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The theme:

The effect of natural lighting in museums

The project:

Museum of History and arts –Biskra -

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Abstract:

In this work, we address the importance of natural light in the architectural space in general and in museums in particular. The goal is to design a regional museum that provides a suitable environment for viewing from a light standpoint. We also aim to support the cultural and tourism sector with a facility that transcends the country's territorial borders.

To achieve these goals, we relied on an introduction-based methodology, which is the topic, the research structure, and a theoretical chapter in which we discussed the most important concepts related to architectural lighting and museums, and an analytical chapter based on extracting the most important technical conditions and requirements that will be included in the design of the project. A practical chapter explaining the objectives of the project, followed by a reading of the simulation results and a detailed presentation of the design steps to conclude with a graphical presentation of the project after simulating the project. By following this structure, we were able to create a light environment suitable for display, which helped the museum to perform its tasks to the fullest, as the research work culminated in the completion of the Regional Museum of Art and History in Biskra, which is a museum that contains 3455 m with an attractive shape capable of changing the visitor's perspective. To this type of institution and more interested in culture and history.

Key Words : Natural Lighting , Museums , Simulation .

ملخص :

في هذا العمل نتناول أهمية الضوء الطبيعي في الفضاء المعماري بشكل عام وفي المتاحف بشكل خاص الهدف هو تصميم متحف إقليمي يوفر بيئة ملائمة للعرض من الناحية الضوئية , كما نهدف الى دعم القطاع الثقافي والسياحي بمنشأة تتعدى الحدود الإقليمية للبلاد . ولتحقيق هذه الأهداف اعتمدنا على منهجية قائمة على مقدمة وهي الموضوع وهيكل البحث وفصل نظري ناقشنا فيه أهم المفاهيم المتعلقة بالإضاءة المعمارية والمتاحف و فصل تحليلي يعتمد على استخراج أهم الشروط والمتطلبات الفنية التي سيتم تضمينها في تصميم المشروع ونتطرق فيه ايضا لمرحلة المحاكات التي تعتبر دعامة للبحث المنجز . وفصل تطبيقي يوضح أهداف المشروع تليه قراءة لنتائج المحاكات وعرض تفصيلي لخطوات التصميم ليختتم بعرض رسومي للمشروع بعد محاكاة المشروع. باتباع هذا الهيكل ، تمكنا من خلق بيئة ضوئية ملائمة للعرض ، مما ساعد المتحف على أداء مهامه على أكمل وجه ، حيث توج العمل البحثي بإتمام المتحف الإقليمي للفنون والتاريخ في بسكرة ، وهو هبة على متحف يحتوي 3455 متراً مربعاً مع شكل جذاب قادر على تغيير وجهة نظر الزائر الى هذا النوع من المؤسسات ومهتمين اكثر بالثقافة والتاريخ .

Dedication

May God prolong his life to whom He has given me all that he has until I fulfill His wishes, to Him who supervised my teaching by the sacrifices of my dear father's mighty.

I dedicate this work to the one that flooded me with all the love and tenderness, to which I had patience for everything and nurtured me the right of care and her pleas for success followed me step by step in my dear mother's work. God prolong her life.

To them I dedicate this humble work may perhaps bring something of happiness to my heart and to my brothers who were in all the details of my career and was a good help and support for me.

I also dedicate my best efforts to my teachers Mme. Ghanemi Faten, Badache Halima who guided me in this long way, and to all my loyal colleagues from near and far.

Thanks

Praise be to Allah for his kindness, his kindness and his gratitude.

After thanking God Almighty, I extend my thanks to the two generous parents who helped me and encouraged me to continue the march of science and research and success,

I would also like to express my thanks and appreciation to me, who has honored me by supervising my research notes, Mme Ghanemi Faten ,Badache Halima whose words are not enough to thank him for his great patience and scientific guidance which contributed greatly to the completion of this work and to all the professors of the Department of Architecture. And I especially mention Mm. Merzougui Wafia and Mme Mebarki Rym

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INTRODUCTIVE CHAPTER

Introduction:

Numerous studies have been done able to demonstrate the importance of natural light for the environment and the built environment. It is essential to our balance vital to our health, well-being and more, daylight is the primary source of energy and element of very important impact in our life. Daylight design in architecture is used to provide lighting to the interior and to exclude unwanted light from the room, since human beings established their shelters with a lighting opening; they have been continuously searching for better methods to obtain suitable natural lighting in the living which know today as luminous comfort. The luminous comfort has a big role in buildings specially the exhibition areas which are important part to museum, gallery

The principal factor in the lighting designs of museums and art galleries is the quality of light although, all objects of arts and sculptures need adequate light to display their color and appearance, the relative brightness of objects, contrast, and glare resulting from direct sunlight are the most important problems, now to design a building and get luminous comfort in space become much easier with this technology development (Simulation Tools) which give us the possibility to control the quantity of light entering the building very precise according to each region in this research, we will study the luminous comfort in museum in Biskra region.

1 Problematic:

- The culture is way of life specific to each group of individuals at given time, there are two directions in the translation of word 'culture' the first trend defines it as knowledge, science and the arts it learns, while the second trend defines civilization (Dr Aref N M-1994- 'Civilization & Culture') the culture is the most effective of increasing community awareness, knowledge.

The city is considered one of the most important spaces that contain and still contain most of the negative changes and development, which it result a heritage that we have to protect. to protect this heritage we need non-profit institutions which preserve it, some of these institution is museum which protect the heritage, expose, educate and associate new functions of expression and production of culture, this institution is based on three important requirements, which is the path, exhibition area, and the lighting. le Corbusier said (The Architecture is a perfect play with light and shapes.) all objects of arts and sculptures need adequate light to display their color and appearance, also the light is an important element as factor of interpretation of luminous comfort of users and visitors, this leads us to wonder how to achieve best luminous comfort in exhibition areas?

2 Hypotheses:

It seems like the dimension, position, and the orientation of slots has effect on the luminous comfort.

3 Objectives:

- The museum base on the good exhibition of objects , so we have to achieve it optimum luminous comfort in exposition areas.
- Some of the arts objects are sensible for the sun radiation or high glare so we have to combine between natural and artificial lighting to achieve luminous comfort.
- In Biskra region have a high sun radiation this result a risk of uncomfortable glare for the visitors so we have to control sun radiation or control the glare in general.

4 Methodology:

Design a perfect space for exhibition in Biskra region have a lot of problems according to lighting control or provide best lighting in museum in general, in this research we will study the luminous comfort in Exhibition areas of museum in Biskra region.

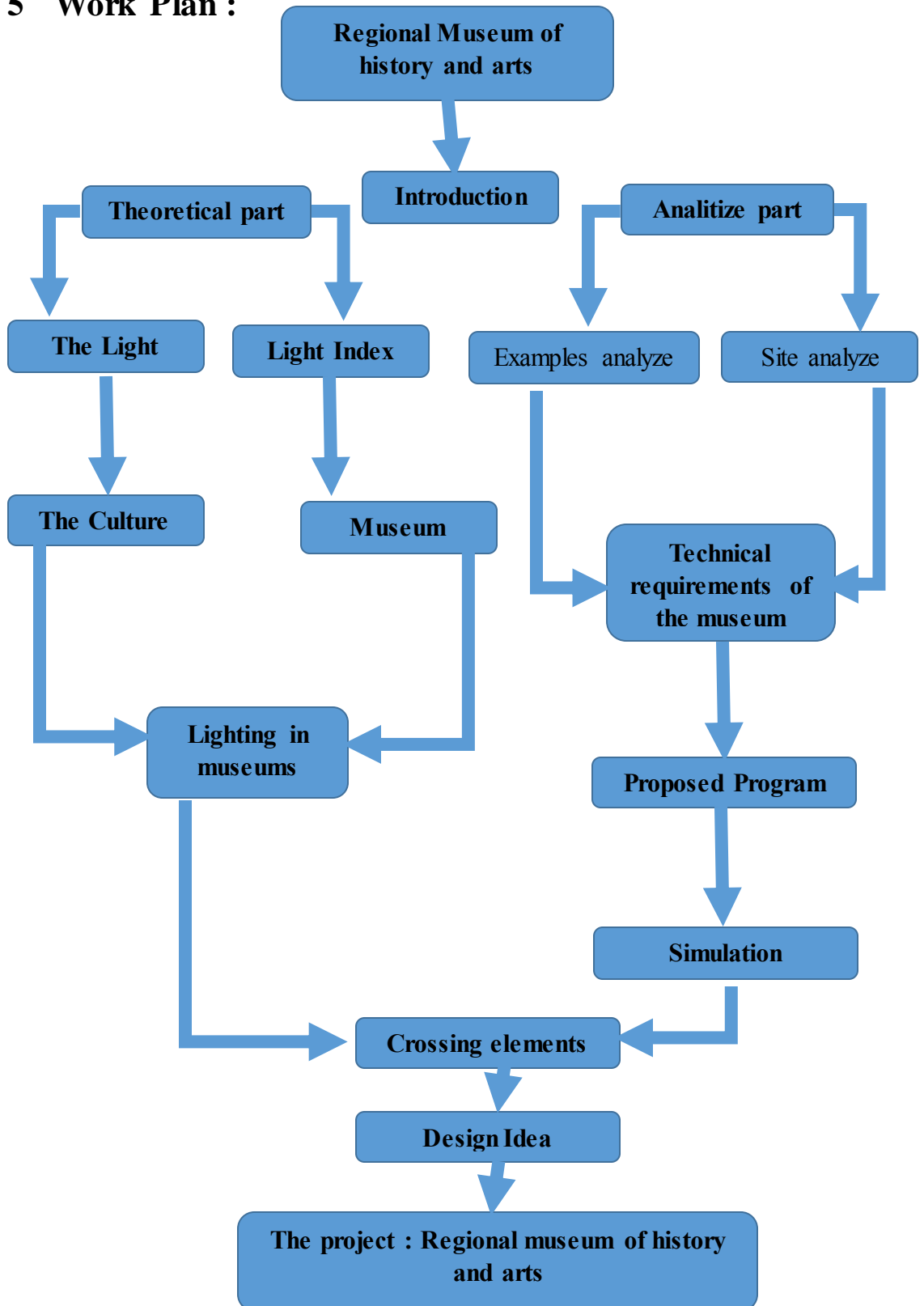
A- the luminous comfort index that we will study is

1-Luminance

2-Illumination

B-The method we use is simulation with DIALux simulation tool this software is for planning, calculation, and visualization of indoor lighting, the software makes professional lighting design easier and accessible everyone .

5 Work Plan :



CHAPTER ONE: THEORETICAL STUDY

Introduction:

Light is of paramount importance for the behaviors of living beings, including humans, on earth. The study of the effect of architecture by light came from the fact that people nowadays spend 90 percent of their time in closed areas, contributing to the emergence of illnesses, sick building syndromes. The work sheds light on how humans interact with light through various historical times, and how man treated whether and how much light penetrated the room in different ways, whether through windows or at points where walls touch each other, or finding side receptions to access the light from above. Or pull out parts of the building to allow light to penetrate through side windows inside. Through the roof, or the place where the wall touches the building's roof, light may be carried into the interior. The yard should also provide natural lighting for all rooms overlooking the building, all in keeping with the practical nature of the space and the psychological orientation of the space users. This chapter contains the necessary definitions of lighting and brief methods for calculating daylight are described for the first part, the second part considerations of daylight in museums and the control method and devise of luminous comfort in museums and exhibition areas.

1 The Luminous Comfort:

In European standard EN12665 (2011), light comfort is defined as a subjective condition of visual well-being induced by the visual environment. (Carlucci, Causone, and al. 2015 ;Castillaand al. 2014).

For his part, Narboni (2006) defined this concept as good vision conditions, with the absence of glare. (B-BERKOUK 2017)

2 Types of light:

There are two types of light the natural light and the artificial light we can define them as follows:

2.1 Natural Light:

Light is described as the part of the electromagnetic spectrum (380–780 nm) that gives rise to a visual sensation. Natural light is a term as simple as that. It is the collection of solar rays that can clearly render our universe. The sun as the main source, provides us with a significant amount of light during the day through the movement of the earth all around. (MUDRI. L, 2002)

2.2 Artificial Light:

In contrast to natural light artificial light refers to any light source produced by electrical means. Artificial lighting has many different applications and is used at home as well as in industry.

Synthesis : It should be an integration of both natural and artificial lighting to ensure optimal visual comfort (author 2020).

3 The Luminous Comfort:

«For Holl, architecture is the science of experience...Light is not itself the plenum of matter, but rather what reveals and conveys it, like water in the paper into which pigment is placed». (S. Holl, 2011)

3.1 The Luminous comfort parameters:

3.1.1 Illumination:

corresponds to a luminous flux received per unit area. the unit of illumination is lux. $I = dF/dS$, hence it is flux divided by the area over which the flux is distributed

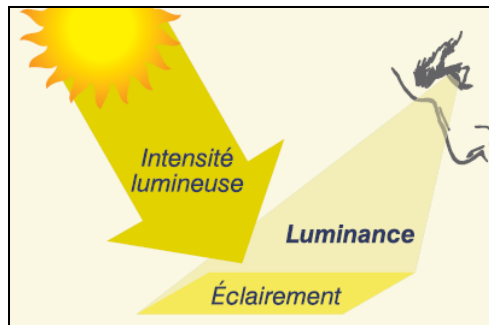


Figure1. 1 Representation of illuminance, luminance and intensity luminance, Source (Liébard and De Herde 2005(cited by B BARKOUK , 2017)

3.1.2 luminous intensity:

Is the flux emitted by a point source in a given direction. $I = d f/dw$, It is flux divided by the solid angle over which the flux is distributed. Us unit is the CANDIE (c) (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972)

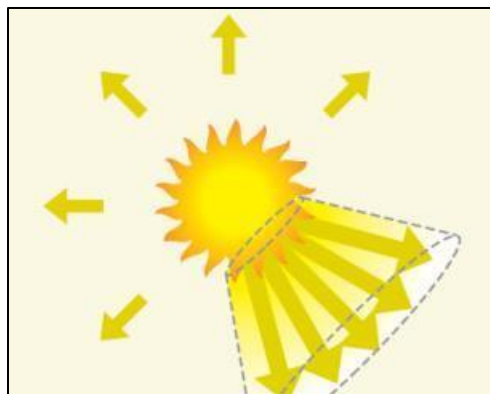


Figure1. 2 Representation of light intensity (Liébard and De Herde 2005 B.BARKOUK , 2017)

3.2 The Luminous Index:

3.2.1 Luminance:

Is the intensity of a source in a given direction, divided by the apparent area of that source in the same direction. The Cd / m² unit. $L = dI / dA \cos \alpha$. (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972)

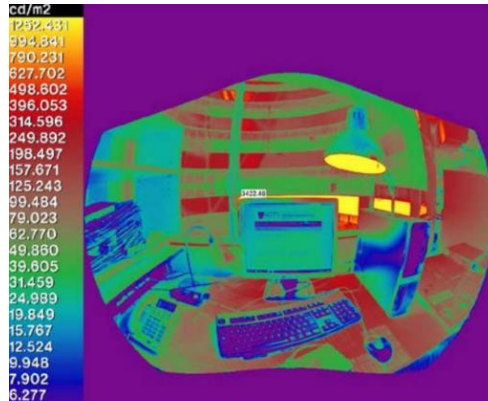


Figure1. 3Luminance mapping (Hirning, Lim and Reimann 2016 by B.BARKOUK 2017)

On the other hand, the luminance allows us to assess glare because it is a quantification tool for the impression acquired by the eyes of a resident who looks at a light source or a surface lit directly and in a certain direction.

3.2.2 Contrast:

One of the factors influencing visual performance. It is interpreted by the difference between two ranges or between the object and its background. It is essential for the performance of visual tasks, therefore for visual comfort. (D.BARKOUK , 2017)

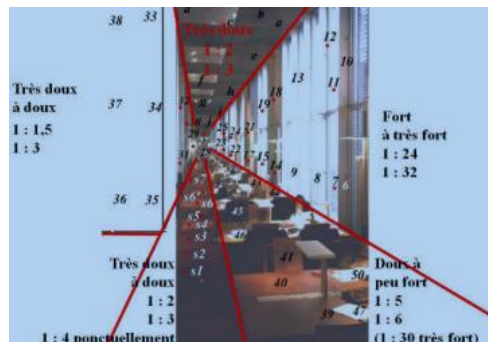


Figure1. 4 Contrast Scale (Salma S.2012)

3.2.3 Glare:

Glare is a well-known problem in built environments, especially in Saharan regions. Glare is a phenomenon bright which causes vision difficulties for the occupants of an environment bright due to overly bright artificial or natural lighting (Carlucci, Causone, and al. 2015 edited by D.BARKOUK).

3.2.3.1 Direct glare:

Where, the sun is in the immediate field of vision of the users .It is caused by the presence of an intense light source located in the same direction as the object viewed or in a nearby direction (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972).

3.2.3.2 Indirect glare:

It comes from a disruptive reflection of light sources on shiny surfaces, glare disability is due to excessive amounts of light reaching the eye and resulting in scattering of light inside the eye. A form of disability glare which is commonly found in buildings is due to the reflection of either artificial light or sky light, from the polished surfaces of furniture. Although the worker is often unconscious of this type of glare, the effect is detectable by errors or a slowing down of his performance. (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972).

Reflected glare: the presence of the mirror effect on the surface of the monitor. Most glare-related clues aim to assess uncomfortable feeling occupants .

Background glare: the presence of a contrast in brightness between the screen and monitor background .(D. BERKOUK , 2017)

4 Indices for evaluating the quantity of light:

The quantification of daylight and its distribution in environments interiors is the first step to properly design lighting and lighting systems carry out an energy-efficient control and also to assess consumption energy

4.1 Daylight factor (DF):

The DF is usually expressed as a percentage, so there is no consideration of absolute illuminance values ($DA = (E_{int} / E_{ext}) \times 100 \%$) knowing that these researchers used judgment scale as follows:

- FLJ <10: the optimal amount of light to superimpose;
- 5 <FLJ <10: good quality of natural light;
- 2 <FLJ <5: request for additional artificial lighting;
- FLJ <2: request for total artificial lighting.

(K .ROBERTSON,2010 , D E BAROUD, 2018)

5 Lateral lighting:

Lateral lighting characterized by the use of daytime outlets is associated, according to C. TERRIERAND B. VANDEYYVER edited by D E BAROUD, 2018)

It's one of the most used, especially in hospital spaces, for practical reasons but also because it allows the view to the outside, it is the oldest type of natural lighting historically.

5.1 Types of lateral lighting:

5.1.1 Unilateral lighting:

This is lighting provided by one or more vertical openings arranged on the same facade of a given orientation. This arrangement allows for relief effects and harmonies of contrasts. The disadvantage of this type of natural lighting system is the possibility of annoying shadows, due to lighters, especially if the walls of the room are dark. (D E .BAROUD 2018)

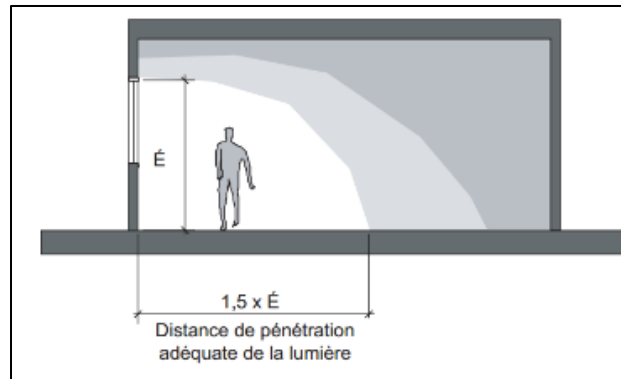


Figure1. 5 Approximate Penetration of Source Natural Light:
(ROBERTSON, 2003 D E BAROUD, 2018)

5.1.2 Bilateral lighting :

Bilateral lighting consists of having vertical openings on two walls, either parallel or perpendicular, from the same room. This solution remedies the major defect posed by unilateral lighting. Indeed, according to (A.ANDENPLAS), the depth of the rooms lit by a bilateral device can reach easily four times the distance between the ceiling and the use object. (D E BAROUD, 2018)

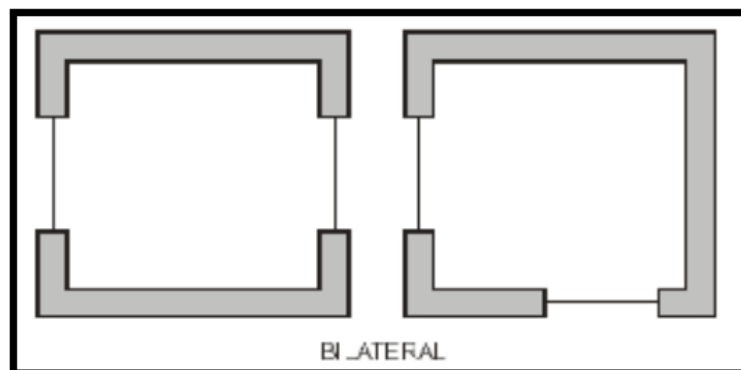


Figure1. 6 Source bilateral lighting devices (D. E BAROUD, 2018)

5.1.3 Multilateral lighting:

Multilateral lighting has many advantages, including:

-Promote natural cross ventilation of the rooms by doubling or tripling it and reduce dense shadows and increase the contrasts inside the rooms , also reduce the risk of dazzling the sky by increasing the illumination of the walls. But it has certain constraints, the most important of which is to increase the risks overheating in summer as well as heat loss in winter.

5.2 Slots zenith:

These are Slots, which capture the light of the sky, avoiding any entry of solar radiation. If the glazed part of the sheds is generally arranged towards the North; received as a significant solar radiation .



Figure1. 7 Source Zenithal lighting devices
(<https://www.tourismevalenciennes.fr/en/organize/activities-having-fun/heritage/musee-des-beaux-arts-539152>)

5.3 Type of Slots zenith:

5.3.1 Skylight

This type of slots have two opposite glass faces surmounted by an opaque roof. (2018, Licht)

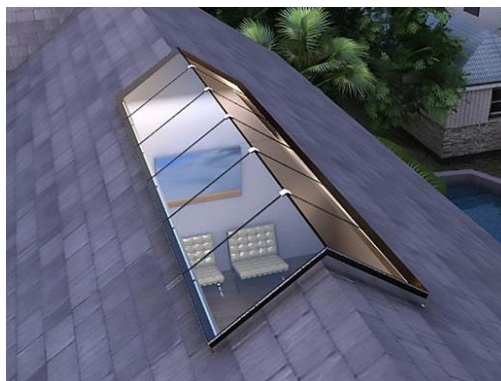


Figure1. 8 Skylight slot
(Pinterest 2020)

5.3.2 The Shed :

It is a saw tooth unit, often treated to depict part of the light rays, with alternating glazed and opaque surfaces. (2018, Licht)

5.3.3 Light spots :

This form of overhead opening is known as a light source for points . (2018;Licht)

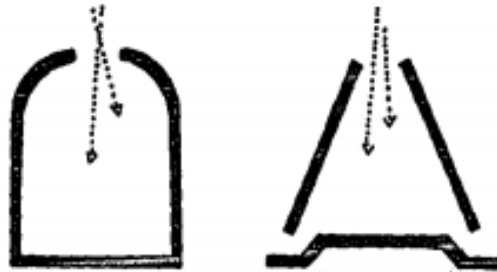


Figure1. 9 Light Spots Device (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972

5.4 Definition of culture:

According to the Microsoft encyclopedia: «Beliefs, language behavior and lifestyle specific to each group of individuals at a given time, culture includes customs, ceremonies, works of art, invention and technology. “

6 Presentation of Museum:

In this part we will definition museum from the following points :

6.1 Museology:

6.1.1 According to Georges Henri Rivère1:

An applied science, the science of the museum. It studies the history and role in society, specific

forms of research and conservation, physical presentation, animation and dissemination, organization and operation, new or musical architecture, sites received or chosen, the typology, the deontology

6.2 Museography:

The term museography first appeared in the 18th century and is older than the word museology. It has three specific meanings:

Currently museography is essentially defined as the practical or applied aspect of museology, that is to say the techniques which have been developed to fulfill museum operations, in particular with regard to the planning and fitting out of the museum premises, conservation, restoration, security and exhibition.

In French the use of the term museography identifies the art (or the techniques) of exhibitions. For some years the term expography (exhibit design) has been proposed for the techniques involved in exhibitions, whether they be in a museum or in a non-museum space.

Formerly and through its etymology, museography referred to the description of the contents of a museum. Just as a bibliography is one of the fundamental stages of scientific research, museography was devised as a way to facilitate the search for documentary sources of objects in order to develop their systematic study. (Mairesse, 2011)

6.3 Definition of Museum:

The word ‘museum’ comes from the Greek Mouseion, meaning a place for the Museum a place of study and or a library.

Until only recently this has been a fitting description of the shape and form of museums generally. That is, until perhaps the latter half of the twentieth century museums were open only to an elite, either by literally restricting access, or later, by making museums such imposing edifices that the general population .

7 The roles of museum:

Museums are responsible for the missions as follows:

Preserving, maintaining, researching and enriching their collections; acquiring material cultural property; participating in work relating to their field; making their collections accessible to the public by any means; gathering data relating to their purpose; and disseminating knowledge relating to their purpose; conducting animation programs (conferences , exhibitions);

Contribute to the advancement and dissemination of information and science related
 Reviewing collections and guiding research related to their objectives; organizing and engaging in national and international scientific seminars; exchanging museum collections among national and/or foreign museums;

(Article 9--- Source: Direction Of Culture)

8 Classification Of Museums

8.1 The concept of opening and closing

Open Type	Closed Type
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<p>Museum in which the glass walls play a main role . (Public Space Design in Museums 1982)</p>	<p>It is characterized by an opaque joint, this type of design focuses attention on the object it is characterized by an opaque joint, this type of design focuses attention on the object. (Public Space Design in Museums 1982)</p>
<div data-bbox="278 391 681 659" data-label="Image"> </div> <p data-bbox="312 673 638 784">Figure1. 10Norval Foundation Museum(arhidaily.com)</p> <div data-bbox="281 963 666 1221" data-label="Image"> </div> <p data-bbox="312 1233 638 1344">Figure1. 11Norval Foundation Museum(arhidaily.com)</p>	<div data-bbox="813 395 1223 663" data-label="Image"> </div> <p data-bbox="845 673 1177 784">Figure1. 12Guggenheim Museum, Bilbao (Arhidaily.com)</p> <div data-bbox="807 963 1194 1221" data-label="Image"> </div> <p data-bbox="845 1233 1177 1344">Figure1. 13Guggenheim Museum, Bilbao (Arhidaily.com)</p>

Table1. 1Concept of opening and closing (Author 2020)

Linear type	Type circular	Types labyrinth
<p>This principle works according to the idea of a main axis of circulation with additional sectors, the accesses can be made in the axis or on the sides. (Public</p>	<p>It is organized around a central space that becomes a space of transition between the deferent exhibition spaces. (Public Space</p>	<p>A series of different spaces, although linked to each other, imposes no constraints of circulation. (Public Space Design in Museums 1982)</p>




Space Design in Museums 1982)	Design in Museums 1982)	
		
Figure1. 14 (Archidaily.com)	Figure1. 15 Guggenheim Museum (Archidaily.com)	Figure1. 16 Labyrinth type

Table1. 2Concept of Path type (Author 2020)

8.2 The type of Exhibition :

8.2.1 General museum -the castle-museums

Museum that groups together (includes) several departments that each have a different theme (science, art, culture, history, ...)

General museum The castle- museums	natural history museums	The painting museums	The automobile museums
Museum that groups together (includes) several departments that each have a different theme (science, art, culture, history, ...) (zahdi, 1988)	Natural history museums contain collections of living or naturalized beings. (zahdi, 1988)	Paintings are the most common works that one can admire in a museum. (zahdi, 1988)	The Automobile Museum of Mulhouse (in the Haut-Rhin) is the largest of the museums devoted to the automobile, but also the third museum in France, all museums confused (zahdi, 1988)

Table1. 3Concept of Exhibition type (Author 2020)

The Art and crafts museum	The design museums	Scientific and technical museums.	Ethnographic museums
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<p>There are many sculptures in art museums. They can be works of Antiquity or history posterior of a country or a region of the world. (zahdi, 1988)</p>	<p>Some museums specialize in the decorative arts. For example, in Germany, the Vitra Design Museum is one of the main design museums in the world. (zahdi, 1988)</p> <p>It offers a vast panorama of industrial creation of designer furniture. (zahdi, 1988)</p>	<p>Science museums offer programs interactive around knowledge. explained by a series interactive experiences</p>	<p>Museum with subcategories by geographical origin, by object type preserved (museums of arts and popular traditions, eco-museums which constitute collections of habitats, missing or disappearing activities or lifestyles)... (Public Space Design in Museums 1982)</p>
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Table1. 4Concept of Exhibition type (Author 2020)

9 The Requirements of Museum:

9.1 The Path:

Must be considered as the path that follows the visitor to visit the exhibition , there are often two categories of path: Partial and Full.

Partial Path	Full Path
<p>In this type of route, visitors are given the choice of visiting either the entire exhibition or just a part. It is applied in the string and labyrinth type</p>	<p>By consisted in this kind of course, the visitor is not free because he will be sentenced visited all collections, which are exposed.</p>



Figure 1.
17Presentation of
partial path
(Style park 2020)



Figure1. 18Orsay Museum
(Archidaily.com)

Table1. 5The Path Requirements (Author 2020)

9.1.1 Presentation of the types of lights:

Natural light enters the buildings, through openings, which give rise to typologies, as well as zenithal or lateral lighting.

Zenithal Slots	Lateral Slots
<p>These are Slots, which capture the light of the sky, avoiding any entry of solar radiation. If the glazed part of the sheds is generally arranged towards the North; the Lanterns and the Canopy receive them, a significant solar radiation. (standard NBR 15215-2)</p>	<p>These kind of openings give life to the buildings, and allow, a relation with the outside, they are often source of reflections for the objects presented, under a glazed protection. (standard NBR 15215-2)</p>

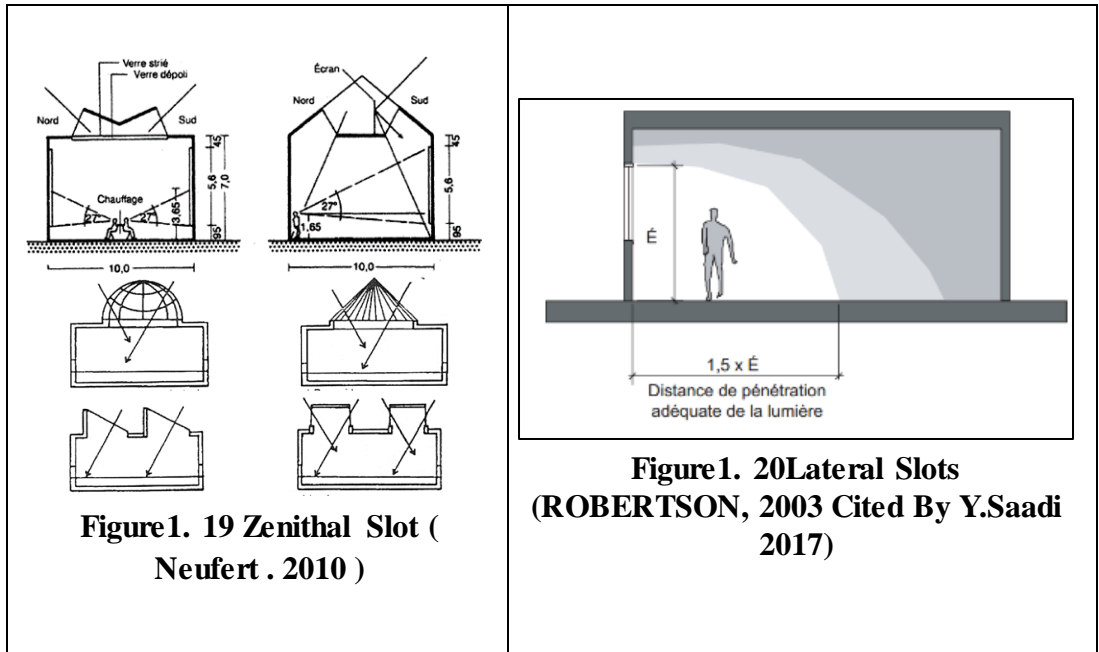


Figure1. 19 Zenithal Slot (Neufert . 2010)

Figure1. 20Lateral Slots (ROBERTSON, 2003 Cited By Y.Saadi 2017)

Table1. 6type of light (Author 2020)

10 Exposition areas:

The museum is a machine for the preservation and display of works of art. Le Corbusier , as Le Corbusier said the exhibition areas is one of the bases of museums

10.1 Type of exhibition areas:

There are two type of exhibition (Permanent/Temporary)



Permanent Exhibition	Temporary Exhibition
<p>It is based on three main points: - Harmony - Balance (organization of the order) - Unity (symbolic value of the exhibits) .</p>	<p>In the modern period the exhibition halls and museums give importance to the temporary display so as to make the dynamic of the frequency on the hall .</p>
 <p>Figure1. 21 permanent exhibition (Archdaily.com)</p>	 <p>Figure1. 22 Temporary exhibition (Archdaily)</p>

Table1. 7Exhibition Requirements (Author 2020)



Width in one space	Outdoor Exhibition
<p>A modern trend in the formation of large spaces by dividing them by the separate is one of the possibilities of this type to achieve simplicity, efficiency and flexibility with the possibility of diversity in use, as well as maintaining the purity of the overall shape even if it needs to be divided into different spaces in size. (Museum design)</p>	<p>The first outdoor show was in 1881 and it depends on the surrounding conditions of buildings, trees and flats waters, and sometimes the sky in the background composition of the exhibits and in this system connects the inside out completely without any breaks physical or visual. In addition, it takes more care to coordinate the surrounding location, innovation, innovation and simplicity .(Museum design)</p>
 <p data-bbox="347 1030 666 1141">Figure1. 23Museum of Veterinary Medicine- Zurich (Archdaily)</p>	 <p data-bbox="806 1020 1107 1090">Figure1. 24 Etihad M (Archdaily.com)</p>

Table1. 8The Exhibition Requirements (Author 2020)

10.2 Lighting in Exposition areas:

Use both of artificial and natural light to :

10.2.1 Lighting objects:

Directional	Supplementary Directional	Solely directional
Directional lighting for the wall, diffuse lighting for the room (Licht, 2018)	Supplementary directional lighting for objects in the room. (Licht, 2018)	Indirect and direct components produce diffuse and directional lighting respectively (Licht, 2018)

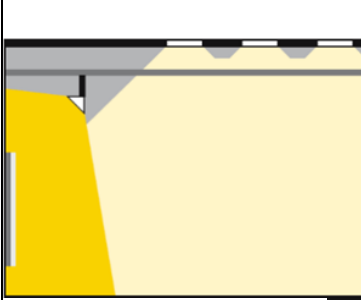
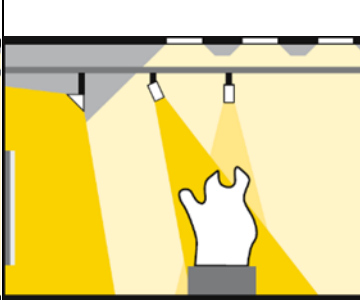
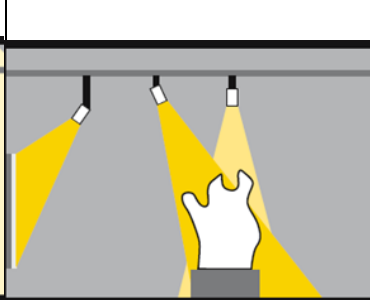
		
<p>Figure1. 25 Directional Lighting (Licht.2018)</p>	<p>Figure1. 26 Supplementary Directional (Licht.2018)</p>	<p>Figure1. 27 Solely Directional (Licht.2018)</p>

Table1. 9Object Lighting in museum (Author 2020)

11 Lighting in the Museum:

Transmitting and conserving light makes cultural objects visible.

Light scenarios to guide the Visitor.

Wall lighting for harmonious atmosphere

Model sculptures by shadow and light.

12 Natural lighting in museums:

The principle factor in the lighting designs of museums and art galleries is the quality of light, Although, all objects of arts and sculptures need adequate light to display their color and appearance ,the relative brightness of objects, contrast, and glare resulting from direct sunlight are the most important problems, As ultra violet light tends to deteriorate most items on display in museums and art galleries, it would seem important to work with low illumination levels and to make certain that these are maintained for the short time intervals, It also suggests that all natural light sources should be capable of being obscured so that daylighting can be moderated when it becomes excessive and if necessary totally excluded .

It is difficult to give a "safe" level of illumination for sensitive materials because any light may cause some deterioration, To some extent the limit imposed on the illumination level must be arbitrary and dependent on the object being illuminated ,

- In French maximum illumination of 50 lumens per sq.ft, is prescribed for the artificial lighting of oil paintings.

30 lumens per sq.ft, for pastels, water colors and other critical materials.

-In the Natural Gallery, London, and in recent galleries in Portugal and Australia, the illumination on pictures is restricted to 15 lumens per sq.ft.

-The quality of light obtained from north-facing openings has long been considered as the best, however other factors may make it impossible to obtain light with "north" light qualities. (DAYLIGHTING IN ARCHITECTURAL DESIGN 1972)

12.1 Presentation of the types of lights:

Natural light enters the buildings, through openings, which give rise to typologies, as well as zenithal or lateral lighting.

12.2 1Zenithal Slots:

It is Slots on the roof allowing the penetration of light vertically.

Skylight	The Shed
<p>This type of opening has two opposite glass faces surmounted by an opaque roof. (Licht, 2018)</p>	<p>It is a saw tooth device, with alternating glazed and opaque surfaces, they are often treated to reflect part of the light rays . (Licht, 2018)</p>
<div data-bbox="204 689 705 919" data-label="Image"> <p>An architectural rendering of a museum interior. The space is bright and open, with a large skylight on the ceiling that allows natural light to enter. The walls are white, and there are various exhibits and art pieces displayed.</p> </div> <p data-bbox="249 935 621 1008">Figure1. 28J . Museum Al . (Archdaily.com)</p>	<div data-bbox="789 685 1178 911" data-label="Image"> <p>A photograph of a museum roof featuring a 'shed' lighting device. The roof is composed of a series of white, saw-tooth shaped panels that alternate between being glazed and opaque, designed to reflect and direct light into the building.</p> </div> <p data-bbox="828 947 1136 1056">Figure1. 29 Museum Lighting Shed device . (Archdaily.com)</p>
Light spot	
<p>this type of overhead opening, is considered a point source of light. (Licht, 2018)</p>	<div data-bbox="800 1205 1240 1475" data-label="Image"> <p>A photograph of a museum interior showing a circular light spot on the ceiling. The light is focused on a specific area, creating a bright spot on the floor and casting soft shadows on the surrounding walls.</p> </div> <p data-bbox="828 1487 1206 1560">Figure1. 30J . Museum Al . (Archdaily.com)</p>

Table1. 10 Object Zenithal device (Author 2020)

12.3 Lateral lighting :

12.3.1.1 Contain two types.



Direct Lighting	Reflected Lighting
<p>Lighting is a basic vehicle in design, if light the sun refreshes and energizes the spaces .(Licht, 2018)</p>	<p>This type of illumination allows for viewing and preservation conditions, allowing for versatility in the space within the field and thus the breadth and vitality .(Licht, 2018)</p>
 <p>Figure1. 31 Presentation of direct lighting (Archdaily.com)</p>	 <p>Figure1. 32 26 Presentation of reflected lighting (Archdaily.com)</p>

Table1. 11 Lateral device (Author 2020)

12.3.2 Artificial lighting in museums :
Artificial lighting must be:

- Properly position of the lighting sources.
- Reduce the visitor's drop shadow.
- Avoid reflective glare.
- Highlight walls and works.
- Enlighten boxes without dazzling .

We can summarize the difference between of natural and artificial lighting in the following points .

12.3.3 Difference between natural lighting and artificial lighting :

DAY-LIGHTING	ARTIFICIAL LIGHTING
Superior color rendition	Light is based on a single color
Continuous spectral curve	Intermittent spectral curve
Lively natural environment	Can be manipulated as per need
U-V radiation corrodes sensitive objects displayed	It is non-corrosive
It is a planning constraint	Freedom in planning

Table1. 12 natural and artificial lighting Source: (Licht, 2018)

Conclusion:

After we touched on two important elements in the museums architecture, the Lighting and design typologies and explained the importance of each of them to meet the appropriate internal requirements of the museum and to reach the best result .

Since the museum is a museum of History and Arts the most important thing in the exhibition will be entirely related to Culture even the exhibition methods everything inside the museum is related to Arts and culture.

After discussing the subject of Lighting and museum design in detail, we have to understand the project in which we will apply these two elements. By understanding all the characteristics and requirements of technical and functional and architectural of the museum and this in order to increase the effectiveness of the museum's internal and external role and reach the desired goals and this is what we will discuss In the next chapter to study everything related to the museum and to know the most important elements in its design.

**CHAPTER TWO- ANALYTIQUE
CHAPTER**

Introduction :

Every project or value building must have a tangible physical and spirit structure, or a message to be delivered through it. Throughout this chapter, we will address the project of the Regional Museum of History and Arts by listing all the information that indicate both material and moral, Factors that strongly interfere with the design and construction of this building also explain and clarify the message that informs it to the fullest extent that the museum's assets and the most important linked areas have been discussed . We talked about the most important definitions that addressed the museum linguistically and conventionally, then we tried to learn about the technical aspects of the museum, which directly interfere with the smooth functioning of the functions and the welfare of users and the protection of holdings, as we presented a summary of the most important examples of examples analyzed. This chapter represents the most important stage in the architectural project design. Everything we have discussed is a cornerstone and a general item for achieving the museum's ideal design, which is planned to meet the full needs of tourists, staff and collectibles, and to serve all the necessary functions of the cultural and scientific community, as well as being the emblem and monument of the Biskra region.

1 Analysis of examples:

The analysis tables have been developed according to a method which depends on the classification the most compatible examples in relation to the conditions related to the museum according to international standards and Neufert and the analytical study.

An analysis according to the INSE approach which contains two levels of analysis are:

- ✓ The external level which study the urban integration. Accessibility. Circulation and mechanical and pedestrian flow and volumetric as well as facades
- ✓ The interior levels which study the spatial and functional organization. Horizontal and vertical circulation and project structure

We analyzed four museums projects but the comparison is made according to the two best projects which are the most appropriate with technical requirements (Alkam & Dali, 1989).

1.1 Reasons of choosing :

- The studied projects have the same characteristics of the studied case in terms of climate and the nature of the ground .
- Different shapes give us several ways to deal with natural lighting .
- The combination between the artificial and natural lighting in this project .
- Each of the selected projects has unique design characteristics in terms of the path and proposed program .

2 Technical cards:

Maxxi Zaha Hadid		
 <p>Figure2. 1 Maxxi museum (archidaily.com)</p>	Location	Rome, Flaminio, Italy
	Project Year	2009
	period
	Architects	Zaha Hadid
	Area	27000.0 m ²

Table2. 1 technical card of romanite museum-Source: Author 2020


The Mimesis Art Museum		
 <p>Figure2. 2 Mimesis art museum (archidaily.com)</p>	Location	Paju-si South Korea
	Project Year	2009
	period	from 2006 to 2009
	Architect in Charge	Alvaro siza
	Architect	Alvaro siza
	Area	8500.0 m ²

Table2. 2 The Mimesis Art Museum Source: Author 2020


Louvre Abu Dhabi		
 <p>Figure2. 3 Louver Abu Dhabi (archidaily.com)</p>	Location	Saadiyat Cultural District, Abu Dhabi, United Arabe Emirats
	Project Year	2017
	period	from 2013 to 2017
	Architect in Charge	Jean Nouvel
	Architects	Ateliers Jean Nouvel
	Area	97000.0 m ²

Table2. 3 technical card of Louvre Abu Dhabi-Source: Author 2020


ETIHAD MUSEUM		
 <p>Figure2. 4 Etihad museum (archidaily.com)</p>	Location	Dubai - United Arab Emirates
	Project Year	2016
	period	from 2014 to 2018
	Architects	Moriyama & Teshima
	Area	25000.0 m ²

Table2. 4 technical card of Etihad museum-Source: Author 2020


Mama Museum		
 <p>Figure2. 5 Mama Museum (Author 2020)</p>	Location	Alger. Algeria
	Project Year
	Client
	Architects
	Area	2500.0 m2

Table2. 5 technical card Mama Museum-Source: Author 2020







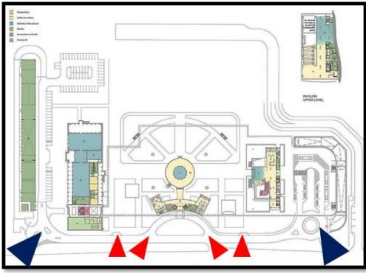


El modjahid Museum		
 <p>Figure2. 6 El modjahid Museum (Author 2020)</p>	Location	Biskra . Algeria
	Project Year
	Client	Biskra
	Architects
	Area m2

Table2. 6 El modjahid Museum-Source: Author 2020

Synopsis Analysis of project examples:

	Maxxi Museum	ETIHAD MUSEUM	synthesis
1-Urban integration	 <p>Figure2. 7 adjacent parcels (Author 2020)</p> <p>-the project is obedience compared to adjacent roads Matching</p> <p>-the project is disobedience compared to the form of adjacent parcels</p>	 <p>Figure2. 8 adjacent parcels (Author 2020)</p> <p>-Note that the project is Adjacent to the town</p>	<p>The museum site must be well located.</p> <p>The integration of museums in their environment is done by integrating or contrasting for the master in value.</p>
	Maxxi Museum	Mimesis Museum	
2- accessibility	 <p>Figure2. 9 type of adjacent roads (Author 2020)</p> <p>-From the city to the project the accessibility is directly and easy</p>	 <p>Figure2. 10 type of adjacent roads (Author 2020)</p> <p>-From the city to the project the accessibility is directly and easy</p>	<p>Good accessibility facilitated the identification of the museum.</p> <p>Diversity of roads leading to the project</p>
	Louvre Abu Dhabi	ETIHAD MUSEUM	

3- The entrances to the area	 <p>Figure2. 11 main entrances (Author 2020) -the operating mode of the ground entrances was separation</p>	 <p>Figure2. 12 type of entrances (Author 2020) -the operating mode of the ground entrances was separation</p>	<p>The diversity and the separation of the entrances (staff, visitor) Facilitate access to the museum and keep order.</p>
	Table2. 7 synthesis of examples analyses (Author 2020)		

	Maxxi Museum	ETIHAD MUSEUM	synthesis
4- the flow	 <p>Figure2. 13 type of the flow (Author 2020) -There is an intersection between the mechanical path and the Pedestrian path</p>	 <p>Figure2. 14 type and direction of the flow (Author 2020) -There is High mechanical flow rate in the area coming from two axes</p>	<p>-The intersection between mechanical and pedestrian flow is acceptable</p> <p>-The flow ratio should be high in the area</p>
	Maxxi Museum	ETIHAD MUSEUM	synthesis


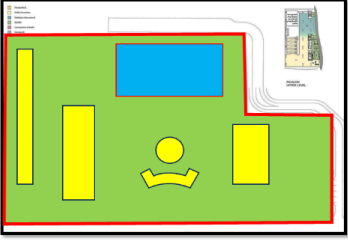






5- built and not built	 <p>Figure2. 15 built and no built (Author 2020)</p> <p>The built up area is estimated at 80% of the total area of the project land</p>	 <p>Figure2. 16 occupation of the ground (Author 2020)</p> <p>The built up area is estimated at 25% of the total area of the project land</p>	<p>Prefaces of the project must be landscaping The building Positioning must located after in-depth study</p>
	Maxxi Museum	Louvre Abu Dhabi	synthesis
6-The volumetry	 <p>Figure2. 17 project composition (Author 2020)</p> <p>The composition of the project is a simple form and a complicated form following</p> <p>The Linear axis principale</p> <p>The design process began by superimposing the two intersecting urban grids onto the site, creating a linear framework.</p>	 <p>Figure2. 18 composition principale (Author 2020)</p> <p>Dome: main(bulk) volume Concrete building : secondary volume Complex volume + dome The Linear axis principale</p>	<p>-The complicated form of the project a special look</p> <p>-the form of the museum must be special</p>

Table2. 8 synthesis of examples analyses (Author 2020)

	Memesis Museum	Maxxi Museum	synthesis
1-Rhythm	 <p>Figure2. 19 facades components (archdaily.com)</p> <ul style="list-style-type: none"> -All facades of the project are fully homogeneous in their components (glass) 	 <p>Figure2. 20 facades rythme (archdaily.com)</p> <ul style="list-style-type: none"> -All the facades of the project are characterized by full homogeneity in its components 	<p>the rhythm of the facade makes the project more attractive</p>
	Louvre Abu Dhabi	Maxxi Museum	synthesis
2-The Empty and filled	 <p>Figure2. 21 the empty and the filled (archdaily.com)</p> <ul style="list-style-type: none"> -The percentage of empty walls does not exceed 10% Proportionality in color and characterized by gradation -The color used is gray and white and there is homogeneity in the colors -The texture is smooth 	 <p>Figure2. 22 the outer envelope (archdaily.com)</p> <ul style="list-style-type: none"> -The envelope makes the empty and filled reading difficult -The color used is gray and white and there is homogeneity in the colors -The texture is smooth 	<ul style="list-style-type: none"> -The empty and the filled is up to the exterior nature and the interior function <p>In the museum we need to control the natural light</p> <p>It interpreted the identity and the museum container.</p>
	Louvre Abu Dhabi	Maxxi Museum	synthesis



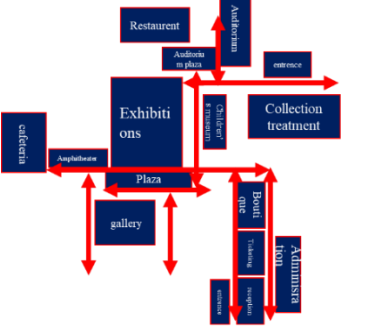
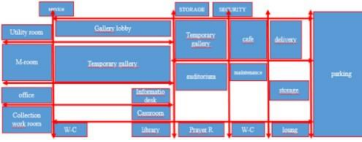
3-The entrances	 <p>Figure2. 23 the outer envelope (archdaily.com)</p> <p>louvre entrance Source: archdaily.com</p> <p>-there is no volumetric fit of the entrances with the facades</p> <p>-The main entrance is characterized by the presence of pergola</p>	 <p>Figure2. 24 Maxxi museum (archdaily.com)</p> <p>-Note that there is volumetric fit of the entrances with the facades</p> <p>-All entrances are marked behind the cover</p>	<p>The main entrance must be clearly attractive</p>
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Table2. 9 synthesis of examples Facades analyses (Author 2020)

	Louvre Abu Dhabi	ETIHAD MUSEUM	synthesis
1-Spatial organization	 <p>Figure2. 25 Louvre spatial organization(Author 2020)</p> <p>-all spaces are positioned linearly</p> <p>-Organized linearly and knotty</p>	 <p>Figure2. 26 Etihad spatial organization (Author 2020)</p> <p>-all spaces are positioned linearly-<u>Organized linearly</u></p>	<p>The separation of the three main zones:</p> <p>Exhibition, service, public.</p> <p>Consider flexibility and continuity between exhibition spaces.</p>
	Louvre Abu Dhabi	ETIHAD MUSEUM	synthesis


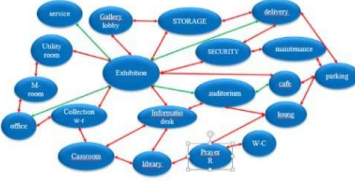
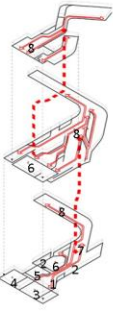

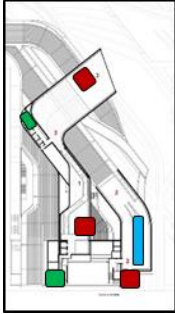



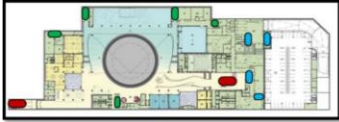


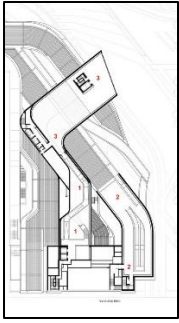



<p style="writing-mode: vertical-rl; transform: rotate(180deg);">2-Functional organization</p>	 <p>Figure2. 27 Louvre functional organization Source: researcher 2019</p> <p>↔ Strong relation ↔ weak relation</p>	 <p>Figure2. 28 Etihad functional organization Source: researcher 2019</p> <p>↔ Strong relation ↔ weak relation</p>	<p>-The storage and the exhibitions strong</p> <p>the galleries and the auditorium weak</p> <p>the galleries and the security strong</p>
	<p>Maxxi Museum</p>	<p>Louvre Abu Dhabi</p>	<p>synthesis</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">3-horizontal movement</p>	 <p>Figure2. 29 circulation Source: Author 2020</p> <p>There is two types of circulation vertical and horizontal</p>	 <p>Figure2. 30 h circulation Source: Author 2020</p> <p>— VIP circulation — visitors circulation — Worker circulation</p>	<p>the visitors must be separated from the others circulation</p> <p>Collections circulation and the workers can be crossed</p>

Table2. 10 synthesis of examples Internal study analyses (Author 2020)

	Maxxi Museum	ETIHAD MUSEUM	synthesis
1-vertical movement	 <p>Figure2. 31 Louvre spatial organization Source: Author 2020</p> <p>  collections circulation  visitors circulation  Worker circulation </p> <p>-The vertical movement is homogeneous in the Project</p>	 <p>Figure2. 32 Etihad spatial organization Source: Author 2020</p> <p>-the multiplicity of vertical movement zones and methods (stairs, elevator , ramp)</p> <p>-Separation in the spaces of vertical circulation</p>	<p>synthesis</p> <p>-The simplify of the vertical movement for all the categories</p> <p>-All the methods of the vertical movement must be use</p>
2-Structural System	 <p>Figure2. 33 concrete walls Source: archdaily.com</p> <p>The structural system of the building generally depends on the bearing walls of the special reinforced concrete with a Metal construction roof</p>	 <p>Figure2. 34 concrete structure Source: archdaily.com</p> <p>The structural system of the building generally depends on the bearing walls of the special reinforced concrete</p>	<p>synthesis</p> <p>The use of the bearing system aims to create large spaces for the exhibition spaces</p>
	Maxxi Museum	Louvre Abu Dhabi	synthesis

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">3-Functional unit Construction Unit</p>	 <p>Figure2. 35 structure system Source: archdaily.com</p> <p>There is two types of circulation vertical and horizontal</p>	 <p>Figure2. 36 structure system Source: archdaily.com</p> <p>one functional unite(exhibition)=one structural unite</p>	<p>It is preferable that the exhibition spaces have no structural obstacles</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">4- Natural Lighting</p>	 <p>Figure2. 37 Natural Lighting L.Abu D (Archdaily.com)</p> <p>Eight layers help to reflect sunlight and introduce enough amount to the space .</p> <p>The Louvre Abu Dhabi benefits from natural lighting: both lateral and zenithal.</p>	 <p>Figure2. 38 Natural lighting MAXXI (Archdaily)</p> <p>The special lighting design is truly one if not the most impressive feature about the building , the mixed linear and curvaceous glass roof selling offers natural light in most spaces</p>	<p>The good quality of lighting enhances even more the exposed art objects.</p> <p>using zenithal lighting is the best method for the upper floors lighting .</p>



5- Artificial Lighting	 <p>Figure2. 39 Artificial lighting Etihad Museum (Archdaily.com) using structure as an industrial lighting platform</p>	 <p>Figure2. 40 Artificial lighting Maxxi Museum (Archdaily.com) Using stairs as a support for the artificial lighting .</p>	<p>The combination of the two types of natural and artificial lighting is done according to the nature of space and the quality of the objects of art.</p>
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Table2. 11synthesis of examples Internal study analyses (Author 2020)

3 Day Light Analyze of Memesis Museum:

3.1 Simulation

3.2 First Floor

the illumination levels on the first floor were the maximum illumination level of 757 lux, minimum of 130 lux and average of 239 lux 2

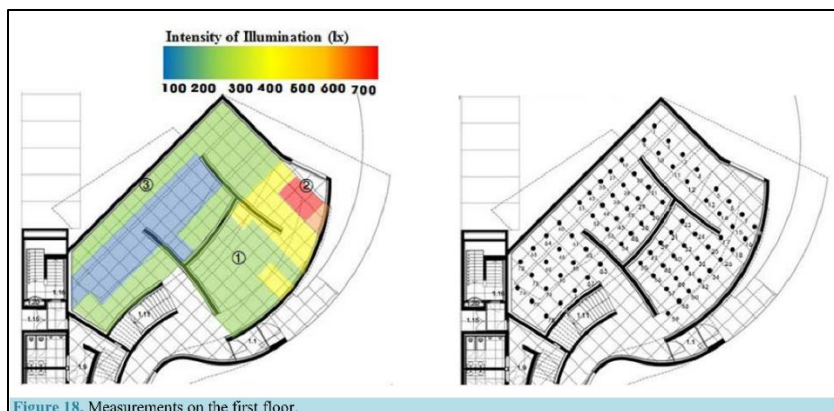


Figure2. 41 1st Floor Measurement (Chang Sung Kim 2014)

3.3 Simulation 3rd Floor

The measurements on the third floor showed the maximum illumination level of 892 lux, minimum of 260 lux and average of 539 lux as shown

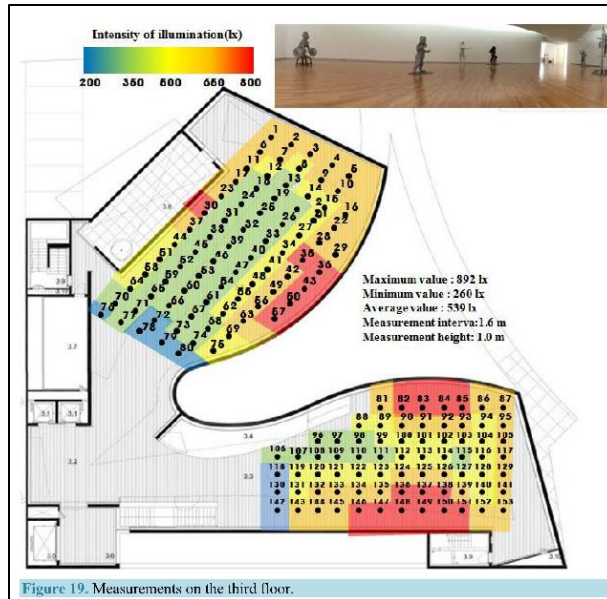


Figure2. 42 3rd Floor Measurement (Chang Sung Kim 2014)

3.4 Survey of the Visitors' Satisfaction about the Lighting Conditions

A survey was conducted to evaluate visitors' satisfaction under the lighting conditions of the Mimesis Art Museum

The survey was comprised by 5 questionnaires the main question is : The visitors' satisfaction under the natural lighting condition of the museum

Questionnaires regarding the above issue distributed to 90 visitors, who were composed of 54 male and 36 female.

3.4.1 The survey was comprised by 5 questionnaires as below:

What do you think is the most important design factor to influence viewing satisfaction in the museum?

- Circulation 32
- Environment 21
- Method 29

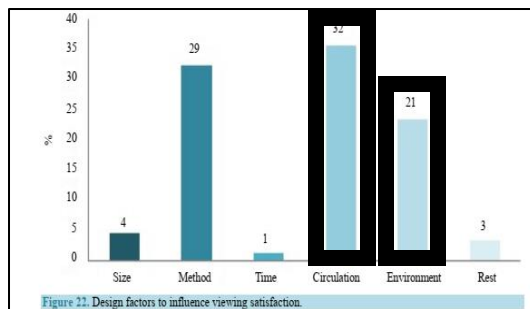


Figure2. 43 Design factors to influence viewing satisfaction (Chang Sung Kim 2014)

2) What do you think is the most important factor to offer stable environment in exhibition spaces of the museum?

Lighting 41

Color 21

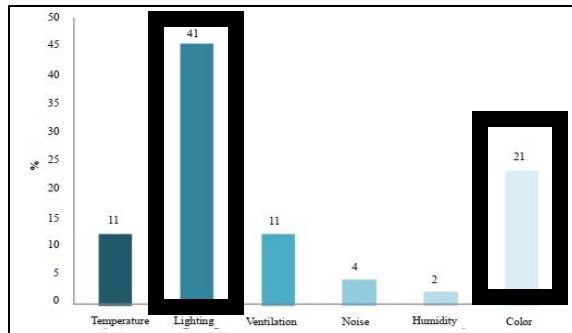


Figure2. 44 Environmental factors for comfortable museum(Chang Sung Kim 2014)

3) How did you feel about the lighting condition of the museum when you have viewed exhibits?

Satisfied 80

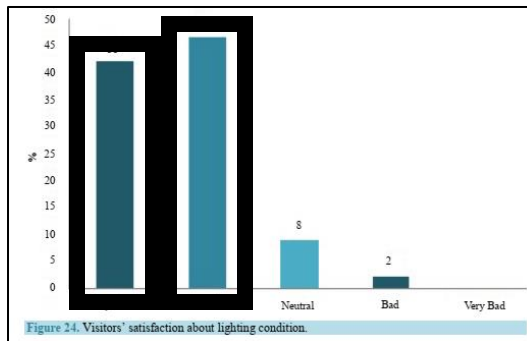


Figure2. 45 Visitors' satisfaction about lighting condition(Chang Sung Kim 2014)

4) How much were you dazzled by glare problem in the exhibition areas of the museum while you were in the museum to view exhibits?

Undazzled 78

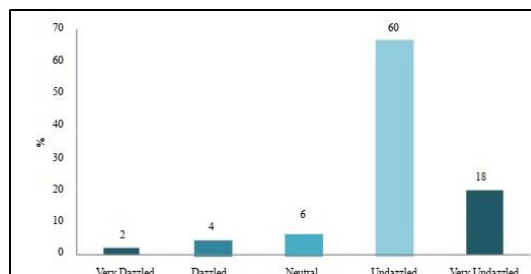


Figure2. 46 Glare problem (Chang Sung Kim 2014)

How did you feel about illuminating the exhibition areas of the museum with the natural lighting? Was it helpful for you to view exhibits in the museum?

Satisfied 72

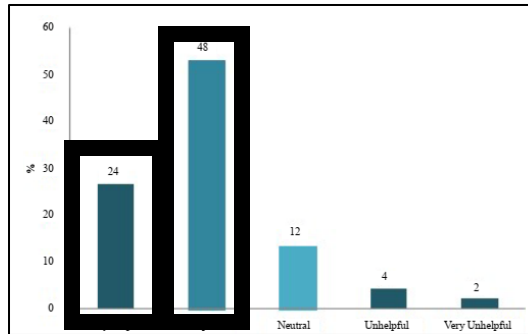


Figure2. 47. Responses about natural light (Chang Sung Kim 2014)

4 Analysis of site project ground:

4.1 Historical overview of the city:

"Zayban" is a collection of the word "Zab" which means in the language or dialect of the southern desert in Algeria, "Palm Oasis".

It is necessary to talk about Biskra back to its ancient history and its privileged position, it is rooted in the depths of history, where successive civilizations and revolutions from the Roman era to the Islamic conquests to the French invasion and independence.

4.2 Astronomical location

The city of Biskra lies between longitudes 5° and 6° and northeast of the line between latitudes 34° and 35° N ..

4.3 Geographical location:

The province of Biskra serves as a bridge between East, West, North and South thanks to its location in the southeastern part of Algeria,

Biskra is bordered by Batna

It is northeast of Khenchela Province

It is northwest of M'Sila

It is southwest of Djelfa

It is to the south of the Oued.

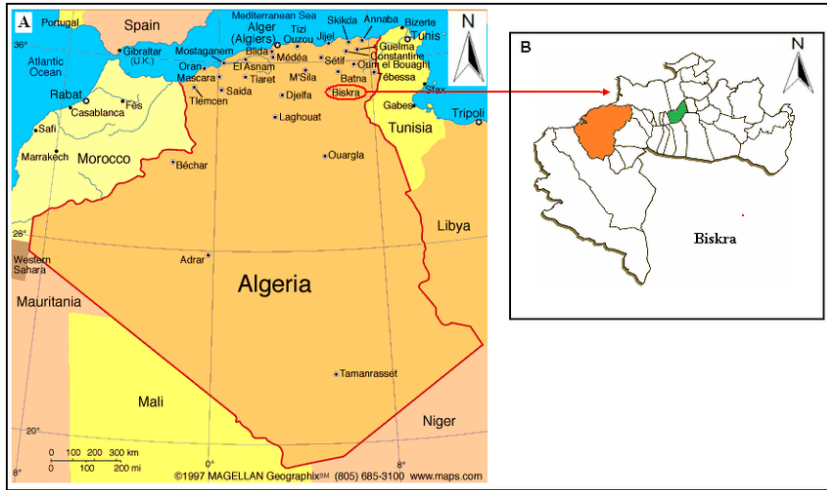


Figure2. 49 Algerian map (Researchgate)

4.3.1 Heat

Average thermal m 0	Thermal range m 0	Minimum temperature m0	Maximum heat
23.3	21.2	13.4	34.6

Figure2. 50 Heat parameters

4.3.2 Humidity

Maximum humidity is about 67% in December and minimum humidity is about 29% in July

Source: Directorate of Programming and Budget Follow-up 2017

4.3.3 precipitation

4.3.4 prevailing winds

Lower Gauge (mm)	Maximum precipitation scale (mm)	Average Yearly (mm)
0	30.4	95.1

Figure2. 51 Prevailing winds

We find strong winds cold winter coming from the north-west, which comes from the upper plains and sandy winds in the spring coming from the south-est in general.

4.4 Geographical location :

The site is located in Alia area next to the national road No. 31 leading to the province of Batna.

4.5 Municipal boundaries :

It is bounded by the west of the brow

Municipality of Umash South.

Municipality of Sidi Oqba from the southeast.

Municipality of Shtma from the east.

Municipality of Al Wataya and Branis north

Road To University

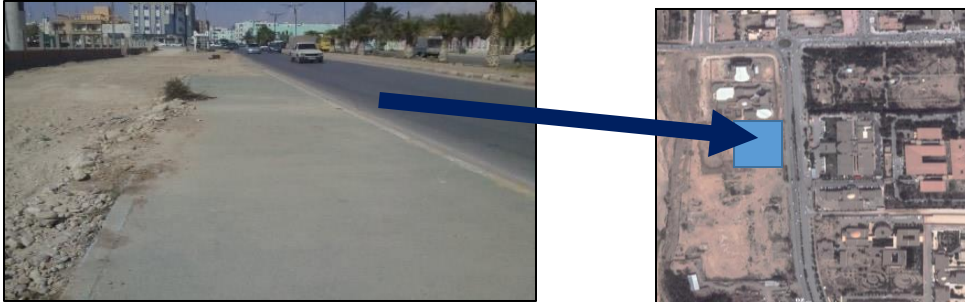


Figure2. 52 Road to university
(Researcher2020)

4.6 Adjust the boundaries of the Site:

Engineering Lift:

Site dimensions: 80 m X 120 m



Table2. 12 Cultural Center
(Author 2020)

4.7 Accessibility :

Have good accessibility



Table2. 13 Accessibility of the site
(Author 2020)

4.8 Study of well-being :

4.8.1 Wind effect:

Exposure of the ground to the wind from all sides

- ❖ Hot winds, known as the Southeast winds
- ❖ The cold winds, known as the Northwest winds



Figure2. 53 Domination winds (Author 2020)

4.9 Sun path :

Most of the project floor is exposed to the sun throughout the day because the astray of the buildings does not cover all the floor .

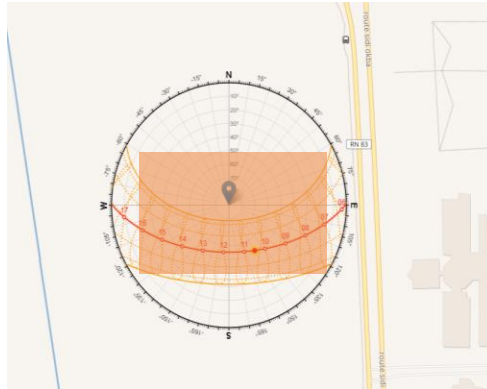


Figure2. 54 Sun Path (Author 2020)

4.9.1 Shading :

All of the project floor is exposed to the sun :

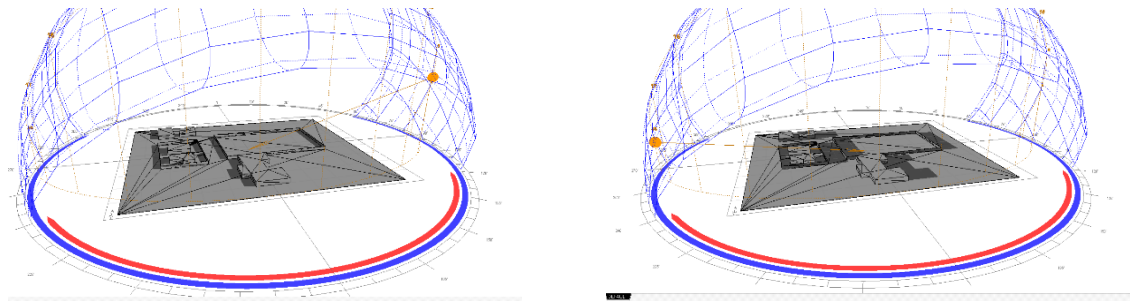


Figure2. 55 Shading With Ecotect (Author 2020)

4.10 Weak Point:

Exposure of the ground to the wind from all sides .

Most of the project floor is exposed to the sun throughout the day because the astray of the buildings does not cover all the site .

4.10.1 Strong Points :

Have good accessibility

The absence of a topographic problem in order to place the site away from the valley.

The easement distance between valley Sidi Zarzour and the site shall be 15 m.

Good position in the city.

5 Project's Programming :

S P A C E 2	Official Program	Mojahid Museum
1. RECEPTION	409m²	
Hall clearance	120	122
Security Station	120	/
. General reception of the publi	50	280
. Home group and school	30	/
. Ticketing	10	/
. Shop	15	/
. Cafeteria	25	/
.Restaurent	/	/
. Cloakrooms	15	/
. Public sanitary .	15	/
. Infirmary	09	/
2. ANIMATION	139m²	
Animation workshops	64	/
. Arrangement	15	/
. Outdoor terrace	60	/
3. EXHIBITIONS	260m²	
. Permanent exhibition	120	520
. Forum	60	120
. Temporary exhibition	80	180
.Children Museum	/	/
. Exterior Exhibition	/	/
4. CONSERVATION	164m²	<i>/²</i>
Workshops	64	/
. Reserve	100	/
5. LIBRARY	195m²	138m²
Management and loan bank	20	100
. Reading / child racking /	80	/
Adults / periodicals	35	/
. Multimedia / Audio	60	/
. Library storage	30	38
. Introductory and animation workshop	35	/
6- CONFERENCE ROOM for 100 seats	200m²	420m²
7. MUSEUM MANAGEMENT	215m²	/
Executive Office	40	25
. Management Office	25	42
. Secretary's Office	25	21
. Hall of Rebirth	80	/
. Rest area	45	/
8. TECHNICAL FACILITIES	50	/
9. CIRCULATIONS	15%	/
10.PARKING	/	/

TOTAL SURFACE UTILE	1650 m2	/
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Table2. 14 Analyse of programs example/official (Researcher/M of Culture)

S P A C E2	Louvre Abu Dhabi	MAXXI Museum
1. RECEPTION	409m²	
Hall clearance	100	340
Security Station	/	/
. General reception of the publi	80	/
. Home group and school	/	/
. Ticketing	/	/
. Shop	114	53
. Cafeteria	580	266
.Restaurent	600	/
. Cloakrooms	/	/
. Public sanitary .	/	/
. Infirmary	/	/
2. ANIMATION	/	
Animation workshops	/	/
. Arrangement	/	/
. Outdoor terrace	/	/
3. EXHIBITIONS	10000m²	19640 m²
. Permanent exhibition	6400	19197
. Forum	1400	/
. Temporary exhibition	2000	443
.Children Museum	200	/
. Exterior Exhibition	/	/
4. CONSERVATION	/	950m²
Workshops	/	/
. Reserve	/	/
5. LIBRARY	/	/
Management and loan bank	/	/
. Reading / child racking /	/	/
Adults / periodicals	/	/
. Multimedia / Audio	/	/
. Library storage	/	/
. Introductory and animation workshop	/	/
6- CONFERENCE ROOM for 100 seats	420m²	400m²
7. MUSEUM MANAGEMENT	550m²	/
Executive Office	/	/
. Management Office	/	/
. Secretary's Office	/	/
. Hall of Rebirth	/	/
. Rest area	/	/
8. TECHNICAL FACILITIES	50	/
9. CIRCULATIONS	15%	/

10.PARKING	/	/
TOTAL SURFACE UTILE	64000 m	29000 m²

Table2. 15 Analyse of programs example/official (Researcher/M of Culture)

6 Program Proposed of the Museum of History and art:

This program is the program developed through the official program of the Ministry of Culture in addition to the technical requirements and analysis of examples and analysis of the ground and the architectural and urban programming.

S P A C E 2	Louvre Abu Dhabi
1. RECEPTION	559m²
Hall clearance	120
Security Station	120
. General reception of the public	50
. Home group and school	30
. Ticketing	10
. Shop	15
. Cafeteria	25
.Restaurent	150
. Cloakrooms	15
. Public sanitary .	15
. Infirmary	09
2. ANIMATION	139m²
Animation workshops	64
. Arrangement	15
. Outdoor terrace	60
3. EXHIBITIONS	1350m²
. Permanent exhibition	600
. Forum	100
. Temporary exhibition	200
.Children Museum	100
. Exterior Exhibition	350
4. CONSERVATION	164m²
Workshops	64
. Reserve	100
5. LIBRARY	195m²
Management and loan bank	20
. Reading / child racking /	80
Adults / periodicals	35
. Multimedia / Audio	60
. Library storage	30
. Introductory and animation	35
workshop	
6- CONFERENCE ROOM for 100 seats	200m²

7. MUSEUM MANAGEMENT	215m²
Executive Office	40
. Management Office	25
. Secretary's Office	25
. Hall of Rebirth	80
. Rest area	45
8. TECHNICAL FACILITIES	50
9. CIRCULATIONS	15%
10.PARKING	200m²
TOTAL SURFACE UTILE	3455m²

Table2. 16 Program Proposed of the Museum of history and art (Author 2020)

7 Standard:

7.1 Humidity and temperature:

Dangerous, too, for the collections when they are not controlled, these phenomena constitute a whole, because of their close natural relation. It is also known that it is not good conservation without a relatively constant climate atmosphere sudden fluctuations, hygrometric or thermal, are much more dangerous than slow variations of the same amplitude. In general, the standard of conservation for relative humidity is $55 \pm 5\%$; for the temperature: 18 ± 2 °C. (culture, 2008)

Archeological Materials	
Negligible Climate-Sensitive Materials	30% – 65%
Climate Sensitive Materials	30% - 55%
Significantly Climate Sensitive Materials	30% - 40%
Metals.....	<35%
Natural History Materials	
Biological specimens.....	40% - 60%
Bone and teeth.....	45% - 60%
Paleontological specimens	45% - 55%
Pyrite specimens	<30%
Paintings.....	40% - 65%
Paper	45% - 55%
Photographs/Film/Negatives	30% - 40%
Other organics (wood, leather, textiles, ivory).....	45% - 60%
Metals.....	<35%
Ceramics, glass, stone	40% - 60%

**Figure2. 56 (I-18) Relative Humidity
Optimum Ranges for Various Materials
Housed in a Park's Museum Collection.
(Floray 2005)**

Temperature and relative humidity must monitoring so that we know what the environment in your storage and exhibit spaces is like over time.

The Monitoring helps to:

Set a baseline of temperature and humidity to see if the storage space is adequate.

Identify variations in the temperature and humidity throughout collections areas.

Monitor equipment to be sure it is working right.

Help develop strategies to improve the environment.

Identify whether your strategies are working to improve the environment. (Floray, 2005)

Monitoring equipment:



Figure2. 58 Assman Psychrometer
Source: (Floray, 2005)



Figure2. 59 Thermo-Hygrometer
Source: (Floray, 2005)



Figure2. 57 Electronic data loggers
Source: (Floray, 2005)

7.2 Conference Room :

An auditorium will often be desired, whose capacity and equipment will depend on the cultural policy of the museum; it can thus be presented in the form of a more or less versatile room (conferences, films, concerts, theatrical, choreographic, etc.). Preferably located on the ground floor or in the basement, opening directly on the general reception (having openings on the outside that the regulatory emergency exits), with a particular control, it must meet a number of technical requirements (acoustics and lighting in particular) . (culture, 2008)

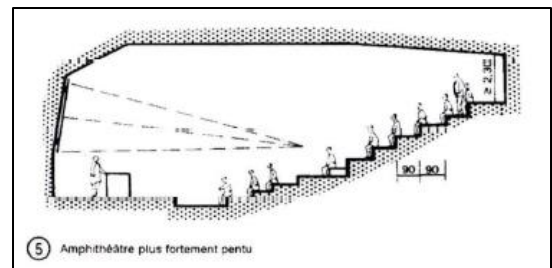
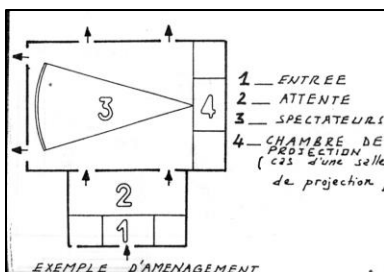




Figure2. 60 Amphitheatre standards
Source: (neufert, 2010)

7.3 Coffee and restaurant:

A restaurant or cafeteria, or both, are on the hospitality program, their location - before or after the checkpoints: both advantages and disadvantages, in both cases well weigh, especially from the point of view of safety -, their service links, their aeration and the evacuation of odors, the storage of materials, foodstuffs and products will be studied with as much care as all that falls directly from the

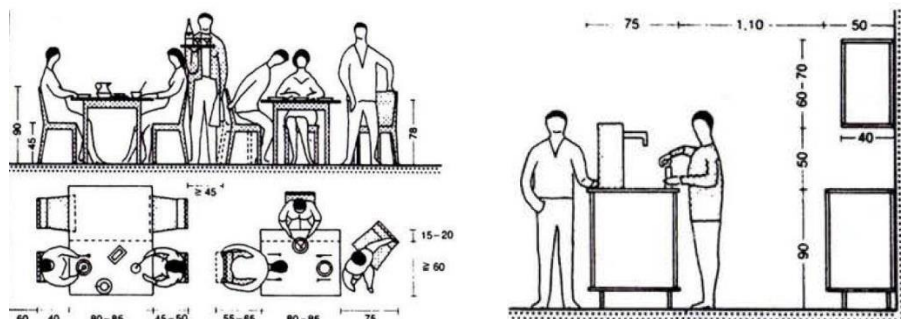


Figure2. 61 Coffee and restaurant standards **Source: (neufert, 2010)**

7.4 Hall ceiling:

The ceiling of the hall plays an important role in providing the sound reflections of the audience and directing them, the sound is reflected from the reflective surfaces the same mechanism of light reflection from the mirror and an angle of reflection equal to the angle of the fall. According to the geometric shape, reflective roof patterns are divided into:

1- Level 2- Concave 3- Convex

- Many cracks help distract the sound instead of putting it in one place, where it is proven

Horizontal ceilings are not good at providing good sound inside the halls (cinemas, theaters, conferences).

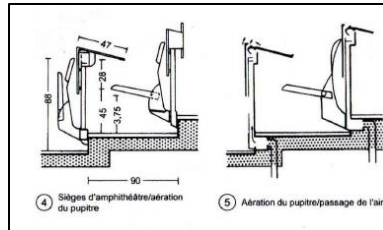
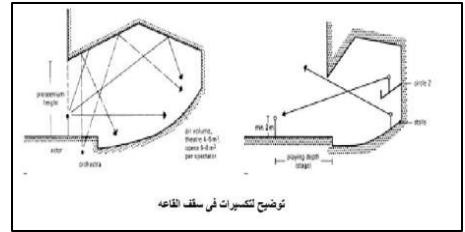
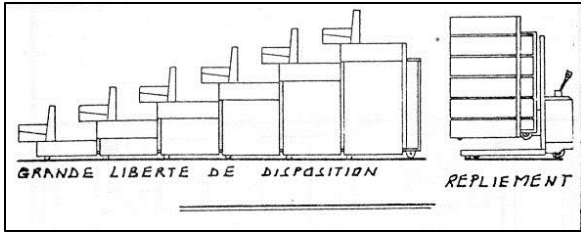


Figure2. 62 Hall ceiling (neufert, 2010)

7.5 Hall entrance hall:

The public must exit from the hall to a dump hall that is suitable for the number of attendees to accommodate them and requires an area of 1 m² per seat.

Sitting Hall : Requires an area of 0.8 square meters per seat.

7.6 Archive :

The space required for consultation and movement is 5 meters

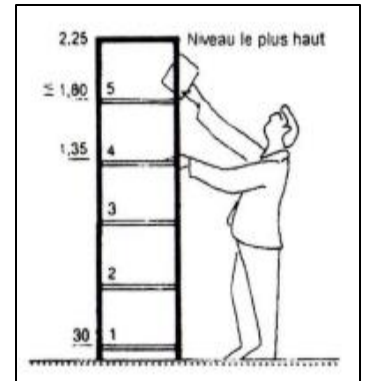
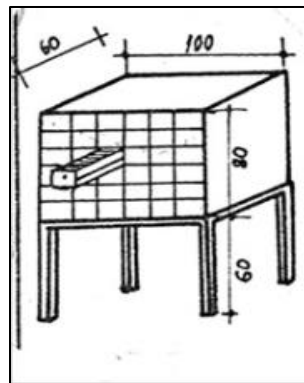
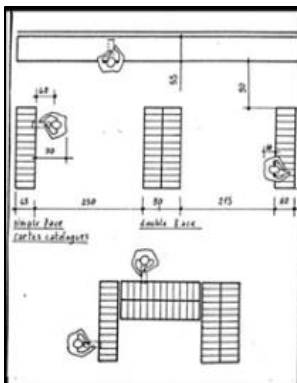


Figure2. 63 Archives (neufert,2010)

7.7 Ventilation :

Be lit and well ventilated

- * Application of the causes of fire prevention.
- * Isolated well from moisture and weather.

7.8 Lighting

The amount of lighting from 250 to 400 lux is used

Natural and artificial lighting

8 Office of the Director: 15 square meters

Secretariat: 10 square meters

Assistants: 4 offices with an area of 9.3

Meeting room: 24 square meters

Archive: 8.25 square meters

Toilet: 2 * 2.03 square meters

With 15 percent of the movements

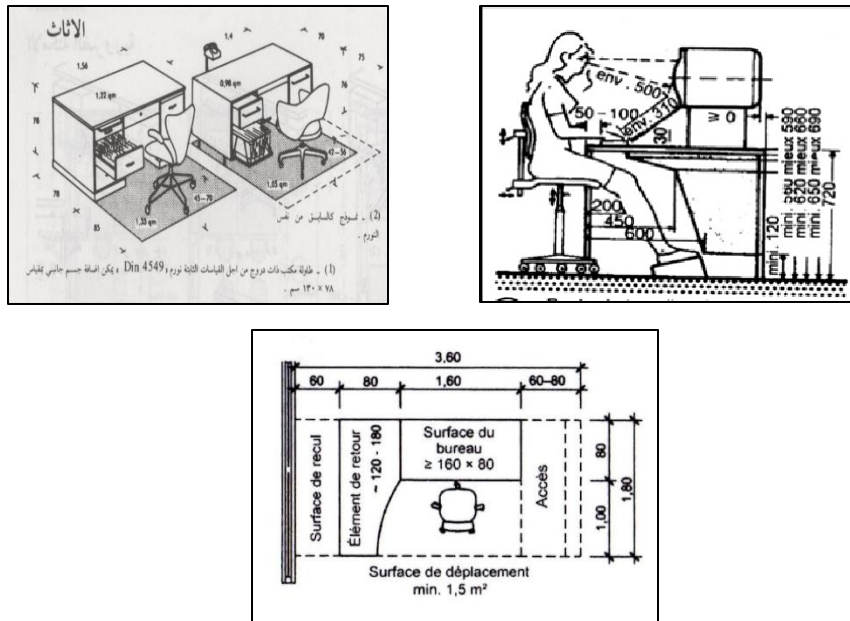


Figure2. 64 Office of the Director
(neufert,2010)

8.1 Lobby:

The reception hall is the main control area for the movement of the masses and the public is counted.

* Provide the hall lighting and ventilation, preferably spacious and attractive and contains a box office and examination room and inspection (neufert,2010)

8.2 Hall Chairs:

The distance between the back of the chair to the back of the chair should be from 86 cm to 144 cm, where

The last distance is suitable for the person so that he does not stand to pass another person in the same row

Auditorium seats.

1. The width of the corridors shall be at the level of the hall 2.3 m. In other levels the width shall be 1.5 m.

2- Distributing all the necessary seats for the hall in a complete manner according to the inclinations of vertical and horizontal viewing angles for the limits of the opening of the hall. Maximum distance from an individual plank 50 meters.

3 - Requirements for the distribution of seats distance between the eye and the back of the chair 15 cm.

4 - the anchored distance between the eye of the viewer and the floor of the lounge 1.60 m.

Space needed for a standing person

Are 0.235 square meters

Space needed for a sitting person

It is 0.537 square meters

Hence the space needed for a person

Are 0.386 square meters

8.3 the doors:

The width of doors shall be 1 m per 100 m² of the area of the hall at a minimum, and at the level of the hall put two doors and one door width between (1.5 m - 1.25)

The external doors of the hall should not be opened directly on the hall so that the light does not enter directly from

Exterior There is a dazzling eye, so there must be an area or transit corridors between inside and outside the room.

8.4 Ventilation:

In the ventilation process inside the hall is the air inlet from the ceiling and the side walls, either the air outlet It will be from beneath the seats.

8.5 Traffic lanes:

The minimum width is 1.5 m and a ramp may be used instead of stairs in case of level difference.

8.6 The stairs:

Stairs should be at a maximum height of 18.5 cm and a minimum width of 26.5 cm.

9 Software of simulation :

9.1 Why we use it :

DIALux is a free software developed by DIAL for professional light planning. ... This software is really helpful to design simply and intuitively lighting systems for and gives you the ability to calculate , visualize light environment for indoor and outdoor , create a unique atmosphere with real products of Dialux partner's .(Dialux.com)

9.2 In our project :

In our project we are interesting with good lighting environment so the index we need to calculate in this simulation is :

Illumination

Luminance

9.3 How to simulate with Dialux :

9.3.1 Import :

First of all we have to import the project plan from archicad by DWG extension

We choose the ground floor exhibition area for simulation .

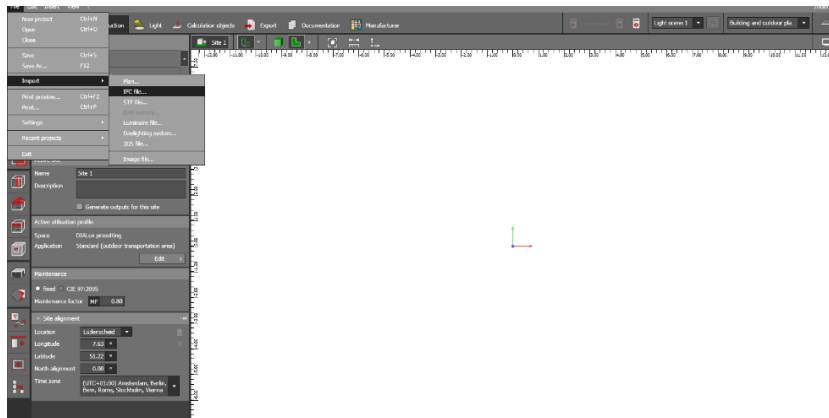


Figure2. 65 Dialux interface (Author 2020)

9.3.2 Orientation and Origin :

After this we specify the scale and orientation of project

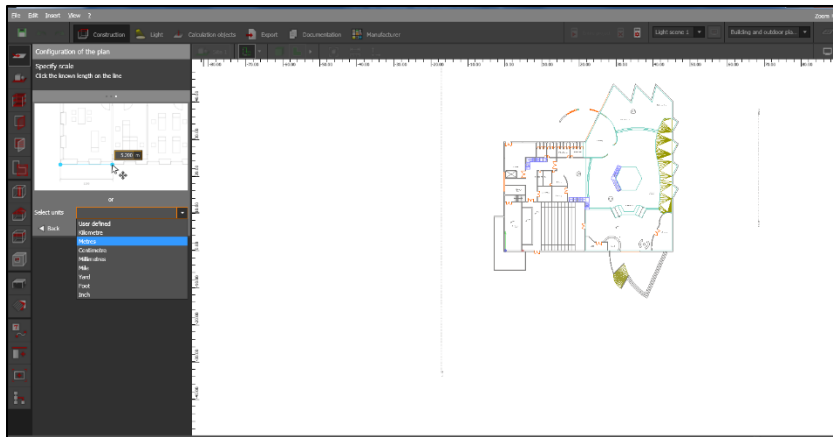


Figure2. 66 Parameters of the project in Dialux (Author 2020)

9.3.3 Site Parameters :

Next step we select site location and north arrow direction .

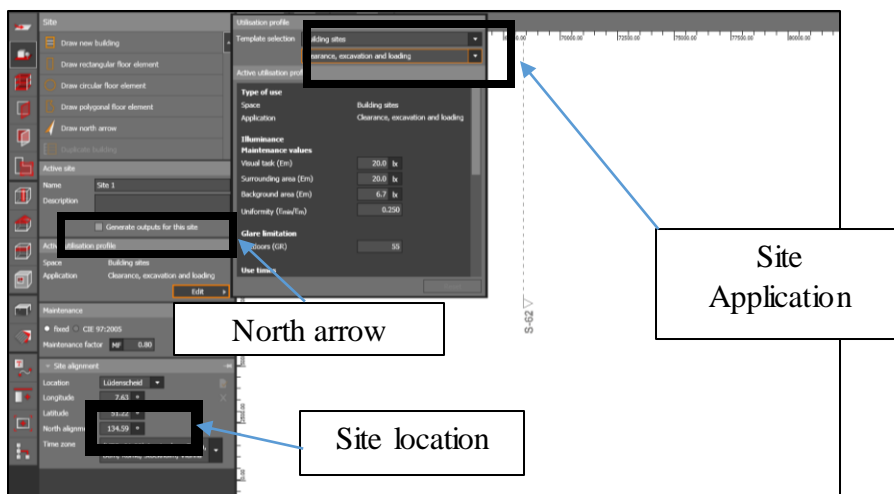


Figure2. 67 Site parameters Dialux evo 8.1 (Author 2020)

9.3.4 Project drawing :

In this step we draw the zone we need to simulate .

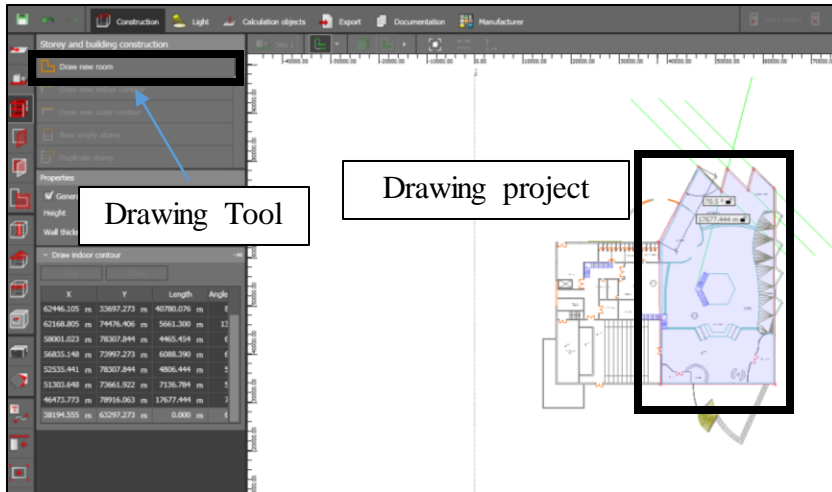


Figure2. 68 Drawing/Conseption with Dialux evo 8.1 (Author 2020)

9.3.5 Making slots :

After drawing walls we can put the slots and specifies their size .

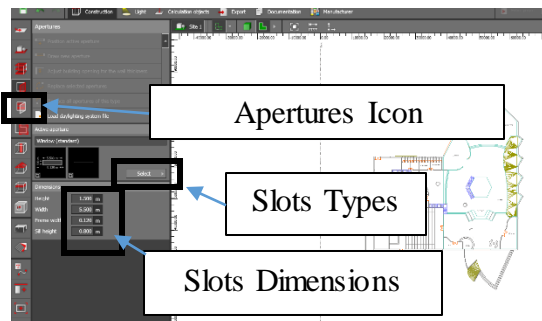


Figure2. 69 Slots Parameters Dialux evo 8.1 (Author 2020)

9.3.6 Light Properties :

In this step we select the lighting field and the area we need to study .

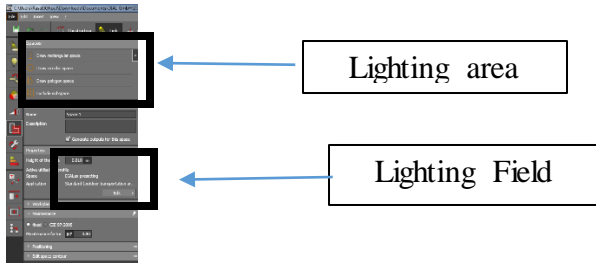


Figure2. 70 Light Properties Dialux evo 8.1 (Author 2020)

9.3.7 Light scenes :

Now we need to select the type of sky in our condition we select clear sky and the date that we study.

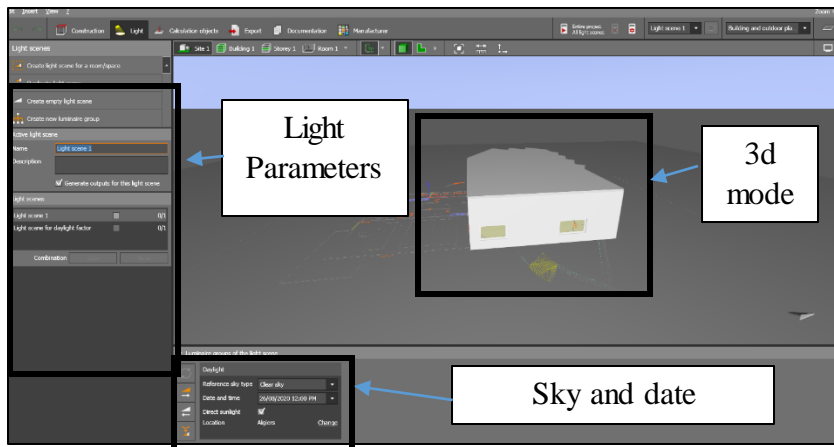


Figure2. 71 Light Scene Dialux evo 8.1 (Author 2020)

9.3.8 Start simulation :

Now we almost done ; we can start the simulation it may take few minutes .

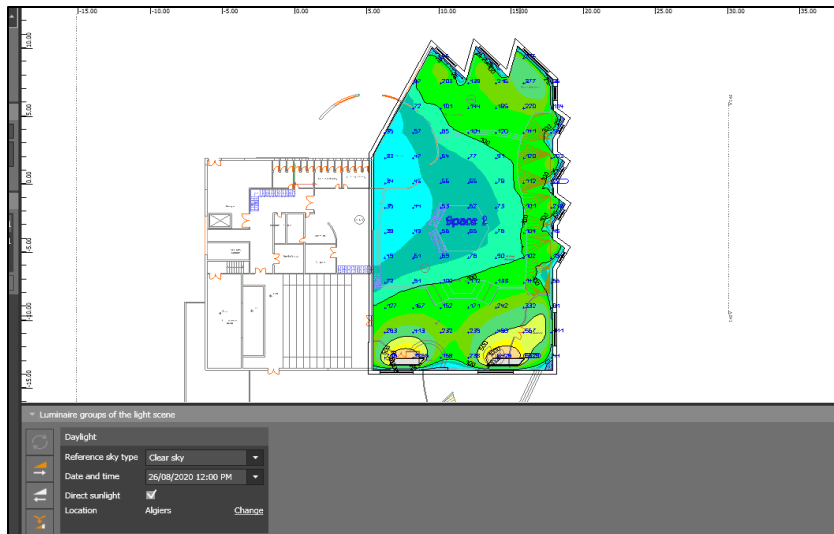


Figure2. 72 Simulation result Dialux evo 8.1 (Author 2020)

Conclusion :

After we discussed in this chapter everything related to the museum, from the cultural intellectual affiliation to the science that falls within it through the most important definitions and the functional and spatial characteristics and after mentioning the most important conclusions extracted from the analysis of the examples and the ground we can say that the study phase has been done and we have all The points we need in the design of the museum from standards and laws and methods of applying the techniques of the subject in our design of the museum

And from the most important laws and standards that we have extracted from our study is the full physical integration of our project to the good study of the mechanical and pedestrian connectivity and the absolute clarity of the entrances of the ground and the project and the external design of the

project ground is very importance like the internal design and the most important extracted from the exterior study is the project's mentality, which must give an impression on the difference and the intellectual and architectural importance through its unusual shape and its vague facades that give the desire to explore this building and know its function while not forgetting the nature and the surrounding environment Which affects the project and is affected by either internally As for any project dedicated to the public, the welfare of the users must be studied carefully and the project message should be delivered to them with ease and clarity. We should not forget the importance of preserving of the exhibits from the hour of their entrance to the museum, to the storage to display and its techniques to maintenance.

With the most important applications of our subject in the project, which will be on the level of the outer envelope and exhibits.

From here we have got all that we need to pass directly to the design phase of the Regional Museum of History and Arts aims and objectives that we will discuss in the next chapter .

CHAPTER THREE : PRATICAL CHAPTER

Introduction :

After analyzing and describing everything relevant to the architectural lighting of museums and after theoretical analysis of the museum, noting all the associated concepts and characteristics and technological and practical criteria and after extracting the regional museum's spatial software, we have collected all we need to go through to the design stage.

In this chapter, we will clarify the design processes of the project and how to incorporate all that resulted from the previous theoretical analysis in order to design a museum that achieves all its goals and to demonstrate how to apply the concept at the museum's external and internal level and how the most relevant elements of the theme are incorporated in the project.

In order to explain what we said earlier, this chapter will include the most important objectives and elements of the concept that will be implemented throughout the project and also the most important project objectives with a concurrent description of the transformation elements, the internal and external behavior of the project and the construction phases and the basic design concept in the form of the building, the facades and the various

With an interactive overview for all the plans of the project's interior and exterior views and some details of the dynamic design features used in the project .

Through this chapter we intend to demonstrate how a good lighting atmosphere museum can be used internally and externally in the display and the exhibits and in the museum's external envelope and we intend to shift the concept of the old museums and to give new look to museums and a new approach to architecture towards the widespread and growing tourism sector.

1 Crossing elements:

1.1 External Study:

1.1.1 Insolation:

Without any cover the site is open to sunshine all day. use afforestation to protect the project from excessive radiation.

1.1.2 The wind:

The site is not protected from and completely exposed to wind, so we use dynamic shape to guide direct cold wind to project and hot wind out of it.

1.1.3 Physical disabilities:

Floor topography is smooth and has no barriers, it should take into account the safety distance between the project and the valley.

1.1.4 Accessibility and flow :

-The city's mechanical access to the project is fantastic with the nature of the project floor between the university and the valley of Sidi Zarzour , by using origami shape we change people 's museum views and encourage and develop their visit culture, and change the way projects are planned and constructed, and broadly promote the use of technologies.

1.2 Internal study:

1.2.1 The most important sections in the museum are:

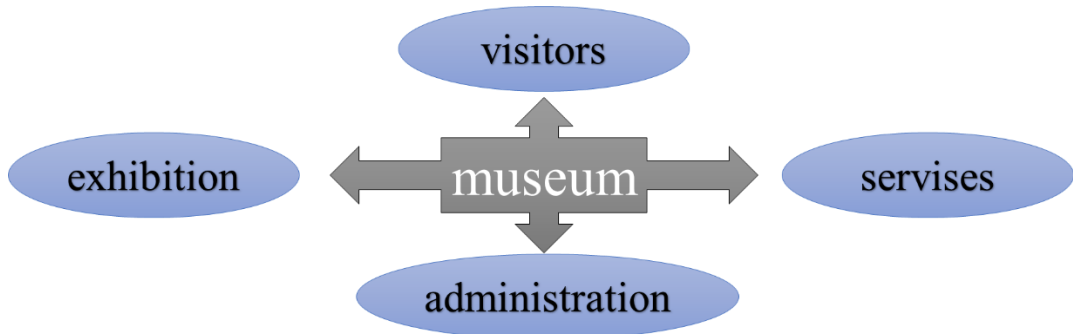


Figure 3. 1 important sections in the museum (Author 2020)

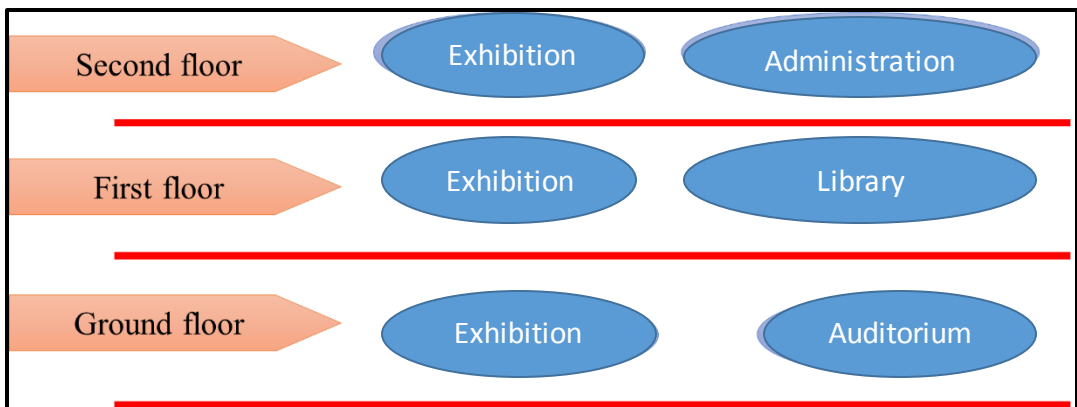


Figure 3. 2 important sections in the museum (Author 2020)

2 Design Idea :

The design process began by superimposing the two intersecting urban grids onto the site, creating a linear framework.

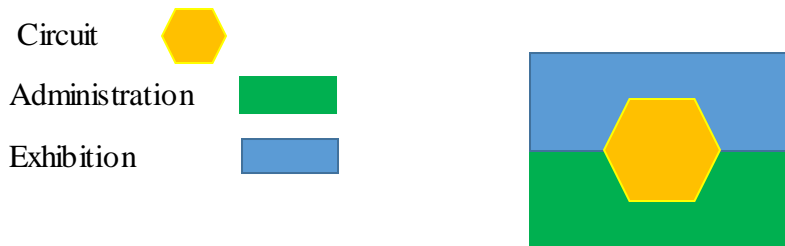


In the valley side we use the zigzag form to control the sun radiation in the out (let the light enter without radiations).to minimize the heat in this side.

2.1 Functions:

There are 2 types of function in museum; Administration and exhibition related with circuit.

so we separate the project to 2 sectors (Administration/exhibition)



So we have 3 main function ; and for the subfunction we have 3 circuit exterior exhibition exterior , parking .

We use this as the site division



2.2 Sun Radiation :

In the valley side we use the zigzag form to control the sun radiation in the out (let the light enter without radiations).to minimize the heat in this side.

For the roof we use origami system to reflect sun radiation and minimize the

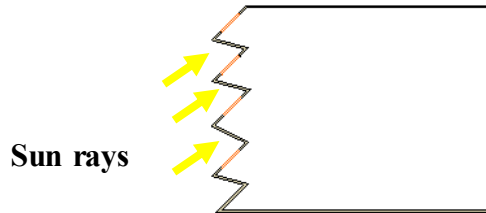


Figure 3. 3 Sun Rays control (Author 2020)

For the roof we use origami system to reflect sun radiation and minimize the



Figure 3. 4 Origami System (Pinterest.com)

2.3 Wind effect:

For this problem we use guide walls let the cold winds get in project and the hot winds out of the project ;

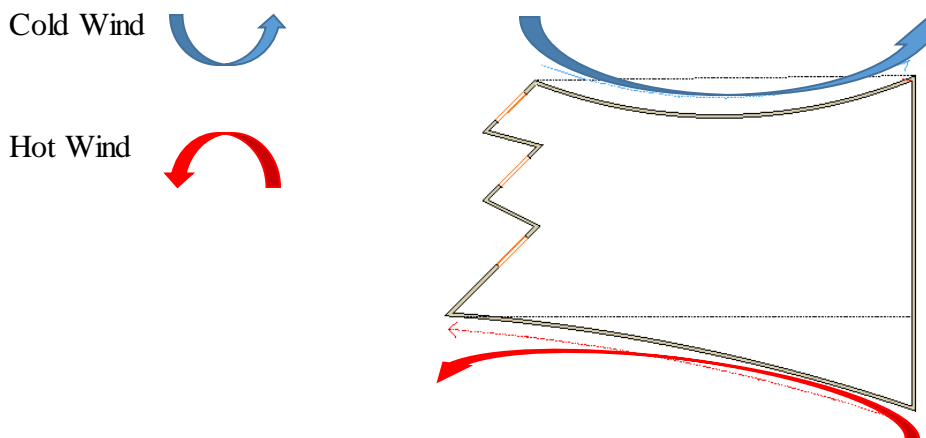


Figure 3. 5 Guide walls (Author 2020)

And to decrease the velocity of dominant wind ; orientate the project first from 45 degree to minimize wind velocity

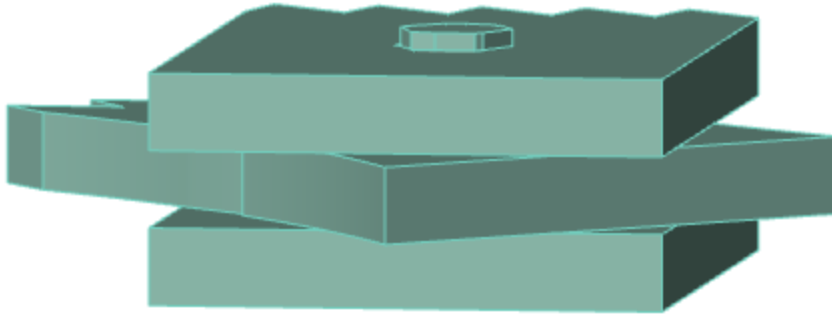


Figure 3. 6 Project Volumetric (Author 2020)

3 Reading and analyzing simulation results:

3.1 Reading and analyzing results (simulations) :

The amount of lighting from 250 to 400 lux is used

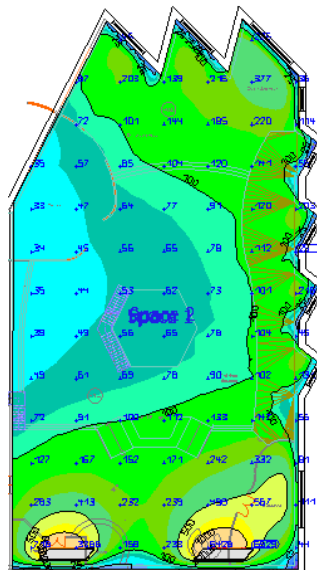
Natural and artificial lighting (Nefeurt)

3.1.1 Results :

The blue area is between 33-100 lux

The green area between 101-300 lux

The yellow area between 300-600lux



3.1.2 interpretations and results syntheses:

In the first area South side , the lighting is below the required level 33-100 lux and for the ordinary case in exhibition areas is 250- 400 lux, due to the lack of space for light slots .

The second area (East / West) need less lighting correction 101-300 lux we can get optimum lighting in this area 250-400 lux with increasing slots dimensions (more 5x5 m) and the position of it .

The third area 300-600 lux east side we have to decrease the slots dimensions in this side (less than 5x6m) to evade the sun glare and minimize the heat entrance .

3.1.3 Simulation after correction :

In the first area we add slots in the south side with precise dimensions (7.5x5.0m)



Figure 3. 7 South Slots Dimentions Dialux evo 8.1 (Author 2020)

The second area north side of project we can increase the dimension slots without getting any problems and for the west side , we increase the slots dimension from (5 x 5m) to (4.5 x 7m)

And by using zig zag form we can decrease the sun glare from this side .



Figure 3. 9 West Slots Dimentions Dialux evo 8.1 (Author 2020)

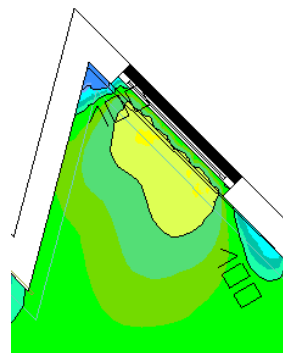


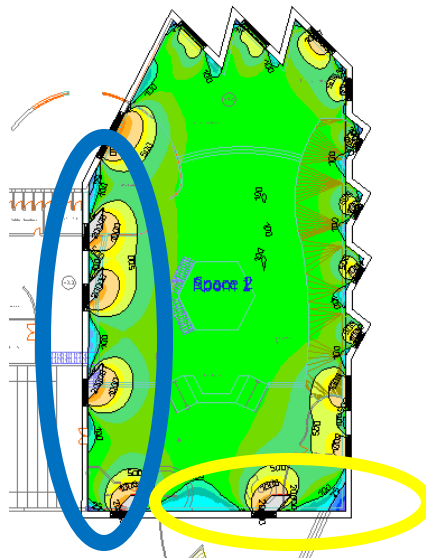
Figure 3. 8 Zig zag form (Author) 2020

For the third area east side we decreased slots dimension (5x6m) to 5 x3.75 m

,and change the slot position from horizontal to vertical .

Dimensions	
Height	6.000 m
Width	3.750 m
Frame width	0.120 m
Sill height	0.800 m

Figure 3. 10 East Slots Dimentions Dialux evo 8.1



**Figure 3. 11 Simulation Final
(Author 2020)**

4 Graphic presentation of the project:

4.1 Project introduction:

The project is located in Biskra, specifically in serves as a bridge between East, West, North and South thanks where the general form is not understood and ambiguous, which makes the project prominent and well known

The project contains a 3 floors where ground floor contains auditorium and children museum , distributed to other floors according to their requirements while the administrative sector is located on the second floor away from the public.

4.2 Site plan:

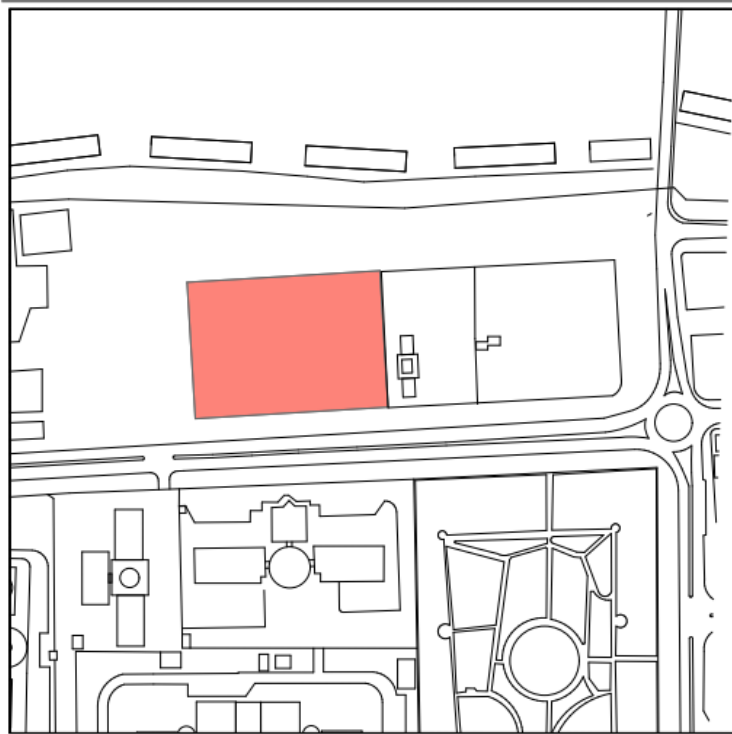


Figure 3. 12 Site Plan (Author 2020)

4.3 Master plan:

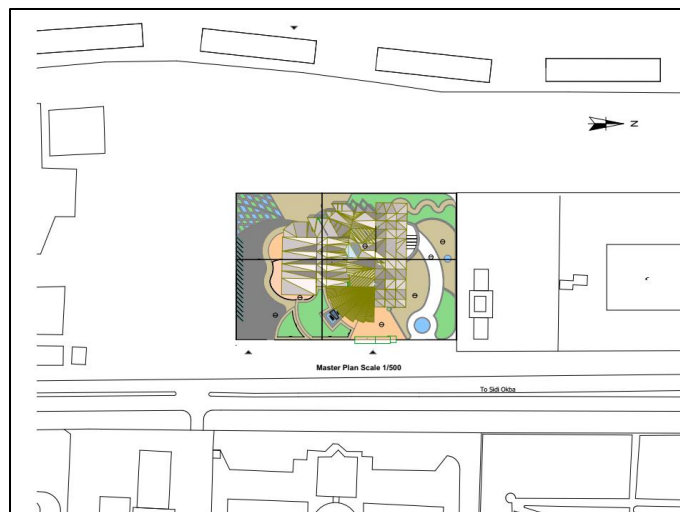


Figure 3. 13 Master Plan (Author 2020)

4.4 Ground Floor :

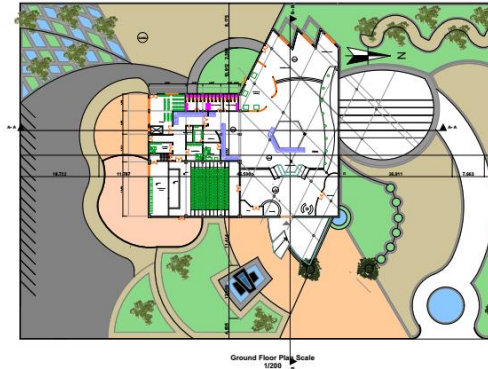


Figure 3. 14 Ground Floor (Author 2020)

4.5 First Floor :

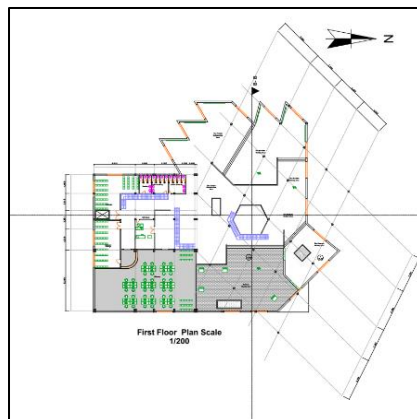


Figure 3. 15 First Floor (Author 2020)

4.6 Second Floor:

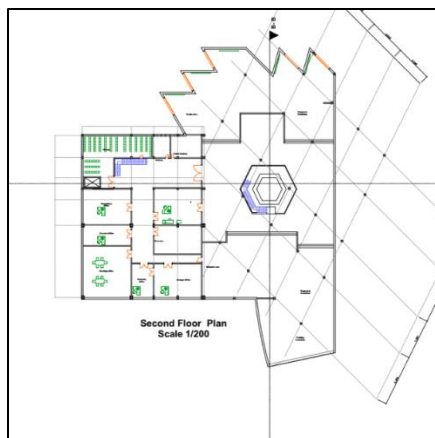


Figure 3. 16 Second Floor (Author 2020)

4.7 The Sections:

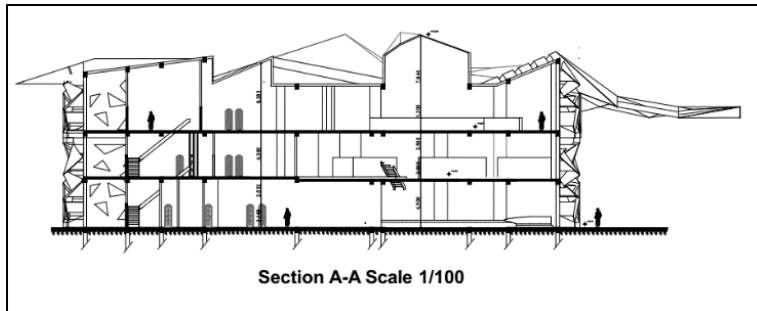


Figure 3. 17 Section A-A (Author 2020)

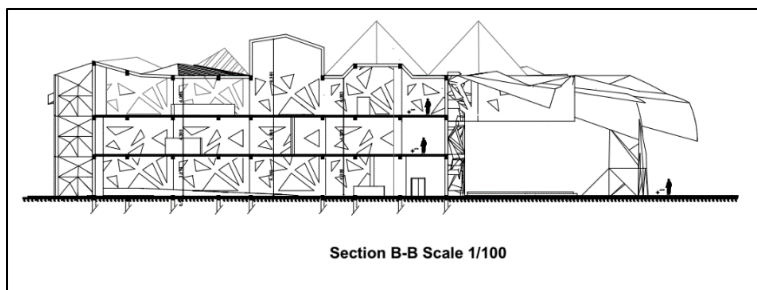


Figure 3. 18 Section B-B (Author 2020)

4.8 The Facades:

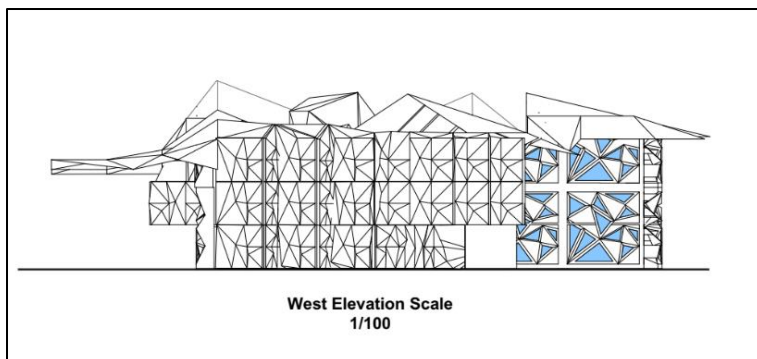


Figure 3. 19 West Elevation (Author 2020)

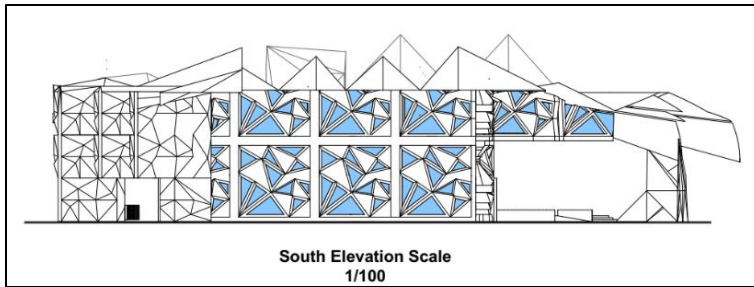


Figure 3. 20 South Elevation (Author 2020)

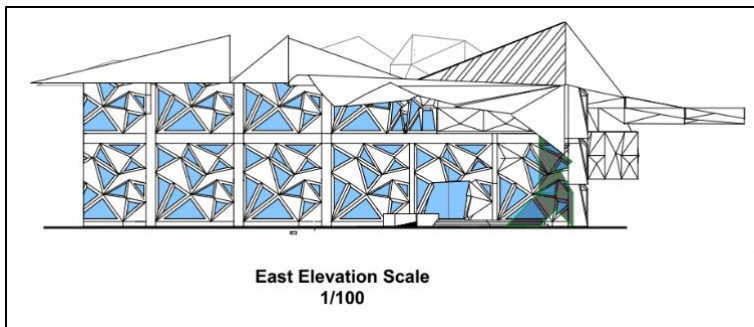


Figure 3. 21 East Elevation (Author 2020)

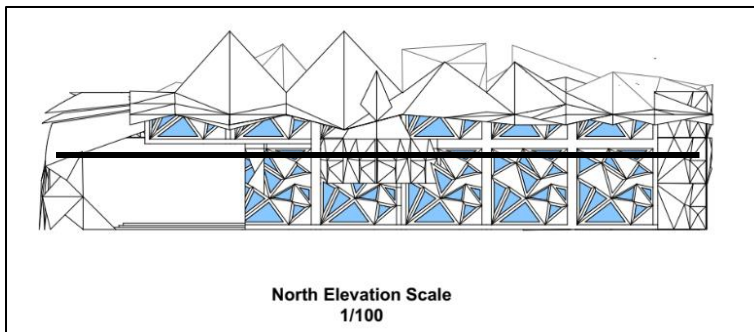


Figure 3. 22 North Elevation (Author 2020)

4.9 The views :

4.9.1 Exterior Views :

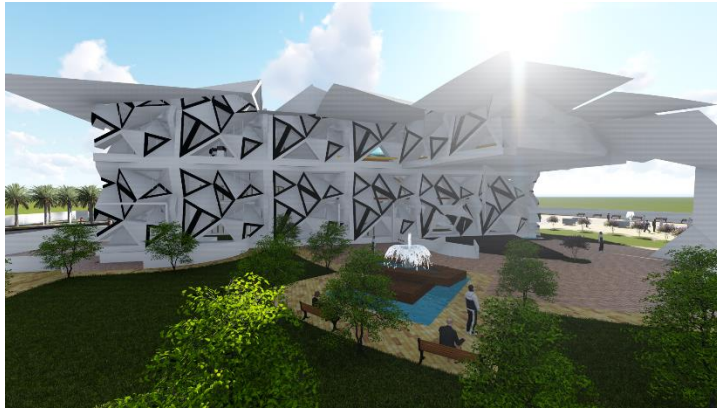


Figure 3. 23 Exterior View (Author 2020)

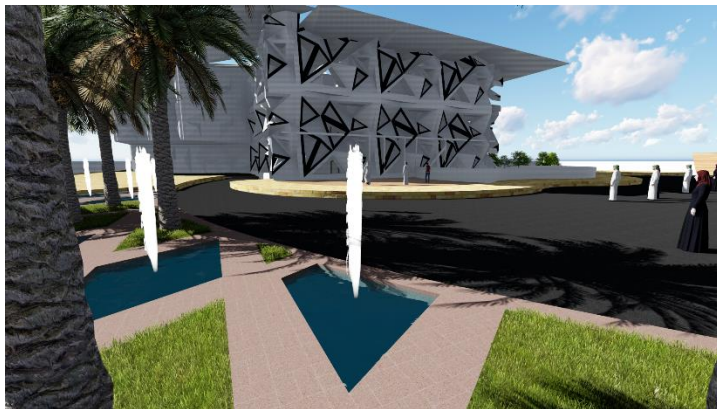


Figure 3. 24 Exterior View (Author 2020)

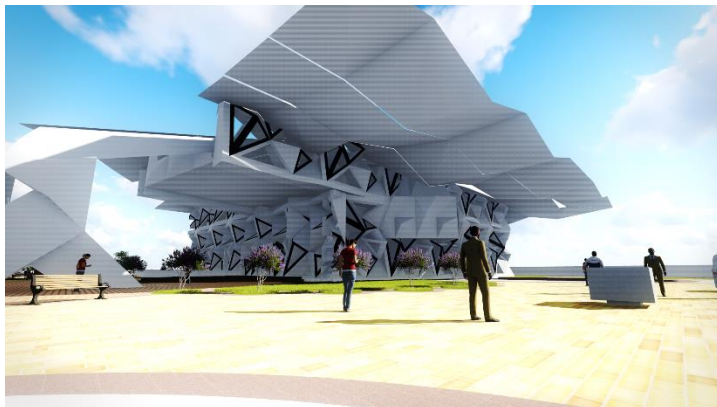


Figure 3. 25 Exterior View (Author 2020)

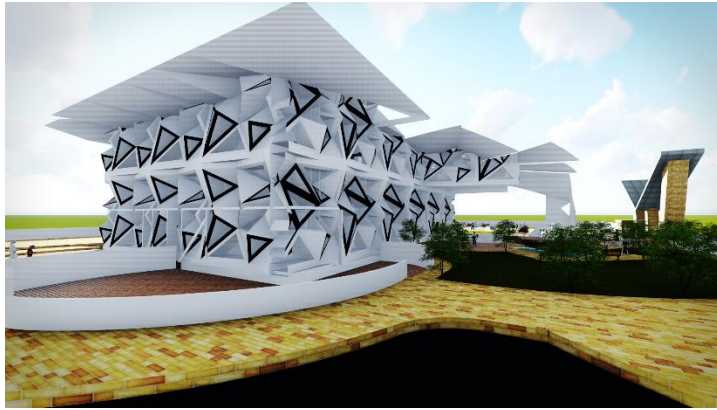


Figure 3. 26 Exterior View (Author 2020)

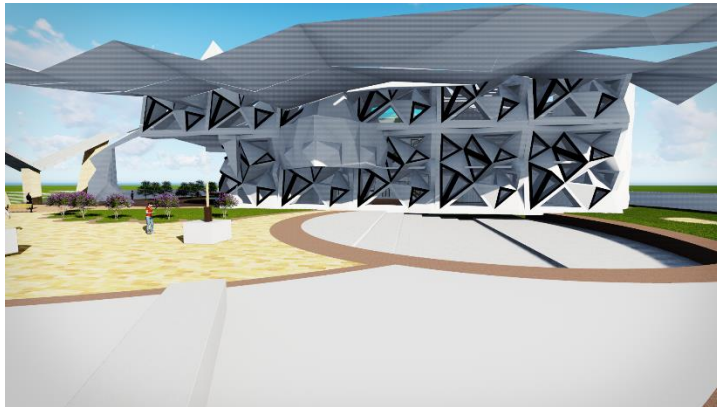


Figure 3. 27 Exterior View (Author 2020)

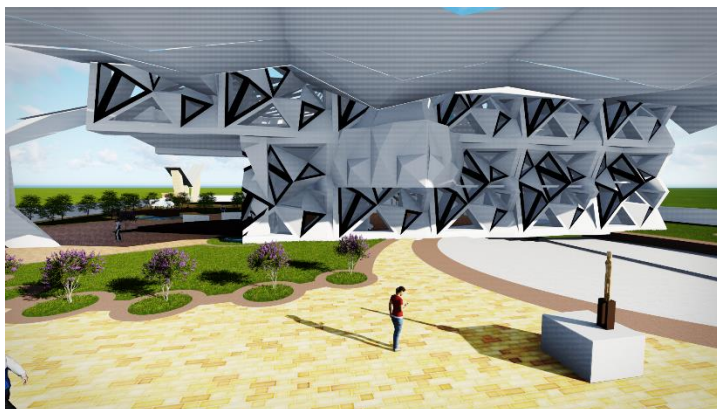


Figure 3. 28 Exterior View (Author 2020)

4.9.2 Interior Views:



Figure 3. 29 Interior View (Author 2020)



Figure 3. 30 Interior View (Author 2020)



Figure 3. 31 Interior View (Author 2020)



Figure 3. 32 Interior View (Author 2020)

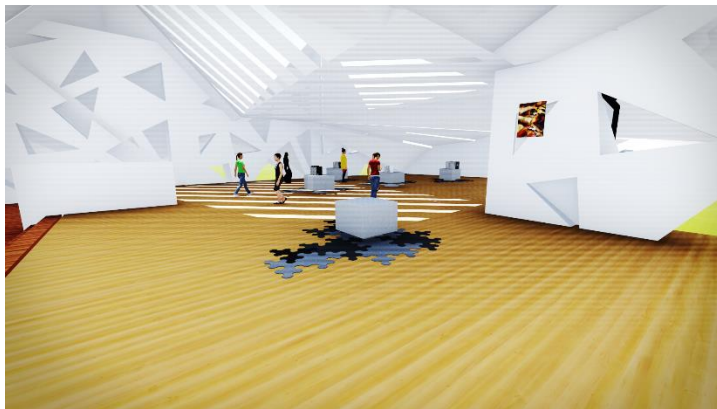


Figure 3. 33 Interior View (Author 2020)

Conclusion:

After the completion of the conceptual and analytical study of everything related to the subject and the project we have extracted all the need for the design of the regional Museum of art and history

In this chapter we discussed the most important stages of the design of the museum starting with the objectives and applications of the subject and the objectives of the project Then we mentioned the elements of transit, which include study of the internal and external behavior of the project and the general design idea and the design idea of the facades and then the graphic presentation of the entire project from plans facades sections and Interior and exterior views, and some details of complex architectural elements

After following the previously established crossing elements and incorporating the subject techniques into the project, we were able to change the museum from a traditional project (a traditional museum) to a modern architectural masterpiece. It brings attention and makes people come to visit it through its unusual form we have also been able to minimize energy use and control the amount of light within the project with simulation .

The most important goal has been to change the concept of the museum and move it from the historical museum, which presents everything related to history, customs and traditions to the modernity and modern

With the widely use of unique form and using technology in simulation to create an optimum lighting environment to bring largest number of visitors, attracted by passion and love of new knowledge in advanced technology.

General Conclusion:

Daylight design in architecture is used to provide adequate lighting to the interior and to exclude unwanted light from the room, Since human beings established their shelters with a lighting opening, they have been continuously searching for better methods to obtain suitable natural lighting in the living.

In our time and its impact on all areas of life made it the destination and goal of all and to acquire it and control lighting in all fields of life in the life of the individual and groups of economy, culture, education and medicine.

In the light museums in one of the most important rules in museum design, in order to find the best ways and means to integrate lighting systems and museum engineering, we present this work and the systems of the first entrance stages through which we were able to understand and know the reasons for choosing a regional museum of arts and history, the most important of which is the development of tourism and the spread of culture Museums and the first chapter covers all concepts related to architectural lighting system, and the most important thing related to the museum, from culture and museology, to the museum definitions. The second chapter dealt with the most important systems and technical requirements of the museum. We analyzed the project and topic examples, discussed the most important applications of this research in the project, and presented a comprehensive analysis of the site . And it culminated in the recent launch of the official program of the regional museum, and the most important thing related to our study is simulation, as we made a preliminary simulation of the lighting behavior of the project with its stages explained.

From this chapter we extracted the most important standards, rules and technical requirements for the design of the project

And the third chapter is the applied chapter in which the objectives of the project and the elements of transit and the interpretation of simulation results and get luminance value from (30-600 lux) we try to get an optimum lighting comfort by changing slots dimensions and orientation to fix lighting problems in the project after all these changes we get the final simulation result with optimum luminance value 200- 350 lux . after this we make all this change in the project graphic presentation .

And for the good functioning of this work we followed the methodology of I.N.E.S that helped us to reach and achieve the goals we sought to achieve from this subject and the project and one of the most important of these goals

Setting up a world tourist destination in Biskra.

Establishing a culture of museum visits to the Algerian people

Building an environmentally friendly building

In the end we find the necessity of using this kind of projects in future architectural projects, which would raise the level of tourism and culture in the country and the use

of technology in museums design (simulation) in order to get them out of the idea that museums are historical facilities only and that their function is storage and display only, but are places of science Entertainment and highlighting the culture of societies. It should be remembered that contemporary museums have become economic and tourist facilities.

Recommendation:

For the south side the ground floor and 1st floor we recommended that the lighting slots or the empty area in facades between (60 – 70 %) .

For the north side we recommended that the ground and 1st floor can go for (70 - 85 %) empty surface from facade .

For the East side we recommended less empty area can be between(30-40 %)

The West site need more protection from the sun rays so we recommended that empty percentage is between (30-35%) and with protection in this project we choose the zigzag system for the protection from this problem .

For the upper floor we recommended for the zenithal natural lighting particular the spot method .

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