Research objectives and scope

Through this research, we have set ourselves some fundamental objectives and a practical objective that is also fundamental.

Fundamental objectives

The two fundamental aims of this research work are to demonstrate the shortcomings of the 2022 specifications for all mosques in Algeria, and the fundamental contribution of digitizing all mosque construction data. In other words:

[7] Executive Description no. 14-27 of 1 February 2014 setting out the urban, architectural and technical requirements applicable to buildings in the southern wilayas

1. Understanding why legislators do not take into account local and regional specificities in the design and construction of mosques in Algeria.

2. Including all the mosque inventories that have been futile or even useless.

Another practical and fundamental objective:

Designing a platform, not only an inventory, to capitalize on data related to the design and construction of mosques. This platform will serve the Ministry of Religious Affairs and Wakfs, legislators, architects, religious associations, civil society, institutions, and researchers. It will facilitate interaction with all mosque-related data, including location, components, designers, typologies, and more.

Methodology

To achieve our research objectives, we moved from a broad macro study to a detailed micro study. We began with a chronological overview of all legislation governing mosque construction in Algeria and then examined the architectural components of mosques in El Oued. Our analytical approach is both descriptive and comparative, as it involves analysis in both dimensions.

The descriptive aspect focuses on Algerian mosque construction legislation, historical references, and inventories. We divided the chronological review of legislation into two parts: one addressing mosques as public facilities and the other as spaces for Muslim worship. This legislation highlights recommended architectural styles and essential components of mosques.

The section on historical references showcases architectural features of notable mosques, supported by graphics and illustrations to inform our analysis grids for the platform. Additionally, we review existing mosque inventories at both national (Ministry of Religious Affairs and Wakfs and Ministry of culture) and international levels. (Ce S.A.D.A.)

An introductory review of the current state of research on proximity mosques and architectural typologies is woven throughout the chapters, with references subject to ongoing observation and cross-referencing. Given the scarcity of studies on proximity mosques in Algeria, we conducted investigations at various institutions, including the El Oued wilaya's Religious Affairs and Culture Departments, consultancy firms, and local residents.

Data gathering involved documentary research followed by in situ investigations, which highlighted the formal, functional, and decorative aspects of mosques in El Oued. The comparative method allowed us to analyse fieldwork results in subsequent chapters, helping us address our research problem and verify our hypotheses.

Our field study on proximity mosque typology in El Oued yielded a wealth of diverse elements for analysis. Recognizing the complexity of analysing this data, we proposed a flexible platform to capitalize on field data and previous inventories. Collaborating with a software developer, we spent over a year developing this platform as a digital inventory and analysis

tool, which goes beyond simply listing proximity mosques. The Platform is designed for in-depth field analysis to study and analyse data while integrating existing inventory information.

Structuring research

The thesis is structured in two parts, each divided into three chapters:

The first part, entitled Algerian Mosques: Legislation, References and Digitization Tools, is divided into three chapters. Chapter One provides a comprehensive and chronological examination of all Algerian legislation related to the construction of mosques, addressing the subject first as a public facility and then specifically as a mosque.

Chapter Two offers a concise overview of the primary architectural and historical references for mosques in Algeria and the broader Maghreb region. This chapter aims to delineate the various characteristics of mosque architecture by region and dynasty in Algeria. Additionally, it discusses the inventory of mosques in Algeria and highlights the UNESCO inventory of Islamic heritage.

Chapter Three delves into the genesis, concept, and design of a digital platform for mosques, using data from existing inventories. It outlines the rationale, methodology, functionalities, and practical implementations of this platform which will be applied in the field analysis presented in Part Two.

Chapter Four presents case studies of proximity mosques in the wilaya of El Oued, focusing on those that meet the criteria established by the 2022 specifications.

In Chapter Five, we examine case studies that do not align with the recommendations of the 2022 specifications, revealing deficiencies and ambiguities in architectural components.

Chapter Six addresses the unexpected findings from our fieldwork, which coincided with the global COVID-19 pandemic. The health guidelines associated with the pandemic notably impacted mosques, particularly in the wilaya of El Oued.

The general conclusion of this research compares the identified problems, the hypotheses formulated, and the objectives pursued with the data and results obtained in the field. Finally, it discusses potential new research perspectives emerging from this study.

Part 1

Algerian mosques: legislation, references and digitization tools

Chapter 1. Legislative Framework for Mosque Construction in Algeria.

Chapter 2. Historical and Architectural References in the Maghreb and Algeria: the source of inspiration

Chapter 3. From an Inventory to the Design a Digitized Platform

CHAPTER 1

LEGISLATIVE FRAMEWORK FOR MOSQUE CONSTRUCTION IN ALGERIA.

1 Introduction

Like any other construction, mosques architectural organization and construction are governed by laws, regulations, and technical standards. In the context of our research, we aim to explore the legislative framework that outlines the building of mosques in Algeria. We must gain a comprehensive understanding of the legislation that governs this domain. This chapter examines the chronological progression of texts related to mosque construction in Algeria from independence until today. This analysis aims to unravel the legislative recommendations concerning mosque definitions, construction requirements, regulatory bodies, architectural styles, and recommended components.

To conduct a rigorous investigation tailored to our research, our efforts focused on scrutinizing the legislation about mosque construction in Algeria from 1981 to 2022. Our primary emphasis was dissecting the stipulations outlined in the interministerial decree dated May 29th , 2022. This decree serves as a vital document establishing standardized specifications for constructing mosques nationwide.

Our analysis identified two types of legislative texts: those directly related to mosques and those indirectly associated with mosques. Essentially, some texts discuss mosques as public facilities, while others concentrate on mosques as places of worship.

Our research at JORADP[8] revealed that there were no laws or legislative texts regarding the construction of mosques at the time of independence[9]. The first decree mentioning the term "mosque" was issued in 1981, outlining the responsibilities of the commune and wilaya in the religious affairs sector. Subsequently, a series of decrees and orders were issued. To date, five aspects directly pertain to the architectural production of the mosque as a place of worship. The texts related to 1988, 1991, 1999, 2013 and 2022 are presented chronologically[10].

Our investigations found four texts still in effect, indirectly relating to legislation concerning mosques as public facilities. These texts include Law No. 08-15 of 2008, Executive Decree No. 15-19 of 2015, Executive Decree No. 20-342 of 2020 and Executive Decree No. 22-55 of 2022. We will begin by analysing the texts concerning the construction of mosques as facilities, following their chronological order. To understand the importance of these texts, we

[8] Journal officiel de la République algérienne démocratique et populaire (Official Journal of the People's Democratic Republic of Algeria)
[9] https://www.joradp.dz/HAR/Index.htm consulted 30/06/2020.
[10] The legislative texts are presented in the chapter.

will briefly explain the hierarchy[11] and distinctions[12] of the law, of the decree, of the order, of the instructions ,circulars and article.

The law which is known to be the initiative of a member of the National Constituent Assembly or that of the Government (draft law), generally sets out the rules or determines the fundamental principles in the following matters:

- Civil rights and fundamental guarantees granted to citizens
-General organization of the National Defence.
-Administrative organization of the country and electoral system.
- Nationality
- Personal law (status, capacity, marriage and matrimonial regimes).
- Crimes and offences
- Education
-Taxes (finance laws and programme laws).
- Status of the civil service.
- Property regime and land reform, civil and commercial obligations
- Labour law, trade union law, social security.

The decree may be either a decree in the Council of Ministers or a simple decree, the decree may go into detail if the matter dealt with requires, on the other hand, it regulates according to the law voted by the Assembly.

The order has its legal basis in a decree and lays down the rules for its application.

The instruction and circular go even further into the details of the application of an order or even a decree. They have a more technical aspect and are addressed mainly to specialized officials. Little different from each other, the instruction is more generally an important and developed basic document, a fundamental tool of the work of the executing official.

The circular deals with specific points, provides clarifications on the occasion of a difficulty in interpretation, reminds the public and especially the civil servants of a provision which has been lost from view, insists on the desirability of a more stringent application of a regulation.

[11] Far from any pretense of competence in law, we limit ourselves here to definitions that allow us to understand the texts with an architect's vision.
[12] https://www.joradp.dz/TRV/F2004B03.pdf consulted 30/06/2020.

2 Legislation governing mosques as public facilities

2.1 Law no. 08-15 of 2008

Law No. 08-15 of 2008[13] outlines the regulatory framework for completing and upgrading buildings to meet established standards. By Article 23 of the law. The completion permit granted carries a time limit of 24 months for residential construction, 12 months for commercial, service, or artisanal construction, 24 months for mixed residential and commercial or service construction, and 24 months for the construction of public facilities. It is imperative to adhere to the aesthetic harmony and quality of a building's facade.

Regarding the sanctions for constructing or attempting to construct a building without proper planning permission, structures that have already been built or are currently under construction before the publication of this law in the Official Journal may be brought into compliance if they meet the conditions outlined in the legislation. However, this process must be done systematically according to the various steps that the law requires. In the context of this law and mosque construction, our experience in this field has shown that several mosques have been granted building and completion permissions, and certificates of conformity. Additionally, some mosques have been built with or without planning permission . The actual construction which differs significantly from the initial permission. Overall, this first law on public facilities, including mosques, is primarily concerned with ensuring compliance with construction deadlines and implementing regularization measures if construction permissions are not acquired in advance.

2.2 Executive Decree no. 15-19 of 2015

Decree No. 15-19[14] of 2015 lays out the rules and regulations for instructing and issuing town planning documents[15], encompassing urban planning. Under this text, certificates such as subdivision permits, building permits, and demolition permits may be given, as well as special provisions about buildings that threaten collapse. Furthermore, the decree establishes regulatory bodies for overseeing town planning documents. These bodies, including committees for the control of town planning documents, are formed under the authority of the Minister responsible for town planning, the Wali, and each communal people's assembly president.

2.3 Executive Decree No. 20-342 of 2020

Executive Decree No. 20-342[16] of 2020 provides the procedures for examining and issuing urban planning documents. It specifies the types of urban planning certificates that will be reviewed and published, such as subdivision, building, and demolition permits. The decree also outlines the control of town planning acts and the legal actions that the responsible

[13] Law n° 08-15 of 20 July 2008 setting out the rules for bringing buildings into conformity and completing them.
[14] Executive Decree no. 15-19 of 25 January 2015 setting out the procedures for the appraisal and issuance of planning documents
[15] The planning act means here the building permit and certificate of conformity.etc.
[16] Executive Decree n° 20-342 22 November 2020 amending and supplementing the Executive Decree n° 15-19 of 25 January 2015 setting out the procedures for the investigation and issuance of urbanism acts

administrative authorities can undertake. A supplementary decree, Executive Decree No. 22-55 of 2022, pre-existing Executive Decree No. 15-19 of 2015. These decrees ensure a thorough framework for evaluating and authorizing urban planning documents while addressing the unique considerations that mosque construction and development may involve.

2.4 Executive Decree no. 22-55 of 2022

The Executive Decree no. 22-55[17], published on February 2th, 2022, incorporates Article 03[18], which specifies that all constructions completed or currently under construction but have building permissions that did not adhere to the provisions of the preceding decree shall be subject to the regulations outlined in this decree. Additionally, Article 4[19] emphasizing the necessity to conform to the conditions and general rules of urban planning, in particular, regulations pertaining to encroachment on setback areas within the property.

Article 12[20] grants the revised building permission or certificate of conformity, a regularization measure, after paying a fine. This fine is calculated based on a percentage varying between 10% and 25% of the fixed value of the additional or altered sections of the structure, contingent upon the purpose of the construction. Notably, this regulatory framework extends to mosques as well. As an illustrative example, to elucidate this process, detailed in the table below. The simulation encompasses various elements, including the nature of the construction, the cost per square meter, the standardized cost attributed to non-compliant facades, a fine set at twenty percent.

Table 1. 1 Example of a fine applied in the event of an overrun noted in the field (such as non-compliance with the architectural file of the building permit issued).
(Source: Own elaboration with data from JORADP)

	The sanctions applied here refer to Executive Decree no. 22-55					
Type of construction	Cost per square meter (m^2)	Flat-rate cost applied to the facade	Percentage of fine	Cost of fine applied per (m^2)	fine cost applied per facade	Total of cost of fine
Operation	(01)	(02)	(03)	(04) =(01) x (03)	(05) =(03) x (03)	(06)=(04)+05)
Construction projects (e.g., hotels, center, clinics)	15000 DZD	50000 DZD	20%	15000 x 20%= 3000 DZD /m^2	50000 x 20%= 10000 DZD /facade	

[17] Executive Decree no. 22-55 of 2 February 2022 setting the conditions for regularization of constructions not in accordance with the building permit issued
[18] Article 03: The provisions of this Order apply to all constructions carried out or in the course of being carried out Who have a building permit and are not the latter, prior to publication of this Decree.
[19] Article 04 Constructions that can be regularized must meet the following conditions - General rules of planning in terms of:a) encroaching on the rearward space within the property;b) openings on facades not authorized by the permit to build issued;(c) the elevation of unauthorized levels or floors;(d) overrun of ground clearance.
[20] The modified building permit or certificate of conformity, as a regularization, shall be established and notified to the applicants by the competent authority after the withdrawal of reservations, where applicable, within the time limits set duly established and verified by the committee and payment of a fine calculated on the basis of a percentage ranging between 10 and 25%

To summarize, there are four (04) legislative texts including one (01) law and three (03) executive decrees. Legislative Decree 22-55 of 2022 outlines penalties for unauthorized construction and overruns without permits, which are observed in some mosque projects. These constructions can be partially regularized by Law 08/15 of 2008 which imposes sanctions against any individual who attempts to construct a building without a permit. To apply this law, constructions whose building work has been completed or is currently being completed before the publication of this law in the Official Journal can be brought into compliance when they meet the requirements set forth by this law.

The new and latest Executive Decree no. 22-55 of 2022 supplements the previous decree, allowing builders to regularize modifications made or to be made in return for payment of a fine. In the case of mosques, this decree makes it possible, among other things to regularize unfinished constructions by opting for the measures dictated by this decree.

Table 1. 2 Summary of legislative texts on facilities in general including mosques.
(Source: Own elaboration with data from JORADP)

Text type	References	Year of publication	Article on facilities including the mosque	Online link
Law	n° 08-15	2008	Article 02	https://www.joradp.dz/FTP/jo-francais/2008/F2008044.PDF
Executive decree	n° 15-19	2015	Article 20, Article 41	https://www.joradp.dz/FTP/jo-francais/2015/F2015007.pdf
Executive decree	n° 20-342	2020	Article 02	https://avocatalgerien.com/wp-content/uploads/2020/12/F2020071.pdf
Executive decree	n° 22-55	2022	Article 03	https://www.joradp.dz/FTP/JO-arabe/2022/A2022061.pdf?znjo=61

3 Legislation specific to the mosque

The legislative texts presented here directly concern the mosque as a place of worship; they are also presented in chronological order.

3.1 Decree no. 81-386 of 1981

Decree no. 81-386[21] of 1981 establishes the roles and responsibilities of the commune and wilaya in the religious affairs sector. Under this decree, the construction of mosques is a joint responsibility of the State, represented by the wilaya, the commune, and religious associations. Mosques are classified into three categories: historic, national and communal. Article 6 of the decree specifies that the State should support the commune and wilaya in the planning and construction processes. Although this article marks the first piece of legislation

[21] Decree no. 81-386 of 29 December 1981 establishing the responsibilities of the commune and wilaya in the area of religious affairs

directly linked to mosques, it does not include a "legal" definition of a mosque.

3.2 Decree no. 88/50 of 1988

Article 01 of Decree no. 88/50[22] defines a mosque as *"The house of God, the place where believers go to perform their prayers, read the Quran (God's book), and listen to what is useful to them in their religion and lives."* This definition is the mosque's first legal characterization, positioning it as a facility to accommodate the faithful. The role of the mosque is limited to prayer and the recitation of the Quran, as stipulated in the article. The construction conditions for mosques are outlined under articles 6 and 7. Mosques that have been granted a building permit must undergo technical supervision and are required to comply with current safety regulations.

According to the decree, the State and legal entities as associations are responsible for the construction of mosques. This point remains unchanged from the previous decree which likewise, identified the same authorities involved in the construction process. The decree categorizes mosques into three groups: historic mosques, national mosques as classified in the previous decree, and the local mosques and non-commune mosques, also identified in the last decree. Notably, the present decree mandates that mosques must be national. The ambiguity surrounding this decree's "national" character concept has sparked diverse interpretations, which may be fortunate or unfortunate depending on the context.

Our fieldwork, discussed in Part II, enabled us to demonstrate that the national character cannot be applied because, on the one hand, it has to be defined and on the other hand, how can it be applied to the entire Algerian territory, from north to south and from east to west

3.3 Executive Decree No. 91-81 of 1991

In Algerian legal frameworks, Decree no. 91-81[23] of 1991 has expanded upon the definitions provided in Decree no. 88/50 of 1988, focusing on mosque construction. The current decree includes more stringent conditions for mosque construction which stipulates that construction work must not interfere with or duplicating existing mosques. Additionally, the religious association must be approved before construction, and both individuals and legal entities are now authorized to build local mosques. Individuals must acquire administrative authorization from the Religious Affairs Department for mosque construction.

Altering the terminology from "national" to "authentic Islamic" character in Decree No. 91-81 of 1991 has provided more interpretations of random architectural styles within Islamic architecture. This modification of the legal framework highlights the complexity of maintaining authenticity while considering various construction approaches and preferences.

[22] Decree no. 88/50 of 13/03/1988 concerning the building of mosques their organization and management

[23] Executive Decree N°91-81 of 23/03/1991 on the construction of the mosque, its organization and operation and setting out its mission. (J.O. n°16 of 10/04/1991).

3.4 An Interministerial order of 1999

The Interministerial order of 1999[24], published on April 10th , is an extension of decree no. 91-81 of 1991, and Article 04 of this new decree outlines more specific construction conditions to ensure the authenticity of the Islamic architectural style.

It is crucial to recognize that the precise architectural spaces mentioned in Article 04 of the 1999 decree are delineated as a feature of mosque construction. These spaces include the prayer hall, Mihrab, Minaret, Imam's compartment, ablution facilities, Quran teaching classroom, at least two staff quarters, and a store.

Regarding mosque classification, historical and national mosques are designated in the previous decree (no. 88/50 of 1988) as pre-defined categories. However, the present decree introduces new categorizations, specifically categorizing mosques into archaeological, national, and local mosques, as specified in Article 8. Additionally, Article 9 provides an extra classification that includes local collectives and mosques.

3.5 Executive Decree No. 13- 377 of 2013

Decree no. 13- 377[25] of 2013 defines a mosque similarly to the previous decrees. The present decree requires prior approval from the administration of Religious Affairs and Wakfs for the construction of mosque, the project data sheet, obtaining a building permit, justification of compliance with the rationale for the absence of a "*dhirar* mosque,"[26] justification of the conformity of the mosque being built according to the classification of mosques.

Article 15 also introduces a new sub-category. This recent decree (Senhadji, 2017) extensively discussed, was issued by the Ministry of Religious Affairs and Wakfs following consultations with architects and researchers regarding the inconsistent architectural styles of mosques. Consequently, this decree emphasizes architectural coherence, mandating that architectural plans for mosque projects draw inspiration from the Maghrebian architectural heritage. extensively examines this legislative development(Senhadji, 2017). However, due to the lack of specific definitions, uncertainties and varying interpretations persist regarding the term 'Maghrebian.

Additionally, article 26 is fascinating as it mandates the drafting of standard specifications for mosque construction by a joint order from the Minister for Religious Affairs and Wakfs, the Minister for the Interior and Local Authorities, and the Minister for Housing and Urban Planning. These specifications aim to address the legislative gaps. We provide a summary table of the texts discussed above about the construction of mosques.

[24] Interministerial order of 10 April 1999 on the mosque card
[25] Executive Decree no. 13-377 of 9 November 2013 on the status of the mosque
[26] Mosque dhirar means nuisance, which brings harm.

Table 1. 3 Summary of texts cited above concerning the construction of mosques
(Source: Own elaboration with data from JORADP)

Legislation	Building conditions	Who builds	Classification	Architectural character	link
Decree no. 81-386 of December 29, 1981	The characteristics and technical standards of infrastructures linked to the religious activities of the commune and the wilaya are set by joint order of the Minister of the Interior and the Minister of Planning and Development, and the Minister of Religious affairs.**(Art.5)**	-State (wilaya and commune) **(Art. 3)** -Religious association	Historical National. **(Art. 3)** Mosque(commune) **(Art.2)**	The State provides the commune and wilaya with assistance in planning and implementation.**(Art. 6)**	https://www.joradp.dz/FTP/jo-francais/1981/F1981052.PDF
Decree no. 88/50 of 13/03/1988	The relevant authorities issue a building permit. **(Art. 6)** -Technical control of construction. **(art 7)** -Compliance With Safety Regulations**(Art.7)**	- The State**(Art.2)** -Individuals who have duly formed an association **(Art. 5)**	Three categories 1-Historical 2-National. 3-Local(**Art.3)**	**National character** **(Art.8)**	https://www.joradp.dz/FTP/jo-francais/1988/F1988011.PDF
-Executive Decree No. 91-81 of 23/03/1991	-The mosque must not interfere with or duplicate another existing mosque. -the association must be approved; natural persons must have administrative authorization **(Art. 5)** - A building permit -The requirement to respect the Qibla. -Technical building inspections. -The obligation to comply with the specifications issued by the wilaya authority in charge of religious affairs **(art. 7)** -The Construction Contractor Must Comply With Construction Conformity Standards**(Art.8)**	- The State - Associations - Natural or legal persons **(Art. 5)**	In three categories: 1- Historical: Classified or in the process of being classified as 2- National 3- Local **(Art.3)** -If it meets the conditions of this decree, a prayer room may be classified as a mosque. **(art.9).**	**Respect for the authentic Islamic character of the architecture** **(Art.7)**	https://www.joradp.dz/FTP/jo-francais/1991/F1991016.PDF
Interministerial order as of April 1999	-Compliance with articles 5.7.8 of decree 91-81 -Commitment to The Qibla -Piece commitment to preserving authentic islamic architectural style -Commitment to compliance with Article 5 **(Art. 4)** Installation is of prime importance -a prayer room - Mihrab -the minaret -the Imam's compartment -ablution facilities Class for teaching the Holy Koran -at least two staff housing units -a store **(Art. 5)**	/	1-Archaeological mosque 2-National mosque - 3 -Local mosque **(art.8)** A- Local collective mosque B- Local mosque **(Art. 9)**	**Authentic Islamic architectural style**	https://www.joradp.dz/FTP/JO-FRANCAIS/1999/F1999033.pdf?znjo=33
Executive Decree No. 13-377 of November 9, 2013	- Prior approval from the administration Religious Affairs and wakfs -Public wakf contract or equivalent official document - Project data sheet - Architectural documents and plans for the project, the construction of which must be inspired by Maghrebian architectural heritage -Obtaining a building permit -Justifying compliance with the Qibla ; - Justification for the absence of a "dhirar mosque" -Justification of the conformity of the mosque sends of construction according to the classification of mosques **(Art. 25)**	-State - Duly registered mosque committees - Natural or legal persons - **(Art.22)**	1-Jamaâ El Djazaîr. 2-Historic buildings: listed or in the process of being listed 3-Pricipal mosques 4- National mosques 5-Local mosques 6-Neighborhood mosques **(Art. 13)** - Prayer rooms **(Art.15)**	**Inspired by heritage Architectural Maghreb** **(Art. 25)**	https://www.joradp.dz/FTP/JO-FRANCAIS/2013/F2013058.pdf
Order of June 29, 2017, establishing the form and content of the national file of Mosques	- A Technical specification sheet for the mosque; - The Agreement of the relevant technical services, in particular the civil protection services and the technical building control services, to ensure that the mosques are safe and secure; -A Certificate of conformity -Naming minutes -Classification report -The report establishing orientation towards the Qibla **(Art. 05)**	/	/	/	https://www.joradp.dz/FTP/JO-FRANCAIS/2017/F2017057.pdf?znjo=57

4 The final legislative text for mosque construction: An Interministerial order and specifications for 2022:

An Interministerial order dated on May 29th , 2022[27], was issued in response to article 26 of the 2013 decree[28]. This decree is intended to address the shortcomings of the legislative texts cited above and relate to the construction of mosques. According to Article 01, these are standard specifications for constructing mosques. Article 01 also lays down the urban planning, architectural, technical, and programmatic standards for sustainable development relating to the design of all mosques in the Republic, whatever their classification, throughout the national territory, in keeping with the national religious referent. A reference is drawn from the Maghreb's Islamic architectural heritage. However, it is crucial to note that the reference to Maghrebian Islamic heritage is already cited in the 2013 decree. No details are added to explain what the term Maghreb Islamic implies regarding architectural components.

What do these specifications dictate about the construction of mosques?

In the recent interministerial order dated on May 29th , 2022 encompassing a series of specifications, several elements directly linked to the architectural typology of mosques stand out. Due to their significance, we will thoroughly analyse these specifications, contributing to and enriching the framework established within this thesis.

4.1 Architectural components in the 2022 specifications

The 2022 specifications encompass architectural spaces and elements. It is worth noting that these components were also present in the 1999 and 2017 decrees. By comparing the architectural elements outlined in the 1999 decree, the 2017 decree, and the 2022 specifications, a summary table has been compiled as a reference.

A notable feature of the 2022 specifications is the detailed list of architectural components and spaces designated for each mosque type, distinguishing it from the provisions of the 1999 and 2017 decrees. Specifically, the 2022 specifications categorize mosques into four types: principal, national, local, and neighbourhood (refer to table 1.4). The analysis reveals that while specific components are common to all mosque types, others are unique to one or two particular types.

4.2 Architectural components are standard to all mosques, as cited in the 2022 specifications.

A prayer room for men and a prayer room for women.
An ablution room for men and an ablution room for women.
The Minaret (SOUMÂA)[29]

[27] Interministerial order of 29 May 2022 setting the standard specifications for the type of mosque construction. Published September 19, 2022
[28] Executive Decree no. 13-377 of 9 November 2013 on the status of the mosque
[29] written as the Interministerial order setting the standard specifications relating to the typology of the construction of mosques.

Ceiling and dome (El Qobba)[30]
The Mihrab
The Minbar
A call to prayer room
A Maqsura for the Imam
Sahn[31] and outdoor spaces
wakf[32]
Parking.

Other spaces have been added, including:

Deposits.
A boiler room
A water tank is an irrevocable component for all types of mosques.

On the other hand, the Quranic school or classroom, on-calling space, transformer station, and electrical generator are only necessary for principal, national, and local mosques. It is essential to highlight that while the presence of administration and offices in the main mosque is justified, the absence of offices in national mosques and their presence in local mosques raises questions.

In these new specifications, additional spaces and components have been designated based on the size and significance of each mosque. Special attention has been given to installing and including technical equipment such as boiler rooms, water tanks, transformer stations, and electrical generators. For the boiler room and water tank surface area, a minimum of 12 m² is required for all mosque types. As an architect, it is essential to note that the equipment requirements for boiler rooms and water tanks vary significantly between a main mosque and a neighbourhood one. Furthermore, outdoor spaces, circulation areas, and parking facilities are crucial requirements for all mosques.

[30]written as the Interministerial order setting the standard specifications relating to the typology of the construction of mosques
[31] Ibid
[32] Ibid

Table 1. 4 Summary of the architectural components present in the two decrees of 1999 2017 and the specifications for 2022 (Source : Own elaboration with data from JORADP)

The components	Interministerial order dated April 10, **1999** establishing the mosque map	Order of June 29, **2017,** establishing the form and content of the national file of mosques	Interministerial order of May 29, **2022,** setting out standard specifications for the construction of mosques.			
	All types of Mosques	Any type of Mosque	Principal	National	Local	Neighbor hood
Prayer room for men	*	*	*	*	*	*
Prayer room for women		*	*	*	*	*
Men's ablution room	*	*	*	*	*	*
Women's ablutions room			*	*	*	*
Shower		*				
Koranic school/class	*	*	*	*	*	
Administration/office			*		*	
Meeting room			*	*		
Library + Study room		*	*	*		
Maqsura for the Imam	*	*	*	*	*	*
Call to the prayer room.			*	*	*	*
Multi-purpose hall			*	*	*	
Deposit			*	*	*	*
Boiler room: water tank			*	*	*	*
Transformer substation			*	*	*	
Electric generator			*	*	*	
The Minaret (SOUMÂA)	*	*	*	*	*	*
Dome		*	*	*	*	*
On-call space	*	*	*	*	*	
Commercial premises		*				
Wakf		*				
Store	*	*				
Mihrab	*		*	*	*	*
Outdoor area, Crow movement area, Carparks			*	*	*	*
Terrace and courtyard		*				
Green space		*				

*: Required component

Given our research problem and the significance of the 2022 specifications which represent the most recent legislation on mosques, we provide an analysis for each component hereby. Before this analysis, we outline how the specifications have been structured into chapters, sections, and subsections to enhance the readability of these articles (appendix 01), it is evident that the specifications are divided into eight chapters, some with sections and subsections. The articles are sequentially numbered from 01 to 116. Therefore, we have chosen to analyse the specifications directly based on article (appendix 01).

5 Two thousand twenty-two specifications: architectural analysis of components.

5.1 The prayer room

Various articles have addressed the prayer room differently, sometimes focusing on its shape and other times on its surface area. The distinguishing feature of this new specification is its emphasis on Article 17[33] which states, "*Access to the prayer room must not be through the entrances to the Qibla facade but should be through the rear or side facade*. "From an architectural design perspective, Article 17 does not account for scenarios where the sole access is through the Qibla facade. Likewise, Article 18[34] mandates the creation of separation areas (SAS)[35] at prayer room entrances for men and women. The law definition of this "SAS" separation remains ambiguous. It could manifest in various forms if it serves as a transition space.

5.1.1 The shape and dimensions of the prayer room:

From a formal perspective, Article 22[36] emphasizes that: "*The rectangular shape of the prayer hall is recommended in mosque design, ensuring that the front wall of the Qibla occupies the longest part of the rectangle*." This article advocates for the rectangular and elongated shape of the prayer room. Regarding surface area, Article 23 specifies that: "*The prayer room's surface area should be calculated based on the number of worshippers, aiming for an average of 0.75 m² per worshipper during prayer and allocating 12% of the total room area for circulation*."

A notable change observed is the revision of the surface area allocated to each worshipper, replacing the previous ratio of 03 persons per 2.00 m²[37].

5.1.2 The size and height of the prayer room:

According to Article 23, "*The surface area of the prayer room may be distributed over one or more levels if the land base is limited, and must not exceed three levels, to ensure visual continuity with the imam in the direction of the Qibla*." This article recommends a prayer room at most three levels.

5.1.3 The height of the prayer room:

From the perspective of the prayer room's height, Article 29[38] stipulates, "*The height of the prayer room must be proportional to the size of the mosque*." It is crucial to note the

[33] In Chapter 04, section 4.1, sub section 4-2-1 of the Interministerial order
[34] ibid
[35] Intermediate room located between two rooms, or between two environments, for which direct communication is to be avoided.
[36] In Chapter 04, section 4.1, sub section 4-2-2 of the Interministerial order
[37] Decree no. 76-36 of 20 February 1976 on protection against fire and panic risks in establishments receiving the public, section establishment of worship, article v2 (Source paper)
[38] In Chapter 04, section 4.2, sub section 4-2-4 of the Interministerial order

ambiguities surrounding the word or term "size." Article 30[39] states, "*The minimum height of the prayer room is calculated in proportion to the other dimensions (length and width) and considering the necessary air volume. The minimum height under the ceiling or false ceiling must correspond to one-third (1/3) of the length of the prayer room with a minimum of 4.5 meters*".

Let us closely examine the two articles in question, 29 and 30. The prayer room's height is determined by dimensions (length and width), the minimum height requirement is (at least 4.5 meters) and the necessary air volume. A prayer room's minimum height is 4.5 meters or higher. It is essential to highlight that this minimum height may challenge smaller prayer halls and mosques.

5.1.4 Crow movement:

As per Article 31[40], "*The prayer hall should feature a clear passage in a loop, enabling worshippers to move freely towards the front rows without causing disturbance and easing their exit after the prayer*. "This article suggests establishing a circulation loop within the prayer room to enhance movement and streamline crow flow. Designers are advised to consider this recommendation carefully.

5.1.5 The structure:

Upon initial review of Article 25[41], it states, "*The structure can be constructed using reinforced concrete, metal or mixed materials, or any other material that complies with current safety standards and regulations*". This provision allows for utilizing various structural materials beyond conventional choices like reinforced concrete, metal, or mixed materials to ensure compliance with safety standards. Furthermore, Article 25 highlights the importance of aligning the structural selection with the architectural style inspired by the Islamic heritage of the Maghreb region. This underlines the significance of harmonizing the structure with the architectural ethos drawn from the Maghreb's Islamic legacy.

Regarding the building materials, several articles 73[42], 92[43], and 93[44] advocate for using local materials in mosque construction where these materials can serve a structural purpose. These local materials encompass stone, brick, and wood (Article 92). The term "local" raises questions: Do articles 73, 92, and 93 encourage the adoption of vernacular architecture? The materials mentioned are stone, brick, and wood. Does this mean that concrete and other "innovative" materials in the context of eco-friendly or smart architectures are not allowed?

[39] In Chapter 04, section 4.2, sub section 4-2-4 of the interministerial order.
[40] ibid
[41] In Chapter 04, section 4.2, sub section 4-2-3 of the Interministerial order.
[42] In Chapter 05, section 4.2, sub section 4-2-4 of the Interministerial order.
[43] In Chapter 06, section 6.3, of the Interministerial order.
[44] In Chapter 04, section 4.2, sub section 4-2-4 of the Interministerial order.

5.2 The ceiling and dome (*El Qobba*)[45]:

The new specifications encompass articles addressing the design and dimensions of domes[46] or cupolas[47]. Article 32[48] suggests a preference for flat roofs, with a recommendation for low ceilings to accommodate specific town features (such as multiple domes) or for climatic considerations in colder regions. This guidance has led to adopting multi-domed mosque designs in certain towns acknowledging the unique characteristics of areas like El Oued. The prevalence of multiple domes in this region is notable along with the consideration of sloping roofs in colder climates.

On the other hand, Article 33[49] specifies that only one dome per mosque is advised, positioned in front of the Mihrab within the prayer hall, circular with lateral openings. In summary, Articles 32 and 33 recommend three distinct roofing typologies.

- Multi-domed mosques.
- Mosques with low ceilings.
- Mosques with a single dome.

Additionally, the dome should be located upstream from the Mihrab, and its design should feature a circular shape with lateral openings.

5.2.1 Size and type of dome:

Regarding the dome's size, "*The dimensions and height of the dome should be proportionate and adjusted based on the mosque's overall size and particularly the prayer room's dimensions while being inspired by the architectural style of Maghreb Islamic heritage*." The article emphasizes that the dome's size is left to the designer but must align with the mosque and prayer room's proportions. It is crucial to highlight that the dome's design should draw inspiration from the "Maghreb Islamic architectural style." However, specific shapes or features of domes reflecting this style are not specified, leaving the selection of dome types open for determination.

On a different note, Article 34[50] advises against constructing any facilities on the roof, such as offices, ablution rooms, or on-call accommodations for the prayer hall.

[45] El Qobba: written as the interministerial order setting the standard specifications relating to the typology of the construction of mosques.
[46] a hemispheric roof covering an edifice.
[47] is most often the inner and concave part of a dome.
[48] In Chapter 04, section 4.2, sub section 4-2-5 of the interministerial order.
[49] Ibid.
[50] In Chapter 04, section 4.2, sub section 4-2-5 of the interministerial order.

5.3 The Mihrab:

Article 37[51] of the specifications addresses the Mihrab, stating that "*the Mihrab must have a curvilinear shape with an average surface area of between 2 and 3 m². The Maghreb Islamic architectural style should inspire the Mihrab's design*." This provision suggests that the Mihrab's surface area should range from 2 to 3 m², which may not apply to all mosques regardless of size.

5.4 The Minbar:

Article 38[52] of the specifications states, "*The Minbar should be crafted from high-quality wood, designed for easy mobility in its intended function. Its design should draw inspiration from the authentic religious heritage guided by the national religious authority*. Importantly, constructing a balcony adjacent to the Mihrab for Minbar use is prohibited." This article advocates using a single movable wooden Minbar, emphasizing a design approach rooted in referenced architectural traditions.

5.5 Openings and facades:

The specifications dictate that the design of facades, the dimensions of openings, and their shapes and styles should draw inspiration from Maghreb's Islamic architectural heritage, as outlined in Article 41[53] of the exact specifications. Regarding the size of openings, Article 44[54] recommends that they be of medium size and have an arched shape. However, this recommendation poses challenges due to its ambiguity, especially concerning facade treatment. The term "medium" lacks clarity in defining its relation to what aspect—whether the mosque's size, surface area, or facade height.

Furthermore, Article 91[55] emphasizes that the design of windows and openings should consider the specific climatic conditions of each region. The climatic factor plays a significant role in determining the dimensions of openings. Additionally, mentioning "[...] the arched shape" introduces a wide range of arch forms, often arbitrary or imaginative.

In contrast, Article 48[56] suggests "*the use of the horseshoe or semi-circular arch typical of Maghrebi Islamic architecture*." This legislation limits the arch types to the pointed horseshoe and semi-circular arch, symbolizing Maghrebi Islamic architectural heritage.

[51] In Chapter 04, section 4.2, sub section 4-2-7 of the Interministerial order.
[52] In Chapter 04, section 4.2, sub section 4-2-8 of the Interministerial order.
[53] In Chapter 04, section 4.4, of the Interministerial order.
[54] ibid
[55] In Chapter 06, section 6.2, of the Interministerial order.
[56] In Chapter 04, section 4.4, of the Interministerial order.

5.6 The women's prayer room:

Article 54[57] explains, "*When designing the mosque, avoid building the women's prayer room on the main prayer room or in front of the Qibla wall. Generally, it should account for 20% of the area allocated to the men's prayer room*." This article suggests that the space reserved for women's prayer should be approximately 20% of the total area allocated to the men's prayer room, which aligns with the surface program outlined in the exact specifications.

However, only the principal mosques comply with this specification, with 20% of the space dedicated to women. In contrast, the space allocated to women in national (10.71%), local (15%), and district (15%) mosques is less than 20%. It is important to note that the location of the women's prayer room is also recommended. It should not be built above the main prayer room, which means not above the men's or in front of the Qibla wall. Experience shows that many women's prayer rooms are naturally built above the men's prayer room.

5.7 The Minaret (SOUMÂA)[58] :

As a significant component, the minaret was ambiguous in legislation before the 2022 specifications. There was a need for constructive recommendations regarding its realization, except for statements by various Ministers since 2013 encouraging the construction of a single square minaret. However, the 2022 specifications have determined the number and shape of the minaret. Article 56[59] states, "*Regardless of its classification, the mosque must include one (1) single square-shaped Minaret, crowned by a couplet whose design is inspired by the Maghreb Islamic architectural style*."

For the position of the minaret in the mosque in general, article 57[60] explains that "*The Minaret may be positioned on the axis of the Mihrab in the direction of the Qibla, or on one of the four sides of the mosque, preferably on the right-hand side, taking into account architectural aspects*." This article then provides five (05) locations for the minaret, but preference is given to its location on the right-hand side of the mosque's Qibla wall.

Article 57[61] states, "*The height of the minaret varies according to the urban fabric in which the mosque is located*." No indication is given here, whereas, in reality, other parameters could intervene in the height of the minaret, such as the size and dimension of mosques in general, the technical regulations in force, and the nature of the soil.

For the ornamentation of the minaret, article 58[62] stipulates that "*The Minaret must be adorned with geometric motifs and decorated with arches. Mosaics and ceramics may form*

[57] In Chapter 04, section 4.6, of the Interministerial order.
[58] SOUMÂA: writing as the Interministerial order setting the standard specifications relating to the typology of the construction of mosques.
[59] In Chapter 04, section 4.7, of the Interministerial order.
[60] ibid
[61] In Chapter 04, section 4.7, of the Interministerial order.
[62] ibid

part of the minaret's external decoration." While recommending confident choices, this article allows designers free rein in the architectural repertoire.

5.8 The ablutions room:

Several articles emphasizing that they should not be outside the mosque's perimeter (Art. 59[63]). These rooms must have independent access without passing through the prayer room or outdoor areas (Art. 60[64]).

5.9 Outdoor areas:

The 2022 specifications place particular importance on outdoor areas. Article 70[65] states, "*An outdoor space known as the 'Sahn' shall be designed in the open air, depending on the available land allocated for mosque construction*." This article is noteworthy as it specifies the location of the Sahn, integrating it as an outdoor area.

5.10 Housing:

Regarding housing, all legislative texts concerning mosques advocate for the inclusion of staff housing. Article 03[66] of Chapter 02 in the 2022 specifications mandates staff housing for principal and national mosques and at least one unit for local mosques." The specifications require a minimum of one dwelling according to Article 03 and three dwellings per Article 114 for the same type of mosque. This discrepancy has led to confusion, prompting a comparison with Executive Decree no. 13-377 from 2013, referenced in the footnote, and the 2022 specifications regarding the number of on-call housing units, detailed in the table below.

Table 1. 5 Number of housing units required in the 2013 decree and the 2022 specifications

(Source: author)

<table>
<tr><td></td><td colspan="4">Type of mosque</td></tr>
<tr><td>Number of units required</td><td>principal</td><td>National</td><td>Local</td><td>Neighbourhood</td></tr>
<tr><td>According to Executive Decree No. 13- 377 The year 2013</td><td>02 and more</td><td>02 and more</td><td>01 at least</td><td>0</td></tr>
<tr><td rowspan="2">According to the Interministerial order of May 29, 2022, setting the standard specifications</td><td rowspan="2">6</td><td rowspan="2">4</td><td>Three housing (article 114)</td><td rowspan="2">0</td></tr>
<tr><td>01 dwelling at least (article 03)</td></tr>
</table>

The 2022 specifications represent the initial legislative document outlining a quantified program defined in the specifications through quantitative and qualitative parameters for mosques.

[63] In Chapter 04, section 4.8, sub section 4-8-1 of the Interministerial order.
[64] ibid
[65] In Chapter 04, section 4.9, sub section 4-9-1 of the Interministerial order.
[66] In Chapter 04, section 4.2, sub section 4-2-5 of the Interministerial order.

Table 1. 6 Presentation of the mosque's quantitative and qualitative program according to the 2022 specifications.

(Source: Own elaboration with data from the 2022 Interministerial order)

Type of mosque	principal	National	Local	Neighbourhood	principal	National	Local	Neighbourhood
Spaces	**Number**				Surface area **m²**			
Prayer room for men	1	1	1	1	5200	2500	850	85
Prayer room for women	1	1	1	1	1300	300	150	15
Men's ablution room	1	1	1	1	500	200	100	20
Women's ablution room	1	1	1	1	120	40	20	10
School/class koranic/	1	1	1	/	360	240	120	/
Administration/office s	1	/	1	/	160	/	12	/
Meeting room	1	1	/	/	250	120	/	/
Library + Study room	1	1	/	/	300	100	/	/
Maqsura for the Imam	1	1	1	1	20	12	12	12
Call to prayer room	1	1	1	1	20	12	12	12
Multi-purpose hall	2	2	1	/	120	80	40	/
Deposit	4	2	1	1	80	40	20	12
Boiler room-Water tank	1	1	1	1	12	12	12	12
Transformer substation	1	1	1	/	20	20	12	/
Electric generator	1	1	1	/	12	12	12	/
housing	6	4	3	/	600	400	300	/
Total built area					9074	4088	1680	178
Outdoor area, crown area + Car parks					1.814,80	817,60	336	35.60
Total surface area					10.888,80	4.905,60	2016	213.60

5.11 Analysis: In terms of prayer area and several worshippers:

We compared the prayer hall's surface areas and the number of worshippers to determine if these areas were minimal, maximal, or average. This assessment was based on the estimated allocation of 0.75 m² per worshipper, 12% of the total surface area designated for circulation within the prayer hall, and the required number of worshippers for each mosque type. The summarized data is as follows

Table 1. 7 Review of mosque surface program

(source: author)

	Principal	National	Local	Neighbourhood
Prayer room for men	5200	2500	850	85
Prayer room for women	1300	300	150	15
The total surface area of the prayer room	6500	2800	1000	100
Faithful capacity	7626	3285	1173	117
Number of devotees recommended by the specifications	More than 10 000	More than 1000	Less than 1000	/
Actual surface area based on the recommended number of devotees	8400 m²	From 840 to 8399 m²	From 839 to 0	/

Subsequently, we observe that the principal mosque type, catering to over 10000 worshippers, features a prayer hall area of 6500 m² for both men and women.

Our computations reveal that this area can accommodate 7626 worshippers. This clarifies why the specified prayer area for a principal mosque could be deemed a minimum requirement.

In comparison, the national mosque type, serving more than 1000 worshippers, entails a prayer room surface area of 2800 m² for men and women. Our calculations indicate that this space can host 3285 worshippers. This elucidates why the designated prayer area for a national mosque could be considered an average requirement to adhere to, encompassing all variables between 840 m² and 8399 m² for prayer halls accommodating over 1000 but less than 10000 worshippers. On the other hand, the local mosque type, accommodating fewer than 1000 worshippers, features a prayer room area of 1000 m² for both genders. In practice, this area can house 1173 worshippers. This explains why a local mosque's prescribed prayer area could be considered a maximum requirement to meet.

The Neighbourhood mosque type without a defined worshipper count presents a prayer room surface area of 100 m² for men and women. In practice, this space can cater to 117 worshippers. This clarifies why the specified 100 m² prayer area for a neighbourhood mosque could be considered a minimum standard to uphold.

The discrepancy between surface area and worshippers is evident across all mosque types and is particularly noticeable between local and neighbourhood mosques concerning worshippers and space allocation. Both categories accommodate fewer than 1000 worshippers but differ in programs and Friday prayers. This raises the question of classifying a mosque with 800 worshippers as either a Neighbourhood or local mosque.

5.12 In terms of prayer room surface area and other space:

Adopting the new parameter for calculating the space required for a worshipper of 0.75 m² has aided in enhancing the prayer area for both men and women. Consequently, we have implemented the ratios between prayer and ablution areas for men and women.

Table 1. 8 The ratio between surface area and mosque program
(source: Own elaboration with data from JORADP)

Type of mosque	Principal	National	Local	Neighbourhood	Principal	National	Local	Neighbour-hood
Spaces	Surface area in m²				The surface area in the ratio			
Prayer surface	6500	2800	1000	100	6500	2800	1000	100
Prayer room for men	5200	2500	850	85	80%	89.28%	85%	85%
Prayer room for women	1300	300	150	15	20%	10.71%	15%	15%
Men's ablutions room	500	200	100	20	7.69%	7.14%	10%	20%
Women's ablutions room	120	40	20	10	1.84%	1.42%	2%	10%
Outdoor area, Traffic area, Car parks	1814,80	817,60	336	35.60	20% of the total built-up area			

We have observed some confusion regarding the calculation of this ratio, with women's

prayer room space in the neighbourhood and local mosques accounting for 15% of all prayer room space, the principal mosque for 20%, and the national mosque for 10.71%. The latter ratio does not resemble the neighbourhood and local or principal mosques.

Regarding ablution room surface area for men and women, our analysis necessitates identifying a method of calculating surface area or ratio. Consequently, the different ratios range from 1.42 to 10%. (Table 1.8).

5.13 Specifications for mosques

The Interministerial order of May 29, 2022, outlines specifications for mosques. One notable aspect of these specifications is their applicability to mosques nationwide. Another significant feature is the detailed consideration of local and regional peculiarities, particularly in cities along the southern routes.

Several elements directly pertain to architectural typology. Given the paramount importance of our research problem, we will analyse these articles. This analysis will serve as the foundation for our fieldwork and the platform we intend to develop as part of our thesis.

The initial article of Chapter 1, referred to as the "T. O. R"[67] (specifications), emphasizes the universal application of directives to mosques across the country, irrespective of their classification. This implies that the specifications are uniformly applicable nationwide, potentially overlooking regional and local architectural nuances. Nevertheless, efforts are made to acknowledge specific characteristics. For instance, Article 32 in Chapter 04 guides roofing, addressing whether a flat roof should be preferred. Additionally, it considers unique aspects of certain cities, such as utilizing multiple dome for climatic reasons or recommending low ceilings in colder regions.

Article 32 signifies a "legislative" acknowledgment of regional climatic and cultural distinctions without explicitly specifying the regions. It is essential to note that while there are legislative provisions for regional specifications for facilities in general, there is a lack of specificity regarding mosques in the southern regions of Algeria.

6 Town-planning, architectural, and technical regulations applicable to buildings in the southern wilaya s without specifying mosques.

Decree no. 14-27[68] of 2014, about the urban planning, architectural, and technical requirements applicable to construction in the wilayas of the South, addresses specific regional features. It stipulates that the urban and architectural forms proposed must harmonize traditional forms with the contemporary needs of users, encompassing both aesthetic and comfort aspects. This decree applies to the southern wilayas' communes, excluding their capital cities, regarding

[67] Terms of reference
[68] Executive Description no. 14-27 of 1 February 2014 setting out the urban, architectural and technical requirements applicable to buildings in the southern wilayas

land use, built environment organization, and building typology[69]. It also outlines the exterior treatments to be adopted, such as the color and ornamentation of facades, openings, structure, size, and terraces. We present them here in the following table:

Table 1. 9 A summary of decree no. 14-27 of 2014 relating to local specificities about construction and architecture in the southern regions.

(source: Own elaboration with data from of decree no. 14-27 of 2014)

Aspect	Articles of decree no. 14-27		
Color and ornamentation	**chapter 02- section 1- article 15**	**appendix- chapter 02- section 5- article 30**	**appendix- chapter 02- section 5- article 31-**
	page 04 of decree no. 14-27	**page 07 of decree no. 14-27**	**page 07 of decree no. 14-27**
	Color trends ranging from light to ochre are recommended for these localities. The natural color of the traditional material used locally for exterior rendering is recommended. (Art. 15)	The natural color of the material used for rendering is recommended. The light color or ochre, in its various shades from white to red ochre, is recommended in the southern wilayas. (Art. 30)	Facade elements should draw on local references; elements of local treatment and ornamentation can be incorporated into the facades of equipment projects, such as Arcades and vaults, door decorations, and carpentry elements based on local motifs.(Art. 31)
Openings	**Chapter 02- section01- article 12-**	**appendix- chapter 02- section 02- article 16**	**appendix- chapter 02- section 3-article 23-**
	page 04 of decree no. 14-27	**page 06 of decree no. 14-27**	**page 07 of decree no. 14-27**
	West and east-facing windows should be reduced. Minimum surface area for adequate lighting and ventilation.(Art. 12)	It is highly recommended to orient the longitudinal axis in an East-West direction so that windows face North and South. (Art. 16)	Small openings, few in number, can be tolerated on facades exposed to prevailing winds and sunlight. (Art. 23)
Structure and template	**Chapter 01- section 02- article 10**	**Appendix -chapter 02- section 06- article 10**	**Appendix-chapter 03- section 01- article 33-**
	page 04 of decree no. 14-27	**page 07 of decree no. 14-27**	**page 08 of decree no. 14-27**
	By derogation, buildings for professional or administrative use and those intended for a principal function other than housing may have a maximum of 03 built-levels.**(Art. 10)**	The landscape must have an architectural template of 9m for dwellings and 12m for public facilities. **(Art. 32)**	Given the region's seismic and climatic conditions, chain-linked masonry load-bearing structures are highly recommended in the southern wilayas. **(Art. 33)**
The terrace	**Chapter 02- section 02- article 17**	**Appendix- chapter 02- section 03-article 22**	**Appendix- chapter 03- section 02- article 39**
	Page 04 of decree no. 14-27	**page 07 of decree no. 14-27**	**page 08- of decree no. 14-27**
	A suitable device must protect the terrace receiving the most radiation. **(Art. 17)**	Protective measures can be taken including the integration of overhanging roofs, sunshades, adjustable or fixed louver-type shutters, and screens,**(Art. 22)**	Roofs must be either flat terraced or domed. **(Art. 39)**

[69] Article 02 of the executive describes n° 14-27 of 1 February 2014

With the force of decree No. 14-27 of 2014, constructions in the southern wilayas that do not comply with these recommendations will still require a building permit to be issued[70].

6.1 South wilayas, according to a decree dated March 31, 2014

The legislation sets out the urban planning, architectural, and technical requirements applicable to construction in the wilayas of the South. The articles above deal with two crucial points: The wilayas of the South concerned by these prescriptions, including El Oued, and the elements to be considered for regional and local specificities. These are color and ornamentation, openings, structure and size, and terraces. These requirements also apply to mosques.

The legislation is based on Decree No. 14-27 of 2014, followed by an order of March 31, 2014, setting the wilayas of the South concerned by applying urbanistic, architectural, and technical prescriptions applicable to constructions in the South. According to article (Art. 2) of the decree of March 31, 2014, the wilayas of the South concerned by these prescriptions are fixed as follows: Adrar, Laghouat, Biskra, Bechar, Tamenghest, Illizi, Tindouf, El Oued, Ghardaïa except the commune of El Menea Ouargla, except for the daïra of Touggourt including the communes of Touggourt, Nezla, Zaouia El Abidia, Tebesbest. These requirements also apply to mosques, as stated in the legislation.

[70] Article 06 of the executive describes n° 14-27 of 1 February 2014

7 Conclusion

In this academic exploration focusing on mosque legislation and architectural guidelines, a meticulous chronological examination of the legal framework governing mosque construction from 1981 to 2022 has been undertaken. The analysis commenced with a detailed review of crucial legislative documents such as Law no. 08-15 of 2008, Executive Decree no. 15-19 of 2015, Executive Decree no. 20-342 of 2020, and the latest Executive Decree no. 22-55 of 2022. These regulations address crucial aspects, including the regularization procedures for mosques lacking building permits and the protocol for approving modifications by builders with associated penalties.

The legislative landscape surrounding mosques is further delineated by Executive Decree No. 15-19 of 2015 and Executive Decree No. 20-342 of 2020, complemented by the recent Executive Decree No. 22-55 issued in 2022. This latest decree introduces provisions for legitimizing alterations made or planned by builders through the payment of fines, offering a pathway to regularize incomplete constructions in alignment with the decree's stipulations. Moreover, it aims to address architectural inconsistencies in local mosques.

A comprehensive analysis of mosque legislation unfolds progressively, revealing a nuanced evolution in regulatory frameworks over time. Two primary texts currently govern mosque construction: Executive Decree no. 13-377 of 2013 and the Interministerial Order dated May 29, 2022, focusing on specifications encompassing architectural typologies reflecting Maghrebian Islamic characteristics, spatial organization, and functional elements.

As articulated in Executive Decree No. 13-377, the definition of a mosque underscores its significance as the House of Allah where Muslims congregate for prayers, Quran recitation, religious education, and spiritual enrichment. The responsibility for mosque construction is shared among the State, associations, and individuals or entities as outlined in the decree.

The classification of mosques has evolved from historical or national categories to include Jamaâ El Djazaîr, principal mosques, local mosques and neighbourhood mosques following the Interministerial order of May 29, 2022. Emphasis on architectural style mandates adherence to a national character inspired by Maghreb heritage to maintain authenticity and cultural continuity.

The latest Interministerial order, dated May 29, 2022, introduces specifications to standardize mosque typology nationwide while accommodating regional nuances and integrating sustainable development principles. However, challenges persist in classifying mosques based on capacity thresholds, warranting a refined categorization scheme to better align with contemporary needs.

Further research in specific regions like El Oued would provide valuable insights into these regulatory specifications' practical implications and limitations within distinct local contexts.

CHAPTER 2

HISTORICAL MOSQUES: A HERITAGE REFERENCE MOSQUE AND ARCHITECTURAL REFERENCES

1 Introduction

The most recent Algerian legislation concerning the construction of mosques, notably the 2013 decree[71] and the Interministerial order of May 29th , 2022, calls for the adoption of a Maghrebian architectural style or a character inspired by the Maghrebian architectural heritage[72].Furthermore, the 2022 specifications[73] were designed to be applied nationwide, while taking partial account of regional architectural specificities (see Part I, Chapter 1, Article 1 of the specifications)[74] .Thus, we observe architectural and stylistic recommendations that oscillate between generalization and consideration of regional particularities. Moreover, the legislation merely suggests an architectural style, without providing many details or explanations.

Attempting to understand the significance of the Maghrebian architectural style therefore naturally implies a return to the architectural references of historic Maghrebian and sometimes even universal[75], mosques.. We use existing references and writings to better understand the term used in the article[76] concerning the Maghrebian style in Algeria.

This analysis will enable us to compile an inventory and documentary directory of the elements identified and the knowledge relating to this built religious heritage. This inventory and analysis work constitutes a tool and a reference for current legislation. Indeed, data analysis has enabled us to highlight the architectural typology of each mosque, as well as the architectural and stylistic references of each element.

---

[71] Executive Decree No. 13- 377 of November 9th , 2013 on the status of the mosque

[72] Article 2 of Interministerial Order of 29th May 2022 fixing standard specifications related to the typology of construction mosques. Published September 19, 2022

[73] Interministerial order of May 29th , 2022 setting out standard specifications for the construction of mosques. Published September 19th , 2022

[74] article 01 of the specifications states: The purpose of these standard specifications is to establish the type of mosque construction. In particular, they establish the urbanistic, architectural, technical and programmatic standards within the framework of sustainable development for the design of all mosques in the Republic, regardless of their classification, throughout the national territory, in accordance with the national religious referent).

[75] https://www.khanacademy.org/humanities/art-islam/chronological-periods-islamic/islamic-art-late-period/a/arts-of-the-islamic-world-the-later-period accessed 16.02.2021

[76] Article 2 of Interministerial Order du 29th May 2022 fixing standard specifications related to the typology of construction mosques (published September 19th , 2022) and Article 25 of Executive Decree no. 13- 377 of November 9, 2013 on the status of mosques.

2 A brief overview of the main architectural components of mosques in Maghreb and Algeria from the Aghlabid to the Ottoman

For the purposes of our study, we first focus on the dynasties that have marked the history Maghreb and Algeria. The aim is not to retrace the Muslim history of the Maghrebian, but to recall the architectural and even architectonic characteristics of mosques according to the dynasties. We analyse the main historic mosques in the Maghrebian to highlight their characteristics and typologies.

We then turn to Algeria's historic mosques, by region and wilaya, to highlight their architectural and design features. In order to gain a better understanding of the mosques built under previous dynasties and their undeniable value, we have listed several mosques belonging to various dynasties, located in different wilayas and regions of Algeria. These mosques are classified as historic monuments, in the process of being classified, protected in a safeguarded sector or unclassified.

2.1 The AGHLABID

The Great Mosque of Kairouan inherited the site of the first oratory Muslim in the Maghreb.The mosque is hypostyle plan with naves perpendicular to the wall of the Qibla. A wider span along the wall of the Qibla and the wide axial nave underlined by double columns meet forming a T-shaped spatial device(Uluhanli, 2018). It served as an example for most Ifriqiyan mosques spread to the Maghreb, Sicily, Spain and Egypt (Uluhanli, 2018).

The meeting of these two axes determines a square area at the front of the Mihrab above of which a ribbed cupola was erected on trunks. Another dome rises from the middle nave and is the central motif of the facade of the double anterior gallery that borders the courtyard, a kind of narthex that massive wooden doors separate from the actual prayer room. The niche of the Mihrab represents a row of plates with white marble plates and cover the lower wall of the niche.

From the outside, this dome, rests on an octagonal stone drum at slightly concave faces, each of which is pierced in the middle by a window rectangular. The octagonal drum is decorated, in the upper part of each its faces.

The minaret of Kairouan consists of three square towers superimposed. The highest is crowned with a cupola. The lower tower has this peculiarity that the faces are not vertical. An opening door gives access to the staircase that runs around of a central core.

The courtyard extends forward of the prayer hall and its narthex. Two double galleries in the extension of the extreme naves of the room, border both sides of the court(Uluhanli, 2018).

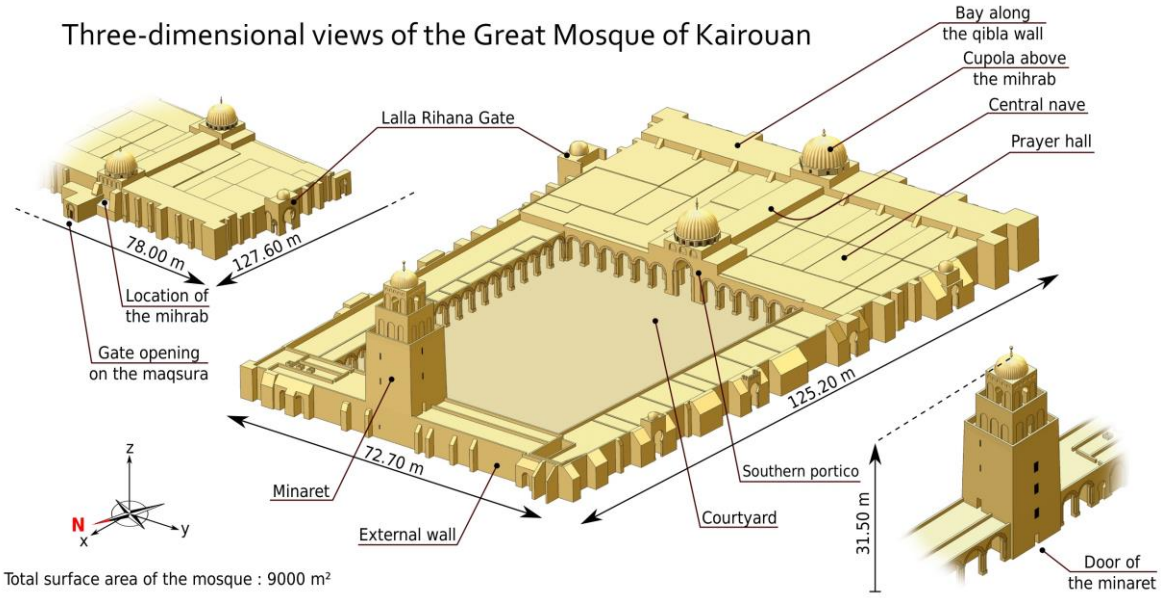


Figure.2 1 The Great Mosque of Kairouan
(Source https://www.khanacademy.org/humanities/art-africa/north-a/x1f9f8bff:tunisia/a/the-great-mosque-of-kairouan)

2.2 IDRISSIDE

There are very few achievements that have been made. Al-Andalus and al-Qarawiyin.The Qarawiyin mosque, according to a plan quadrangular consisting of four naves parallel to the wall of the Qibla, a courtyard, of a Mihrab and minaret. which stood on the opposite side of the Mihrab, almost in the middle of the north façade(Hillenbrand, 1994). The mosque experienced several increases that were made by crystallization around the initial core, the mosque has parallel aisles to the wall of the Qibla. This ordering of Medina type previously adopted in Syria.

2.3 ZIRIDE

The foundation of the Sidi Abu Merouan mosque is located between about 425H/ 1033 under the reign of the Al-Muizz ruler. The prayer room, roughly square (19.3 x 19.64 m), is divided into seven naves perpendicular to the Qibla wall and seven bays. Mosque is built over two levels of caves that could have existed before the mosque itself. The sahn (courtyard) has undergone too many transformations for its original state.

The current appearance of the minaret to those portrayed in old lithographs to get an idea of the changes it has been subjected , points out a small prayer hall that is accessed through the minaret.

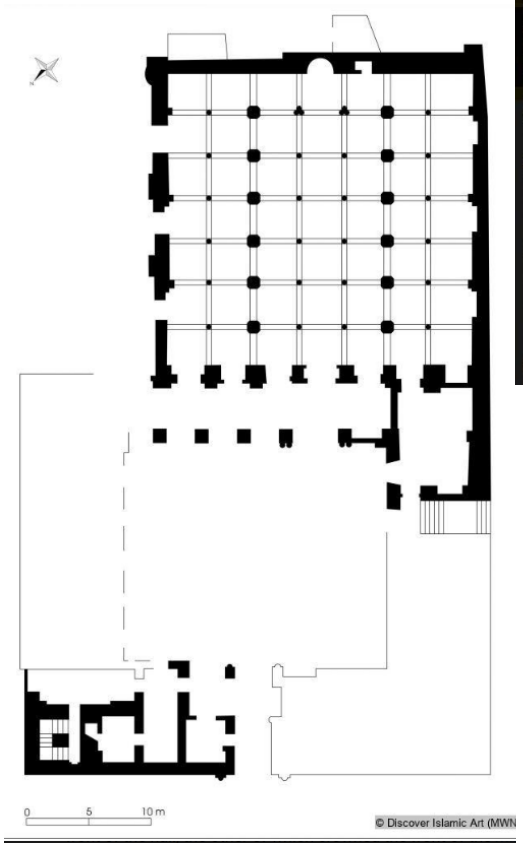


Figure.2. 2 The Abi Marwane mosque
(Source: islamicart.museumwnf.org)

Figure.2 3 Sahn of Abi Marwane mosque
(Source: islamicart.museumwnf.org)

Figure.2. 4 Prayer room of Abi Marwane mosque
(Source: islamicart.museumwnf.org)

2.4 HAMMADID.

The Hammadides dynasty was founded in 1014-1015 AD by Hammad Ibn Bologhine The religious building consists of a large rectangular building of 66 meters by 54 meters in external foothills, of which only the foundations remain. The courtyard, 53.20 by 26.90 meters is surrounded by a portico, whose columns were cylindrical and white marble.

The mosque had a prayer room divided into thirteen naves perpendicular to the wall of the Qibla, separated by arcades on pillars connected to each other by charpentes wooden. A space built of rubble, contains the Mihrab and part of the three rows of columns on either side of the central nave.

In the axis of the Mihrab, included in the north wall, is a minaret built on a square plane of 6.5 m side and height is 25 meters.

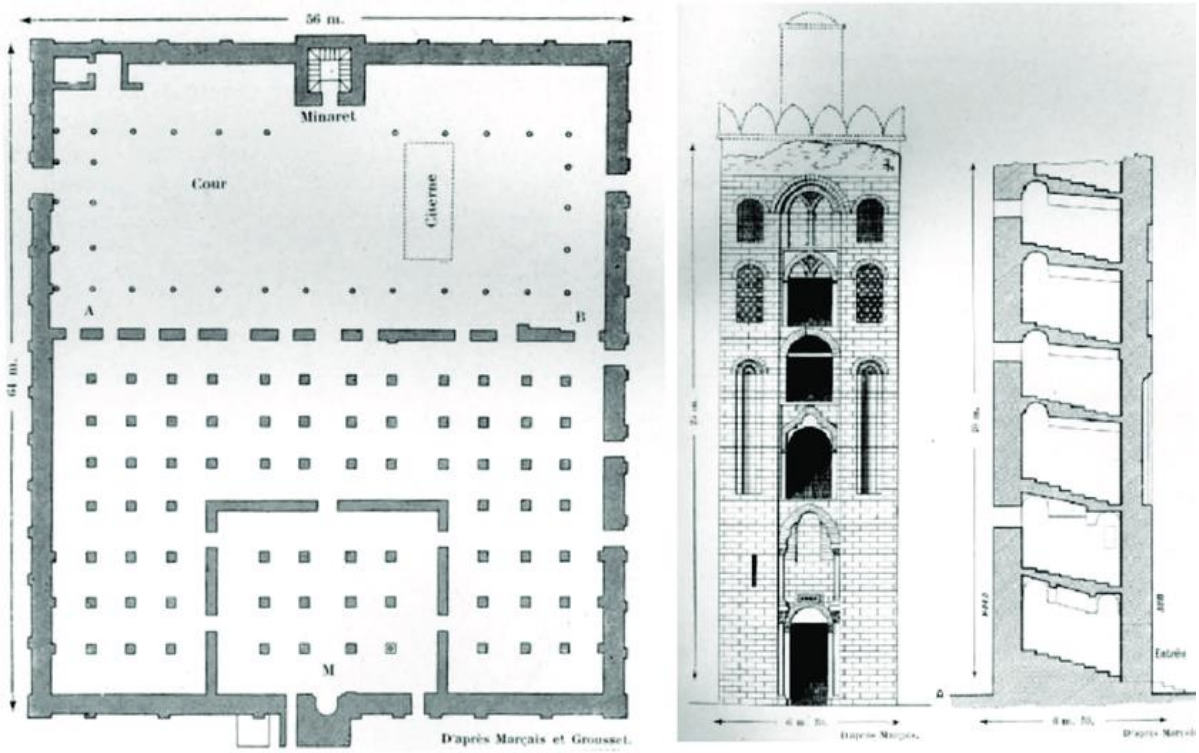


Figure.2. 5 The Kalaa mosque
(Source: Beylié, 1909. Drawings by Georges Marçais and soldier Grousset)

2.5 ZIANIDE.

Tlemcen became the most important commercial hub of the Maghreb under the Zianides, the Zianid rulers built many monuments and evolved Maghreb art in terms of decoration and ornament: the minaret and extensions of the northern part of the Great Mosque of Tlemcen, the minaret of Agadir as well as the Mechouar (Iles & Hamma, 2019)

The mosque of Sidi-Brahim has a room composed of five naves perpendicular to the wall of the Qibla.(Iles & Hamma, 2019) The extreme right and left aisles are covered with crested vaults. The mihrab is preceded by a dome.

The mosque of Sidi Bellahsen with modest dimensions(Iles & Hamma, 2019), richly decorated, covered with a muqarnas dome, It opens with an arch in brass surrounded by a rectangular frame surmounted by three openings furnished with claustra finely opened with rosettes. The dimensions of the minaret are modest.

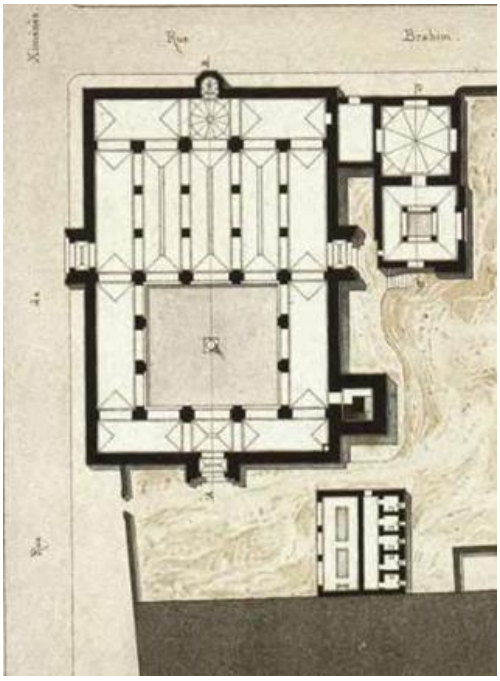


Figure 2. 6. The Sidi Brahim mosque in Tlemcen
(Source :Koumas & Nafa, 2003)

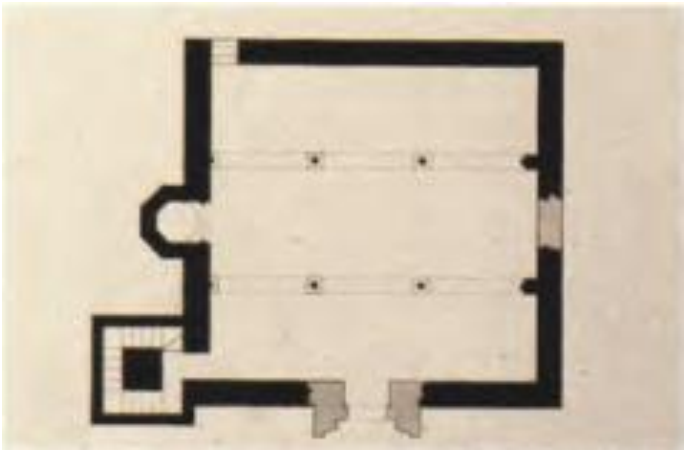


Figure 2. 7 The Sidi Belhsen mosque in Tlemcen
(Source:Koumas & Nafa, 2003)

2.6 MARINID

The Religious architecture of Marinide extends in its broad lines from The great mosque of Fez el Djedid to the expansion of the Taza mosque to the Merinid mosques in Algeria. The Merinid art reserves a special place for religious buildings by building of many mosques and medersas.

The mosque of Mansoura shows a prayer room in a hypostyle form consisting of naves perpendicular to the Qibla wall. The Mihrab, a small piece, is set in a rectangular space protruding from the wall. A large square placed in front of the Mihrab occupies the length of three naves. It is materialized in volume by a large dome placed on a drum.

The minaret is placed in the middle of the north face of the mosque in the Mihrab axis. Quadrangular plan, its height reaches 38 m and its width 10 m. It is one of the greatest minaret of Algeria (Merzoug, 2012) .

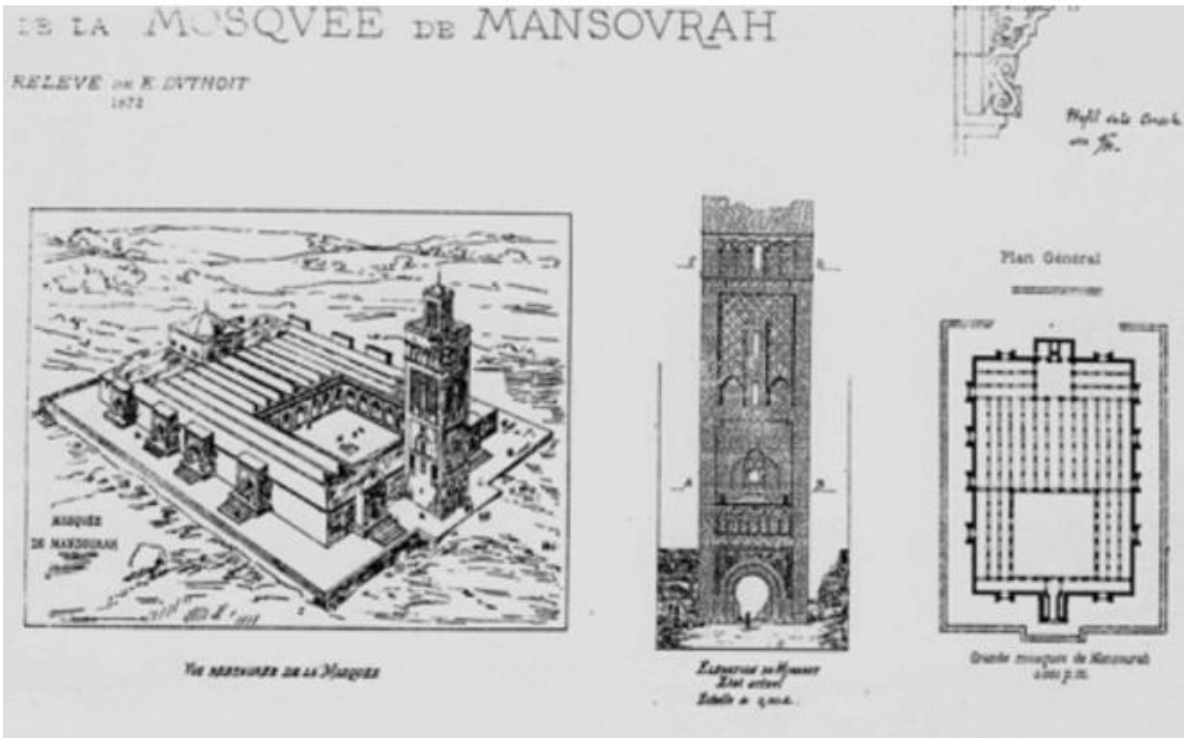


Figure.2 8 Mosque of Mansourah
(Source :Edmond Duthoit 1872)

The Sidi el Halwi mosque is part of the tradition of Merinid mosques, shaped rectangular, it is deeper than wide. Of absolutely symmetrical plan, it measures 17.40 m x 27.50 m. The prayer room is divided by five naves each three meters wide, at the exception of the middle nave, slightly wider which extends to the wall of the Qibla.

The dome of Sidi- el Halwi, are built in wood. The minaret is in a quadrangular shape. Its decoration is composed of panels with diamond-shaped networks carried by lambrequin bows (Merzoug, 2012).

The Sidi Boumediene mosque is organized around a square tower surrounded by a portico. The prayer room is removed at the back of the courtyard. It has five naves perpendicular to the Qibla wall. The naves are separated by broken horseshoe arches resting on pillars based rectangular or redentent. The courtyard is lined on its north, east and west sides with simple galleries with pillars cruciform with horseshoe bows.

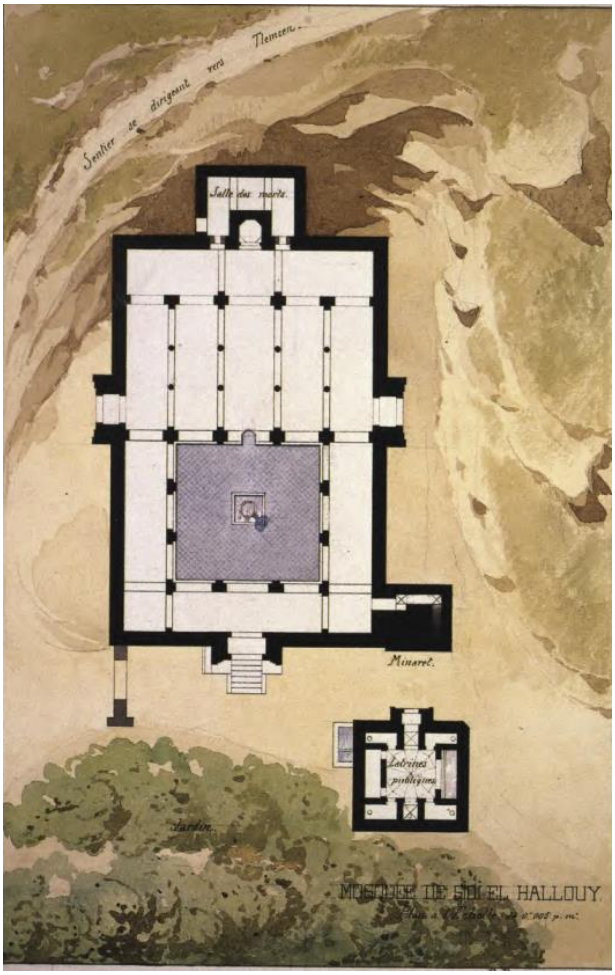


Figure.2. 9 Sidi el Halwi
(Source: Koumas & Nafa, 2003)

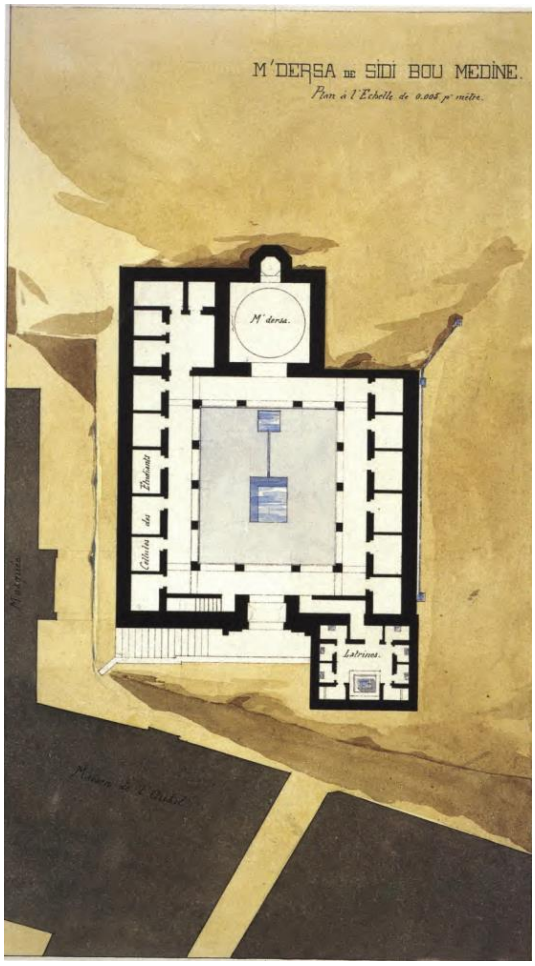


Figure.2. 10 Sidi Boumediene
(Source: Koumas & Nafa, 2003)

2.7 ALMORAVID

In the Almoravid era, a number of elements appear and impose themselves, The use of the ribbed dome. The use of the Muqarnas cupola has Begun to become widespread at this time.

The restitution of The great mosque of Algiers plan would give it a rectangular shape, wider than deep. The latter has eleven naves perpendicular to the Mihrab and five bays. The nave central and the extreme naves are wider than the others and the first span more as the following. The courtyard is twice as wide as deep. It is framed on its two small flanked by two groups of three naves extending the side aisles of the prayer hall. Only one gallery borders the façade[77].

Tlemcen grand mosque, in its current state, has thirteen naves perpendicular to the Mihrab .It is based on five rows of pillars with a central nave wider than the others. Two East-West lines of arches divide the prayer room into two groups of three spans. Next to the Mihrabs opening arches which are round-necked arches, are find broken arcs, lobed arcs and a

[77] Chergui Samia,"Al-Djama al-Adham ou le processus conservatoire d'un patrimoine religieux islamique "in Vie des villes https://viesdevilles.net/file_download/145/article_09_05.pdf

recticurviline arc.

The Mihrab is a niche of polygonal section surmounted by a copulate at sixteen Fluting. It opens with an arch in a rectangular frame, the dome before the Mihrab is very light ribbed of dodecagonal plan whose geometric ribbing doubles as a floral arch. Its basic drum is made up of the Mihrab wall and the arches that span he central nave and the first bay.

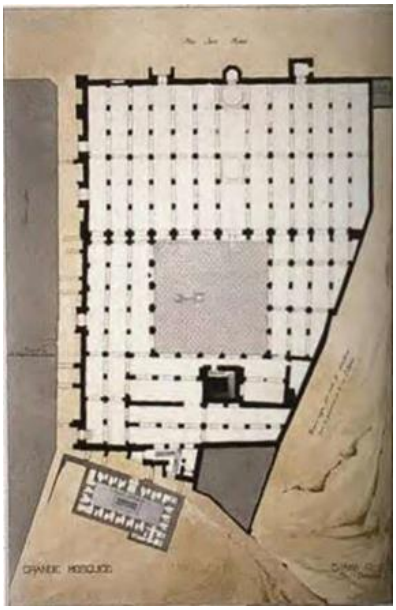


Figure.2 11 The Great Mosque of Tlemcen
(Source: Koumas et Nafa,2003)

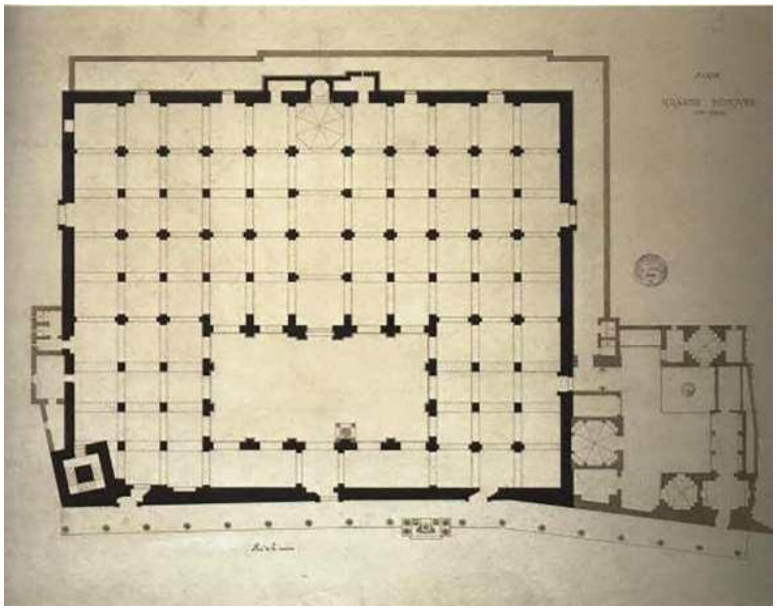


Figure.2 12 The Great Mosque of Algiers
(Source: Koumas et Nafa, 2003)

2.8 OTTOMAN

The influence of the Ottoman Empire, which extended to Algeria from the 16th to the 19th century, was translated into urban and architectural plans, by the construction of several public buildings monumental buildings, especially religious ones.

The essential features of the Ottoman mosque are a plan topped by a large dome supported by half-domes and resting on large pillars. The rectangular courtyard is lined with cuvette galleries. High polygonal or cylindrical minarets that complete the pyramid profile of the whole.

A category of Ottoman mosques has influence at the level of the plan or modes of coverages will be particularly in Algeria. This influence is expressed through the adoption of the central-floor and roofed mosque type in dome with the adoption of octagonal minarets, but also traditional minarets.

Jamaa el Jadid Mosque is one of the buildings of the Ottoman period in Algeria, its foundation dates back to the first half of the 17th century, its plan is basilical, its three naves are perpendicular to the wall of the Qibla and are cut by five spans,with a height of up to 10 m, it is crossed by the wide and high transept preceding the Mihrab, whose crossing is in a

square shape marked at its corners by four pillars and crowned by an ovoid dome(Koumas & Nafa, 2003).

The Mihrab has an octagonal niche. it opens with a horseshoe bow, supported by two semi-engaged columns crowned with scroll columns. The minaret is divided into three parts characterized by the corniche that runs through the upper edge. The whole of the minaret is crowned by a parallelepiped lantern crowned with an octagonal cupolette.

The mosque of Hassan Pasha is a mosque built in 1796, The mosque is designed on a square plan of about 27.50 m of side that overlooks a dome Octagonal drum-shaped, flanked by smaller lower domes and half domes covering of the tubes.

The minaret of the Pasha mosque in Oran consists of two parts separated by a corniche. The lower part is furnished with two overlapping interlaced lobes arches surmounted by a frieze of ceramic tiles. The upper part has two floors of interlaced lobes but it is less wide than the previous one. It is crowned by a corniche on which rests an iron balustrade forged(Arrar, 2014).

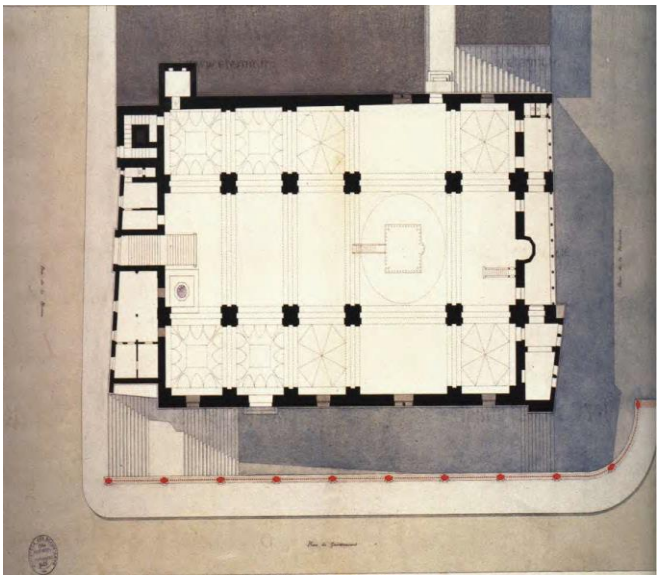


Figure.2 13 Djamaa Jdid
(Source:Koumas & Nafa, 2003)

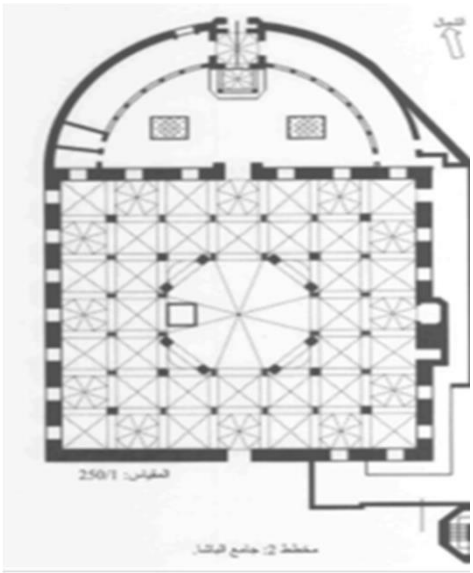


Figure.2 14 The Pacha Mosque
(Source: Boutchicha 2009).

As we see before a rich architectural heritage dating back to the various dynasties that succeeded one another. These dynasties have contributed significantly to the architectural and cultural development of the Maghrebian region, in particular through the construction of mosques in Algeria.

3 Historic mosques in Algeria

Algeria boasts a vast territory with highly diverse climatic and geographical regions. Its long history, marked by significant cultural diversity, is illustrated by its architectural heritage comprising over five hundred (500) objects mainly historic buildings (Benarbia, 2014), one third (1/3) of which are mosques. In this part, we focus on the dynasties that have left their mark on Algeria and on historic mosques by region, in order to highlight the architectural and architectonic elements specific to each area. This analysis has enabled us to compile a sort of inventory or documentary repertory of the architectural and architectonic components of Algeria's built religious heritage.

To more understand this diversity, we have divided the whole region into four main parts according to directions: The north, the south, the east and the west .

The main aim of this study of historic mosques by region is to identify common features between mosques in the same region, as well as distinctive features between those in different regions. The results have been categorized into tables. The first table lists all the mosques classified as historic monuments in Algeria, by dynasty and region, wilaya. We counted twenty-six (26) classified mosques in nine (09) wilayas, distributed as follows: five (05) in Algiers, the capital, seven (07) in Tlemcen, three (03) in Constantine, one (01) in Chlef, four (04) in Ghardaïa, two (02) in Annaba, two (02) in Biskra, and (01) in El Oued.

Table.2 1 List of some historic mosques in Algeria.

(Source: Ministry of Culture https://www.m-culture.gov.dz/index.php/fr/liste-des-biens-culturels)

mosques	Period	Presence	Protection measures and dates	Date of publication (JORADP)
Algiers				
The Grand Mosque of Algiers	1096	Almoravid	Classified as a historic site and monument on 30/03/1887,	N° 07 of 01/23/1968
Djamaa Safir	1535	Ottoman	Classified as a historic site and monument on 13/05/1905,	N° 07 of 01/23/1968
Ali Betchine	1622	Ottoman	Classified as a historic site and monument on April 29th , 1949,	N° 07 of 01/23/1968
Djamaa Jdid	1660	Ottoman	Classified as a historic site and monument on 30/03/1887,	N° 07 of 01/23/1968
Ketchaoua	1794	Ottoman	Listed as a historic monument on 26/03/1908,	N° 07 of 01/23/1968
Tlemcen				
Tlemcen's grand mosque	1136	Almoravid	Classified as a historic site and monument on 18/09/1912,	N° 07 of 01/23/1968
Sidi Belhcen	1296	Zianide	Listed as a historic monument in 04/1904,	N° 07 of 01/23/1968
Mansourah	1303-1336	Marinid	Classified as a historic site and monument in (L.1900),	N° 07 of 01/23/1968
Sidi Boumediene	1339	Marinid	Classified as a historic site and monument in (L.1900),	N° 07 of 01/23/1968
Sidi Haloui	1353	Marinid	Classified as a historic site and monument in (L.1900),	N° 07 of 01/23/1968
Agadir	1364	Idrisside	Classified as a historic site and monument in (L.1900),	N° 07 of 01/23/1968
Sidi Brahim	13 s	Zianide	Listed on the general inventory of immovable cultural property by order of 07/14/2007	N°60of 09/26/2007
Constantine				
The Great Mosque f Constantine	1136-1137	Hammadid	Safeguarded sector by Executive Decree no. 05-208 of 04/06/2005,	N° 39 of 05/06/2005
Souk El Ghezel	1730	Ottoman	Classified as a historic site and monument on 27/04/1903,	N° 07 of 01/23/1968
Sidi Lakhdar	1743	Ottoman	Classified as a historic site and monument on 05/01/1905,	N°07of 01/23/1968
Oran				
Pach**a**	1792-1799	Ottoman	Classified as a historic site and monument on 06/08/1952,	N° 07of 01/23/1968
Chlef				
Mosque of Old Ténès	/	Idrisside	Classified as a historic site and monument on 09/05/1905,	N°07 of 01/23/1968
Ghardaïa				
Ghardaïa's old mosque	1048	Ibadite	In the protected sector by Executive Decree no. 05-209 of 04/06/2005	N° 39 of 05/06/2005
The great Bennoura mosque	1349	Ibadite	In the protected sector by Executive Decree no. 05-209 of 04/06/2005	N° 39 of 05/06/2005
Beni isguen	1321-1347	Ibadite	In the protected sector by Executive Decree no. 05-209 of 04/06/2005	N° 39 of 05/06/2005
Guerrara	1040	Ibadite	Listed on the general inventory of immovable cultural property by order of 07/14/2007	N° 60 du 6/09/2007
Annaba				
Abi Merwane	1033	Ziride	Listed as a cultural asset by decree of 21/01/2015	N° 08 of 15/02/2015
Saleh Bey	1792	Ottoman	Listed on the general inventory of immovable cultural property by order of 07/14/2007	N° 60 of 09/26/2007
Biskra				
Sidi Okba	686	Ziride	Listed on the general inventory of immovable cultural property by decree of 07/14/2007,	N° 60 of 09/26/2007
Sidi Mabrouk	1628	Hafsides	Classified as cultural property by decree of 21/01/2015,	N° 08 Of 15/02/2015
El Oued				
El Adouani	13 s	/	Demolished (not classified)	
Sidi Messaoud	1597	/	In the protected sector by Executive Decree no. 11-140 of 28/03/2011	N° 20 du 30/03/2011

Admittedly, this work of assembling architectural and architectonic elements specific to heritage mosques, classified by dynasty, is not unprecedented. However, our research is based on this collection of data in order to contribute to the development of legislation on the architectural typology of mosques on a national scale. The Maghrebian style, sought here through this heritage and these listed mosques, is to be identified.

So, our main question, in relation to the 2013 legislation[78], is as follows: Is the national heritage conceived as an architectural reference by the legislator and sufficiently unified throughout the national territory to serve as a unifying criterion?

To answer this question, we have chosen to analyse the historic mosques listed in Table 1. This analysis was carried out by wilaya, then by dynasty. Mosques from nine wilayas in four regions were examined[79],: the South[80], the Central region with the wilayas of Algiers, the Eastern region with the wilayas of Constantine and Annaba, and the Western region, including the wilayas of Tlemcen and Oran. The aim was to determine whether the typology of historic mosques in Algeria depends more on regional specificities or on the architectural style specific to each dynasty.

We consulted many previous works[81] that had already dealt with these buildings. We studied the various spaces: the prayer room, Mihrab, minaret, dome, sahn, and arches, referring to the architectural and architectonic components mentioned in the 2022 specifications rule book. This analysis was based on a classification of mosques according to the region to which they belong, taking into account the diversity of builders and construction periods within the same wilaya and region.

3.1 The northern central region

A comparative reading of these mosques, built by different dynasties, has enabled us to identify certain points of similarity and divergence in the elements analysed.

We have identified elements such as the prayer room, which is generally rectangular in shape, wider than it is deep. In Ottoman mosques. The arches present in these rooms vary, while the Grand Mosque of Algiers exhibits a variety of arches. In terms of mosque typology, we find structures with one or more domes. In Ottoman mosques, the dome is often located in the centre,

[78] Executive Decree no. 13- 377 of November 9th , 2013 on the status of the mosque.

[79] five (05) in the capital Algiers, seven (07) in Tlemcen, three (03) in Constantine, one (01) in Chlef, Ghardaïa four (04), Annaba two (02), Biskra two (02) and the wilaya of El Oued two (02).

[80] Ghardaia Biskra and El Oued.

[81] Book and articles will be cited respectively.

while in the Almoravid mosque in Algiers, it precedes the Mihrab.

The Sahn is unique to the Grand Mosque of Algiers, and is absent from Ottoman mosques. However, a typological unification can be observed in the Algiers mosque, where the adoption of a single minaret is common, although its form varies according to the dynasty.

Table.2 2 Historic mosques in central Algeria
(Source: Own elaboration with data from Authors[82])

	Wilaya	Algiers				
	Dynasty	Almoravide	Ottoman			
	The mosque	The Grand Mosque Algiers	Djamaa Safir	Ali Betchine	Djamaa jdid	Ketchaoua
Prayer room	Shape	Rectangular	Square	Square	Rectangular	Square
	Dimension	9.7 X 28.30m		500 m²	39,56 X24.57m	11.5 x11.5m
	Layout	Wider than deep	/	/	Wider than deep	/
	Arc	Polylobed bow/ Offset semicircular arch Slightly broken horseshoe bows	Broken bow	Broken bow	Raised arch	Broken beyond past bow
Minaret	Shape	Quadrangular	Octagonal plan	Quadrangular	Quadrangular	Square/ Octagonal base
	Number	01	01	01	01	02
	Location	The north-west corner	Southwest	North East	North East	
	Height		16.75	26/15	30	
			Low arch niche		Octagonal niche	
Dome	Type	Basket dome			Egg-shaped dome	Hemispheric
	Location	Precedes Mihrab	Central	Central	Central	Central
	Number	Mono			Mono	Multi
Sahn	Shape	Rectangle	/	/	/	/

3.2 The Eastern region:

Our analysis for the Eastern region focused on mosques in the wilayas of Constantine and Annaba, as shown in the table above. These mosques, located in Constantine and Annaba, present a strong dissimilarity due to the diversity of dynasties that have marked the region.

[82] (Barbier, s. d.; Hannache, 2018; Koumas & Nafa, 2003; Marcais, 1954; Menhour, 2012)

Table.2 3 Historic mosques in eastern Algeria
(Source: Own elaboration with data from authors[83])

	Wilaya	Constantine			Annaba	
	Dynasty	Hammadid	Ottoman		Ziride	Ottoman
	mosque	The Great mosque of Constantine	Souk el ghezel	Sidi Lakhdar	Abi Marwane	Saleh bey
Prayer room	Shape	Irregular (Trapezoid shape)	Rectangular	Rectangular	Square	Square
	Dimension	15.40X 19m	19.3 X33.8m	12.60x15.30m		
	Layout	Deeper than it is wide	Wider than deep	Deeper than it is wide		
	Arc	broken/full center /deform at top/ persane	Recticurviline arc bow, Arch with lambrequin	Overshot bow, Broken bow		Round arch, Low arch Bowor basket
Minaret	Shape	Square		Square, octagonal	Square, conical shape.	Square and cylindrical
	Number	01	01	01	01	02
	Location					
	Height	25m		25 m		
Mihrab	Mihrab	Curvilinear niche	Raised arch niche	Low recess	High arch niche	Hexagonal niche
Dome	Type		Eight-sided dome	Eight-sided dome		Hemispheric
	Number		Multi	Multi		
	Location			Central and Precedes the Mihrab		
Sahn	Shape	Rectangle	/	/	/	Irregular

3.3 The Western region:

The Western region covered was Tlemcen and Oran, where we took in the Grand Mosque in Tlemcen, the Mansoura Mosque, the Sidi Boumediene Mosque, the Sidi Haloui Mosque, the Sidi Belahcen Mosque, the Sidi Brahim Mosque, the Agadir Mosque and the Pacha Mosque in Oran.

What's remarkable in this region is the presence of the Sahn in the mosques of the Zianid, Marinid and Almoravid dynasties, as well as in the Ottoman Pacha mosque. This element, shared between different dynasties, suggests that this typology is adapted to the

[83](Hannache, 2018; Koumas & Nafa, 2003; Menhour, 2012; Redjem, 2014)

region's culture and climate. Thus, regional particularity could be seen as a factor influencing architectural typology.

Table.2 4 Historic mosques in Western Algeria
(Source: Own elaboration with data from authors [84])

	Wilaya	Tlemcen					Oran
	Dynasty	Almoravid	Marinids	Zianide		Idrisside	Ottoman
	Mosque	Tlemcen's grand mosque	Mansourah/ Sidi Boumediene/ Sidi haloui	Sidi Belahcen	Sidi Brahim	Agadir	Pacha
Sahn	Shape	Irregular quadrilateral	Rectangular	Square	Rectangular	Irregular quadrilateral	Square
	Dimension	9.7 X 28.30m		10 x 9.70m	15.40X 19m	48/42x39/45	15.95x15.95
	Layout	Wider than deep	Deeper than it is wide	/	Deeper than it is wide	/	/
	Arc	Full horseshoe arch / polylobed arch / broken arch	Broken horseshoe bows/ Horseshoe bows	Overshot bow	Broken bow		Bows Broken Outrepassés
Minaret	Shape	Quadrangular	Quadrangular	Quadrangu lar	Quadrangular	Quadrangular	Prismatic with octagonal base
	Number	01	01	01	01	01	01
	Minaret location	Northwest corner	North in line with Mihrab / Northwest corner / Northwest corner	South_East corner	Northwest corner	North in line with Mihrab	south-east corner
	Minaret height	29,15m	38m / 27.50m / 25.17m	14.25m	16.55	25.60m	20.50
Mihrab	Mihrab	Polygonal niche	Hexagonal niche	Hexagonal niche.			Polygonal section
Dome	Dome	Ribbed					Ribbed
	Location		Precedes the Mihrab		Precedes the Mihrab		Central
	Number		Mono				Multi
Court	Sahn	almost square	Square / Rectangle / Square	/	Square	/	Half-circle
	Exterior courtyard		/		Irregular		/

[84] (ARRAR, 2014; Hillenbrand, 1994; Iles & Hamma, 2019; Koumas & Nafa, 2003)

3.4 The Southern region

Our analysis for the southern region focused on mosques in the wilaya of Ghardaïa (Ghardaïa mosque, Bennoura mosque, Beni Isguen mosque, Guerrara mosque), the wilaya of Biskra (Sidi Okba mosque), and the wilaya of El Oued (El Adouani mosque, Sidi Massoud mosque), enabled a comparative reading of the historic mosques of Ghardaïa, Biskra and El Oued. These mosques, although built under similar climatic conditions, have similarities and differences due to the different players involved in their construction.

Prayer halls are generally rectangular or irregular in shape, often due to successive extensions, with particular adaptation to the topography of the site.

As far as the minaret is concerned, a single pyramid-shaped minaret(Zerari et al., 2020), starting with a quadrangular base and stiffening towards the top, is a common feature between the M'Zab (Ghardaïa) and Ziban (Biskra, El Oued with the El Adouani mosque) regions. This pyramidal minaret construction technique is a characteristic feature shared throughout southern Algeria, dictated by the building techniques and materials specific to this region (Chabbi, 2007). Notable exceptions are the Ghardaïa mosque.

The dome above the prayer hall varies in shape, from hemispherical to faceted. However, these domes generally occupy the same position above the prayer hall, preceding the Mihrab. It's important to note that in Ibadite mosques, the dome takes on a different shape, called a "chebek" [85], a feature specific to the houses(Beloucif et al., 2019) and mosques of Ghardaïa. What's more, some of the historic mosques in this southern region, such as the Beni Isguen mosque.

The Mihrab, meanwhile, varies between semi-circular and curvilinear shapes. both inside and outside the mosque, due to successive extensions. Finally, the outdoor spaces take two forms: a typical Sahn inside the mosque's enclosure, and outdoor courtyards also dedicated to prayer, located outside the main prayer hall.

This analysis of mosques in southern Algeria reveals distinctive features among mosques built at different times and under different dynasties. All of these typologies are adapted to the climatic[86] and cultural (Soltanzadeh, 2015) conditions specific to the region

[85] An opening in the ceiling distributes soft light. closed with an iron grille.

[86] High summer heat

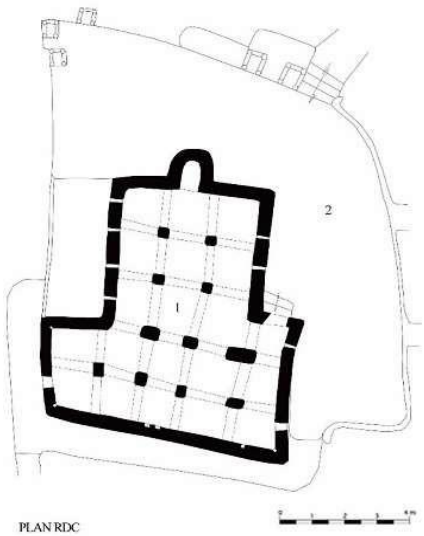


Figure.2 15 The Bâba Waldjimma-Guerdaia funerary mosque
(Source: Ben younes, 2018)

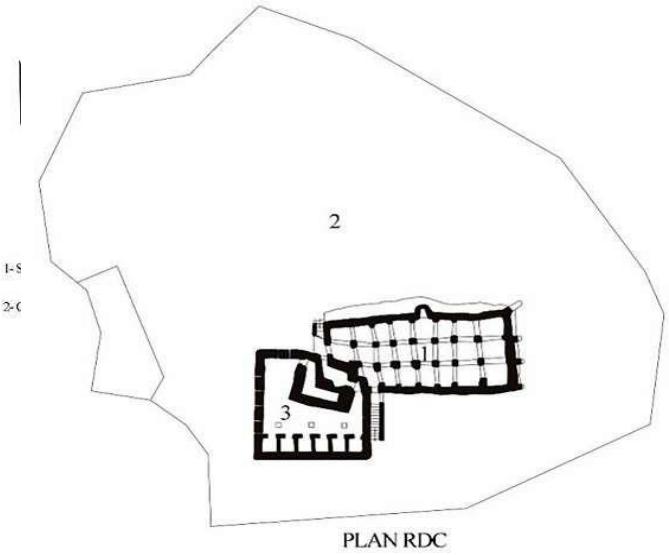


Figure.2 16 The great Bounoura-Ghardaia mosque
(Source:Ben younes, 2018)

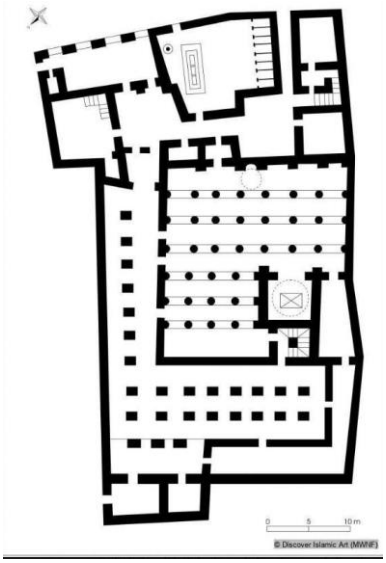
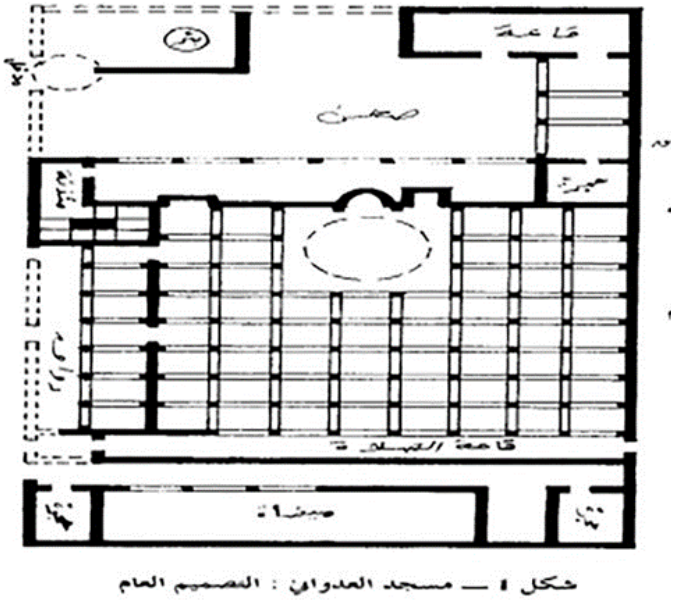


Figure.2 17 [17]**the Sidi Okba mosque**
(Source: islamicart.museumwnf.org)



شكل ٤ — مسجد العدواني : التصميم العام

Figure.2 18 The El Adouni-El Oued mosque
(Source: Chahbi, 2007)

Table.2 5 Components present in historic mosques in the southern region

(Source: Own elaboration with data from authors[87])

	Wilaya	Ghardaïa				Biskra	El oued	
		Ghardaïa	Bennoura	Beni isguen	Guerrara	Sidi okba	El adouani	Sidi Massoud
Prayer room	Shape	Irregular	Irregular	Rectangular	Rectangular	Irregular	Rectangular	Rectangular
	Dimension	955.52 m²	100 m²	1600 m²	1753.43 m²	230 m²	17x18	29.6x23.48
	Layout	Wider than deep	Wider than deep	Wider than deep	Wider than deep	Deeper than it is wide	Wider than deep	Wider than deep
	Arc			Bends	Bends	Overshot arch	Bends	A horse shoe arch
Minaret	Shape	Pyramidal tower	Pyramidal tower	Pyramid tower	Pyramidal tower	Rectangular	Pyramidal tower	Quadrangular
	Number	02	01	01	01	01	01	04
	Location	Northwest	Southwest	Northwest	North angle	The north West corner	North- east	/
	Height/m	23 6.00		22.00	21.90		14	
	Mihrab	Semi-circular		Semi- circular	Raised cavity	Niche Round arch	Curvilinear	Curvilinear
Dome	Type	/	/	/	/	Faceted	Hemisphe ric	Faceted
	Location	/	/	/	/	Precedes the Mihrab	Precedes the Mihrab	Precedes the Mihrab
	Number	/	/	/	/	Multi	Multi	Multi
	Court	Irregular	/	Rectangular inclined	Rectangular inclined	/	/	
	Exterior courtyard	/	Irregular			/	Irregular	/
	Patio	Yes		Yes	Yes			
	Terrace	/	/	Yes	/			

In summary, an analysis of the characteristics of historic mosques in Algeria has highlighted the evolution of architectural and architectonic elements through the different periods of its history. This study shows that the architectural characteristics of mosques vary from one region to another.

The idea of selecting a single, unified mosque prototype seems hardly feasible, given the regional, climatic and cultural peculiarities(Soltanzadeh, 2015), construction techniques and materials used, as well as the vision of the designer.

It is important to note that designers and approvers for new built mosque, who are supposed to respect the legislator's directives dictated in the new specifications, must determine the typology of mosques and their components? Are they capable of designing mosque components that respect both the Maghrebian style, the legislation of the new specifications, and regional particularities without limiting themselves to a single prototype?

The architectural diversity of mosques is a rich source of heritage and reference. It is a

[87] (Ben younes, 2018; Koumas & Nafa, 2003; Shohbi, 2007; Zerari et al., 2020)

source of inspiration that Algerian legislators should consider when defining the typologies to be adopted (Asfour, 2016). However, the diversity of mosque characteristics is not really recorded in a clear and accessible inventory of all typologies, which would be useful for architects, the Ministry of Religious Affairs, researchers and other stakeholders.

4 A digital inventory

Referring to the paragraph above, and starting from the recommendation to "draw inspiration from the Maghrebian character", we felt it appropriate to propose the creation of a referential catalog grouping together some, if not all, of the architectural components of historic mosques(Redjem, 2014). While there may be initiatives to design such a catalog of referential typologies, this project could prove complex and time- consuming.

In this context, it would be a good idea to build on existing work, carried out under the patronage of UNESCO, This inventory covers the historical-architectural heritage of the Islamic period(ARRAR, 2014), which has been influenced or transformed by the spread of Islamic culture over the last fourteen centuries. The inventory covers several regions and countries around the world, including Algeria.

The main objective of this inventory is to make known a significant part of the heritage of humanity scattered across several countries of the three continents forming the Old World. The essential aim of the computerized inventory is to include as many monuments as possible, whether major or minor, known or little-known, well-documented or insufficiently documented, lacking precise information, partially destroyed, reduced to ruins or to archaeological traces.

Monuments are classified on the basis of their belonging to different categories corresponding to typologies progressively invented according to the various requirements and functions encountered in urban life and territorial equipment in Islamic countries. The inventory is based mainly on published works and articles, and is limited to monuments that still exist today or are documented in modern documents.

A number of confidential reports and unpublished theses(Arrar, 2014), as well as lists of listed monuments, small monographic works, and articles from journals published in various places, often with small print runs and limited distribution, edited in all the languages of the three continents of the Old World, are also taken into account as sources for the database of this inventory.

4.1 Structure of the inventory;

Data on Islamic monuments is organized and presented in the form of "Monument cards" (inventory sheets), which aim to represent each monument or monument complex in its entirety, covering all aspects: historical, cultural, political, geographical, topographical, typological, as well as those related to use, architecture, construction techniques and decorative details. Each inventory sheet always includes one or two bibliographical references to indicate the source of the information(Comneno, 2020).

These monument maps, drawn up as part of this computerized inventory, provide chronological, architectural and technical information, while using graphic elements to represent the essential features enabling monuments to be identified and located in their urban or territorial context. All the sources of the information mentioned are clearly cited, making it possible to compile a methodical catalog of data and information from these sources.

The inventory is classified by modern country, grouped into regions according to their geo-cultural affiliation. Within each country, monuments are listed in alphabetical order of the town or village concerned. The monuments of each locality are then presented in a typological sequence, organized as follows: city plans and architectural complexes, religious architecture, civil architecture, military architecture and utilitarian architecture. Each typology is then subdivided into sub-categories corresponding to the different building types.

Table.2 6 Organization of the inventory C e s a d a

(Source: General Inventory of Islamic Architecture: Project rerview,https://www.archnet.org/publications/2480)

Information	Code	Meaning
Code	From 1 to 4127	Monument card code number
Name		As cited by the main source
Typology		Monument type
Type	From 1 to 157	Monument type
City		Code number and name of the most important town in the area, including monument; name of the country and code number and abbreviation; concise map of the country with position of reference points
Local term	From 0 to 462	The name of the type of monument in the everyday language of the place where the monument is located, or deduced from local usage
Dynasty	From 0 to 165	The name of the dynasty reigning in the capital or main city of the state or region where the monument is located
Start and end year_AD		Date of start and finish of construction work, in the double form of the year of our era and hegira
Start and end year Hegira		
Country	From 1 to 227	Name of the town, city, village or isolated site where the monument or complex is located
Reference location	From 0 964	Topographical, geographical toponymal information, such as orientation and distance from nearest main center
Structure_01		Respective standardized information generally concerning the features, monument or parts annexed to the main building
Structure_02		
Structure_03	200 a 565	
Hardware	From 1 to 130	Names of the main materials used in the building
Decoration_	From 1 to 252	Names of the main decorative motifs
Additional information		Additional information is available in the following sections, which can be integrated schematically.
Bibliography	From 1 to 3464	Two bibliographical references, one plus one optional; bibliographical reference code number, surname of main author, year of publication, title of publication, indication of pages (p), possible figure / photos / tables (f), plan or graph (pl).

We were able to use the *General Inventory of Islamic Architecture* database[88] to identify the structure of the inventory system used. This is based mainly on a detailed inventory sheet and a digital database associated with each listed historic monument.

Monument card

Code	3940	Plan ☑ Available Map		☑ Bibliogr. Reference	
Name	GEDIK AHMET PASHA CAMII				
Type	56	mosque		religious typologies	
Loc. term	220	cami			
Dynasty	109	Ottomans			
		1281	Turkey,Near East,Arabia, Egypt,North Africa,Balka		
Date	1472	1473 (A.D.)	877	878 (Hegira)	
Town	Afyon				
Location					
Ref. place	563	Afyon	Turkey	56	(Turk)
Struct. 1	227	rectangular prayer hall			
Struct. 2	407	spiral minaret			
Struct. 3	518	ribbed dome/s			
Material	18	hewn stone			
Decoration	134	carved wood+marble slab			
Bibliography	71	Kuran-1968	p. 144-5 f. 157-9 pl. 156*		
		The Mosque in Early Ottoman Architecture,			
	84	Ayverdi 3-1973	p. 1-16 f. 3-23 pl. 1-2*		
		Osmanli mimarisinde Fatih devri (Fatih period in Ottoman architecture)			
Add. information		founded by Gedik Ahmet Pasha. See Külliye no. 7986			
Compilation	18	y.d.			

Figure.2 19 Monument map

(Source :Comneno, M.A.L, 2020)

[88] General Inventory of Islamic Architecture: Project Overview, https://www.archnet.org/publications/2480

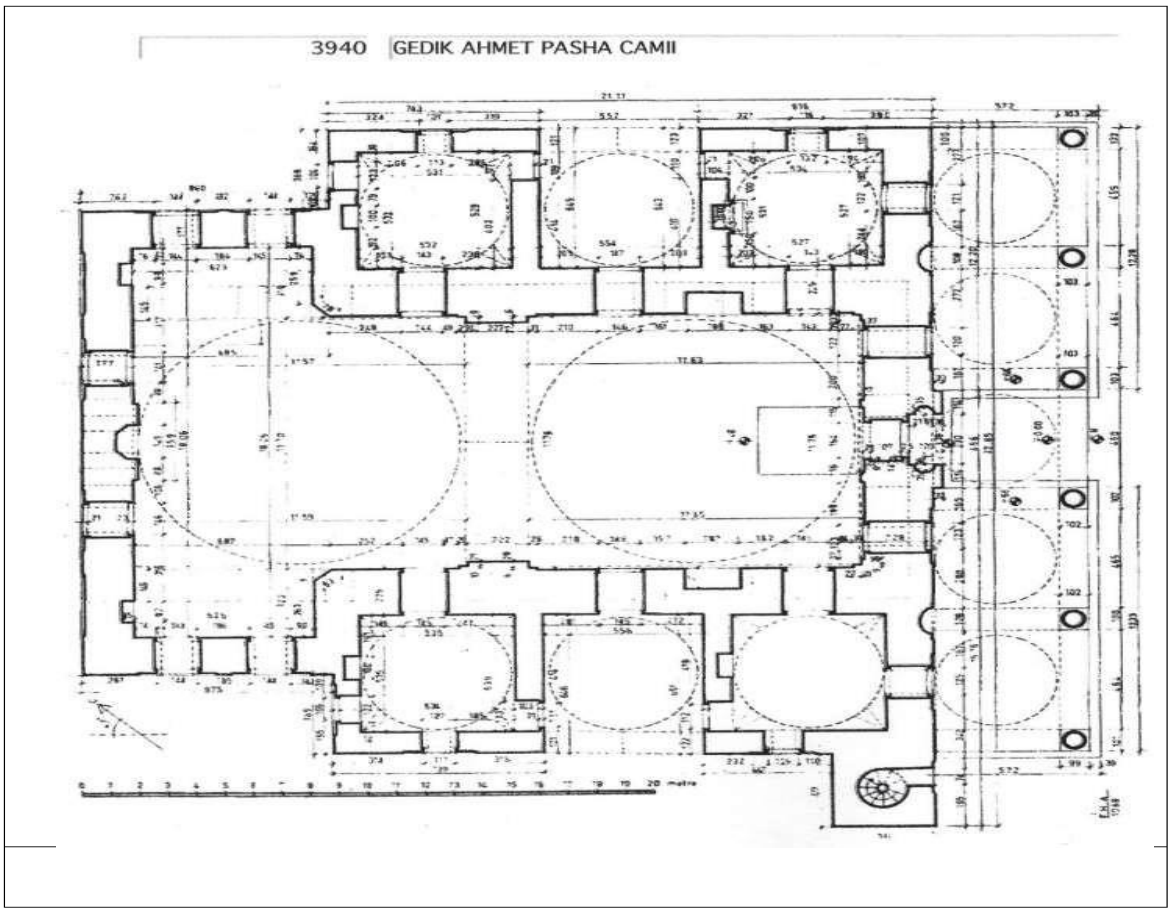


Figure.2 20 Example of a monument plan

(Source :Comneno, M.A.L, 2020)

It's worth pointing out that this inventory system has been adopted in the Algerian context, notably in the research work (Arrar, 2014), who studied four mosques in Oran using this tool. Our own research, focused on the Pacha mosque in Oran, has confirmed the effectiveness of this approach, which is based on a detailed inventory sheet and a digital database.

Our exploration of the Ce.s.a.d.a inventory and its associated database[89] reveals considerable

[89] https://www.archnet.org/publications/2480,General Inventory of Islamic Architecture: Project Overview, https://www.archnet.org/publications/2479 (accessed 02.10.2022).
https://www.archnet.org/publications/2478 (accessed 02.10.2022).
https://www.archnet.org/publications/2477 (accessed 02.10.2022).
https://www.archnet.org/publications/2476 (accessed 02.10.2022).
https://www.archnet.org/publications/2475 (accessed 02.10.2022).
https://www.archnet.org/publications/2474 (accessed 02.10.2022).
https://www.archnet.org/publications/2473 (accessed 02.10.2022).
https://www.archnet.org/publications/2472 (accessed 02.10.2022).
https://www.archnet.org/publications/2471 (accessed 02.10.2022).
https://www.archnet.org/publications/2470 (accessed 02.10.2022).
https://www.archnet.org/publications/2469 (accessed 02.10.2022).
https://www.archnet.org/publications/2468 (accessed 02.10.2022).

potential for the creation of a digital reference directory or catalog. Such a catalog could build on the existing work of the Ce.s.a.d.a inventory.

Further analysis of the minaret and dome studies, in particular using the inventory grid (Table 2.7), has enabled us to identify specific codes associated with the shape and number of minarets and dome. For example, codes 400 to 424 provide a detailed description of this architectural feature of minaret.

Table.2. 7 An example of codes for minaret and dome

(Source: https://www.archnet.org/publications/2480,General Inventory of Islamic Architecture: Project Overview)

	Description of structure 03		
Structure code	**Minaret**	**Structure code**	**Dome**
400	Square minaret	500	Domed
401	Rectangular minaret	501	Domes
402	Cylindrical minaret	502	one Dome
403	Polygonal minaret	503	Two Domes
404	Conical minaret	504	Three Domes
405	Pyramidal minaret	505	Four Domes
406	Helical minaret	506	Five Domes
407	Spiral minaret	507	Six Domes
408	Octagonal minaret	508	Nine Domes
409	Fluted minaret	509	Ten Domes
410	multi-storeyed minaret	510	Dome+one semi dome
411	Square, polygonal minaret	511	Dome+two semi domes
412	Square cylindrical minaret	512	Dome+three semi domes
413	Cylindrical, conical minaret	513	Dome+four semi domes
414	Square, conical minaret	514	Dome on six pillars
415	Conical, polygonal minaret	515	Dome on eight pillars
416	pagoda-like minaret	516	Domed hall
417	small roofed minaret	517	Domed hall+portico
418	wooden minaret	518	Ribbed dome/s
419	staircase minaret	519	Smooth dome/s
420	A minaret	520	Dome/s with geometrical reliefs
421	Two minarets	521	Dome/s with floral reliefs
422	Ottoman minaret	522	Kashi covered dome/s
423	Minaret on mihrab	523	Geometrical kashi dome/s
424	Minarets	524	Floral kashi dome/s

In reality, the minaret and dome is just examples. Exploring other inventory codes would enable us to establish a detailed typology of many other architectural elements of the mosque, such as the prayer hall and courtyards. Exploiting the database devoted to inventoried mosques would constitute a reliable and valuable source for the design of a typological reference catalog(Myers, 2016).

5 Conclusion

The first chapter highlighted the two-fold orientation of the Algerian legislation concerning mosque architecture, the promotion of a unified Maghrebian style and the establishment of a detailed inventory. Based on this observation, our study focused on the analysis of historic Algerian mosques considered as architectural and heritage references.

Our analysis revealed great typological diversity, closely linked to historical, geographical and climatic factors. Thus, we observed significant contrasts between different regions, particularly in terms of the presence or absence of interior courtyards (Sahn) and the shape of arches. These variations can be explained by local building techniques and materials. Similarly, the pyramidal shape of the minaret is a specific feature of the southern region.

This architectural diversity represents a genuine heritage to be preserved and enhanced. It offers considerable potential for inspiring designers and political decision-makers by proposing a wide range of solutions adapted to local contexts. We propose to set up a digital catalogue of this architectural wealth, based on existing (Ce.s.a.d.a) inventory work. This catalogue would constitute a valuable database for all those involved in the construction and restoration of mosques. Finally, in a context marked by the development of digital technologies, this chapter lays the foundations for inventory and database creation work, which will be explored in greater depth in the next chapter of this thesis.

CHAPTER 3

FROM AN INVENTORY TO THE DESIGN A DIGITIZED PLATFORM

1 Introduction:

Since 1999, an Interministerial decree was issued on April 10th , 1999[90], outlining the mosque mapping initiative. The primary objective of this mapping is to establish a structured framework for each mosque at the local, communal, and regional levels.

In 2017, a subsequent decree was enacted on June 29th , 2017[91], defining the format and details of the national mosque database, serving as a tool for cataloguing all mosques across the country. This registry is essential for efficient mosque management. According to Article 9 of the same decree, the Ministry's central services are authorized to conduct technical studies on the information stored in this registry. The national mosque registry mandated by law encompasses the following data points:

- A technical description of the mosque: name, location, classification, capacity
- The legal and material status of the mosque.
- Information about the mosque's outbuildings.
- Mosque staff.
- The mosque's movable and immovable property.
- Topographical and safety plans for the mosque.
- References relating to the person responsible for the construction and equipment.

2 The inventory of the Department of Religious Affairs

To conduct a comprehensive analysis of the architectural typology of mosques, a methodical study was initiated, involving a systematic survey of a region to establish a thorough inventory. This endeavour encompassed visits to mosques selected to form a representative sample comprising one hundred local religious structures[92].

The data obtained from the El Oued and Medea Religious Affairs Departments highlighted a significant gap in the form of an incomplete inventory of mosques. Instead, the documentation primarily consisted of Excel files containing partial information, such as the mosque's name, address, and occasionally its dimensions. Furthermore, there was a notable absence of files and

[90] Interministerial order of 29th May 2022 setting the standard specifications for the type of mosque construction. Published Septembre 19th , 2022

[91] Order June29th 2017 fixing the form and content of the national file of mosques https://www.joradp.dz/FTP/JO-FRANCAIS/2017/F2017057.pdf (accessed 06.10.2020).

plans for several of these religious structures.

Despite the issuance of a decree dated June 29, 2017[93], advocating for the establishment of a national register of mosques, intended to serve as a comprehensive tool for cataloguing all mosques within the national territory, this register was envisioned to ensure effective management of these places of worship. As stipulated in article 9[94] of the decree, the central services of the Ministry are authorized to undertake any technical studies concerning the information contained in the register.

However, even if the creation and completion of this register were feasible. Outlined by current legislation, this National register of mosques encompasses a range of specific data, including:

- A detailed description of the mosque, encompassing its name, geographical location, classification, and capacity.
- The legal and material status of the mosque, covering its legal framework and physical infrastructure.
- Information pertaining to associated outbuildings, such as annexes or related spaces, linked to the mosque.
- Certainly, here's the revised text:
- Personnel responsible for the management and operation of the mosque, comprising managers and administrative staff.
- A comprehensive inventory detailing both movable and immovable assets owned by the mosque.
- Topographical and security plans essential for ensuring effective management of the premises and ensuring the safety of worshippers.
- Documentation identifying the individual accountable for the construction and outfitting of the mosque, facilitating the tracking of the architectural design and arrangement of the religious structure.

3 The design of a digital inventory tool:

After the completion of the data collection phase, we were confronted with a substantial volume of information, comprising fragmented data, photographs, plans, and a significant number of mosques dispersed across a vast and diverse geographic area.

To better manage the collected data, our initial approach involved the utilization of commercially available software. Initially, we employed Excel for data analysis, which proved effective for processing numerical data and conducting calculations. However, we encountered limitations in effectively managing the entirety of the collected data.

This challenge prompted us to conceive a specialized tool tailored to the processing of mosque-related data, aimed at facilitating their organization and analysis. Such a tool would primarily facilitate the compilation of a comprehensive inventory containing general information

[93] Order of 29th June 2017 setting out the form and content of the national file on mosques. https://www.joradp.dz/FTP/JO-FRANCAIS/2017/F2017057.pdf (accessed 06.10.2020).
[94] ibid

about mosques, including plans, photographs, names, locations, capacity, and other pertinent data, drawing inspiration from the aforementioned national register. Its implementation would streamline the centralization of all collected data into a unified platform, enabling simultaneous exploitation and documentation of the information.

Our endeavour to develop this tool prompted us to enlist the expertise of a software developer to translate our idea and concept into a tangible reality. Initially focused on creating an inventory, the necessity to classify and analyse mosque data through this tool naturally emerged. The developer advocated for the adoption of a secure, web-hosted platform and emphasized the importance of preliminary design of the platform architecture.

Following, we recognized the paramount importance of delineating an overarching concept for the platform before delving into its concrete realization. Thus, to give substance to this platform, we emphasized the centralization of all collected mosque data into a singular repository. Drawing from the information contained in the national register of mosques, we formulated a structured mosque inventory sheet comprising five sections: general data, legal aspects, material characteristics, construction history, and potential extensions. These sections will be seamlessly integrated into the platform, offering the flexibility for partial or complete completion for each inventoried mosque, thereby furnishing an exhaustive and easily accessible data repository.

Additionally, we proposed that the platform design should accommodate the inclusion of plans and photographs, which will be housed within the same interface as the inventory sheet. This sheet can be populated in three distinct ways: through predefined selections within the system, via textual input, or through a combination of both methods. Moreover, the inventory sheet will afford the capability to be updated at any juncture to append or modify any requisite information. As previously delineated, the inventory sheet will encompass the following elements:

3.1 General section

This encompasses all the essential general information pertaining to the inventoried mosques, as outlined in Table 3. 1. This information comprises:

- The name of the mosque.
- A unique inventory code assigned to each mosque, facilitating their identification during subsequent searches.
- The mosque address, structured into four fields for completion. This process commences with the selection of the wilaya and commune from predefined options within the system. Subsequently, the precise address is entered in text format. To ensure precision, a designated field is provided for inputting GPS[95] coordinates, to be utilized at a later stage.
- The mosque's location, categorized as either urban or rural, is also specified.
- Lastly, the legislative classification[96] of the mosque is determined and documented.

[95] Global Positioning System

[96]Five classifications that are dictated by Article 13 of Executive Decree No. 13-377 of November 9, 2013 on the status of the mosque, https://www.joradp.dz/FTP/JO-FRANCAIS/2013/F2013058.pdf

Table 3. 1 The material component of the inventory.
(Source:Khoukhi et al., 2023)

Information	Nature					Mode
Mosque name						Text
Registration						Text
Wilaya	From a list of Algeria's wilayas					Choice
Municipality	Based on the List of 1541 Algerian Municipality					Choice
Address						Text
GPS[97] data	Latitude		Longitude			Text
Location region	Urban		Rural			Choice
Classification	History	Principal	National	Local	Neighborhood	Choice

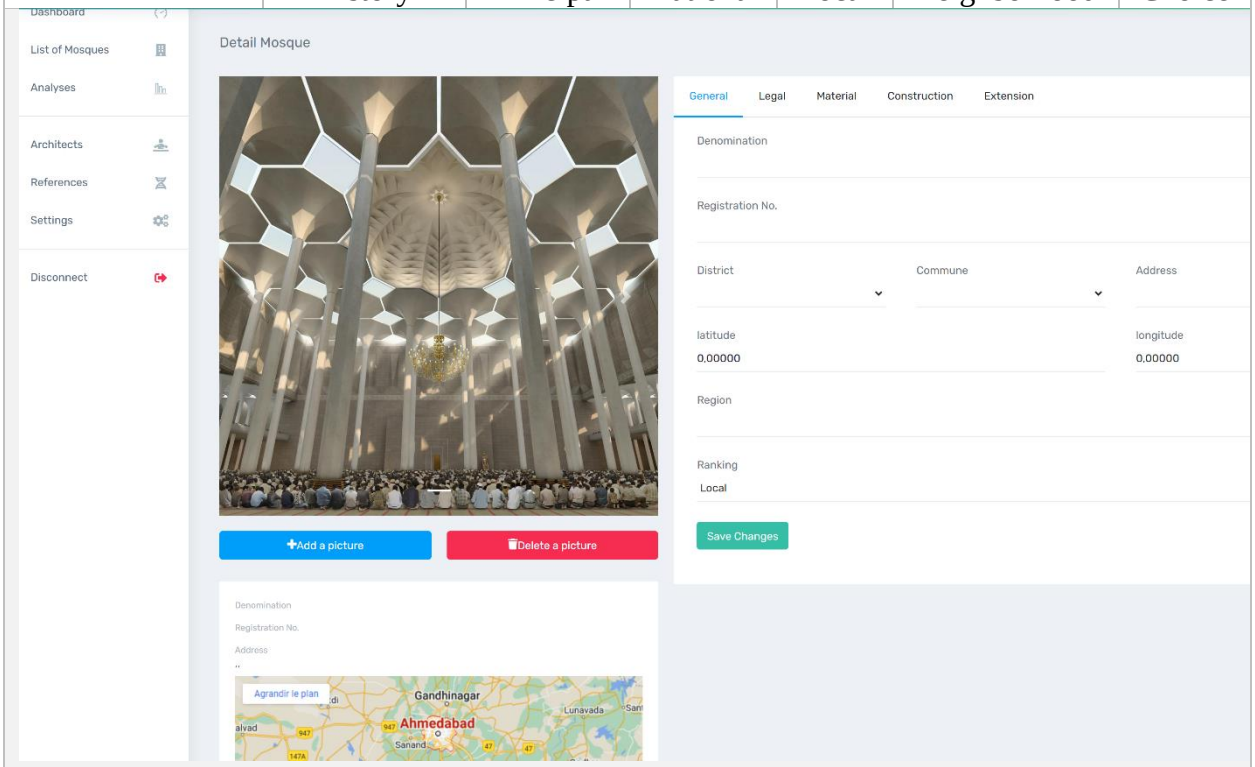


Figure 3. 1 Capture of inventory material
(source: platform screen shot)

3.2 Legal information:

This part of the inventory is dedicated to the legal nature of the land. We have the choice between private or public, we also have the property reference and the authority in charge of construction[98] (Table 3. 2).

[97] who are the States, Religious Associations, Moral and physical person dictated by Article 22 of Executive Decree No. 13-377 of November 9, 2013 on the status of the mosque, https://www.joradp.dz/FTP/JOFRANCAIS/2013/F2013058.pdf

Table 3. 2 Legal aspects of the inventory
(Source:Khoukhi et al., 2023)

Information	Nature			Mode
Legal nature of the land	Private		Public	Choice
land Reference				Text
Title deeds				Text
Construction authority	States	Religious associations	Moral and physical person	Choice

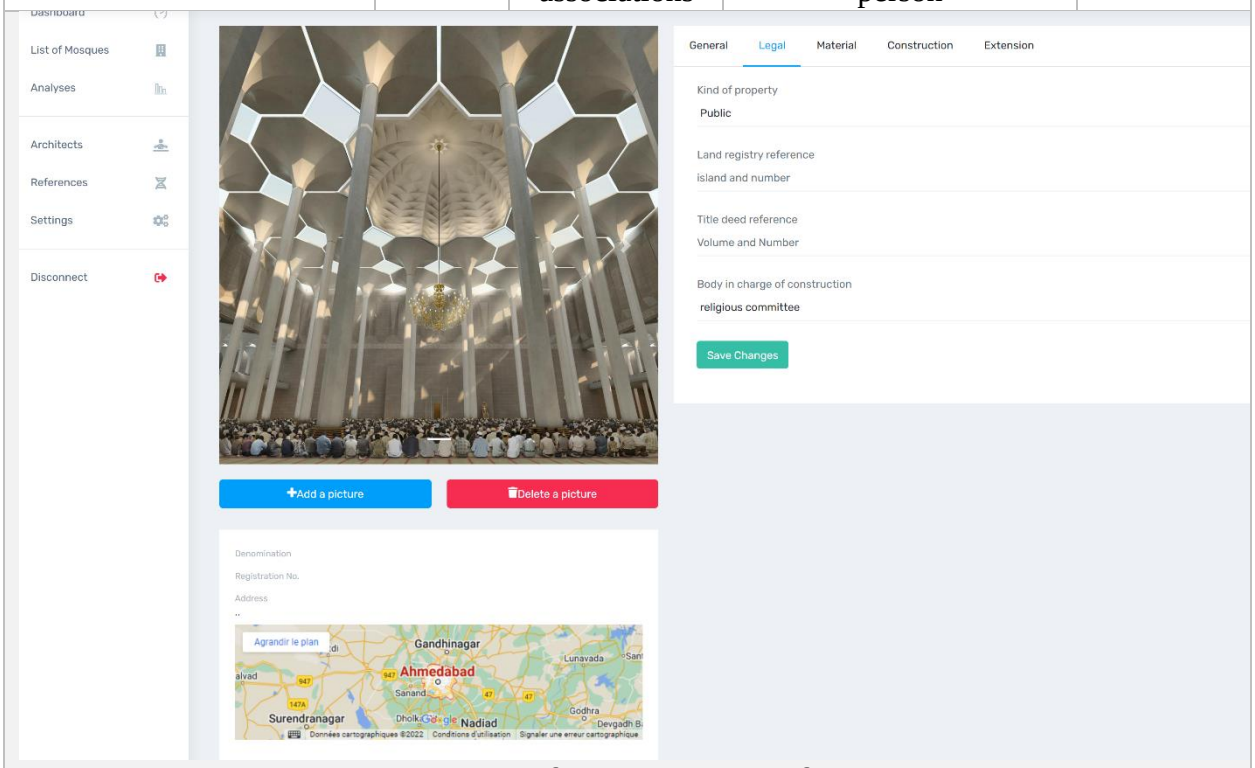


Figure 3. 2 Capture of the legal aspect of the inventory
(source: platform screen shot)

3.3 Equipment section:

This section includes technical information about the construction (Table 3. 3):

- The surface area of the plot and the built-up area, expressed in square meters.
- Specification of the mosque template, with the option of choosing between (S) for a mosque with basement and (R) for a mosque without basement, accompanied by the actual number of existing levels. The total height of the template can also be indicated in meters.
- The total number of entrances to the mosque, as well as the number of disabled entrances.
- The mosque's capacity, expressed in terms of the number of male and female worshippers.
- Construction starts and end dates, to be entered in a digital diary integrated into the system. In the case of unfinished construction, it is possible to leave the end date blank and move on to the box for unfinished work, specifying the percentage of completion.

Table 3. 3 The material component of the inventory
(Source:Khoukhi et al., 2023)

Information	Nature		Mode
Surface area	In M²		Text (number)
Built-up area	In M²		Text (number)
Template	S+ (basement)	R +	Text + choice
Total height	In m		Text (number)
Number of outputs			Text (number)
Number of disabled access points			Text (number)
Male capacity			Text (number)
Women's capacity			Text (number)
Start date			Choice
Construction completion date			Choice
Finished work	Yes	No	Choice
Progress	%		Text (number)

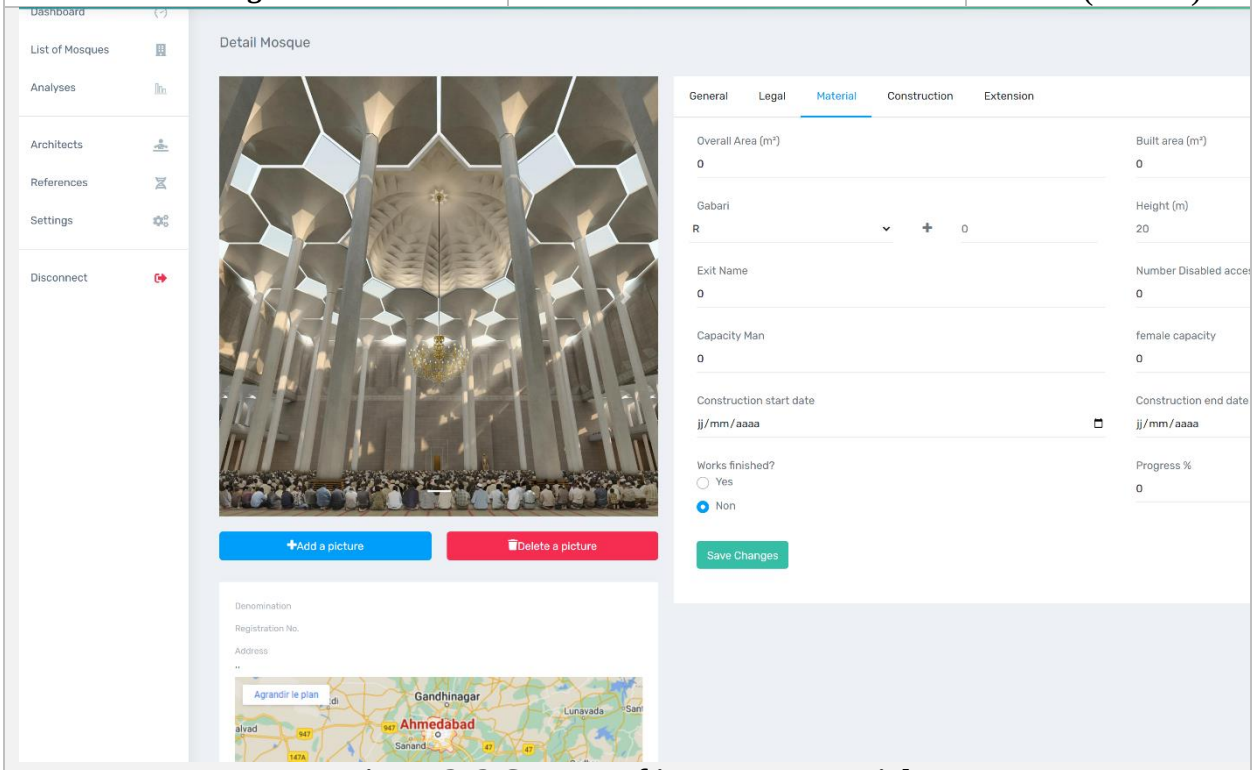


Figure 3. 3 Capture of inventory material
(source: platform screen shot)

3.4 Construction section:

The information presented in this section (Table 3.4) pertains to the stakeholders involved in the planning, supervision, and construction of mosques, namely contractors, architects, and monitoring organizations. It encompasses details such as allocated funds and project completion timelines. To streamline the management of this data, a feature has been incorporated into the platform specifically dedicated to listing architects responsible for the design and oversight of mosque construction projects. Comprehensive data sheets containing all pertinent information regarding these architects have been generated. This data is seamlessly integrated into the

platform's construction system. Therefore, upon completion of the architects' data sheets, users can effortlessly select the corresponding design firm within the construction segment. From there, they can choose the appropriate architect from a pre-established list, streamlining the selection process.

Table 3. 4 The construction part of the inventory
(Source:Khoukhi et al., 2023)

Information	Nature		Mode
Contractor			Text
Name			Text
Address			Text
Contact			Text
Contractor's contract			Text
Financing			Text
Construction time			Text
Design office			Choice
Design date			Text
Design office			Choice
Engineering contract			Text
Approval of civil protection			Text
Opening type	Partial	Total	Choice
Opening reference			Text

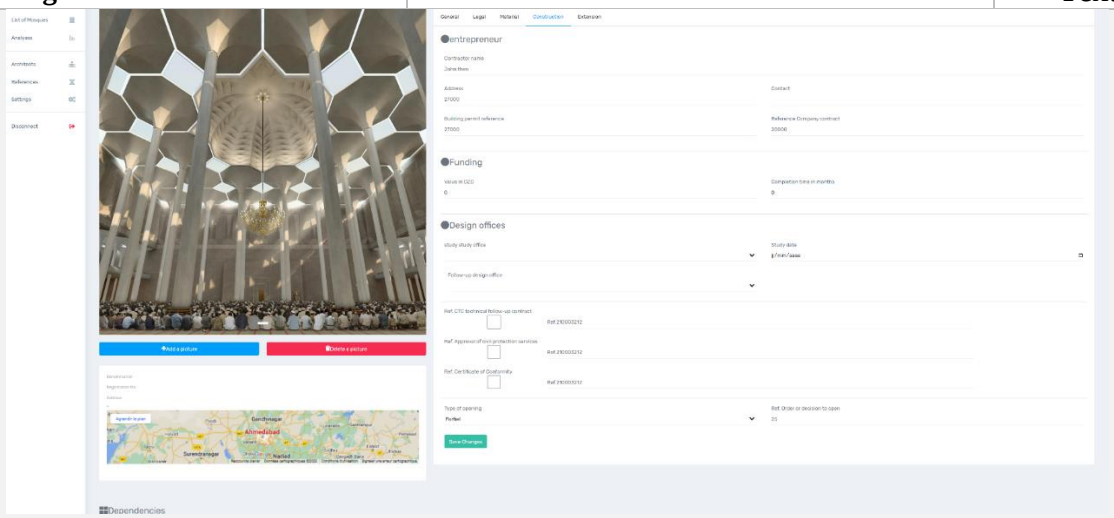


Figure 3. 4 Capture Inventory construction
(source: platform screen shot)

3.5 The extension section:

This section offers the possibility of adding additional information on mosques, in particular on any extensions they may have undergone, whether in terms of land base or built structures. This information can be added at a later date for mosques that have already been inventoried and may have undergone extensions since their initial registration (Table 3. 5).

Table 3. 5 Extending the inventory
(Source:Khoukhi et al., 2023)

Information	Nature		Mode
Extension	Yes	No	Choice
Surface extension			Text
Other extension	Yes	No	Choice
Nature of extension			Text

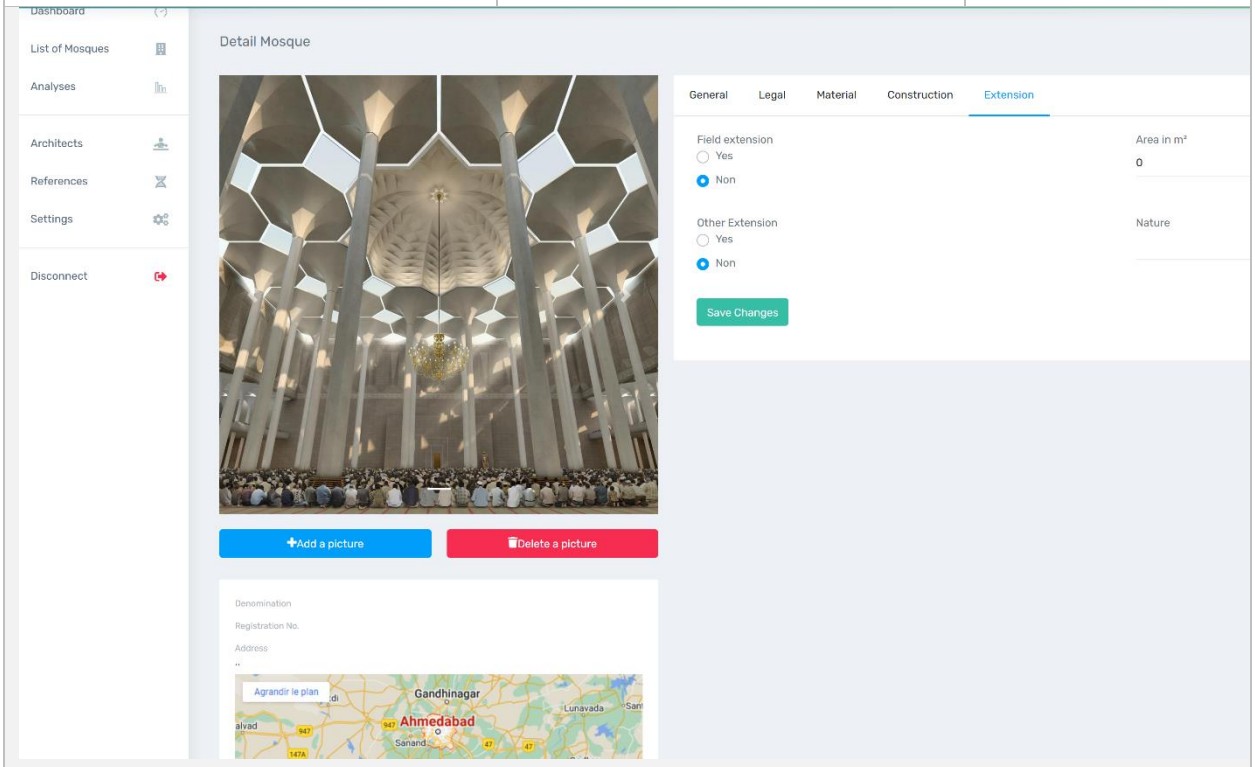


Figure 3. 5 Capture Inventory extension
(source: platform screen shot)

The following is a brief summary of the inventory form for each component. This form (Table 3. 6) sets out all the data to be entered into the platform, and could be used manually before being digitized. This inventory, through this platform, will serve our research and objectives, but it can also form part of a wider digitization and digitalization process, given that recently built mosques can become the heritage of the future(Bousmaha et al., 2018)

Table 3. 6 Complete inventory of the mosque
(Source: author)

Information	Nature		Mode	Section
Mosque name			Text	General
Registration			Text	
Wilaya	From a list of Wilayas		Choice	
Municipality	From a list of 1541 communes		Choice	
Address			Text	
GPS data			Text	
Location region	Urban	Rural	Choice	
Classification	History /National /Local/ Neighbor hood		Choice	
Legal nature of the land	Public	Private	Choice	Legal
Land register reference			Text	
Building authority	States /Religious associations /Moral or physical person		Choice	
Total surface area			Text	Equipment
Built-up area			Text	
Number of levels	S+ (basement)	R +	Text +Choice	
Height			Text	
Number of outputs			Text	
Number of disabled access points			Text	
Male capacity			Text	
Women's capacity			Text	
Start date			Text	
Construction completion date			Text	
Finished work	Yes	No	Choice	
Progress	%		Text	
Contractor			Text	CONSTRUCTION
Name			Text	
Address			Text	
Contact			Text	
Contractor's contract			Text	
Financing			Text	
Construction time			Text	
Design office			Text	
Design date			Text	
Design office			Text	
Engineering contract			Text	
Civil protection approval			Text	
Opening type	Partial	Total	Choice	
Opening reference			Text	
Extension	Yes	No	Choice	Extension
Extension zone				
Other extension	Yes	No	Choice	
Nature of extension				

3.6 Architects inventory

As part of the same work we have enriched this inventory by adding the names of the architects who designed those mosques. This process made it possible to combine all the data base of the mosques and their architect's in one unique platform (Figure 3. 6).

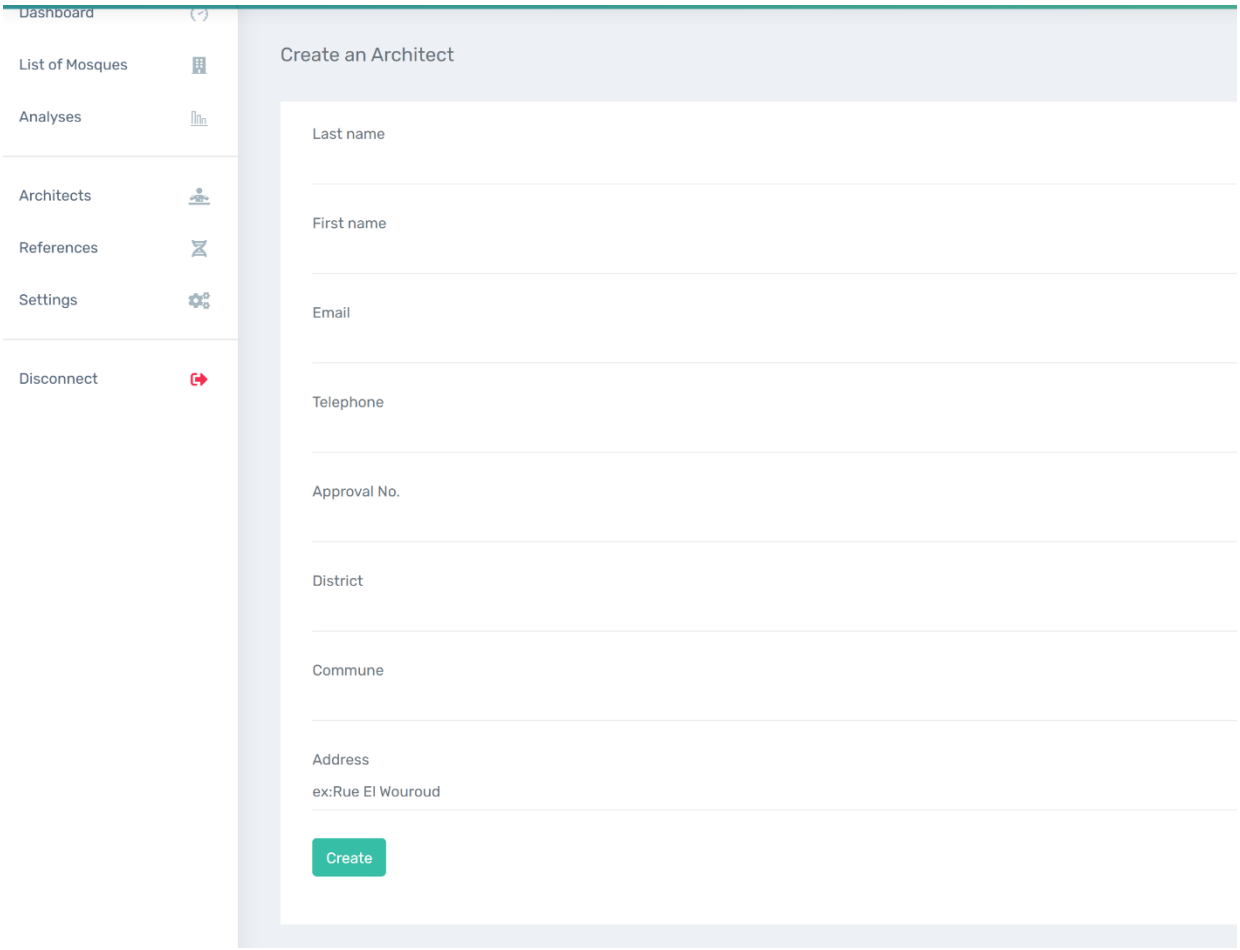


Figure 3. 6 Architects inventory from platform
(Source: platform screen shot)

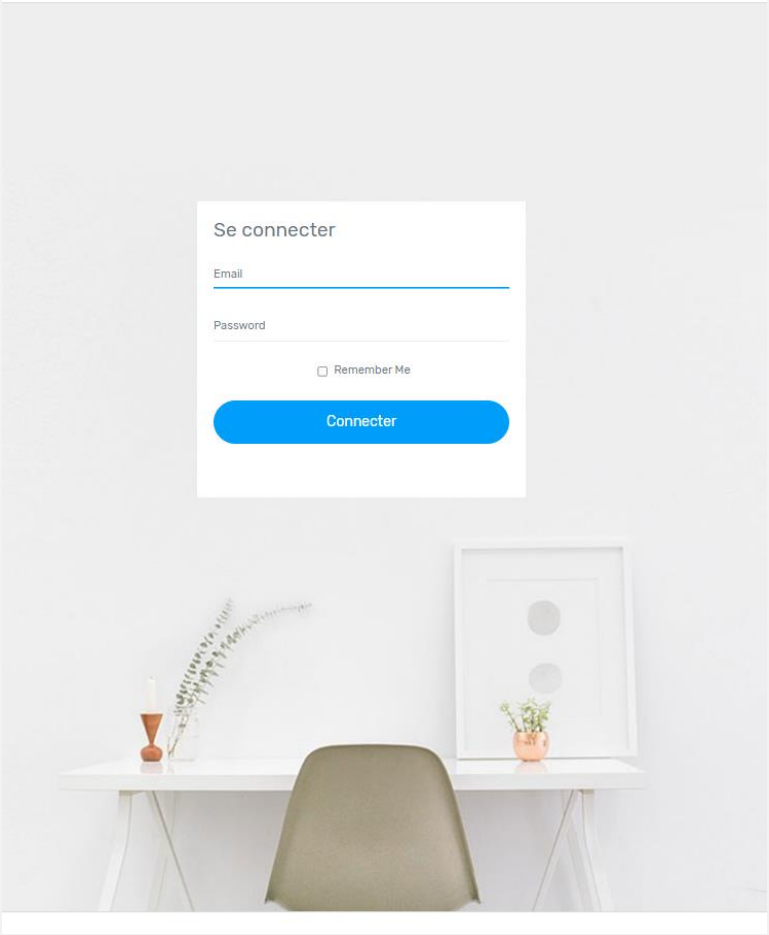
4 Testing the platform as an inventory tool:

The platform was launched online on the Internet. Access to the platform was secured via a username and password system.

Initially, the platform site was functioning correctly, but connection interruptions led to instability on the platform's hosting server. This instability resulted in the total loss of the database and the inventory we had digitized, putting an end to a colossal task. As a result, we decided to change the platform's host and assign it a new domain. The creation of a new domain forced us to restart the data entry process on the platform. However, this unfortunate experience taught us some valuable lessons. This time around, we set up a backup system on the platform, a tool that enables the database to be saved as a downloadable file, which can then be stored on an external drive.

This incident also gave us extra motivation to continue thinking about our research topic and to develop the platform as an analysis tool.

Table 3. 7 Secure access to the platform
(Source: author)

Features	Description
 **Figure 3. 7 platform access point capture.** (source: platform screen shot)	The platform has been hosted on a secure server, where access is by username (email) and a password defined in the platform system.

4.1 Using the platform as an inventory tool:

We commenced the digitization process of all collected data. Upon completion of the inventory, a comprehensive list of all inventoried mosques became accessible(Figure 3. 8). Users can perform primary searches on any mosque using criteria such as name, address, or other pertinent information. This step facilitated continuous monitoring of data digitization progress(Figure 3. 9) and allowed for an initial ranking of mosques. The platform played a pivotal role in expediting data digitization, ensuring efficiency and mobility, while also guaranteeing accurate geolocation of each inventoried mosque as the examples below(Figure 3. 10Figure 3. 11).

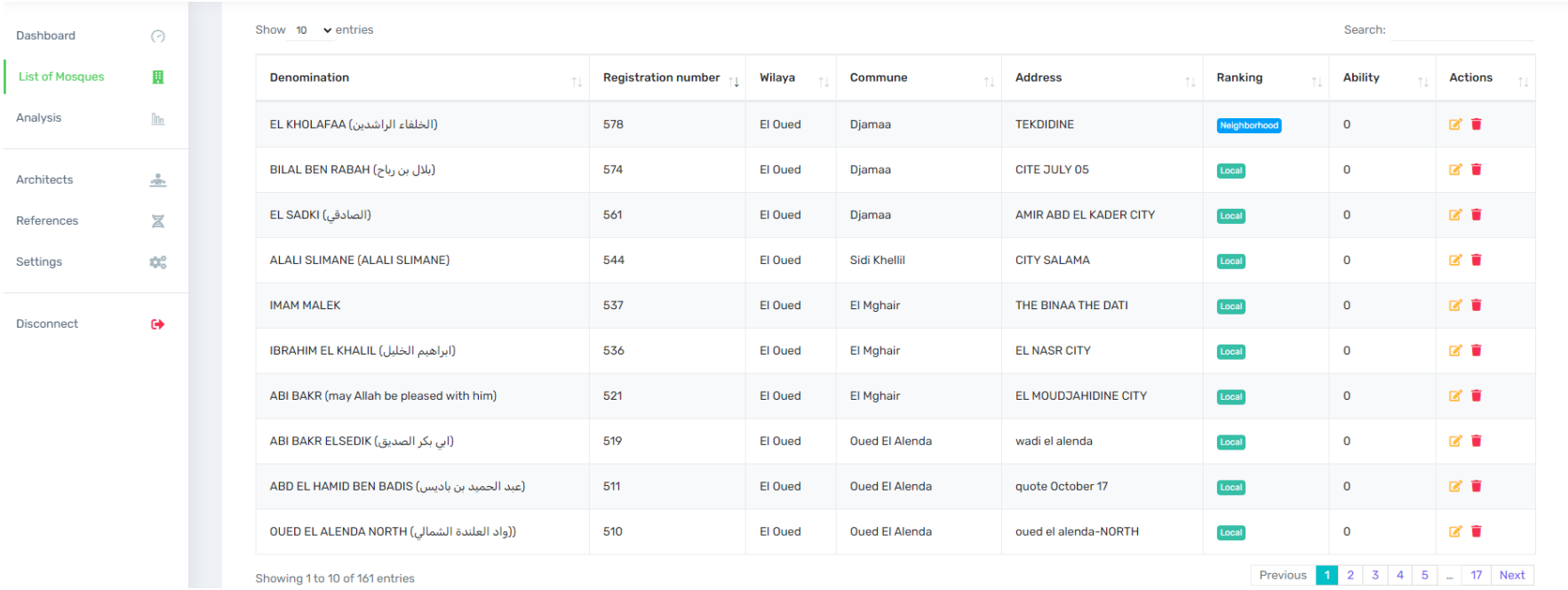


Figure 3. 8 A list of mosques inventoried
(Source: platform screen shot)

Also the platform is equipped with a tool of statistics to have information on the number, type and date of the mosques inventory.

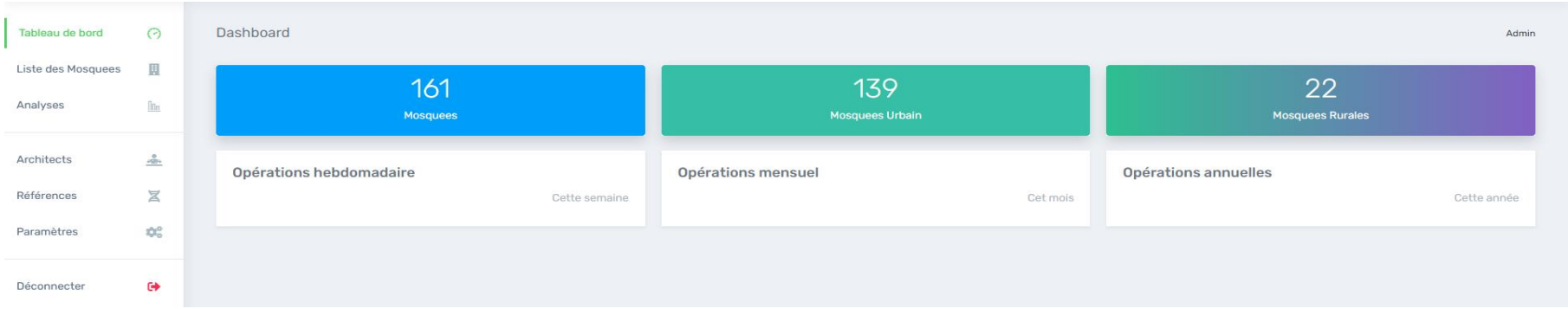


Figure 3. 9 Dash board of platform
(Source: platform screen shot)

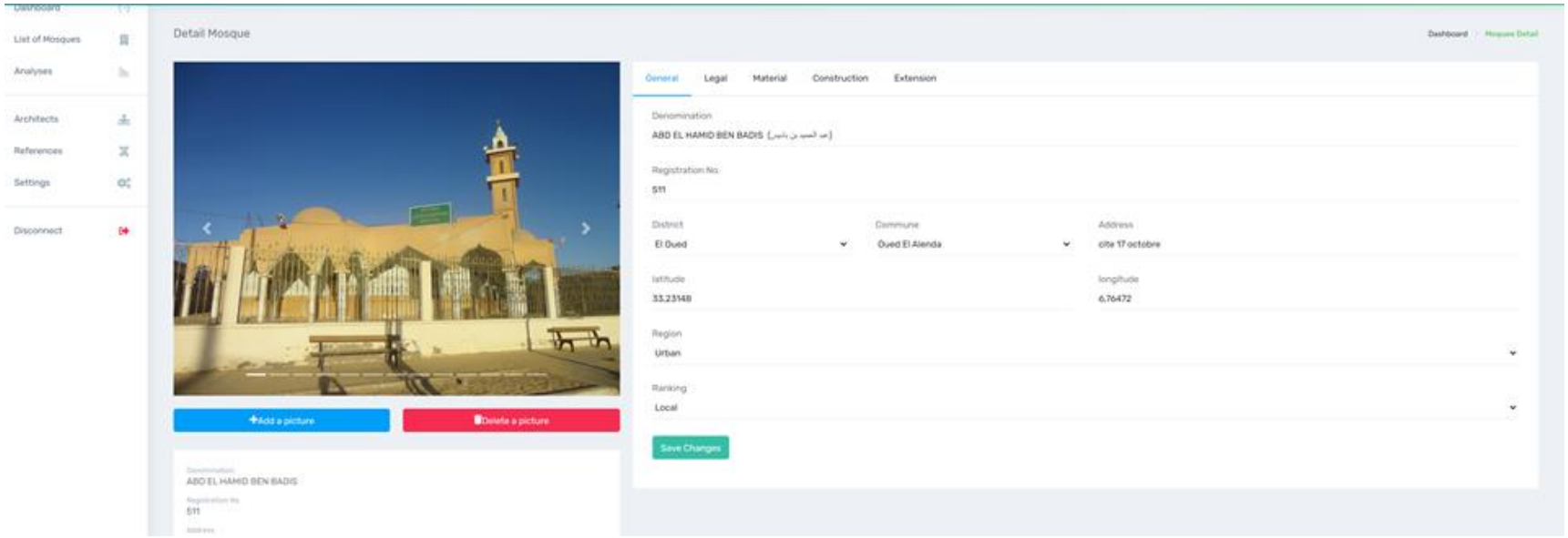


Figure 3. 10 Case of the inventoried mosque of Abd el Hamid Ben Badis
(Source: platform screen shot)

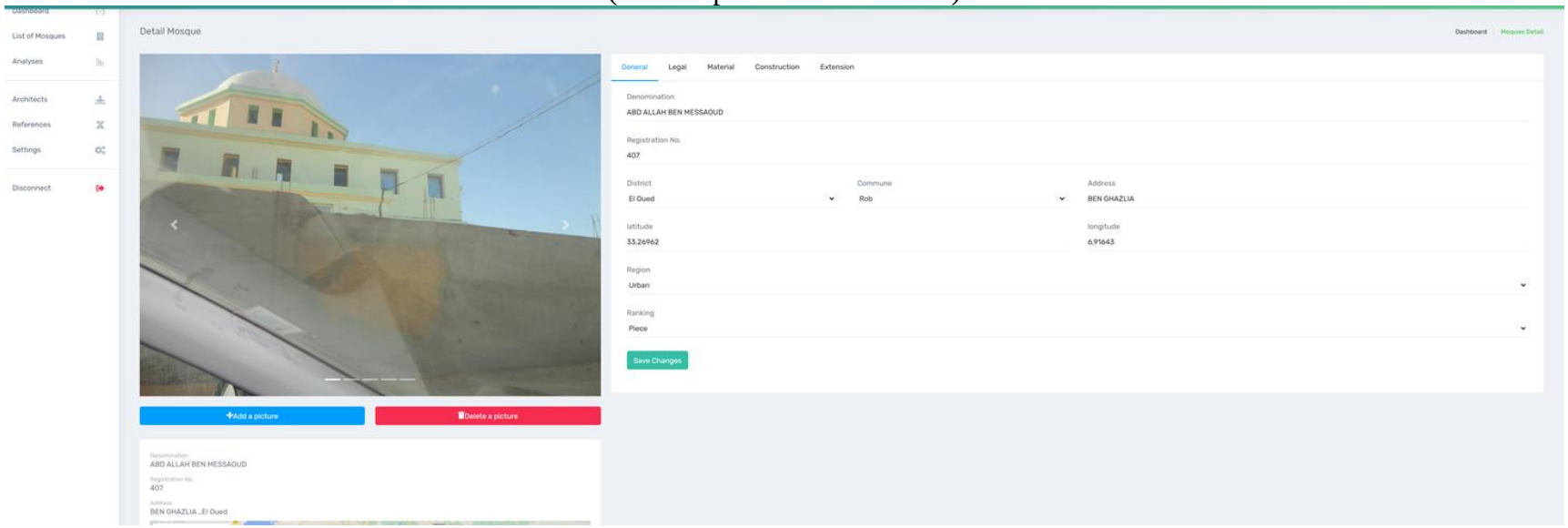


Figure 3. 11 Case of the inventoried mosque of Abd El Allah Ben Messaoud
(Source: platform screen shot)

4.2 Developing the platform as an analysis tool:

Once the inventory has been filled in and completed, a well-structured and organized data warehouse is conceivable, which can help us establish in-depth analyses and advanced classifications(McDonnell et al., 2015). The classification of a building according to (Ekholm, 1996) consists describing its entities in a standardized way in order to define the object of the classification. The purpose of classification is to define its properties. Consequently, purpose and properties are fundamental characteristics of a classification system(Ekholm, 1996).

Several approaches have been tried out to classify mosques. According(Elkhateeb et al., 2018) ,mosques can be classified firstly on the basis of their dominant features. It should be noted that the basis of classification methods lies in the interpretation of the mosque's components. In other words, the typology of each specific character of each component of each mosque is examined for classification, which implies that classification is done by taking into account one or more important details that may have a different value.

Mosque classification determines the properties and nodes of the taxonomy, and different classification objectives can lead to different taxonomies for the same objects(Jørgensen, 2011). As mentioned above, mosque classification is based on the property elements of its components. property of component proportionally influences its own classification as well as that of the mosque as a whole. Consequently, mosque classification remains flexible and interdependent.

This reflect on two concepts: the decomposition of the mosque and the flexibility of the analysis and classification system. The question then arose: how could we apply these two concepts to the architecture of our platform? In other words, how could we decompose the mosque into defined entities and create a flexible analysis system enabling the user or researcher to dynamically define his or her own analysis grid? In other words, classification properties would be dynamically and flexibly defined for any desired classification and analysis.

We have integrated these two concepts into the platform's system architecture. For the decomposition, we referred to the national register of mosques, which lists fifteen mosque related dependencies or components (Table 3.8). We used this list to configure the platform system.

In addition, this national register of mosques includes fifteen mosque-related outbuildings or components.

Table 3. 8 Mosque dependencies dictated by legislation
(Source:Khoukhi et al., 2023)

Dependencies				
Prayer room	Ablutions room	Library	Housing	Koranic school
Koranic classes	Maksourah	Activity area	Green space	Shower
Courses	Minarets	Domes	Stores	Wakfs

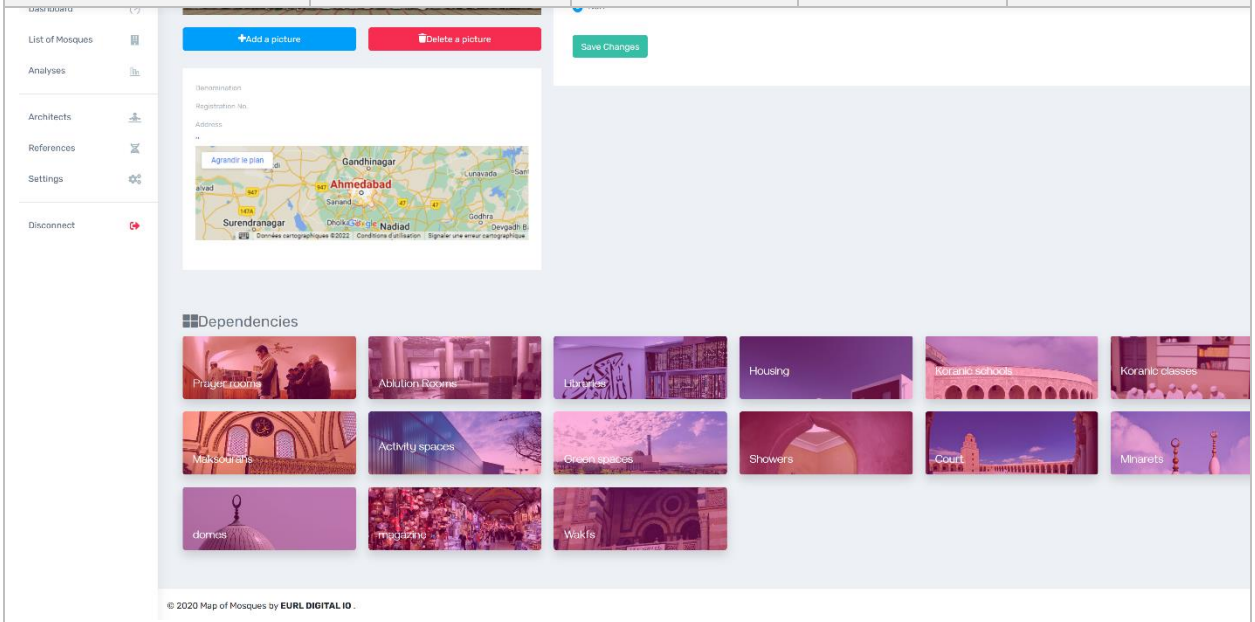


Figure 3. 12 Mosque dependencies dictated by legislation
(source: platform screen shot)

The development of the platform architecture for the inventory and the mosque components resulted in the appearance of the windows for each mosque to be inventoried. Each mosque component has specific properties that lead to the creation of a corresponding analysis grid. Thus, the design of the grid is fundamentally based on the principle of flexibility, allowing the user to create or modify an analysis grid for each component according to classification needs and objectives.

4.3 Design and operation of the platform analysis grid:

The design of this grid is based on two elements (Venkatesh et al., 2013). To analyse a component, it is necessary to create a list of analysis criteria, where each criterion must have a list of analysis sub-criteria. At this stage, we've set the number of criteria to ten, meaning that a component can have up to ten analysis criteria, with an unlimited set of sub-criteria for each criterion. However, it should be noted that these criteria can be updated to extend the number.

To this end, we've created a reference icon for creating and modifying the customized analysis grid. Simply click on the reference icon, then on the component you wish to analyse and classify(Figure 3. 13). Next, we can add analysis criteria and give them a name, choosing between numerical (number) or qualitative (text) criteria. In other words, if the analysis is quantity based, we select a number. If it's descriptive, we choose the (text) option. This option was introduced to

facilitate and broaden the scope of analysis, as illustrated in the example below (Figure 3. 14) for the minaret as a component.

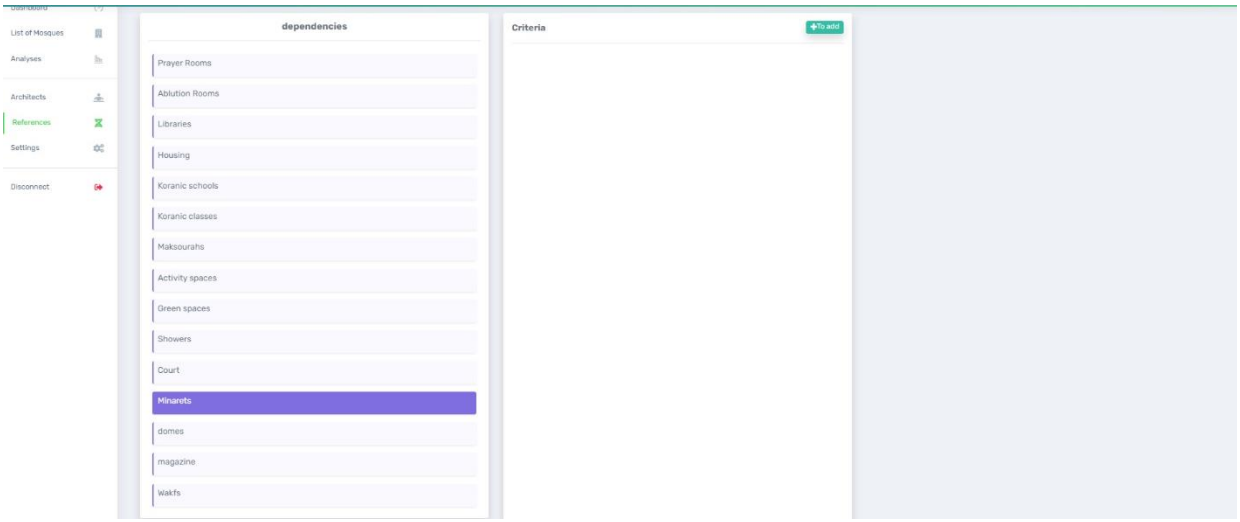


Figure 3. 13 First step of analysis grid creation
(Source: platform screen shot)

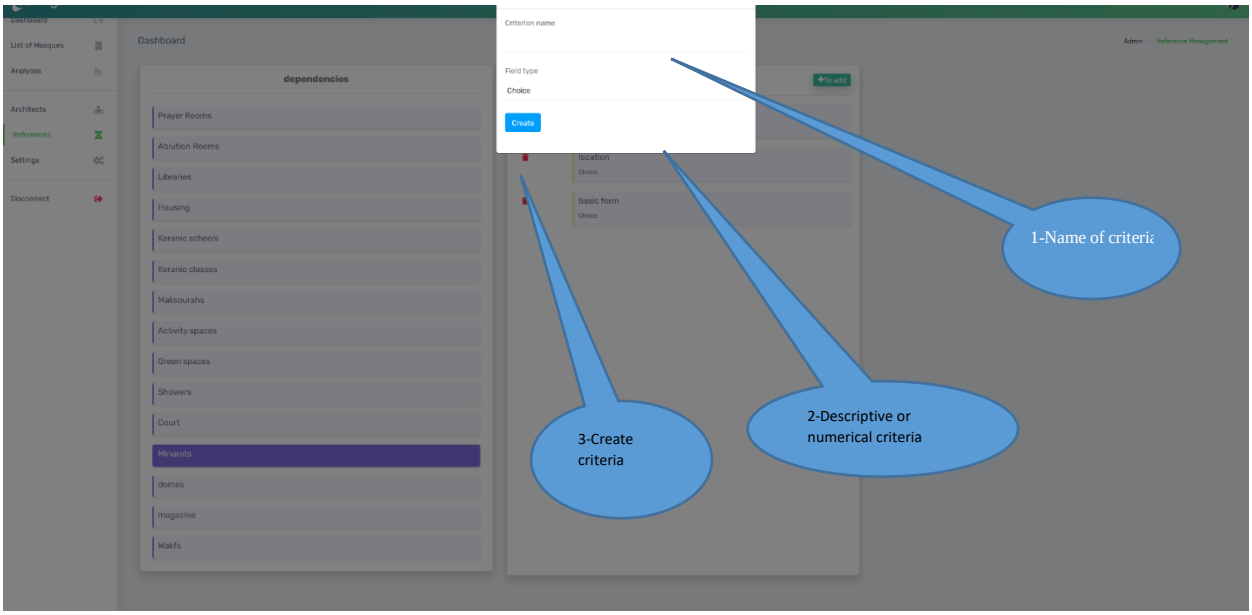


Figure 3. 14 Creation of the criterion for the minaret analysis grid
(Source: Khoukhi et al., 2023)

Once the analysis criterion is established, the subsequent step involves defining the analysis sub-criteria, exemplified by the selection of the minaret for analysis (refer to Figure 8). In this regard, three criteria have been delineated:

1. This criterion is defined as a numerical measure, with the sub-criterion field left vacant initially. The sub-criterion will be populated subsequently using a numerical system tailored to the analysis.
2. This criterion entails determining the geographical placement of the minaret.

3. For this criterion, several sub-criteria options have been proposed, including square, rectangular,

circular, hexagonal, and other shapes. It is noteworthy that this serves as merely one example of creating an analysis grid.

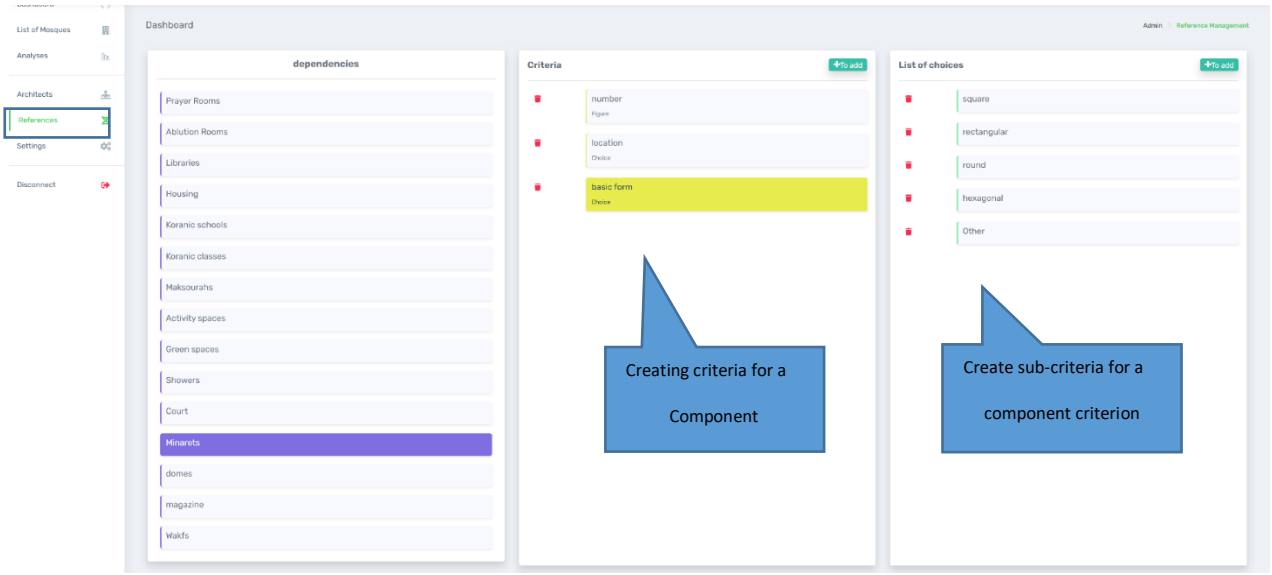


Figure 3. 15 Creation of the criterion and sub-criteria of an analysis grid for the minaret
(Source: Khoukhi et al., 2023)

When configuring a component's analysis grid in the reference section, it becomes a list of choices to be filled in (Figure 3. 16). When returning to each mosque inventory sheet, it is then necessary to select only the appropriate sub-criteria for each criterion and save these choices. It should be emphasized that the flexibility of the platform's system allows the addition of any new criteria or sub-criteria deemed essential for the analysis, or in other cases, the creation of a new analysis grid adapted to the user. The analysis grid can be modified and updated by simply returning to the reference icon.

Once the grid is designed and populated for all the mosques earmarked for analysis, the analysis methodology is executed through the creation of analysis filters. Initially, this involves selecting the component slated for analysis, followed by specifying the criterion, and lastly, choosing the appropriate option. Subsequently, the system automatically identifies all mosques sharing the same analysis filter across all study cases, which proves instrumental in generating precise and focused information.

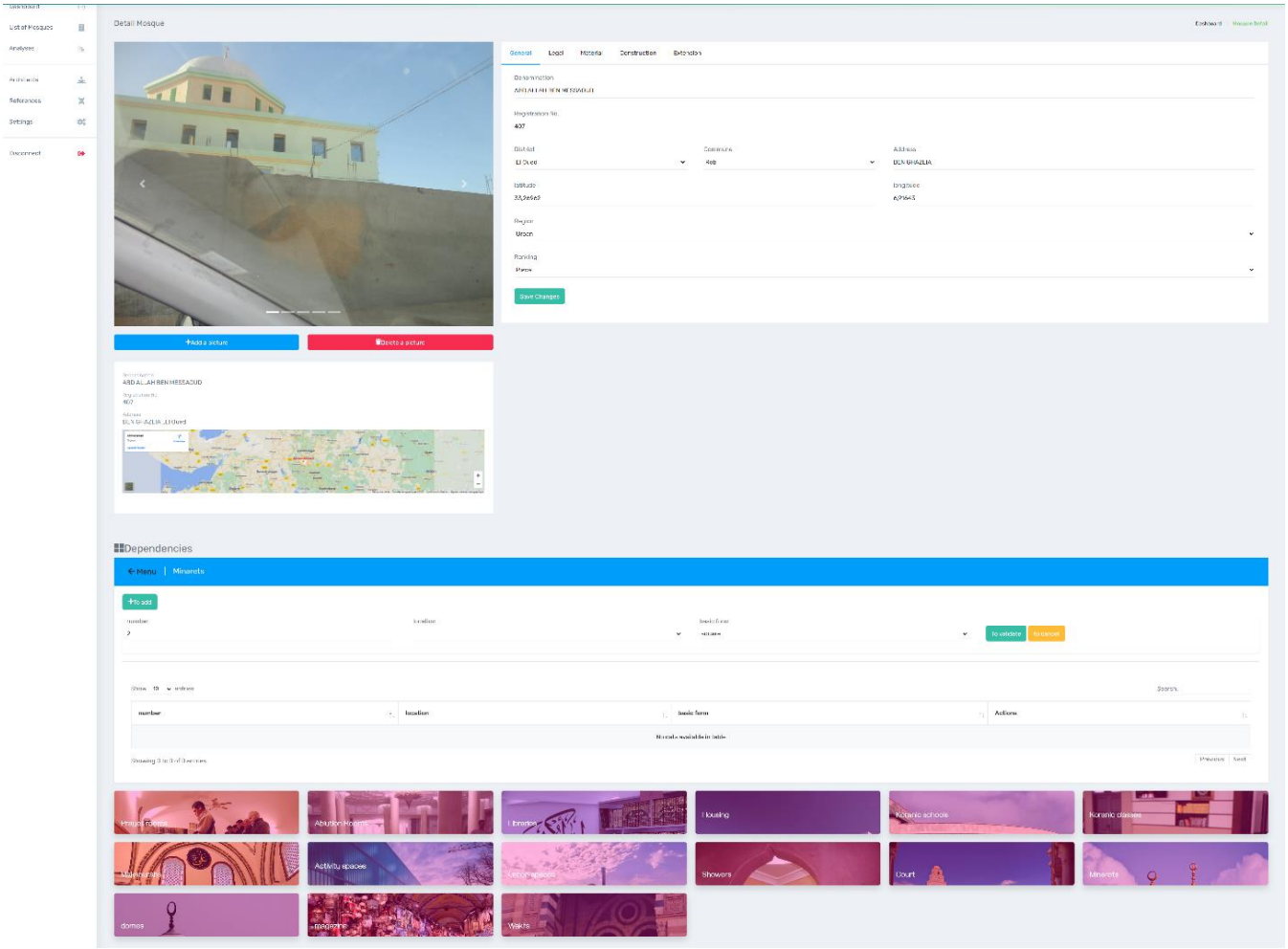


Figure 3. 16 Application of the analysis grid to a mosque minaret
(Source: platform screen shot)

Figure 3. 17 Application of the analysis grid to a mosque minaret
(Source: Khoukhi et al., 2023)

Moreover, the platform facilitates the accumulation of analysis filters, enabling multi-criteria analysis. This functionality empowers users to analyse several criteria and sub-criteria for the same or multiple components concurrently. Similar to single-criteria analysis, multi-criteria analysis serves as a valuable tool for generating comprehensive insights and classifications.

To date, the platform's development has rendered it operational in two capacities: as both an inventory and analysis tool, and as a dynamic classification system serving diverse purposes.

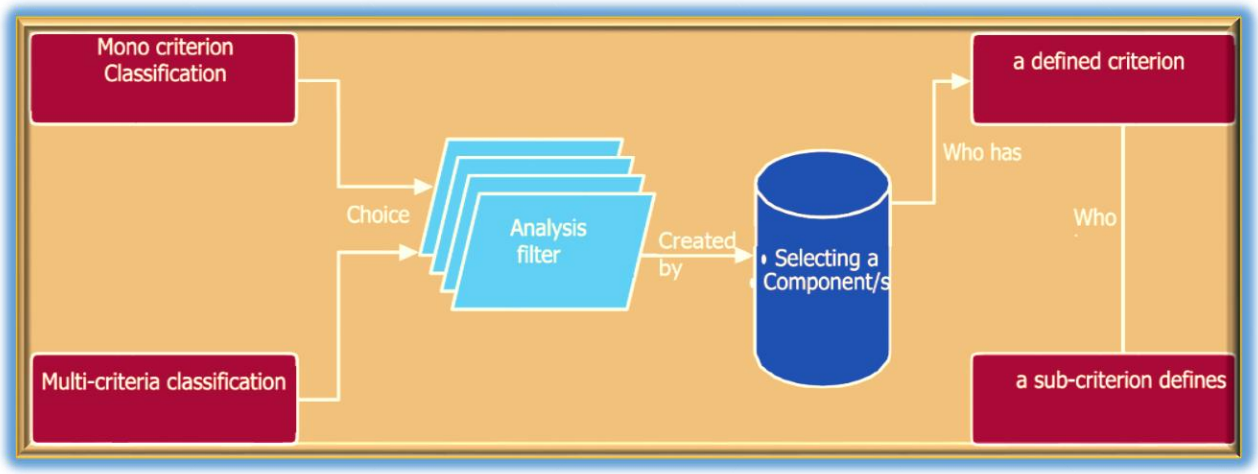


Figure 3. 18 Schematic diagram of how platform analysis works
(Source: Source: Khoukhi et al., 2023))

To initiate the analysis process, we have introduced an icon termed "analysis". This feature facilitates the creation of analysis conditions (depicted in Figure 3. 19), whereby users first select the component, followed by specifying the criterion, and finally choosing the sub-criteria, which are recognized as options by the system. To enhance the depth of analysis, we have incorporated a condition (operation) offering two alternatives:

1. The first option is labeled "normal", denoting "and". In essence, if multiple conditions are to be overlaid.
2. The second alternative is "or", indicating a juxtaposition of analysis filters. However, the ultimate result will be one of these analysis conditions.

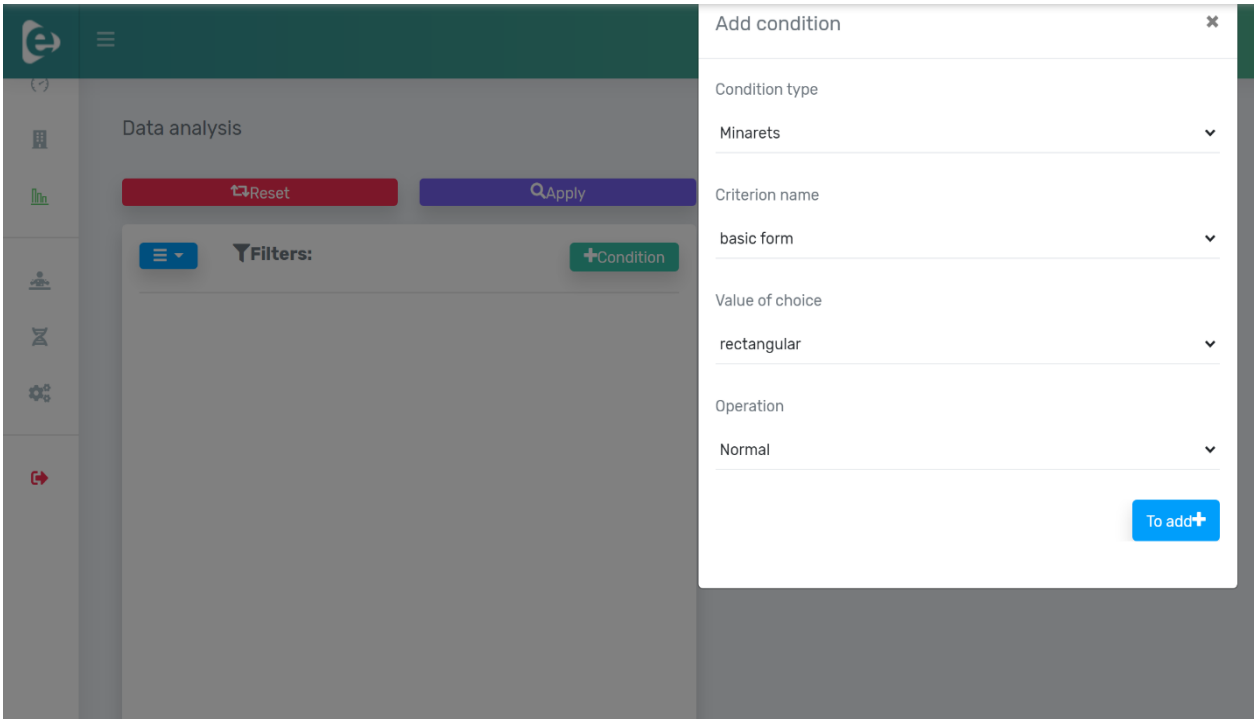


Figure 3. 19 Example of how to create an analysis filter
(Source: Khoukhi et al., 2023)

These analysis filters are user-defined and can be saved in a file recognized by the system for later use (Figure 3. 20). The platform also lets you modify filters already saved.

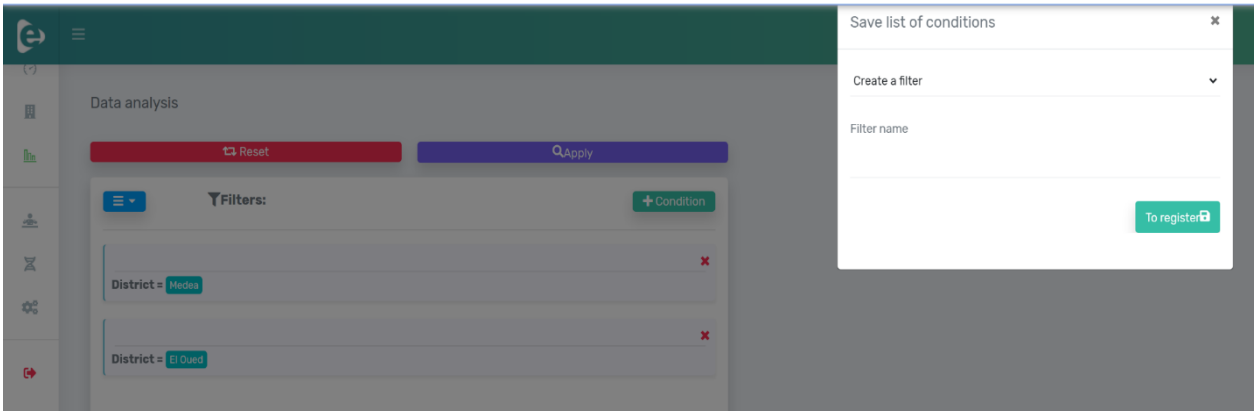


Figure 3. 20 Saving the analysis filter
(Source: Khoukhi et al., 2023)

However, whether the analysis is carried out on a single or multi-criteria basis, the result will be presented. Firstly, in list form (Figure 3. 21). The example presented here concerns an analysis filter containing only wilayas as a condition. The mosques listed share the same analysis filter and the same ranking condition. The list of results can be consulted, and details of each mosque can be viewed by clicking on "details", which opens a new window in the platform to display these details. In addition, the platform allows results to be displayed on an interactive geographical interface (Figure 3. 22). This allows the user to extract various conclusions, zoom in on the map, and consult each mosque in detail.

Figure 3. 21 Presentation of analysis results in list mode
(Source: Khoukhi et al., 2023)

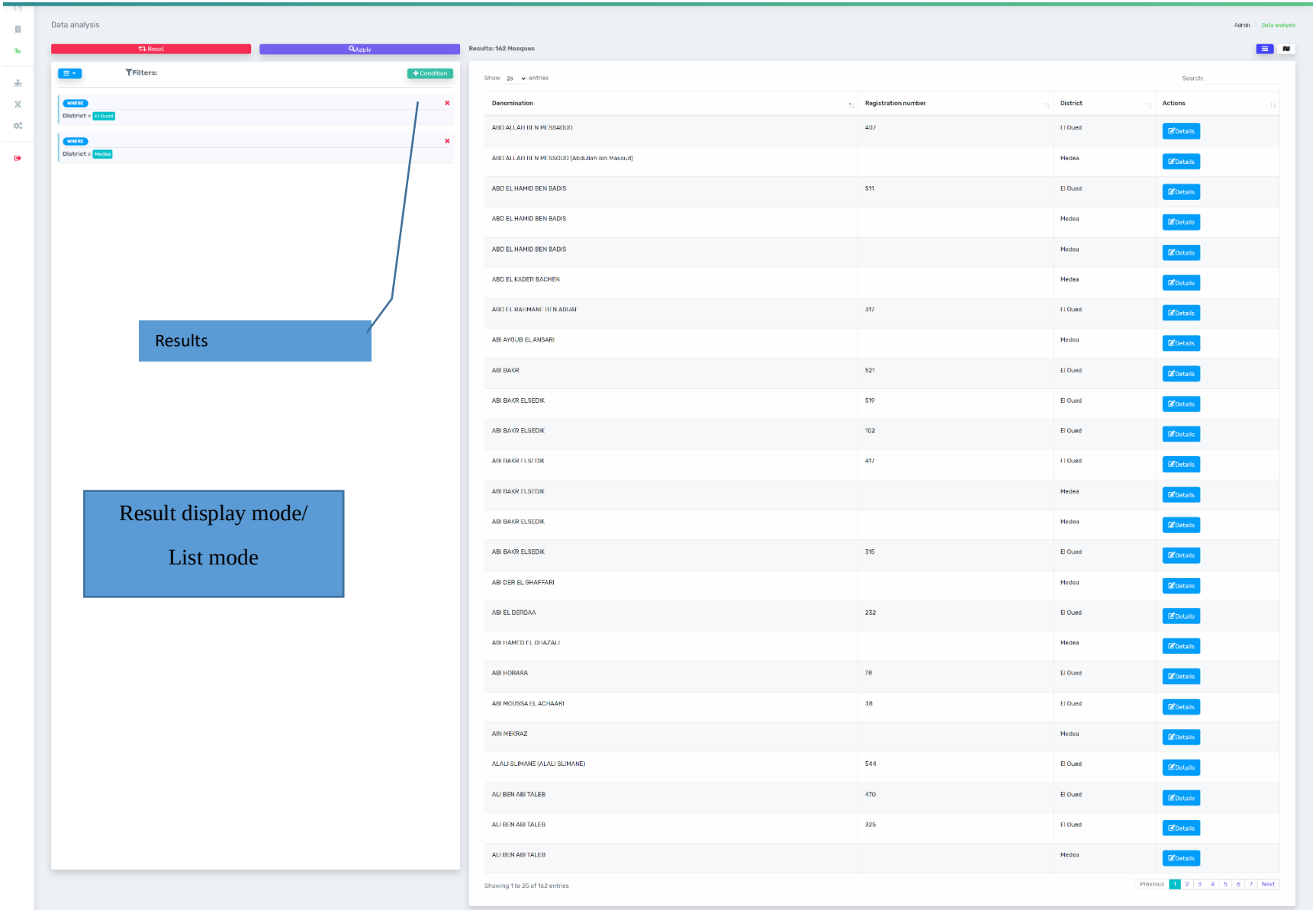
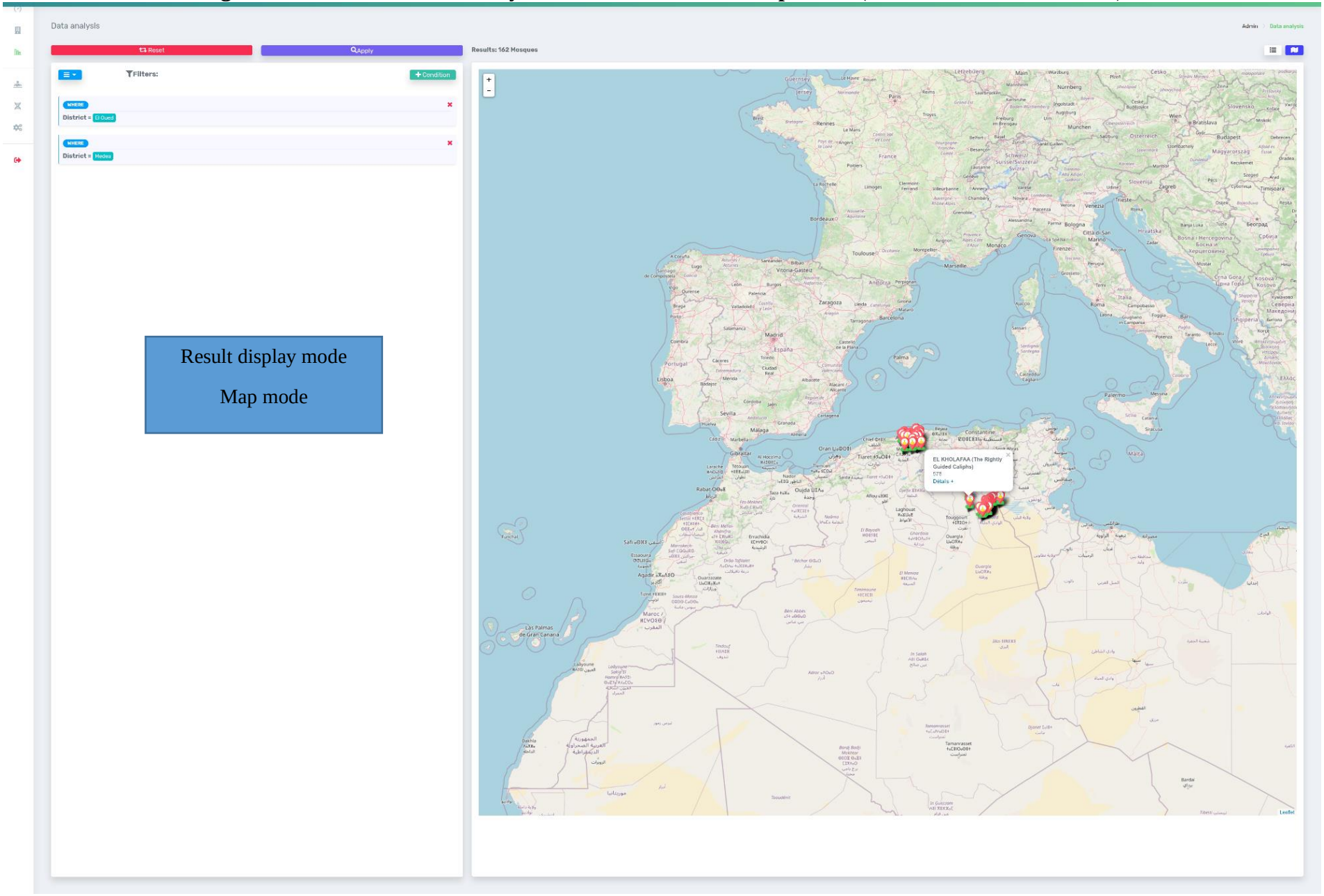


Figure 3. 22 Presentation of analysis results in interactive map mode (Source: Khoukhi et al., 2023)



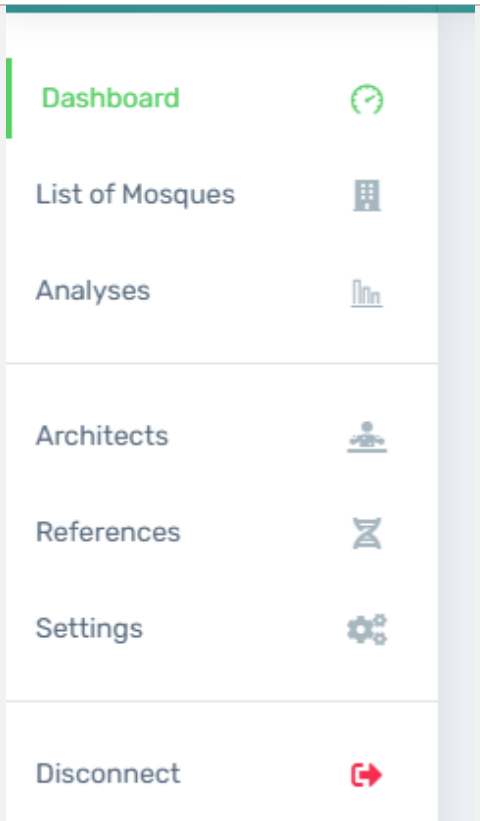
5 Application of the platform:

This platform serves as a valuable tool for comprehending and categorizing the architectural elements of all proximity mosques (and others) inventoried in El Oued. Furthermore, it facilitates the expansion of the study scope to regional, national, and potentially international levels. It functions as a mechanism for identifying and accentuating the architectural peculiarities of these mosques.

To execute this classification, we devised an analysis grid primarily grounded in field observation, encompassing both common and uncommon criteria and choices for each component of these mosques. Similarly, the grid is rooted in the observation of criteria and sub-criteria prevalent in the mosques studied within a specified area. The outcome of this classification endeavour will facilitate comparisons and correlations between these mosques and established references, be it in terms of legislation or heritage.

As conceived, the platform is equipped to analyse the sample mosque components mentioned earlier. However, we set an analysis grid grounded in in field observation of prayer room, Dome, Minaret, and Courtyard

Table 3. 9 Functionality of platform
(Source: author)

Functionality	Description
	**Dashboard**: icon represents a tool to calculate, see the general status of progress of the inventory
	List of mosques: allowed to see the entire list of mosques inventory
	Analyses: allows to access the analysis, proceed to create the analysis filters and view the results.
	Architects: a census tool allows to create information sheets on the architects responsible for designing and monitoring the mosques inventories, it relate in the inventory
	References: icon dedicated to the analysis grid assembly
	Settings: icon dedicated to the probable connections with other platform
	Disconnect: an icon allows to leave the platform disconnected by the user

5.1 The prayer room analysis grid

Based on articles of the Interministerial order of May 29th , 2022 that have addressed the prayer room component's, focusing on its shape and form. An analysis grid is created based on the field observation. The prayer room analysis grid contains five criteria.

- first; the template with three sub-criteria (one floor, two floors and underground and a floor).
- Secondly; the presence of gallery in the prayer hall.
- Thirdly; the prayer hall form, the choice is between square, rectangle, octagonal and irregular.
- Fourthly; the gallery location and the choices are multiple as shown in the Table 3. 10.
- Finally; if the prayer hall proportion is rectangular, the sub-criteria of the front wall can be longest or shortest (Figure 3. 23)

Table 3. 10 Prayer room analyses grid

(Source: author)

Component	Criterion	Sub-criteria
Prayer room	Template	One floor
		Two floor
		Under ground and floor
	Gallery	Yes
		No
	Form	Square
		Rectangle
		Octagonal
		Irregular
	Gallery location	Left Qibla
		Right Qibla
		Left and right
		Back wall
		Left, right and back
		Right and back
		All sides
		Left and front
		Right and front
		Front and back
		Left and back
		Back
		Left, right and front
	rectangle position	The front wall of Qibla is the longest
		The front wall of Qibla is the shortest

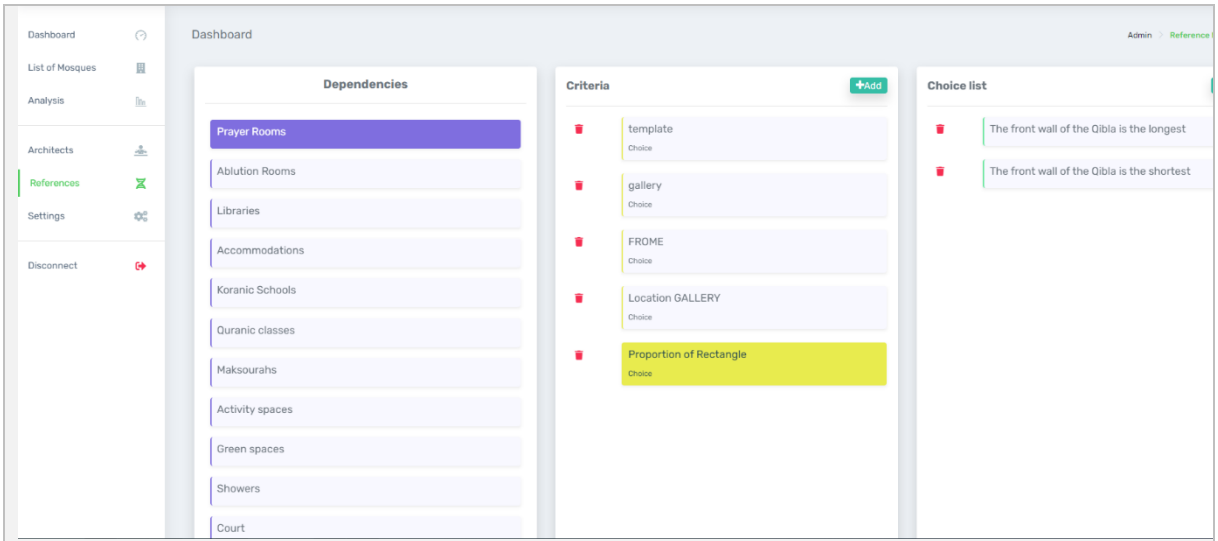


Figure 3. 23 Prayer room analysis grid from platform
(source: platform screen shot)

5.2 Dome analysis grid:

The dome grid analysis includes kind, number, typology, location, secondary dome location and typologies, structure support of dome, exterior and interior aspects and finally if the dome is in proportion with the mosque, it enables us to identify all the different typologies of domes observed in the field.

- The kind criterion has two choices; mono dome mosque or multi dome mosque.
- The number criterion; the choice will be set automatically with the platform.
- The location criterion; the sub-criteria are above the Mihrab, central, entrance and other location.
- Typology criterion dome; Hemispherical, faceted, lowered, ogival, onion and other undefined typologies.
- Secondary location and typologies are criteria about the secondary domes of the multi dome mosque typologies.
- The structure support of dome criterion has three sub-criteria; a dome that starts from a square or an octagonal or a hexagonal form and structure.
- A varied Exterior appearance of dome criterion of paint, sculpture, waterproof or cement coating.
- The last criterion about proportion means if the dome size is proportionally with the mosque size.

Table 3. 11 Dome analysis grid
(Source: author)

Component	Criteria	Sub-criteria
Dome	kind	Mono dome
		Multi dome
	Number of dome	
	Location	Above the Mihrab
		Central
		Entrance
		Other
	Typologies	Hemispherical
		faceted
		lowered
		Ogival
		Onion
		Other
	Secondary location	Entrance
		Gallery
		Other
		Gallery and Entrance
	Secondary Typologies	Hemispherical
		lowered
		Ogival
		Onion
		Faceted and Hemispherical
	Support	Square
		Octogonal
		Hexagonal
	Exterior appearance	Paint
		Sculpture
		Waterproof coating
		Cement coating
	Proportion	Yes
		No

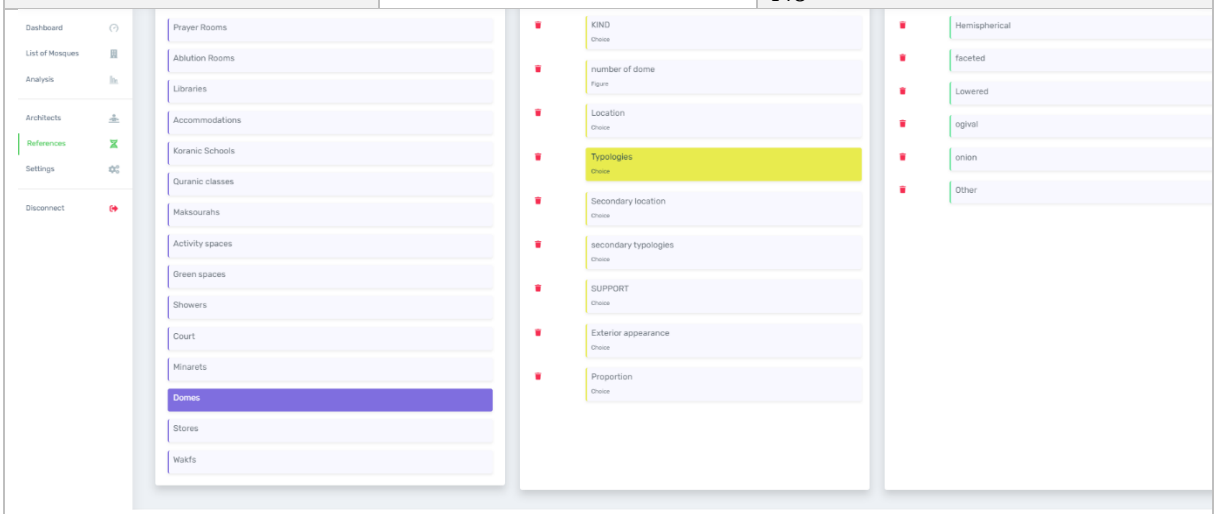


Figure 3. 24 Dome analysis grid from platform
(Source: platform screen shot)

5.3 Minaret analysis grid

The minaret analysis grid contains number, location basic form and small cupola typologies dimension of the minaret as criteria.

- The number as the first criterion examine the presence and numbers of minaret(s).
- The second criterion is the minarets location of in mosques. The sub-criteria are all the possible location that can be found in the field.
- The Basic form criterion define the minaret basement form, so the minaret form can be square, rectangle, round, hexagonal, octagonal or other forms.
- We add a criterion called unified form, this criterion to define if the same minaret form from down to up, the choice will be yes or no.
- We add another criterion called form of the minaret second part if it does not have a unified form. In this case, we can choose from a list of sub-criterion.
- The lantern presence criterion.
- The small cupola typologies are initiated with four sub-criteria: hemispherical, onion, lowered or pyramidal cupola.
- The typologies and shapes of minarets.
- The last criterion concerns the height and size of minaret whether proportional with the mosque size or not.
- For more details; a criterion of level number is introduced to analysis height of each minaret.

Table 3. 12 Minaret Analysis grid platform

(Source: author)

Component	Criterion	Sub-criteria
Minaret	Number	
	Location	Left and before Qibal wall
		Right and before Qibal wall
		Left and back Qibal wall
		Right and back Qibal wall
		Qibla wall
		Back wall of Qibla
		Other
	Basic form	Square
		Rectangle
		Round
		Hexagonal
		Octagonal
		Other
	Dome (small cupola)	Hemispherical
		Onion
		Lowered
		Pyramidal
	H/L proportion	Yes (good)
		No
	Lantern	Yes
		No
	Unify form	Yes
		No

	Form of second part	Square
		Hexagonal
		Round
		Octagonal
	Number of level	

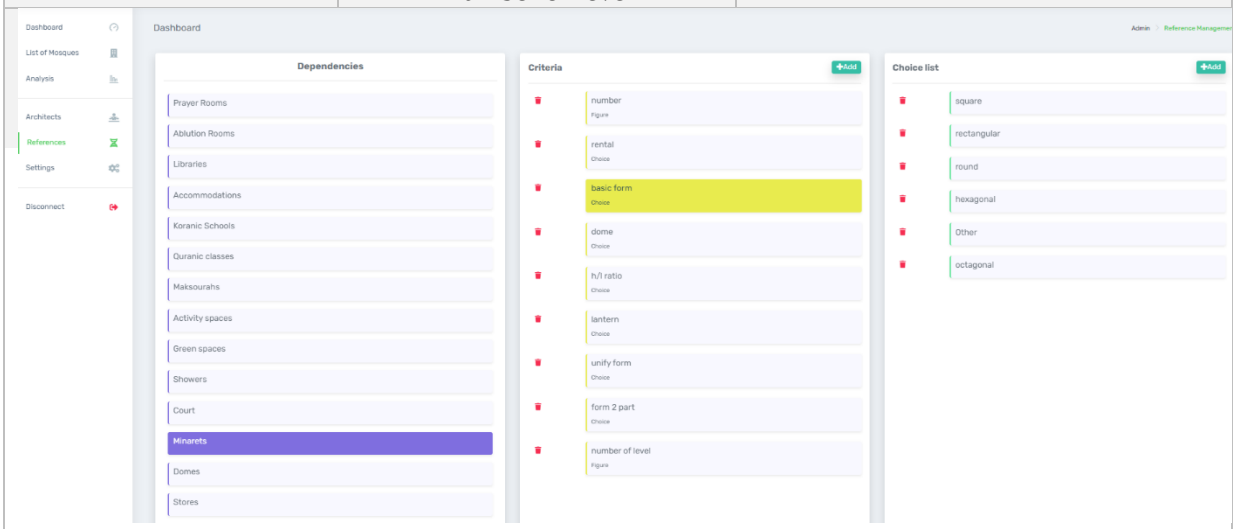


Figure 3. 25 Minaret analysis grid from platform
(Source: platform screen shot)

5.4 Courtyard analysis grid

The courtyard analyses grid contains the presence, configuration and location criteria.

- First criterion is the courtyard presence in mosque with sub-criteria (yes or no).
- The second criterion is the location .

Table 3. 13 Courtyard analysis grid from platform
(source: author)

Component	Criterion	Sub-criteria
Courtyard	Presence	Yes
		No
	location	Opposite Qibla
		Back
		Right
		Left
		Front Qibla +back+ Right+ Left
		Opposite Qibla and left
		Back and right
		Opposite Qibla and Right
		Back and left

6 Conclusion:

In the era of growing urbanization, Algeria, like any other country, has a remarkable number of mosques built or under construction;a number that is constantly increasing within a large territory marked by diversity .They require a general inventory that must contain all their currently available data (digital map, photo,). Hence, some of them can become the heritage of the future. This inventory through this platform is part of a larger process of digitization and architectural classification for multiple use.

The use of modern technology and digitization to benefit both heritage and the entire construction has become highly desirable. The proposed platform for mosques has a dual role for inventory and classification. Its design depends essentially on the dynamic analysis grid for multiple classification purposes along with the decomposition of the mosque into entities or components, each component has a criterion and sub-criteria. For the inventory of a component of a mosque, a list of criteria and of inventory sub-criteria must be created. As the criteria and sub-criteria are fully designed and fulfilled for all the mosques inventorised, the analysis method is carried out by creating analysis filters. In this case, the system automatically detects all mosques with the same analysis filter. The platform also has a multi-criteria analysis, an analysis of several criteria in one or more components at the same time.

As the platform system architecture is open to various fields and studies, it can be adapted to other building types, churches, museums, castles. The researcher should specify the dependencies and criteria he wants to collect and analyse. This research is a creation of a database for all contributors, its future depends on making it available and up-to-date for research in all fields.

Conclusion of part one

The legislation of 1991 decree cites the «Islamic» character of the mosque and the that of 2013 mentions the «Maghrebian» character. The ambiguities surrounding these two terms are at the origin of some of the architectural «anomalies»

A new specification was designed and published in September 2022 by the Ministry of Religious Affairs and Wakfs. the new "recommendations" of the new 2022 specifications cited and presented in chapter 1 for the construction of mosques in Algeria emphasises the architectural style mandates adherence to a national character inspired by Maghreb heritage to maintain authenticity and cultural continuity. It has taken into consideration some specificities of the region from the south of Algeria.

The analysis of the characteristics of historic mosques in Algeria has highlighted the evolution of architectural and architectonic elements through the different periods of its history. This study shows that the architectural characteristics of mosques vary from one region to another that fact that requires a general inventory that should include all available data on these mosques Besides, this inventory should be part of a larger project of digitization and architectural classification for multiple use.

The countless data from the field and the gaps in the current legislation have given us the idea to think about creating a platform. this platform devoted to mosques, has a dual role of inventory and classification. Then, we proceeded to input the data, an analysis of the data and a dynamic grid that classifies the mosques according to their architectural components. In relation to our work, this platform serves to highlight the specificities and components by regions. It can be linked to another database that is interested in heritage of all its forms so that it helps us understand what exist today the field, the information and results obtained can provide a solid basis for researchers, architects and authorities to understand the present, connect it with the past and plan for the future.

Part 2

Field and exploitation of the platform, the mosques of El Oued wilaya as a case study

Chapter 4. The Proximity Mosques in The wilaya Of El Oued: Studies And Analyses Of Mosque Components

Chapter 5. The Field: Developer Of Various Interpretations Of 2022 Specifications

Chaptre 6. The Unexpected Result Of The field: The wilaya of El Oued Mosques And COVID-19

CHAPTER 04

THE PROXIMITY MOSQUEES IN THE WILAYA OF EL OUED: STUDIES AND ANALYSES OF MOSQUE COMPONENTS

1 Introduction

This chapter outlines the framework of our research and the study region, namely the wilaya of El Oued. Our field survey aims to shed light on the typology, architectural features and factors influencing the construction of proximity mosques. To conduct a comprehensive analysis of the architectural typology of mosques in the wilaya of El Oued, a methodical study was initiated involving a systematic survey of the region to establish a thorough inventory. This endeavor encompassed visits to mosques in seventeen municipalities within the wilaya, selected to form a representative sample comprising one hundred proximity mosque's. Simultaneously, consultations were held with the Religious Affairs Directorate and Wakfs of El Oued. (DARW), yielding access to an inventory documenting a total of 633 mosques[99] dispersed across the thirty municipalities[100] constituting the wilaya.

The methodology employed integrated fieldwork with the compilation of the inventory provided by the Religious Affairs Directorate and Wakfs of El Oued. detailing the 633 mosques. This approach resulted in the creation of two distinct samples (refer toTable 4. 1). Examination of the table reveals that the total number of mosques documented in (DARW) inventory stands at 633 units, of which 314 were selected for analysis based on the availability of architectural data.

Among these, the analysis includes the one hundred mosques surveyed in the field across the thirty municipalities, as well as the fifty-three mosques identified both through fieldwork and within the inventory of the 314 structures. All this data collected about mosques are filled and stored in the created platform.

This inventory via this platform will be used for our research and its objectives. This platform helps to classify the architectural and architectonic elements of mosques inventories in our study areas as it was developed. Or Several elements directly pertain to architectural typology. Given the paramount importance of our research problem, we will analyse mosque components' in the same order of the Interministerial order of May 29th, 2022 article's about the components, shape, number, location and proportion. etc....

[99] 138 of the 633 mosques are under construction, 17 of the 633 mosques are deserted and abandoned due to their dilapidated state, and 478 of the 633 mosques have been completed.

[100] The wilaya of El Oued comprises thirty (30) municipalities. Following the new administrative division of December 11th , 2019 and the creation of the wilaya of Meghair, the number of municipalities has been reduced from 30 to 22 municipalities.

Table 4. 1 Case studies by municipality in the wilaya of El Oued (Source: author)

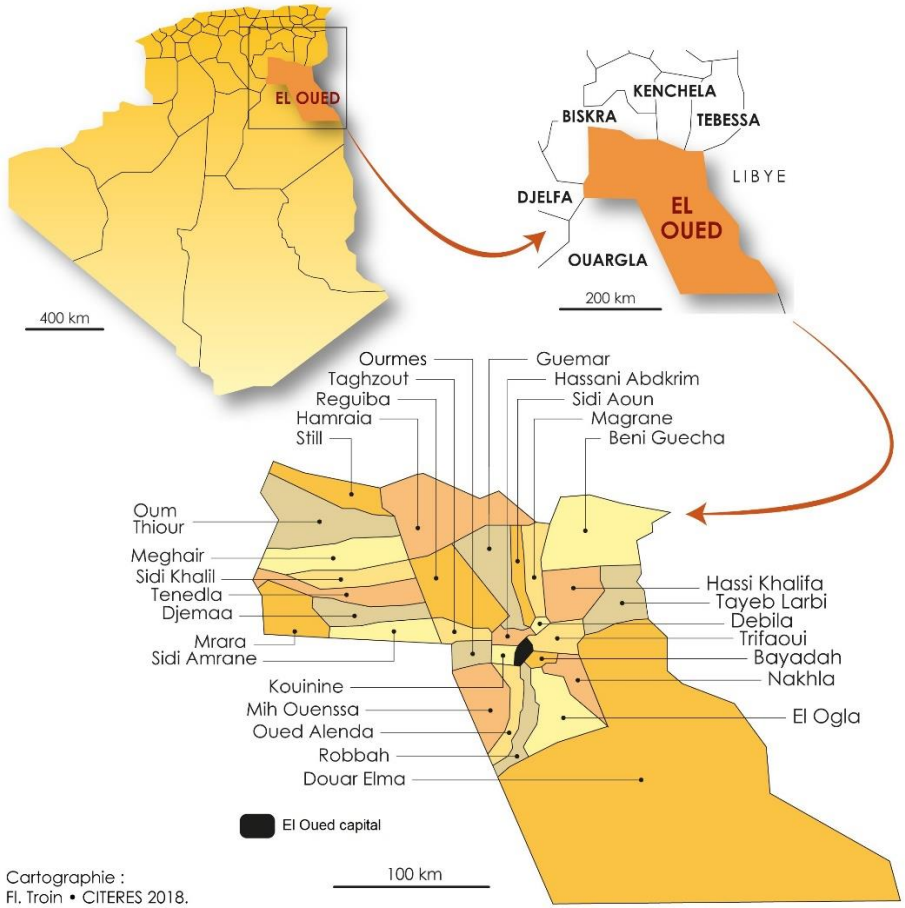


Figure 4. 1 EL Oued proximity and municipalities.
(Source:Kadri & Chaouche, 2018)

N°	Municipality	Administrative division		Number of mosques			
		Of February 04th ,1984	From December 11th ,2019	Total in the field	Sample analyzed from inventory	Field survey sample	Sample found (Land and inventory)
01	EL OUED	E L O U E D	E L O U E D	99	69	25	18
02	KOUININE			17	04	02	01
03	REGUIBA			41	22	00	00
04	HAMRAIA			04	02	00	00
05	GUEMAR			74	37	13	08
06	TAGHZOUT			12	07	00	00
07	OURMS			11	05	00	00
08	DEBILA			22	15	03	03
09	HASSANI ABDKRIM			29	19	07	04
10	HASSI KHELIFA			35	24	10	07
11	TRIFAOUI			11	06	00	00
12	MAGRAN			21	10	00	00
13	SIDI AOUN			14	08	00	00
14	ROBBAH			20	05	08	01
15	NAKHLA			14	03	03	00
16	EL OGLA			09	02	02	00
17	BAYADAH			34	21	06	04
18	TALEB LAARBI			07	01	03	01
19	BENI GUECHA			02	01	00	00
20	DOUAR EL MAA			07	00	01	00
21	MIH OUNESSA			25	11	06	02
22	OUED ALENDA			11	02	04	00
23	MEGHAIR		M E G H A I R	24	12	03	02
24	SIDI KHELIL			04	03	01	01
25	STILL			04	02	00	00
26	OUM THIOUR			09	01	00	00
27	DJEMAA			32	09	03	01
28	SIDI AMRANE			27	08	00	00
29	MRARA			04	02	00	00
30	TENDELA			10	03	00	00
	TOTAL	*	**	633	314	100	53

* wilaya according to the administrative division of February 4th , 1984.
** according to the new administrative division of December 11th , 2019

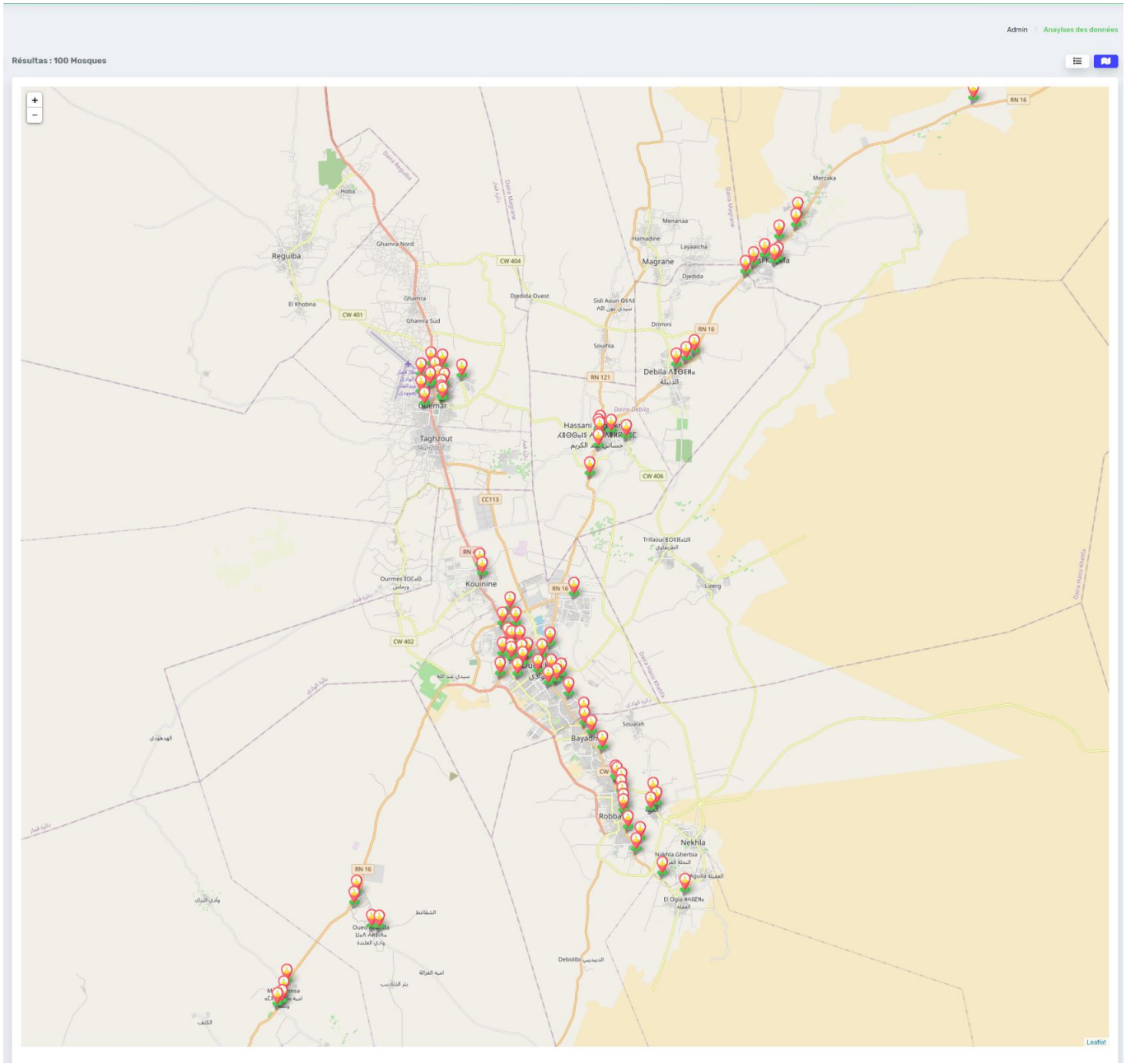


Figure 4. 2 Geographical distribution of cases studied in El Oued issue from the platform
(Source: platform screen shot)

2 Field exploration

In the course of our fieldwork, with the aim of understanding the organization and architectural typology of mosques in the wilaya of El Oued[101] , one specific prayer room caught our interest.

Are these atypical prayer halls? Among those that caught our attention in the said wilaya is the one located on the outskirts of the El Magrane municipality[102] (Figure 4. 3). This prayer room is a space, specifically designed for travelers and transients. Its layout is square, with walls made of sandwich panels[103] and topped by a dome formed by assembling a series of sheet metal panels.

Figure 4. 3 Prayer room in El Magrane
(Source: author)

From the outside, the square configuration is noticeable. Inside the prayer room, the layout appears regular. In elevation, the entire space is enveloped by a false ceiling. We have therefore concluded that this is a false dome located above the prayer room.

[101] the 30 municipalities of the El Oued willaya became 22 after the 2019 administrative division),
[102] located at the intersection of RN 121 and RN48A, twenty kilometers from the municipality of El Magrane).
[103] Sandwich panels are a building material for insulating and covering roofs and claddings. They consist of two steel plates with insulation in between.

At the top of the prayer hall, two elements symbolizing minarets caught our eyes. They consist of a square base volume transformed into a cylinder, embellished with a decorative element. In addition, the ablution room is adjacent to the prayer room. Based on these observations, it seems that builders attach more importance to functionality than to aesthetics, as well as to sanitary conditions and architectural standards.

During our fieldwork, we came across another prayer hall[104] (Figure 4. 4) located twenty kilometers from the municipality of Reguiba, precisely at the intersection of the RN 48A and the road leading to the municipality of Reguiba. This prayer hall is distinguished from the previous one by the absence of minaret representations and by the shape of the Mihrab, which adopts a curvature.

Figure 4. 4. Prayer room in Reguiba
(Source: author)

In general, this prayer room is subject to the same principles of organization and construction as those observed in the previous review of the Example cited above. This has led us to conclude that the builders of both prayer halls consider the prayer space, Mihrab, dome and ablution room to be indispensable components in the construction of a prayer hall. However, the minaret is considered optional. So what about the construction of proximity mosques in El Oued?

[104] one single small prayer room

3 Architectural components cited in the 2022 Specifications and the field

Various articles of the Interministerial order of May 29th , 2022 have addressed the prayer room component's, focusing on its shape and sometimes on its surface area of the prayer room. The distinguishing feature of this new specification is its emphasis on specifying that the rectangular shape of the prayer hall is recommended in mosque design. Besides,The surface area of the prayer room may be distributed over one or more levels, and must not exceed three levels. Also ,the new specifications encompass articles [105] addressing the design and the dimensions of domes.

Article 37 stating that the Mihrab must have a curvilinear shape with an average surface area between 2 and 3 m². The Maghreb Islamic architectural style should inspire the Mihrab's design. Article 38 advocates using a single movable wooden Minbar, emphasizing a design approach rooted in referenced architectural traditions.

As methodological way those articles about the prayer room will serve as the foundation for our fieldwork analysis .and all the grid analysis will set in the same order

Table 4. 2 Article about prayer room of the interministerial order of May 29th , 2022
(Source: the interministerial order of May 29th , 2022)

Number of Section	Section title	Section title	Article
4-2	The prayer room	Shapes and dimensions	Article 22 and 23
		Size and height of the prayer room	Article 29 up to 31
		Ceiling and dome (El Qobba)	Articles 32 to 34
		The Mihrab	Article 37
		The Minbar	Article 38

3.1 The prayer room in El Oued mosque's

The process of building a mosque in our study area begins with the acquisition of a plot of land dedicated to this purpose. Once the land has been obtained, the builder[106] proceeds to demarcate the landed property by erecting a boundary wall.

Next, an initial nucleus is established: a provisional prayer room. The construction of this first "provisional" prayer hall marks the beginning of the process of creating a mosque, and above all the launch of fund-raising and financial resources for its realization.

Subsequently, this space can be used as Koranic classrooms or incorporated into the mosque's new prayer hall, which is planned to be built at a later date. The temporary prayer room, designed as a building, can be integrated into the new mosque or remain independent as part of

[105] Articles 32 to 34 of the Interministerial order of May 29th , 2022

[106] Generally speaking, associations and individuals.

the mosque's ancillary facilities. Until now, this approach has remained "classic[107]"(Senhadji, 2017) in the process of building mosques by associations.

The El Karama mosque in Guemar, for example, is a prime example of this construction process. On site, we can see a fence and a provisional prayer hall already erected (Figure 4.7). However, the construction of the mosque is ongoing, with the infrastructure work completed and the superstructure under construction (Figure 4. 6). At the entrance, a sign (Figure 4. 5) encourages benefactors to contribute financially to complete the mosque's construction.

Figure 4. 5. Sign installed at the entrance of El Karama mosque
(Source: author)

Figure 4. 6 Superstructure of El Karama mosque
(Source: author)

Figure 4.7 El Karama Mosque Provisional Prayer Room
(Source: author)

3.1.1 The shape:

From a formal perspective, Article 22[108] emphasizes that: "*The rectangular shape of the prayer hall is recommended in mosque design, ensuring that the front wall of the Qibla occupies the longest part of the rectangle*." This article advocates for the rectangular and elongated shape of the prayer room.

In the course of our fieldwork, we observed a great diversity in the architectural forms of mosques. Consequently, we set out to study these forms, which led us to categorize our sample into four distinct categories (Table 4. 3).

[107] The same in the region of Oran.
[108] Interministerial order setting the standard specifications relating to the typology of the construction of mosques. Available at: https://www.joradp.dz/FTP/JO-francais/2022/F2022061.pdf?znjo=61

Table 4. 3 General shape of the mosque in El Oued

(Source: author)

	The general shape of the mosque			
Number of mosques	Square	Rectangle	Irregular	Octagonal
100	36	47	16	01

Note: the result was produced using the platform.

Field analysis reveals a variety of mosque shapes, including square, rectangular, irregular and octagonal, with varying proportions. This observation mainly concerns the external shape of the mosques, not the interior configuration of the prayer hall. Unfortunately, analysis of the interior shape of the prayer hall for the entire sample proved difficult, if not impossible, due to the health situation linked to COVID-19 and the measures taken by the authorities.

As far as rectangular mosques are concerned (Table 4. 4), we counted 47 buildings with this configuration. This shape takes two distinct forms: a rectangle with an extended Qibla front wall (30 out of 47 mosques), and a second rectangle model with a shorter Qibla front wall than the first (17 out of 47 mosques). The adoption of the rectangular shape with a long front wall is motivated by religious considerations[109] .

Table 4. 4 Layout of rectangular mosques

(Source: author)

30 mosques	17 mosques
The front wall of the longer Qibla	The front wall of the shorter Qibla

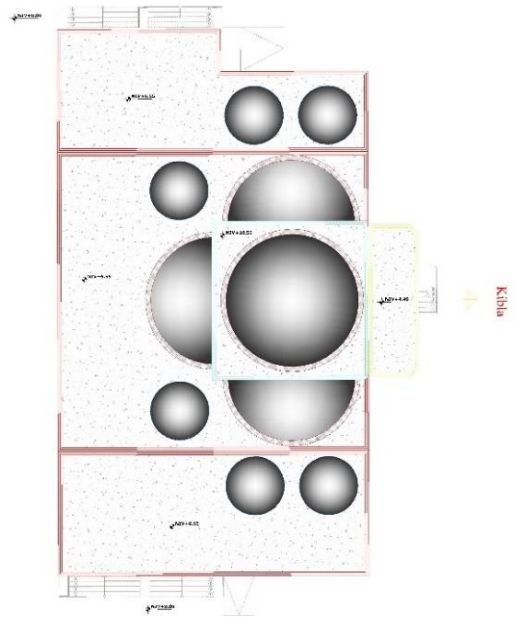
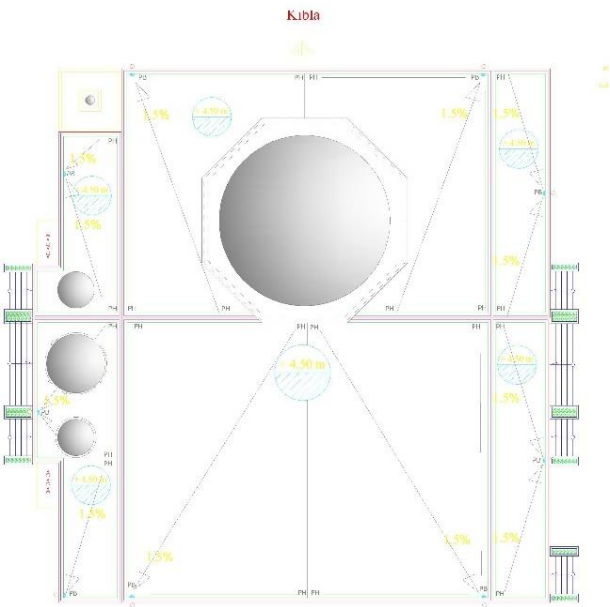

	

Figure 4. 8 The Ibrahim El Khalil-El Oued mosque (Source: Ben Khelifa Ayoub)	**Figure 4. 9 The El Asr mosque** (source: DARW El Oued)

[109] The importance given to the front rows of the prayer.

It's important to note that the external shape of the mosque, as well as that of the prayer room can be identical or totally different. To clarify this observation scientifically and ensure greater reliability, we have analyzed two examples. In the first example, we observed a mosque with an irregular exterior shape, while the interior prayer room adopts a rectangular shape (Figure 4. 10). Similarly, in the second example, the mosque has a rectangular external shape, but the prayer room is square in shape due to the separation between the men's and women's areas (Figure 4. 11). These examples confirm the possibility of compatibility between interior and exterior shape, or on the contrary, incompatibility between the two.

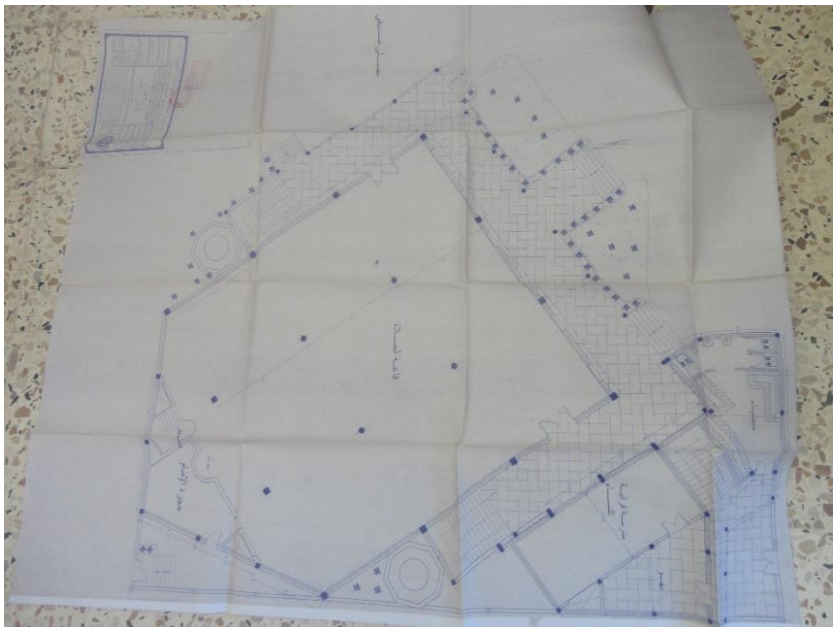


Figure 4. 10 Mosque plan of Ahmed ben Hanbale-El Oued
(Source : DARW[110] El Oued)

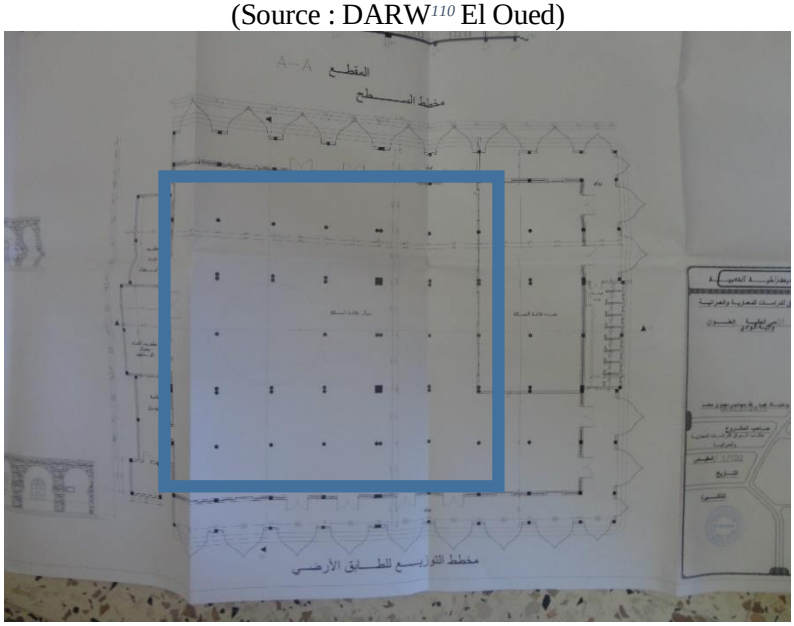


Figure 4. 11. Mosque plan -El Oued
(Source : DARW El Oued)

[110] the Religious Affairs Directorate and Wakf of El Oued.

3.1.2 Mosque surface areas:

Based on a census of 314 mosques, we undertook an analysis of the surface areas of these buildings (Table 4. 5). This analysis is based on the following criteria: mosques with a surface area of less than 500 m², those with a surface area of between 500 m² and 1000 m², those with a surface area of between 1000 and 1500 m², and finally those with a surface area of over 1500 m².

Table 4. 5 Mosque surface areas in El Oued

(Source: author)

Mosque surface area in m²	Number of mosques	Percentage	Average surface area in m²	Overall average
Less than 500 m²	111	35.35%	348.38	667.11 m²
From 500 and under 1000 m²	154	49.04%	651.05	
From 1000 to 1500 m²	41	13.06%	1180.65	
Over 1500 m² of floor space	08	2.55 %	2590.44	

the results obtained (Table 4.4) were essential for extracting a set of data that we articulate as follows:

- 111 mosques have a surface area of less than 500 m², representing 35.35% of the sample.
- 154 mosques have an area of between 500 m² and 1000 m², representing 49.04%.
- 41 mosques have a surface area ranging from 1000 m² to 1500 m², representing 13.06%.
- 08 mosques have a surface area exceeding 1500 m², i.e. a percentage of 2.55%
- The average surface area of mosques in the entire sample is 667.11 m².
- The largest mosque in terms of surface area is the Abd el Madjid Haba mosque in El Meghier, with a surface area of 7000 m².

Based on these results, we conclude that mosques in El Oued are generally built on modest (less than 500 m²) and medium (500 to 1000 m²) surfaces.

During the analysis of mosque surface areas, we observed a notable similarity between these buildings in terms of surface area. This prompted us to undertake a further analysis, focusing primarily on mosques sharing similar surface areas, notably those located in the same municipality(s) (Table 4. 6).

Table 4. 6 Similarities of mosque surfaces in El Oued

(Source: author)

	Surface area in m²	Mosques Number	Number of municipalities including mosques of this size	Leading municipalities by number of mosques with the same surface area	Number From Mosques	%
01	Equal to 100	04	02 municipalities	Hassani abdelkrim	03	75 %
02	Equal to 200	04	04 municipalities	/	/	/
03	Equal to 250	04	03 municipalities	Miah wenessa	02	50%
04	Equal to 300	11	06 municipalities	Guemar	04	36.36%
				El Oued	02	18.18%
05	Equal to 320	02	02 municipalities	/	/	/
06	Equal to 350	06	03 municipalities	Guemar	04	66.67%
07	Equal to 375	02	02 municipalities	/	/	/
08	Equal to 396	02	02 municipalities	/	/	/
09	Equal to 400	21	11 municipalities	Guemar	06	0
				Miah wenessa	03	28.57%
10	Equal to 450	05	04 municipalities	Ouermas	02	40.00%
11	Equal to 453	02	02 municipalities	/	/	/
12	Equal to 460	02	02 municipalities	/	/	/
13	Equal to 481	02	02 municipalities	/	/	/
14	Equal to 483	02	01 municipality	Guemar	02	100%
15	Equal to 476	02	02 municipalities	/	/	/
16	Equal to 486	03	01 municipality	Reguiba	03	100%
17	Equal to 500	39	16 municipalities	El Oued	06	15.38%
				Byadha	06	15.38%
				Hassi khelifa	05	12.82%
				Sidi aouane	03	7.69%
				Debila	03	7.69%
18	Equal to 512	03	01 municipality	El Oued	03	100 %
19	Equal to 550	03	02 municipalities	El Oued	02	66.67%
20	Equal to 570	02	02 municipalities	/	/	/
21	Equal to 575	02	02 municipalities	/	/	/
22	Equal to 600	15	11 municipalities	/	/	/
23	Equal to 630	02	02 municipalities	/	/	/
24	Equal to 700	13	06 municipalities	El Oued	06	.4615%
25	Equal to 726	04	01 municipality	Guemar	04	
26	Equal to 800	09	09 municipalities	/	/	/
27	Equal to 846	02	02 municipalities	/	/	/
28	Equal to 900	07	04 municipalities	El Oued	03	42.86%
29	Equal to 976	02	02 municipalities	/	/	/
30	Equal to 1000	09	08 municipalities	El Oued	02	22.22%
31	Equal to 1200	08	05 municipalities	El Oued	03	37.50%
32	Equal to 1300	04	04 municipalities	/	/	/
33	Equal to 1500	02	02 municipalities	/	/	/

The results obtained have enabled us to conclude that similarity is observed in 33 cases of surface areas, classified according to their extent; each case grouping together two or more mosques sharing the same surface area.

Mosques measuring 500 m² are the most common, with 39 buildings. This means that 39 mosques in 16 municipalities of El Oued have the same surface area.

Other cases also predominate, such as:

- Mosques of 400 m², with a total of 21 buildings in 11 municipalities.
- Mosques of 600 m², with 15 buildings in 11 municipalities.
- Mosques of 700 m², comprising 13 buildings in 06 municipalities.
- Mosques of 300 m², with 11 buildings in 06 municipalities.

Other cases, although less dominant, group together mosques sharing the same surface area within a single municipality, such as:

- Mosques of 726 m², with 04 buildings in the Guemar municipality.
- Mosques of 512 m², with 03 buildings in the municipality of El Oued.
- Mosques of 486 m², with 03 buildings in the municipality of Reguiba.
- Mosques of 483 m², with 02 buildings in the Guemar municipality.

This similarity can be seen in two ways: on the one hand, in terms of identical surface areas for mosques located in several municipalities; on the other, in terms of surface areas for mosques located in the same municipality. This uniformity of surface area raises the following question: is the architectural typology of mosques in El Oued the result of deliberate design or adaptation to local constraints?

3.1.3 Mosques' heights

Mosques in El Oued are only built in ground floor and ground floor plus one floor (Table 4. 7), while respecting the configuration of the city's urban fabric.

Table 4. 7 Mosques of the studied sample

(Source: author)

Height	Ground floor	Ground floor plus one floor	Underground floor plus one floor
Number of mosques	51	48	01

Field investigations and examination of the plans of various mosques reveal a fully-covered, single-block design. These constructions may or may not include a single-storey elevation, as well as an open-air outdoor space bounded by a boundary wall.

A notable exception in construction concerns the absence of basement mosques, mainly

due to the topography of the terrain and the nature of the soil, where water runs off and risks of rising water are present (Figure 4. 12 and Figure 4 . 13), affecting certain areas of the wilaya(Kadri & Chaouche, 2018; Kouzmine & Avocat, 2007).

Figure 4. 12. Excavation of the el Touba- Jamaa mosque

(Source: Ben Khelifa Ayoub)

Figure 4 . 13. Excavation of the el Touba- Jamaa mosque

(Source: Ben Khelifa Ayoub)

3.2 The Dome:

The dome is an ancient architectural feature in the Muslim world, having been observed as early as the Dome of the Rock in Jerusalem, also known as the Mosque of Omar. This monument represents one of the earliest achievements of Islamic architecture to have survived virtually intact. Over time, the dome has become one of the emblematic symbols of mosque architecture, adopted in a variety of forms and proportions(Korbendau, 1997)

Symbolically, the dome is closely linked in Algeria to an entire city: El Oued, designated for over a century as "the city of a thousand cupolas"(Amri & Djamel, 2018). This designation underlines its importance as the region's local architectural heritage. This local heritage should be a source of inspiration for any new architecture adopted, as it represents the long experience of the region, evolving over time to find the best design solutions.

Indeed, the dome is a common feature in El Oued, found in housing, facilities and, of course, mosques. Its identity, as a dome, remains unchanged. Understanding the typology of this architectural component, among others, would therefore contribute to a better understanding of the diversity of mosques.

By observing and analyzing data collected in the field, based on a sample of proximity mosques, we have devised an analysis grid. The grid includes number, typology, location, exterior and interior aspects, as well as construction techniques. It will enable us to identify all the different types of domes observed in the field.

3.2.1 The number:

In order to shed light on the presence of domes within the mosques in our case study, we undertook statistics to assess the number of domes in each mosque studied.

Table 4. 8 Number of domes per mosque

(Source: author)

Number Dome- shaped	01 dome	02 domes	03 domes	From 04 to 09 domes	More than 10 domes
Mosques	70	7	7	8	8
Percentage	70%	7%	7%	8%	8%

Note: the result was produced using the platform.

The results of the table show a prevalence of mosques with a single dome. Contrary to the widespread perception that mosques in El Oued have several domes, due to the presence of old mosques with several domes.

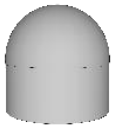
Today, we're seeing the predominance of a single-domed construction typology. This trend stems from the widespread adoption of this construction technique by builders and building control bodies, due to the advantages it offers in terms of durability and cost.

3.2.2 The Dome typology :

We have chosen to classify the typologies of domes present in the mosques in our study area, in order to analyze the results exhaustively. To do this, we divided the sample into two groups: mosques with a single dome and those with several domes. In this study, we focused on the main dome, as mosques with several domes can present different typologies. Thus, we have limited ourselves to the main domes in terms of volume, size and layout preceding the Mihrab of the prayer hall. The other domes are considered secondary and will be the subject of a later analysis.

Table 4. 9 Dome typologies

(Source: author)

Number of mosques	**Type 01** Hemispheric	**Type 02** Faceted	**Type 03** Low-profile	**Type04** Ogivale	**Type 05** Onion	**Type 06** Not defined	**Type 07** Onion	**Type 08** Not defined
								
Mono-dome mosque (total number of mosques is 70)								
52	●							
12		●						
03			●					
01				●				
01						●		
01								●
Multi-domed mosque (total number of mosques is 30)								
26	●							
01*		●	●		●			
01			●					
01		●						
01							●	

Note: the result was produced using the platform.

*a mosque with three domes, both main and secondary.

The results presented in the table above reveal the diversity of dome typologies in our sample. We have identified eight types of dome:

1. The hemispherical dome stands out as the most predominant. Of the mosques studied, 52 have a single hemispherical dome, while 26 have several domes, the main one of which is

hemispherical. Thus, the hemispherical dome is present in a total of 78 mosques, representing 78% of the sample studied. This predominance will be analyzed in greater detail in the section on dome construction techniques.

2. Low domes and faceted domes are the second most common type. They enjoy a respected status in local reference, particularly in the region's historic mosques. For example, the faceted dome of the Sidi Mesoud mosque[111], located in the old Laachache district and dating from the 16th century, is considered the oldest in El Oued.

3. The other types of dome we've studied have interesting features, which we've examined in a descriptive and analytical way. To illustrate these features, we have selected three examples of mosques.

3.2.3 Dome location:

As part of our analysis aimed at understanding the elements determining the typology of domes and their construction, we examined the location of these structures in relation to the prayer hall and the mosque as a whole. This study of dome location is based on a classification of mosques into two categories: those with a single dome and those with several domes, the latter being subdivided into central and secondary domes.

We have drawn up an analysis grid based on our observations in the field, taking into account a series of location criteria.

Table 4. 10 Dome location

(source: author)

Location	Typology							
	Single-domed mosque		Multi-domed mosque					
			Main dome		Location Secondary dome			
Precedes the Mihrab	●		●					
Central		●		●				
Input					●	●		
Gallery					●		●	
Other								●
Results	67	03	29	01	07	03	14	04

Note: the result was produced using the platform.

Gallery: Covered passageway outside a prayer room

Other: means outside the location indicated in this table

For single-domed mosques, the majority - 67 out of 70 - feature the dome before the Mihrab. However, two mosques, El Fath and El Takoua, located in the municipality of El Oued and supervised by a local architect, stand out for their different dome layout. This could be interpreted as the adoption of a new design approach specific to the region. This raises the question of the extent to which the architect's training and professional experience can influence the typology and design of mosques.

[111] The mosque is located in the protected area of Lacheche in the municipality of El Oued.

In multi-domed mosques, the main dome is also often placed before the Mihrab, as in single-domed mosques. As for the secondary domes, their location varies: 14 out of 30 are located above the gallery, indicating a certain architectural uniformity with the main prayer hall. In addition, three mosques feature a dome above each entrance, underlining their symbolic importance as entrance markers. In addition, seven mosques feature secondary domes at both gallery and entrance level, while in four mosques their location seems more random.

In summary, this study reveals the main dome preceding the Mihrab, demonstrating consistency with historical references and a reaffirmation of the importance of this layout in mosque design.

3.3 The Mihrab[112] :

It is an essential component in defining the Imam's position and the Qibla's direction. In the past, a noticeable stone block marked the Qibla at the Prophet's mosque in Medina. The Mihrab was frequently indicated in early Islamic mosques by an inlaid stone block within the Qibla wall or a straightforward paint strip. Mosques today display many interpretations of the Mihrab. Given this, we have devoted our attention to studying the different types of Mihrabs that are present in El Oued mosques. Article 37 of the specifications addresses the Mihrab, stating that "*the Mihrab must have a curvilinear shape. The Maghreb Islamic architectural style should inspire the Mihrab's design*."

El Oued's Mihrabs usually have a curved shape with a particular niche. This niche can be found in mosques in two main configurations. The niche can be seen from the Maksoura room in the first configuration, giving spectators a view of the Mihrab's exterior. On the other hand, the Mihrab niche is hidden from view from the exterior of the mosque. As such, the Mihrab niche is located in a specially allotted area between the back of the Mihrab and the mosque wall that serves as a Maksoura.

Figure 4. 14. Mihrab Mosque El Fath -El Oued (Source: author)

Figure 4. 15 Mihrab Mosque Guemar (Source: author)

[112] According to the Encyclopedia of Islam, the Mihrab is a niche that points in the direction of the Qibla.

When the alternate configuration is used, the back of the Mihrab can be seen from the outside of the mosque. This characteristic makes it easier for spectators to understand the mosque's architectural design, making it possible to recognize its many elements and determine the Qibla's direction.

Figure 4. 16 Mihrab of the El Sahwa-Guemar Mosque
(Source: author)

Figure 4. 17 Mihrab of the El Aziz Mosque
(Source: author)

Bricks are used to construct the curved Mihrab, which uses the corbelling technique. We witnessed the construction of the El Takwa mosque's Mihrab during our visit to the building site. The front and rear sides of the Mihrab are covered with a layer of plaster or cement once the brickwork is finished. The outside of the Mihrab is usually covered in a simple plaster finish, with the inside section receiving more elaborate decorating and adornment. This method makes it possible to design a variety of Mihrab facades.

Figure 4. 18 Mihrab of the El Takwa Mosque in El Oued
(Source: author)

Figure 4. 19 Mihrab under construction at the El Takwa Mosque in El Oued
(Source: author)

Investigating mosque interiors revealed a variety of Mihrab treatments, including shaped arches held up by ornamental pillars and a wide range of interior decorations, including marble and ceramic coating. The Mihrab area is given a great deal of attention, as evidenced by the careful attention to detail that puts its arrangement ahead of the mosque's overall interior design. This emphasis highlights the Mihrab space's religious significance in the architectural setting. In addition, it is traditional for the Mihrab to be placed next to the Minbar, which is always to the right of it, emphasizing the complementary functions of spiritual guidance and leadership inside the mosque's ritual framework.

Figure 4. 20 Mihrab of the Othmane Ben Afane- Hassi Khelifa mosque
(Source: author)

Figure 4. 21 Mihrab of the Malek Ben Anes Mosque
(Source: author)

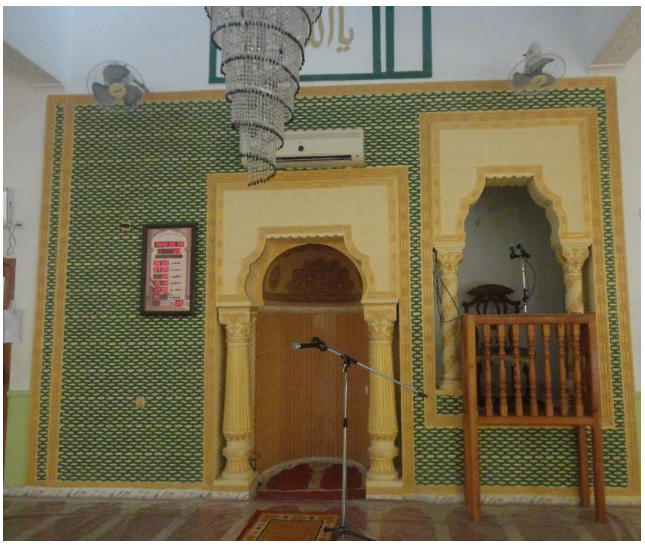


Figure 4. 22 Mihrab of the Ali Ben Abi Taleb- Hassi Khelifa mosque
(Source: author)

Figure 4. 23 Mihrab of the El Chohada El Karya-Guemar Mosque
(Source: author)

3.4 The Minbar:

Article 38[113] states, "*The Minbar should be crafted from high-quality wood, designed for easy mobility in its intended function. Its design should draw inspiration from the authentic religious heritage guided by the national religious authority. Importantly, constructing a balcony adjacent to the Mihrab for Minbar use is prohibited*."

This article advocates using a single movable wooden Minbar, emphasizing a design approach rooted in referenced architectural traditions.

Through our analysis of the Minbar, we have been able to identify two distinct forms as well as its inherent value and crucial position as a fundamental component of any mosque.

3.4.1 Movable Minbar:

The traditional wooden Minbar is found mostly in mosques built in the last few decades. The amount of movable Minbars found in mosque construction has drastically decreased as balcony Minbars become more and more common in contemporary mosque designs.

Figure 4. 24 Mihrab and mobile Minbar of the El Takwa mosque -El Oued
(Source: author)

[113] Interministerial order setting the standard specifications relating to the typology of the construction of mosques. Available at: https://www.joradp.dz/FTP/JO-francais/2022/F2022061.pdf?znjo=61

3.5 Minarets (SOUMÂA)[114]:

At present, it is generally accepted that the construction of a mosque should essentially include a series of components, among which minarets occupy an important place.

Our study, closely linked to the typology of mosque construction, has led us to focus on one of these components: minarets. In other words, in this phase we aim to study the typology of minarets, identify the predominant types of construction, and examine their historical reference and modus operandi. Our fieldwork revealed that minarets are not confined to mosques. For example, as soon as you enter the town of El Oued, you'll find an isolated minaret, entirely separate from its perimeter, with the municipality's headquarters in the background.

Figure 4. 25 The minaret and the new headquarters of the El Oued municipality

(Source: author)

Figure 4. 26 Former el Oued railway station

(Source: Moudjib Khelil[115])

The dissimilarities between the two images presented below (Figure 4. 25andFigure 4. 26) prompted us to investigate the history of this minaret, which turns out to be as follows: During the colonial period, this minaret was built during the construction of a railway station, which explains its construction typology similar to that of railway stations at the time. In recent years, local authorities have launched a project to build a new headquarters for the municipality of El Oued. As part of this project, the staff in charge considered demolishing the station and minaret. However, due to the opposition and intervention of civil society and the Ministry of Culture, the demolition was blocked. As a result, the minaret was preserved, giving it its current appearance. This incident highlights the divergent perceptions of heritage and its value between the authorities and society.As far as public facilities are concerned, minarets are present in some of them, such as that of the Hôtel Transatlantique, an Arab office dating from the colonial period (FEKIH, 2019).

[114] SOUMÂA: writing as the Interministerial order setting the standard specifications relating to the typology of the construction of mosques.

[115] Moudjib Khelil; Face book page.

Their shapes and ornamentation are inspired by local reference catalogs and blend harmoniously into the city's urban fabric(FEKIH, 2019). However, this sometimes creates visual confusion with mosques, as in the case of the Hotel Transatlantique, often perceived as a mosque due to its mosque-like components. The multiplication of minarets and domes in mosques and urban facilities could thus justify El Oued's appellation as the "city of a thousand domes and minarets".

Figure 4. 27 Bureau Arab
(Source: Moudjib Khelil)

Figure 4. 28 Dar Diaf
(Source :Moudjib Khelil)

Figure 4. 29 Hotel Transatlantique
(Source: Moudjib Khelil**)**

3.5.1 The oldest minaret in EL OUED :

It is undeniable that the aim of our study is to focus primarily on the typology of new mosques built by religious associations. However, it would be extremely beneficial not to neglect the region's older mosques, and to analyze all the elements that could help us understand the terrain.

One of the highlights of El Oued is the Sidi Salem minaret, located in the old quarter of the town. During our visit, accompanied by a guide and a local architect, we had the opportunity to observe the minaret's architecture in its entirety, both from the outside and the inside, as well as from its summit for a panoramic view of its surroundings. Square in shape, it is crowned by a lantern and surmounted by a facetted dome. Locals claim that this minaret is the oldest in the region.

With this in mind, we ask the question: could this old minaret serve as a reference(Noureddine & Abdelmalek, 2019) for the construction of new minarets?

Figure 4. 30 Sidi Salem Minaret
(Source: Tourism and Crafts Directorate of the wilaya el oued, https://el-oued.mta.gov.dz/fr)

Figure 4. 31 Sidi Salem Minaret
(Source: author)

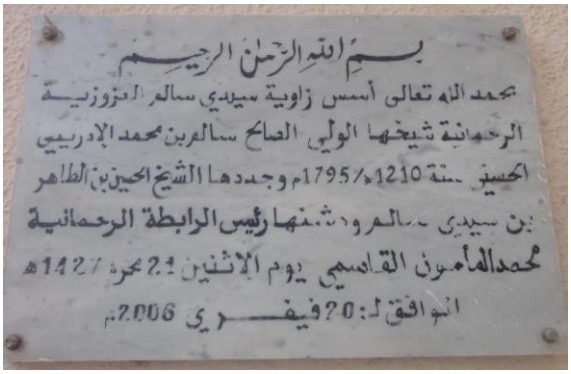


Figure 4. 32 Sidi Salem Minaret
(Source: author)

3.5.2 The minarets of El Oued's proximity mosques:

In the course of our research, we undertook a study of 100 mosques sample.in the municipalities of El OUED. This study focus on:

- ✓ Examining the presence and numbers of minarets.
- ✓ The typologies and shapes of minarets.
- ✓ Minaret components.
- ✓ The location of minarets in mosques.
- ✓ The proportion of minarets.

Those steps are made in the same order of the Interministerial order of May 29th , 2022 articles[116] about the number shape, location and dimension of the minaret.

[116] Articles 56 to 58 of Interministerial order setting the standard specifications relating to the typology of the construction of mosques. Available at: https://www.joradp.dz/FTP/JO-francais/2022/F2022061.pdf?znjo=61 (Accesed 16 novembre 2022)

3.5.2.1 Number:

In the course of our research, we undertook a study of the construction typology of new minarets. This study first focused on examining the number of minarets in mosques. The data collected in the table below provided us with the necessary information.

Table 4. 11 The presence of minarets

(Source: author)

Typology	No minaret	single minaret	Two minarets	Four minarets
Number of mosques	36	43	19	02

Note: the result was produced using the platform.

Shapes of minaret case of single minaret:

Our study revealed that 43 of the mosques surveyed, spread across several municipalities, have a single minaret. We then classified these minarets according to their shape and general structure, as illustrated in table. Two distinct cases emerged: those with a completely unified shape and those with a non-unified shape.

Table 4. 12 Minaret shape for mosques with a single minaret

(Source: author)

Classification criteria		Number of mosques			
The shape	Type	21	11	01	10
Form unify	Square	●			
	Octagonal		●		
	Hexagonal			●	
Non-unified shape	Square base, octagonal upper part				●

Note: the result was produced using the platform.

These minaret shapes will be studied as follows:

1. 1-Atik mosques with a single square minaret
2. New mosques with a single square minaret
3. Mosques with a single claustra-covered square minaret
4. Unique single square minaret

3.5.2.2 Atik mosques with a single square minaret:

The minarets of the El Atik[117] mosque construction method are quite common in every municipality(Noureddine & Abdelmalek, 2019) . Their appearance is reminiscent of a series of minarets that are ubiquitous in local heritage. For example, the minaret of the El Forkane mosque

[117] El Atik means mosques whose construction is neither new nor old.

in El Oued (Figure 4. 36) continues to exist without having been modified or demolished, despite the reconstruction work undertaken on the mosque.

The minaret has a square shape and inscriptions indicate that it dates from 1970, with a total height of 26 m. What sets this mosque apart is the juxtaposition of two elements. Indeed, we note that the new mosque is built without a minaret, while the old minaret has been integrated into it.

Figure 4. 33 Minaret of the El Ridaa Mosque
(Source: author)

Figure 4. 34 Minaret of Abi Bakr El Sedik mosque
(Source : author)

Figure 4. 35 Minaret of the Imam El Ghazali-Hassani Abd Elkrim Mosque
(Source: author)

Figure 4. 36 Minaret of the El Forkane mosque
(Source: author)

3.5.2.3 New mosques with a single square minaret:

At the heart of our study of square minarets, we spoke to the architect at El Oued's Religious Affairs Department, who explained that approval for the study of new mosques is closely linked to the presence of a single square minaret, in accordance with the 2013 decree.

We have used various examples to describe the organization of these square minarets. In general, these minarets are similar in terms of measurements and proportions, with a light, reinforced concrete and brick framework, not requiring the use of sails (Figure 4. 39). Unlike building practices in other wilayas, El Oued is not a seismic zone, so minarets are often lighter in structure.

The example below illustrates a great similarity in the way the minarets are organized, built entirely of brick with small, alternating openings. Although this example confirms this similarity in terms of external appearance, we have noted a certain diversity in the materials used.

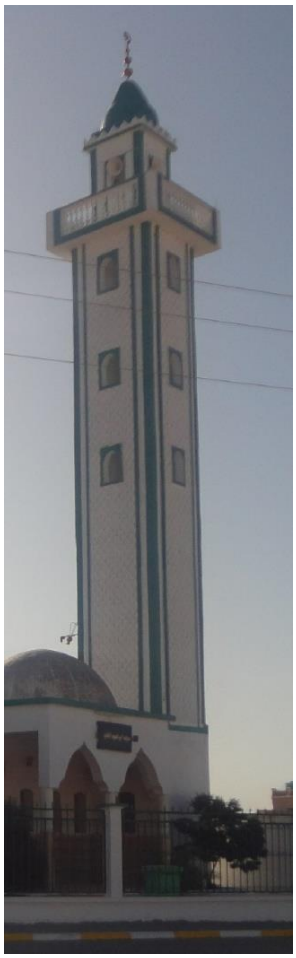


Figure 4. 37 Minaret of the Ibrahim El Khalil Mosque
(Source: author)

Figure 4. 38 Minaret of the Abd El Hamide Ben Badis mosque -Oued Alenda
(Source: author)

Figure 4. 39 Abi Horaira- El Oued mosque
(Source:author)

3.5.2.4 Mosques with a single claustra-covered square minaret:

Observation of mosques with a single square minaret revealed the diversity of materials used to build these minarets. In five mosques where the facades are treated with clerestory, we noticed that four minarets (Figure 4. 40 Figure 4. 41 Figure 4. 42 and Figure 4. 43) are built with the same clerestory pattern, but painted differently. The technique employed is to use prefabricated motifs assembled piece by piece to ensure a unitary, homogeneous appearance. Only the Othmane Ben Afane mosque (Figure 4. 44) features claustra's identifiable by separate pieces.

Figure 4. 40 Minaret of Omar Ben Abd El Aziz mosque

(Source: author)

Figure 4. 41 Minaret of Sadki-Jamaa mosque

(Source : author)

Figure 4. 42 Minaret of El Nour mosque

(Source : author)

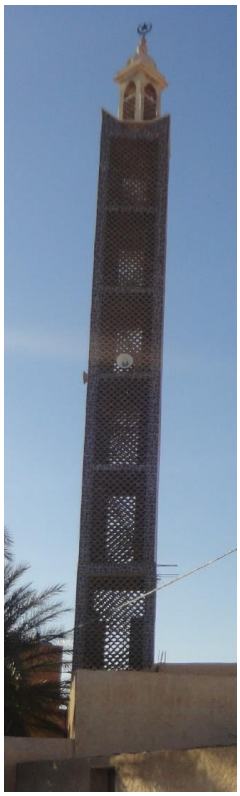


Figure 4. 43 Minaret of El Imane-Debila mosque

(Source : author)

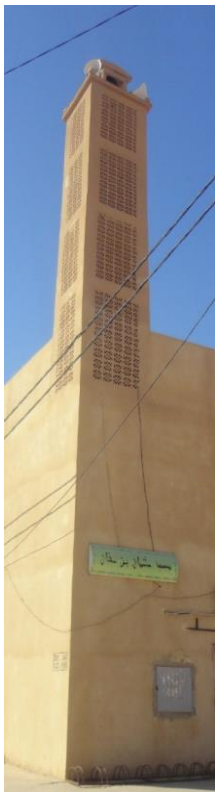


Figure 4. 44 Minaret of Othmane Ben Afane mosque

(Source : author)

This construction approach leads to two different forms of organization:

Clerestories used as decorative elements, as in the Omar Ben Abd El Aziz (Figure 4. 40) and El Sadki (Figure 4. 41) mosques, where they were applied to brick walls. Claustras used as both decorative and structural elements, as in the El Nour, El Imane and Othmane Ben Afane mosques. Rather than building brick walls to fill the space between the minaret's structural elements (posts and beams), the builders opted for claustra walls. This technique ensures a certain structural lightness[118], reduces financial costs and provides an aesthetically pleasing appearance.

[118] Structural: Claustrate infill instead of brick.

3.5.2.5 Unique Mosques with a single square minaret:

Our investigation has enabled us to identify other mosques with types of minarets that differ in number and shape from those discussed above. These include the mosques of El Izza, Hamza(Figure 4. 46) and El Adouani(Figure 4. 47). Each minaret in these three mosques has its own distinctive characteristics compared with the minarets studied previously.

Figure 4. 45 El Izza Mosque
(Source: author)

Figure 4. 46 Hamza Mosque
(Source: author)

Figure 4. 47 El Adouani Mosque
(Source: author)

As for the minaret of the El Izza mosque, its concrete structure is structurally attached to the mosque, an arrangement[119] not recommended by the construction regulation. In addition, its exterior treatment is characterized by protruding vertical elements, offering a modern appearance.

[119] The frame of the minaret must be independent of the mosque, in accordance with construction regulations.

As for the minaret of the Hamza mosque (Figure 4. 46), its impressive structure is distinguished by its considerable size at the lower level. What's more, its square shape gradually evolves from wider to narrower. The lower part of the minaret has been clad on the outside with metal cladding, while the treatment of the other parts remains unfinished. This feature indicates that the minaret as a whole is still in the process of being finished.

The El Adouani mosque (Figure 4. 47), one of the oldest in the region(Shohbi, 2007), has been completely rebuilt. This new construction has given the mosque a distinctive minaret. The minaret is probably the tallest in El Oued. Its exterior treatment is distinguished by a decorative relief pattern on all eight structural levels, made from glass bricks[120]. Generally used in homes and equipment for its ability to let light through, its resistance to humidity and its good thermal and acoustic performance, the choice of Nevada seems to be motivated more by aesthetic than functional considerations.

3.5.3 Minaret component:

With a view to studying minaret typology in greater depth, we based ourselves on the work of (Merzoug, 2012), who inspired us to treat minarets according to the principle of breaking down architectural elements into sub-elements, conceived as study criteria. We then focused minaret components as lantern and the dome.

For the lantern is considered a fundamental element in the design and construction of minarets[121]. In fact, it is present in 60 of the 64 mosques with minarets. However, there are only four mosques whose minarets are built without a lantern. Interestingly, three quarters of these mosques were built decades ago, with the exception of one mosque, which is newly constructed.

3.5.3.1 Small cupola:

The analysis of these minarets also revealed the number of cupolas and their typology, which was studied according to their shape (table 4.13). The results highlight the presence of cupolas of various shapes, such as hemispherical, onion-shaped, low-slung and pyramidal. In addition, some are present with a lantern, while others are not.

Table 4. 13 Small cupola typology

(Source: author)

	Hemispheric	Onion	Low-profile	Pyramidal
Typology	●			
		●		
			●	
				●
Number of mosques	31	24	06	03
Percentage	48.44%	37.50%	9.38%	4.69%

Note: the result was made using the platform.

[120] Glass blocks are great for thermal control, improving aesthetics and encouraging the flow of natural light.

[121] 36 out 100 mosques do not include minarets.

According to the analysis table above, we can see that the shape of the small cupolas varies considerably, as follows:

- The hemispherical cupola represents 48.44%.
- Onion small cupola accounts for 37.50%.
- The low cupola represents 9.38%.
- The pyramid-shaped cupola represents 4.69%.

Two dominant typologies emerge: the hemispherical cupola and the onion cupola, which are the two types mainly adopted in newly-built mosques. The lowered cupola is mainly found in so-called "Atik" mosques, while the pyramidal cupola is observed in "Atik" mosques as well as in newly-built mosques. Below, we have selected four mosques representing each of the c small cupola typologies mentioned above.

Figure 4. 48 Hemispherical small cupola of the Amir Abd El Kader mosque (Source: author)

Figure 4. 49 Cupola of the Oulad Messoud Mosque (Source: author)

Figure 4. 50 Cupola of the Abi Bak El Sedik-Hassi Khelifa Mosque (Source: author)

Figure 4. 51 Pyramidal cupola of the Sidi Ahmed Doghmane -Guemar mosque (Source: author)

3.5.4 Location of minaret:

At Continuing our study based on the minaret typology previously examined, we also looked at the location of minarets in relation to the mosque as a whole. To do this, we set up an analysis grid, taking into account the common locations of minarets observed in certain mosques. We then focused our attention on the specific location of minarets, studying all cases in two distinct stages.

First, we examined the location of minarets in mosques with a single minaret. Next, we examined the location of minarets in mosques with two minarets.

3.5.4.1 Mosques with a single minaret:

After analyzing 43 mosques with a single minaret, we identified two dominant locations for these minarets, as presented in the analysis table (Table 4. 14). These dominant locations can be illustrated according to the results collected as follows:

- A minaret in the southeast corner (to the left of the Qibla wall), representing 37.21% of cases.
- A minaret in the southwest corner (to the right of the Qibla wall), representing 44.19% of cases.

Table 4. 14 Location of minaret for mosques with one minaret

(Source: author)

	Number of mosques				
Location	16	19	02	04	02
South-east corner	●				
Southwest corner		●			
North-east corner			●		
Northwest corner				●	
Other					●

Note: the result was made using the platform.

- Presence of elements

Focusing on the results, it seems that the major location of the minaret is on the axis of the Qibla, sometimes to the left and sometimes to the right. This choice of location is determined by the intention to make the minaret visible in relation to the urban fabric and the main thoroughfare.

3.5.5 Proportion between minaret heights and the mosque's overall heights:

We compared the heights frequently adopted in minaret construction with the[122] mosque template.

Table 4. 15 Comparison between minaret height and mosque size
(Source: author)

Height in M	14.50	16.00	17.50	20.00	20.10	21.70	22.68	24.50	26.10
Number Mosque	02	02	02	03	02	02	02	02	04
Ground floor	●	●	●	●	●	●		●	●
Under floor plus floor							●		
Two floors	●		●				●	●	●

The results show that identical minaret heights are present in different mosque templates. For example, heights of 14.50 m, 17.5 m, 24.50 m and 26.1 m are observed in both single-floor and two-floor mosques, even though these types of mosque differ considerably in height.

This raises questions about the appropriateness of the proportions between minarets and mosques. The proportions don't seem to follow a well-established architectural standard.

[122] The gauge: is translated as height and differs naturally between the ground floor, two floors

4 Conclusion

In the light of our study, based on the architectural typology of proximity mosques in El Oued, and after a field survey and analysis of the data collected via our platform, we were able to identify several answers on the invariant components of mosques and their architectural typologies. The results can be broken down into several levels and factors.

The recently enacted 2022 legislation mandates that local mosques as classification must exceed 1000 m² our research indicates that this type of mosques in the wilaya of El Oued are generally smaller than 1000 m², a characteristic closely linked to local urban and demographic factors.

We observed that the prayer room is generally built in three forms: a rectangular shape with an often long Qibla wall, an irregular shape adapted to the configuration of the terrain, and a square shape, these spaces are part of an architectural organization of mosques with a surface area of less than 1000 m² and a height of one or two floors.

The legal requirement for a rectangular prayer hall ensuring that the front wall of the Qibla occupies the longest part of the rectangle in new construction contrasts sharply with observations in the field, only 30% of mosque have this criterion

The common feature of many mosques, with a hemispherical typology preceding the Mihrab, built on three levels inspired by Aghlabid architecture. However, other forms of dome (facetted and lowered) also exist.

The law requires a single dome at the national level, and exceptionally allows multi-domed mosques in the wilaya of El Oued in order to preserve a characteristic regional identity. However, our research shows a decline in this local trend. Single-domed mosques predominate with 70 % due to technical and financial constraints, even in this region where tradition calls for multiple domes.

The legal requirement for a single square minaret in new construction contrasts sharply with observations in the field, only 21 % of mosque have single square minaret.

As a preliminary result we found that only 10 % of mosques in the field that have a rectangular prayer hall with an often long Qibla wall, a single square minaret, a single or multi hemispherical dome.in other word 10 % of mosque respects the new 2022 specification rule book. The rest of typology seem not correspond with the new 2022 specification will be treated and focus on it in the next chapters.

CHAPTER 5

THE FIELD: DEVELOPER OF VARIOUS INTERPRETATIONS OF 2022 SPECIFICATIONS

1 Introduction

As a preliminary result we found some mosques in the field that respect the new 2022 specification. The rest mosques developed different way of architectural interpretation .as the chapter four treated the commune components in the field and legislation. This chapter will treat the various interpretation in the field. In the same logic of chapter four we will analyses the various prayer room, prayer room component's, the dome, the Mihrab, Minbar and the Minaret.

In this chapter we focus on elements that developed in the field and which do not correspond with articles of new 2022 specification or in other case that do not mentions any way in the last.

2 The field and the various Interpretations of 2022 Specifications

Examination of the plans for new mosques in El Oued reveals a marked adopting the square shape (36 mosques out of 100 are square) both as the exterior form of the mosque and as the interior form of the prayer hall, even if the general topography of the terrain would allow rectangular or other shapes to be opted for. In our opinion, the tendency to build square-shaped mosques(Figure 5. 1) can be explained structurally by the stability offered by regular square shapes .

Table 5. 1 The general shape of the mosque

(Source: author)

	The general shape of the mosque			
Number of mosques	Square	Rectangle	Irregular	Octagonal
100	36	47	16	01

Indeed, civil engineers often support and favor the square shape as well as the square plan, as verification and approval of these shapes are generally quicker and more favorable than for other shapes.

As far as irregularly-shaped mosques are concerned, we found 16 buildings with this configuration. In some cases, this shape could be attributed to the irregular topography of the land, while in others it could be the result of successive extensions that have shaped this irregularity.

As for octagonal mosques, we have observed only one building with this configuration

Figure 5. 1 The square plan of EL Ababsa El Gherbia mosque in El Oued
(Source: DARW El Oued)

3 Prayer room; gallery:

The feature that distinguishes El Oued's architectural structures, including mosques, from other buildings, are the galleries[123],. This is a common feature of vernacular building in and around El Oued. many vernacular construction has one or two Riwaq. The location of these galleries can vary, some being arranged opposite each other around the central courtyard, to provide shade and coolness during the summer (MEKI, 2016). This is a covered shelter with arches. This element continues to be present today, whether in equipment or in the streets of El Oued, as it plays a protective role against the sun's rays. We tried to assess the extent to which this element is present in El Oued's mosques. The example of Abd El Hamid Ben Badis mosque (Figure 5. 2) show clearly the typology newly adopted in mosque ,a square shape of mosque ;a prayer room with gallery.

Table 5. 2 Presence of galleries in El Oued mosques

(Source: author)

Number of galleries	Without gallery	A gallery	Two galleries	Three galleries	Four Galleries
Number of mosques	14	40	31	10	05
Presence of galleria	No	Yes			
Total number of mosques	14	86			

Note: the result was produced using the platform.

This study revealed that the majority of mosques in El Oued are built with galleries, there are four sub-types of mosque, depending on the number of galleries: mosques with a single gallery, totaling 40 buildings; mosques with two galleries, present in 31 buildings; mosques with three galleries, numbering 10; and the remaining 05 mosques comprising four galleries. Only fourteen mosques have no gallery at all.

these galleries are important for reasons other than aesthetics. We explore their positioning, prevalence, architectural form, and building methods.

[123] Riwaq: Arcade roofed or street

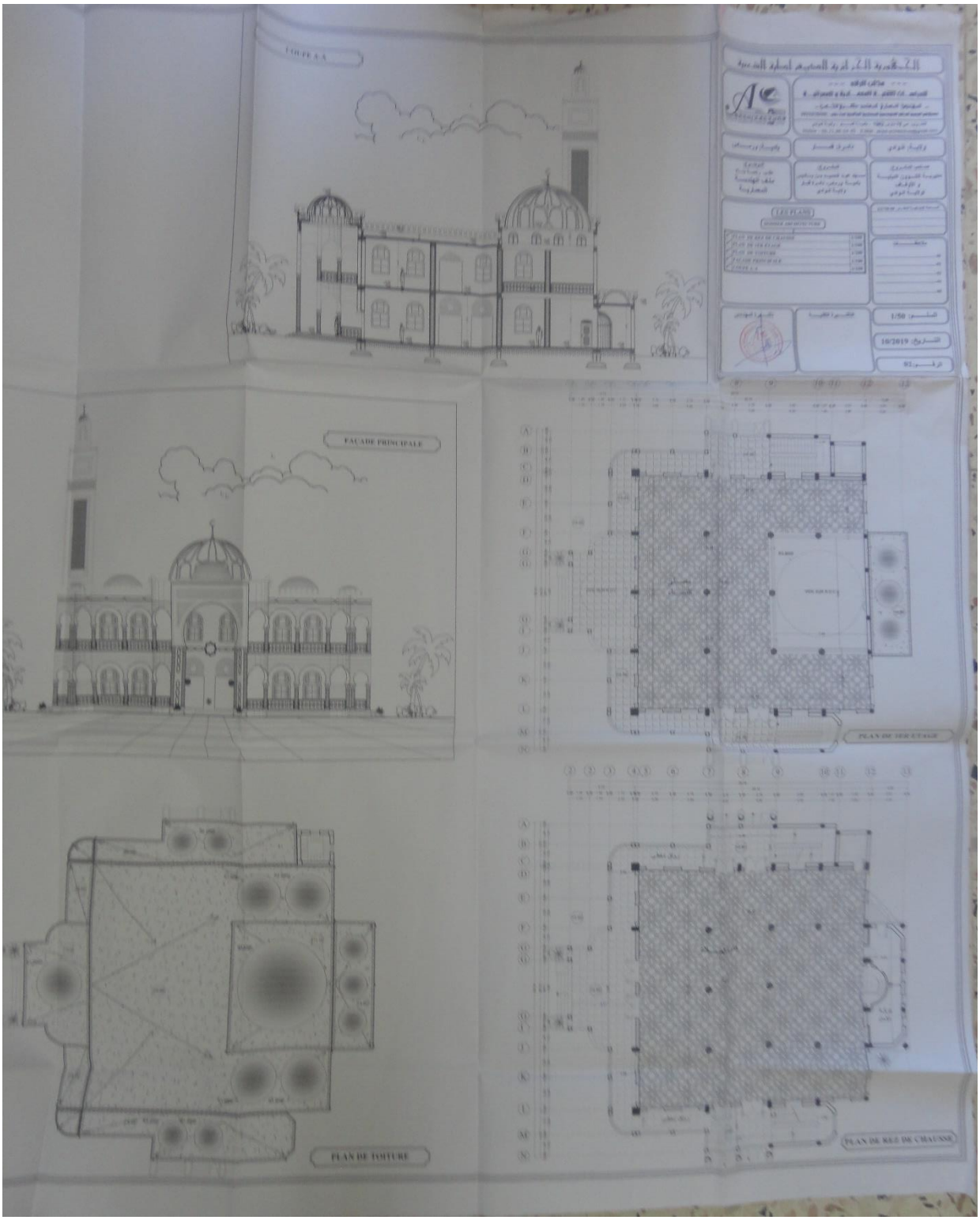


Figure 5. 2 Plan of Abd EL Hamid Ben Badis mosque in El Oued
(Source: DARW El Oued)

3.1 Location of Gallery:

The presence of a gallery was highlighted in the upstream section, and observation showed us the different possible locations of the gallery in relation to the spatial organization of the mosque. Four locations were identified and are presented below:

Table 5. 3 Location of Gallery in relation to the mosque

(Source: author)

		A gallery				Two galleries						Three galleries		Four Galleries
Location in relation to Qibla	To the left	●				●	●		●			●	●	●
	To the right		●			●		●		●		●	●	●
	Rear			●			●	●			●	●		●
	Before				●				●	●	●		●	●
Number		16	16	03	05	15	02	07	03	02	02	08	02	05

Note: the result was produced using the platform.

The data collected in the field has enabled us to understand the location of the galleries, and we can summarize this information by focusing on the number of galleries.

For all galleries, whatever their number, they share similar dominant locations. In other words, they are located to the left and right of the Qibla wall, in order to be functional. They are usually attached and aligned parallel to the entrance to the prayer hall.

While this functionality is present in the locations mentioned, the galleries at the front and rear of the prayer room are designed more for aesthetic than functional considerations.

3.2 Gallery architecture:

The sheer number and variety of site layouts mentioned above led us to focus on the architecture of the galleries in question, with the aim of understanding their composition, organization and arcade forms.

In the case of a mosque built solely on the first floor, a gallery is made up of a series of arcades arranged consecutively. In the other case, when the mosque is built on two levels, we observe three types of organization: a gallery only on the first floor, a gallery only on the second floor, and finally the case where galleries are present on both levels simultaneously. Here are a few examples to illustrate the typology observed in the field.

Figure 5. 3 Gallery of the El Amir Abd El Kader- El Byadha mosque
(Source: author)

Figure 5. 4 Gallery of the El Atik Hai El Awachir-El Byadha mosque
(Source: author)

The two mosques shown in the example are very similar, as illustrated in(Figure 5. 3 and Figure 5. 4). They are located in two separate districts, facing the same axis and the main thoroughfares of the El Byadha municipality.

This similarity is remarkable in terms of the location, dimensions, proportions and shape of the lancet arches, which are identical. This led us to reflect on the origin of this similarity, with the aim of answering the following questions: Are the shape and typology of the arches the same in the mosques of the other municipalities? Could the similarity discovered in the mosques of the El Byadha municipality also be present in the mosques of other municipalities?

To answer these questions, we undertook a comparative study, classifying mosques according to municipality and arch form. We visited the municipality of Oued Alenda, which gave us the opportunity to work on the example below.

Figure 5. 5 Gallery of the Abd El Hamid Ben Badis mosque - Oued Alenda
(Source: author)

Figure 5. 6 Gallery of the Oued Alenda El Chamali- Oued Alenda mosque
(Source: author)

It should be noted that the Abd El Hamid Ben Badis (Figure 5. 5) and Oued Alenda El Chamali (Figure 5. 6) mosques show distinct nuances in their overall design. The galleries of the Abd El Hamid Ben Badis mosque feature two types of arch: one triangular and the other braced. This type of arch can also be seen in the Alenda El Chamali mosque.

In the municipality of Jamaa, we examined the following two mosques: Bilal Ben Rabah (Figure 5. 7) and Omar Ben El Khattab (Figure 5. 8).

Figure 5. 7 Gallery of the Bilal Ben Rabah-Jamaa mosque
(Source: author)

Figure 5. 8 Gallery of the Omar Ben El Khattab-Jamaa mosque

(Source: author)

The arches and galleries of these two mosques are undeniably similar. However, we note an adoption of braced and tri-lobed arch typologies that differs from that observed previously.

3.3 Gallery construction

We broadened our field of research to include mosques currently under construction, in order to understand the origins and methods of execution leading to this diversity of shapes and arches. To this end, we visited a number of construction sites, including Khadija Oum el Mouminine (Figure 5. 9) in the municipality of El Oued and El Tawba (Figure 5. 10) in the municipality of Hassani Abdelkrim.

Figure 5. 9 Gallery of the Khadija Oum El Mouminine mosque -El Oued

(Source: author)

Figure 5. 10 Gallery of the El Tawba - Hassani Abdelkrim mosque
(Source: author)

We note that the reinforced concrete arches are very complex and varied in form (see Appendix. 1), in contrast to the older mosques in the region, which generally feature semicircular arches. This evolution illustrates the role played by construction techniques and the materials used. Indeed, the use of reinforced concrete in new mosques, as opposed to stone and gypsum in the past, has favored the adoption of these complex shapes.

Our intention to understand the technique used to build these reinforced concrete arches led us to study this type of construction in greater depth on site. We visited the site of the El Krama mosque (Figure 5. 11) in the municipality of Guemar. This visit enabled us to understand the method used by the builders to erect these arches. This is done using a prefabricated metal formwork that can be modified as required. Construction of the arch involves setting up the formwork, which serves as a support for pouring the concrete to give it the desired shape. This type of construction is considered easy and accessible to all builders, which explains why it facilitates the task while ensuring a sophisticated appearance.

Figure 5. 11 The arcades of the El Karama- Guemar Mosque
(Source: author)

The similarity of the arches, already observed and mentioned in the previous examples, is explained by the construction technique, which relies on the use of ready-made formwork. These forms are rented or loaned between builders in the same region and municipality, resulting in the adoption of an identical arch typology. On the other hand, builders are not concerned with the historical reference of these arch models, nor with the shape of the arches indicated in the construction plans. For them, the most important factor is the availability of formwork, its condition, and the possibility of adapting it to the dimensions of the structural framework.

From an architectural point of view, this construction technique could lead to the standardization of all the arches present in a single mosque or in other mosques. What's more, it could give rise to other arch typologies that appear to be disconnected from local, historical and heritage references.

3.4 Other use of gallery

The electricity demand is particularly warranted, especially in a region with high temperatures, necessitating the installation of air conditioners in residences, establishments, and mosques.(Figure 5. 12 and Figure 5. 13) depict a single mosque with approximately ten air-conditioning units. While incorporating these units inside the mosque is justified, considering the region's climatic conditions, questions arise regarding their integration with the mosque's exterior and aesthetic appeal.

Figure 5. 12 Air conditioners at the Ahmed Labidi Mosque
(Source: author)

Figure 5. 13 Ahmed Labidi Mosque
(Source: author)

In El Oued, we have also seen a different method of installing air conditioning outside mosques, namely in their galleries. In contrast to installations such as the one at the Ahmed Labidi mosque, these galleries provide a less obvious way to install air conditioners.

The Abd El Hamid Ben Badis mosque (Figure 5. 14) and El Adwani mosque are illustrative instances of how t these galleries are used to integrating air conditioning equipment.

Figure 5. 14 Gallery and air conditioners at the Abd El Hamid Ben Badis Mosque
(Source: author)

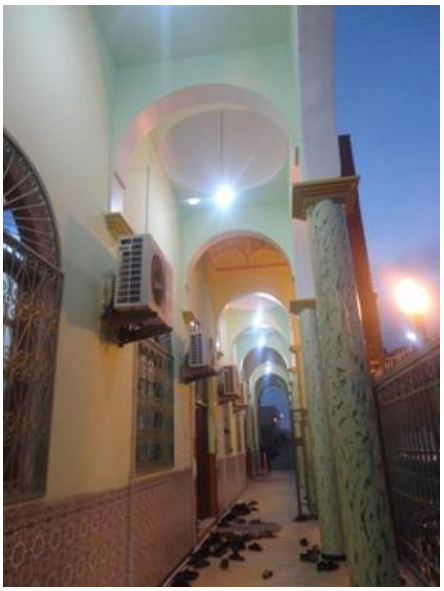


Figure 5. 15 Air-conditioning units in the El Adwani-mosque
(Source: author)

3.5 Capitals in prayer hall and gallery:

In this context, we would like to point out that the adoption of the metal mold technique has also influenced the production. However, we observed a strong similarity in the capitals of the mosques of El Oued, in contrast to the variety of shapes observed for the arches. The capitals appear similar in most of the mosques we visited, suggesting the use of a single type of mold. In Guemar, for example, the galleries of the El Karama and Abi El Derdaa mosques feature identical capitals.

Figure 5. 16 Capital at the El Karama –Guemar Mosque
(Source: author)

Figure 5. 17 Capital at the Abi El Derdaa-Guemar Mosque
(Source: author)

In the municipality of El Oued, we focused on the El Fath mosque, which is currently undergoing extension work. This mosque is entirely decorated with the same capital pattern, in the main prayer room, the secondary prayer room and the entrance. This type of capital appears to be a constructive prototype for this mosque. The presence of this same capital model in other mosques in the Wilaya of El Oued led us to reconsider the historical reference of this capital.

Figure 5. 18 Capital at the entrance to the El Fath -El Oued Mosque
(Source: author)

Figure 5. 19 Capital of the El Fath Mosque
(Source: author)

Figure 5. 20 El Fath -El Oued Mosque prayer hall
(Source: author)

3.5.1 The origin of this capital model :

Extensive research was carried out to trace the origin of these capitals in the mosques of El Oued. Indeed, this type of capital can be found in Medina residences such as Dar Balma and Dar el Haddad, whose construction dates back to the 16th century. These homes are attributed to families of Andalusian origin. This type of capital can also be found in Tunisia's historic mosques, such as the Mosque of Andalous. The presence of this same model in Tunisia, combined with the close historical relationship between the Wilaya of El Oued and Tunisia, raises the question of whether the adoption of this mold and model is justified by this correlation.

Figure 5. 21 Dar Balma gallery Hasfid capital, Author Revault, Jacques ,

(Source : https://cinumed.mmsh.univ-aix.fr/collection/item/97900-chapiteau-de-type-hasfide-galerie-du-dar-balma?offset=10-

Figure 5. 22 Dar el-Haddad ,

(Source :http://zaherkammoun.com/2015/06/21/la - medina-de-tunis-premiere-partie/)

Figure 5. 23 Andalusian Mosque, Tunis

(Source:http://www.inp.tn/cnsa/ensemblemongal.php?idMon=564)

Figure 5. 24 The Great Mosque of Tesour

(Source: Nizar Sayari)

4 Dome:

The results presented in last chapter(Table 4. 9 Dome typologies) reveal the diversity of dome typologies. We have identified eight types of dome:

The hemispherical dome stands out as the most predominant. Of the mosques studied, 52 have a single hemispherical dome, while 26 have several domes, the main one of which is hemispherical. Thus, the hemispherical dome is present in a total of 78 mosques. This predominance will be analyzed in greater detail in the section on dome construction techniques.

Low domes and faceted domes are the second most common type. They enjoy a respected status in local reference, particularly in the region's historic mosques. For example, the faceted dome of the Sidi Mesaoud mosque, located in the old Laachache district and dating from the 16th century, is considered the oldest in El Oued.

The other types of dome we've studied have interesting features, which we've examined in a descriptive and analytical way. To illustrate these features, we have selected three examples of mosques.

4.1 The Takwa mosque:

In the municipality of El Oued, the Takwa mosque, located in the El Nakhil neighborhood and dating from the 1980s, offers a unique opportunity to analyze the concordance between the original plans and the actual construction. Once we had access to the original plans for this mosque, we were able to make a detailed comparison with the structure as it stands today. This comparison reveals a high degree of conformity between the initial plans and the actual implementation in the field.

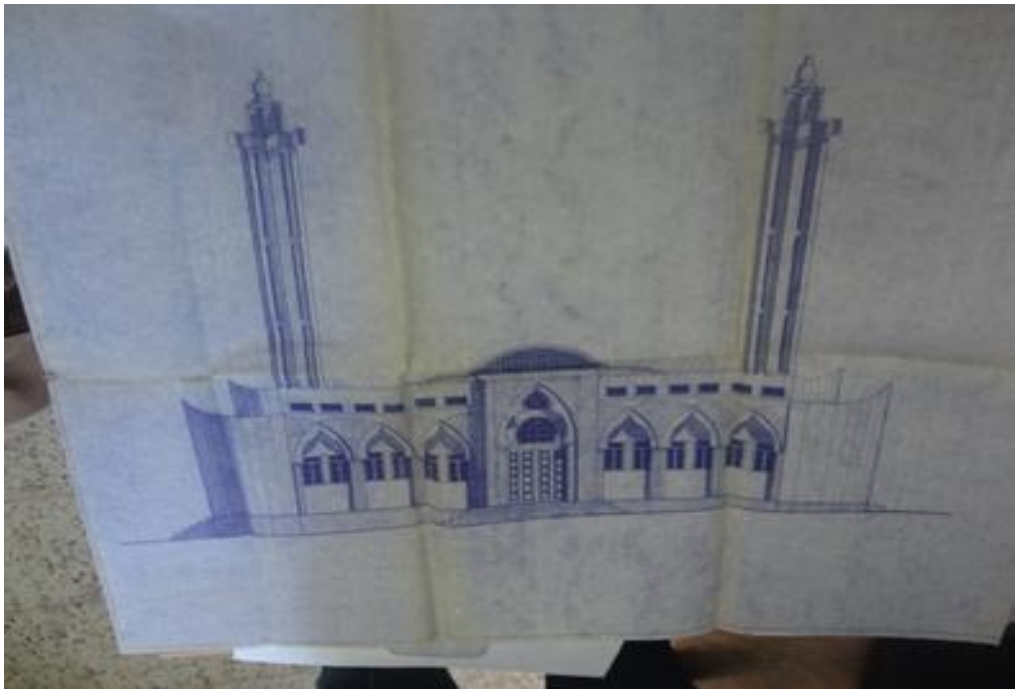


Figure 5. 25 Plan of the El Takwa mosque
(Source: DARW El Oued)

The design of this mosque is distinguished by two distinctive elements: the vault covering the prayer hall and the shape of the dome preceding the Mihrab (see Figure 5. 26). This design is characterized by a desire to reconcile the initial plan with the final realization, introducing a form that finds no equivalent in the local heritage, although elements such as the vault and dome are present in the regional architectural repertoire. This demonstrates that has drawn inspiration from the heritage while making the necessary adaptations.

Figure 5. 26 Dome of the Takwa mosque
(Source: author)

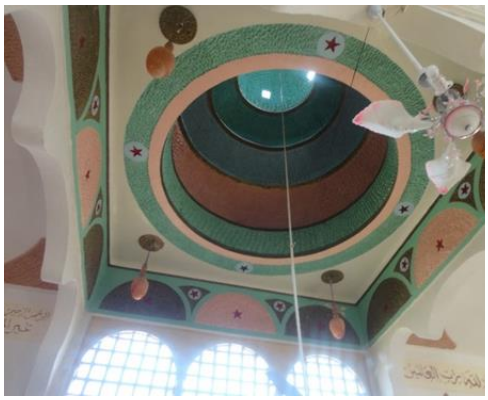


Figure 5. 27 View of the dome inside the Takwa mosque
(Source: author)

Figure 5. 28 The Takwa mosque
. (Source: author)

4.2 The Dou El Nouriane mosque :

During our visit to the interior of the Dou El Nouriane mosque (Figure 5. 30), we noticed that the large central dome is actually a false dome, only visible from the outside. This observation raises the question of prioritizing aesthetics and external image to the detriment of essential architectural functions such as interior aesthetics, thermal and acoustic comfort.

Moreover, the presence of onion-shaped domes once again raises questions about architectural choices, which seem to deviate from the local and Maghrebian reference. This question has already been raised concerning the mosques in Oran(Senhadji, 2017).

Figure 5. 29 Inside the Dou El Nouriane mosque
(Source: author)

Figure 5. 30 Exterior of the Dou El Nouriane mosque
(Source: author)

4.3 El Izza mosque:

In the third example, the El Izza mosque in Kouinine[124] (see Figure 5.31) is distinguished by the presence of three types of juxtaposed domes: an onion-shaped central dome, flanked on either side by a hemispherical dome, and an ogival dome. This diversity of domes within a single structure bears witness to a singular architectural choice, reflecting the ancestral know- how of the region's builders when it comes to making domes.

This achievement highlights the importance of the placement of domes in mosques, an aspect we focus on in our analysis.

Figure 5. 31 The El Izza mosque
(Source: author)

[124] Kouinine is a municipality located 06 km northwest of El Oued.

4.4 Abi Moussa Al Achaari mosque :

At the entrance to the town of El Oued, the Abi Moussa El Achaari mosque is visible to any visitor due to its size and location on the main axis of the town center. The mosque has several distinctive features. It was demolished in 2005 and then rebuilt. A comparative study of the old and new mosques provided us with a wealth of information. Notably, the old mosque had a single square minaret, while the new one has two, with their unique design and location, differ from all the other minarets previously studied, according to the construction plans (Figure 5. 34).

This example illustrates a change in mosque typology, involving technical and technological advances. Similarly, the new dome differs completely from that of the old mosque, which was hemispherical and built according to local tradition. The new dome, on the other hand, is made of metal framework and equipped with a mechanical and electrical system enabling its opening and closing to be manipulated according to climatic needs.

Figure 5. 32 Abi Moussa Al Achaari Mosque

(Source: author)

Figure 5. 33 Abi Moussa Al Achaari Mosque before demolition

(Source: Moudjib Khelil)

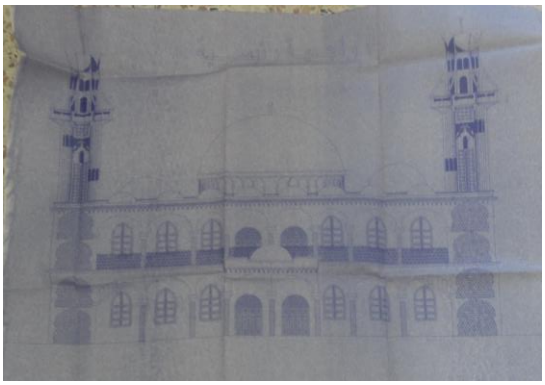


Figure 5. 34 Abi Moussa Al Achaari Mosque

(Source: DARW El Oued)

Figure 5. 35 Abi Moussa Al Achaari dome

(Source[125] https://fb.watch/hOGnBIFCa8/)

[125] Extract from a video consulted on 21/08/2021. (Https://fb.watch/hOGnBIFCa8/)

4.5 External appearance of dome:

Continuation After examining the location of the domes, we decided to focus on the diversity of the external aspects of the domes, which prompted us to take this study further. We based our analysis on four criteria common to all the mosques studied, as shown in the table below. This analysis process enabled us to gain a better understanding of the different variations in the external appearance of the domes of the mosques studied.

Table 5. 4 External appearance of the dome

(Source: author)

	Number of mosques			
Exterior appearance	42	03	46	09
Paint	●			
Sculpture		●		
Waterproof coating			●	
Cement plaster				●

Note: the result was produced using the platform.

After analyzing the paint on the domes, it emerged that 42 mosques had painted domes, usually in the same color as the mosque itself.

As far as sculpture is concerned, we noted the presence of three mosques whose domes are decorated in a way that differs from the dominant external appearance. One example is the Imam Malek mosque (Figure 5. 36). Its dome is attractively sculpted and decorated, in contrast to the interior, which remains rather simple (Figure 5. 37).

Figure 5. 36 Dome of the Imam Malek mosque -Sidi Khelil

(Source: author)

Figure 5. 37 View of the interior dome of the Imam Malek mosque -Sidi Khelil
(Source: author)

After examining the external appearance of the domes, it's worth noting a remarkable feature: the use of a waterproof plaster in a variety of colors, with a predominance of glossy gray. This appearance creates a perceptual divergence from the regional urban aesthetic, which tends towards a color rooted in the local heritage.

It is widely accepted that the main purpose of applying this waterproof coating is to prevent water infiltration. However, this practice in a region with low rainfall raises questions, especially as the other domes are built differently. Two hypotheses have been put forward to explain this phenomenon:

1. It's possible that the construction of these domes did not comply with building standards and regulations, perhaps due to inexperienced workmanship or the use of unsuitable materials.

2. This could be a preventive measure to protect the interior decoration of the domes, adorned and decorated with plaster, from any potential infiltration.

4.6 Interior appearance of the dome:

Despite the simplicity of the exterior, the interior of the domes is quite different. They are adorned with plaster sculptures, ranging from the simple to the highly detailed. The diversity of these ornaments depends on the resources available, as well as the quality of the skilled labor available to create them.

Our fieldwork revealed the existence of a carving school in Guemar[126], founded by a certain Omar Gaga, who greatly contributed to the development of this craft[127] and to the training of many craftsmen in the region. Today, we see the presence of a skilled workforce, often referred as "Senayii", which means master craftsman. On the site of the Takwa[128] mosque, currently under construction, we had the opportunity to meet the person in charge of the sculpture, who is originally from Guemar and trained with his team at the same school.

In our discussion with this craftsman, we learned that plaster sculpture is a demanding and costly business. The choice of motifs and colors remains a personal decision for each craftsman. Despite its high cost, this sculptural work is widely accepted by society. Construction investors see it as a form of sacralization, given the importance of the mosque within the community. This observation led us to understand that interior carving is of paramount importance and must be carried out at all costs.

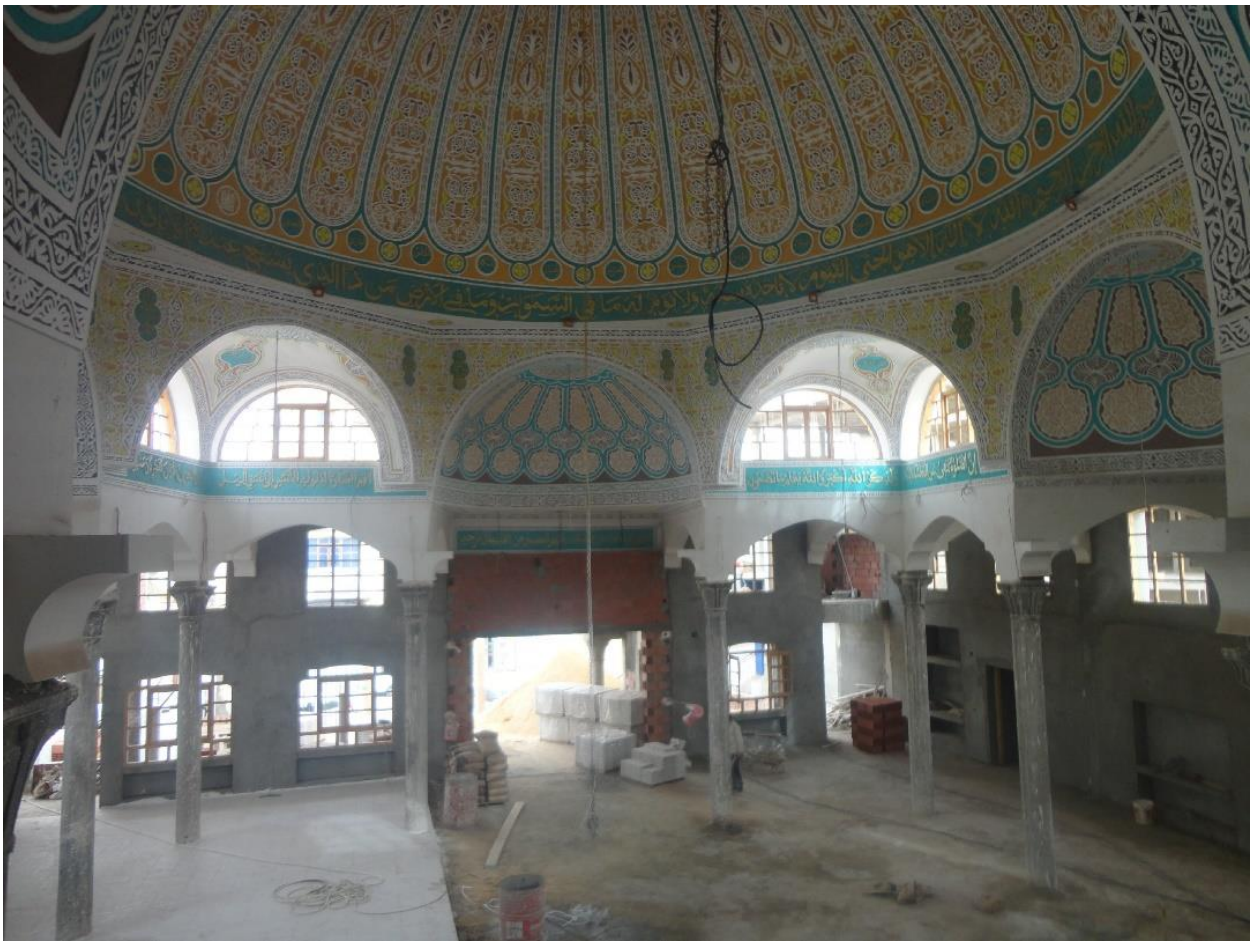


Figure 5. 38 The interior of the El Fath mosque - El Oued
(Source: author)

[126] Guemar is located 18 km northeast of the wilaya.

[127] Bachir khalef (2013), فـن النّقش..بصمةٌ من بصمات الهـويّة, https://thakafamag.com/?p=3214 (accessed: 14/03/2021).

[128] Extension project underway, located in el Messaaba municipality El Oued.

4.7 The dome and the manufacturing technique:

Ancestral local know-how in the construction of domes was explored thanks to the great technical mastery we observed on two building sites. We had the opportunity to see a dome and a Mihrab, both built from bricks bonded with gypsum(Lebsir, 2016), using the corbelling technique(Korbendau, 1997) that has a long history in architecture and construction.

Figure 5. 39 Dome of the Khadija Oum El Mouminine mosque
(Source: author)

Figure 5. 40 Secondary dome of the El Rahmane -Eloued Mosque
(Source: author)

Figure 5. 41 Dome of the Khadija Oum El Mouminine mosque
(Source: author)

Figure 5. 42 Secondary dome of the El Rahmane-El Oued Mosque
(Source: author)

The technique appears to be quite advantageous from a structural(CNERIB, 1993), economic, aesthetic and thermal comfort point of view(Drissi & Cherif, 2016), compared with the reinforced concrete dome used in other parts of Algeria.

The dimension and size of the dome depend essentially on the space reserved for the prayer room floor. This reservation in the structural framework generally takes the form of a square, serving as a support for the emergence of the dome. The use of this support serves as a starting point for the creation of a drum of various shapes, between square, octagonal and hexagonal, to create the dome. In other cases, the drum is created by superimposing two supports, one square and the other octagonal. This system is the most widespread, accounting for 69% of all cases studied, and is widely used in the Guemar area. This practice finds its reference in the three-tiered dome of the Great Mosque of Kairouan.

Table 5. 5 The drum shape of the dome
(Source: author)

Number of mosques	29	69	02
Square	●		
Octagonal		●	
Hexagonal			●

Note: the result was produced using the platform.

The initial results of this analysis of the domes show that the construction of these elements is an established tradition in the region. However, this does not preclude the presence of different typological references. The mosque typology with a single hemispherical dome preceding the Mihrab, built on three levels, is dominant, testifying to the influence of Aghlabid architecture.

5 The Minbar-balcony:

There have been a few cases when a balcony has been added next to the Mihrab, and it acts as a minibar. This architectural element is becoming more common in mosques that are being built or are in the process of being built, as it is now a well-known and favored option for both Imams and worshippers. This balcony is stationary, which sets it apart from the mobile Minbar and provides useful benefits that the neighborhood values. This balcony's thoughtful placement ensures that the first prayer row remains sacred for worshippers. It does not infringe on it.

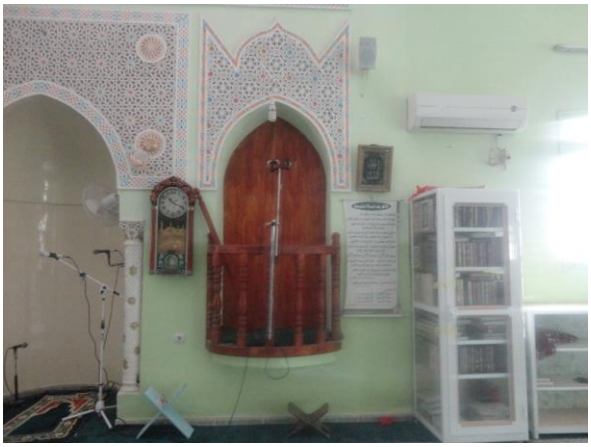


Figure 5. 43 Minbar balcony of the El Hoda mosque - Guemar
(Source: author)

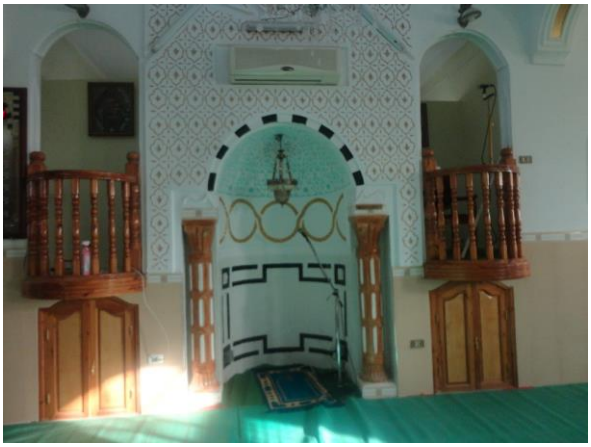


Figure 5. 44 Minbars balcony of the Mosque Dou El Nouriane -Hassi Khalifa
(Source: author)

6 The minarets of El Oued's new mosques:

In the course of our research, we undertook a study of the construction typology of new minarets. This study first focused on examining the number of minarets in mosques. The data collected in the table below (Table 5.6) provided us with the necessary information.

Table 5. 6 The presence of minarets
(Source: author)

Typology	No minaret	A single minaret	Two minarets	Four minarets
Number of mosques	36	43	19	02

Note: the result was produced using the platform.

The result shows us the presence of mosques: with a single minaret, two minarets, four minarets and mosques without minarets. This result is used to study mosques as follows:

1- Mosques without minarets

2- Mosques with a single octagonal minaret

3- Unique minaret

4-Mosque with two minarets

5-Mosque with four minarets

6.1 Mosques without minarets:

Our field analysis reveals that 36 of the 100 mosques surveyed (or 36%) were built and completed without minarets. Despite the absence of minarets, these mosques are functional and are registered with the El Oued Religious Affairs Department. They are classified according to their respective municipality, as shown in Table 4.18.

Table 5. 7 The presence of mosques without minaret

(Source: author)

Municipality	El Oued	Guemar	Hassani Abdkrim	Hassi Khelifa	Robbah	El Ogla	Mih Ounessa	Taleb Laarbi	Djemaa
Sample	25	13	07	10	08	02	06	03	03
Results	06	10	04	03	05	01	03	03	01
Percentage	24%	76.92%	57.14%	30%	62.50%	50%	50%	100%	33.33%

Note: the result was produced using the platform.

The present study, focusing on mosques without minarets, reveals a significant prevalence of this building typology in the municipality of Guemar. The high frequency of this typology, with an average of 10 out of 13 mosques (i.e. 76.92%), suggests that it may be a feature specific to this municipality. To better understand the organization of these mosques without minarets, we examined four specific examples of mosques located in this municipality, as shown below.

Figure 5. 45 El Sahwa Mosque - Guemar

(Source: author)

Figure 5. 46 El Tawhid Mosque –Guemar
(Source: author)

Figure 5. 47 El Hoda Mosque -Guemar
(Source: author)

The examples cited above highlight the common absence of minarets in the four mosques studied. When we asked the staff in charge of building the El Karama mosque about this absence, they explained that it was the result of financial constraints. Indeed, financial constraints force builders to prioritize other aspects of the mosque, such as prayer and ablution rooms, over minarets.

Figure 5. 48 El Karama Mosque -Guemar
(Source: author)

Traditionally, minarets are used to make mosques visible in the urban fabric. To compensate for the absence of minarets, religious associations have adopted a new model. This model involves raising the part of the building usually dedicated to domes by one level, thus reserving this space for a future vertical extension of the mosque. This dome-minaret design continues as the additional floor are built.

This type of mosque without minaret, observed in new buildings, can also be found in some old mosques, such as the El Zgom mosque(Figure 5. 49), built in 1957. This observation leads us to consider the legislative implications of this type of mosque. Should this type of mosque be defined as one without a minaret, based on the historical context of its construction? Or should legislation make provision for the minaret as an indispensable element of a mosque?

Figure 5. 49 El Sahn El Gharbi Mosque-Zgom
(Source: author)

6.2 Mosques with a single octagonal minaret:

During our survey, we identified 21 mosques with a single minaret among the 43 studied. The dominant shape of these minarets is octagonal, with 11 mosques featuring a unified octagonal minaret, while 10 have a square base with an octagonal top. To better understand this typology, we first examined the exterior treatment of these minarets, which enabled us to distinguish:

6.3 Mosques with a single octagonal minaret and balconies:

The examples shown below (Figure 5.50, Figure 5.51 and Figure 5.52) illustrate octagonal minarets crowned with octagonal balconies. The number of balconies varies from two to three. These minarets are generally treated vertically, with clerestories on two or four of the octagon's facets, which contribute to the visual aspect by accentuating the length.

Figure 5. 50 El Rahmane mosque -El Byada
(Source: author)

Figure 5. 51 El Amir Abd El Kader Mosque
(Source: author)

Figure 5. 52 El Fath Mosque -Guemar
(Source: author)

A look at the mosque plans reveals that these buildings were carefully planned. For example, the plan for the El Fath mosque in El Oued features an octagonal minaret with two balconies, while the plan for the mosque in Hai El Modjahidine includes three balconies on its octagonal minaret.

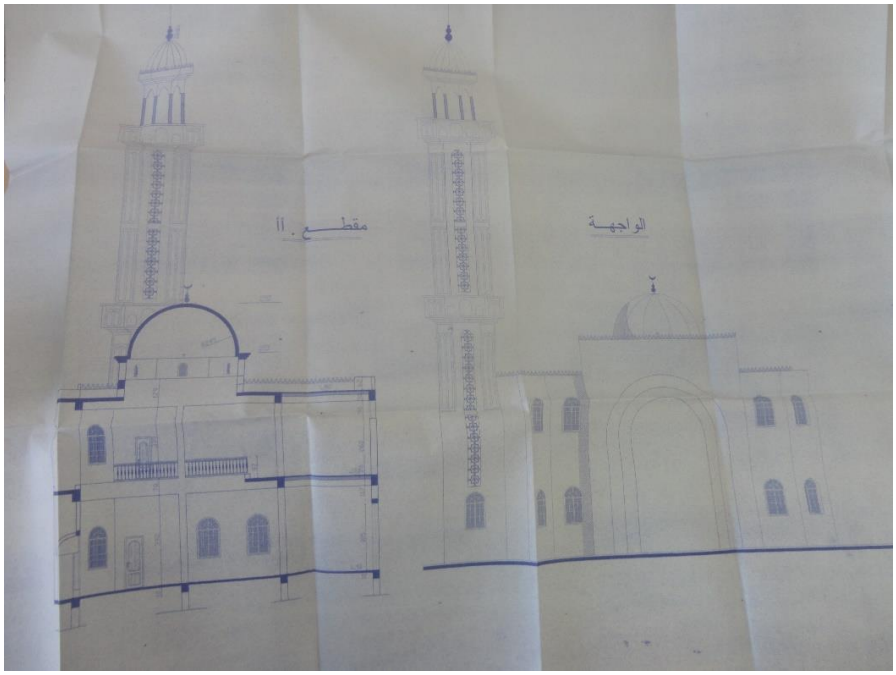


Figure 5. 53 El Fath mosque -El Oued
(Source:DARW El Oued)

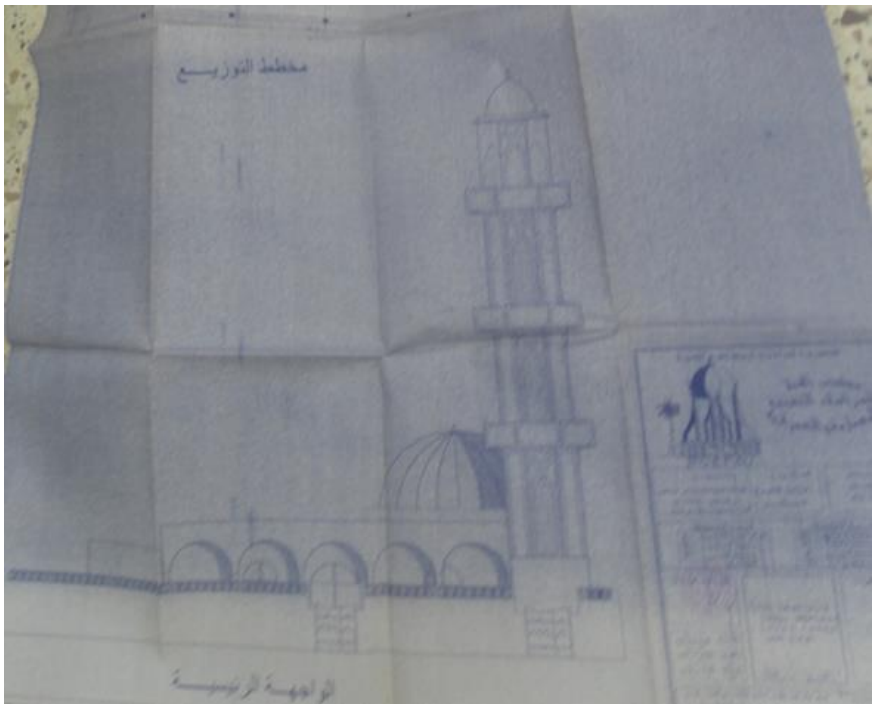


Figure 5. 54 The Hai El Modjahidine mosque -El Oued
(Source: DARW El Oued)

6.4 Mosques with a single octagonal minaret and covered balcony:

It is interesting to note the presence of other octagonal minarets where open balconies are replaced by covered ones. This choice is observed in varying numbers, from a single balcony at the Ben Arefa mosque (Figure 5.55) to two balconies at the Tarek Ben Ziad mosque (Figure 5.58). The idea of introducing this element into the minaret's configuration has its origins in a typology of configuration present in Mecca. The adoption of these covered balconies in minaret design is motivated by visits, as emphasized for the mosques of Oran(Senhadji, 2017).

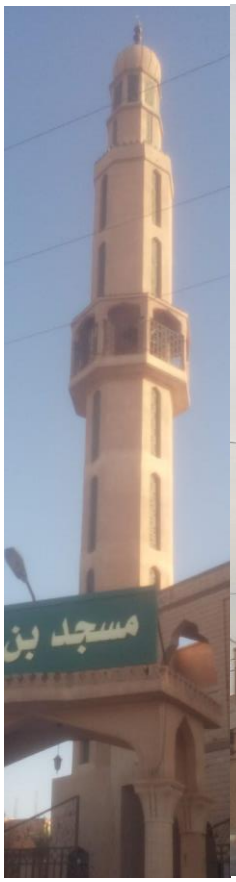


Figure 5. 55 Minaret of the Ben Arfa Mosque -El Bayada (Source:author**)**

Figure 5. 56. Minaret of the Arafa mosque--El Oued (Source:author)

Figure 5. 57 minaret of the El Chafii mosque-El Oued (Source: author**)**

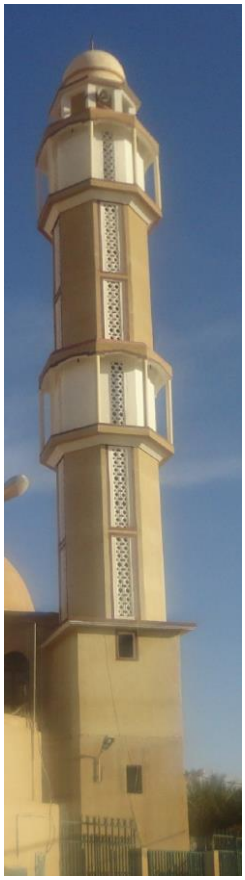


Figure 5. 58 Minaret of the Tarek Ben Ziad Mosque (Source:author)

Figure 5. 59 Masjid El Haram Mosque -Mekah (Source: https://www.pinterest.com/pin/639300109598472249/)

This typology of minaret with covered balcony, observed in the field, is echoed in the plans and studies archived at the El Oued Religious Affairs Department. A study approved for the construction of the minaret at the Abi Der El Ghafari mosque in El Oued (Figure 5.60) reveals a minaret design in perfect harmony with the terrain. The minaret starts from a square base and develops into an octagonal shape, reaching a total height of 31 meters and featuring two covered balconies.

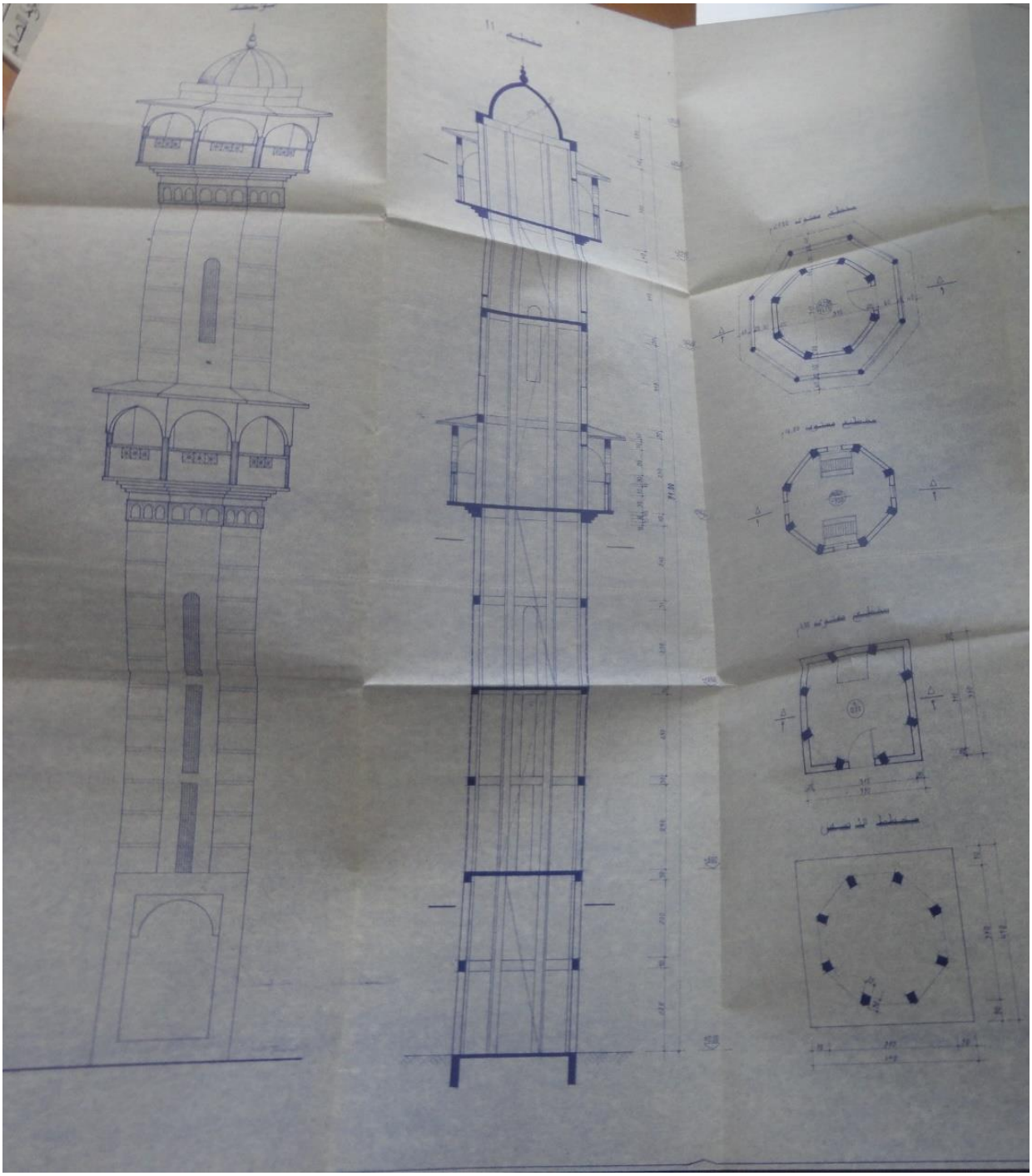


Figure 5. 60 The minaret plan of the Abi Der El Ghafari mosque -El Oued
(Source: DARW El Oued)

6.5 Unique minarets:

Using an analysis grid based on number and typology, we have classified the aforementioned minarets. We will now present three examples of minarets (Figure 5. 61 Figure 5. 62 and Figure 5. 63) that are completely different from those previously mentioned.

Figure 5. 61 Minaret of the Khaled Ben El Oualid mosque -Hassi Khelifa
(Source: author)

Figure 5. 62 The minaret of the El Nour Mosque -El Oued
(Source: author)

Figure 5. 63 The minaret of the El Kholafa mosque
(Source: author)

The first minaret, that of the Khaled Ben El Oualid mosque (Figure 5. 61), adopts an octagonal shape and is fully ornamented, in stark contrast to the overall treatment of the mosque. It seems an alien element in terms of appearance and aesthetics in relation to the rest of the mosque.

The second example concerns a mosque under construction (Figure 5. 62), where the

minaret seems to have taken a back seat to the mosque itself. A gap can be seen between the staircases and the boundaries of the mosque, which was used to erect the minaret, resulting in an irregular shape.

The third case (Figure 5. 63) features a mosque with a hexagonal minaret, which clearly distinguishes it from other mosques in the region. This type of minaret is very rare[129] in El Oued.

6.6 Mosque with two minarets:

In our study of mosques with two minarets, we identified a total of 19 mosques, classified into two categories according to the shape of their minarets. Details are shown in the table (Table 5. 8) below.

Table 5. 8 Minarets and their shapes for mosques with two minarets

(Source: author)

Classification criteria		Number of mosques		
The shape	Type	04	03	12
1-Uniform shape	Square	●		
	Octagonal		●	
2-Non-uniform shape	Square base, octagonal upper part			●

Note: the result was produced using the platform.

The results of our survey reveal four mosques with unified square minarets, and three mosques with unified octagonal minarets. Twelve mosques, on the other hand, have minarets of a non-uniform shape, with a square base and octagonal top. This diversity of shapes prompted us to take a closer look at these three cases.:

6.7 Mosques with two square minarets:

The four mosques with unified, square-shaped minarets are illustrated in the examples below. Remarkably, the two minarets of the El Rahmane Mosque (Figure 5. 64) show a strong similarity to those of the Omar Ben Abd Aziz Mosque (Figure 4. 40), both in terms of architecture and external appearance. This case suggests a form of reproduction and imitation.

The two minarets of the Abi Bakr El Sedik mosque (Figure 5. 65), currently under construction, attract attention for their overall architecture and octagonal shape. These two minarets are erected independently of the mosque, which is an unusual model in the region. According to the El Oued Religious Affairs Department, the mosque was built without authorization or a building permit.

[129] Only one hexagonal minaret was found in the 100 mosques surveyed.

Figure 5. 64 Minarets of the El Rahmane Mosque -El Oued
(Source: author)

Figure 5. 65 Minarets of the Abi Bar El Sedik mosque-Oued El Alenda
(Source: author**)**

The Imam Hocine mosque (Figure 5. 66) is somewhat different from other mosques with a single minaret, where the shape is generally harmonious. Indeed, balconies usually follow the shape of the minaret, whether square or octagonal. However, in the case of this, we see a fusion of different shapes: a square minaret with octagonal balconies.

Figure 5. 66 Minarets of the Imam Hocine Mosque
(Source: author)

Figure 5. 67 Minarets of the El Nasr Mosque -El Oued
(Source: author)

In the three two-minaret mosques mentioned above, we note a certain harmony in the exterior treatment between the mosque and the minarets. In other words, the minaret and the mosque are treated with the same color and texture. In contrast, the external appearance of the El Nasr mosque (Figure 5. 67), which has two minarets, reflects two different styles of treatment: a rather simple minaret in white and green, and a mosque covered with a plaster called "granito".

This substance is used in many parts of Algeria, for homes and mosques. This treatment is also seen in other mosques recently built in El Oued, such as the Abi Moussa El Achaari mosque (Figure 5. 68).

Figure 5. 68 Exterior rendering of the Abi Moussa El Achaari Mosque-El Oued
(Source: author)

The "granito" is generally composed of sea sand and grains, with a small proportion extracted from coastal areas. This raises questions about the extent to which these practices comply with environmental standards. We also wonder whether the typology of mosques could have negative effects on the environment(Ghodbani et al., 2015).

6.8 Mosques with two minarets and octagonal balconies:

Of the 15 mosques surveyed with two octagonal minarets, we can distinguish two main types: three mosques with unified octagonal minarets and 12 mosques with minarets that are square at the base and octagonal at the top.

By analyzing the exterior treatment of these minarets, we have identified two categories: those with simple balconies and those with covered balconies.

In terms of general architecture, an alignment has been reached between mosques with a single minaret and octagonal balconies, the number of which is increasing.

Figure 5. 69 Minarets of the El Bassir Mosque
(Source: author)

Figure 5. 70 Minarets of El Atik Mosque - Hassi Khelifa
(Source: author)

Consultation of the mosque plans in the archives of the El Oued Religious Affairs Department confirms that the choice to build mosques with two minarets was in plans. However, following examination of the plans recently submitted to the directorate, it seems that this typology has now been sidelined, and approval is now reserved solely for mosques with a single minaret.

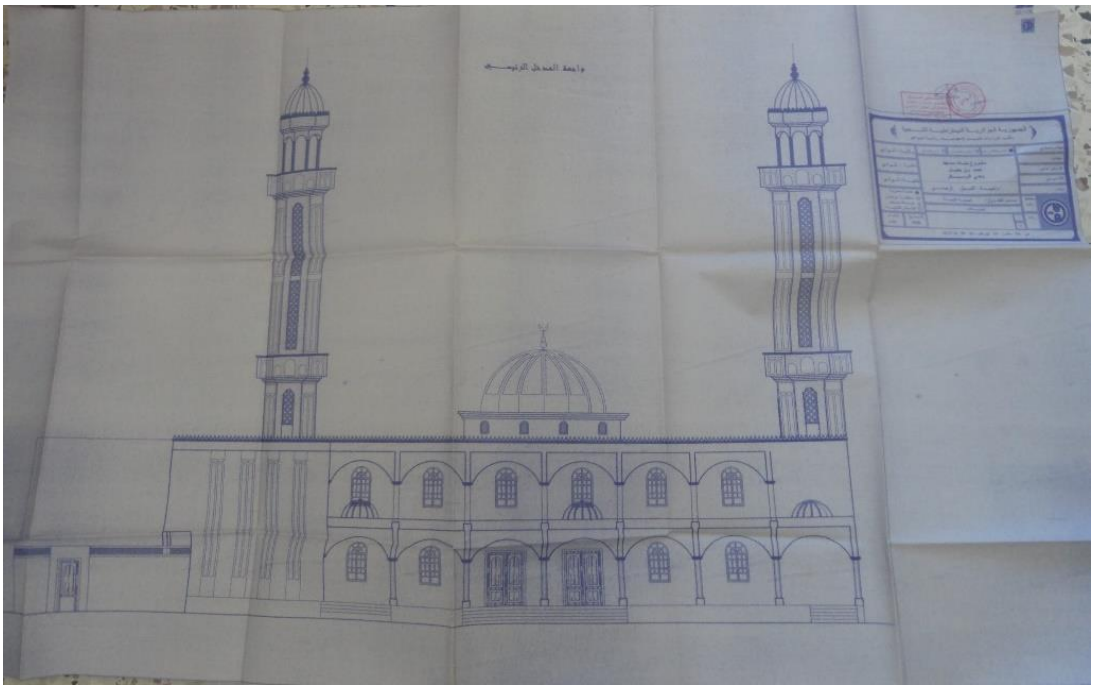


Figure 5. 71 The facade of the Ahmed Ben Hanbal- El Oued mosque
(Source: DARW El Oued)

6.9 Mosques with two octagonal minarets and covered balcony:

From a typological point of view, we observe that the typology of this minaret resembles that found in the previous mosques, with the only difference being that the number of minarets increases to two. The figures of these mosques (Figure 5. 72 Figure 5. 73 and Figure 5. 74) show a great respect for symmetry, as the two minarets of each mosque look exactly alike. This remark could be applied to all two-minaret mosques, whatever their architecture.

Figure 5. 72 Minarets of the El Choudlia Mosque
(Source: author)

Figure 5. 73 Minarets of the El Anouar El Rabania mosque
(Source: author)

Figure 5. 74 Minarets ofthe El Ben Ghazlia Mosque
(Source: author)

6.10 Mosque with four minarets

6.10.1 The El Aziz mosque with four minarets

The El Aziz mosque (Figure 5. 75), currently under construction, is built next to the old one. The complex ornamentation of the interior is also evident on the exterior.

This mosque is characterized by its four minarets, two of which are located at the main entrance, lower than the other two aligned with the Qibla wall. This architectural model is unique among recently built mosques. Moreover, this mosque is directly linked to the former Sidi Massoud mosque (Figure 5. 76) in El Oued. We noted a similarity and inspiration in terms of the number of minarets, location and lantern decoration. Although this mosque refers directly to a local reference(Noureddine & Abdelmalek, 2019), no other recent mosque resembles it.

Figure 5. 75 El Aziz Mosque
(Source: author)

Figure 5. 76 The historic Sidi Masouad Mosque -El Oued
(Source: author)

6.10.2 The Si Moussa mosque:

Situated in the heart of the town of El Oued and difficult to access. This mosque stands out for its four square minarets and its central onion-shaped dome. The land and construction of this mosque were secured by a benefactor. A visit to this mosque revealed that it is almost square in shape, covered entirely with a large central dome, reducing the number of posts inside the prayer hall. This refers to Ottoman typology.

Despite the importation and adoption of such a mosque typology, we can easily see an attempt to integrate certain elements of local reference. Examples include the vault at the entrance, the gallery, the arches, the secondary domes below the gallery and the plaster ornamentation.

Figure 5. 77 Si Moussa Mosque - seen from a distance
(Source: author)

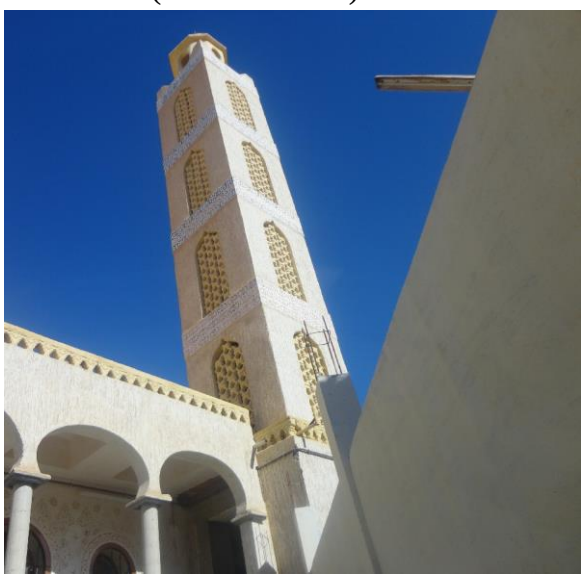


Figure 5. 78 Si Moussa Mosque - close-up view
(Source: author)

6.11 Location of minaret(s):

The previous study is based on the minaret typology, now the location of minarets in relation to the mosque as a whole will be treated. To do this, we set up an analysis grid, taking into account the common locations of minarets observed in certain mosques. Then the attention is paid to the specific location of minarets, studying all cases in two distinct stages, the location of minarets in mosques with two minarets is examined.

6.11.1 Mosques with two minarets:

Mosques with two minarets are generally located on the Qibla axis, with 16 of the 19 mosques confirming this finding (Table 5. 9).

Table 5. 9 Minaret location for two-minaret mosques

(Source: author)

Location	16	02	01
Qibla axis	●		
Back wall of Qibla		●	
Other			●

Note: the result was made using the platform.

Two of the mosques shown below have minarets located on the axis of the Qibla. However, we have also observed other mosques where minarets are placed on the opposite wall to that of the Qibla. One example is the Abi Bakr El Sedik mosque in Oued El Alenda, mentioned earlier.

Figure 5. 79 Minaret of El Atik mosque -Hassi Khelifa

(Source : author)

Figure 5. 80 Minaret of El Atik mosque -Robbah (Source : author)

6.12 Minaret dimensions:

After observing the various minaret typologies in terms of number, location and height, which differ from one minaret to another (see Appendix. 4), we set out to uncover the factors primarily responsible for such diversity. To do this, we examined order forms for the (CTC)[130]. (see Appendix. *2*) These orders are descriptive sheets on the mosques under study, serving as the official request on the basis of which examines the mosque's civil engineering plans. These vouchers are completed and forwarded by the design office to the Religious Affairs Department, which then returns them to the technical control. Depending on the surface area of the mosque, its outbuildings and, in particular, the dimensions of the minaret, the technical control can calculate its fees.

Table 5. 10 Dimension of minaret and mosque

(Source: author)

Number of mosques	Base area in m²	Basic dimension (dimension) in (m)	Height in (m)	Proportion between height and dimension
06	6.25	2.50 x 2.50	26.10	10.44
			20.00	8.00
			20.10	8.04
			18.30	7.32
			14.55	5.82
			14.50	5.80
01	7.30	2.70 x 2.70	14.50	5.37
01	7.80	2.79 x 2.79	26.10	9.35
08	7.84	2.80 x 2.80	26.10	9.32
			22,68	8.10
			22,68	8.10
			21.10	7.53
			17.00	6.07
			17.53	6.26
			17,50	6.25
			17,23	6.15
01	7.85	2.80 x 2.08	22.00	7.85
01	8.40	2.89 x 2.89	26.10	9.03
01	8.70	2.94 x 2.94	22.15	7.53
02	9.00	3.00 x 3.00	20.00	6.66
			20.00	6.66
01	9.76	3.10 x 3.10	20.25	6.53
01	11.56	3.40 x 3.40	23.74	6.98
01	12.11	3.48 x 3.48	23.20	6.66
01	13,47	3.75 x 3.75	20.10	5.36
01	15,21	3.90 x 3.90	21.70	5.56
01	25.00	5.00 x 5.00	24.50	4.90

[130] (CTC) technical control of the construction

By analysing the data collected from the order forms, we proceeded to examine the base surfaces, height and proportions of these minarets. First, we classified these mosques according to the minaret's base dimension. Next, we calculated the dimensions of its sides, and finally, we established the proportion between the total height and the dimension of the minaret.

From these results, we note the presence of different minaret base dimensions. The most dominant dimension is the square minaret with a base of 7.84 m², and sides of 2.80 m, present in 08 of the 27 mosques studied. Similarly, the square minaret with a base of 6.25 m² and sides of 2.50 m is found in 06 of the 27 mosques. Other base dimensions vary between 6.25 m² and 25 m², with sides ranging from 2.5 m to 5 m.

As far as proportions are concerned, we noted that for the same base dimension, there are different minaret heights, resulting in different proportions between the dimension and the total height of the minaret. This variability of proportions was observed throughout the sample analyzed. What's more, these proportions vary considerable, ranging from 4.90 to 10.44

6.12.1 Minarets and their size:

The comparison of minaret dimensions and the designers associated with these minarets generated a series of data. Analysis of this data led us to structure this comparison in two ways:

6.12.1.1 Same size, different designer :

Detailed examination of this case, and the emphasis placed on it, reveals that the designers opted for a similar adoption in terms of the size of the base area and the overall height of the minaret. Indeed, in two different municipalities[131], the ground-floor mosques were designed by different designers but feature the same minaret dimensions. Similarly, in the same municipality of El Oued, two mosques of different sizes and by different designers also have the same minaret dimensions (Table 5.11).

Table 5. 11 Comparison between minaret dimensions and designers

(Source: author)

	Mosque name	Municipality	Mosque surface area in m²	Mosque template	Basic dimensions in m²	Height in m	Architect
01	Abu Bakr El Sedik	Sidi Ouan	368	Single floor	7,65/20,25	16	Different architect
02	El Takwa	Debila	450	Single floor	7,56/20,25	16	
01	Ibrahim El Khalil	El Oued	1036,48	two floor	7,84	22,68	Different architect
02	El Ghamama	El Oued	741	two floor	7,84	22,68	

[131] Municipalities of Sidi Aoun and Debila

6.12.1.2 Different size, same designer :

In the course of this study, which was based primarily on the dimensional similarity of minarets, a further analysis was carried out to examine the role of the same mosque designer in the dimensional convergence of minarets. This study focuses on the layout of mosques as follows:

In the same municipality, we observed two mosques designed by the same designer, with the same basic minaret dimensions but different heights (Table 4.12). In another municipality, we observed two mosques with the same minaret heights but different basic dimensions (Table 4.12).

In these examples, where there are various convergences and divergences in terms of municipality, designers, templates, basic dimensions and minaret height, it is difficult to determine the reasons for the dimensional similarity observed in the first place. To understand this, we turned to mosques with multiple versions of purchase orders.

Table 5. 12 Comparison between minaret size and designers

(Source: author)

	Mosque name	Municipality	Mosque surface area in m²	Mosque template	Basic dimensions in m²	Height in m	Architect
01	Ben Hammami	Hassani Abdelkrim	426.00	Two floor	7,84	21,1	same architect
02	Abou Der El Ghafari	Hassani Abdelkrim	516,35	Two floor	7,84	17	
01	Cite 20 Aout	Debila	520,51	Two floor	7,8	26,1	same architect
02	El Nour	El Mghair	752,28	Under floor and floor	6,25	26,1	

The multiplication of purchase orders for the same mosque was justified by reservations expressed by civil engineer. The removal of these reservations requires a reformulation of the purchase order. What is remarkable about these purchase orders is that, for the same mosque, surface and dimensional data vary from one purchase order to another. By examining Table 5.13, we have identified mosques with several purchase orders in order to decipher their data.

Table 5. 13 Data from purchase orders

(Source: author)

	Mosque name	Municipality	Mosque area /m²	Mosque template	base dimension	Minaret height In m	Approval phases
1	El Sayida Hadjer	Hassi Khelifa	520	Single floor	6,76/16	18,5	1
			606.30	Single floor	9,61/24	22,7	2
			620.70	Single floor	9,61/24	21,7	3
2	Merazka mosque	Hassani Abdelkrim	630	Single floor	9,6/25	24,5	1
			630	Single floor	9,6/25	21	2
3	Ali Derbal	Robbah	740	Single floor	8,7	22,15	1
			742	two floor	8,7/22,56	23,1	2
4	El Takwa	Debila	368	Single floor	6,25	20,1	1
			450	Single floor	7,56/20,25	16	2
5	El Amir Abdelkader	Douer El Maa	421.47	Single floor	6,25	20	1
			514.53	Single floor	6,25	14.50	2

Analysis of the results in Table 5.13 shows that the majority of the mosques studied were the subject of several proposals. These proposals related to the height of the minaret, the basic dimensions, the overall surface area of the mosque and their templates. The engineer intervenes on the dimensions of the minaret, whether in height or basic dimensions, according to its own technical standards and the nature of the ground.

It seems that the design and construction of the minaret were mainly influenced by technical factors. This led to a dimensional convergence and divergence resulting from a technical exchange between the designer and the civil engineer.

7 Conclusion

For Prayer Room we observed that the prayer room is generally built in three forms: a rectangular, an irregular shape, and a square shape, which tends to become dominant. Due to technical and urban factors, these spaces are part of an architectural organization of mosques with a surface area

The gallery is considered an essential element in mosque construction. Their number varies from one to four, with architecture varying from one municipality to another. The presence of these galleries is inspired by local references and the vernacular habitat of old neighborhoods, responding to social and climatic needs.

Capitals are beginning to take on a certain value in mosque construction. They are often made using a single type of metal mold, modeling a typology of capitals based on Hafsid references, which is becoming increasingly widespread.

There are two types of Mihrab: interior and exterior. The inner Mihrab is often associated with a dome, because of its sacred value. And Two types of Minbar have been identified: a balcony Minbar and a mobile wooden Minbar. The Minbars of recent mosques are generally balcony-style.

The minaret is absent from some mosques, due to historical and economic factors. When present, minarets come in a variety of shapes: square, octagonal, or other non-local forms. These minarets often include skylights and small cupolas of varying typologies.

We noted a diversity of construction techniques: builders used both modern and classical techniques. The dome and Mihrab are generally built in brick using the corbelled technique, although some domes are made of metal. Galleries and capitals are often made of reinforced concrete with prefabricated metal molds.

Two approaches are observed among architects: a differentiation of architectural products according to training and background, and an exchange of ideas and designs that leads to similarities between mosques. The civil engineer acts as one of determining factor in mosque typology, particularly with regard to dimensions. The Religious Affairs Department, meanwhile, plays a limited role due to a lack of resources.

For typologies mosques financed by a single benefactor often feature unique typologies, reflecting the subjective choices of that benefactor.

The style in El Oued is mainly based on local, Maghrebian, Aghlabid and Hafsid references, although some unidentifiable typologies also exist. These typologies are influenced by technical, climatic, cultural, sanitary, subjective and legislative factors, which we will verify by comparing the reality on the ground with current legislation. Based on the number of minarets and the number of domes. We have presented an initial summary of the typologies of mosques located in El Oued:

This analysis enabled us to identify the predominant typologies based on the number of domes and minarets in El Oued's mosques. In addition, the analysis revealed the prevalence of other architectural components, such as galleries (present in 86% of cases).

CHAPTER 6

MOSQUES AND COVID-19: THE UNEXPECTED RESULTS OF OUR FIELDWORK

1 Introduction:

The worldwide pandemic and its unintended consequences have highlighted the critical, perhaps foundational, role that a number categorization system for mosques should play, as defined within existing statutory frameworks. As a result, in accordance with preventive measures similar to those implemented by other Muslim countries, the Algerian government ordered the nationwide shutdown of all mosques on February 17th, 2020. However, as the public health crisis progressed, a decision was taken on August 15th , 2020[132], based on capacity concerns, to partially reopen mosques. Notably, only mosques with an estimated capacity of more than 1000 attendees were allowed to reopen during this first period. A subsequent ruling was issued on December 2nd, 2020[133], allowing mosques with a capacity of more than 500 worshipers to resume operations. Notably, the COVID-19 epidemic has highlighted the need for a unique categorization of mosques that was previously lacking from existing classifications and regulatory frameworks. Until the complete reopening of all mosques on February 14th, 2021, several mosques were closed for 363 days, or 11 months and 26 days.

Figure 6. 1 Preventive measures against COVID-19 at the El Takwa mosque
(Source: author)

[132] Executive Decree No. 20-225 of August 8th , 2020, lightens the burden of preventing and combating the spread of the Coronavirus (COVID-19)

[133] Executive Decree no. 20-360 of December 1st, 2020, adopts measures to prevent and combat the spread of the coronavirus (COVID-19).

2 Prayer rooms and measures were taken against COVID-19:

It is important to note that the required measures, notably physical distancing (Olivera-La Rosa et al., 2020), had a considerable impact on prayer halls. The established distancing technique required a spatial separation of around one meter between worshipers, which was maintained by designated spaces with floor markings within each prayer room. Furthermore, a preventive precaution was implemented by covering carpets with plastic sheeting (refer Figure 6. 2) to prevent the spread of COVID-19.

In a deliberate attempt to reduce the danger of viral transmission, the ventilation mode experienced a significant metamorphosis, shifting from mechanical to natural ventilation methods. As a result, air conditioning devices and fans became unworkable, as shown at the El Takwa mosque (Figure 6. 3), where fans were turned off. measures required of all mosques in Algeria.

Figure 6. 2 The interior of the El Takwa Mosque
(Source: author)

Figure 6. 3 El Hoda Mosque -Guemar
(Source: author)

Nonetheless, at the Dou El Nouriane mosque's prayer hall (refer Figure 6. 4), an extra COVID-19-related preventive precaution has been adopted. This endeavor included the construction of a hand-washing station (see Figure 6. 5) and a hand drier at the entrance to the prayer area, which was not specifically required by regulatory legislation.

The mosque's Imam explained the reasoning behind the introduction of these amenities, emphasizing their value in helping worshipers wash their hands and perform ablution—a ritual made more difficult by the closing of facilities[134] specifically designated for that purpose.

Figure 6. 4 Dou El Nouriane mosque
(Source: author)

Figure 6. 5 Dou El Nouriane mosque (Source: author)

[134] The ablution closets remained closed despite the opening of the mosques. They were re-opened on Nov 22th ,2021, a closure period of 464 days or 1 year, 3 months and 7 days

In this regard, COVID-19 is a pivotal determinant influencing the functionality of specific components within mosques, notably the ablution facilities and the associated hygiene protocols. Consequently, the water demand is particularly pronounced. given that article 16 in section 3-1 of the interministerial order 2022 states to provide a water tarp in accordance with the standards and requirements of the hydraulic and protection services civil. Hence, the inquiry arises: How did the mosques of El Oued address this requirement both prior to and amidst the pandemic?

2.1 Water supplies to mosques in El Oued:

2.1.1 Underground tanks :

While inspecting the El Takwa mosque grounds, we came upon prefabricated subterranean water reservoirs (Figure 6. 6). The engineering of these reservoirs combines tank and nozzle construction techniques (Figure 6. 7). Most notably, from a visual perspective, the reservoirs blend in perfectly with the sandy soil they are placed in. Because the nozzle-shaped water tanks have a slimmer profile than other tank designs, they are more cost-effective from a structural standpoint. Furthermore, these components' prefabricated design makes it easier to install them quickly, enabling quick deployment. It is imperative to recognize, nonetheless, that this method requires higher energy usage in order to run the water pumps during installation.

Figure 6. 6 A water tank at the El Takwa -El Oued mosque construction site
(Source: author)

Figure 6. 7 A water tanks at the El Takwa -El Oued mosque construction site
(Source: author)

This remarkable method led us to investigate its application in other mosques, taking into account both its benefits and the geographical characteristics of the region. Nevertheless, our research also showed the existence of additional water storage techniques, such as cisterns and cistern niches.

2.1.2 Tanks:

Regarding the practice of water reservation in mosques, our findings suggest that rooftop-mounted cisterns are often used. Because of the region's ongoing problems with water shortage(Kouzmine & Avocat, 2007), this strategy draws inspiration from a long-standing legacy of water storage that goes beyond mosques to include institutional and residential buildings in El Oued and beyond. From an architectural standpoint, integrating these cisterns into mosque designs presents inherent challenges, given their varying volumes, shapes, and colors juxtaposed against the aesthetic considerations of the mosque's exterior. Examining individual examples, we detect a characteristic that has become an inherent part of mosque design; it is frequently placed next to the dome (Figure 6. 9), close to the minaret (Figure 6. 8), or on either side of the dome (Figure 6. 10). Of particular note is the striking visibility of these colorful cisterns, which draw the eye immediately and enhance the mosque's overall visual atmosphere.

Figure 6. 8 Cistern at the Salah El Dine El Ayoubi Mosque
(Source: author)

Figure 6. 9 Cistern at the El Anouar El Rabania Mosque
(Source: author)

Figure 6. 10 Cistern of the El Imam Malek Mosque
(Source: author)

Figure 6. 11 Cistern at the El Nasser Salah El Dine Mosque
(Source: author)

2.1.3 Niche tanks:

Two mosques with rooftop-installed cisterns were among the evidence supporting the incorporation of cisterns that our inquiry found. To prevent these cisterns from overheating, safety precautions were taken, such as building recesses (Figure 6. 12) with masonry walls (Figure 6. 13). As a result, the cisterns are hidden under a slab, making them invisible from the outside.

Figure 6. 12 Cistern niche in the Bilal Ben Rabah-Jamaa mosque
(Source: author)

Figure 6. 13 Cistern niche of the Mosabe Ben Omair mosque
(Source: author)

Incorporating this niche represents, introducing a vertical extension that, regrettably, risks becoming a prevalent feature. However, it should be noted that these kinds of niches are usually seen in El Oued, looking more like the Mihrab than just cistern enclosures. As a result, our research has shifted to examining mosque exteriors in order to determine the different styles and designs of Mihrabs.

3 The Sahn[135] (Courtyard) :

Two things that immediately stood out to us during our first visits to the El Oued mosques: (1) the absence of the inner courtyard, on the mosque grounds and (2) the existence of an outside courtyard next to the built mosque[136]. When compared to conventional residential constructions, this juxtaposition creates a paradox. In contrast to the architectural rules seen in traditional dwellings, El Oued's mosques lack the characteristic inner courtyard (Sahn). On the other hand, having an external courtyard becomes crucial, as was made especially clear when mosques were reopened after the global pandemic (COVID-19).

Figure 6. 14 Exterior courtyard of the El Bassir Mosque
(Source:Khoukhi & Senhadji, 2022)

[135]Sahn: written as the Interministerial order setting the standard specifications relating to the typology of the construction of mosques.
[136] Mosque in a single closed building.

This outdoor courtyard has a different function than the conventional mosque Sahn. It is very important in El Oued worship, where it is mostly used during periods of high attendance in the winter, it accommodates prayers during the day and acts as an overflow area. In order to obtain a more profound understanding of the operation of these courtyards, we first carried out in-depth field studies. In order to manage the issues posed by the epidemic, these studies involved assessing the layout, dimensions, placements, management, and utilization of these courtyards.

3.1 Outdoor courtyard creation

By enclosing the land and designating a section for the construction of the mosque, an external courtyard was created—a transitional area between the mosque and the surrounding wall. This open space outside the mosque was unavoidably used for prayer, either fully or in part. Examining these 100 mosques in the 17 municipalities of El Oued according to this criterion table 6.1, our research revealed three different types of mosques:

3.1.1 Mosques without courtyards

These mosques are built as a single block that takes up almost the whole piece of land. They do not have an outside courtyard or an inner courtyard. These mosques are usually located in highly congested urban areas with little to no available land.

3.1.2 Mosques with outer courtyard and inner courtyard

Mosques within the Wilaya of El Oued could be regarded as relatively new to the concept of "a Sahn." Among them, only the Drissi Mohamed[137] Mosque in Hassani Abdelkrim and the Khadîdja Oum El Mouminine[138] The mosque in El Oued possesses both an inner and outdoor courtyard. While these two mosques share similar architectural designs, the critical distinguishing factor lies in the orientation of the Qibla.

3.1.3 Mosque with outdoor courtyard

Each municipality has two different mosque layouts that are determined by the land's shape and urban planning. The courtyard shapes in Configuration (A) are regular or almost regular due to the Qibla wall running parallel to the plot boundaries and fence. On the other hand, Configuration (B) (see Table 3) rotates the structure to make it line up with the Qibla, creating asymmetrical courtyard designs.

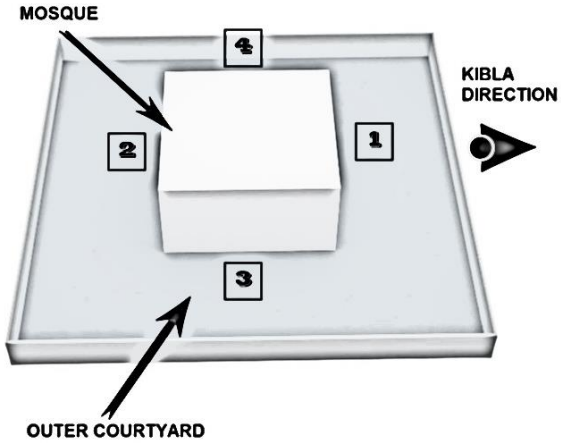
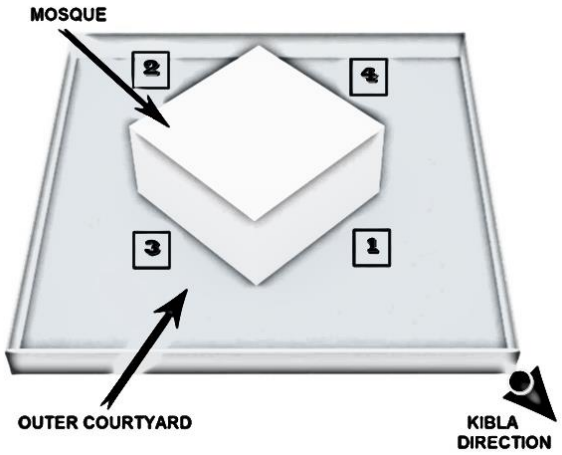
There are four possible locations for outdoor courtyards in both designs. Depending on arrangement and capacity, the majority of the exterior courtyard is usually set up for prayer. Regardless of the arrangement, worshippers are able to offer prayers wherever in the mosque, including the spaces directly across from the Mihrab.

[137] 100% completed and inaugurated on November 18, 2020.

[138] It still needs to be completed; the building permit is dated 21/08/2017.

Table 6. 1 Location of prayer space in the outdoor courtyard

(Source:Khoukhi & Senhadji, 2022)

Location	Number of mosques	Qibla wall			
		Before	Rear	Right	Left
First Configuration		1	2	3	4
	15	●			
	06		●		
	09			●	
	08				●
	02	●	●		
	02	●		●	
	01		●	●	
	01		●		●
	02	●	●	●	●
	04				
Second configuration					
	21	●			
	07		●		
	03			●	
	01				●
	02	●	●		
	02	●		●	
	05		●	●	
	02	●			●
	02	●	●	●	●
	05				

(● stands for presence of elements)

The results show that:

- 50 mosques are located according to configurations A and B.
- 15 mosques with an outdoor prayer space in front of the Qibla wall according to configuration A, and 21 mosques according to configuration B.
- 04 mosques have no outdoor prayer space according to configuration A, and 05 mosques have none for configuration B.
- The location of the prayer space in front of the mosque's Qibla wall is the most common in both configurations (36 mosques out of 91, or 37.5%).
- To the right of the Qibla wall is the second choice of prayer space according to configuration A.
- Behind the Qibla wall is the second choice of prayer space according to configuration B.

These results clearly show that the inclusion of outdoor courtyards or prayer spaces in the El Oued mosques was a deliberate choice.

3.2 Outdoor courtyard area:

In this section, we delve into the analysis of the surface areas of external courtyards among mosques, focusing on those categorized within the 500 m² to 1000 m² range. The findings, drawn from an examination of 314 mosques, are as follows):

- 4.14% of mosques (equivalent to 13 mosques) exhibit no external courtyard, effectively possessing a surface area of 0 m².
- 24.20% of mosques feature outdoor courtyards smaller than 500 m².
- 28.66% of mosques boast outdoor courtyards ranging between 500 m² and 1000 m² in size.
- 42.99% of mosques showcase outdoor courtyards exceeding 1000 m², with an average area of 2165.74 m².

Table 6. 2 Presence of outdoor courtyard

(Source: Khoukhi & Senhadji, 2022)

Courtyard surface area in m²	Number of mosques	Percentage	Average surface area in m²
0	13	4.14 %	0
Less than 500 m²	76	24.20 %	264.79
From 500 to 1000 m²	90	28.66 %	748.63
More than 1000 m²	135	42.99 %	2165.74

A juxtaposition of the outdoor courtyard areas of 314 mosques with their built-up areas unveils a distinct emphasis on outdoor space over built-up space, as depicted in Table 6. 3.

Table 6. 3 Surface area of the outer courtyard as a proportion of the mosque's built-up area

(Source: Khoukhi & Senhadji, 2022)

Number of mosques	Surface Built-in m²			Surface Exterior courtyard in m²			Report courtyard/building	Number
	Min* - Min	Max**	Average***	Min* - Min	Max**	Average***		
55	178	2068	767.6	0	635	169.27	Less than 50	110
55	200	1942	686.85	100	1418	525.76	50% à 100 %	
44	269	7000	857.27	331	7460	1019.15	101% à 150%	204
40	186	1800	652.74	331	3228	1128.78	%153à 200 %	
49	225	1500	633.32	675	3500	1584.53	201% à 300%	
45	100	1300	542.57	480	4472	2082.61	%304à 500 %	
19	160	1200	484.84	1215	6450	2759.10	501% à 931%	
05	100	483	317.2	1799	5047	3709.6	%1024à 1779%	
02	100	100	100	4590	4734	4662.00	4590% à 4734%	
314	100	7000	667.11	0	7460	1209.79	241%	314

*the minimum. **the maximum. *** The average

The results of this analysis show that:

- 110 mosques have less outdoor courtyard space than built-up areas.
- 204 mosques (64.97% of the sample studied) have outdoor courtyard areas larger than their built-up areas. The external courtyard is 2.41 times[139] more extensive than the mosque's built-up area,
- The El Rayane mosque in the Hassani Abdelkrim municipality[140] has an outer courtyard
- 47.34 times larger than the mosque's built-up area of 100 m², while its outer courtyard is 4,734 m².
- The Abd El Madjid Haba at El Meghair[141] The mosque is the exception, with the most prominent external courtyard area equal to 7460 m², while the average surface area of external courtyards in the entire sample is 1209.79 m².

3.3 Exterior courtyard landscaping:

From a spatial arrangement perspective, we discerned three distinct forms of utilization within this outdoor prayer area. These comprise undeveloped spaces, delimited spaces, and developed spaces.

[139] This ratio is calculated by adding the surface area of external courtyards divided by the built-up area of the entire sample

[140] Located to the east of the capital of the Wilaya of El Oued.

[141] Formerly part of the wilaya of El Oued, it is now the capital of the wilaya of El Mghair.

3.3.1 An outdoor courtyard and prayer area :

These outdoor courtyards have not undergone any remodeling or refurbishing; they are still in their original, untouched state. These kinds of arrangements are usually found in mosques that are located in rural areas and are officially classified as neighborhood mosques. These buildings typically include some enclosed areas, creating large outdoor prayer courtyards.

Figure 6. 15 Exterior courtyard of the el Rahma - Taleb Laarbi mosque
(Source:Khoukhi & Senhadji, 2022)

The el Rahma-Taleb Laarbi mosque exemplifies the first instance[142] (Figure 6. 15), which occupies a total surface area of 875 m², with a built-up area comprising only 280 m². This configuration yields an external courtyard 2.12 times larger than the mosque's built-up area.

The second example is illustrated by the Ali Ben Taleb mosque, depicted in Figure 6. 16, where worshippers are observed performing the Tarawih prayer[143] on the sand floor during Ramadan (May 08th , 2021) while adhering to social distancing measures (Sun & Zhai, 2020). The built-up area of this mosque spans 375 m² on a plot measuring 2400 m², resulting in an external courtyard that is 5.14 times the size of the mosque's built-up area.

[142] Taleb Larbi is a municipality in the northeast of the wilaya of El Oued on the Algerian-Tunisian border.

[143] Performed daily on the night after Isha, during the fasting month of Ramadan

Figure 6. 16 Exterior courtyard of the Ali ben Abi Taleb mosque -Taleb Laarbi

(Source: https://www.facebook.com/Dar.eloued39/photos/ 4051141868286260)

3.3.2 An outdoor courtyard and enclosed prayer area :

There are low, raised walls with clerestories that only mark out a portion of the outer courtyard that is used hollow bricks or stones, a second boundary, more symbolic, is also created, which can be adjusted as desired (see Figure 6. 25).

As an illustration, the Abi Horaira mosque (Figure 6. 17), which is located in the El Moudjahidine neighborhood of the El Oued municipality, has an outdoor courtyard that is 1050 m² in size and a constructed space of 700 m².

The second example is the El Chamali mosque (Figure 6. 18), which is situated in the municipality of Oued el Alenda. Regretfully, accurate surface information was not available for this mosque.

Figure 6. 17 Exterior prayer area of the Abi Horaira Mosque -El Oued
(Source:Khoukhi & Senhadji, 2022)

Figure 6. 18. Exterior prayer area of the Oued El Alenda El Chamali Mosque - Oued El Alenda
(Source:Khoukhi & Senhadji, 2022)

3.3.3 An outdoor courtyard and prayer area :

The unique aspect of this arrangement above earlier ones is the existence of a covering or "roof" that is held up by a metal structure. The area set aside for prayer is defined by a boundary, which is often constructed of stone. One such is the El Bassir mosque in the Debila municipality(Figure 6. 19).

Figure 6. 19 Exterior prayer area of the El Basair mosque
(Source:Khoukhi & Senhadji, 2022)

It is important to emphasize that formal plans or studies for the construction of mosques usually do not include these specific layouts. Our research and fieldwork have revealed that these arrangements, which take into account local needs and expertise, are the result of the voluntary efforts of mosque administrators and religious associations.

As such, this classification is still pending. This upstream and downstream classification may need to be reevaluated in the event of any future development or refurbishment intervention. The two mosque cases below, which we looked at using Google Earth's time-lapse feature, serve as examples of this phenomenon. Using this technique, we were able to monitor how the outside courtyards changed throughout the months and years before.

The Imam El Termedi mosque in the El Oued community serves as an example of the first (see Figure 36). This sample is especially notable since it illustrates four different developmental stages. The outside courtyard was initially empty in 2007 (Figure 6. 20A). Then, in the outer courtyard, a prayer area was created in January 2015 (seeFigure 6. 20B); however,

it was taken down in May of the same year, returning the courtyard to its undeveloped form (see Figure 6. 20C). But by 2021, the prayer area had once more been redrawn and reorganized, with distinct variations from its 2007 configuration, most notably in the dimensions and form of the "Mihrab" (see Figure 6. 20D).

Figure 6. 20 Imam El Termedi mosque-El Oued
(Source: Khoukhi & Senhadji, 2022)

The El Chamali mosque in the municipality of Oued El Alenda is another striking illustration (Figure 6. 21). Its exterior courtyard underwent a striking metamorphosis, going from an empty lot to a carefully designed prayer space. This sequence of events implies a rational path of growth, moving from an empty courtyard to a bounded area and possibly to a covered, fully constructed courtyard.

Figure 6. 21 Oued El alenda El Chamali Mosque
(Source:Khoukhi & Senhadji, 2022)

4 The distinctive elements outdoor courtyards

4.1 The Mihrab in outdoor courtyards:

Apart from the traditional Mihrab that is located inside the mosque. These are also the spaces where people pray outside that have been carefully marked off and manicured. These outdoor Mihrabs are usually hemicycle-shaped, though you can sometimes find rectangular ones (see Figure 6. *25*).

Several of these outdoor Mihrabs have plugs for power to make installing sound equipment easier (see Figure 6. *23*). This configuration generates an additional Mihrab, separate from the internal one, creating an external prayer area that operates separately but stays close to the current building. In essence, having a self-contained Mihrab means that a second outdoor mosque has been established to supplement the primary covered mosque.

Figure 6. 22 Exterior Mihrab of the Abi Horaira Mosque
(Source: author)

Figure 6. 23 Exterior Mihrab of the El Bassair-Debila Mosque
(Source:Khoukhi & Senhadji, 2022)

Figure 6. 24 Exterior Mihrab of the El Atik Mosque - Oued El Alenda
(Source: author)

Figure 6. 25 Exterior Mihrab of the Othmane Ben Afan Mosque
(Source:Khoukhi & Senhadji, 2022)

4.2 Sand:

While there are some variations among these layouts, numerous similarities exist. In nearly all instances, the flooring of the outdoor courtyards. According to local sources[144], historically, prayer hall floors were consistently covered with sand from nearby dunes. One notable characteristic of this sand (Bendhia, 1998), which, as per local accounts, aids in lowering the temperature within the mosque. From a scientific standpoint, this is substantiated by the thermal properties of El Oued sand(Mahfoudi Nadjiba, 2016), characterized by its heat capacity.[145] (Cp) of 920 J/kg °C. This thermal capacity is a crucial parameter in evaluating the performance of building materials. During the summer, materials with high thermal capacity effectively maintain cool temperatures within rooms for extended periods. Conversely, in winter, they retain warmth for prolonged durations. Utilizing this sand provides a moderately high thermal capacity at a lower cost than materials like tiles or marble, which typically have a thermal capacity of 1000 J/kg °C.[146], or carpet and textile coverings, whose thermal capacity ranges from 1300 to 1800 J/kg °C.

Regrettably, the widespread adoption of air conditioning has led to the erosion of this ancestral tradition.[147] Within mosques, it is now limited to outdoor courtyards. The community's older residents, who are used to this habit, make it apparent that they prefer to worship on the sand. They contend that the physical characteristics of sand make kneeling easier and provide people the flexibility needed for prayer. Additionally, they claim that sand prayer eases the challenges brought on by a number of illnesses, including back and joint pain.

[144] According to the head of the Department of Religious Affairs and Wakf in El Oued, a native of the region
[145] The heat capacity of a material is the energy required to raise its temperature by one degree. Thermal capacity, expressed in joules per kelvin (J/K) and designated by the capital letter "C," represents a material's ability to absorb a quantity of heat (Q) and heat up (raise its temperature) by ΔT.
[146] Courgey-Oliva (2021) database.
[147] It is important to note that the bed generally needs to be changed twice a year once the sand has become dusty.

4.3 Other use of the courtyard outside mosques:

The experience in the area has also shown how important a role many of these outdoor courtyards play in tackling major urban and technical concerns. In fact, the need to create additional substations and problems with limited electrical supply has been greatly alleviated by these courtyards. Because there isn't enough land, the appropriate services are using parts of these outdoor courtyards to meet the electricity needs of the surrounding neighborhoods. These courtyards have also fulfilled the requirements of mosques, some of which we have already examined.

Figure 6. 26 Imam Shafii Mosque substation
(Source: author)

Figure 6. 27 El Forkane El Oued Mosque substation
(Source: author)

The COVID-19 pandemic revealed the importance of outdoor spaces. Indeed, the WHO's recommendations also affected places of worship, stipulating that any gathering during prayers should occur in an outdoor space where ventilation should be assured, if not adequate. The WHO's recommendation of outdoor space in the context of the pandemic points the finger directly at the outdoor courtyards that already exist in the mosques of El Oued, which we have detailed at length above.

The COVID-19 pandemic underscored the significance of outdoor environments. Notably, the recommendations[148] issued by the World Health Organization (WHO) also concerned places of worship. The WHO's directive regarding outdoor spaces amidst the pandemic[149] Distinctly highlights the existing outdoor courtyards within the mosques of El Oued, a topic thoroughly discussed earlier.

[148] World Health Organization (2020). Reconciling Ramadan practices and personal safety during the COVID-19 pandemic.
[149] World Health Organization. 2020). How to use the WHO risk assessment tool for mass gatherings during the COVID-19 pandemic.

Figure 6. 28 Exterior courtyard of the Jamma mosque
(Source: author)

It is crucial to emphasize that improving these outdoor areas may prove to be a workable way to manage pandemic health measures such as those that were faced with the COVID-19 outbreak.

According to the Department of Religious Affairs and Wakfs[150] The partial reopening on August 15, 2020, in El Oued, affected 88 local mosques.[151], predicated on their capacity to accommodate 1,000 worshippers and the surface area of the primary covered prayer hall[152]. Our on-site surface area analysis corroborated this, revealing that 04 mosques[153] Out of 66, they were operational despite lacking outdoor spaces or courtyards. Because of the undervaluation and neglect of these outdoor areas in the mosques under study, we propose that the current regulations pertaining to mosque classification be reviewed. Mosques can hold up to 1,000 attendees thanks to these special prayer rooms.

A suitable classification might have reduced the number of worshipers and their influx. In other words, the natural population density decreases with the number of mosques that are opened and with the amount of space that is available. A study on the spread of the COVID-19 virus in Algeria (Kadi & Khelfaoui, 2020) delineated the correlation between population density and its transmission. Increased public gatherings amplify the risk of virus transmission.

[150] Interview with the El Oued Wilaya's Religious Affairs and Wakf Department architect in December 2020.
[151] List published on the face book page of the Religious Affairs Directorate and Wakf of El Oued.
[152] The main one here is the outdoor prayer space created by the courtyard.
[153] The Moad ben Djebel, Khaled Ben el Walid, and Sidi Abdellah mosques are in the municipality of El Oued, and the Ahmed Ben Slimane mosque is in the municipality of Taghzout.

In order to bring the idea of a new mosque classification system based on capacity to life, we thought it would be helpful to use our sample of 314 mosques, which included 204 neighborhood mosques, 59 local mosques, and 51 mosque projects. Unfortunately, the only information we have about outdoor courtyards is their total surface size and built surface area.

Initially, we analyzed plans from five mosques.[154] In El Oued to, establish a method for calculating capacity. Adhering to the legislation's stipulation[155], we deducted the surface area occupied by the structure, circulation space, and various ancillary areas.

The results show that regardless of the building's size—usually one or two stories—the built surface area in square meters (m²) closely corresponds with its capacity[156]. In general, a mosque that has a built-up space of 1000 m² may hold about 1000 worshipers. Regarding outdoor courtyards, taking into account all of the previously discussed plan variations and using the same logic, the surface area of outdoor courtyards is equivalent to the total number of worshipers. This supposition produces outcomes that show how important outside courtyards are for increasing mosque capacity (seeTable 6. 4).

Table 6. 4 Reclassification of mosques

(Source: Khoukhi & Senhadji, 2022)

Legislative Type of mosque			Outdoor area		Covered hall		Covered + external	
			In more than x (worshippers)					
Local	Neighborhood	Project	500	1000	500	1000	500	1000
140	23	40			●			
29	05	15				●		
153	37	17	●					
91	27	30		●				
195	54	50					●	
110	17	41	●		●			●
161	36	40						●

[154] Mosque closures meant that we had to survey a larger sample. These are plans in digital format.

[155] Decree no. 76-36 of February 20th , 1976, on protection against the risks of fire and panic in establishments open to the public, religious establishments section, article v2

[156] Variable, the average is The capacity in faithful is +4.47% compared to the built-up area in m²

5 Conclusion

The COVID-19 pandemic has influenced the way mosques operate, imposing preventive measures.

Our field study revealed the presence Outdoor courtyards, with their large surface areas and varied organization, are often reserved for outdoor prayer. They meet social, climatic and cultural needs.

Two distinct types of Mihrab: one located within the mosque and the other completely exterior. While the legislator delineated the typology of the interior Mihrab, he did not address the exterior Mihrab, which is a common feature in the Wilaya of El Oued. This illustrates the local specificity of the Mihrab in the face of the new regulations.

Also the global pandemic of 2020 demonstrated the necessity for this space, often sandblasted, has been utilized for outdoor prayer, thereby demonstrating its efficacy in terms of spatial and sanitary management. This discovery suggests that should be incorporated into the specifications for mosques, not only in the Wilaya of El Oued but throughout southern Algeria. And can be a key element for new mosque classification system based on real capacity.

Conclusion of Part 2

While our field results were to be faced with the latest legislation in force, that of 2013, concerning mosque construction, we confronted them with the new 2022 specifications, presented in chapter one for mosque construction in Algeria. The proximity mosques in El Oued were tested against the new specifications. In the previous sequence of ideas, we took an in-depth look at the architectural and architectonic components of our samples, opting for an analysis of the data collected. This multi-criteria analysis, initiated on our platform, is essentially based on components that are commune in the field and the new 2022 specifications.

Based on the results gathered from these two analyses, we proceeded to compare the data in order to understand the relationships between them and their link with the architectural typology of the mosques studied (Table 6. 5)

The results (Table 6. *5*) were classified according to their dominance, validating the result criteria for mosques with at least two occurrences, with the exception of those with four minarets.

For mosques without minarets and with a single dome, two dominant typologies emerge:

- Rectangular mosques, built on the ground floor, with galleries and external courtyards, and a hemispherical dome preceding the Mihrab (8 mosques).
- Square mosques, built on the ground floor, with galleries and external courtyards, as well as a hemispherical dome preceding the Mihrab (2 mosques).

For mosques without minarets and with several domes, two dominant typologies stand out:

- Rectangular mosques, built in on the ground floor, with galleries and external courtyards, and a hemispherical main dome preceding the Mihrab (3 mosques).
- Rectangular mosques, built on two level, with galleries and external courtyards, and a hemispherical main dome preceding the Mihrab (3 mosques).

For mosques with a single minaret and a single dome, two dominant typologies are identified:

- Square mosques, with ground floor levels, galleries and external courtyards, featuring an octagonal minaret to the right of the Qibla wall, and a hemispherical dome preceding the Mihrab (4 mosques).
- Rectangular mosques, built with two level, with galleries and external courtyards, featuring an octagonal minaret to the right of the Qibla wall, and a hemispherical dome preceding the Mihrab (2 mosques).

For mosques with two minarets and a single dome, three dominant typologies emerge:

- Rectangular mosques, built on two levels, with galleries and external courtyards, featuring

octagonal minarets on the axis of the Qibla, and a hemispherical dome preceding the Mihrab (2 mosques).

- Square mosques, built on two level, with galleries and external courtyards, featuring octagonal minarets on the axis of the Qibla, and a hemispherical dome preceding the Mihrab (2 mosques).
- Square mosques, built at ground-floor level, with galleries and external courtyards, comprising octagonal minarets located on the axis of the Qibla, and a hemispherical dome preceding the Mihrab (2 mosques).

For mosques with two minarets and several domes, a dominant typology stands out:

- Square-shaped mosques, built on two level, with galleries and external courtyards, featuring octagonal minarets on the axis of the Qibla, and a hemispherical main dome preceding the Mihrab (2 mosques).

For mosques with four minarets and several domes, a typology is observed:

- A rectangular mosque, built at ground-floor level, with galleries and external courtyards, featuring square minarets placed at the four corners, and a hemispherical main dome preceding the Mihrab (1 mosque).

With the exception of mosques with a single minaret and several domes, for which we were unable to identify a typological dominance based on the analysis criteria adopted, a dominant typology emerges: that of mosques of varying gauges, square or rectangular in shape, with galleries and external courtyards, and a hemispherical dome preceding the Mihrab. The number of domes and minarets varies in these mosques, which make up 59% of the sample studied in El Oued. This typology, with its specific characteristics, can be described as a typology of proximity mosques.

Table 6. 5 Mosques in El Oued
(Source: author)

General organization									Minaret									Dome				Results
Floor		Mosque shape			Gallery		Exterior courtyard		Number				Minaret shape		Minaret location			Type		Dome typology	Dome location	
one	two	Square	Rectangle	Irregular	Yes	No	Yes	No	0	1	2	4	Square	Octagonal	Right	Left	Qibla axis	Mono	Multi	Hemispheric	Precedes Mihrab	
									●									●				26
									●										●			10
										●								●				31
										●									●			12
											●							●				13
											●								●			06
												●							●			02
Single-domed mosque without minaret																						
●			●		●		●		●									●		●	●	08
●		●			●		●		●									●		●	●	02
Mosque without minaret and multi-domed																						
●			●		●		●		●									●		●	●	03
	●		●		●		●		●									●		●	●	03
Mosque with one minaret and one dome																						
●		●			●		●			●				●	●			●		●	●	04
	●		●		●		●			●				●	●			●		●	●	02
Mosque with two minarets and one dome																						
	●		●		●		●				●			●			●	●		●	●	02
	●	●			●		●				●			●			●	●		●	●	02
●		●			●		●				●			●			●	●		●	●	02
Mosque with two minarets and multiple domes																						
	●	●			●		●				●			●			●		●	●	●	02
Mosque with four minarets and multiple domes																						
	●		●		●		●					●	●						●	●	●	01

Note: The result was compiled using the platform

GENERAL CONCLUSION

The subject of our thesis work " The Architecture of Proximity Mosques Legislation Vs Field: the Contribution of a Digital Platform (Case of El Oued Mosques)," is the study of the architecture of proximity mosques in the face of Algerian legislation on the construction of mosques. We chose to work on the wilaya of El Oued because of architectural specificities including the presence of multiple domes in buildings in general.

However, we are well aware that the theme of the architecture of contemporary mosques in Algeria as elsewhere constitutes a field of timeless research largely invested. In this regard, we had no pretension to undertake research on the architecture of historical or contemporary mosques as such or on Islamic architecture. Many reference works exist. Our objective is the mosques of proximity.

It should be noted that Algeria has legislations on the construction of mosques since 1991. In 2022, while we were analyzing the field data and writing the thesis, an order and a national rule book has been issued by the Ministry of Religious Affairs and Wakfs to try to define the architecture to be adopted in mosques. Alerted by the reality of the field, the main ordering officer in the construction of mosques: The Ministry of Religious Affairs and Wakfs has attempted to better define the architecture to adopt and to overcome or explain the misunderstandings of previous legislative texts. Thus, the typology and architectural components of the proximity mosques of the wilaya of El Oued faced the texts of this new specification that took into account the specificities of the regions of Southern Algeria. Recalling here that in relation to our problem what our initial questions were:

1. How to reconcile the architectural typology of the proximity mosques?
2. Is the current legislation on mosque construction appropriate and consistent with the reality of the proximity mosques?

After having faced the field data with the legislation in force and the 2022 new specifications in relation, it has allowed us to obtain the following results:

1-For mosques before the appearance of the 2022 specifications, the plurality of legislation (1991,2013.) has participated in one way or another to generate a multiplication of typologies of mosques.

2- The two and four-minaret mosques are the result of the “application” of legislation or the pre-2013 text that did not specify the Maghreb style. In other cases, 2013 legislation has not been respected.

3-Most of One square minaret-mosques are the result of application of 2013 legislation.

Although we have presented the results of the field part in the conclusion of part 2, we highlight more the results of all our research through the comparison of the questions, assumptions and objectives that have been set. For example, in terms of the “essential” architectural components of proximity mosques, the field revealed that:

For surface area**,** proximity mosques in the Wilaya of El Oued are generally less than 1000 m², this characteristic closely linked to local urban and demographic factors. in details 35.35 % of proximity mosques have a surface area of less than 500 m² and 49.04 % have a surface

area between 500 m² and less than 1000 m². Totally an 84.39 % of mosque less than 1000 m², 64.94 % of those mosque is classified as local mosque. The 2022 specifications classify mosques of more than 1000 m² as being local type mosques where Friday prayer or "Djoumoua" is performed and a mosque of less than 1000 m² as neighborhood mosque. A stipulation that disregards the local context.

For the prayer hall, it is generally built in three main shapes: rectangular with a Qibla wall running lengthwise, irregular according to local topography, and square. It is noteworthy that the 2022 specifications, as outlined in the referenced article, prioritize the rectangular shape over the irregular shape. This may be attributed to the neglect of the square shape which is growing about 36 % and it is arguably the most favorite shape according to our findings.

For the Mihrab, our field study revealed the presence of two distinct types of Mihrab: one located within the mosque and the other completely external. While the legislator delineated the typology of the interior Mihrab, s/he did not address the external Mihrab, which is a common feature in the Wilaya of El Oued. This illustrates the local specificity of the Mihrab in the face of the new regulations.

For the Minbar, our investigations identified two types of Minbars inside El Oued mosques: a mobile Minbar and a Minbar built into a balcony. Although the latter is commonly seen in several mosques in Algeria, the 2022 specifications prohibit it, without considering existing Minbars.

Regarding the gallery**,** a significant architectural component, it is omitted from the 2022 specifications. This discrepancy underscores the necessity for a comprehensive revision of the regulations to more effectively integrate local architectural nuances. The integration of heritage, aesthetic, and functional components of mosques into specifications is of paramount importance, particularly in light of their multifaceted values. The analysis conducted as part of this thesis revealed a multitude of dynamics and issues pertaining to the construction of mosques in the Wilaya of El Oued, illustrating a discrepancy between legislative requirements and on-the-ground realities.

For the Minaret**,** the legal requirement for a single square minaret in new construction contrasts sharply with observations in the field, where many mosques are designed without minarets. These mosques, although designed with a minaret, are often not completed, even when the funds are available, leaving the structures "unfinished" by legal standards.

For the Dome, the choice of field was made in relation to this component present and known in the El Oued. However, our research shows a decline in this local trend. Single-dome mosques predominate due to technical and financial constraints, even in this region where tradition calls for multiple domes.

For materials and construction techniques, the specifications offer a certain freedom in terms of materials and construction techniques, while at the same time legitimizing architectural interventions that are sometimes incompatible with regional and climatic specificities.

All the elements mentioned above concern our field, the Wilaya of El Oued. But announced beforehand in the introductory part, our practice of the profession of architect also revealed other elements. In response to the 2022 specifications, we were disconcerted for the design and construction of mosque in the Wilaya of Medea.

The analysis of the field of the Wilaya of El Oued has shown us that both situations cannot adapt to this Wilaya. The application of the first situation a «prototyping» of the components resulting from the specifications cannot be made because some components are not frequent. For example, the Sahn is replaced by much more frequent exterior courtyard. For the second situation, the so-called local components are not considered as the case gallery.

For the actors although we have not addressed all the actors involved in the construction of the proximity mosques of El Oued, the Technical Building Control has become a determining factor, even key in the typology, completion and reception of mosques on the ground. Moreover, the legislator through the 2022 specifications has granted more power for compliance with technical standards when building mosques. What has changed with the specifications is a more "determined" involvement of technical standards in mosque projects. The Technical Building Control and civil engineer plays a pivotal role in the completion of mosques, meticulously applying technical standards, which frequently result in the compromise of traditional architectural proportions.

We found that the legislation and the new rule book still contain shortcomings and gaps, which demonstrate once again that the problem of the typology of proximity mosques remains unresolved. The gap between legislative texts and their interpretations is visible. This was further confirmed during the COVID 19 health crisis with unexpected fallout in the architectural components of mosques. Our field study revealed the existence of a "new" architectural component that could be considered or even integrated into the current legislation on mosque construction.

Thus, our research and field investigations have demonstrated the existence outer courtyard, usually on the periphery of the gallery located outside the mosque. A primacy of the surface of this space is given in relation to the area of the covered mosque. This outdoor space, which is an integral part of the mosque, has been used in various forms for outdoor prayer. The study of its location in relation to the mosque confirmed that it was a deliberate choice in response to the needs of society.

However, an outdoor prayer room and a Mihrab separate from those of the covered mosque could be interpreted as an "introduction" to a new outdoor mosque attached to the original roofed mosque has allowed the spatial and sanitary management during the crisis related to COVID-19. This space has naturally served for prayer in the midst of the COVID crisis. The traditional and cultural sand soil has been a real therapeutic response during the COVID-19 crisis. Therefore, this criterion should be included in the architectural components not only in the wilaya of El Oued or even in the South of Algeria. It should be supported in the mosque classification parameters. These are mosques with exterior courtyard.

In relation to the hypothesised led us to the following:

Hypothesis 01: the policy developed from the legislative texts relating to the construction of mosques is general and generalist, excluding local or regional specificities of factors, climate, social and cultural.

Hypothesis 02: local or regional specificities of factors, climate, social and cultural are not always respected in the field.

Hypothesis 03: the creation of a platform to capitalize previous inventory studies categorise and analyse the architectural components found in the field, this can be a great contribution to the

legislators of the Ministry of Religious Affairs and Wakfs.

The field has demonstrated that the analysis and cross-checking of the countless data from the field as well as the gaps identified in the legislation in force gave us the idea to think of designing a digital platform with dynamic analysis grids. All our field work was carried out with this platform.

The platform development took more than a year of work devoted to mosques. But before starting the work, we had to call on a software developer and host the platform's website. Then we proceeded to introduce the data, their analyses then we gave a dynamic grid that classified the mosques according to their architectural components. The platform is useful for bringing out the specific features and components of mosques.

We have applied this platform to our field in El Oued wilaya. We have entered all data; we have analysed it through the platform. The platform was a tool for analysis and study for our research work on proximity mosques.

In relation to the objectives set, we have set fundamental objectives and a fundamental practical objective.

1-Understand why local and regional specificities are not taken into account by legislators in the design and construction of mosques in Algeria.

2- Understand all the empty and unnecessary mosque inventory operations.

We have applied the platform in the wilaya of El Oued ,but it can be applicable to all other wilayas and communes of Algeria. This platform is continuously fed with real-time data. We tried -in vain- to protect our platform through the copyright institutions so that it could be availablefor the Ministry of Religious Affairs and Wakfs, researchers, architects, students, the Ministry of Housing and Urbanism... etc.

The platform is, thus , designed as a working basis for all actors. Its future depends on its update for more research topics. The value is to be able to apply it to other areas such as urban planning, mapping… etc.It can also be connected with other databases that are interested in heritage in all its forms. The accumulated information and results constitute a database of very important work for researchers, architects and authorities. The data and results of the platform can be used to understand the data about the newly built mosques.

For the research perspectives that can emerge from our thesis are:

- The Extension of the analysis to all regions of Algeria via the platform in order to highlight the essential and specific components by region for the construction of mosques.
- The exploitation of the results of the platform for proximity mosques to fill or better specify the current legislation and the specifications of September 2022 by regions in Algeria.
- The exploitation of the platform by the Ministry of Religious Affairs and Wakfs and the Ministry of Housing and Town Planning.
- The exploitation of the platform for other research fields and building typologies (housing,

museums, palaces, …)

In conclusion, this research underscores the necessity to adapt legislation and specifications to local realities, while employing modern technologies for optimal management and enhanced preservation of the architectural heritage of mosques in Algeria.

Bibliography

1. Abdou, A. A. (2003, February). Measurement of acoustical characteristics of mosques in Saudi Arabia. The Journal of the Acoustical Society of America, 113, 1505–1517. doi:10.1121/1.1531982

2. Adli, L. C., & Chemrouk, N. C. (2015, June). On Drafting a New Architectural Syntax: Case Study of the Great Mosque of Algiers. Journal of Islamic Architecture, 3, 106. doi:10.18860/jia.v3i3.2740

3. Adnane, ع .م. (2019, December). المكونات المادية للمسجد وأثرها التفاعلي. مجلة قبس للدراسات الإنسانية والاجتماعية, 3, 218–255. Retrieved July 18, 2020, from https://www.asjp.cerist.dz/en/article/105156

4. Adnane, ع .م. (2020, June). البعد التفاعلي في تسمية المساجد وتحديد أنواعها. الذاكرة, 8, 118–146. Retrieved July 18, 2020, from https://www.asjp.cerist.dz/en/article/115569

5. Ahmed, A.-A. (2019, May). Conceptualising Mosque Diversity. Journal of Muslims in Europe, 8, 138–158. doi:10.1163/22117954-12341390

6. Aillet, C. (2016, June). L'ibadisme maghrébin en contexte fatimide (début xe-milieu xie siècle). Revue des mondes musulmans et de la Méditerranée, 127–146. doi:10.4000/remmm.9467

7. Aillet, C. (2018, September). L'ibadisme dans les sociétés de l'Islam médiéval: Modèles et interactions. Walter de Gruyter GmbH & Co KG.

8. Allès, E. (2009, July). La mosquée chinoise : support d'identités et de modernités. Revue des mondes musulmans et de la Méditerranée, 111–121. doi:10.4000/remmm.6211

9. Almagro, A., Carbonnell, M., & Madran, E. (1988). Relevés photogrammétriques de centres urbains anciens en pays islamiques. Retrieved July 16, 2020, from https://digital.csic.es/handle/10261/22069

10. Amer, I. (2012, July). دراسة تطور عمارة المساجد بين الآصالة و المعاصرة رصد للمساجد في القاهرة الكبري.

11. Amri, K., & Djamel, A. (2018). *Knowledge of the vernacular heritage of Souf Khaoula AMRI*.

12. ARRAR, M. (2014). *Elaboration d'une base de données des mosquées du Baylik El Gharb : La méthode - CE S. A. D. A (UNESCO)*. EPAU.

13. Assoule, D. E. (n.d.). compacité et tendances d'étalement urbain. Cas d'étude : Les grandes villes du Bas-Sahara algérien. 320.

14. Azil, C., Djebri, B., Fratini, F., Misseri, G., & Rovero, L. (2020, September). Desert Rose Stone Constructions Covered with Domes in the Souf Region (Algeria). International Journal of Architectural Heritage, 0, 1–20. doi:10.1080/15583058.2020.1813353

15. Aziz, S. (2017). Mosque, Memory and State: A Case Study of Jama Masjid (India) and the Colonial State c. 1857. doi:10.19205/47.17.1

16. Asfour, O. S. (2016). Bridging the Gap Between the Past and the Present : A Reconsideration of Mosque Architectural Elements. *Journal of Islamic Architecture*, *4*(2), 77-85. https://doi.org/10.18860/jia.v4i2.3559

17. BARADI, ahmed. (2018). الجمعيات الدينية الخاصة ببناء المساجد، وآليات تمويلها وفق التشريع الجزائري Religious association for mosque building and its financing mechanisms in Algerian law. *مجلة الاجتهاد للدراسات القانونية والاقتصادية*, *7*(4), 298-312.

18. Baharudin, N. '., & Ismail, A. S. (2014, October). Communal Mosques: Design Functionality towards the Development of Sustainability for Community. Procedia - Social and Behavioral Sciences, 153, 106–120. doi:10.1016/j.sbspro.2014.10.046

19. Barbier, B. (s. d.). L'inventaire du patrimoine architectural de la période ottomane en Algérie : Du recensement à l'étude. [Billet]. *Patrimoines du Maghreb à l'ère numérique*. Consulté 25 mai 2021, à l'adresse https://patmagh.hypotheses.org/174

20. Belhadj, م. ب. (2019, April). التواصل الفني بين تركيا والجزائر في العصر الحديث -المساجد ذات القبة المركزية دراسة حالة-. مجلة منبر التراث الأثري, 4, 163–184. Retrieved July 18, 2020, from https://www.asjp.cerist.dz/en/article/85395

21. Beloucif, O., Fartas, S., & Aidat, A. (Encadreur). (2019). *L'évolution typologique de la maison traditionnelle de la vallée du m'Zab* [Thesis, Université de Jijel]. http://dspace.univ-jijel.dz:8080/xmlui/handle/123456789/347

22. Benabbou, L., Guitouni, A., & Lang, P. (n.d.). Méthodes de Classification : Revue de la littérature, Essai de Caractérisation et de Comparaison. 35.

23. Benkoula, S. M. (2007, December). Approche de la question de l'"éventuelle" édification des mosquées en France. Insaniyat / إنسانيات. Revue algérienne d'anthropologie et de sciences sociales, 111–117. Retrieved February 14, 2021, from http://journals.openedition.org/insaniyat/3257

24. Bernard, G., & Besson, M. L. (1971). Douze méthodes d'analyse multicritère. Revue française d'informatique et de recherche opérationnelle. Série verte, 5, 19–64. doi:10.1051/ro/197105V300191

25. binti Othman, R., Inangda, N., & Ahmad, Y. (n.d.). A typological study of mosque internal spatial arrangement: A case study on Malaysian mosques (1700-2007). A typological study of mosque internal spatial arrangement: A case study on Malaysian mosques (1700-2007).

26. Ben younes, houda. (2018). *L'architecture des mosquées Ibadites au Mzab et à Djerba : Propriétés syntaxiques et modes de structuration* ·. https://ibadica.org/s/bibliographie/item/1459

27. BENARBIA, I. (2014). *L'EVALUATION DE LA VALEUR ESTHETIQUE DES MONUMENTS HISTORIQUES Cas de la grande mosquée de Nédroma* [PhD Thesis]. https://scholar.google.com/scholar?cluster=5575581971188766702&hl=en&oi=scholarr

28. Bendhia, M. H. (1998). *Quelques particularités de l'utilisation du sable de dune en construction routière*. *213*, 33-42,.

29. Bousmaha, S., Zouaoui, M. C., & Chergui, S. (2018). THE CONTEMPORARY MOSQUE IN ALGERIA: A NEW PERSPECTIVE OF HERITAGE. *International Journal of Human Settlements*, *2*, 13.

30. Bouzid, Z., bouzid, Z., & CPS. (2017, January). L'architecture sacrée de l'Islam Les mosquées historiques en Algérie. Alger: Zaki Bouzid.

31. Brebbia, C. A., & Boquera, A. M. (2016, July). Islamic Heritage Architecture and Art. WIT Press.

32. Chergui, S. (2009, July). La « Nouvelle Mosquée » d'Alger. Le déroulement d'une procédure constructive au xviie siècle. Revue des mondes musulmans et de la Méditerranée. doi:10.4000/remmm.6267

33. CNERIB. (1993). *VOUTES ET COUPOLES EN MATERIAUX LOCAUX*.

34. Comneno, M. A. (2020, December). A Project of digitalization and classification of Architectural Monuments of Islamic Countries. DISEGNARECON, 13, 12–12.6. Retrieved November 29, 2022, from https://disegnarecon.univaq.it/ojs/index.php/disegnarecon/article/view/757

35. Dawood, H. (2020, June). Dynamic of Globalization and its Intellectual Transformations in the Interior Design of Contemporary Mosques.

36. DECHAICHA, A. (2020). La soutenabilité de la ville au Sahara entre compacité et tendances d'étalement urbain. Cas d'étude : Les grandes villes du Bas-Sahara algérien. doctoral, Université Mohamed Khider – Biskra. Retrieved February 14, 2021, from http://thesis.univ-biskra.dz/5301/

37. Doty, D. H., & Glick, W. H. (1994, April). Typologies as a Unique Form of Theory Building: Toward Improved Understanding and Modeling. The Academy of Management Review, 19, 230. doi:10.2307/258704

38. Drissi, H. S., & Cherif, A. M. (2016). *ALGERIAN URBAN HERITAGE BETWEEN TRADITIONAL SOLUTIONS AND URBAN SUSTAINABILITY*. *8*(1), 7.

39. Ekholm, A. (1996). A Conceptual Framework for Classification of Construction Works. *Journal of Information Technology in Construction (ITcon)*, *1*(2), 25-50.

40. Ekholm, A. (2003, January). A Conceptual Framework for Classification of Construction Works. Journal of Information Technology in Construction (ITcon), 1, 25–50. Retrieved December 3, 2022, from http://www.itcon.org/paper/1996/2

41. Ekholm, A., & Häggström, L. (2011). BUILDING CLASSIFICATION FOR BIM – RECONSIDERING THE FRAMEWORK. CIB. Retrieved November 29, 2022, from http://lup.lub.lu.se/record/2201252

42. Elghonaimy, I., & Eldardiry, D. (2019, November). The Revival of Courtyard Consolidation in Mosque Architecture.

43. Elkhateeb, A. A. (2012, April). Domes in the Islamic Architecture of Cairo City: A Mathematical Approach. Nexus Network Journal, 14, 151–176. doi:10.1007/s00004-011-0103-3

44. Elkhateeb, A., Attia, M., Balila, Y., & Adas, A. (2018). The classification of prayer halls in modern saudi masjids : With special reference to the city of jeddah. *International Journal of Architectural Research: ArchNet-IJAR, 12*, 246. https://doi.org/10.26687/archnet-ijar.v12i2.1411

45. Elrahman, h. (2020, April). CLASSIFYING MOSQUES ACCORDING TO THE SYMBOLISM OF THE ARCHITECTURAL ELEMENTS AN ANALYTICAL STUDY OF A BASOUNAH MOSQUE - EGYP. Journal of Al-Azhar University Engineering Sector, 15, 631–641. doi:10.21608/auej.2020.87844

46. Encyclopédie de l'Islam: Mahk-Mid. 6]. (1986). E. J. Brill ; Paris.

47. Erarslan, A. (2019, March). A Contemporary Interpretation of Tradition in Mosque Design. Marmara Ilahiyat Mosque, Turkey. European Scientific Journal ESJ, 15. doi:10.19044/esj.2019.v15n8p97

48. FEKIH, M. (2019). *Eléments et composition des façades des édifices publics de l'époque coloniale au Sud-est Algérien Cas des villes de Biskra, El Oued, Touggourt et Ouargla* [Masters, Université Mohamed Khider - Biskra]. http://thesis.univ-biskra.dz/4504/

49. Fiès, B. (n.d.). Classification of Building Object Types - Misconceptions, challenges and opportunities. 11.

50. Ghéon, H., & LACHASSE, P. I. (1999). Au pays du sable: le Souf (Sud algérien). Bulletin des Amis d'André Gide, 27, 37–63. Retrieved February 14, 2021, from https://www.jstor.org/stable/44813067

51. Ghodbani, T., Milewski, A., & Bellal, S.-A. (2015). The wetlands of the Terga area, a vulnerable coastal ecosystem in the southern Mediterranean (western Algeria). *Mediterranee*, *125*, 153-164.

52. Gilles, I. (n.d.). TERTRAIS Maëlle – Les nouvelles mosquées en Turquie. Entre tradition et contemporain. TERTRAIS Maëlle – Les nouvelles mosquées en Turquie. Entre tradition et contemporain. Retrieved July 18, 2020, from https://oui.hypotheses.org/4010

53. Godard, A. (1951). L'origine de la madrasa, de la mosquée et du caravansérail à quatre īwāns. Ars Islamica, 15/16, 1–9. Retrieved February 14, 2021, from https://www.jstor.org/stable/4515665

54. Hakim, N. (2008). Mosque Architecture Past and Present. In R. Stegers (Ed.), Sacred Buildings: A Design Manual (pp. 46–53). Basel: Birkhäuser. doi:10.1007/978-3-7643-8276-6_3

55. Hannache, I. (2018). *FOR A VALORIZATION OF OTTOMAN RELIGIOUS ARCHITECTURAL HERITAGE: CASE OF EL-BEY MOSQUE IN ANNABA.* 10.

56. Henriet, L. (n.d.). Systèmes d'évaluation et de classification multicritères pour l'aide à la décision: Construction de modèles et procédures d'affectation. 161.

57. Hessari, P., & Ahmadnejad, A. (2019, September). Architecture and performance of mosque.

58. Hidayati, R., & Setiawan, W. (2020, March). The architectural transformation of historic mosques in Javanese rural settlements. IOP Conference Series: Earth and Environmental Science, 447, 012043. doi:10.1088/1755-1315/447/1/012043

59. Hillenbrand, R. (1994). *Islamic Architecture : Form, Function and Meaning*. Edinburgh University Press.

60. Iles, S. M., & Hamma, W. (2019). *THE ZIANIDES MOSQUES IN TLEMCEN: AN ARCHITECTURAL STUDY*. *3*, 9.

61. Imane, ا.ع. (2020, June). الزخرفة في العمارة الدينية "دراسة وصفية فنية لمسجد كتشاوة بعد الترميم أنموذجا". جماليات, 6, 542–564. Retrieved July 18, 2020, from https://www.asjp.cerist.dz/en/article/118086

62. Jørgensen, K. A. (2011). Classification of Building Object Types : Misconceptions, challenges and opportunities.

63. Kadi, N., & Khelfaoui, M. (2020, August). Population density, a factor in the spread of COVID-19 in Algeria: statistic study. Bulletin of the National Research Centre, 44, 138. doi:10.1186/s42269-020-00393-x

64. Kahera, A., Abdulmalik, L., & Anz, C. (2009, October). Design Criteria for Mosques and Islamic Centres. Routledge.

65. Kalayci, P. D., & Çelđk, E. Ş. (2014). Public's Judgment on Contemporary Mosque Design Approaches. 10.

66. Kadri, S. R., & Chaouche, S. (2018). La remontée des eaux dans la région du Souf : Une menace sur un écosystème oasien. *Les Cahiers d'EMAM. Études sur le Monde Arabe et la Méditerranée*, *30*, Article 30. https://doi.org/10.4000/emam.1554

67. Khan, H. (2008). Contemporary Mosque Architecture. *ISIM Review*, *21*(1), 52-53.

68. Khoukhi, I., & Senhadji, D. (2022). The architecture of Mosques and the Covid-19 pandemic. *Conservation Science in Cultural Heritage*, *22*, 73-95. https://doi.org/10.6092/issn.1973-9494/17303

69. Khoukhi, I., Senhadji, D., & Hellal, M. Z. E. (2023). New Mosques Architectural Platform : Digitalised Inventory and Analysis for Mosques Referencing. *Journal of Islamic Architecture*, *7*(3), Article 3. https://doi.org/10.18860/jia.v7i3.21060

70. Korbendau, Y. (1997). *L'architecture sacrée de l'Islam*. ACR. https://books.google.dz/books?id=tJZkQgAACAAJ

71. Kouider, R., & Ivashko, J. (2018). Study methodology of the architectural periodization of Algerian mosques and the ritual role of elements (Mihrab, Minbar, Qibla, Bath for Ablution) in the Islamic worship service. Środowisko Mieszkaniowe, 28–36. Retrieved February 21, 2022, from https://bibliotekanauki.pl/articles/905450

72. Koumas, A., & Nafa, C. (2003). *L'Algérie et son patrimoine : Dessins français du XIXe siècle*. Monum, Éd. du patrimoine. http://catalogue.bnf.fr/ark:/12148/cb39092580t

73. Kouzmine, Y., & Avocat, H. (2007). *L'eau et les territoires sahariens en Algérie, Mutations et enjeux*. 255p. https://shs.hal.science/halshs-00389860

74. Kurniawan, H. (2011). Familiarity in Designing a Mosque: A Practice of Universal Design. doi:10.13140/RG.2.2.28069.19687

75. Lamunière, J.-M. (1988). Le classement typologique en architecture. doi:10.5169/SEALS-128866

76. LEBSIR, A. (2016). *Les Cultures Constructives Traditionnelles, Cas des Aurès, L'Oued Mya et Le Souf.* [Masters, Université Mohamed Khider - Biskra]. http://thesis.univ-biskra.dz/2519/

77. Mahmutćehajić, R. (2006). The mosque: the heart of submission (1st ed ed.). New York: Fordham University Press.

78. Mahfoudi Nadjiba. (2016). *Stockage de la chaleur dans un milieu granuleux solide.* [Thesis]. http://archives.univ-biskra.dz:80/handle/123456789/24806

79. MARCAIS, G. (1954). *L'Architecture Musulmane d'Occident.* (First Edition). Arts et Metiers.

80. McDonnell, R., Lloyd, C., & Burrough, P. (2015). *Principles of Geographical Information Systems*. Oxford University Press.

81. Merabet, L. (2009). Vulnerability Of The Lower Sahara And The Human Impact On The Increase Of Desertification (The Case Of Oued Righ And Oued Souf Region). In A. Marini, & M. Talbi (Eds.), Desertification and Risk Analysis Using High and Medium Resolution Satellite Data (pp. 229–240). Dordrecht: Springer Netherlands. doi:10.1007/978-1-4020-8937-4_21

82. MEKI, H. (2016). *السباطات في العمارة الإسلامية من خلال المخطوطات والوثائق الشرعية في العصر العثماني*. مركز المعرفة الرقمي. https://ddl.mbrf.ae/book/7001311

83. Menhour, asma. (2012). *MEMOIRE DE MAGISTER : preservation de la mosquée en tant que patrimoine architectural religieux -cas de la mosquée Ottomane à constantine.* https://doi.org/10.13140/RG.2.2.32666.66245

84. MERZOUG, N. A. (2012). *MINARETS DES MOSQUEES DE TLEMCEN Étude architecturale et artistique*.

85. Miloudi, M. (2020). Les incidences de la politique linguistique algérienne à l'ère de Bouteflika sur les pratiques langagières des habitants de la commune d'El-Oued. 19.

86. Myers, D. (2016). Heritage inventories : Promoting effectiveness as a vital tool for sustainable heritage management. *Journal of Cultural Heritage Management and Sustainable Development*, *6*(2), 102-112. https://doi.org/10.1108/JCHMSD-02-2016-0009

87. Nadjem, ن.م., & Chellali, ش.ل. (2020, March). دور المؤسسة الدينية في الجزائر بين تحديات الماضي ورهانات المستقبل زاوية الفقيه المصلح المغيلي التلمساني التواتي أنموذجا. مجلة مفاهيم, 1, 270–282. Retrieved July 18, 2020, from https://www.asjp.cerist.dz/en/article/111972

88. Noureddine, M., & Abdelmalek, T. (2019). The Influence of the El Atik masjed on the architecture of the plans of the sétifmasjeds, Algeria. *J. Architecture Plann*, *31*(1), 103-118.

89. Okuyucu, Ş. E. (2016, April). Evaluation of Spatial Fictions, Design Concepts, Aesthetic Quests of Traditional, Modern Mosques from Past to Present and the Analysis of Mosque Samples. Civil Engineering and Architecture, 4, 54–66. doi:10.13189/cea.2016.040203

90. Olivera-La Rosa, A., Chuquichambi, E. G., & Ingram, G. P. D. (2020). Keep your (social) distance : Pathogen concerns and social perception in the time of COVID-19. *Personality and Individual Differences*, *166*, 110200. https://doi.org/10.1016/j.paid.2020.110200

91. Prevost, V. (2009). Les mosquées ibadites du Maghreb. *Revue des mondes musulmans et de la Méditerranée*, *125*. https://doi.org/10.4000/remmm.6253

92. Ra'ouf, Z. (2019, May). Indicators of the Mosque as a Social Type. Journal of University of Babylon for Engineering Sciences, 27, 150–170. doi:10.29196/jubes.v27i2.2323

93. Redjem, M. (2014). *L'évolution des éléments architecturaux et architectoniques de la mosquée en vue d'un cadre référentiel de conception Cas des mosquées historiques de Constantine.*

94. Remini, B. (2006). LA DISPARITION DES GHOUTS DANS LA REGION D'EL OUED (ALGERIE). 14.

95. Riddell, S., Goldie, S., Hill, A., Eagles, D., & Drew, T. W. (2020, October). The effect of temperature on persistence of SARS-CoV-2 on common surfaces. Virology Journal, 17, 145. doi:10.1186/s12985-020-01418-7

96. Salhi, M. B. (2000, August). Eléments pour une réflexion sur les styles religieux dans l'Algérie d'aujourd'hui. Insaniyat / إنسانيات. Revue algérienne d'anthropologie et de sciences sociales, 43–63. doi:10.4000/insaniyat.7970

97. Sekhri, ع. (2018). عمارة المساجد في عصر العولمة بين الهوية، الأصالة والعصرنة : حالة مساجد مدينتي قسنطينة والجزائر العاصمة [Thesis]. http://dspace.univ-setif.dz:8888/jspui/handle/123456789/1839

98. Senhadji, D. (2017). Mosquées algériennes et expérimentations architecturales. Une législation en cours. L'Année du Maghreb, 16, 307-317. https://doi.org/10.4000/anneemaghreb.3099

99. Senhadji Khiat, D. (2010). Les mosquées en Algérie ou l'espace reconquis : L'exemple d'Oran. L'Ann*ée du Maghreb*, *VI*, 291-303. https://doi.org/10.4000/anneemaghreb.907

100. Shohbi, A. A. (2007). النمط المعماري للمساجد الأثرية بالصحراء الجزائرية « مسجد العدواني بالزقم في وادي سوف نموذجا ». *حولية الاتحاد العام للآثاريين العرب*, *10*(1), 565-578. https://doi.org/10.21608/cguaa.2007.38560

101. Soltanzadeh, H. (2015). The Role of Climate and Culture on the Formation of Courtyards in Mosques. *Space Ontology International Journal*, *4*(3), 19-28.

102. Sun, C., & Zhai, Z. (2020, November). The efficacy of social distance and ventilation effectiveness in preventing COVID-19 transmission. Sustainable Cities and Society, 62, 102390. doi:10.1016/j.scs.2020.102390

103. Taib, M. Z., & Rasdi, M. T. (2012). Islamic Architecture Evolution: Perception and Behaviour. Procedia - Social and Behavioral Sciences, 49, 293–303. doi:10.1016/j.sbspro.2012.07.027

104. Uluhanli, L. (2018). *Mosquées* (Illustrated édition). Citadelles & Mazenod.

105. Verkaaik, O. (2020, April). The Anticipated Mosque: The Political Affect of a Planned Building. City & Society, 32, 118–136. doi:10.1111/ciso.12241

106. Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the Qualitative-Quantitative Divide : Guidelines for Conducting Mixed Methods Research in Information Systems. *MIS Quarterly*, *37*(1), 21-54. https://doi.org/10.25300/MISQ/2013/37.1.02

107. Zerari, S. (2019). Berber contributions to Muslim religious architecture in the Ziban (Algeria): Case of mosques. 3, 10.

108. Zerari, S., Sriti, L., & Mansouri, K. (2019). Dégradation du patrimoine ksourien du sud algérien. 10.

109. Zerari, S., Sriti, L., & Pace, V. (2020). Morphological Diversity Of Ancient Minarets Architecture In The Ziban Region (Algeria) : The Question Of Form, Style And Character. *METU JOURNAL OF THE FACULTY OF ARCHITECTURE*. https://doi.org/10.4305/METU.JFA.2020.2.6

110. Zulkiple, A. G. (n.d.). History, Distribution and Affiliation of Mosque in Muslim Minority of Sri Lanka. International Journal of Humanities and Social Science, 3, 11.

Law

01 Law no. 08-15 of 20 July 2008 laying down the rules for bringing buildings into conformity and completing them

02 Executive Decree no. 15-19 of 25 January 2015 setting out the procedures for the appraisal and issuance of planning documents

03 Executive Decree n° 20-342 22 November 2020 amending and supplementing the

04 Executive Decree n° 15-19 of 25 January 2015 setting out the procedures for the appraisal and issuance of planning documents.

05 Executive Decree no. 22-55 of 2 February 2022 setting the conditions for regularization of constructions not in accordance with the building permit issued

06 Executive Decree no. 81-386 establishing the responsibilities of the commune and Wilaya in the area of religious affairs

07 Executive Decree no. 88-50 of 13/03/1988 on the construction, organization and operation of the mosque

08 Executive decree no. 91-81 of 23/03/1991 on the construction of the mosque, has its organization and operation and sets out its mission.

09 Executive Decree no. 91-81 of 23/03/1991 on the construction of the mosque, has its organization and operation and sets out its mission

10 Interministerial decree 24 of 10/04/1999 on the mosque card

11 Executive Decree no. 13-377 of 09/11/2013 on the status of the mosque

12 Executive Decree no. 14-27 of 1 February 2014 setting out the urban, architectural and technical requirements applicable to buildings in the southern Wilayas

13 Decree of 31 March 2014, determining the wilayas of the South concerned by the application of urban, architectural and technical requirements applicable to buildings.

14 The decree of June 29, 2017 fixing the form and content of the national file of mosques

15 Interministerial order 29 May 2022 setting the standard specifications for the typology of mosque construction. Published September 19, 2022

16 Decree no. 76-36 of 20 February 1976 on protection against fire and panic risks in establishments receiving the public, section establishment of worship, article v2 (Source paper).

17 Executive Order n° 20-225 of 8 August 2020 on the reduction of the device for preventing and combating the spread of the Coronavirus (COVID-19).

18 Executive Decree n° 20-360 of 1 December 2020 adapting the measures of the device for preventing and combating the spread of the Coronavirus (COVID-19)

19 B. DTR, "Algerian Seismic Rules, RPA99/Version 2003", National Center for Applied Research in Earthquake Engineering CGS Algiers, 2003

Websites

01 Algorithmes de classification sous contraintes et méthodes multicritères. (n.d.). Algorithmes de classification sous contraintes et méthodes multicritères. Retrieved February 15, 2021, from http://ori.univ-lille1.fr/notice/view/univ-lille1-ori-88911

02 islamicart.museumwnf.org

03 https://www.archnet.org/publications/2480,General Inventory of Islamic Architecture: Project Overview, (accessed 02.10.2022).

04 https://www.archnet.org/publications/2479 (accessed 02.10.2022).

05 https://www.archnet.org/publications/2478 (accessed 02.10.2022).

06 https://www.archnet.org/publications/2477 (accessed 02.10.2022).
07 https://www.archnet.org/publications/2476 (accessed 02.10.2022).
08 https://www.archnet.org/publications/2475 (accessed 02.10.2022).
09 https://www.archnet.org/publications/2474 (accessed 02.10.2022).
10 https://www.archnet.org/publications/2473 (accessed 02.10.2022).
11 https://www.archnet.org/publications/2472 (accessed 02.10.2022).
12 https://www.archnet.org/publications/2471 (accessed 02.10.2022).
13 https://www.archnet.org/publications/2470 (accessed 02.10.2022).
14 https://www.archnet.org/publications/2469 (accessed 02.10.2022).
15 https://www.archnet.org/publications/2468 (accessed 02.10.2022).
16 www.facebook.com/Dar.eloued39/photos/4051141868286260. [Consulted: 19/08/2021]
17 www.facebook.com/Dar.eloued39/posts/pfbid02dsJrj1E5KFD5bDzVLyjZZzibrsAMxAmRJqd5Wicr5Lbs6eJuviW9275ZbzfrroWJ [consulted : 19/08/2021]
18 https://apps.who.int/iris/handle/10665/331791., World Health Organization (2020). Reconciling Ramadan practices and personal safety during the COVID-19 pandemic. [Consulted : 21/08/2021]
19 https://apps.who.int/iris/handle/10665/332077, World Health Organization. (2020) . How to use the WHO tool for assessing the risks of mass gatherings during the COVID-19 pandemic. World Health Organization. [Consulted : 21/08/2021]
20 https://associationarcanne.files.wordpress.com/2021/04/bdd-materiaux-courgey-oliva-2021-04.pdf Courgey-Oliva. (2021) data base.
21 https://cinumed.mmsh.univ-aix.fr/collection/item/97900-chapiteau-de-type-hasfide-galerie-du-dar-balma?offset=10 (accessed 18.07.2023).
22 http://zaherkammoun.com/2015/06/21/la-medina-de-tunis-premiere-partie/ (accessed 18.07.2023).
23 http://www.inp.tn/cnsa/ensemblemongal.php?idMon=564 (accessed 18.07.2023).
24 https://lapatrienews.dz/demolition-dune-mosquee-historique-a-oued-souf-malika-bendouda-ordonne-larret-immediat-de-loperation/ (accessed 18.07.2023).
25 https://el-oued.mta.gov.dz/fr/,direction des tourismes et de l'artisanat de la wilaya el oued (accessed 18.07.2023).
26 https://www.m-culture.gov.dz/index.php/ar/
27 https://www.khanacademy.org/humanities/art-islam/chronological-periods-islamic (accessed 16.02.2021).

28 https://www.france24.com/fr/20200816-covid-19-d%C3%A9but-du-d%C3%A9confinement-en-alg%C3%A9rie-r%C3%A9ouverture-des-caf%C3%A9s-plages-et-mosqu%C3%A9es (accessed 19.06.2021).

29 https://www.frstrategie.org/publications/notes/covid-19-distance-sociale-confinement-proximite-une-approche-sciences-sociales-2020 (accessed

30 https://www.radioalgerie.dz/news/fr/article/20210214/207219.html (accessed 6.19.2021).

31 http://www.habous.gov.ma/fr/architecture-des-mosqu%C3%A9es/244-architecture-des-mosqu%C3%A9es.html [WWW Document], (accessed 2.05.21).

32 https://www.aps.dz/algerie/108347-covid-19-dispositif-sur-l-ouverture-progressive-des-mosquees (accessed 6.19.21).

33 https://thelevantnews.com/2020/03/غلق-المساجد-يثير-جدلاً-كبيراً-وسط-الجز/ (accessed 18.07.2020).

Appendix 1 Chapter, section, sub-section, and article of the 2022 Interministerial order
(Source : Own elaboration with data from JORADP)

Number	Chapter title	Section	Section title	Sub section	Section title	Article
01	General provisions	/	/	/	/	From 01 to 02
02	Classification of mosques	/	/	/	/	Article 03
03	Urban integration	3-1	General guidelines	3.1.1	Urban planning of mosque needs	Article 04 and05
				3.1.2	Choice of site	Articles 06 to 09
		3.2	Specific guidelines	/	/	Articles 10 to 14
04	Urban planning rules	4.1	Direction of the Qibla	/	/	Article 15 and16
		4-2	The prayer room	4-2-1	Accessibility	Articles 17 to 21
				4.2.2	Shapes and dimensions	Article 22 and 23
				4.2.3	Structure	Articles 24 to 28
				4.2.4	The size and height of the prayer	Article 29 up to 31
				4.2.5	Ceiling and dome (El Qobba)	Articles 32 to 34
				4.2.6	Prayer room level and wall bases	Articles 35 and 36
				4.2.7	The Mihrab	Article 37
				4.2.8	The Minbar	Article 38
		4.3	Dependencies	4.3.1	The Maqsura	Article 39
				4.3.2	Room for the call to prayer (El Adhan)	Article 40
		4.4	Openings and facades	/	/	Articles 41 to 48
		4.5	Mosque decorations, inscriptions and tapestries	/	/	Articles 49 to 53
		4.6	Prayer room for women	/	/	Article 54 and 55
		4.7	The Minaret (SOUMÂA)	/	/	Articles 56 to 58
		4.8	Ablution room and storage shoes	4.8.1	Ablutions room	Articles 59 to 68
				4.8.2	Shoe storage	Article 69
		4.9	"Sahn" and outdoor spaces	4.9.1	"Sahn" of the mosque	Article 70
				4.9.2	Outdoor areas	Article 71
05	Technical standards	5. 1	Structure and materials	/	/	Articles 72 to 74
		5.2	Fire safety requirements	/	/	Article 75 up to 79
		5.3	Air conditioning and ventilation	/	/	Article 80
		5.4	Electricity	/	/	Article 81 and 82
		5.5	Remote monitoring system	/	/	Article 83 and 84
		5.6	Audio visual and IT	/	/	Article 85
		5.7	Sound system.	/	/	Article 86
06	Sustainable development	6.1	Renewable energies	6.1.1	Solar energy	Article 87Article 88 and 89
		6.2	Natural lighting	/	/	Article 90 and 91
		6.3	Local materials	/	/	Article 92 and 93
		6.4	Natural ventilation	/	/	Articles 94 and 95
		6.5	Water use and treatment	/	/	Article 96 and 97
		6.6	Green spaces	/		Article 98 and 99
07	Specific rules for mosque equipment			/	/	Article 100 up to 106
		7.1	Comfort standards	/	/	Article 107 up to 110
08	Miscellaneous provisions	/	/	/	/	Article 111 to 116

Appendix 2 Example of the Purchase Order

(Source: Ben khelifa ayoub)

Maitre de l'Ouvrage	direction des affaires et des wakfs El Oued		
Adresse	cité 19 mars El Oued		
NIF	3 9 0 0 1 9 0 0 0 5 0 5 5 0	Tel	032139453
E-MAIL	dareloued39@gmail.com	Fax	032139452

BON DE COMMANDE

MISSION DE CONTROLE TECHNIQUE (CTC) DE NORMALISATION DE RISQUE- MISSION M1

Intitulé du Projet	Mosquée El Hoda cité El Moussaba ouest			
Situation du Projet	Wilaya: El Oued	Commune: EL OUED	Lieu dit: cité El Moussaba ouest	
Maitre d'œuvre	Dénomination : BET BEN KHELIFA AYOUB Adresse : Cité El mossaba -commune d'El oued Email : ayoub.benkhelifa@gmail.com Tél : 0558115988 — Fax :		Avancement des études à la date du Bon de Commande	Esquisse ☐ Avant Projet ☐
Bureau d'Etudes Techniques	Dénomination : BET MESSOUDI ABDERAHIME Adresse : -commune DEBILA Email : Tél : 0699991266 — Fax :			Projet d'exécution ☒
Laboratoire Etudes de Sol (Géotechnique) :	Dénomination : LABORATOIRE D'INFRASTRUCTURE DE BASE ET BATIMENTS Adresse : siège social cité 400 logts el oued Email : Tél : 0661447644 — Fax :			

DESCRIPTION DES BATIMENTS et/ou OUVRAGES

Surface Totale du Terrain D'Assiette en M² : ____ Date prévisionnelle du début des travaux ____ Délais des Travaux en Mois : ____

Désignation du Bâtiment et/ou Ouvrage	Emprise du Bâtiment *et /ou Ouvrage* au Sol en m²	Nombre d'Etages du Bâtiment *et/ou Hauteur de l'ouvrage*	Nombre de Bâtiments *et/ou Ouvrages*
extenstion Salle de priére -Mosquée-	189.15	RDC H =9.70	01
école coranique + maitha	209.28	RDC+1 H =7.70	02
Minaret	13.47	H =20.10	03

Le Maitre d'ouvrage Date, Signature, Cachet et Griffe	Authentification par **le Maitre d'œuvre** Date, Signature et Cachet

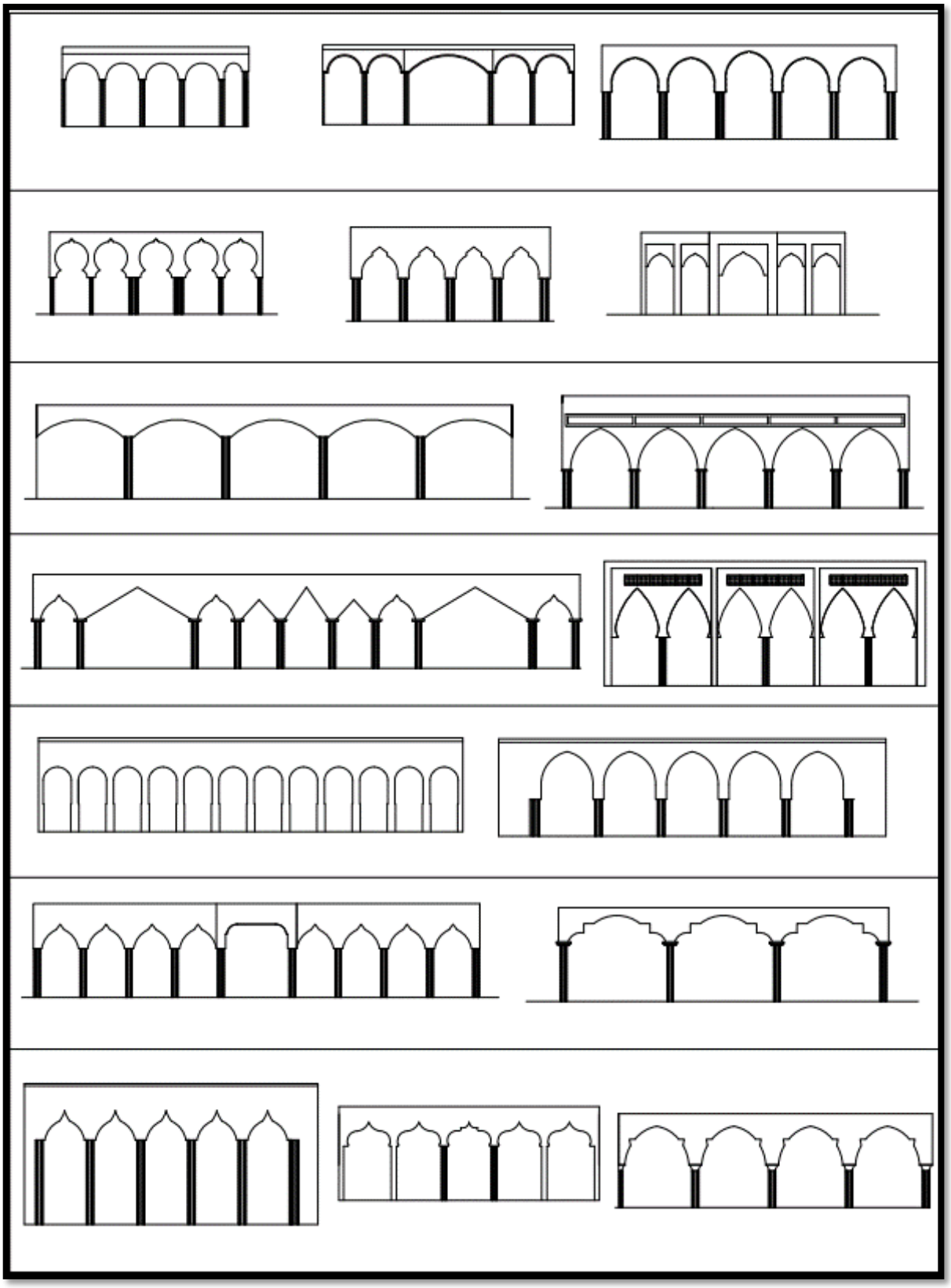
CADRE RESERVE AU CTC

Reçu le	Vérifié par	Décision du Directeur d'Agence	Visa Direction Régionale

Document de Référence N1-02 ; Révision 3 **Janvier 2018**

Appendix 3 Galleries present in in the field

(Source: author)



Appendix 4 Minarets identify in the field

(Source: author)