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Faculty of Science and Technology
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MASTER'S DISSERTATION

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Presented and defended by:
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Theme: Architectural envelope as a light ambience regulator.

The project: Fitness center

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Dedication

To my hero , my muse and the man who made me who I am , my dear father .

To the woman who gave me life , the woman I owe everything to, my beloved mother

I hope I could give you back a drop from the oceans you always offered me.

To my life's ray of light , my pride and joy , my brothers.

And to my aunt may she rest in peace, you would have been so proud of me.

Acknowledgements

First and foremost, I thank god for giving me strength, will and patience to make it through and get this work done.

I have to thank my research supervisors, Doctor Boukhabla Moufida and Madam Meliouh Fouzia for their assistance and dedicated involvement in every step throughout the process, this paper would have never been accomplished without their guidance . Thank you very much for your support and understanding that you have shown me .

My thanks go to the jury members who have taken the time and effort to look through this humble work .

To every single mentor I had on my journey , I am most grateful for every word and every thought you have given me , thank you for your guidance and tolerance and motivation .

To my family and friends thank you for being by me .

Last but not least , my sincere gratitude goes to everyone around me , thank you all for the inspiration , the experiences and the lessons .

ملخص

يعتبر الضوء عنصرًا أساسيًا في التصميم المعماري لأنه يلعب دورًا في التوجيه الوظيفي للمشاريع المختلفة من خلال توفير الإضاءة اللازمة في المباني

تلعب المرافق الرياضية دورًا مهمًا في الحياة الاقتصادية والاجتماعية والترفيهية. يعتبر تكامل الإضاءة الطبيعية والاستخدام السليم للإضاءة الاصطناعية أحد الاهتمامات الرئيسية للمهندسين. كان الهدف الرئيسي للعديد من الدراسات في هذا المجال هو إيجاد حلول لتصميم مظروف معماري ، والذي يلعب دورًا أساسيًا في الحماية ويوفر مبنىًا جماليًا لافتًا للنظر ، مما يضمن ظروفًا مثالية وبيئة داخلية مريحة تساهم في الإدارة الجيدة للمبنى.

الغرض من هذا البحث هو التوصل إلى حلول وتوصيات تهدف بشكل أساسي إلى تنظيم أجواء الإضاءة من خلال الغلاف المعماري في مراكز اللياقة البدنية وخلق مناخ داخلي يتفادى المعيقات التي قد يسببها التواجد في منطقة تتميز بالمناخ الحار و الجاف، من خلال ضمان الراحة البصرية مع الاستفادة القصوى من الضوء الطبيعي بالتوازي. تجنب الآثار السلبية للإفراط في الإضاءة

الكلمات المفتاحية:

الاضاءة ، مركز لياقة ، الغلاف المعماري.

Summary

Light is considered an essential element in architectural design because it is reflected in the role it plays in the functional orientation of various projects by providing the necessary lighting in buildings.

Sport facilities play a crucial role in economic, social and recreational life. The integration of natural lighting and the proper use of artificial illumination is considered a real problem and one of the main concerns of engineers. Finding solutions to design an architectural envelope , that has a primary role of protection and offering an aesthetic eye catching building has been the main goal of many studies in this field , ensuring optimal conditions and a comfortable indoor environment that contributes to the good management of the building, creating a welcoming light ambiance .

The purpose of this research is to come up with operational solutions as well as recommendations aimed mainly at regulating light ambiance through the architectural envelope in fitness centers and creating an indoor climate as opposed to the obstacles that being in a hot arid climate zone may put in the way , by ensuring visual comfort while making the most of the natural light in parallel. Avoiding the effect of glare, poor heat transfer and uneven distribution.

Key words:

Light, architectural envelope , light ambiance , fitness center

Table of contents

List of figures

List of charts

GENERAL INTRODUCTION

Introduction

Since the beginning of times humans have searched to find a way to create a home , a place that adapts to different needs of his , and one of those primal needs is adapting to the climatic conditions , but then , humans evolve , and so do their needs , so man moved from basic needs like eating , finding warmth and hiding from cold , into a search for ways to make his life more enjoyable and entertaining , so he created activities that will help him improve his state of mind and serve his wellbeing . And among those activities , we find Sports, an activity that has always been an escape from the daily life pressure , a way to release the stress and relieve the mind.The process of creating a place where one could seek wellbeing has become a center of interest in order to fulfill the increasing needs of the sports' facilities users . The design of these places is a direct response to many necessities

In the context of Modern sports facilities architecture **,** fitness centers in the world today do not only meet the needs of sports, but also a lot of other functions in the field of entertainment, hospitality and education. These modern sports complexes resemble increasingly modern supermarkets, in appearance, multi- functionality, organization . They present more complex open and closed areas and facilities. The Fitness Center is a health, recreational, and social facility geared towards exercise, sports, and other physical activities, typically organized around the fitness spaces that accommodate both the serious athlete and the casual recreational user. Daylight is critical in Fitness Center design as equipment technology is constantly changing and sports and classes move in and out of fashion.

To choreograph light is to create intentional relationships between the desired luminous qualities and other architectural design variables such as spatial sequence, activities, materials, structure, and performance. The dimension of time, while predictable in the apparent movement of the sun during the course of the day and the year, introduces an oftentimes unpredictable and transient beauty embodied in dynamic, fleeting, and momentary luminous phenomena , while taking under consideration the hot arid climate that the fitness center is located.

I. PROBLEM STATEMENT:

the use of natural light in interior of the fitness center is strongly supported by many benefits such as energy saving and minimizing the amount of artificial light and reduce electricity costs ,. It's easy to assume natural light is always preferable to artificial, but sometimes it can offset its advantages such as excessive light penetration and Glare;where direct sunlight on shiny surfaces reflects bright light, making it difficult to see or work , natural lighting can result in unwanted and expensive heat cooling costs , unbearable heat gains especially when it comes to creating such facilities in a specific type of climate , such as hot and arid one . That is why daylighting requires more than just windows and skylights on a building.

The climatic region and function of the building are the two most important parameters in terms of the design of the building envelope .Accommodating the daylight ambiances to user's needs depends greatly on how the architectural envelope is conceived in a hot and arid climate. Because it plays an important mediator, whether as climate change perceived or as cultural patrimony intangible, between the building and its surrounding conditions. especially in an arid and hot climate

the architectural envelope is a complex interface that has a capability to function as a protective or regulatory element against severe fluctuations of external climate , it is important to ensure a building that isn't just attractive from the outside, but also provides a comfortable internal environment.

A glazed facade might look like a clever or intricate design, but intelligent design involves delivering a healthy interior without consuming more resources than a building needs to.The amount of glazing relative to wall area and floor area affects daylight harvesting as well as solar heat gain. Climate zone, daylighting system, fenestration and ceiling height, shading, the need for views, and other aspects of design all work together to create a successful daylighting scheme

any good daylight building must limit direct sunlight from entering. Use strategies that bounce, redirect, and filter sunlight so that direct radiation does not directly enter space for any significant period of time. Limiting direct solar penetration into the space can be achieved through proper orientation as well as shading, filtering, baffling, and/or reflecting solar radiation at each daylighting aperture.

The design of a building envelope, the nature of its composition and its integration with the design patterns, shape, size and distribution of the external openings affect the efficiency of the internal architectural space, This integration plays an important role in providing daylighting, reducing glare, providing sight and view, and protecting occupants from direct solar radiation while acting as insulation and a thermal barrier . This affects the comfort, performance and productivity of the users within the space .

II. RESEARCH QUESTION:

A well studied choice of architectural envelope is an efficient way to design the daylight ambiance to support the qualities of the fitness centers and avoid the negative effect of the arid and hot climate .How can the fitness center's daylight ambiance be influenced by the architectural envelope in a hot arid climate ?

III. HYPOTHESIS:

For any building's lighting strategy to be considered truly human-centric, it should incorporate daylight as much as possible to provide well-lit, dynamic and comfortable internal spaces and that could mostly be achieved by proper fenestration and studied choice of fenestration system and the architectural envelope's configurations

IV. OBJECTIVES OF THE STUDY:

The aim of the work is to choreograph daylight in a way that brings out the desired luminous qualities in the fitness center by adjusting the architectural envelope of the center to in the apparent movement of the sun during the course of the day and the year according to the climate of the area through the study of fenestration and shading devices (for sun oriented envelopes of the building)

V. RESEARCH METHODOLOGY:

This study is a research that requires firstly , an understanding of different concepts and key notions , linked to architectural envelope , lighting and climate , this crucial theoretical part allows us to understand the connection between the physical exterior environment and the architectural envelope . Secondly , the analytical part that includes the fitness center with its two main aspects : functional and spatial ; along with contextual dimension that comes as a necessary standpoint to develop an innovative conceptual process for a one of a kind

project in our country . We are to try through analysis and a comparison between examples and deduct a combination of guidelines which we will take as foundation to create and select criteria of the project , to select a site in which we will place the project . This step lastly, will be based on the design process of this project

VI. THESIS STRUCTURE

In order to confirm the validity of our hypothesis , our work is organized into :

An introductive chapter : which is divided into three parts , the first one is about architectural envelope and everything that concerns it , then the light ambiances and all that comes along with the notion of light , such as types of lighting and light fixtures, last but not least , the fitness center , its components and types based on a functional and a spatial aspect.

Second chapter : dedicated for the example analysis , where each example shows a different feature of what a fitness center is perceived as , to obtain a conceptual model of a fitness center that fits into the context .

Third chapter :

Containing passage elements and the conceptual process of the project , showing the genesis of the idea and the logic behind the concept of the fitness center

Lastly , a general conclusion to seal the work and showcase the conceptual results

Chapter 01

Conceptualization

Introduction

Fitness is a crucial activity for human's well being , in order to benefit from this act , the space where the sports activity take place must be welcoming and comfortable , therefore ,the design of that building must take many parameters under consideration .
Building perimeters are defined by the architecutral envelope that encloses them as well associated illumination.
That's why Lighting quality plays an essential role in the appeal and safety of interior and exterior spaces.
In this chapter we will discover the definitions of each notion , its types and components in order to understand the aspects of each architectural element

1 Architectural envelope

1.1 Definition of architectural envelope

The building envelope (or the more modern term, building enclosure) is all of the elements of the outer shell that maintain a dry, heated, or cooled indoor environment and facilitate its climate control. Building envelope design is a specialized area of architectural and engineering practice that draws from all areas of building science and indoor climate control.[1]
The building envelope can be considered from different aspects:
 For the thermal engineer, it is a transition zone between an indoor environment and an outdoor environment.
 For the architect: it is a contact zone between the building and the city.
 For the engineer: it is the point of connection between passive components and active systems.
 For the project manager: this is the object on which he will coordinate the interventions of different trades, from the designer to the workers.
 For the legislator: this is one of the characteristic elements of the building for which it will seek to bring as close as possible the high-performance technologies available and generalizable regulatory requirements.
For the occupant: finally, these surrounding walls are elements of thermal and visual comfort and constitute an aesthetic factor of its building[2]

1.2 Components of architectural envelope

1.2.1 Roofs:

A building's roof is like the seal to an envelope. It's meant to close the envelope securely, keeping the contents safe from outside elements. [3]

1.2.2 Walls:

The walls can be compared to the sides of a box — each meets in a corner.
Based on their function, we have three types of walls:
-load bearing walls
-enclosure walls
-retaining walls

1.2.3 Fenestration:

Fenestration systems represent the design, construction or presence of openings in a building.

[1] (NIBS Guideline 3-2012 Building Enclosure Commissioning Process BECx)

[2] ([Online] URL :http://www.etudier.com enveloppe architecturale)

[3]([Online] URL : https://energyeducation.ca/wiki/images/5/58/Building_Envelope.png)

1.2.4 Foundation:

The BELOW-GRADE WATERPROOFING, which is essential to the integrity of the entire building envelope environment. Correct installation of below-grade systems is critical in preventing foundation leaks. [3]

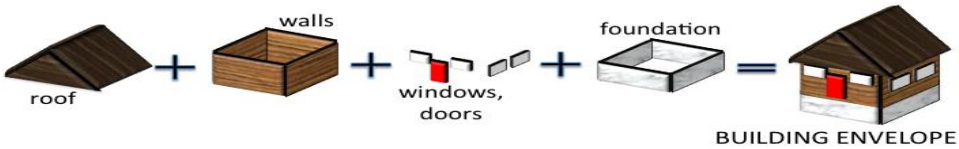


Figure 1. Architectural envelope components
Source ([Online] URL : https://energyeducation.ca/wiki/images/5/58/Building_Envelope.png **)**

1.3 Function of an architectural envelope

1.3.1 Support functions:

To support, resist, transfer and otherwise accommodate all the structural forms of loading imposed by the interior and exterior environments, by the enclosure, and by the building itself. [4]

1.3.2 Control functions:

to control, regulate and moderate all the loadings due to the separation of the interior and exterior. [4]

1.3.3 Finish functions

To finish the enclosure surfaces, the interfaces of the envelope with the interior and exterior environments. Each of the two interfaces must meet the relevant visual, esthetic, wear and tear and other performance requirements [4]

1.4 Environmental loads on architectural envelope

buildings are often classified according to the primary drivers for space conditioning loads. This translates into two major profiles of buildings: skin-load dominated; and internal load dominated. The design of the building enclosure must account for these characteristics to deliver thermal and visual comfort to the occupants.[5]

1.4.1 SKIN-LOAD DOMINATED BUILDINGS

A skin-load dominated building has the largest proportion of space conditioning energy loads determined by the building enclosure. It is characterized by a relatively low occupant density where internal heat generation is minimal ,natural ventilation and daylighting may be easily accomplished.[5]

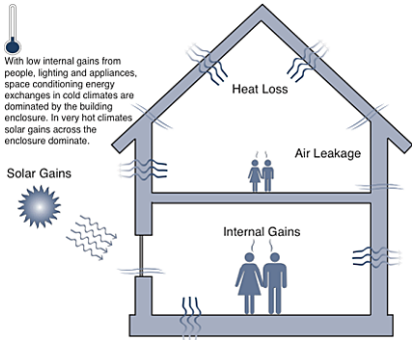


Figure 2. Skin-load dominated buildings benefit the most from high-performance building enclosures
Source ([Online] URL : https://www.wbdg.org/resources/building-enclosure-design-principles-and-strategies)

[4] ([Online] URL: https://www.buildingscience.com/documents/digests/bsd-018-the-building-enclosure_revised)
[5] ([Online] URL : https://www.wbdg.org/resources/building-enclosure-design-principles-and-strategies)

1.4.2 INTERNAL-LOAD DOMINATED BUILDINGS

Buildings that have high occupant densities and high internal gains from lighting and/or equipment are considered internal-load dominated buildings. Sometimes these are also referred to as a core-load dominated building. Regardless of climate type, the internal heat generation puts high demands on ventilation and cooling that are further driven by solar gains.[5]

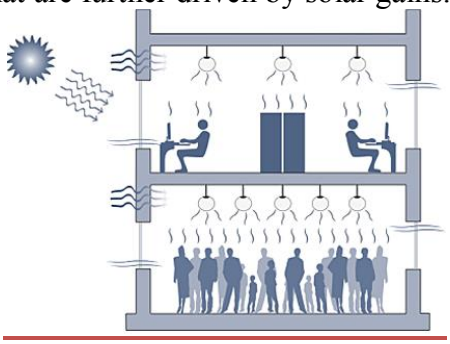


Figure 3 the energy performance of internal-load dominated buildings
is strongly influenced by the window-to-wall ratio
Source ([Online] URL: https://www.wbdg.org/resources/building-enclosure-design-principles-and-strategies)

1.5 Types of architectural envelope

1.5.1 Based on layers

Architectural envelope is categorized into two main types:

1.5.1.1 Single skin façade building envelope (air tight façade)

For façade systems consisting of a single layer, usually brick masonry walls , A single-stage system relies on the exterior "skin" to prevent leakage without a secondary system to manage water leakage[6]
these facades are classified by the building materials , such as :

1.5.1.1.1 Masonry veneer

It consists of a brick veneer, rigid insulation, and backup wall. There are options, as with any material, for brick sizes, colors, texture, and more. Other masonry types such as stone and CMU can be used instead of or with brick as well[7]

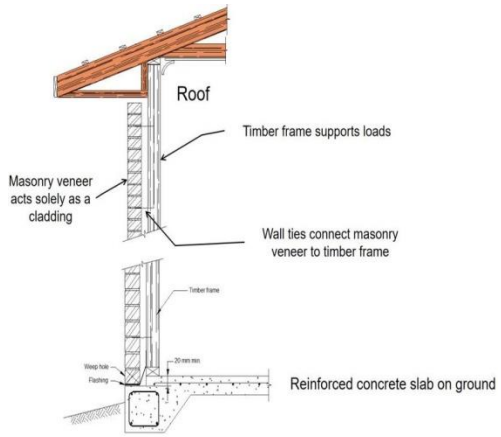


Figure 4 masonry wall details
Source([online] google image)

[6] ([Online] URL : https://www.buildings.com/articles/35451/total-building-envelope-concept)

[7] ([Online] URL : https://schmidt-arch.com/5-common-facade-systems-materials/)

1.5.1.1.2 Metal Wall Panels

Insulated metal wall panels can provide a higher R-value than typical wall construction with encapsulated insulation .supplemental framing may be required to support the façade.[7]

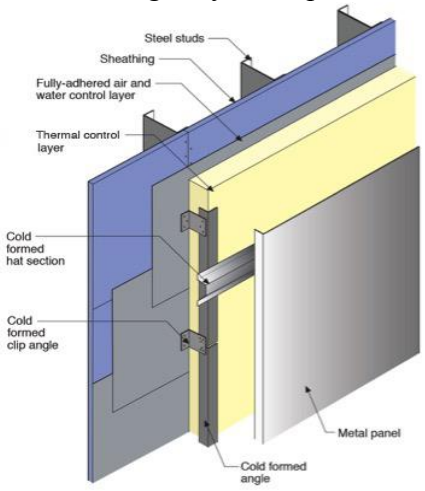


Figure 5 Metal wall panels components
Source([online] google image)

1.5.1.1.3 EIFS

Exterior insulation and finish system (EIFS) is a veneer system that insulates. The system generically consists of a rigid insulation board adhered to back-up wall construction with a sprayed-on, finish system. [7]

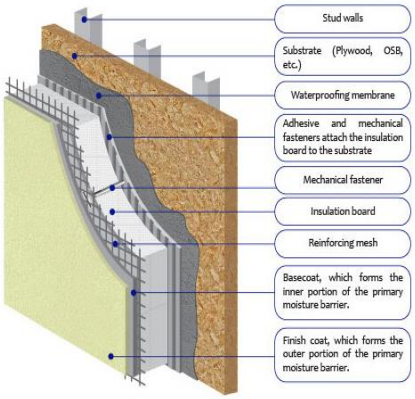


Figure 6 Exterior insulation and finish system components
Source([online] google image)

1.5.1.1.4 Cementitious (Fiber-Cement) Siding

Cementitious siding is becoming more and more prevalent in commercial buildings. The material is most comparable to wood lap siding, although it is also available as panels and panels made to look like lap siding or shakes. This façade systems hold up well under the elements and doesn't require much maintenance. It is available pre-finished or can be field-painted [7]

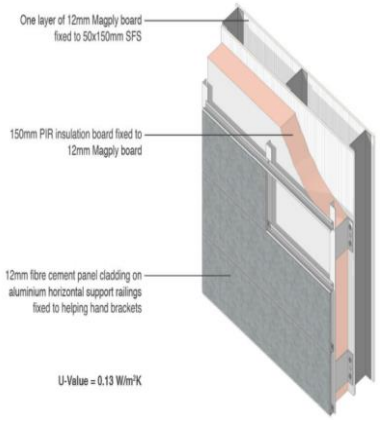


Figure 7 cementious siding panels datail
Source([online] google image)

1.5.1.1.5 Precast concrete

These panels provide an entire wall and structural system, and they can be effective when dealing with tight construction schedules. There are many options with precast concrete panels as far as appearance goes. The panels are built in a factory, delivered, and installed onsite. They are held in place with braces until the roof structure is in place[7]

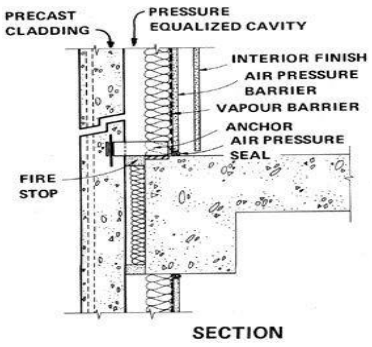


Figure 8 precast concrete panels assembly
Source([online] google image)

1.5.1.2 Double skin façade building envelope (ventilated façade)

1.5.1.2.1 Definition of double skin façade building envelope

Façade systems consisting of two layers, usually glass, wherein air flows through the intermediate cavity. This space (which can vary from 20 cm to a few meters) acts as insulation against extreme temperatures, winds, and sound, improving the building's thermal efficiency for both high and low temperatures , The extra skin can reduce cooling demand in summer and heating demand in winter[8].

1.5.1.2.2 Classification of double skin façade

These facades are classified based on different settings :

1.5.1.2.2.1 The partitioning of the façade [9]

This classification is based on the types of partitions of the exterior glazing , among the common types we mention :

[8] ([Online] URL: https://www.archdaily.com/922897/how-do-double-skin-facades-work#:~:text=Double%20skin%20façades.,flows%20through%20the%20intermediate%20cavity.&text=In%20cold%20climates%2C%20the%20air,a%20barrier%20to%20heat%20loss)
[9] ([Online] URL https://www.mdpi.com/1996-1073/12/14/2671/htm)

1.5.1.2.2.1.1 Corridor type Cavity:

It is a corridor in which one can walk through it .The cavities of each floor are separate from others ,It is not limited vertically .

1.5.1.2.2.1.2 Shaft box :

Composed of juxtaposed façade modules and vertical ventilation duct .The air is naturally drown into the ventilation ,duct and evacuated by means of the outlet located floors above.

1.5.1.2.2.1.3 Multi storey Cavity:

It is not partitioned either horizontally or vertically .The cavity is large enough to individual ,access for cleaning or maintenance There is high acoustic performance

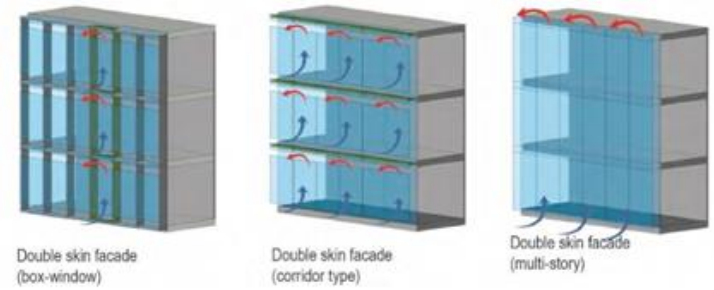


Figure 9 facade cavity diversities
Source([online] URL: https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings)

1.5.1.2.2.2 The types of ventilation [10]

Double-skin façades are adaptable to cooler and warmer weather. It is this versatility that makes them so interesting: through minor modifications, such as opening or closing inlet or outlet fins or activating air circulators, the behavior of the façade is changed. The airflow within the building is another factor that controls the type of façade that is being used.
The type of ventilation is divided into three main categories:

1.5.1.2.2.2.1 Natural ventilation [10]

In this kind of ventilation hot air moves upward, and air flows in the cavity, moreover the occupants have access to the air flow.

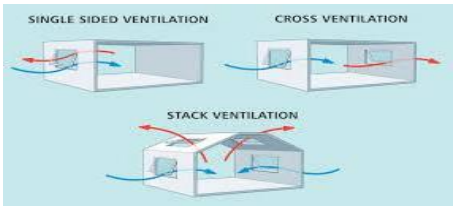


Figure 10 natural ventilation modes
Source([online] URL: https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings)

1.5.1.2.2.2.2 Hybrid ventilation [10]

Hybrid ventilation includes both natural and mechanical ventilation in which we use mechanical ventilation when natural ventilation is not sufficient or it cannot work properly.

[10] ([Online] URL https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings

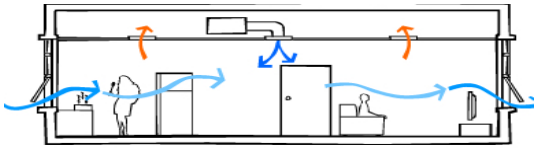


Figure 11 hybrid ventilaltion modes
Source([online] URL:
https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings)

1.5.1.2.2.2.3 Mechanical ventilation [10]

In mechanical ventilation, air flows with the aid of powered air movement component.

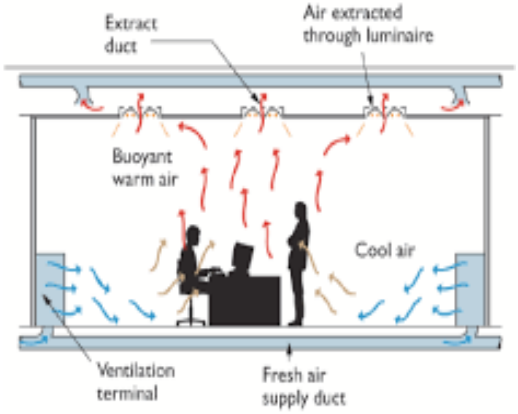


Figure 12 mechanical ventilation settings
Source([online] URL:
https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings)

1.5.1.2.2.3 The modes of ventilation of the cavity [11]

The cavity is the part of the façade that sets the mechanisms of air flow within the building , which controls the ventilation inside the room.

There are multiple modes for this regime , the most common ones are:

a. Indoor air curtain {1},{2} Air comes from the inside of the room and returned to the inside of the room, naturally or mechanically
b. Outdoor air curtain {3},{4} Air comes from the outside and evacuated toward outside
c. Air exhaust {5},{7} Air comes from the inside of the room and is rejected to the outside
d. Air supply {6},{8} The outdoor air flows to inside of the room or into the ventilation system
e. Open {9} Air can come from both out side and inside(no ventilation in cavity)
f. Close {10} Cavity forms a buffer zone between the inside and the outside

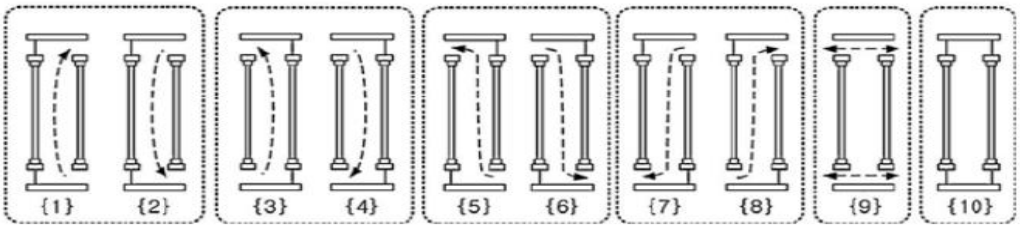


Figure 13 Six ventilation modes and ten airflow regimes (blind slats not drawn for clarity)
Source([online]URL:
https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings

[11] ([Online] URL
https://www.researchgate.net/publication/293333056_Classification_of_Double_Skin_Facade_and_Their_Function_to_Reduce_Energy_Consumption_and_create_sustainability_in_Buildings)

1.5.1.2.2.4 Based on load bearing [12]

This classification is mainly based on the weight of the overall façade material , it is mainly separated into two categories :

1.5.1.2.2.4.1 Lightweight architectural envelope[13]

The materials that are normally used for cladding include glass and metal, lightweight facades provide less heat and sound insulation, and they have higher maintenance costs in the medium and long term.

1.5.1.2.2.4.2 Curtain wall[14]

Curtain wall systems are non-structural cladding systems for the external walls of buildings. typically curtain wall systems comprise a lightweight aluminum frame onto which glazed or opaque infill panels can be fixed.

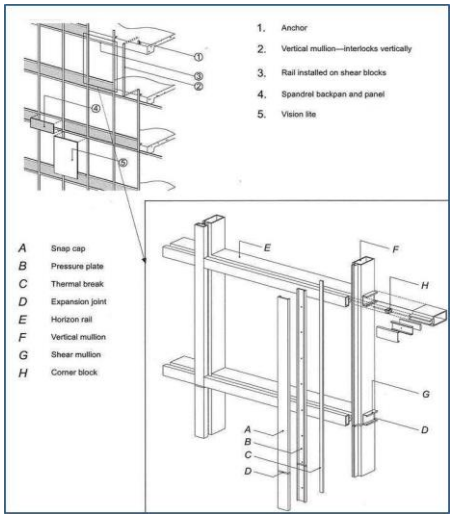


Figure 14 curtain walls components
Source([online] URL: https://www.designingbuildings.co.uk/wiki/Curtain_wall_systems)

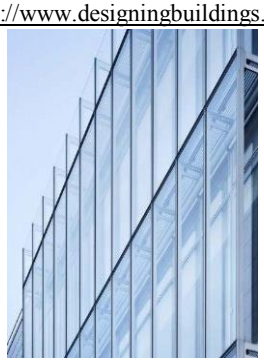


Figure 15 curtain wall a business building
Source([online] URL: https://www.designingbuildings.co.uk/wiki/Curtain_wall_systems)

1.5.1.2.2.4.2.1 Panel Façade

It means that the exterior of a building is covered with panels of different material than the cover-up. To maintain the structure, frame and exterior walls of a building. The panels are installed over other materials used in construction[15]

[12] ([Online] URL https://www.cupapizarras.com/int/news/types-of-facades/)
[13]([Online] URL https://www.architectmagazine.com/product/load-bearing-facade-systems_1)
[14] ([Online] URL: https://www.designingbuildings.co.uk/wiki/Curtain_wall_systems)
[15] ([Online] URL https://www.archdaily.com/69559/quadroclad%25e2%2584%25a2-glass-facade-panels-hunter-douglas-contract)

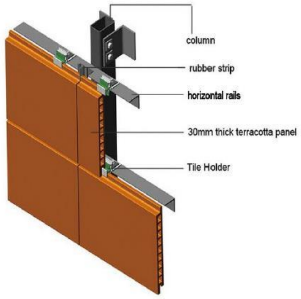


Figure 16 panel facade system detail
Source([online] URL: https://www.designingbuildings.co.uk/wiki/Curtain_wall_systems)

Figure 17 facade panels in different colors
Source([online] URL: https://www.designingbuildings.co.uk/wiki/Curtain_wall_systems)

1.5.1.2.2.4.3 Heavyweight Architectural envelope

This type of facade tends to be made up of construction materials of considerable weight. For a facade to be considered heavyweight, the average weight, including the solid and hollow elements, must be above 100kg per square meter. Within this category we find different types of facades which, depending on the thermal insulation needs, may be load-bearing or self-supporting and may or may not have an air chamber. It is divided into these categories :

1.5.1.2.2.4.3.1 Prefabricated façades

This type of facade is formed mainly of prefabricated modules that are joined together or assembled on-site. The components of these facades are manufactured industrially in highly mechanized plants, and they often use wood and concrete panels. [16]

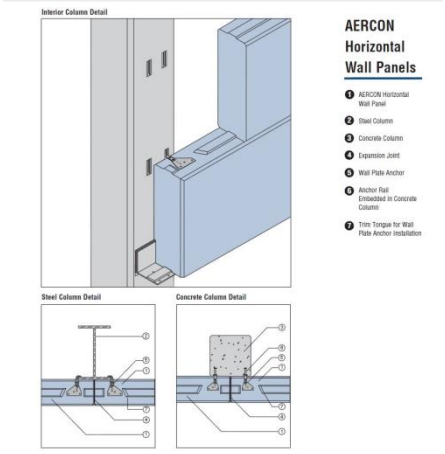


Figure 18 prefabricated facade pannels assembly detail
Source([online] URL: https://www.cupapizarras.com/int/news/types-of-facades/

[16]([Online] URL : https://www.archdaily.com/catalog/us/search/category/construction-materials-facade-systems-enclosures-double-skin-facades-panels-prefabricated-assemblies)

1.5.1.2.2.4.3.2 Traditional facades

This classification includes facades that use traditional construction materials such as brick, stone, wood, ceramics, rendering, etc. On the other hand, since classic facades do not have an air chamber or insulation, they provide less heat and sound insulation, which means fewer energy savings. [17]

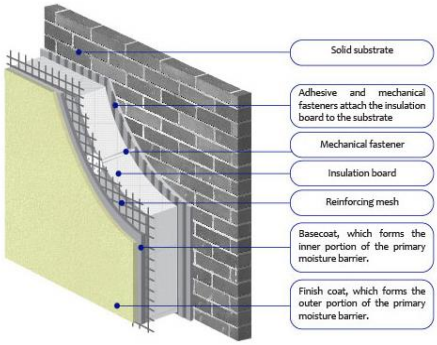


Figure 19 traditional facade system materials setting
Source([online] URL: google.image.com

1.5.1.2.2.4.3.3 ETI Systems

External Thermal Insulation systems consist of installing plates of insulation material all around the building. The most frequently used materials in the insulation aspect of an ETI system are expanded polystyrene , extruded polystyrene graphite expanded polystyrene and mineral wool .it reduces thermal bridges and the risk of condensation.

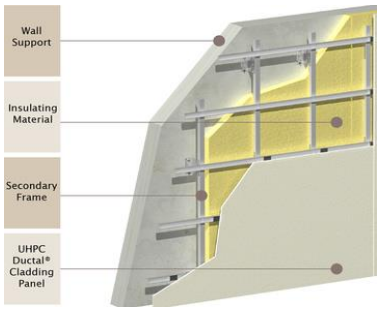


Figure 20 external thermal systems setting
Source([online] URL: google.image.com

1.5.1.2.2.4.3.4 Rainscreen cladding

Ventilated facade system is made up of a load bearing wall, an insulation layer and the cladding material, which is fixed to the building using a supporting structure .The main difference between this and the ETI system is that it has an air cavity between the load bearing wall and the cladding material. [18]

[17]([Online] URL: https://elzinc.es/en/installer/installation-systems/traditional-facade-systems/)
[18] ([online] URL: https://www.cupapizarras.com/int/news/types-of-facades/)

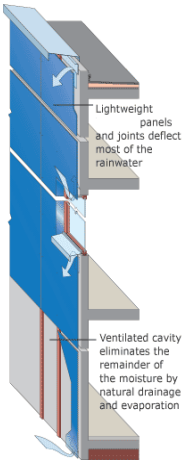


Figure 21 rainscreen cladding system components
Source([online] URL: https://www.cupapizarras.com/int/news/types-of-facades/

1.5.1.2.2.5 Based on shape

The forms that compose the envelope are main contributors when it comes to giving the façade an identity , these two factors led to the creation of many types of envelopes , from which we mention :

1.5.1.2.2.5.1 Sculptural envelope

The liaison between architecture and sculpture has been known for as long as we could remember ,The modern movement has even associated these two disciplines .[19]

Figure 22 : Ronchamp Chapel, Corbusier
Source([online] URL: google.image.com

Figure 23 Guggenheim museum
Source([online] URL: google.image.com

1.5.1.2.2.5.2 Biomorphic envelope

Biomorphic architecture is intended to be the heir to F.L. Wright's organic architecture through its relationship with nature. Two attitudes can be distinguished, the Blob architecture and the digitized environment.[20]

[19] A book (COMBES CYRIL.2008. Vers de nouvelles enveloppes. Séminaire FINC-AV. Ecole Nationale Supérieure d'Architecture Toulouse.2008 page 11)

1.5.1.2.2.5.3 organic envelope

We will first recall the origins of organic architecture. Almost a hundred years ago F.L. Wright created many buildings in harmony with the environment

Figure 24 Wterfall villa
Source([online] URL: google.image.com

1.5.1.2.2.5.4 Blob envelope

The shape of the envelope of blobs is soft and often inspired by nature the term blob is first used by Gregg Lynn in 1995 These soft shapes are generated by programming 3D software[20]

Figure 25 Blob envelope
Source([online] URL: google.image.com

Figure 26 blob envelope
Source([online] URL: google.image.com

1.5.1.2.2.5.5 Based on texture

In the past few years , the texture of an envelope has become related to the latest trends in architecture , because it promotes the building's envelope to become more modern and up to date , the types are constantly changing , the most commonly used are :

1.5.1.2.2.5.6 pixilated envelope

A double skin that gives different appearances depending on the position and the brightness from which you look at it[21]

[20] COMBES CYRIL.2008. Vers de nouvelles enveloppes. Séminaire FINC-AV. Ecole Nationale Supérieure d'Architecture Toulouse.2008 page 15

[21] COMBES CYRIL.2008. Vers de nouvelles enveloppes. Séminaire FINC-AV. Ecole Nationale Supérieure d'Architecture Toulouse.2008 page 26

Figure 27 Torre Agbar and Glories
Source([online] URL: https://www.shbarcelona.fr

1.5.1.2.2.5.7adaptive envelope

These envelopes are described as a building skin, which is able to alter its properties and control the various parameters of a building skin. These changes are operated based on change in the climatic loads or changed indoor environment, so it can enhance the occupants' comfort [22]

Figure 28 : adaptative envelope design
Source([online] URL: google.image.com

[22] Source([online] URL: https://www.sciencedirect.com/science/article/pii/S1110016818302230)

2 Light ambiance

2.1 Definition of light

Light as a physical entity

According to André Grand champs (2005): "Light is a form of energy, just like electricity or heat. It is made up of tiny particles called photons and moves in a wave form. Light is actually generated by the vibrations of electrons in atoms. "

Light has a visible spectrum, is radiation with a wavelength between 380 and 760 nanometers, and continuous in shape. (De Herde and Liébard. 1996).

Light is a physical phenomenon that can produce a visible spectrum, it is a mixture of electric and magnetic waves: so we say that light is an electromagnetic wave. [23]

Light in architecture

"Light is positioned as a design tool and as a technical factor. "(Reiter and De Herde. 2003).

Light in architecture is a major functional and aesthetic component. It is essential to enhance a building or an interior. (Van Uffelen. 2003)[24]

2.2 Importance of light

2.2.1 Forming functional zones

Light can be used to emphasize individual functional zones in an area, e.g. traffic areas, waiting areas, and exhibition areas. Zonal lighting with delineated beams of light visually separates one area from another. Different illuminance levels establish a perceptual hierarchy and direct the viewer's gaze. The differentiation of light colors creates contrasts and emphasizes individual zones.[24]

2.2.2 Defining spatial borders

Floor illumination emphasizes objects and pedestrian surfaces. Vertical spatial borders are emphasized by illuminating wall surfaces. Uniform light distribution emphasises the wall as a whole, whereas accentuating, grazing light gives the wall structure by adding patterns of light. Bright walls create a high level of diffuse light in the room. [25]

2.2.3 Emphasizing architectural features

The illumination of architectural details draws attention away from the room as a whole towards individual components. Columns appear as silhouettes in front of an illuminated wall. Narrow-beam downlights emphasize the form of the columns. Grazing light accentuates individual elements or areas and brings out their form and surface texture. [25]

2.3 Types of light

The types are controlled by many settings, from which we mention :

2.3.1 Based on function

The type of activity influences the choice of lighting in the space , this is why these types of lighting are used:

2.3.1.1 General lighting

These types of lighting sources provide basic lighting requirements to create an accessible space where users can move around easily in a safe way. Recessed ceiling lights, or overhead ceiling fixtures can meet general lighting needs. General lighting can sometimes be the existing lighting or part of the new lighting design plan[25]

---

[23] Aicha MESSAHAL Chahira HEDDOUR Wissam FENIZA master memoir Université Mohamed Seddik BENYAHIA – Jijel)

[24]([online] URL https://www.erco.com/guide/designing-with-light/lighting-interior-spaces-1848/en/?gclid=Cj0KCQiAjKqABhDLARIsABbJrGmDH3cIjuao5C__R_OXG2frri_ACXB-opCcEDUV-LtQC0N9Ch-iHEQaAlZmEALw_wcB)

[25] ([online] URL https://m.dkorinteriors.com/lighting-modern-interior-design/)

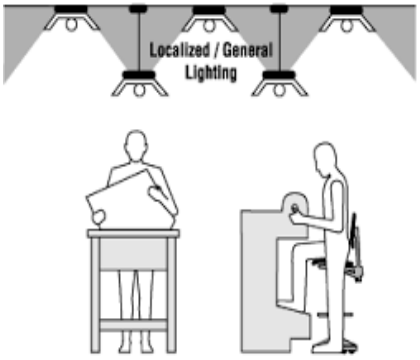


Figure 29 General lighting scheme
Source([online] URL: google.image.com

2.3.1.2 decorative / accent lighting

Accent lighting is a resource used in modern interior design that can highlight certain elements like paintings, sculptures, an entrance or an architectural feature. Often times, accent lighting may be it's own unique design element that is the showpiece of the space such as an elegant chandelier, or dramatic pendants[26]

Figure 30 accent lighting scheme
Source([online] URL: google.image.com

2.3.1.3 task lighting

Task lighting allows us to place appropriate light sources where it is most needed, illuminating specific areas and providing visibility for activities such as reading, cooking, dressing, or doing homework. Focus on areas above kitchen counters, bathroom vanities, desks, or next to bedsides or chairs to determine the task light that is most appropriate[26]

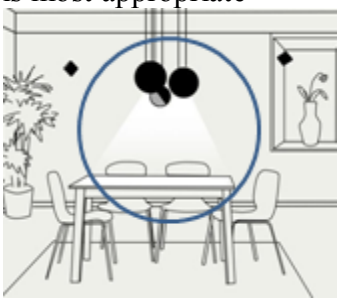


Figure 31 Task lighting scheme
Source([online] URL: google.image.com

2.3.2 Based on lighting scheme

The light flux is a crucial element that helps link the place to an activity , it is mainly distributed according to five schemes , which are :

2.3.2.1 Direct lighting

It is most commonly used type of lighting scheme. In this lighting scheme more than 90 percent of total light flux is made to fall directly on the working plane with the help of deep reflectors. Though it is most efficient but causes hard shadows and glare. It is mainly used for industrial and general out-door lighting[26]

Figure 32 Direct lighting scheme
Source([online] URL: google.image.com

2.3.2.2 Indirect lighting

In this light scheme more than 90 percent of total light flux is thrown upwards to the ceiling for diffuse reflection by using inverted or bowl reflectors. In such a system the ceiling acts as the light source, and the glare is reduced to minimum. The resulting illumination is softer and more diffused, the shadows are less prominent and the appearance of the room is much improved over that which results from direct lighting.[27]

Figure 33 indirect lighting scheme
Source([online] URL: google.image.com

2.3.2.3 Semi-direct lighting

In this lighting scheme 60 to 90 percent of the total light flux is made to fall downwards directly with the help of semi-direct reflectors, remaining light is used to illuminate the ceiling and walls. Such a lighting system is best suited to rooms with high ceilings where a high level of uniformly distributed illumination is desirable. Glare in such units is avoided by employing diffusing globed which not only improve the brightness towards the eye but improve the efficiency of the systems with reference to working place[27]

Figure 34 Semi direct lighting scheme
Source([online] URL: google.image.com

2.3.2.4 Semi indirect lighting

In this lighting scheme 60 to 90 percent of total light flux is thrown upwards to the ceiling for diffuse reflection and the rest reaches the working plane directly except for some absorption by the

[26] ([online] URL https://www.engineeringenotes.com/physics/illumination/lighting-schemes-types-and-design-illumination-physics/24106)

bowl. This lighting scheme is with soft shadows and glare free. It is mainly used for indoor light decoration purposes[27]

Figure 35 Semi indirect lighting scheme
Source([online] URL: google.image.com

2.3.2.5 diffused lighting

In this lighting scheme , light that has an even concentration of light across the beam. It's as if someone threw a light blanket on the object. Whatever is illuminated is illuminated evenly.[27]

Figure 36 Diffused lighting scheme
Source([online] URL: google.image.com

2.3.3 Based on lighting fixtures

Which is divided into two types :

2.3.3.1 Uniform lighting

Uniform illumination bathes horizontal surfaces in light , typically a general lighting technique , it also adds a dramatic impact to a space[27]

2.3.3.2 Non-uniform lighting

Non-uniform downlighting uses less light sources and delivers a more "individualized" beam spread of light . this lighting technique creates a more interesting visual effect in a space as the beams do not overlap as in general uniform downlighting [28]

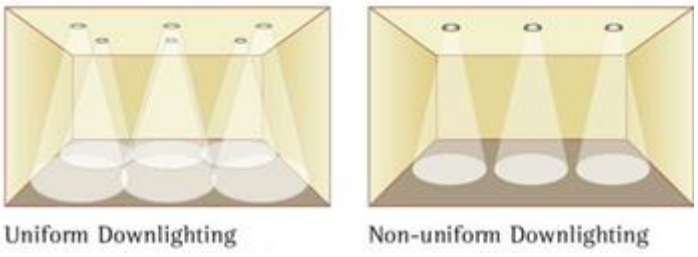


Figure 37 light fixture settings
Source([online] URL: https://fmlink.com/articles/lighting-methods-works-best-different-situations/

2.3.4 Based on direction

2.3.4.1 Side illumination

This means that one side of a subject will be lit and the other side will be in shadow. In terms of helping to convey a subject's shape and form this is ideal. Of the three directions, side lighting creates the strongest sense that a subject has three dimensions.[28]

[27] ([online] URL https://fmlink.com/articles/lighting-methods-works-best-different-situations/)

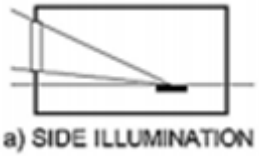


Figure 38 Side illumination scheme
Source([online] URL: google.image.com

2.3.4.2 Top lighting

Also called vertical illuminance , it is the amount of light falling on a vertical surface or plane. In the conference room below, the projection screen surface was chosen as the vertical surface.[29]

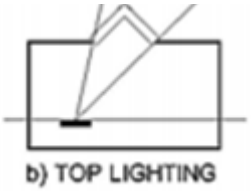


Figure 39 Top lighting illumination scheme
Source([online] URL: google.image.com

2.3.4.3 Hybrid (combined) lighting

Hybrid lighting is a method of lighting that mixes the use of both side and top lighting [30]

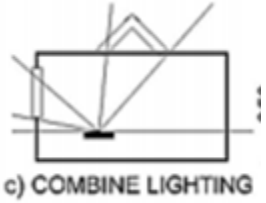


Figure 40 Combined lighting scheme
Source([online] URL: google.image.com

2.3.5 Based on intensity

We can distinguish many types , like :

2.3.5.1 Hard light

It leaves hard-edged shadows – they are well defined with a clear border. The best example is the shadow from sunlight in a clear sky.[30]

2.3.5.2 Soft light

It leaves blurry-edged shadows. When they're slightly soft you can still make out the shape of the object casting the shadow. A super soft light almost makes believe there's no shadow, the best example being an overcast day. [31]

[28] ([online] URL https://www.learningwithexperts.com/photography/blog/understanding-lighting-direction#:~:text=Side%20lighting,-Side%20lighting%20is&text=This%20means%20that%20one%20side,a%20subject%20has%20three%20dimensions.)
[29] ([online] URL https://iarc.uncg.edu/elight/learn/qualitative/la_sub/vertical.html)

[30] ([online] URL: https://wolfcrow.com/what-is-hard-light-soft-light-and-diffused-light/)

Figure 41 Lighting intensity types
Source([online] URL: google.image.com

2.3.5.3 Specular light

It is light that is brighter at the center and then tapers off at the edges. The entire beam doesn't have an even concentration of light. The light from a torchlight is the best example of this.[31]

2.3.5.4 Diffused light

It is light that has an even concentration of light across the beam. It's as if someone threw a light blanket on the object. Whatever is illuminated is illuminated evenly[31]

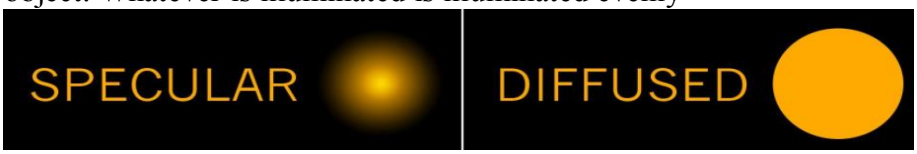


Figure 42 Lighting intensity types
Source([online] URL: google.image.com

2.3.6 Based on source

Simply it is about Where the light comes from , it is based on two sources :

2.3.6.1 Artificial light

It includes man-made lighting used in offices and homes, such as fluorescent or incandescent, in addition to flash.[31]

Figure 43 Types of light bulbs
Source([online] URL: google.image.com

2.3.6.2 Natural light

2.3.6.2.1 Definition of natural light

According to Chauvel and Deribere (1968) "the lighting produced by the canopy of the sky, excluding the lighting produced by the sun. However, in some cases global lighting is considered, but it should always be clarified that this is including light coming directly from the sun or reflected from sunny surfaces.

"Daylighting is the light that is produced by the sky and reflections from the environment, excluding direct sunlight." (Bouvier et al. 2008).[32]

[31] ([online]URL : https://www.slideshare.net/renurajbahak/artificial-lighting-64304254 **)**
[32] ([online]URL : https://www.velux.com/what-we-do/research-and-knowledge/deic-basic-book/daylight/daylight

2.3.6.2.2 types of natural light

2.3.6.2.2.1 zenithal light

Zenithal light is the name we call every the light that comes from an upper source , a light which corresponds to ceiling openings, this type of lighting is divided into two main settings :

2.3.6.2.2.1.1 Direct zenithal light

2.3.6.2.2.1.1.1 skylight

It is arranged horizontally, it is exposed to a larger portion of the sky visible from inside the room, without any obstruction and with a higher luminance. It also provides uniform interior lighting. (Boudoukha, 2015).[33]

Figure 44 Skylight openings lighting
Source([online] URL: google.image.com

2.3.6.2.2.1.1.2 dome

the domes do not require a heavy structure and they achieve the goal in terms of direct daylight factor with an area of about 10 % of glazing index. However, they do not prevent solar penetration and consequently glare. (Benharkat. 2006)[34]

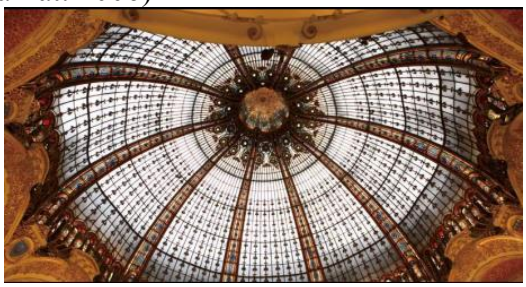


Figure 45 Dome lighting as part of religious experience
Source([online] URL: google.image.com

2.3.6.2.2.1.2 Indirect zenithal light

2.3.6.2.2.1.2.1 Sawtooth or sheds

These devices allow uniformity of illumination by avoiding direct sunlight, the sheds consist of a transparent or translucent surface called "opening" (which will face north), which collects natural light to bring it inside a room. (Chabane. 2017)[35]

[33] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master , Université Mohamed Seddik BENYAHIA – Jijel

[34] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master , Université Mohamed Seddik BENYAHIA – Jijel

Figure 46 light shed parameter
Source([online] URL: google.image.com

Figure 47 ABC museum lighting scheme
Source([online] URL: google.image.com

2.3.6.2.2.1.2.2 Clerestory

A clerestory is a high section of wall that contains windows above eye level. The purpose is to admit light, fresh air, or both.[35]

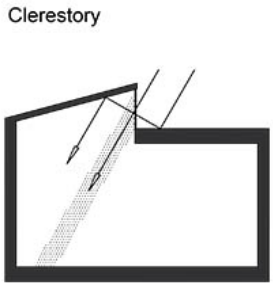


Figure 48 Clerestory lighting scheme
Source([online] URL: google.image.com

2.3.6.2.2.1.2.3 Roof monitor

It is defined as a raised window or a construction straddling the ridge of a roof and having windows or louvers for lighting or ventilating a building [36]

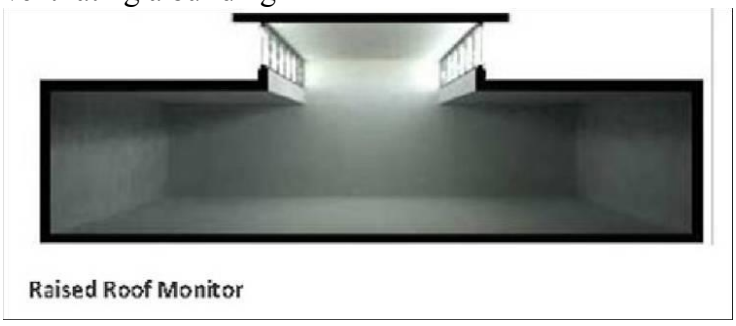


Figure 49 Roof monitor lighting scheme
Source([online] URL: google.image.com

[35] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master;Université Mohamed Seddik BENYAHIA – Jijel

[36] ([online]URL : https://www.thefreedictionary.com/monitor+roof

2.3.6.2.2.2 lateral light

Lateral light is the light that comes from sideway sources .its types are :

2.3.6.2.2.2.1 unilateral light

it's the light that is provided by a single vertical opening or many openings that are installed in a single façade

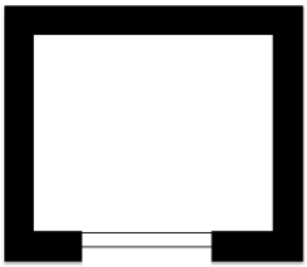


Figure 50 Unilateral lighting scheme
Source([online] URL: google.image.com

2.3.6.2.2.2.2 Bilateral light

It consists of having vertical light sources in two opposed walls , whether they were parallel or perpendicular .[37]

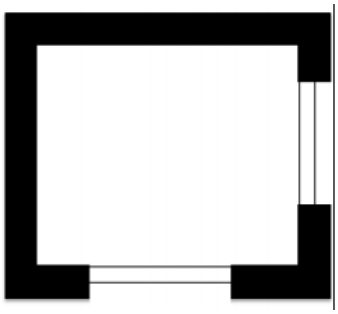


Figure 51 Bilateral lighting scheme
Source([online] URL: google.image.com

2.3.6.2.2.2.3 Multilateral light

It means , having many vertical openings , installed in more than two walls in the same space [38]

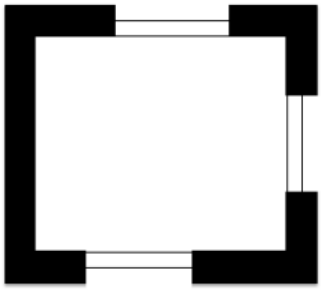


Figure 52 Multilateral light
Source([online] URL: google.image.com

2.3.6.2.2.2.4 composed light

Composed light is a combination of lateral light and zenithal , therefore , we can find openings on the walls and also the ceiling [38]

[37] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master;Université Mohamed Seddik BENYAHIA – Jijel

Figure 53 Composed light scheme inside a commercial building
Source([online] URL: google.image.com

2.4 Lighting performance criteria

The main three basic visual effects in order to design the lighting of any space are :

2.4.1 Focal Glow

Understood as the light that an object, a surface or a detail, the light that attracts attention[38]

2.4.2 Ambient Luminescence

It is the continuous light like that of a foggy sky, it is completely even and uniform without shadows. [39]

2.4.3 Play of Brilliants

The shinning effect of light reflected on a brilliant surface, like the sun on a water spot or the glass drops of a chandelier

The balance of these three elements will create a visually appropriate light scene accordingly to the character and use of a space.[39]

Other settings may olso be taken under consideration in order to improve lighting performance these settings are :

1. Rated input power (P in Watt)
2. Rated luminous flux (flux Φ in Lumen)
3. Rated luminous efficacy (η in Lumen per Watt)
4. Rated luminous intensity distribution (in candela or candela per kilolumen)
5. Rated correlated colour temperature (CCT in Kelvin)
6. Rated colour rendering index (CRI) [39]

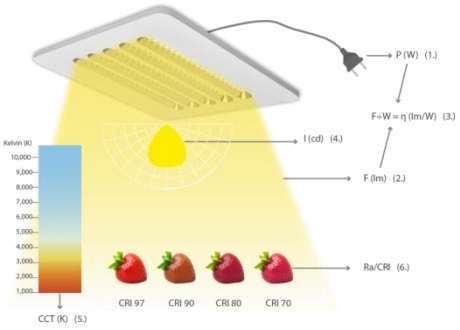


Figure 54 Artificial lighting settings
Source([online] URL: https://www.etaplighting.com/en/news/eight-parameters-to-compare-lighting-solutions

[38] ([online]URL : https://light2015blogdotorg.wordpress.com/2015/01/27/light-in-architecture/)
[39] ([online]URL: https://www.etaplighting.com/en/news/eight-parameters-to-compare-lighting-solutions)

2.5 Light ambiance

2.5.1 Definition of light ambiance

Light ambiance is defined as how all aspects of the light environment affect a subject. Three dimensions constitute this ambiance: light, architectural object and subject. (MATALLAH, 2015) At Narboni, for whom light ambiance is defined as "the result of interaction between one or more lights, an individual, a space, and a use ". (Narboni, R, 2006)[40]

2.5.2 Role of light ambiance

Natural light, creating ambiances : light ambiance can be defined as a sensitive relationship to the world, the atmosphere of a place, of a building, of a room touches the sensitivity of each person by appealing to their senses (visual, sound, olfactory) this is intangible and is part of the spirit of the place. "I enter a building, I see a space, I perceive the ambiance and in a fraction of second, I have a sense of what the ambiance is affecting our emotional perception. "(Zumthor, 2008)[41]

2.5.3 Types of light ambiance

We can distinguish three basic categories of lighting environment. This classification is made according to the degree of luminosity of a space:

Category 1: The penumbra dialogues between the shadow and a "solid" light which pierces it in places. (Gallas, 2009). In recent decades, penumbra in architecture seems to have become an effective language for technological and environmental connectivity. Thus, the variables imposed on the container are educated in the settings of bright environments to adjust new gradients for light and shade[41]

Figure 55 Architectural penumbra
Source : (Anna Barbara .s.d)

Category 2 :The luminescent ambiance or ambient light, omnipresence of a light that tends to disappear because it is everywhere. (Daich, 2011)[41]

Figure 56 The luminescent ambiance
Source : ((Sigrid Reiter and al)

[40] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master;Université Mohamed Seddik BENYAHIA – Jijel

Category 3: The flooded ambiance which is the exaltation of the light which sets the whole space ablaze, too full of an invading and sometimes overwhelming light, however each of these types of ambiances covers a great variety of ways of admitting light and a multitude of qualities of light. [41]

Figure 57 The flooded ambiance
Source : ((Sigrid Reiter and al)

2.5.4 the light ambiance and uses

A light ambiance can be characterized as being the result of an interaction between an individual, a known or supposed use, natural light and a space. The report which Combining natural light with use concerns the quality and quantity of light entering the space concerned. The link between natural light and space concerns the effects of the latter, two different spaces will not reveal light in the same way, their geometry will guide in a singular way specific to the space. The relationship between space and the use of the place concerns the lighting devices to be put in place. (Aurélia, 2012). [41]

2.5.5 Light ambiance configuration

2.5.5.1 the relationship with space

Light creates a relationship between the inside and the outside. LOZOYA Luis once said "Lighting is the only intangible aspect of architecture" because light is intangible. The feeling of space depends on the way in which the light reveals its limits, that is to say the architectural element that changes the perception of spaces, gives them a smaller, larger, warmer, colder dimension. . (Bendekkiche, 2017) [41]

Figure 58 Exposition hall in Barcelone
Source : (Google images)

2.5.5.2 the relationship with the shape and dimension of the space

The quality of light is obviously linked to the structure of the space. It is neat and direct in the closed space, much more diffuse in the open space. Le Corbusier was one of the only architects to deal with. Light also influences the proportions of a space, The perception of the proportions of the space is modified by the play of light on its walls [41]

[41] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master;Université Mohamed Seddik BENYAHIA – Jijel

Figure 59 Ronchamp Chapel ,Corbusier
Source : (Google images)

2.5.5.3 the relationship with structure

The structure has a decisive influence on the character of a lighting environment. When we choose the structure of a building, we also decide on its light. The relationship between any structure and light may seem obvious.[42]

2.5.5.4 the effect of building materials

The perception of a material sometimes turns out to be different depending on the orientation of the light or the position of the observer in relation to the analyzed object. In architecture, the light is considered one of the most beautiful materials; on the other hand, materials are keys to understanding the behavior of light because they directly affect its quantity and quality.[42]

Figure 60 The use of different materials based on how they receive and reflect light
Source : (Google images)

2.5.5.5 the effect of colors

Colors have a huge effect on the feeling of space and on the lighting environment .The colored radiations emitted by objects and the environment can also produce certain psycho-physiological effects on the nervous system. Thus, the colors of long wavelengths (red and orange) have a stimulating effect while those of short wavelengths (blue and purple) have a calming effect. The intermediate colors yellow and green have, like white, a tonic effect favorable to concentration. Dark colors and gray, on the other hand, have a depressing effect. (DAICH, 2011)[42]

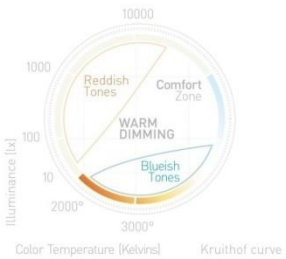


Figure 61 Kruithof diagram
Source : (European Light norms)

[42] Asma HARROUCHE Imad ZAHARIOU Oussama BAZENIAR memoir master;Université Mohamed Seddik BENYAHIA – Jijel

3 Fitness Center : sport

3.1 Definition of sport

Sport is a set of physical activities based on effort and re-training, practiced according to specific rules in the form of individual or group games that can give rise to competitions. The term "sport" is rooted in the Old French word "sport" which means entertainment, physical or spiritual pleasure ".[43]

3.2 Importance of sport

The purpose of sport is :
-The physical and moral development of citizens and the preservation of their health.
-Youth education and its cultural and social promotion.
-The enrichment of the national cultural and sporting heritage.
- The fight against social evils by promoting moral values linked to sports ethics.
-The worthy representation of the nation in the concert of the international sporting confrontation[44]

3.3 Types of sport

Tableau 1 sport activity types

Sport type	**Example**
Outdoor sports	Mountain climbing , jogging
arenas	Martial arts , boxing
Group sports	Football , basketball, rugby
Target sports	Golf , bowling
Gymnastic sports	Trampoline , aerobics , fitness
Mechanical sports	Carting , motocross, rally

3.4 Types of sport activity

The practice of a sport can be broken down into three types of activities: training and Competition and recovery.
Training : Aims to train and train the practitioner so that his performance increases. For be beneficial, training should be spread over a series of regular, progressive sessions and complementary to each other.
The competition : Its objective is to measure athletes against each other and to reward the best. For many sportsmen, competition is the strongest and most enjoyable moment in the practice of sport.
Recovery and relaxation: The objective of these sessions is to give the athlete's body the time and rest necessary for it to gets back into shape to produce the best efforts[45]

3.5 Sport facilities

3.5.1 Sport facilities definition

A sports equipment is a spatial arrangement or a construction allowing the practice of one or more sports. Most often these facilities are called pitch (football, handball, basketball, tambourine, etc.) but they sometimes have a specific name.A sports complex is a set of magnificent constructions which are harmoniously pragmatic and aesthetic, which combine balanced way between various functions, social diversity and economic issues.[46]

[43] Benguedda Wissem et Selka Naziha, 'Sport de santé et bien- être',Master memoir, Université AbouBakr Belkaid – TLEMCEN, 2013
[44] (Gaouar Younes, Benhamadi Abdelhakim, op.cit., p24)
[45] (Bengeudda Wissem et Selka Naziha, op.cit., p32)
[46] (Mebarki Imane, 'le sport', master memoir, université de Abou-Bakr Belkaid-Tlemcen, 2016)

Figure 62 Sport Complex
Source([online] URL: : http://www. pinterest.com)

3.5.2 Sport facilities classification

3.5.2.1 Based on space

Covered equipment with a large room or a juxtaposition of rooms
Specific covered equipment (tennis courts)
Outdoor equipment
Above ground equipment (paris-plage)
The diverted sites (climbing wall on a viaduct)
Demountable, mutable sites.[47]

3.5.2.2 Based on function [48]

Stadiums

Les stades sont des installations comportant un ou plusieurs terrains de compétition associés, accompagnés d'aménagement plus ou moins important pour les spectateurs, En fonction de leur destination et de leurs équipements, on peut classer les stades en deux catégories principales : Les stades spécialisés : Ils permettent la pratique d'une seule activité sportive (tennis, athlétisme, rugby, football).

Pools

The swimming pools are facilities which allow: Learning, swimming and improvement.
-Training and competition (diving, synchronized swimming).
-Individual practice of swimming and diving, relaxing bathing.

Gyms

Specialized halls: -they are intended for a single sporting activity: for example certain gyms are designed for the exclusive practice of basketball.

Multisport halls

They are intended for several sports activities: this is the most common case. A sports hall essentially depends on various activities that one wants to exercise at a practical level (competition, training, school sports, initiation, relaxation.[49]

3.6 Sport in Algeria

The sport in Algeria really begins during the French colonization. Several disciplines are practiced and many competitions are launched after independence, Algeria continues to stay on course to develop several sport disciplines such as football, volleyball, handball, martial arts (taekwondo, judo, karate, full contact, etc.), athletics, swimming, tennis, cycling, boxing, rowing, sailing.[49]

[47] (Mebarki Imane, op.cit., p39)
[48] (Mourid Oussama, Abiayadmounir,'complexe olympique', master memoir, université de Bejaia, 2015)
[49] (Mebarki Imane, 'le sport', Master memoir, université de Abou-Bakr Belkaid-Tlemcen, 2016)

3.7 Fitness center

3.7.1 Fitness center definition

A fitness center is a place where people go to do physical exercise in order to stay or become healthy and fit [50]

3.7.2 Fitness history

• In 1847, a “gymnasium” was opened to the public in Paris by a certain Hippolyte Triat. However,the first "Heath club", as it is understood today, is located in Santa Monica, California, in 1947.

• For a long time, fitness rooms had areas of 600 m2, even 1000 m2.

The current trend is to create more intimate, less expensive, easier to finance, human-sized clubs of around 200 m2.[51]

3.7.3 Fitness center types

Fitness centers are divided into thre main categories , based on the types of the services each one offers :

3.7.3.1 Health club :

They focus is on the whole-body wellness rather than just physical fitness. there are individual and group classes, various amenities such as swimming pools, designated spaces for group sports such as basketball and volleyball, healthy food bars

3.7.3.2 Full body fitness

offers a range of group classes and individual workout programs. Whole-body health and fitness is also promoted by various amenities such as physical therapy, saunas, steam rooms, warm-up and cool rooms

3.7.3.3 Gyms

A typical gym is a place where you focus on weight lifting and similar activities[51]

3.7.4 Fitness center forms

3.7.4.1 Classical activities

Strength training
Cardio training
Group workout
Dance classes
Weight lifting

3.7.4.2 Possible diversification

Aqua gym
Beauty salon
Massage
Sauna
Martial sports
Dietetic sports [52]

[50] (Gaaouar Younes, Benhamadi Abdelhakim,‘Complexe de Formation Sportive’, Master memoir, Université Aboubakr Belkaid– Tlemcen, 2012)

[51] ([online]URL : https://fitathletic.com/health-clubs-san-diego/)

[52] (Sebbag Farah, Mansouri Zineb, ‘Centre de remise en forme’, master memoir, Université Aboubaker Belkaid– TLEMCEN, 2013)

3.7.5 Fitness center requirements

3.7.5.1 Wet zones

3.7.5.1.1 Sauna/ Hammam

A relaxation area, equipped with a sauna and a hammam, where you can relax and recover after your sports activities.

Figure 63 Sauna room
Source : (Google images)

3.7.5.1.2 massage area

They have a toning effect on the skin and muscles, accelerate blood circulation and the elimination of toxins

Figure 64 Massage activity
Source : (Google images)

3.7.5.2 Dry zones

3.7.5.2.1 Weight training

The weight training area is made up of 20 workstations, where you can exercise all of your muscles machine or free (bars and dumbbells)

Figure 65 Weight training equipment
Source : (Google images)

3.7.5.2.2 Cardio training

Composed of the devices: bicycles, pedal boats, cycling, carpets running, stepper, cross trainers and rowers on which you can develop your cardiovascular qualities

Figure 66 Cardio training machines
Source : (Google images)

3.7.5.2.3 Fitness training

Classes focused on muscle strengthening (thighs, buttocks, body bars, etc.), cardiovascular (step, body-tonic, etc.) and flexibility (stretching)

Figure 67 Fitness training equipments
Source : (Google images)

3.7.5.2.4 Yoga

Oriental relaxation technique which is based on the postures adopted by the body on breathing and on the search for inner and outer relaxation. [53]

Figure 68 Yoga area
Source : (Google images)

3.7.6 Fitness center design guidelines

3.7.6.1 Architectural identity

The shape, color, material, lighting and finishes must express the active and energetic functions of the fitness center. The function of the building, as a fitness center, should be apparent in the appearance of the building. The main entrance should be an identifiable focal point. Consider grouping high-rise spaces. The volume of the building must be linked tosurrounding structures [54]

3.7.6.2 Location

Preferably, the fitness center should be located near dormitories, accommodation, community centers, outdoor sports facilities / fields and other compatible facilities.

[53] (Sebbag Farah, Mansouri Zineb, 'Centre de remise en forme', master memoir, Université Aboubaker Belkaid– TLEMCEN, 2013)

[54] (Community public, 'Fitness and Exercise Spaces', edition: Design Guidance Note, England, 2008)

The selected site is expected to allow for future expansion of facility, parking and outdoor activities as required. There are many factors that must be carefully considered when choosing the site. These considerations should include the availability and capacity of the required utilities, the mass / scale of the facility in relation to adjacent structures, Proximity to historic neighborhoods and relationships with existing vehicle and pedestrian traffic patterns.[55]

3.7.6.3 Orientation

Allow the building to capture natural light in accordance with sustainable development recommendations. Make sure that natural lighting does not cause glare or interfere with activities, especially in the gym.[55]

3.7.6.4 Light ambiance

-Natural: Natural light greatly benefits the atmosphere and appearance of agymnastic space and, unless this is impractical, should be provided.
-The views in and out of the gym, especially the reception, pool or gym sport can be beneficial.
-Consideration should be given to balancing daylighting and views against risk solar glare or heat gain.
-This problem can be solved by placing glazing on facades less likely to receive excessive sunlight or sun protection.
-The need for confidentiality, for example Women-only areas may also have an impact on the ability to glaze certain areas of the gymnasium.[55]

3.7.6.5 Colors

Colors play a prominent role in the visual effect of the space design and adapt to the display where the use of consistent colors as the background makes the space larger and more comfortable.[55]

3.7.6.6 Visual continuity and flexibility

This involves creating an open area in the building in addition to controlling the flow and movement between exercise spaces without getting bored while ensuring visual communication.[55]

3.7.6.7 Structure

• Minimize the number of load-bearing walls to allow reconfiguration.
• Use a structural system that allows large areas without columns.
• If possible, provide a structure that can accommodate future vertical expansion in facilities that have site constraints. [55]

Conclusion

In order to create a sports equipment that meets the needs, it is necessary to define objectives to be followed and to offer a sportive diversity in the public term, of activity and of quality, for the latter, the design of a sport equipment must be carefully studied for that there is a relationship between nature and the light present in this place. Thus to guide the visitor from the entrance of the equipment to the outside, where the light is used to create an ambiance that attracts the human eye without causing discomfort, also achieving a feeling of visual comfort. Through different settings such as the source of light and the orientation of fenestration .That's why the architect must find the best method to introduce light in an intelligent way.

Chapter 02

Architectural analysis

1 Example analysis

Introduction :

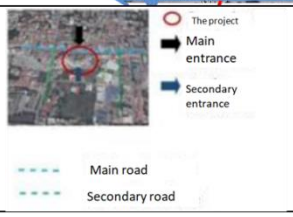
Architectural analysis is an essential step in the process of urban and architectural design. More than a simple reading of the site, the analysis makes it possible to clearly define the primary orientations of the project. Subsequently, we will highlight the ideas, the principles used in sport facilities and the method To finally emerge with a conceptual model of a fitness center adopted in the context.

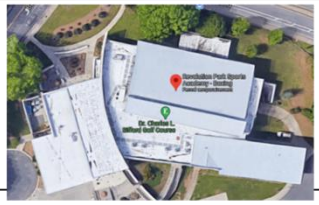
Example analysis :

1.1 Technical sheet

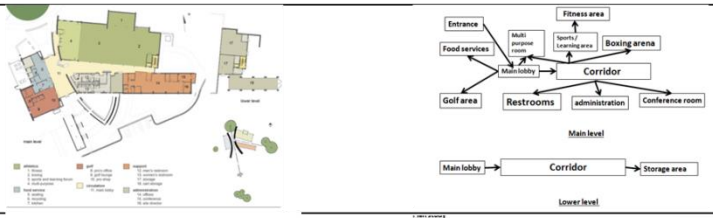
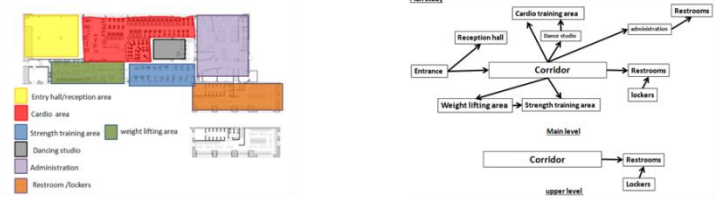
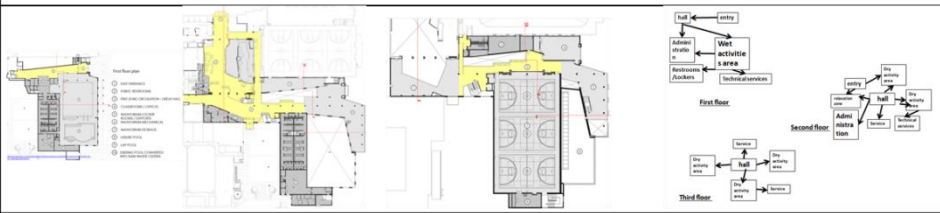
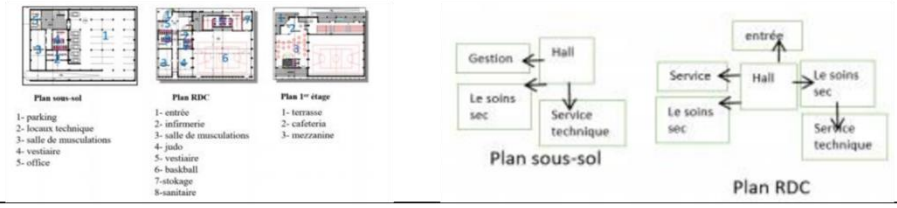
project	Project image	Technical status
Revolution Park Sports Academy		**Status:** Built **Location:** Revolution Park, 2425 Barringer Drive,Charlotte , north carolina **YEAR** :2010 **SIZE** : 30,000-square-foot **Firm Role:** neighboring concepts
Smena fitness club		**Status:** Built **Location:** Streletskaya sloboda, 46 Butyrskaya str., Moscow **YEAR** :2014 **SIZE** : 1291 m2 **Firm Role:** Za bor architects
University of Oregon Student Recreation Center Expansion		**Status:** Built **Location:** eugene , oregon , united states **YEAR** :2015 **SIZE** : 15000 m2 **Firm Role:** RDG planning and design
Sport center_promosim		**Status:** Built **Location:** Blida , algeria **YEAR** :2012 **SIZE** : 2790 m2 **Firm Role** : harazi asma , zouak fatiha

1.2 Urban dimension

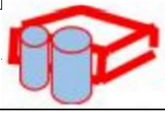
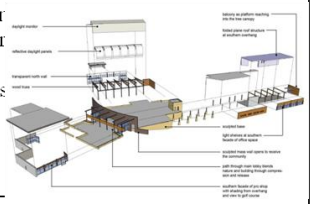
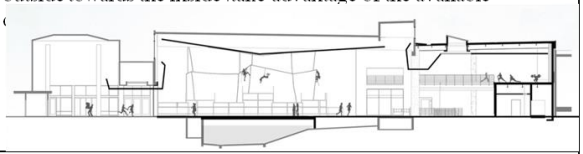
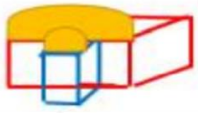
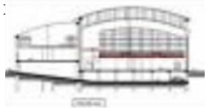
Project	Architectural idea	Accessibility
Revolution Park Sports Academy	the center is a key part of the Revolution Park district. The resulting design incorporates modern lines compared to its historic southern quarter. Therefore, the overall design approach had to not only incorporate sustainable design concepts, but also provide an environment that encourages both social interactions and welcoming to the surrounding community.	
Smena fitness club	In general the fitness center is designed as a laconic space which is the background for dynamic broken volumes that symbolize in this project «dynamics» and «movement» as the quintessence of all sports and healthy lifestyle. The two project architects Peter Zaytsev and Arseniy Borisenko, first approached the design concept from a functional zoning point of view.	
University of Oregon Student Recreation Center Expansion	This two-phased Student Recreation Center addition knits together an existing WPA Physical Education building, and an existing undersized Student Recreation building, while accommodating a not-yet-designed Health and Human Performance Building on an extremely tight site. this design creates a dynamic expanded home for student wellness and physical education	
Sport center SIM	The shape of the project is inspired by the shapes of the buildings that surrounds it	

Project	City level	
	Mass plan study	Mass plan
Revolution Park Sports Academy	The building is ideally located to serve a highly populated area without harming the surrounding natural land and undeveloped areas. It is built on previously developed land, away from wetlands and other environmentally sensitive areas.	
Smena fitness club	The building is ideally located on the lateral side of the land to serve a highly populated area without harming the surrounding natural traits .	
University of Oregon Student Recreation Center Expansion	The building is ideally located on the lateral side of the land to serve a highly populated area and take advantage of the natural protection it offers .	
Sport center SIM	The project is defined by its fluid load bearing ceiling , as a way to express the main activity in the center	

1.3 Functional grid

Project	Organization
Revolution Park Sports Academy	
Smena fitness club	
University of Oregon Student Recreation Center Expansion	
Sport center SIM	

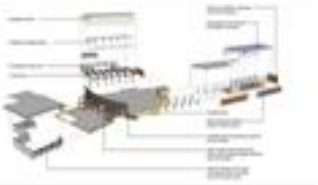
1.4 Conceptual dimension

project	volume	structure
Revolution Park Sports Academy	the project is located on the periphery of the land, it is composed of simple forms (squares , rectangles and a semi circle) combined to make a satisfying overall that is integrated perfectly within the surrounding Tl combination of three main volumes each volume is a cluster linked by a corridor . 	recycled building materials - cor consumer recycled materials - ar flooring, finishes and furniture. This includes all bar rolled steels steel beams and channels used in the project 
Smena fitness club	the center is a single rectangular volume , however it's interior layout is a division of volumes , The red volumes through the space act as functional separation..The functionality of various red volumes presupposes placing of locker rooms, coach rooms and other isolated spaces inside, as well as the division of zones according to noise level: in the two largest volumes located are a «silent» office block and a «noisy» hall with fitness cycles with a powerful aud system and constantly played rhythmic music. 	the building's material is mainly All concrete (including architectural precast concrete) , along with the use of bricks and metal in few parts of the club in order to create a separation between different areas of the fitness center and insulation materials to control the noises 
University of Oregon Student Recreation Center Expansion	the center is a compact volume with different levels , however it's interior is divided into functional areas 	(steel and concrete) The use of light materials such as wood and glass as a separation to -create a continuity and extension of the outside towards the inside .take advantage of the available 
Sport center SIM	The project is a simple composition of ordinary geometrical shapes 	The use of a mixt structural system : a postbeam frame in the underground level , and metallic structure : ceiling to ensure a large scope 

1.5 Envelope and ambiances

project	Envelope	Illustration
Revolution Park Sports Academy	The use of bright soothing colors such as white , harsh textures to go along with the metal's soft texture , the use of wooden and stone colors to maintain the natural aspect of the overall	
Smena fitness club	The use of bright soothing colors such as white , light brown which makes the building blend smoothly with the adjacent buildings , the use of bricks to break the façade patterns and give vitality to the overall , along with the color of glass from the panoramic windows , which enriches the combination without overwhelming it	
University of Oregon Student Recreation Center Expansion	The use of simple light colors , soft texture façades , which gives a modern aspect to the center The use of natural colors (white and grey) as well as dark colors (wooden colors)	
Sport center SIM	The use of light colors like beige and peach color and use of blue color for glass , the use of different type of fenestration based on the kind of activity inside the space	

Project	Natural light	Illustration
Revolution Park Sports Academy	. Illuminated shelves on the southern windows help reflect daylight deeper into the space. The glazed curtain wall on the north wall attracts subdued, even Nordic light, while the skeleton window on the ceiling serves as a large spoon of light to provide natural light to the opposite end of the space. The bottom window and curved reflective wall work in harmony to balance light levels and minimize glare. The light colored floor and hanging white panels also help to balance the light distribution.	
Smena fitness club	The building design uses natural light to provide sufficient light levels for all regularly occupied areas during most hours of occupancy. The use of deep colors to absorb the excess daylight , and the use of silver metal to reflect some of it , along with placing the areas that need most lighting near the panoramic windows , and the ones which need less lighting in the area where the reflected light falls	
University of Oregon Student Recreation Center Expansion	The building design uses natural light to provide sufficient light levels for all regularly occupied areas during most hours of occupancy through the use of glazed walls and zenithal lighting strategy . Along with the use of automatic shading devices in order to control the amount of light that penetrates through .	
Sport center SIM	The building is related to the exterior via large windows to ensure a maximal penetration of daylight	

Project	Artificial light	Illustration
Revolution Park Sports Academy	Artificial lighting systems are linked to actual occupancy; as the sunlight changes, each zone lights up to complement the daylight that enters through the windows. This helps to evenly distribute the light levels throughout the building.	 
Smena fitness club	Artificial lighting systems are linked to actual occupancy; as the sunlight changes, each zone lights up to complement the daylight that enters through the windows. This helps to evenly distribute the light levels throughout the building. Adjusting lighting conditions according to occupancy and needs reduces lighting costs.	 
University of Oregon Student Recreation Center Expansion	Artificial lighting is a major part of the design , used to enhance performance in different areas of the center , especially the wet activities area	 
Sport center SIM	The use of a uniform lighting to ensure the spaces are sufficiently lightened	 

1.6 General synthesis

- The project must have two entrances : main one and a secondary one
- The parking area is placed near to the strong mechanical flow
- Project orientation on axis east- ouest
- The reception hall and administration are best placed in rdc near the entry
- The dry activities area and the wet activities area must be separated
- Wet activities area is best placed underground or first floor , while the dry activities area are best placed in second floor above the previous area
- having locker rooms for each activity area is mandatory
- The use of light structures in order to provide large activity free zones
- The use of nature inspired colors and soft textures
- The change in opening sizes based on the activity zone (large windows for dry activities area and smaller ones for wet activities one)

2 Example programs' study

TYPES OF LOCALS	revolution park sport center	SMENA FITNESS CLUB	Recreation and sport center US	PROMOSIM
	SURFACE (M2)			
CARDIO TRAINING	150	20	25	/
WEIGHT LIFTING AREA	200	200	70	**200**
DANCE STUDIO	/	/	80	/
FITNESS HALL	200	200	70	/
YOGA ROOM	/	/	120	/
MASSAGE ROOM	/	/	50	/
STEAM ROOM	40	/	/	/
MULTI PURPOSE HALL	100	/	150	/
INFIRMARY	/	/	30	**26**
CAFETERIA	80	30	150	**320**
MANAGER OFFICE	20	25	20	**10**
SECRETARY	15	15	20	**10**
MEETING ROOM	40	35	60	/
HUMAN RESSOURCES	20	15	25	/
RECEPTION HALL	60	30	120	**65**
WAITING HALL	40	/	30	**15**
ARCHIVES	15	15	15	/
LOCKERS /SHOWERS	50	42	120	/
CENTER SURFACE			6.430 m²	2790
STORAGE	150	40	100	40
TECHNICAL LODGE / MONITORING	70	20	100	20
PARKING	300	120	230	**600**
YARD	/	/	/	/

3 Quality assessment

space		sauna	massage	shower	restroom
Description and ratio		About 12m2 independent rooms for around 3 people	a space with a view on the sauna and Jacuzzi , requires a good ventilation	A space divided into 5 to 6 separate showers	A space with 1.20 m2 for urinals for around 20 people
	needs	A temperature :65° and 100° Air humidity :100° : 2-5% , at 70° : 5-15%	In the resting area , temperature between 20° and 22° c	Temperature : 24° to 26° c minimal height recommendation : 2.5-2.7m	Height >2.20m A good ventilation
	lighting	Artificial lighting A soothing soft effect Light fixed above chairs or on the wall	Natural lighting Artificial light : 150-200 lux	Artificial lighting : 200 lux	Natural lighting Good ventilation Artificial lighting :120 - 150 lux
	shape	All sorts of dimensions are possible	Mostly square shape or rectangular	Mostly take the shape of a rectangle	Mostly rectangular shapes
	orientation	Close to the Jacuzzi and massage area	/	/	/
	Structure	Use of wood Assure heat and humidity resistance	/	Concrete or bearing walls .	Bearing walls or even concrete structure Considering the water system

space		Strength training area	cardio	Yoga and fitness	Cafeteria	Parking
Description and ratio		Enough space for 40 to 45 person use	A 100 m2 for 20 to 25 users	A 50m2 space for 15 to 20 person	A space of 100m2 for around 30 person	/
	needs	Free height:3m high Must be 6 m large , less than 15 m long Use of neutral colors The possibility to use bright colors for strength training area		For Yoga : pull rope Resistance bands Grip strengthener Jumping rope	Height above 2.75m for a 50m2 . And above 3m for a 100m2 area	Both pedestrian and mechanical road
	lighting	Artificial light : 300 lux Natural light is better as long as glare is treated		Taking precautions against glare effect Artificial light : 150-200 lux	Natural lighting Window rate is 1/10 of total surface. Artificial light : 200-300 lux	/
	shape	Possibility to use all sorts of shapes		Many options when it comes to shape	All shapes are possible	Use of functional shapes
	orientation	North orientation for windows to avoid glare and unwanted sun rays		North is preferred for windows to avoid glare and extra sun rays	/	/
	Structure	Avoiding pillars and divisions within the area use of steel structure to provide a great scope and to have a wide open area			Taking under consideration the underground networks	/

4 The suggested program

function	space	surface	number	Total surface m2
Reception	entry hall	30	1	100
	Reception hall	20	1	
	Waiting room	20	1	
	infirmary	30	1	
administration	Manager office	20	1	60
	secretary	15	1	
	Archive	15	1	
	restroom	10	2	

function	Space	Surface m2	number	Total surface
Wet activity area	sauna	15	1	150
	Massage room	15	2	
	Jacuzzi	25	1	
	locker	30	1	
	shower	30	1	
	restroom	20	1	

function	Space	Surface m2	Number	Total surface m2
Entertainment	Cafeteria	70	1	210
	restroom	20	1	
Technical services	technical lodge	50	1	
	storage	75	1	
parking	200m2			

Function”	space	Surface m2	number	Total surface m2
Dry activity zone	Fitness area	90	1	340
	Strength training area	50	1	
	Cardio training area	50	1	
	Yoga room	70	1	
	Lockers	20	1	
	shower	30	1	
	restroom	30	1	

Site analysis

5 City identification

5.1 Geographic approach

The willaya of Biskra is located in the south-east of Algeria, in the North-West of the Algerian Sahara, it occupies an area of 21,671 km2, its altitude is 128 meters above sea level.

Figure 69 Biskra's location on algerian map
Source : (Google images)

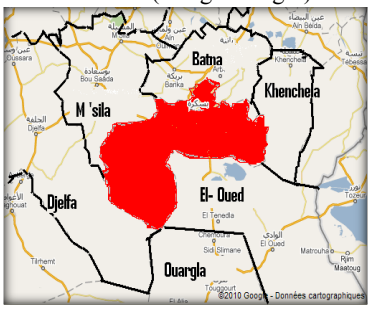


Figure 70 Biskra's location in the south eastern area
Source : (Google images)

The wilaya of Biskra limited by:
The North: Wilaya of Batna.
The North West: Wilaya of Msila.
The east: Khenchla.
The south: Wilaya of Ouargla.
The south-east: Wilaya of El-Oued.
The southwest: Wilaya of Djelfa.
The willaya of BISKRA contains 33 Communes.

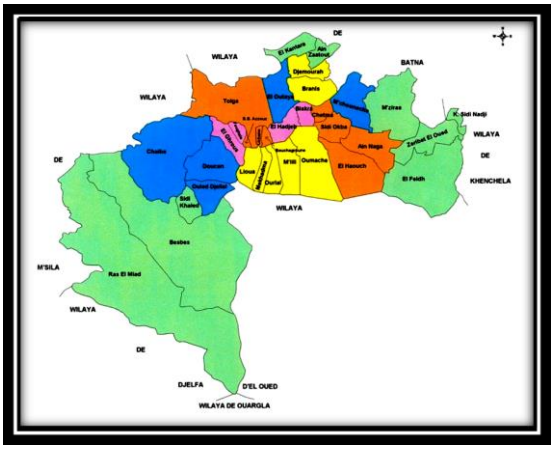


Figure 71 the municipalities in the state of Biskra
Source : (Google images)

Biskra the capital of the State is Located in the north, on an estimated area: 9,925 km 2, surrounded by Municipalities.
The administrative division (territorial reorganization in accordance with Law 84-04 of February 4, 1984) which followed gave as limits:

- To the north, the municipalities of El-Outaya and Branis.
- In the west the commune of El-Hadjeb.
- To the east, the municipalities of Chetma and Sidi-Okba.
- To the south that of Oumache.

Figure 72 map of the administrative division of the wilaya
Source : (Google images)

5.2 Landforms

The city is located at a height of 120m above sea level, between the bands of the desert and the Atlantic, while this connection is the great fissure (southern cracking of the Saharan Atlas).

In the western area of the city we find a series of corpses that runs from southwest to northeast and is divided into two section, the northern branch moving east to north of the city quay with the southern part of a series of Aures, and the equatorial section of a small chain.

Figure 73 top view that shows the landforms of the area
Source : (Google earth)

5.3 Climate

Regarding the climate of the Biskra region, by virtue of its location on the outskirts of the desert climate from semi-arid to relatively dry and that is due to the fact that more of the Atlas, on the one hand and the mountains of Aures and Zab, protecting the city against the north and west wind, this is what gives Biskra a special atmosphere or the heat sometimes accompanied by sent winds "Alsiroko". It is also characterized by cold winters and dry and hot, dry summers; an average annual temperature of 22.3 ° C, with a minimum of 1.6 ° C in February and a maximum of 48.4 ° C in July, very low precipitation: maximum 200mm / year.

5.4 Temperature

it is a hot and arid climate where:
Cold and dry winter .Very hot and very dry summer.
This type of climate for its part contributes a lot to the degradation of the environment if we refer to the following temperature parameters: it oscillates between 7c ° to 42c °.

Tableau 2 the change of temperature during one year period
Source : ([online] URL https://www.cder.dz/vlib/revue/pdf/v016_n3_texte_12.pdf)

	Jan	Feb	Mars	Avr	May	June
Temp. max. en °C	16	18	22	26	31	36
Temp. min. en °C	7	8	11	14	18	24
Precipitation in mm	9	8	12	10	13	6
	Jul	Aug	Sep	Oct	Nov	Dec
Temp. max. en °C	42	41	34	28	21	17
Temp. min. en °C	27	26	23	17	12	7
Précipitations en mm	2	6	20	16	18	8

Precipitation: the annual average is 156mm for 34 days of precipitation.
Humidity: over a decade, the relative average is 47%.
Evaporation: the annual average remains very high 2600mm

Tableau 3 the change in percemipation during one year
Source : ([online] URL https://www.cder.dz/vlib/revue/pdf/v016_n3_texte_12.pdf)

Mois	J	F	M	A	M	J	J	O	S	O	N	D
Humidité relative en %	50	50	46	48	36	42	36	37	48	54	59	60

5.5 Wind

The dominant winds in winter are northwesterly from the moisture carried from North Atlantic, summer winds are south / east-north / west, in the form of drying sirocco.
the characteristic sand winds of the region are frequent during the months of March, April and May.However, it can be noted that they appear during the other seasons with a low frequency.

5.5.1 wind force

The period of high winds is above all the winter between September and May inclusive.

5.5.2 sirocco

Its frequency is especially marked between June and September.

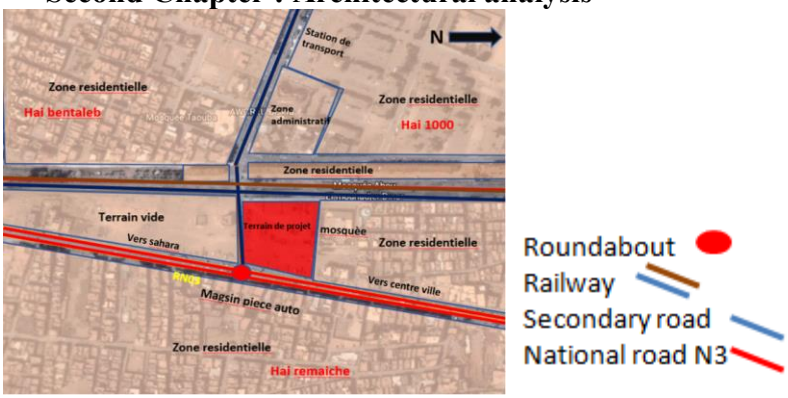
5.6 Identifying comfort conditions based on climatic data According to mahony

Tableau 4 Mahony recommendations based on the climate zone
Source ([online] URL https://www.cder.dz/vlib/revue/pdf/v016_n3_texte_12.pdf

	H3 during winter	E 3-4-5 during summer
1. orientation	• North-south is desired with vertical occupation of spaces	• North- south (west is proscribed)
2. Building area	• Compact plan , avoid walls in contact with the exxterior	• Compact plan , avoid walls in contact with the exxterior
3. Ventilation	/	• Nocturnal ventilation
4. Ouvertures, fenêtres	• Total Openings ratio estimated 0.15 per m2	• average 25% à 40%
5.walls	• Massive walls and floors, daily thermal inertia> 8 hours compromise to be taken with summer	• Massive walls and floors. Strong multi-day thermal inertia (excluding overheating period) with light colors.
6. roofs	• Toiture massive et isolée	Massive walls and floors. Strong multi-day thermal inertia (excluding overheating period) with light colors.
7. Thermal isolation	• Thermally isolated roofs	• Isolated roofs
8. Protection	• Winter sand winds by evergreen plantations growing in the south (Aleppo pine ...)	• Summer protection. Total concealment opening North south opening
9. Vegetation	• Evergreen vegetation for prevailing cold winds and especially sand.	• Vegetation shading walls and windows
10. conditionning	• Passive heating by storage of inert massive walls, phase shift 8 to 12 hours or southern glazing.	• Natural conditionning through air humidification

5.7 Terrain location

The proposed land is located in the town of Biskra in Hai Remaiche Far from downtown 1.5km and the realestate agency and OPGI 194m the mosque of Abu el mouhadjer dinar 120 m and the courthouse 600 m and the museum at 800m.



5.8 Terrain environment

• The land is located directly on the national road, So you must leave a distance if 15m from the axis of the road.
• There is an amount of backfill on the ground that needs to be transferred.
• Not far from the land, there is a railway line but there is a secondary road near the railway line.
• The land has a direct facade at the roundabout (node) We must take a treatment of these angles and treat them separately.

Figure 75 The site surrounding
Source : author 2021

5.9 Mass plan

The site is surrounded by an urban activity , whereas :
North : collective housing projects
South:a commercial private land that is currently used as a parking lot for heavy machinery
East : national road and a dense housing community and commercial buildings
West :railway station

Figure 76 Project environment

5.10 Accessibility

5.10.1 Mechanical flow

-Connectivity directly and organized from the main road and structured in secondary and tertiary roads with a railway passing near the ground and a roundabout
-We notice that the main roads take two directions, which makes the area related to the city

-The flow is strong on the main roads and low on the secondary because there is no continuous road directly from west

Figure 77 Mechanical axis in the studied zone
Source : author 2021

5.10.2 Pedestrian flow

5.11 Terrain morphology

The land has an irregular shape, as shown in the plan, corresponding to its area of 11,781.98 m2.
- The land has an irregular shape, as shown in the plan, corresponding to its area of 11781.98m2.
- the terrain is a flat site with a slight slope

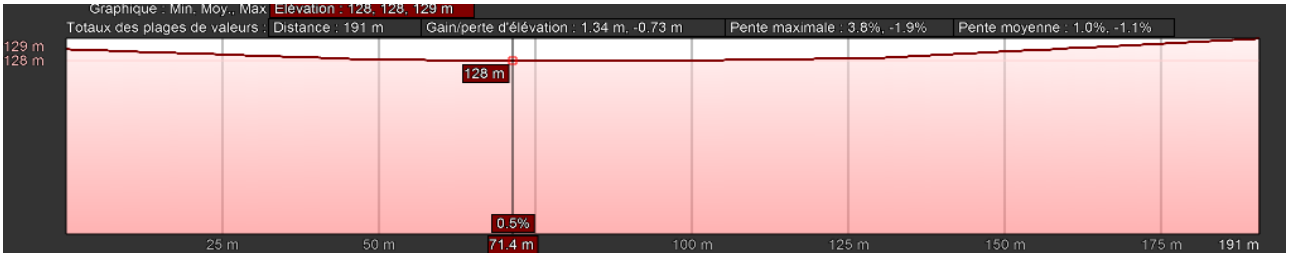


Figure 78 Terrain stability level
Source : google earth

5.12 Climate

5.12.1 Sunshine

The land is almost completely exposed to the sun, so green spaces are needed to break these rays.

Figure 79 Sunshine scheme

5.12.2 Wind

The high standard of the buildings in the northwest part prevents the arrival of cold winds from the ground. With regard to hot winds, we propose to provide green spaces as well as water spaces to be tempered and also to use the architectural envelope on the facades

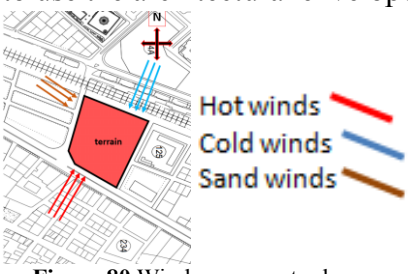


Figure 80 Wind movement scheme

5.13 Site potentials

-Strategic location in relation to the city center. -Existence of several facilities all around.
-The land is close to the landmarks.
-The land takes an important place in its island -Good sunshine all year round.
- availability of different means of transport.
-The site is in an area of high urban density, so it is perfect for a fitness facility , because it will revive the area and give it an authentic reference

5.14 Site constraints

-The site is characterized by sound constraints (nuisances). Due to heavy traffic mechanical and pedestrian along with the railway
-No atmosphere in the site (lack of public space, rest and communication space between people)

Chapter03

Design Process

Design process

Passage elements

1 On an exterior level

1.1 First idea:

Adding a new flavor to the traditional object is the simplest way to make the composition interesting.

Working with smart yet meaningful gestures and twists would help change and adjust the mindset of people and also encourage them to discover each part of the center. This is why it is important to introduce the element of fun through architectural innovation by utilizing each part of the human body from the early stages of design

1.1.1 The form :

Rearranging stacked forms , by combining the abstract idea of regular forms and the implantation on site.

The overall inspiration is to insert the form into the site according to the urban requirement while maintaining an original form , creating an equilibrium between existing elements and new ones.

1.1.2 Structure :

The use of metallic structure to give a light aesthetic frame to the project , along with a load bearing structure to give the project stability and balance.

1.1.3 Architectural envelope :

The use of modern materials to showcase the aesthetic part of the project and give the overall design a specific interior ambiance through the architectural envelope , in a sense where the envelope is highlighted as an aesthetical dynamic shield for the center on an exterior level and a functional light ambiance regulator of the interior .

1.1.4 Exterior spaces

Developing an exterior space where people can gather and admire the center without being intimidated by it , also drawing an implicit map that works as a guide towards the entry of the center through elements like :

-the use of urban furniture to show the function of each area and to divide the exterior into seating areas sorted according to the group of people who would be using it

-Creating a distinction and a movement by changing angles and levels of the visual scene .

1.2 On an interior level

1.2.1 First idea

Creating a well lit space , using a special lighting to emphasis on each space's function, through:

Putting the spaces which need most lighting in the side that receives most sunlight , also protecting the interior from undesirable effects of lighting such as heat gains and glare through the architectural envelope.

1.2.2 Second idea

Creating a visual and functional continuity that relates the space ,events and activities through colors ,lighting scheme and plan organization by

- A free plan , in order to have open spaces which share the same activity .
- The use of large windows to create a visual identity for each space , where "noisy" activities get maximal sunlight , meanwhile , "calm activities are provided with sufficient sunlight and accentuated with artificial lighting to create the desired luminous qualities .

- Installing light monitors to adjust light when there is I slightly high
- Keeping the interior in connection with the exterior through openings to give a sense of freedom and openness , yet maintaining an intimate internal ambiance where the users feel oriented towards workout and healthcare

1.2.3 Third idea

Creating an intangible path that creates movement within the project by using different textures ,colors and light schemes

1.2.4 Fourth idea

Dividing spaces according to the nature of each activity , and dividing activities according to the lighting scheme in the first place , then by the level noise , then by the type of fitness activity .

1.2.5 Architectural envelope

The architectural envelope is the main design focus when it comes to light ambiance regulation within the project , that is why the chosen types of envelope in this work is double skin façade system , by using prefabricated ETI panels , an airtight and thermally insulating system in order to take advantage of the variety of colors and textures , without the risk of excessive heat gains, thermal bridges and the risk of condensation.

1.2.6 light ambiance

- Providing a box window system to boost natural ventilation and moderate sunlight
- Using light shelves Providing exterior fixed shades that block sunlight considering sun path
- Using systems that sufficiently diffuse sunlight to eliminate the potential for glare;
- Providing occupant-controlled adjustable shades

1.3 The project idea

1.3.1 Fitness :

Fitness is the act of constant movement , in search for balance and stability .
The key to being physically active is to reach balance and maintain it , the journey towards finding balance is experienced differently by individuals

1.3.2 The inspiration

The idea of perceiving the physical changes of the human body while performing sport activity and relating that to geometry is symbolically powerfull , through the realization of its ability to transform, move and still maintain balance .

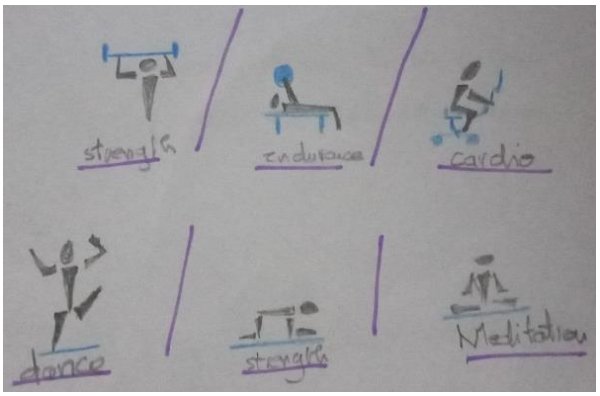


Figure 81 Body movement while performing sport activity
Source : author 2021

1.3.3 The shapes

The shapes used in the design are inspired by the body's posture during meditation
Since meditation is one of the most efficient ways to reach balance and maintain it .
The lotus position, also called "padmasana" is a symbol of growth towards perfection , towards balance.

Figure 82 Body posture during workout
Source : author 2021

When seeing the posture geometrically , one can see a clear composition of pure geometric shapes that differ in their position yet still maintain their equilibrium .
The volume is the result of geometrical transformation of the primary shapes, the transformations are:
Division -rotation – translation – redimensioning - tilting – shifting – addition .

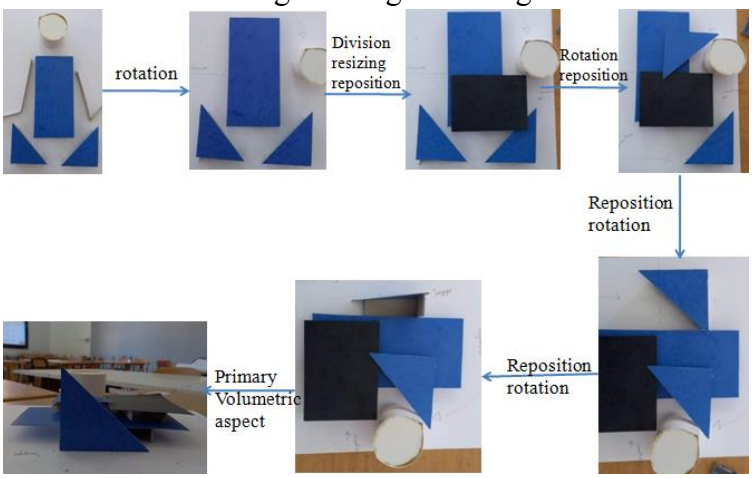


Figure 83 transformation process of the initial forms
Source : author 2021

The Inspiration

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Entry hall	Jacuzzi
Reception area	Lockers
Waiting hall	Shower
Infirmary	Restroom
Manager's office	Fitness area
Secretary's office	Cardio area
Archive	Strength training area
Storage	Yoga room
Sauna	Cafeteria
Massage room	Technical lodge/storage

Dr.Saadi Yacine | MADAM.Magri Oudjari Sahar | Dr.Boukhabla Moufida | MADAM. Meliouh Fouzia

Mass plan

Developing an exterior space where people can gather and admire the center without being intimidated by it , also drawing an implicit map that works as a guide towards the entry of the center through elements like :

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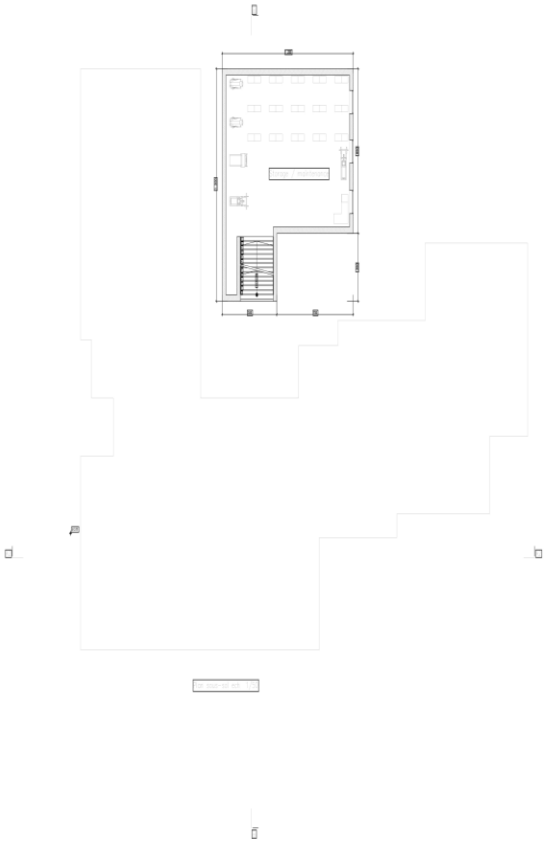
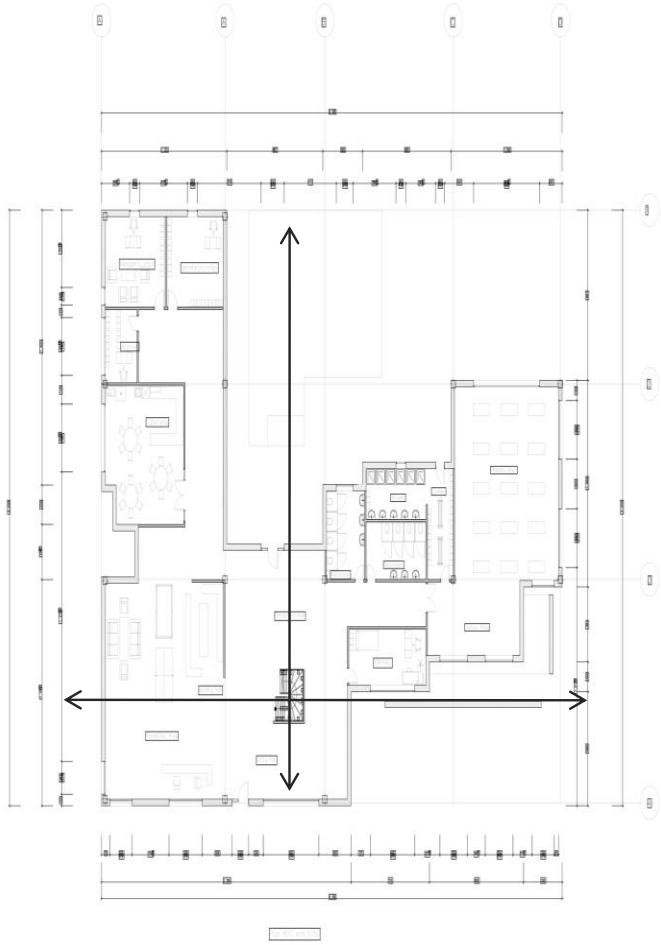
-Creating a distinction and a movement by changing angles and levels of the visual scene .

plans



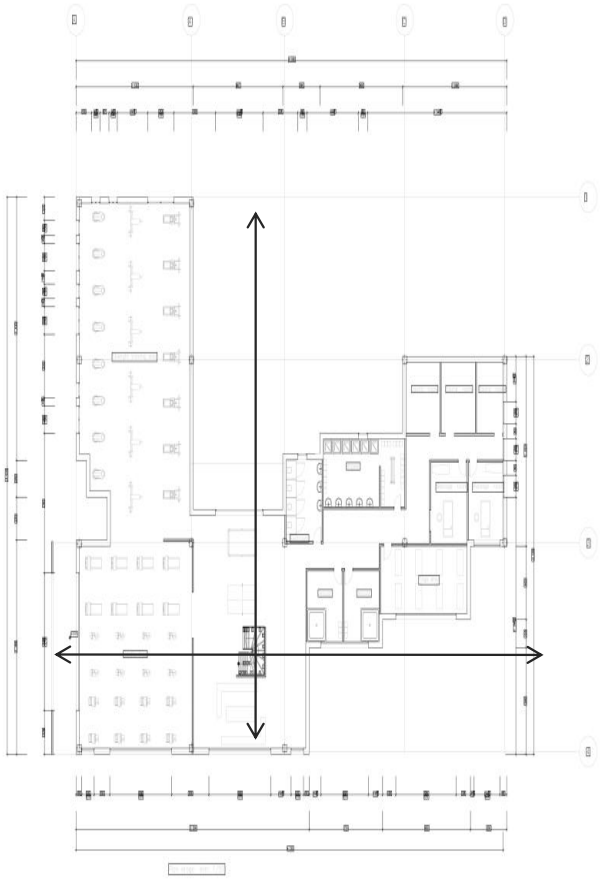
Underground storage plan

plans



Ground floor plan

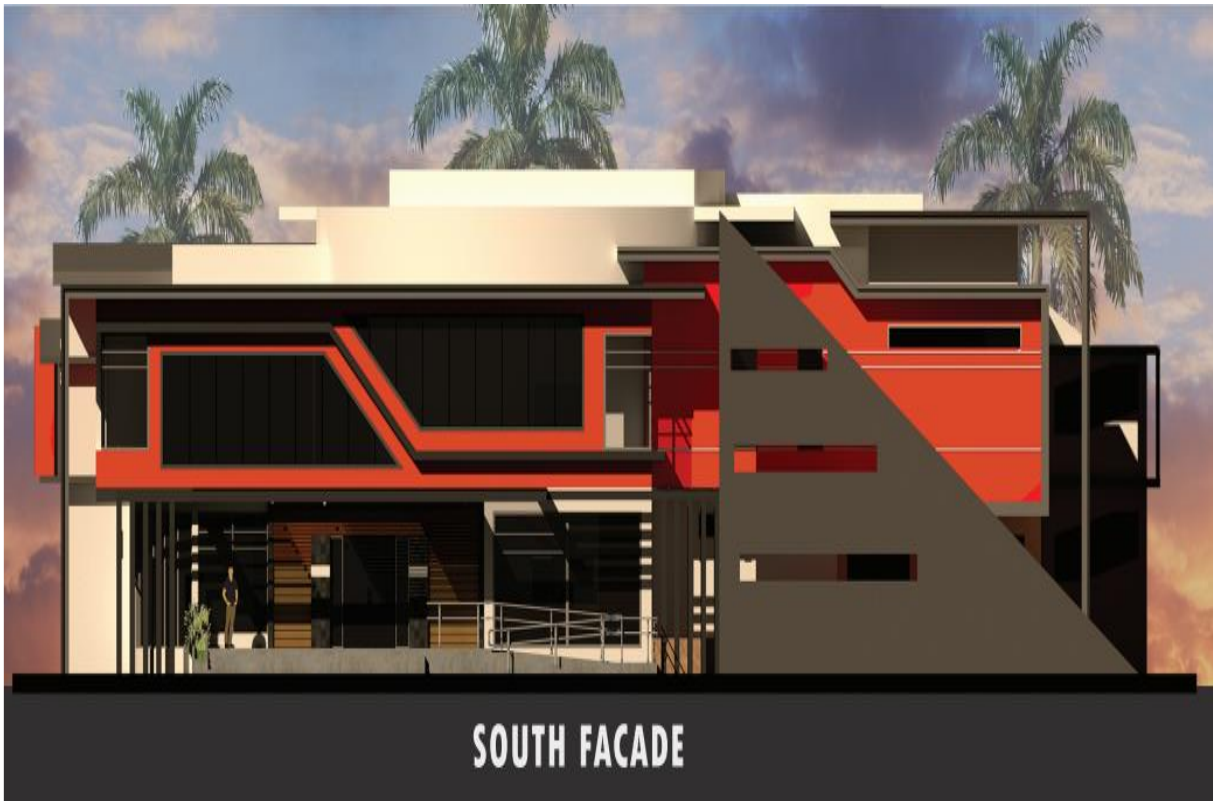
plans



first floor plan

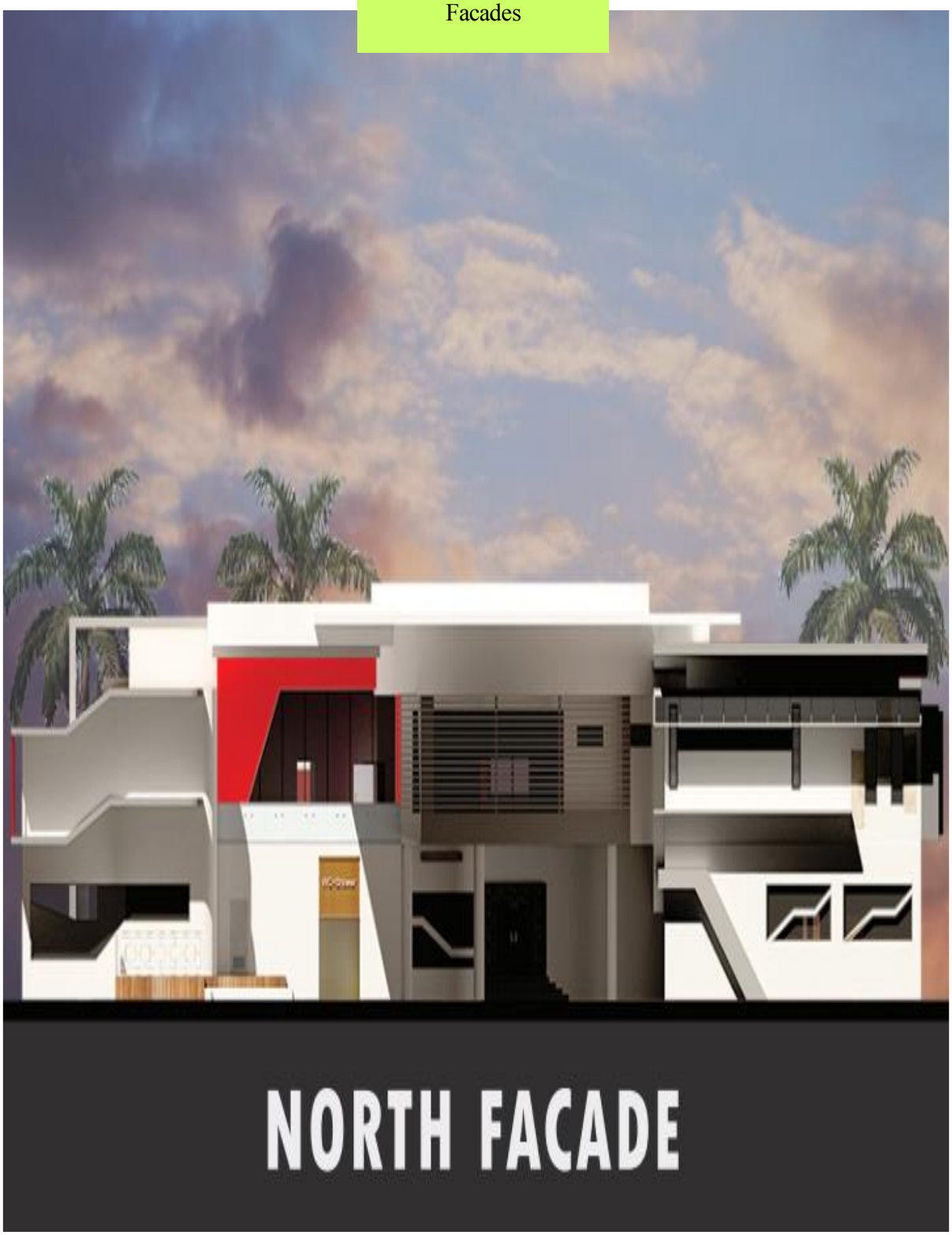
Facades

Main facade

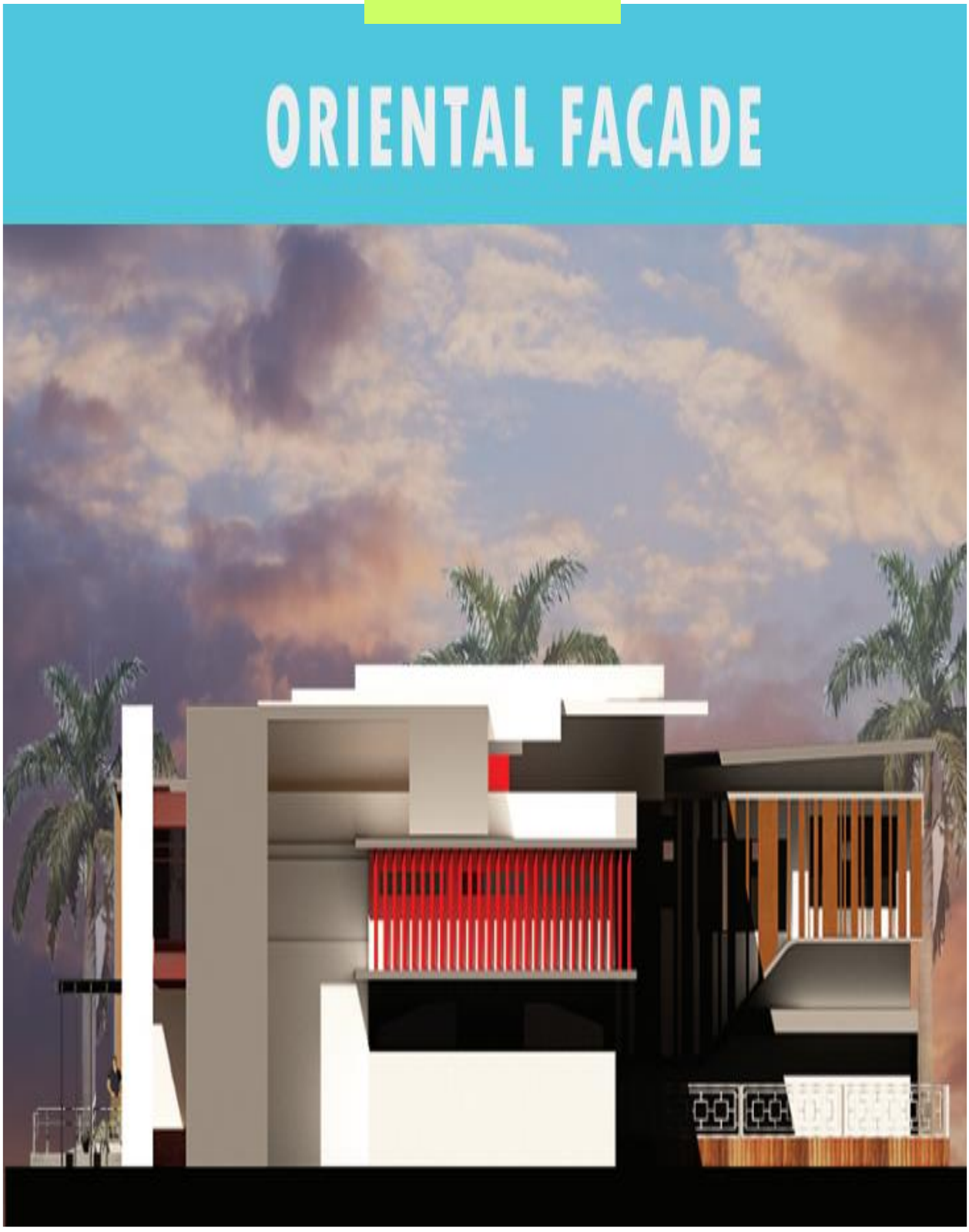


Facades

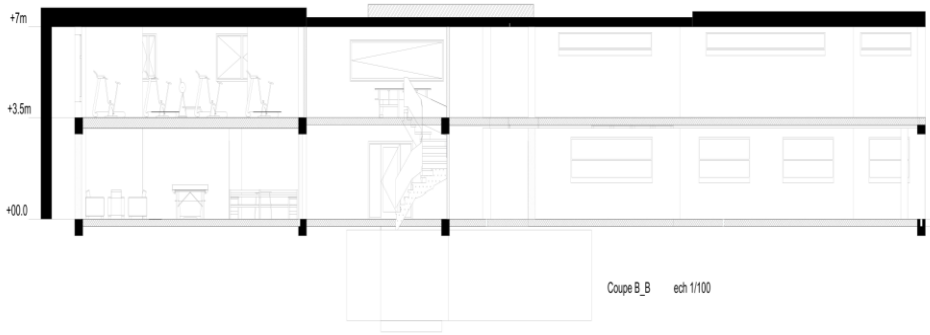
Facades



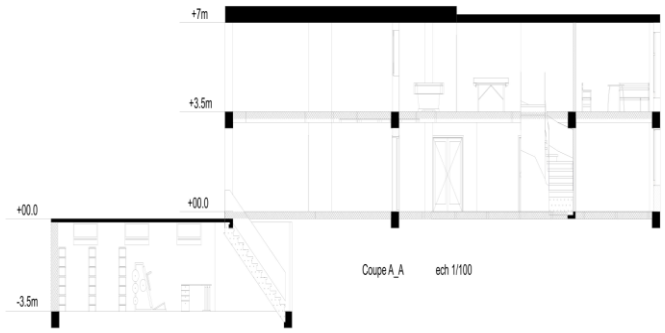
Facades



Sections



Sections



Views and perspectives

Views and perspectives

Main entry

Views and perspectives

Exterior view on the water fountains

View on the garden

Views and perspectives

View on the garden

General conclusion

Throughout the study , we have tried to clarify two notions , the first is the architectural envelope , the types and components and importance of each element of it .the second is the light ambiance and its role in sculpting the interior of the space , by being affected and affecting the space in a way that brings out the desired luminous qualities of the project.

In order to find the most convenient type of architectural envelope to use and its features , we started by exploring the theoretical field that is related to the concept of building enclosure and exterior frame , its components and types , then we followed the same approach by identifying the notions and types and effect of light ambiance in order to set a clear vision of how it relates a harmonious space inside and out .

Generally speaking , the architectural envelope regulates internal light ambiances through different settings , however , the most influential ones have been proven to be related to the fenestration and shading devices along with the building materials and their criteria.

In a fitness center , as seen in previous chapter , lighting plays an essential role in shaping the interior desired ambiance and assure the wellbeing of its users .

Therefore , it is safe to say that in the best conditions , we can integrate those features and maintain a harmonious overall in a project like a fitness center , without depriving it from its aesthetical aspect nor dynamic nature and making sure that the luminous requirements are met inside the space whilst maintaining a comfortable atmosphere , by a wise use of the right building material for the architectural envelope , the proper positioning of fenestration and shading devices and last but not least , conditioning all these factors with the hot arid climate by following the climatic recommendations and putting together what has been previously discussed throughout this work.

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