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The theme:
The impact of the porous facade on natural ventilation

The project:
Cultural center

Jury

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DEDICATE

PraisebetoGodwhohonouredmewithahumbleachievementandwhich Idedicateto

Forthe firstperson in thisworldtoembrace meto theonewhotook meroughpathswithprideandpride

To the big heartthatincludedmeinmyname,verses ofloveandtenderness.

To theone whohasbeen stingy onherselftorestto begraciousandtoleadmeon the pathofsuccesswithhersupplication.

To whomIwillnotfulfilherrightnomatterwhatI sayandwhateverI do.

To mybeloved soul mymother.

To thosewholefttheworld withoutfarewell

To thosewhocoveredhis body withdustandthetime deprivedmeofhisvoiceTo

thosewhoareabsent frommyeyesand presentinmyheart

To the deartomyheart,MAYGodhavemercyon him,andIdwellin hisspaciousness

To mydearmymoonmyfather

To mysupportinatimeofweaknesstowhomto resortwhenthe chestnarrows To

mytwinmysister

To the bloody bondthatallmyaunts, uncles, auntsandunclesbringmetogether

I amoneofyouandI thankyouforyourpatiencewithmeand yourconstant support

ACKNOWLEDGMENT

All praiseisdueto Allahalone,by the multitude ofHiscreation, by HisPleasure, by the weightofHisThrone, and bythe extentofHisWords.andpeaceand blessings beuponhimafterwhomthereis no otherProphet.

I extendmysincerethanks, appreciationandgratitudetothefamilyofthe Faculty of Architecture, and in particularthanks, appreciationandgratitudeto the twodistinguishedprofessorsGhanemiFatineandBadacheHalima,whowerethe best helpin completingthismodestresearch,whichisconsideredafruitof theirblessedeffort. IaskGodto rewardthem.

Likewise, foreveryonewhoforgottomentionthemandhelpedme fromnearor far, I askGodtorewardthemwithgood.

ABSTRACT

The search for thermal comfort and natural ventilation was considered a basic requirement in buildings in the late twentieth century, especially in the summer, and therefore space cooling was the desired factor by users.

The porous facade, which can be said to be the new image of Mashrabiyas, whose main role is to naturally ventilate the space and is considered to be effective to some extent.

Therefore, this research focuses on improving natural ventilation inside buildings, especially cultural buildings, through the porous façade, and it also aims to evaluate the impact and role of the porous façade in obtaining optimal natural ventilation.

The study was conducted in the city of Batna to study the natural ventilation in the area using simulation method by Ecotect program, and the velocity of indoor and outdoor air was tested under the porous façade.

The results showed that:

- the porous façade does not affect in the cell pressure in all the outdoor air velocity cases studied.
- A noticeable air movement near to porous façade in high wind velocity.
- the air flow rate in spaces near the porous façade is increasing as the velocity of outdoor air increases.

key words:

Natural Ventilation, Cultural Center, Thermal Comfort, Facade Porous, Ecotect.

الملخص

يعتبر البحث عن الراحة الحرارية والتهوية الطبيعية مطلبا أساسيا في المباني في أواخر القرن العشرين وخاصة في فصل الصيف وبالتالي فإن تبريد الفضاء هو العامل المرغوب فيه من قبل المستعملين.

الواجهة المسامية والتي يمكن القول عنها أنها الصورة الجديدة للمشربيات التي يتمثل دورها الأساسي في تهوية الفضاء طبيعيا وتعتبر فعالة لحد ما.

لذلك يركز هذا البحث على تحسين التهوية الطبيعية داخل المباني وخاصة المباني الثقافية من خلال الواجهة المسامية ويهدف أيضا إلى تقييم أثر ودور الواجهة المسامية في الحصول على التهوية الطبيعية الأمثل.

تم إجراء الدراسة في مدينة باتنة لدراسة التهوية الطبيعية في المنطقة باستخدام المحاكاة ببرنامج ايكوتكت وقد تم اختبار سرعة الهواء الداخلي والخارجي في ظل الواجهة المسامية.

وقد أظهرت النتائج بأن:

- الواجهة المسامية لم تؤثر على الضغط الداخلي في جميع حالات الهواء الخارجي المدروسة.
- حركة هواء داخلي ملحوظة بالقرب من الواجهة المسامية في حالة ارتفاع سرعة الهواء الخارجي.
- يتزايد تدفق الهواء في الفضاءات ذات الواجهة المسامية مع تزايد سرعة الهواء الخارجي.

الكلمات المفتاحية

التهوية الطبيعية، المركز الثقافي ،الراحة الحرارية ،الواجهة المسامية، ايكوتنت .

TABLE OF CONTENTS

CHAPTER II: ANALYTIC STUDY

CHAPTER III:PRATICAL STUDY

LIST OF PHOTOS

LIST OF TABLES

INTRODUCTIF CHAPTER

INTRODUCTION

At present, it has become necessary for the building to be environmentally friendly due to the increased consumption of energy and its resources. Therefore, the architecture seeks to reduce the negative impact of buildings through efficiency and moderation in the use of materials, energy, development space and the ecosystem in general.

Architecture is currently facing challenges in developing the efficiency, effectiveness and sustainability of buildings to meet the needs of the new era as it tries to install its steps and roots from the twentieth century

Energy efficiency throughout the building's life cycle is the most important goal of sustainable architecture. Architects use much different passive and active methods to reduce building energy needs and increase their ability to capture or generate their energy. Using site analysis is one of the keys to exploiting local environmental resources and influencing energy-related factors such as daylight, solar heat gain, and ventilation.

Clearly, natural ventilation itself is not new. It is only in the past 150 years or so that mechanical ventilation has been used. Prior to that period, all enclosures occupied by humans were naturally ventilated. The beginnings of natural ventilation design can perhaps be considered as the time when these enclosures started to become purpose-built. Evidence of purpose-built ventilation in China dates back to the Neolithic period. Early designs were primarily empirical and evolved from experience. They might almost be described as long-term experiments at full scale. In many countries, traditional passive cooling techniques have developed alongside natural ventilation (e.g. Salmon, 1999; Gadi, 2010).

One of the methods for achieving natural ventilation is the porous façade, which was known as the Mashrabiya .Due to the ever-fluctuating and evolving nature of architecture, it is difficult to determine the exact time in which the mashrabiya appeared, but what can be confirmed is that the processes of developing and improving its performance have not stopped for hundreds of years, as the mashrabiya spread in the Abbasid period (750 - 1258) and was used in palaces, public buildings and It was widely used in the Ottoman era (1805 - 1517), when it reached its glory and spread almost completely in Iraq, the Levant, Egypt and the Arabian Peninsula, because its use in various buildings proved to be very effective in reaching a comfortable and effective internal environment despite the circumstances. The outside is extremely hot.

PROBLEMATIC

building, as they are designed and used today, contribute to serious environmental problems because of excessive consumption of energy and other natural resources. The close connection between energy use in buildings and environmental damage arises because energy intensive solutions sought to construct a building and meet its demands for heating, cooling, ventilation and lighting cause serve depletion of invaluable environmental **(**Energy-efficient Buildings in India , Mili Majumdar 2001).

the façade is one of the building elements, it’s not for the aesthetic aspect only but also for economic and saving energy aspect too, because it faces the external factors like the winds, daylight directly. And there many types of facades one of them it is porous façade, the porous façade is one of the new concepts in this decade and it has strong relation and impact in the external factors. Especially light and natural ventilation, which is considered one of the most important factors considered in achieving thermal comfort in the buildings that we will specialize in this research, which are cultural buildings and specifically the cultural center, which can be said to be a building with an aesthetic façade that can be achieved through the porous façade and it needs to save energy Through natural ventilation.

So, does the porous façade affect in natural ventilation inside a cultural center?

HYPOTHESE

The porous façade can influence by controlling in the quantity of entering air through pore's ratio, dimensions, material, in obtaining an ideal natural ventilation.

OBJECTIVES

This research aims to several and specific objects which is:

- Determination the dimensions of pores to obtain optimal quantity and quality natural ventilation.
- Define construction materials to achieve natural ventilation through porous façade.
- Define the porous position
- Define the porous form

METHODOLOGIE

There are multiple of method can be used to verify that the project provides an aeration comfort; In this research, simulation method was selected for the verification because it shows results close to the reality. Because it is not possible to determine good ventilation in the design of the building without it being completed, and therefore it is a methodology that is available to give a prior perception of the factors that achieving optimal ventilation in the cultural center in an climate such as the climate of Biskra city.

four parameters were choosing because they have a direct impact relationship with natural ventilation:

• Air flow •Wind velocity • air Temperature •Humidity

And for that, the simulated spaces were:

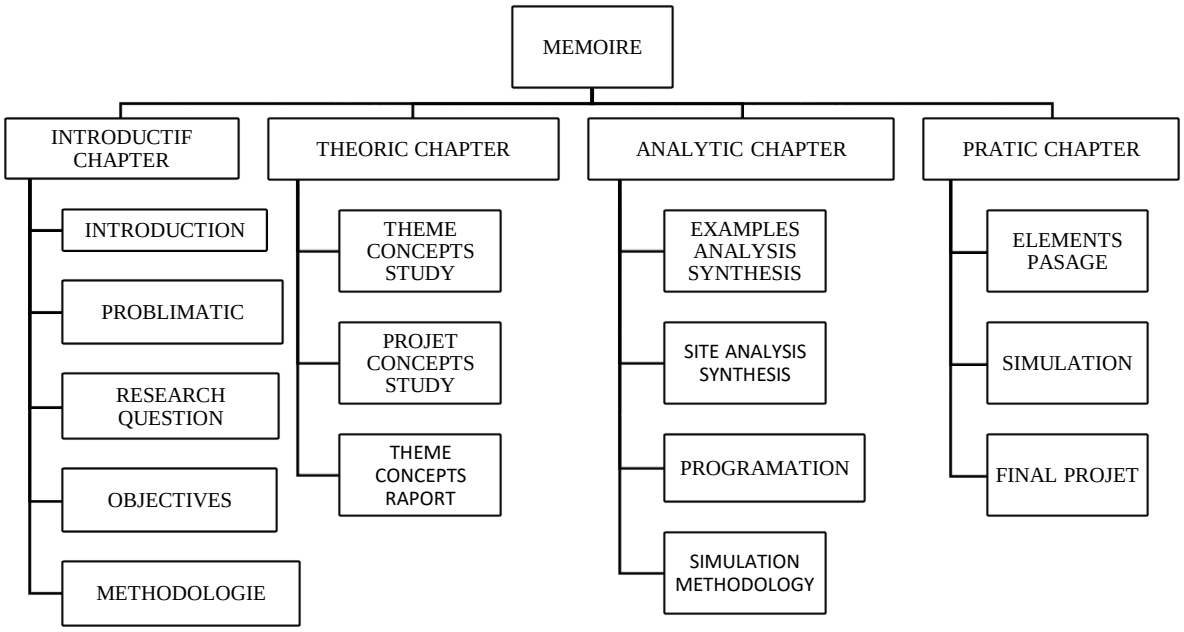
• museum •external envelope

And considering: the pores dimension

the pores form

building orientation

MEMORY STRUCTURE



CHAPTER I: THEORETICAL STUDY

INTRODUCTION:

In this chapter, we will look at the three concepts related to the subject of the study in order to capture aspects of the project.

Beginning with natural ventilation that reduces heat stress inside buildings and it is a solution to the energy consumption problem that can be achieved with ventilation strategies and to know the importance of ventilation not only on energy consumption level but also on users health too , beside knowing the exterior enclosure, a cultural center requirements.

I. NATURAL VENTILATION

I.1.1. The composite of air

Based on research and experimental results we know that air is composed of 78 percent nitrogen, 20 percent oxygen, 2 percent carbon dioxide (CO2), and a fraction of inert gases. Water vapor content amounts to only about 1 percent. (Ulrike Passe and Francine Battaglia,2015)

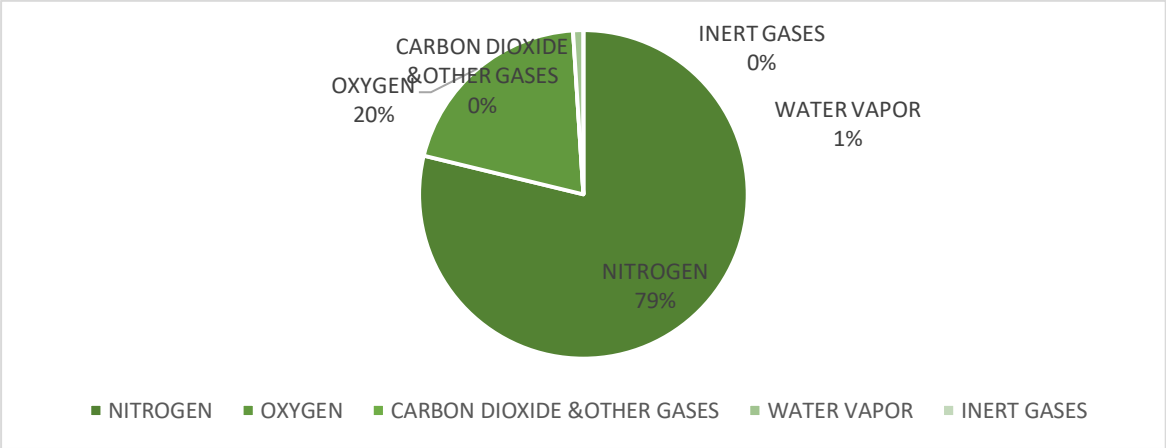


Fig.1: The composite of air **by** author source (Ulrike Passe and Francine Battaglia,2015)

I.1.2. Definition of Ventilation

Ventilation moves outdoor air into a building, and distributes it within the building or room. The overall aim of ventilation in buildings is to provide healthy air for breathing by both diluting the pollutants originating in the building and removing the pollutants from it (James Atkinson & al,2009)

Ventilation is the air movement through the building from outside to inside the building.

I.1.3. Definition of natural ventilation

Natural forces drive outdoor air through purpose-built, building envelope openings. Purpose-built openings include windows, doors, solar chimneys, wind towers and trickle ventilators. This natural ventilation of buildings depends on climate, building design and human behaviour. (James Atkinson & al,2009)

Ventilation describes the means to introduce fresh quality air into a space and extract exhaust, stale, polluted, or odorous air out of the space. Fresh air replenishes oxygen. Diluting CO2 is a different matter, and increased CO2 levels can make occupants feel drowsy. Without proper ventilation we will not suffocate, but air will start to feel hot and smelly. The use of natural driving forces is an

underutilized design strategy to control the indoor environment. It is dynamic, always changing, but not always reliable. Air is also a means to transport thermal energy either for heating or for cooling to moderate thermal comfort. (Ulrike Passe and Francine Battaglia,2015)

I.1.4. The need to natural ventilation

Air is one of the four major classical elements and vital to human life. Ventilating an interior space is essential, yet most people know very little about the reasons we need constant air exchanges in buildings. It is not the oxygen we need. Today, indoor air quality, thermal comfort, and energy are more important issues in occupied spaces. Ventilation is essential to remove odor particles and volatile organic compounds (VOCs) as well as humidity (90 percent of human exhalation is humidity), which are the most annoying indoor air quality disturbances to occupants. It is also necessary to dilute CO2, which can make occupants drowsy. Foremost, we ventilate to remove excess heat that accumulates inside buildings. (Ulrike Passe and Francine Battaglia,2015)

Without ventilation, a building's occupants will initially be troubled by odours and other possible contaminants and heat. Humidity may rise because of indoor moisture sources such as the occupants, laundry, cooking and plants; thus, enhancing moisture hazards (for example, mould growth and condensation). Oxygen will nevertheless not be missed until much later. The purpose of ventilation is to eliminate airborne contaminants, which are generated both by human activity and by the building itself. These are:

. bad odours, to which people entering the room are very sensitive;

. moisture, which increases the risk of mould growth;

. carbon dioxide (CO2) gas, which may induce lethargy at high concentrations;

. dust, aerosols and toxic gases resulting from human activity, as well as from

the building materials (in principle, 'clean' materials should be chosen for internal use, but this is not always possible);

. excessive heat.

Ventilation is hence not only essential to ensure an acceptable indoor air quality, but is also often used to improve thermal comfort. For this air heating or cooling, air conditioning (including air humidity control) or free cooling (increasing the outdoor airflow rate to cool down the building fabric) are used. In order to achieve these goals, several conditions should be met:

. Airflow rates should be adapted to need: if too low, good air quality will not be achieved, or draughts, noise and energy waste may result from an excessive airing.

. The air should be well distributed: ideally, the fresh air should reach any occupied zones first and contaminated air should be quickly extracted.

. The air supply should not decrease comfort. It should not cause complaints about draughts, noise or poor air quality.

. The air supplied by ventilation systems should be clean and, where appropriate, should comply with the temperature and moisture requirements. (claude-alain roulet, 2008, ventilation and air flow in buildings)

I.1.5. Benefits of natural ventilation

The direct benefits of natural ventilation are manifold. Ventilation itself is essential to human health, comfort, and well-being. Natural ventilation, if done right, can achieve all the above with much less energy than mechanical ventilation systems. Natural ventilation removes heat through temperature- or wind-driven pressure differences (or a combination of both), while providing fresh air (good indoor air quality) by removing or diluting particle load, odors, humidity, and Volatile Organic Compound (VOC) concentrations. Utilizing natural forces, air can remove heat that has built up or was emitted by occupants. Natural ventilation as a substitute for mechanical systems helps reduce cost for equipment, for ductwork, and for the space to house both. Natural ventilation can also cool down the building fabric over night by removing heat from thermal mass and providing additional energy storage capacity for the daytime. The air velocity can also cool a human body by evaporation, directly affecting human thermal comfort perception and increasing tolerance for slightly higher air temperatures with slightly higher air velocity. (Ulrike Passe and Francine Battaglia,2015)

Apart from improving the energy performance of a building, natural ventilation plays a key role in providing both good indoor air quality and acceptable thermal comfort conditions for occupants. In addition, the employment of ventilation in an office environment can help to mitigate noise and health problems (Antony Wood & Ruba Salib 2013)

The benefit of natural ventilation can be resumed in these points:

- much less energy.
- essential to human health, comfort, and well-being.
- removes heat.
- providing fresh air.
- remove heat that has built up or was emitted by occupants.
- cool down the building fabric overnight.
- Increasing occupant's productivity.

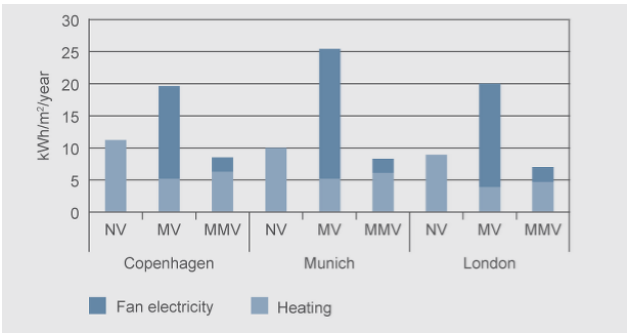


Fig.2: Primary energy consumption (data based on Fraunhofer IBP calculations and assumptions)

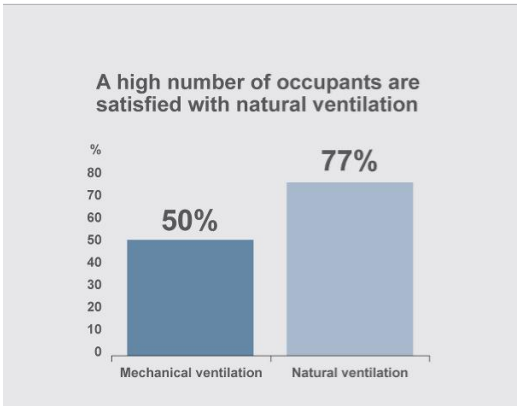


Fig.3: Satisfied occupants (R.T.Hellwig thermal comfort in offices-natural ventilation vs. air conditioning, healthy building 2006)

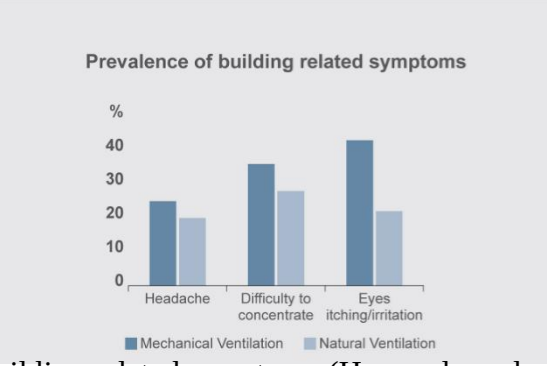


Fig.4: Prevalence of building related symptoms (Hummelgaard J & al indoor air quality and occupant satisfication in five mechanically and four naturally ventilated open-plan office buildings proceeding; indoor air 2005.)

Ventilation provision is thus related either to indoor air quality (IAQ) or thermal comfort. Until recently, most regulations and guidelines on ventilation provision were based on IAQ requirements. However, the function of ventilation to improve thermal comfort in certain situations is also being addressed, mainly by guidelines and newer standards.(Paul Tymkow & al, 2013, Building Services Design for Energy Efficient Buildings)

I.1.6. Natural Ventilation Strategies

A “ventilation strategy” refers to how air is introduced into a building, and how it is extracted out of it. the different strategies used to ventilate buildings can be classified into three main categories:

a: Single-sided ventilation

where fresh air enters the room through the opening on the same side it is exhausted from. This strategy can ventilate the space effectively if the room depth is a maximum of 2.5 times its height (see Fig1). The driving force for single-sided ventilation is wind coinciding with the temperature

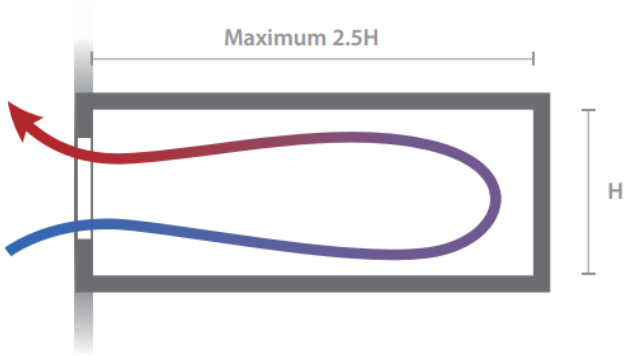


Fig 5: Single-sided ventilation (Ulrike Passe and Francine Battaglia,2015)

b: Cross-ventilation

which relies on the flow of air between the two sides of a building’s envelope due to the pressure differentials between openings in the two sides (air moves from the windward to the leeward side). (see Fig2). The buoyancy effect can also aid the effectiveness of cross-ventilation when the spaces are facing a tall open space such as an atrium.

Fig 6: Cross-ventilation (Ulrike Passe and Francine Battaglia,2015)

c: Stack-ventilation

which involves the entry of fresh air into the building at a low level and its exhaust at a high level due to the occurrence of temperature, density, and pressure differences between the interior and

exterior or between certain zones within a building. Stack-ventilation is often used in buildings which have a central atrium, chimney, or elevated part (see Fig 3). (Antony Wood & Ruba Salib,2013)

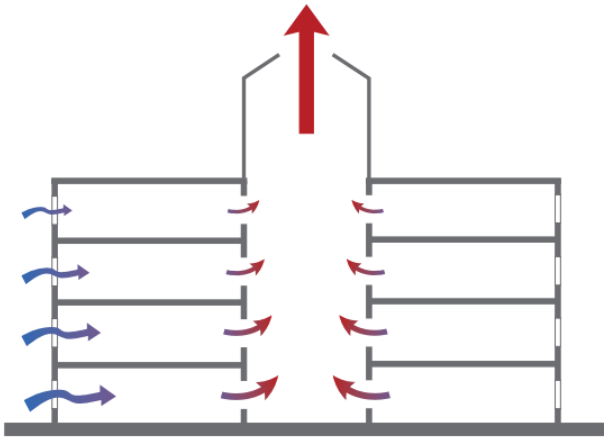


Fig 7: Stack-ventilation (Ulrike Passe and Francine Battaglia,2015)

I.2.THE POROUS FAÇADE

I.2.1. FAÇADE DEFINITION

The aesthetic aspect is generally considered the major component of good design. Exterior appearance is very important; however, exterior building enclosure design is more than just visual appearance. It is the integration of the science of physics with the science of materials. It is the integration of materials, material properties, and performance design principles. It is the application of science and design principles with the art of composition. It is in this intersection of science, art, materials, construction, and many other factors where design and technology, art, and science become architecture. In complete design of exterior building enclosures, beauty is more than skin deep. (Keith Boswell 2013)

The exterior building enclosure. It is the enclosing membrane in vertical, sloped, horizontal, or other geometric configurations separating exterior elements and forces from interior occupied areas.

I.2.2. FAÇADE FUNCTIONS

Each exterior building enclosure has primary functions that include:

1. Structural function: The ability of the system to support itself and the applied loads.

2. Weathertightness: Keeping natural elements outside.

3. Energy efficiency: Performing to high levels by reducing energy consumption. Energy efficiency goes hand in hand with weathertightness.

4. Accommodating building movements. This goes hand in hand with structural. (Keith Boswell 2013)

I.2.3. THE ROLE OF FAÇADE

Reduces Energy Consumption.

Ensures Natural Ventilation.

Provides Acoustic Insulation.

Offers Comfort/Productivity.

Provides Additional Security.

Ensures Aesthetics. (Ruchi Yadav, Jaideep Sarkar and Kartik P. Jadhav 2014)

I.2.4. ELEMENTS AND FORCES ON THE EXTERIOR ENCLOSURE

Newton 's third law of motion is: "To every action there is always an equal and opposite reaction." An enclosure system design needs to accommodate each and every force: the action. Tis accommodation and response is the equal and opposite reaction. Forces are identified in two groups:

1. Exterior forces

2. Interior forces (Frederick S. Merritt, Jonathan T. Ricketts, 2000)

EXTERIOR ELEMENTS AND FORCES

DESIGN	NATURAL						NATURAL & HUMAN			HUMAN CREATED
	WIND	PRECIPITATION (INCL HUMIDITY)	AIR INFILTRATION	TEMPERATURE	SUNLIGHT	SEISMIC	GRAVITY	NOISE	BLAST	BALLISTIC
STRUCTURAL	P	S	S	S	-	P	P	S	P	P
WEATHERTIGHTNESS	P	P	P	P	P	P	S	S	-	-
THERMAL COMFORT	S	P	P	P	P	S	-	S	-	-
MOVEMENT	P	P/S	P/S	P	P	P	P	-	S	S
LIGHT TRANSMISSION	-	-	-	P	P	-	-	-	S	S
ACCOUSTICS	S	S	S	S	S	-	-	P	S	S
SECURITY	-	-	-	S	S	-	-	-	P	P

P = Primary
S = Secondary
- = Not Applicable

Tab1: primary exterior elements and forces and their influence on the enclosure design. (Keith Boswell 2013)

I.2.5. POROSITY

Pore (from Greek *πόρος*) means "a minute opening". *Porosity* or "*the state of being porous*" in the context of organic chemistry and the study of plants and animals indicates the existence of small openings. In biology and in medicine *porosity* is defined as: "*the attribute of an organic body to have a large number of small openings and passages that allow matter to pass through*". The forms, sizes and distribution of pores are arbitrary

Porosity was re-interpreted at Holl's studio, in order to be used in a new tectonic/urban context, to guide the production of a sponge-like building morphology. The use of the concept of *porosity* by Holl's team, reminds the principle of concept displacement, as described in Schön (1963). Holl (2000) notes: "*What if one aspect of a site – porosity – becomes a concept? We hope to develop the possibility of a collection of things held together in a new way where the 'horizon' is open and merges with both exterior and interior*". The synonyms used by Holl's team in the contextual definition of *porosity* form Table 2

porosity	
porous, permeable	honeycomb
screen, net	riddle, sponge
pore	opening, hole
aperture, passageway	cribiformity
sieve-like, sieve	pervious
unrestricted	

TAB2: contextual definition of porosity, by steven Holl architects, NY

I.2.6. POROSITY ADVANGENDS

There are several positives to the porous interface; first is temperature regulation Adjusting the temperatures. In the summer, relatively cold air enters. In the winter, if their openings are facing the sun, this increases the temperature of the interior.

Second light control, through the separation distances and the appropriate size of the bars that cover an opening in the interface so that they intercept direct solar radiation.

Third airflow regulation, large openings help air flow inside, but when lighting considerations require narrow openings to reduce dazzling, the airflow significantly decreases.

Four, humidity control, if the wood is used, it absorbs and filters reasonable amounts of water quite easily as long as it is not covered or painted.

Five, visual privacy, it provides privacy inside, while allowing the outside to be seen through it.

I.2.7. POROUS FACADE'S CONSTRUCTION MATERIALS

The materials used in the porous interface are

aluminum foam: aluminum foam panels are manufactured through an air injection process in molten aluminum, which contains a fine dispersion of ceramic particulate. These ceramic particles stabilize the air bubbles, and create aluminum foam panels which provide an interesting level of detail and variability, generating unique facades with different levels of texture, transparency, brightness, and opacity. (https://buildingandinteriors.com/aluminum-foam-facades-architecture-rich-in-texture-porosity-and-brightness/)

Fig 8: EarthCam Headquarters / Davis Brody Bond + Spacesmith
(https://www.archdaily.com/catalog/us/products/12457/earthcam-headquarters-alusion-stabilized-aluminum-foam-cymat-technologies-ltd?ad_source=neufert&ad_medium=gallery&ad_name=close-gallery/)

Brick: Before the rise of reinforced concrete, brick was the heart and soul of many an early modern building in Korea; As brick architecture was normalized through its use in everything from port facilities and commercial spaces to homes and governments offices, so a particular trend appeared: perforated brick walls. It specifically, though not always, showed itself as a cross shaped design. Perforated brick, from a practical standpoint, was a compromise between privacy and environmental control. By leaving holes in the wall, air could move through.(https://colonialkorea.com/2017/12/17/early-modern-brick-and-the-perforated-qing-cross/)

Fig9: Shopping centre south Korea (https://www.archdaily.com/263967/poroscape-younghanchung-architects)

White aluminum: aluminum is a silvery, soft, ductile, light metal.

Fig10: Outdoor pavilion on the elevated plaza of the Suzhou Center
https://aasarchitecture.com/2018/10/boolean-operator-by-marc-fornes-theverymany.html/

Wood: Wood facades are in vogue. A façade gives to the building its characteristic appearance. For several generations already the exterior cladding is made of wood. Modern architecture increasingly discovered wood façades as a stylish and energy-efficient ingredient.(wood for façade www.seca.com 20717)

Fig11: casa a morchiuso by marco castelletti architects https://www.pinterest.co.kr/pin/539095017892923138/

I.3.THE CULTURAL CENTER

I.3.1. THE CLUTURE DIFENTION

Culture is everything that people have, think, perceive, know, feel, and do as members of society. "Culture is the material and non-material works of arts and science, plus the knowledge; manners; education, made of thought; behaviour and attitude accumulated by people through their history."

I use The Encyclopedia of Philosophy definition which reads, "The whole way of life, material, intellectual, and spiritual, of a given society. «Similarly, Webster's New International Dictionary defines culture as "The complex of distinctive attainments, beliefs, traditions the background of racial, religious, or social group." Also, The Oxford Advanced Learners' Dictionary defines culture as, "The customs and beliefs, art, way of life and social organization of a particular country or group." In simple, Culture is way of life defined by Norms and Values. (SAURAV KOIRALA)

I.3.2. CULTURE AND ARCHITECTURE

Architecture is the manifestation and expression of Culture. So, Architecture and Culture are interdependent and inseparable. Architecture is the part of identity of each community and carries the message of culture of that society. The form and relationships of buildings and spaces acts as a kind of 'cultural marker', which can describe the way of life and social status of its inhabitants. There is no doubt that architecture and layout of buildings, and their interior and exterior facades are among the manifestations of civilization and culture of each community. The physical features of Architecture such as shape, size, decorations, and constructions style etc. are practiced through the cultural system of society. (STEPHEN F. KENNEY, B.S, CULTURAL INFLUENCES ON ARCHITECTURE 1994)

I.3.3. CHARACTERISTICS OF CULTURE IN ARCHITECTURE

Creating space in Architecture appears easy but in fact it is very complex and difficult in deep. It is proven that people are affected by the environment. Human beings cannot adjust in natural environment and hence, they build and organizes artificial environment where they can live in. Types of architectural spaces have changed many times through the history. Culture have both sustainable and dynamic aspects with respect to time. If culture had only stable status, Architecture would have

been consistent continuation throughout the history. But, nature of human and culture of his society had been changed in each and every generation. Therefore, the characteristics of shapes, forms and spaces defined by Architecture is difference and awesome in each period and generations. The changes in Architecture is generally influenced by culture of that period. (SAURAV KOIRALA)

The Main Characteristics of Culture in Architecture:

Shape, Forms, Styles and Space of Buildings.

Design Principles with Context.

Material and Technology for Construction. (SAURAV KOIRALA)

I.3.4. CULTURAL BUILDINGS

I.3.4.1. Definition of cultural equipment:

Cultural facilities: are public or private equipment dedicated and intended for cultural activities.

I.3.4.2. The purpose of cultural equipment:

The impact of cultural equipment in an environment is social and mental balance that we can see it develop in several points:

- Increase cultural activities.

- Aesthetically enrich the city.

- Offer means of expression

- Arouse the thirst for knowledge

- Participate in economic life

I.3.4.3. cultural buildings types

Library	a building, room, or organization that has a collection, especially of books, for people to read or borrow, usually without payment. (https://dictionary.cambridge.org/fr/dictionnaire/anglais/library)
museum	A museum (/mjuːˈziːəm/ mew-ZEE-əm; plural museums or, rarely, musea) is an institution that cares for (conserves) a collection of artifacts and other objects of artistic, cultural, historical, or scientific importance. Many public museums make these items available for public viewing through exhibits that may be permanent or temporary (https://en.wikipedia.org/wiki/Museum)
opera	Opera is a form of theatre in which music has a leading role and the parts are taken by singers, but is distinct from musical theatre. (https://en.wikipedia.org/wiki/Opera)
cinema	is a building that contains auditoria for viewing films (also called movies) for entertainment. Most, but not all, theaters are commercial operations catering to the general public, who attend by purchasing a ticket. Some movie theaters, however, are operated by non-profit organizations or societies that charge members a membership fee to view films. https://en.wikipedia.org/wiki/Movie_theater

theatre	Theatre or theater[a] is a collaborative form of performing art that uses live performers, typically actors or actresses, to present the experience of a real or imagined event before a live audience in a specific place, often a stage. The performers may communicate this experience to the audience through combinations of gesture, speech, song, music, and dance. Elements of art, such as painted scenery and stagecraft such as lighting are used to enhance the physicality, presence and immediacy of the experience.[1] The specific place of the performance is also named by the word "theatre" as derived from the Ancient Greek θέατρον (théatron, "a place for viewing"), itself from θεάομαι (theáomai, "to see", "to watch", "to observe") https://en.wikipedia.org/wiki/Theatre
exhibition	An exhibition, in the most general sense, is an organized presentation and display of a selection of items. In practice, exhibitions usually occur within a cultural or educational setting such as a museum, art gallery, park, library, exhibition hall, or World's fairs. https://en.wikipedia.org/wiki/Exhibition

TAB3: cultural building types (Schéma directeur sectoriel des biens et services et des grands équipements culturels)

I.3.5. CULTURAL CENTER

I.3.5.1. CULTURAL CENTER DEFINITION

Uncertain and ill-defined name given to a space that brings together different cultural activities, gathered in general, but not always around a performance hall. Thus, we have two categories of cultural equipment, one integrated and the other versatile

A cultural center is an equipment dedicated to a set of activities Is a place where there are special organizations in self-managed culture, which revives some activities with a minimum of material and technical means.

The cultural center is an institution and a place which notably offers a program of shows, exhibitions, conferences, but also socio-cultural activities for the local population. (Wikipedia)

I.3.5.2. THE ROLE OF A CULTURAL CENTER

•The promotion of national and popular culture through programs of cultural activities.

• Fostering the education and artistic expression of citizens.

• Encourage the creation and dissemination of artistic and literary works.

• Allow the discovery of young talents in the field of fine arts of letters.

• Help discover and publicize the cultural and historical heritage national.

• Promote traditions and popular arts.

• Organize exhibitions, seminars and cultural visits.

• Organize initiation and development exchange activities in intellectual fields.

I.3.5.3. THE DIFFERENT COMPONENTS OF A CULTURAL CENTER:

• Reception and information area.

• Administration area.

• Research area (media library).

• Creation space (workshops).

• Performance space (museums, performance hall).

• Relaxation and leisure area (restaurant, cafeteria)

I.3.5.4. ARCHITECTURAL QUALITY IN CULTURAL CENTERS

URBAN REQUIREMENTS

The urban requirements are all that are affected in the study of the urban integration of the site and also the scale, which includes the surface and the shape of this site.

Urban integration	-The choice between the two situations, peripheral or central - The impact of the location of the building on the environment (architectural integration, noise pollution, organization of flows, right to sun and light, pollution, preservation of the ecosystem. -The treatment and organization of spaces (climatic conditions, topography of the site, pollution of soil, air, water,).
scale	-surface: less than 1,000 (small equipment). - more than 10,000 (very large equipment). - Two pitfalls should be avoided symmetrically.

TAB4: Urban requirements (author according to normalisation des infrastructures des équipements culturels)

ARCHITECTURAL REQUIREMENTS

Access	- technical access to the stage which must be as direct as possible from the outside - the access doors located 3 m high on the front - access to emergency services, which can be very restrictive depending on the category of the establishment and its urban location - public access and evacuation with respect for standards accessibility for the disabled
Parking Capacity	There is no specific rule for assessing the number of places parking compared to the nature of a cultural facility
Accessibility for handicapped people	-The circulation spaces will be carefully studied to allow accessibility for disabled people (furniture, passage width, floors, visual comfort, contrasting colors, path strip, staircase signalling, height of switches and door handles, Signalling that is only visual must in particular be capable of being audibly or tactile doubled and audible must be capable of being duplicated visually. -the lighting and the visual quality of the signage, do not create any obstacle or danger by the installation of the signage ... The quality of the lighting, artificial or natural, of the interior and exterior common circulation must be such that the entire route is covered without creating visual disturbance.

	- The sanitary facilities fitted out for the disabled, as well as the elevators will be judiciously distributed in the buildings in order to be quickly and easily accessible -The sanitary and shower space and furniture accessible to people with reduced mobility will be carefully studied (door, grab bar, sink, mirror, etc.

TAB5: Architectural requirements (author according to normalisation des infrastructures des équipements culturels.

TECHNICAL REQUIREMENTS

The technical requirements for security systems both protect people against fire, against intrusion and vandalism, in maintenance and upkeep or protect the construction through the protection of foundations against humidity and the rise of d and also the treatment of the facade and how a crawl space is achieved.

security **(Security against fire, people, against intrusion** **and vandalism, in upkeep and maintenance**	-avoid slippery floors. -avoid overhangs and overhangs of the structural work limit the weight of the false ceiling elements - used safety glass for all glass parts located less than a meter from the ground; -limit the sweeping radius of the sashes when they open and give a minimum space requirement to the windows in the open position -The stair treads will have a non-slip stair nosing securely attached. Guardrails for stairs, passageways, mezzanines, etc. will have a minimum height of 1.10 m. The roofs terraces are generally inaccessible. -The equipment and interior fittings will be solid and will resist any deterioration -The doors to the spaces will be equipped with a simple and user-friendly system to avoid any increase in operating and maintenance costs.
Big work **(Foundations, Structure, Facade treatment, Crawl space)**	**Foundations** - The foundations will be protected against humidity and upwelling. - In addition, we will avoid damage to groundwater currents: Appropriate foundations. -Observe the conclusions of the Structure soil study -The architectural plans will clearly show the elements of structure, posts, sails, masonry in order to assess the adaptability of the premises.
	Facade treatment In the height of the ground floor: The facade elements must resist accidental impact, normal friction and deliberate damage. - Plan for the simplicity and ease of cleaning operations (graffiti, wild posting, balloons…) - Prohibit protruding sun breezes accessible to students - Solve the problems of splashing and rising damp at the foot of the facades For all facades:

	- chosen Finishing materials for their decorative aspect but especially for their solidity, their durability, and their ease of care and maintenance. - sought after homogeneity and simplicity - The geometry of the windows will favor natural lighting. - In case of insulation from the outside, provide protection with a hard, solid and washable coating - avoid drips and traces of water (drops of water / water discharges ...) - The parapets and headboards will receive waterproofing protection - The exterior coverings must resist aging. Crawlspace: -Provide accessible crawl spaces (under humid rooms) and technical galleries of 1.50 m minimum width (under collectors and networks). -The free height under the floor will be 2.00 m in the running part and 1.60 m under the beam, lighting 150 lux. The whole will be ventilated naturally -Insulation on the underside with anti-rodent and anti-termite protection - Regulatory access for maintenance work. - prohibit any storage of materials in the crawl space. -Lighting and marking of the service road in serious cement
Flexibility	-The structure of the buildings will be designed according to a regular grid facilitating the establishment of premises of different surfaces The trays will be freed from load-bearing points; range of spans. -Overloads will be unified on the same platform. -Ease of decompartmentalization. -Pending hoppers will be provided at regular intervals to facilitate the passage of vertical networks (downspouts of wastewater, various feeds). - A central distribution of fluids by false ceilings will be provided, with the possibility of connections on the various premises. - - The technical ducts and general distribution cabinets will be largely sized to accommodate any possible increase in power or network. _ In office areas, there will be no break in floor covering between spaces, as on false ceilings.

TAB6: technical requirements (author according to normalisation des infrastructures des équipements culturels.)

In addition to these technical requirements, it is also interesting to study the comforts in cultural equipment, thermal comfort in summer and winter, acoustic comfort (isolation from airborne noise), and visual comfort (natural lighting) for improve working conditions and get the best quality in this equipment.

Thermal comfort (Winter thermal comfort, Summer thermal comfort)	Winter thermal comfort: -In circulation areas, the comfort requirements will be less stringent than in other premises and all or part of the circulation may be unheated or only slightly heated.

	- We will reduce the cold wall effect by favouring highly insulating glass walls (double glazing with low emissivity). - Premises at risk of overheating will be strategically positioned. - to avoid parasitic air movements, the air vents or return or ventilation grilles of the ventilation or heating installations will be well sized and correctly positioned. Summer thermal comfort: -The thermal comfort of summer must be ensured by a good design of the premises with architectural and technical provisions (sun protection, good insulation of the walls, thermal inertia, opening, possibility of assisted night ventilation ...). -Outdoor solar protection will be studied, depending on the orientation, for any vertical glazed surface, oriented from north-west to east via the south (horizontal, vertical masks, external blinds, sun shades, ...). -We will choose devices adapted to each orientation and we will favour those stopping direct radiation but nevertheless transmitting natural light (by reflection or otherwise). -Interior sun protection is prohibited. -We will also take care of the insulation, and in particular that of the roofs. -The ventilation system in summer mode, will be mainly designed for the evacuation of overheating and we will largely use passive cooling and natural ventilation systems. -For facades exposed to noise, comfort will be maintained while maintaining sound insulation. Attention should therefore be paid to the following points: - the choice of directions for premises with a high risk of summer discomfort (occupation or equipment). - the external solar protection implemented for each orientation -reduction of internal loads and in particular those due to office automation, lighting and cooking appliances -the inertia of the building must be sufficient to absorb the peaks of overheating and redistribute during the day part of the freshness stored during the night. - the device must allow night ventilation.
Acoustic comfort (General requirements, Airborne sound insulation)	In terms of interior fittings, the premises where silent activities take place will be distant, both horizontally and vertically, from the rooms where noisy activities take place (simultaneously), and any technical rooms housing noisy equipment. -Phonic insulation solutions will limit the risk of discomfort between indoor and outdoor, between different places and in rooms where calm is sought. Additional solutions could be considered, if necessary, in addition to sound insulation (buffer zones, absorbent materials such as wood, felt, flocking, etc.). -In particular, premises receiving equipment producing noise pollution, such as workshops, music rooms, boiler room or local ventilation ..., will be equipped with absorbent panels or any treatment avoiding resonance phenomena, anti-pads vibrating for machines,
Visual comfort	Diffuse natural lighting is preferred and artificial lighting sources must reconcile control of energy consumption and comfort

(General requirements, Natural lighting)	-The use of natural light (excellent light output, excellent colour yield, ...), for psychological aspects (fight against fatigue) and for its energy value. - Bay windows, at viewing height, overlooking the exterior will allow the eyes to rest and the mind to recover. -choose colours which will create a pleasant and harmonious environment and which will favour the diffusion of light (natural and artificial

TAB7: technical requirements: comfort (author according to normalisation des infrastructures des équipements culturels.)

In order to ensure comfort, high quality building materials must be chosen and the choice depends on technical, architectural and economic criteria:

The materials	• Technical and architectural criteria: -technical performance - functional performance - architectural quality - durability and ease of maintenance • Economic criteria: - investment costs - deferred costs (maintenance, renewal)

TAB8: technical requirements: materials choice (author according to normalisation des infrastructures des équipements culturels.)

FUNCTIONAL REQUIREMENTS:

From the above, we have studied the requirements that must be met for the design of cultural facilities in general, and now these requirements specialize in the design of museums.

The functional requirements of a museum are in-depth studies of the most important spaces in museums and the rules that must be taken into account when designing to perform functions that are designed for it.

Public reception	The need to predict: * in advertising including the cultural centre: - the precise indication - opening hours - access routes - means of public transport □ signage, as visible and continuous as possible, of the route (s) leading to the museum: to make it more immediately readable near the museum, the development, on the surface or underground, of a parking area for vehicles or , failing this, the installation of signage clearly indicating the path to follow to reach the nearest car park
Specific receptions	• Groups of adults for (tourists, members of cultural associations, etc.) or are trained locally to prevent their reception from disturbing that of individual visitors: one or more gathering and waiting areas, with corresponding seats and towards which clear signage will direct them - if not individual locker rooms, at least one route - facilities for passing through checkpoints, • School groups if a specific entrance is reserved for them, they must also

	be able to have assembly points, will be very useful a room equipped for the preparation of the visit, these must also be able to have meeting points, will be very useful a room equipped for the preparation of the visit, • Physically disabled: For: - people who travel in wheelchairs, - seniors, _ visitors who suffer from visual and hearing disabilities. for access to the ground floor, a ramp following a slope as soft as possible (1/20 maximum); use electric trolleys for crossing internal stairs calibrated elevators or, if this is not possible, easily hoists accessible
reception	**Formalities. Hardware amenities** -a space where it is free to mark a time of stopping, of habituation, Vest cloakrooms: classic cloakrooms and, if necessary, lockers, easily accessible -**changing rooms**: classic changing rooms and, if necessary, lockers, easily accessible -**sanitary facilities**: toilets, as close as possible to the changing rooms and without direct opening onto the reception hall. -**telephones**, mailboxes, stamp dispensers, tables or tablets -There must be emergency exits and routes to facilitate the evacuation of people and collections in the event of a disaster. - **IT information devises** : constitues a devise information that allows the visitor to quickly learn, In the museum, **signs, screens: information** tables, **Restaurant. Cafeteria**: Similarly, if a restaurant or cafeteria, or both, location.
Exhibition hall	The exhibition hall is a large space for artistic, scientific or historical works ... etc. - it should open as widely as possible to general and specific reception, if there is one. - either near storage - the size of the room depends on the paintings - for each group of tables, a particular room - for each painting a specific wall - favourable attachment surface between 30 ° and 60 ° for the height of the 6.70m pieces - normal viewing angle for humans 54 ° from the eye, 27 ° above the horizontal - SE-SO orientation must be avoided for the exhibition space because the solar radiation is very strong, shadows, frowned upon object. - Organization of space in areas of various sizes and closely linked to the characters of the objects on display. - the room is well lit with regular, bilateral light - The use of indirect lighting through. - To have good overhead lighting: d <2h - To obtain good lateral lighting: d <1.5 The glazing must be diffusing.

	- Permanent or mobile rampes inside. - Lifts calibrated for the disabled and the elderly
Collection exhibition conditions	• **Atmospheric impurities** - hydrogen sulphide, sulfuric acid. etc. -dirty dust, **Thus, can be recommended**: fluid dynamics studies for the layout and layout of interior spaces. air filtering by general building conditioning It goes without saying that the use of materials in construction as in planning such as certain concretes dust generators • **Light** - Whether they are of natural or artificial origin, whether they are visible or invisible - **Light sources**: - fluorescent tubes _ incandescent lamps_ iodine cycle lamps _ controlled daylight: - 150 to 200 lx for sensitive objects (paintings in particular). -50 to 80 lx for the very sensitive (tapestries, drawings, specimens natural history, etc.) • **Humidity and temperature** -Relative humidity: 55 ± 5%; for temperature: 18 ± 2 C ° as conservation standard - provided thermal insulation by walls of several thicknesses and double panes. - used materials capable of absorbing climatic shocks, hygroscopic in dry climate, water repellent in humid climate. • **Protection of people, works and premises against fire** - It is necessary to set up detection systems (ionic, optical, thermostatic… etc.) - the location of fixed installations such as fire hydrants, hydrants, dry columns, tanks, armed taps, even -To limit the spread of a fire, the premises must be compartmentalized by means of fire doors closing off large interior openings. • **Protection against theft and depredation** - enhanced protection of certain crossing points - isolates all or part of the exhibition area from that of the premises housing the most precious collections. - the embedding of wall displays cases, some of which constitute large enclosed volumes. - the footprint of non-recessed glass, plinths and displays, so that they can be determined.
Research	Certain cultural centres, fundamentally devoted to research, have the qualification of scientists - Anyway, reservations for works not permanently exhibited - the study rooms which they can thus constitute form part of the scientific apparatus of the museum - They must be: -preferably in the basement, _ natural lighting is rarely needed; perfectly insulated (reinforced walls)

	strictly controlled access; a homogeneous block, independent of the rest of the museum their surveillance, • **A laboratory**: to conduct scientific analysis identification, dating, examination of transformations etc. **Its location** - comply with regulations on occupational safety and health; -it can be partially installed in the basement, but only for functions that do not require the permanent presence of personnel. • **Restoration workshops**: research sites linked to that of laboratory **its location**: - the isolation of each of them, - the safety of works being restored, materials and staff, air conditioning, lighting (point, among all, particularly delicate), product storage, connections to the rest of the museum.
Management	Spaces for the actual administration of the establishment: offices, meeting rooms, reception room, toilets, storage rooms, etc. accessible from the outside, -these spaces, linked as directly as possible with the rooms of exposure and reservations. One or more scientific documentation centres • The central monitoring stations - museum security centre, day and night - away from public spaces and even from other service spaces, • A switchboard: - requiring absolute sound isolation, A cafeteria restaurant for museum staff, An infirmary: located so as to allow easy evacuation of people or sick or injured • Technical rooms - power plant and emergency and safety system; _ central storage - distribution of fluids for fire extinguishing systems; - waste pickers and treatment, etc. • A garage _ for service vehicles _ linked directly with the reserve area and with storage premises

TAB9: functional requirements :(author according to normalisation des infrastructures des équipements culturels

Conclusion:

In this chapter we have exposed those three concepts natural ventilation, porous façade and cultural centre.

Based on the foregoing, natural ventilation can be achieved by three different strategies :Single-sided ventilation, Cross-ventilation, Stack-ventilation, and its benefit: much less energy, essential to human health, comfort, and well-being, removes heat, providing fresh air, remove heat that has built up or was emitted by occupants, cool down the building fabric overnight and increasing occupant's productivity.

As for the porous façade, its importance lies in providing more light and aesthetics to the project. It can also give the project a definition through the façade pattern, temperature regulation, humidity control, visual privacy and airflow regulation.

Porous façade can affect natural ventilation by:

Temperature setting; In the summer, the place is soothing, which helps the place users to lose heat from their bodies. The relatively cold air enters the rooms. In winter, its openings are facing the sun's rays, and thus this increases the interior temperature and the residents feel warm.

As the façade allowed large openings in the walls, it became possible for a steady stream of air to pass through the openings into the rooms, which helps to soften the internal environment of the building, and the design of the bars and openings allows sunlight in winter to enter the internal architectural void where these are designed The openings and taking into account the angles of the fall of the sun in winter, as it is closer to the ground and thus increases the air temperature in winter.

Accordingly, it can be said that the cultural center can be given a definition through the porous façade, which in turn helps direct natural ventilation and control airflow.

CHAPTER II: ANALYTIC STUDY

INTRODUCTION:

This chapter aims to synthesis the examples and site analysis through several points and layers in order to result a propriety programme for the project.

These chosen examples are closest as possible to the theme of study, they might light up the way of designing our project by seeing how they used the porous façade in their design concept to achieve natural ventilation.

The site analysis is too important to know the weather circumstances of the project environment.

II.1. EXAMPLES SYNTHESIS

The selected examples are

- MÉCA Cultural Centre (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France : centrally located in Bordeaux, between the river Garonne and Saint-Jean train station, the new 18,000 square meter Maison de l'économie créative et de la culture an Aquitaine, or MÉCA for short, brings together three regional arts agencies: FRAC for contemporary art; ALCA for cinema, literature, and audio-visuals; and OARA for performing arts.

- Cultural Center La Gota - Tobacco ESPAIN Museum: Cultural Centre La Gota is a hybrid building for exhibition spaces that aims to create a new focus of urban centrality in Navalmoral, showcasing the identity of the town.

- HOUSE OF CULURE REDHA HOHO BISKRA: The building of the House of Culture, Ahmed Reda Houhou, for the state of Biskra during the colonial era was original "Palace" descended, then immediately after independence, it turned to the seat of the sixth historical state, after which it became a guesthouse for the state of Biskra in 1974, then it turned into the seat of the state of Biskra until 1988.
In 1988, the House of Culture was established in Biskra, according to a ministerial decree.
The House of Culture seeks to highlight the distinctive cultural character in which it is rich in sugar and revive its cultural heritage, through the contribution and participation of local cultural institutions and associations and all those who are truly interested in the culture.

These examples were chosen because the sites in which they are located are similar to the project site's environmental and weather data, and the facades are designed in the form of porosity that is the subject of the study's research.
These examples can show us the relationship between the porous façade in achieving air comfort and help us design the project.

A. CONTEXT

1.ENVIRONMENT CITY SCALE

1.1 URBAN/NATURAL

MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, FRANCE

Fig12: Méca location (google earth)

Méca cultural center

Bordeaux train

Museum of printing

Sainte Croix church

The Garonne river

The project is in the area of cultural and tourist buildings and close to transportation.

Cultural Center La Gota - Tobacco ESPAIN Museum

the projet

Fig13: La Gota - Tobacco ESPAIN Museum location (google earth)

Municipality of navalmoral

Pabellon Polideportivo Municipal

-The projet is located in administrative and education area.

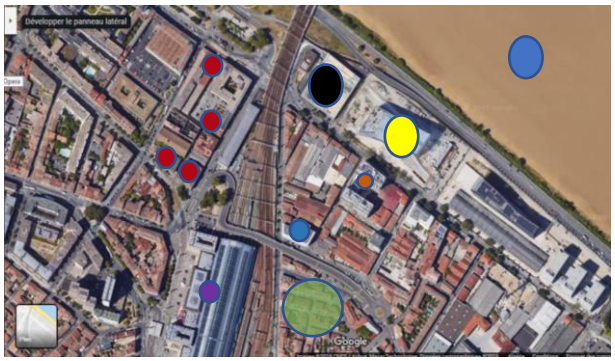
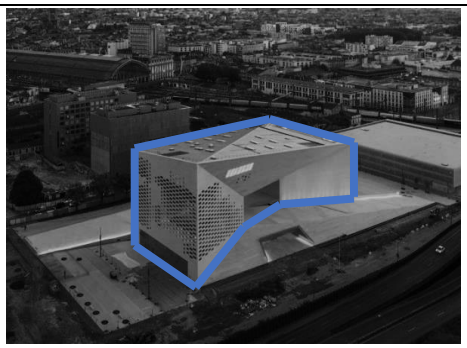
HOUSE OF CULTURE REDHA HOHO BISKRA	 Fig14: House of culure redha hoho biskra location (google earth)
	-The project located in industry area.
Synthesis	
It is better if the building is in areas where people can reach and be the locality.	

TAB10: a. context/ 1. environment city scale /1.1 Urban/Natural.

A. CONTEXT **1.ENVIRONMENT CITY SCALE** **1.2 BUILDING CITY RAPPORT**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig15: MÉCA Cultural Center http://www.nilskoenning.com/index.php?entry=page/3_Architecture/0_MECA/  (Archdaily.com)
	-The building has different shape from other buildings. -The building adds a landmark to the city.

Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig16: Cultural Center La Gota - Tobacco ESPAIN Museum (Archdaily.com)
	-The building has same high as the others and same texture. -The building cannot be found so easily.
Synthesis	
The shape and texture defined whether the project adds a landmark to the city or not.	

TAB11: a. context /1. environment city scale/ 1.2 building city rapport.

A. CONTEXT **2.IMMEDIATE ENVIRONMENT** **2.1. SPOTTING**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig17: MÉCA spotting (google earth) meca river parking hotel Train station Neighbourhood employment pole agency audiovisual cinema book
	

	https://worldarchitecture.org/article-links/ecfhh/big-s-new-cultural-hub-mca-made-from-a-giant-loop-creates-an-urban-room-in-bordeaux.html
	The project is surrounded by cultural and tourist; administrative building adding to that it is near to transpiration and a neighbourhood.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig18: La Gota - Tobacco museum spotting (google earth)
	The project is surrounded by tourist building.
HOUSE OF CULTURE REDHA HOHO BISKRA	 Fig19: house of culture redha hoho spotting (google earth)
	The project located administrative environment.
Synthesis	
The center can be spotted easily if it has a unique shape and design or different texture.	

TAB12: a. context/2.immediate environment/2.1. Spotting.

A. CONTEXT **2.IMMEDIATE ENVIRONMENT** **2.2 INTEGRATION/CONTRAST**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig20: méca integration/contrast (Archdaily.com)

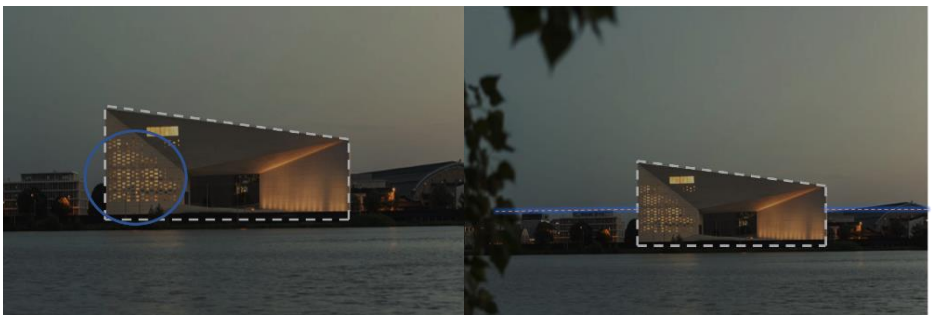
	-The building has a different shape from the near buildings; it offers a contrast. - The building is covered entirely in raw concrete; the material is sandblasted to texture the surface with local sandstone of Bordeaux.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig21: La Gota - Tobacco museum integration/contrast (Archdaily.com)
	The project is integrated by texture and high.
Synthesis	
the texture gives the integration or contrast sign to the building.	

TAB13: a. context/2.immediate environment/ 2.2 integration/contrast.

A. CONTEXT **2.IMMEDIATE ENVIRONMENT** **2.3 IDENTITY**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig22: méca identity(https://ideat.thegoodhub.com/2019/07/02/bordeaux-la-meca-nouveau-totem-de-la-culture-signe-big-et-freaks/)
	- The extension area symbolizes to roman forum. - A cultural center express the city Identity.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig23: La Gota - Tobacco museum Identity (Archdaily.com)

	Lightweight material used in the double skin facade balances out the ambience of the surrounding context in relation to the materiality used on the contextual buildings to reflect the city identity.
HOUSE OF CULTURE REDHA HOHO BISKRA	  Fig24: house of culture redha hoho Identity (house of culture biskra)
	-Using brackets Using columns in the facades. -The building reflects the city identity.
Synthesis	
Using local material or symbolizing form related to the culture of the city in order to express the identity of the local.	

TAB14: a. context 2. immediate environment 2.3 Identity.

A. CONTEXT **2.IMMEDIATE ENVIRONMENT** **2.4 IDENTIFICATON**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig25: méca identification(https://ideat.thegoodhub.com/2019/07/02/bordeaux-la-meca-nouveau-totem-de-la-culture-signe-big-et-freaks/)
	- The porous facade gives art feeling. - The building has different shape and high.

Cultural Center La Gota - Tobacco ESPAIN Museum	Fig26: La Gota - Tobacco museum identification  (https://www.pinterest.com/pin/396035360982716518/)
	- The porous facade adds an art sense to the building which give it an identification.
HOUSE OF CULURE REDHA HOHO BISKRA	 Fig27: house of culture redha hoho identification (house of culture)
	- The building has a tradition element that gives a culture sense.
Synthesis	
To identify the cultural centre; its interface might include an art inspiration or sense.	

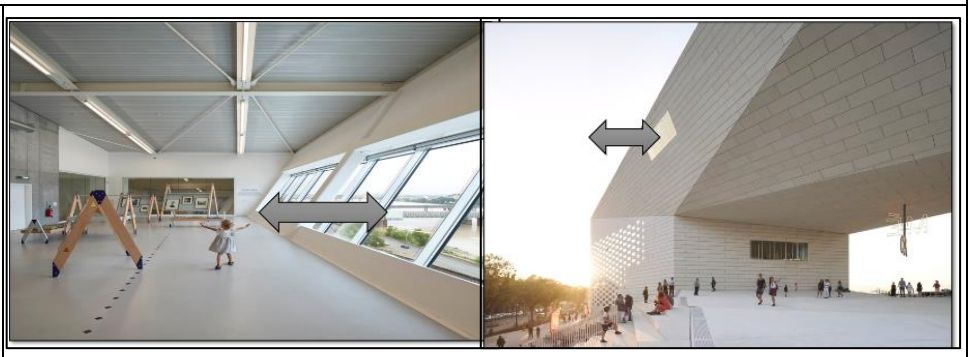
TAB15: a. context/2.immediate environment/2.4 identification.

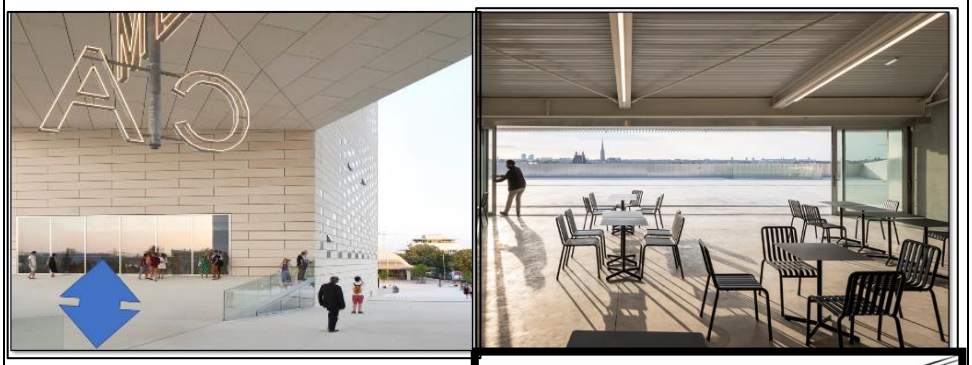
A. CONTEXT

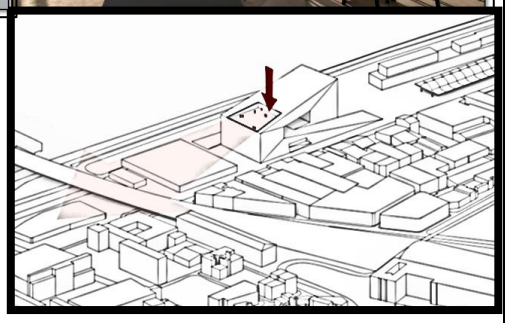
2.IMMEDIATE ENVIRONMENT

2.5 INTERIOR /EXTERIOR RAPPORT

MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France







visual relation

direct relation

Fig28: méca interior /exterior rapport(Archdaily.com)

- Panoramic rooftop terrace over the Bordeaux skyline.
-There is two type of interior/exterior rapport visual and direct.

Cultural Center La Gota - Tobacco ESPAIN Museum

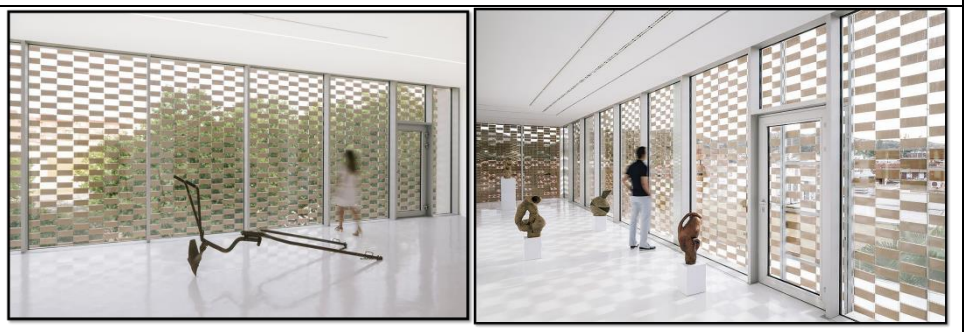


Fig29: La Gota - Tobacco museum interior /exterior rapport (Archdaily.com)

visual relation

-Only visual relation interior/exterior.

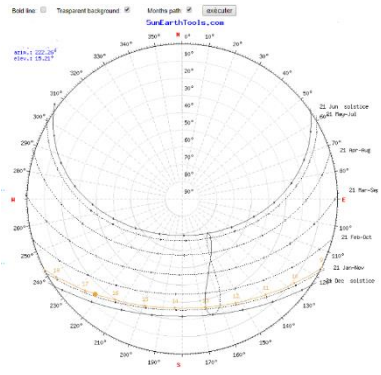
HOUSE OF CULURE **REDHA HOHO BISKRA**	  Fig30: house of culture redha hoho interior /exterior rapport (by the researcher) visual relation Indirect relation
	-There is two type of interior/ exterior relation.
Synthesis	
-The cultural must have interior/exterior rapport and it can be visual or direct and indirect.	

TAB16: a. context/2.immediate environment/2.5 interior /exterior rapport.

A. CONTEXT **2.IMMEDIATE ENVIRONMENT** **2.6 ACCESSIBILITY**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig31: méca accessibility (google earth) street Mechanical road pedestrian Strong pedestrian flow
	-There is two type of accessibility mechanical and pedestrian.

Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig32: La Gota - Tobacco museum accessibility (google earth)
	- The project has two road access and pedestrian flow from two sides.
HOUSE OF CULURE REDHA HOHO BISKRA	 Fig33: house of culture redha hoho accessibility (google earth)
	-The building has one mechanic road access and only 2 on feet flow. -This building has a poor mechanic accessibility.
Synthesis	
-The cultural centre must have a good accessibility by providing at least two mechanic road and pedestrian flow.	

TAB17: a. context/2.immediate environment/2.6 accessibility.

A. CONTEXT **3. THE PROJECT IN ITS CONTEXT** **3.1 LOCATION**
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France  

<table>
<tr><td></td><td> 

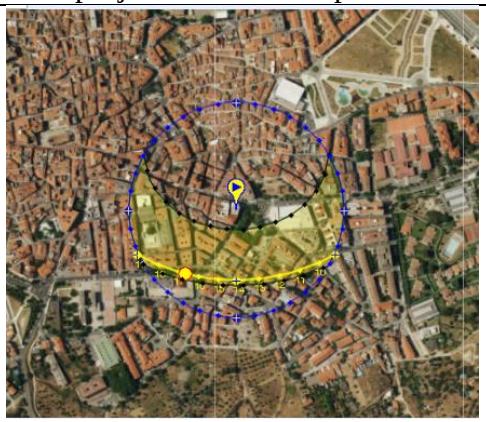
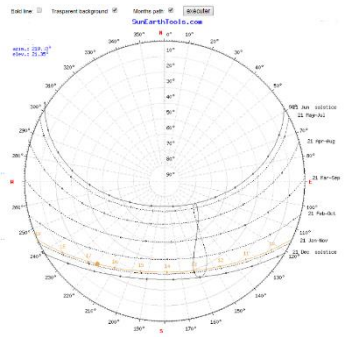
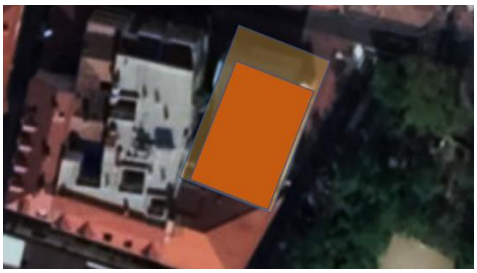
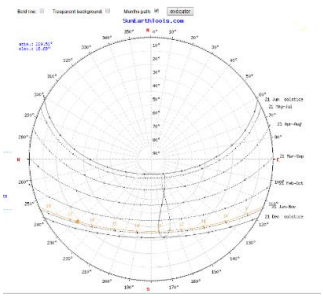
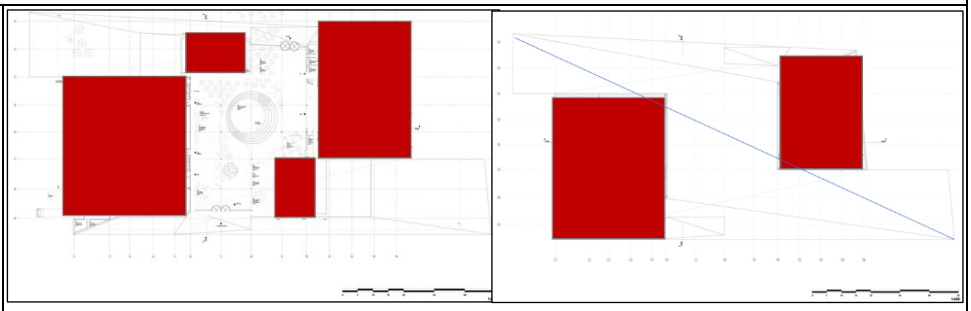
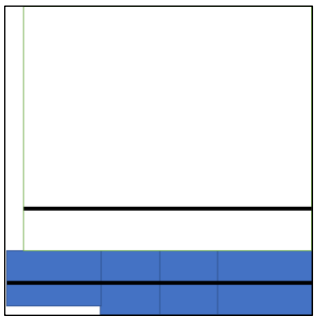
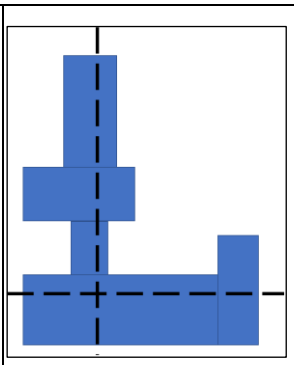
built
not built
Fig34: méca location (google earth)</td></tr>
<tr><td></td><td>-The project is located in plane site.</td></tr>
<tr><td>Cultural Center La Gota - Tobacco ESPAIN Museum</td><td> 
 
 
built
not built
Fig35: La Gota - Tobacco museum location (google earth)
(google earth)</td></tr>
<tr><td></td><td>-The project located in semi exposed site to the sun.</td></tr>
<tr><td>HOUSE OF CULURE REDHA HOHO BISKRA</td><td> 
 
(google earth)</td></tr>
</table>

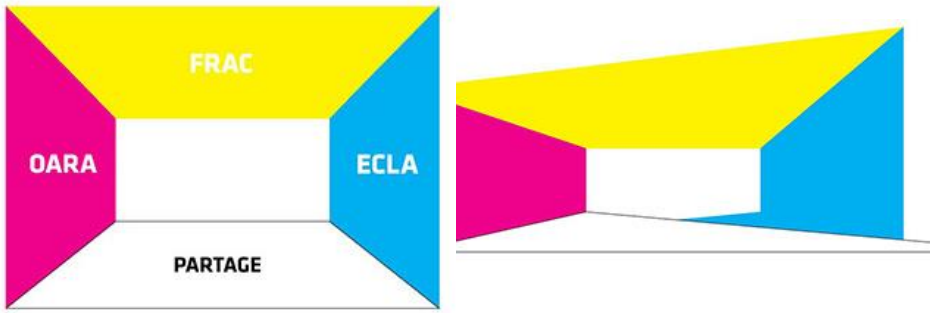
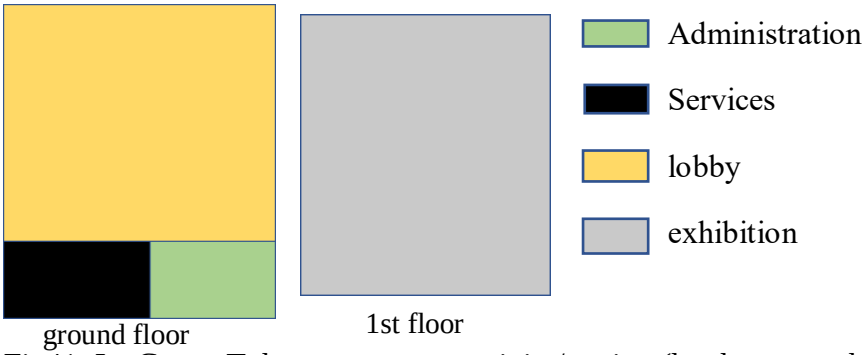
	 Fig36: house of culture redha hoho location (PDAU 2016)
	- The site is exposed to the sunlight.
Synthesis	
The location of the cultural centre characterized by its exposed to the sunlight.	

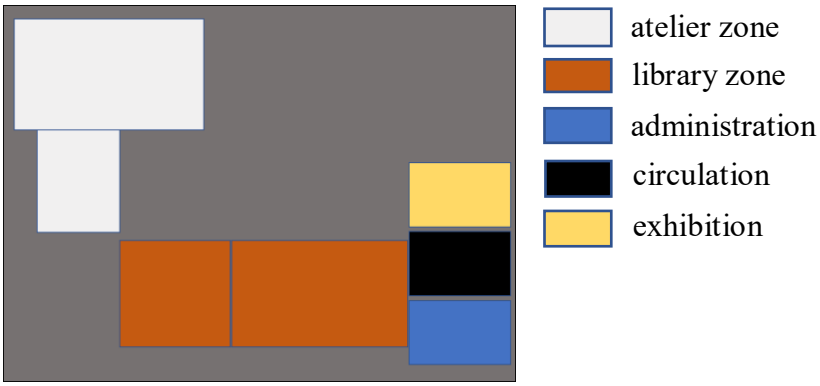
TAB18: a. context/3. the project in its context/3.1 location.

B. ORGANISATION **1.ORGANISATION OF SPACES**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig37: méca organisation of spaces (by the researcher)
	- The spaces are organized by centrality and symmetry in 2nd floor. - The spaces are organized by symmetry in ground floor.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig38: La Gota - Tobacco museum organisation of spaces (by the researche
	- The spaces are linear organized.

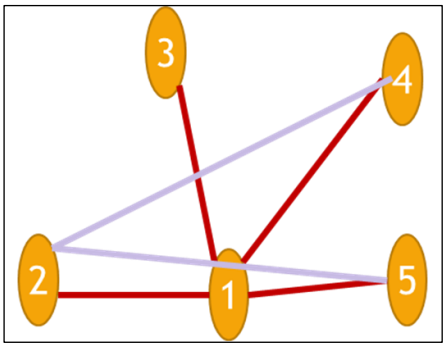
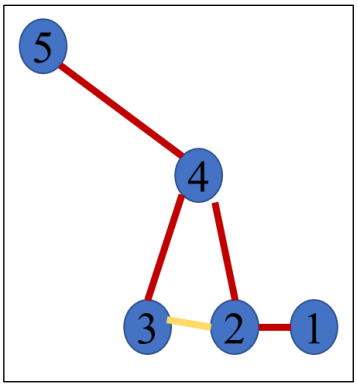
HOUSE OF CULURE REDHA HOHO BISKRA	 Fig39: house of culture redha hoho organisation of spaces (by the researcher)
	-The spaces are linear organized. -Good and easy circulation.
Synthesis	
The spaces are either linear, centrality or symmetry organized.	

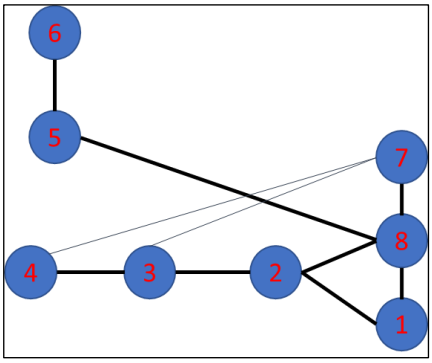
TAB19: b. organisation/1.organisation of spaces.

B. ORGANISATION **2. ACTIVITY/ZONING**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig40: méca activity/zoning (Archdaily.com)
	-FRAC for contemporary art -ECLA for cinema, literature, and audiovisuals -OARA for performing arts
	- Separated spaces according to activity. - Thus, provide privacy and noise isolation.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig41: La Gota - Tobacco museum activity/zoning (by the researcher)
	-The services spaces and admirative in the ground floor. -Separating the exhibition from the other spaces.

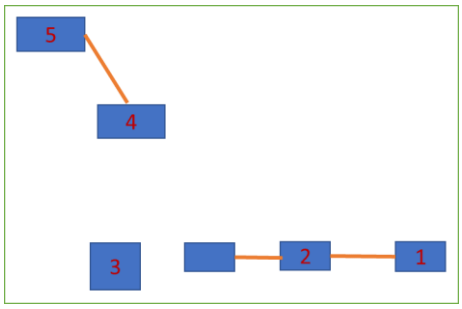
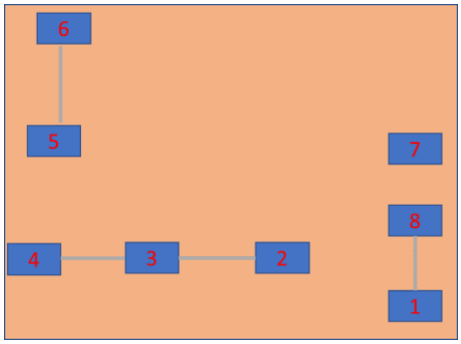
HOUSE OF CULURE REDHA HOHO BISKRA	 Fig42: house of culture redha hoho activity/zoning (by the researcher)
	-Separation between exhibition zone and Ateliers zone. -The calmer zone near to noise zone.
Synthesis	
The separation between the spaces according to the activity in order to provide acoustic isolation and privacy.	

TAB20: b. organisation/2.activity/zoning.

B. ORGANISATION **3. FUNCTIONS STUDY**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 1.Lobby 2.Theater 3.Adminstration 4.Audiovisual 5.liabrary Fig43: MECA functions study (by the researcher)
	-The lobby have a strong relation between all the spaces.
Cultural Center La Gota - Tobacco ESPAIN Museum	 1.Administration 2.Reception 3.Services 4.Lobby 5.Exhibition Fig44: La Gota - Tobacco museum functions study (by the researcher)
	-The lobby have a strong relation between all the spaces.

HOUSE OF CULURE REDHA HOHO BISKRA	 strong weak 1.Adminstration 2.Liberay 3.Audiovisual 4.Theater 5.Children atelier 6.Atelier 7.Exhibition 8.Lobby Fig45: house of culture redha hoho functions study (by the researcher)
	-A strong functional relation between audio-visual library and theatre -The lobby has a strong relation between all the spaces.
Synthesis	
The lobby is the centre and the connecter between the spaces.	

TAB21: b. organisation /3. functions study.

B. ORGANISATION **4. ACTIVITIES STUDY**	
Cultural Center La Gota - Tobacco ESPAIN Museum	 direct 1.Administration 2.Reception 3.Services 4.Lobby 5.Exhibition Fig46: La Gota - Tobacco museum activities study (by the researcher)
	-There is a direct relation admirative area. -A direct relation between the exhibition and the lobby.
HOUSE OF CULURE REDHA HOHO BISKRA	 direct 1.Adminstration 2.Liberay 3.Audiovisual 4.Theater 5.Children atelier 6.Atelier 7.Exhibition 8.Lobby Fig47: house of culture redha hoho activities study (by the researcher)
	-A direct relation between the calm spaces.

Synthesis
It is preferred to create a direct relation between the spaces that have the same activities.

TAB22: b. organisation/4. Activities study.

B. ORGANIZATION

5. CIRCULATION/ FUNCTIONS/ ACTIVITIES RAPPORT

MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France

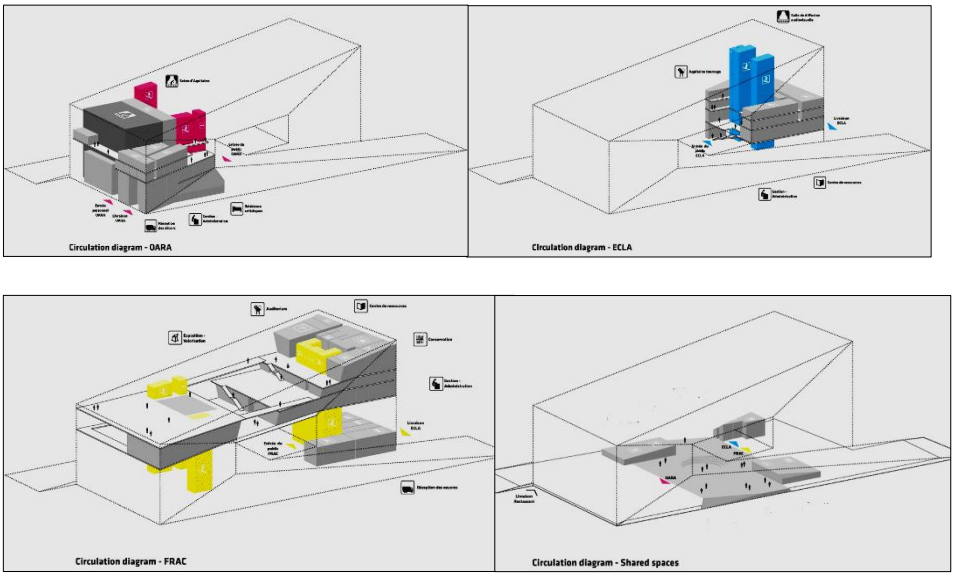


Fig48: MECA circulation/ functions/ activities rapport (https://visuall.net/2012/06/28/cultural-centre-meca-by-big-freaks-freearchitects/)

-A vertical circulation in each type of activity zone.
-And horizontal circulation in the shared space.

Cultural Center La Gota - Tobacco ESPAIN Museum

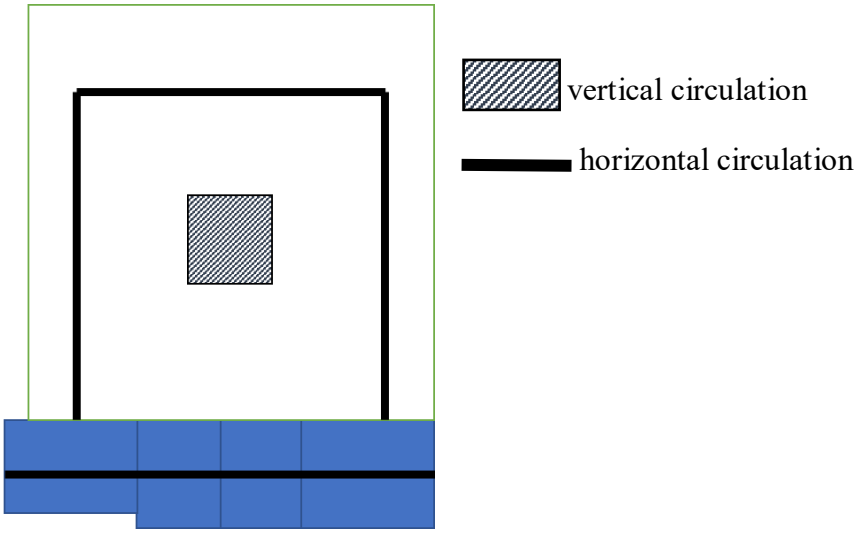
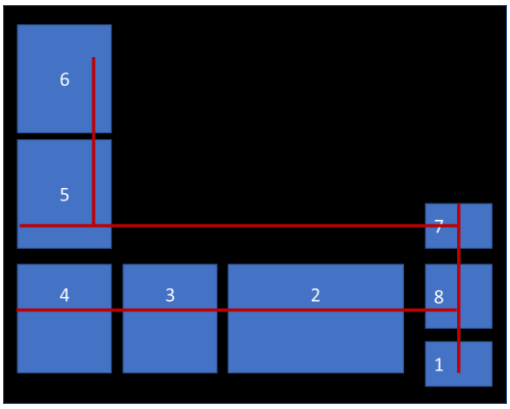
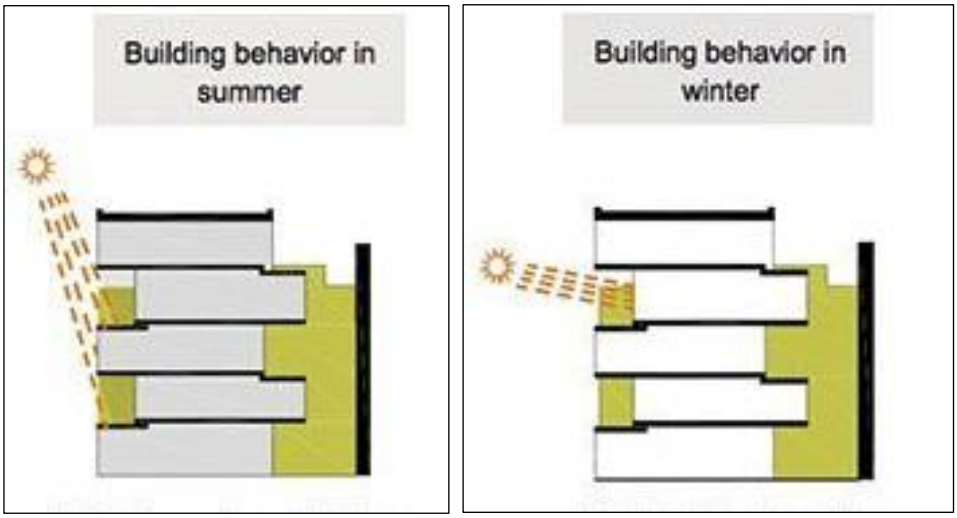


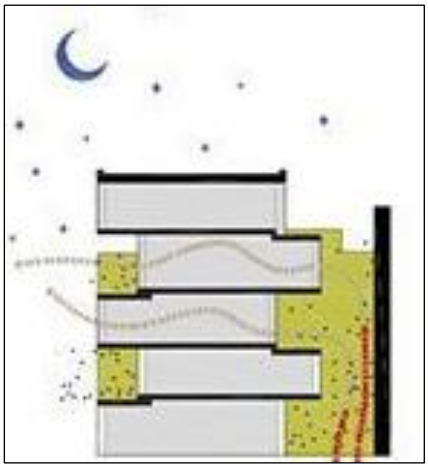
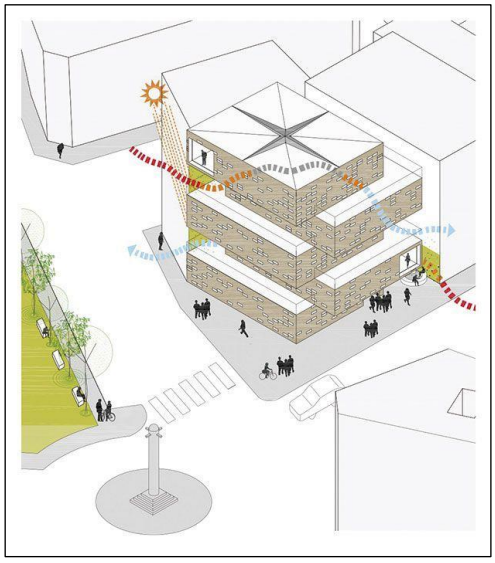
Fig49: La Gota - Tobacco museum circulation/ functions/ activities rapport (by the researcher)

	-There is two type of circulation horizontal and vertical.
HOUSE OF CULURE REDHA HOHO BISKRA	 horizontal circulation 1.Adminstration 2.Liberay 3.Audiovisual 4.Theater 5.Children atelier 6.Atelier 7.Exhibition 8.Lobby Fig50: house of culture redha hoho circulation/ functions/ activities rapport (by the researcher)
	-Circulation linked to the function / activity.
Synthesis	
Function/activity rapport create and control the circulation type.	

TAB23: b. organization/5. circulation/ functions/ activities rapport.

C. AMBIANCES **1. SELECTIVE MODE**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	**NATURAL LIGHT**  (http://www.nilskoenning.com/index.php?entry=page/3_Architecture/0_MECA/) Fig51: MECA natural light (https://www.archdaily.com/)
	-The porous facade and the inside texture provide a good natural lighting.

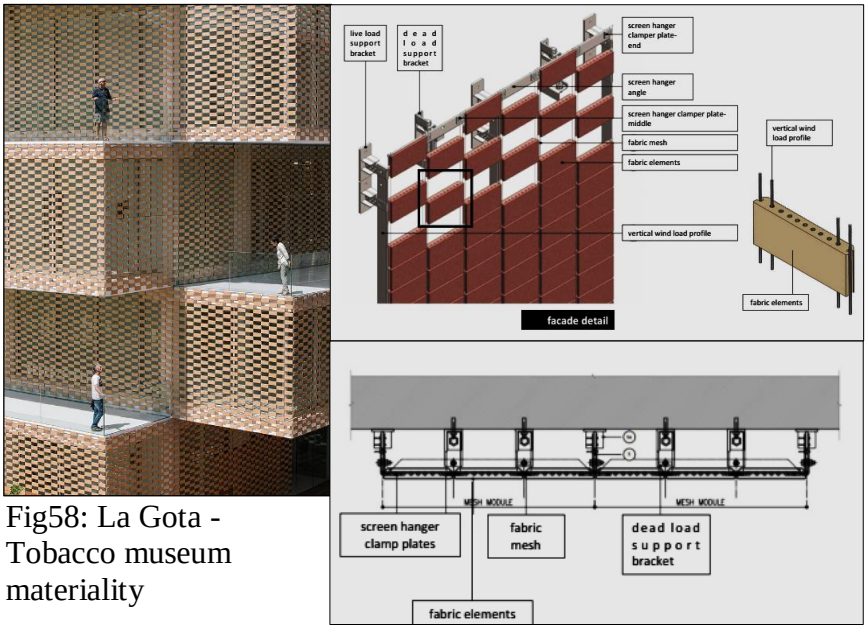
Cultural Center La Gota - Tobacco ESPAIN Museum	**NATURAL LIGHT**   Fig52: La Gota - Tobacco museum natural light (https://www.arch2o.com/cultural-center-la-gota-tobacco-museum-losada-garcia-architects/)
	- The porous facade allows the sunlight to enter inside the building.
	SUNSHINE/SHADOW  Fig53: La Gota - Tobacco museum sunshine/shadow (https://www.arch2o.com/cultural-center-la-gota-tobacco-museum-losada-garcia-architects/)
	- Cantilevers to protect from direct sunlight. - Natural heating with winter sunlight entering the building.

	VENTILATION   Fig54: La Gota - Tobacco museum ventilation (https://www.arch2o.com/cultural-center-la-gota-tobacco-museum-losada-garcia-architects/)
	-Cross ventilation and the cooling effect of the green wall relieve heat during the night.
HOUSE OF CULURE REDHA HOHO BISKRA	**NATURAL LIGHT**    Fig55: house of culture redha hoho natural light(by the researcher)
	- Eblouissement effet and contraste.

	VENTILATION   Fig56: house of culture redha hoho ventilation (by the researcher)
	- Using cupola and the corridor in circulation area. - providing a good natural ventilation and achieving a thermal comfort.
Synthesis	
In the design of the cultural centre considering the lighting and ventilation is so important and the porous façade can help in achieving this objective	

TAB24: c. ambiances/1. selective mode.

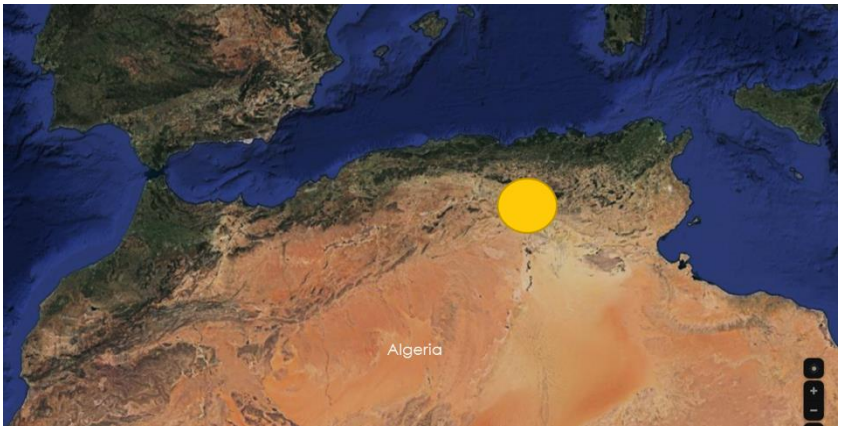
D. ENVELOPE AND MATERIAL **1. MATERIALITY**	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	 Fig57: MECA materiality (https://www.archdaily.com/)
	- MÉCA's façade is composed almost entirely of 4,800 prefabricated concrete panels interspersed with **windows of various sizes** to **control the amount of light** entering inside and to create a sense of **transparency**. The concrete slabs, which weigh up to 1.6 tons, are sandblasted to expose its raw qualities and to texture the surface with the local sandstone of Bordeaux. **Yellow granules** for brightness and

	warmth radiate the building in the sun and integrates MÉCA as a familiar yet new vernacular sight to the city.
Cultural Center La Gota - Tobacco ESPAIN Museum	 Fig58: La Gota - Tobacco museum materiality (https://www.arch2o.com/cultural-center-la-gota-tobacco-museum-losada-garcia-architects/)
	-Ceramic fabric facade is used that was inspired by the traditional brick found in the contextual buildings. The holes of the facade play the role of bringing in sunlight into the interior spaces. The geometric patterns on the façade allows filtration of sunlight through the walls. -**Materiality:** Glass wall and ceramic fabric.
HOUSE OF CULURE REDHA HOHO BISKRA	 Fig59: house of culture redha hoho materiality (by the researcher)
	MATERIALS: reinforced concrete Glass for the windows
Synthesis	
The material used can be local and can be used for the porous façade.	

TAB25: d. envelope and material/1. materiality.

Examples Synthesis	
MÉCA Cultural Center (Maison de l'Économie Créative et de la Culture en Aquitaine) BORDEAUX, France	-The project is in the area of cultural and tourist buildings and close to transportation. -The building adds a landmark to the city. -A cultural centre expresses the city Identity -The porous facade and the inside texture provide a good natural lighting and natural ventilation.
Cultural Center La Gota - Tobacco ESPAIN Museum	-Natural ventilation where the warm air from the cavity can be extracted out by stack effect process and efficient position for sun shading devices. -Acoustic insulation due to the exterior wall. -Energy savings and reduced environmental effects. -Overheating problem in the internal space due to possible overheating in the cavity.
House of culture REDHA HOHO BISKRA	-Good ventilation because of the design of lobby and double skin facade. -The lobby is the link between all the spaces.

TAB26: Examples Synthesis.

SITE ANALYSE	
I.CITY PRESENTATION	**A. GEOGRAPHIC LOCATION:** The city is located in the Aures Mountains northeast of Algeria .1048 (3,438 ft) m above sea level. Coordinats : 35°33′00″N 6°10′00″E  Fig60: Batna location (google earth)
	B. PHYSICAL DATA: The city of Batna is located in a lowland amid mountains. It is bordered to the north by the Balazmah mountain range, which is topped by the summit of Shala 'in 2178. From the east and west the plains and plateaus and from the south the Auras Mountains.

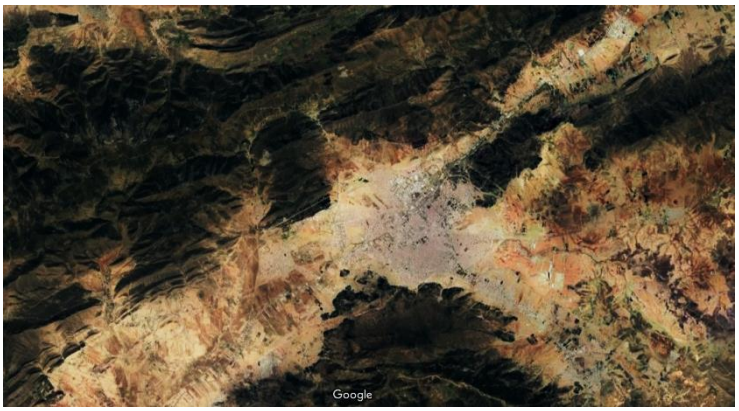


Fig61: Batna geography (google earth)

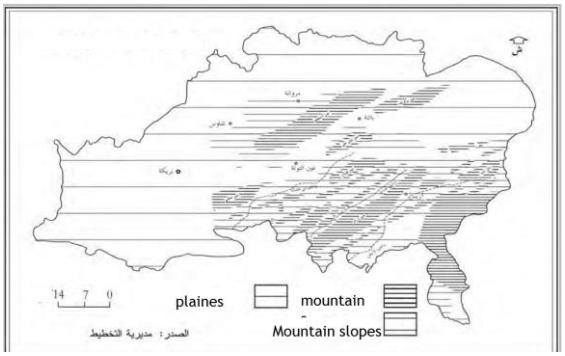


Fig62: Batna geography (planning directorate)

C.LIMITS OF THE CITY:

It is bordered to the north by the wilaya of Mila and, to the south by Biskra, to the east by Oum-El-Bouaghi and khenchla, and to the west by M'Sila and setif. **Surface : 12.038.76.**

Fig63: Batna limits (google)

D.BUILDING MONUMENTS IN THE CITY:

Fig64: 1st November Mosque(google)

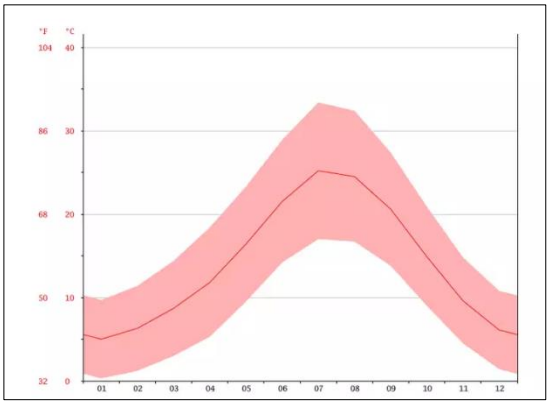
Fig65: Monument 50 years of independence (google)

Fig66: Regional Theater of Batna (google)

Fig67: The Mujahid Museum (google)

II.CLIMATE DATA

A. TEMPERATURES:



The warmest month of the year is July, with an average temperature of 25.2 ° C. At an average temperature of 5.0 ° C, January is the coldest month of the year. Fig68: Batna temperature diagram (Wikipedia)

B. PRECIPITATION:

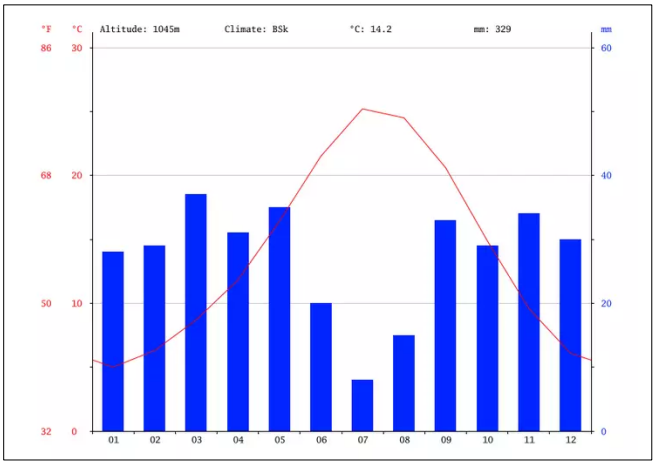


Fig69: Climatic Diagram (Wikipedia)

-The driest month is July, with 8 mm of rainfall.
-With an average of 37 mm, the most precipitation falls in march.

	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre
Température moyenne (°C)	5	6.3	8.7	11.8	16.4	21.5	25.2	24.5	20.6	14.9	9.6	6.1
Température minimale moyenne (°C)	0.3	1.2	3	5.3	9.5	14.2	17	16.7	13.8	9	4.5	1.4
Température maximale (°C)	9.7	11.4	14.4	18.4	23.3	28.9	33.4	32.4	27.4	20.9	14.8	10.8
Précipitations (mm)	28	29	37	31	35	20	8	15	33	29	34	30

Fig70: Precipitation data (Wikipedia)

-The difference in precipitation between the driest month and the wettest month is 29 mm.
During the year the average temperature vary by 20.2 ° c.

C.THE WINDS:

-The dominant winds in Batna are the winds of Djbili that come from the mountain,
-It is often strong and dry, and the wind blowing from the east and south is tribal
-Guebli, Chehili. These winds are dry, threatening the area in the summer as they increase the dryness of the earth.
-The most dangerous wind to Batna is the Sirocco winds blowing from South of Qantara, it is characterized by heat and drought and most often in the upper plateaus (the northern parts of the state), where it reaches its maximum in July. (P.Seltzer)

III.FIELD ANALYSIS

A. SITE SITUATION

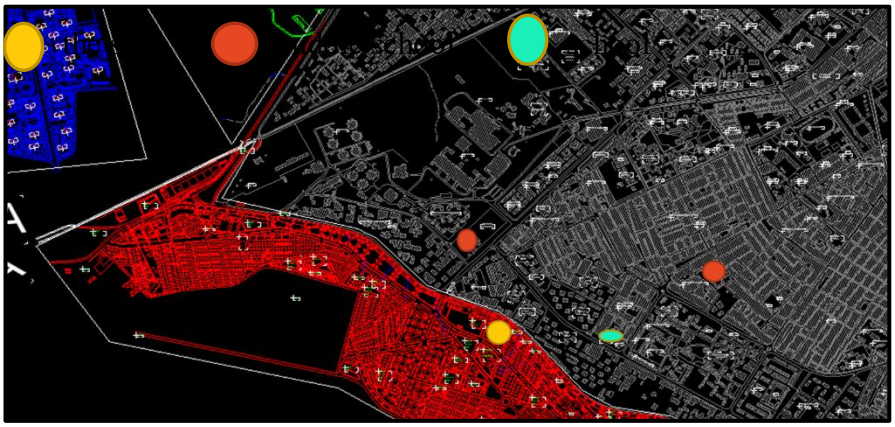


Fig71: The project location (batna PDAU)

-The site is located in education and habitation area

TOPOGRAPHY; -The site is plane

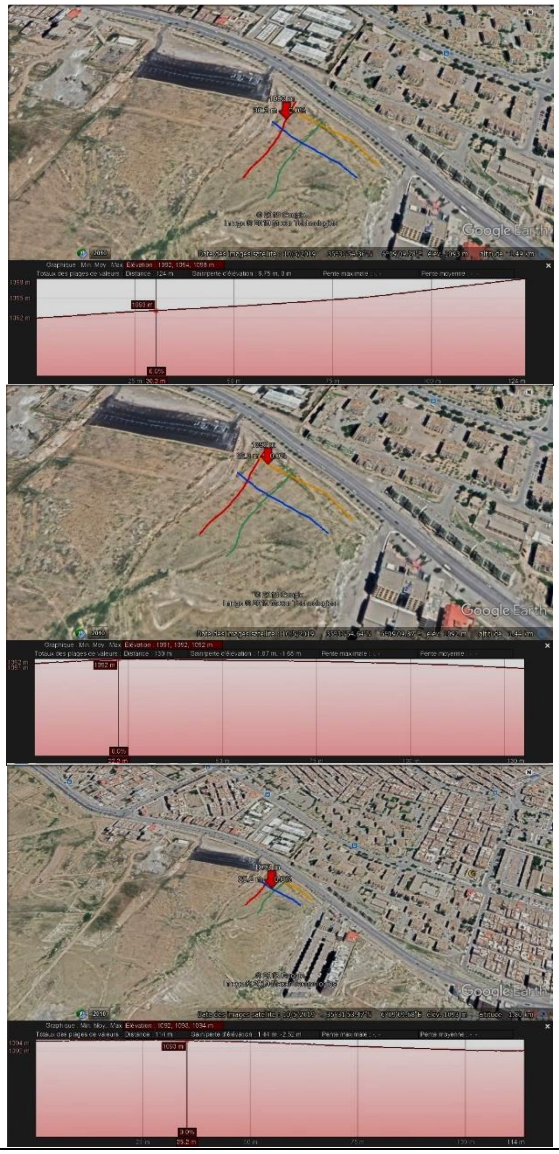


Fig72: The project site topography (google earth)

B. SITE LIMITS:

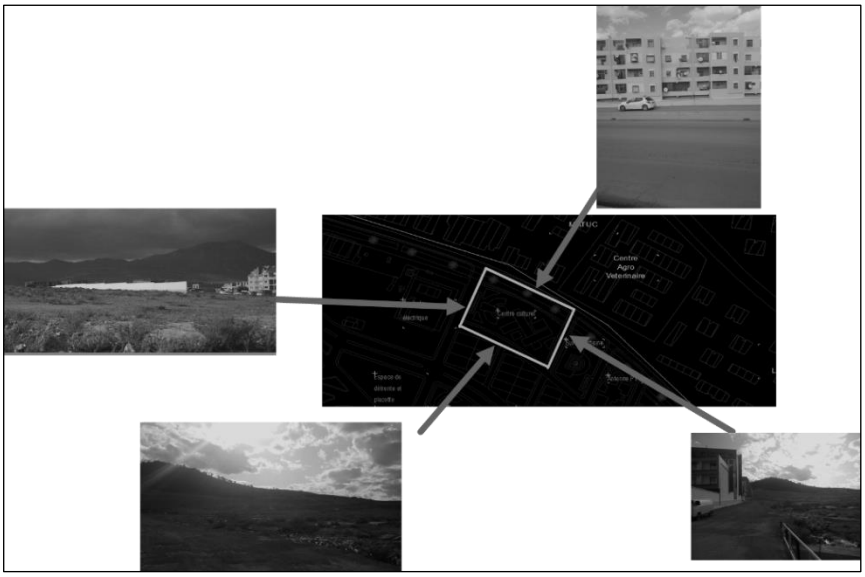


Fig73: The project site limits (by the researcher)

- The site has three free limits.

D.ACCESSIBILITY OF GROUNDS:

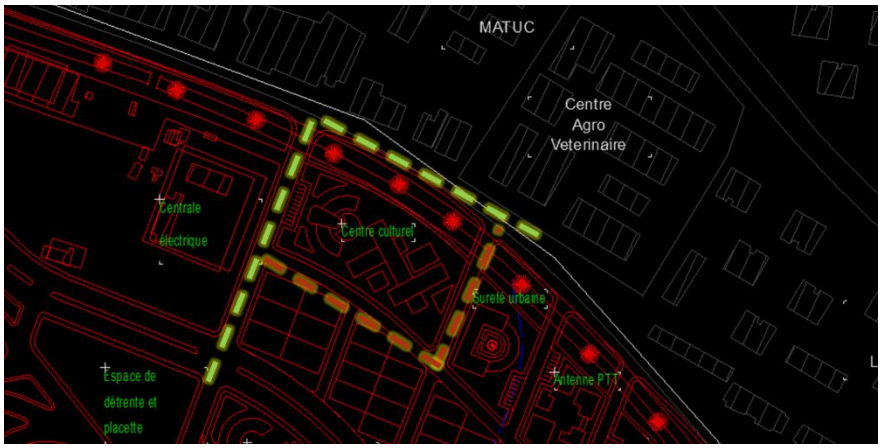


Fig74: The project site accessibility (PDAU batna)

road street

- The site has two road one of them is principal and two street access.

D. COMFORT STUDY

DAYLIGHT

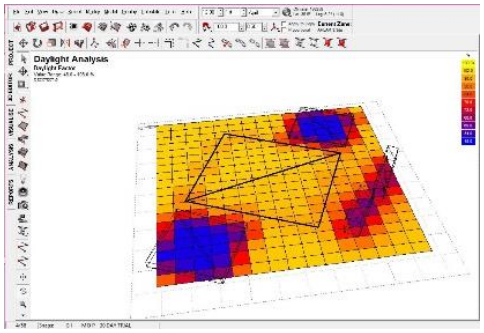


Fig75: The site daylight (Ecotect)

Sunlight hours expose

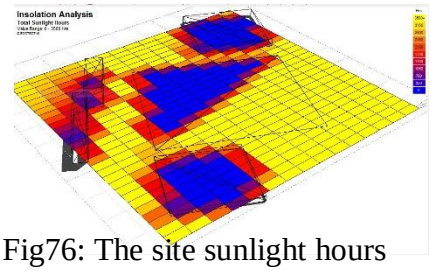


Fig76: The site sunlight hours expose (Ecotect)

SHADING

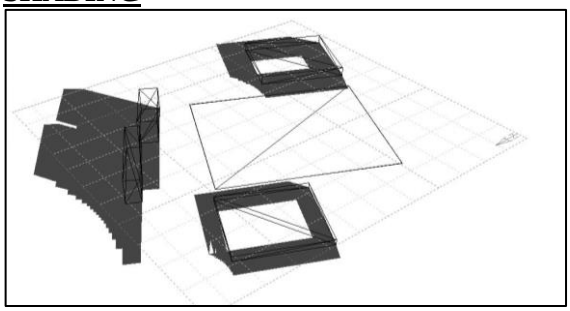


Fig77: The site shading (Ecotect)

-The site is exposed to the sun verry well.

Synthesis

ADVANTAGES:

-The site is in the front of road which give it a good accessibility.

-The site near to education buildings and habitation that means functionality.

-The site is well exposed to the daylighting.

DISADVANTAGES
-The site is covered in December.

TAB27: Site Analysis

PROGRAMMATION

OFFICIAL		MECA	LA GOTA CULTURAL CENTER	HOUSE OF CULTURE BISKRA	NEUFERT	Pproposed program
ACCUEIL						
lobby	100-120	1620	300	350		200
court	100-700					
Honour salon	100-180					
Reception		60	60	15		45
ADMINSTRATION						
Director office	16-20	310	60	100		20
Economy office	12-16					16
Secretary office	20-25					25
sanitary	07					07
LIBERARY						
Reading room adult	700-900	470	60	100		700
Reading room periodic	100-150					100
Reading room children	350-450					350
Restoration workshop	15-20					20
Private sanitary	12					12
Public sanitary	14					14
AUDIO VISUAL						
lobby	45-50	120	/	510		45
Principal room	700-800					700

stage	50-60					50
Preparation room	25-30					30
Projection room	09-30					30
Public sanitary	09-12					12
Private sanitary	16					16
MEUSEUM						
Exhibition gallery	600-700	750	1200	220		700
Restoration workshop	45-60					60
Research office	15-20					20
Secretary office	12-16					16
deposit	80-90					90
sanitary	07					
CREATION ATELIER						
painting	50-60					60
sculpture	45-60					60
embroidery	45-60					60
Scientific club	30-50					
cinema	60-100					45
Photo lab	45-60					80
Coordination office	80-100					
deposit	150					150
sanitary	12					12
Conference room		100	800	/		
Caffe/restaurant		200	/	/		70
TOTAL						3,815

TAB28: programming

The proposed program was reached by taking the average studied examples programs and the official program while respecting the regulatory criteria.

Synthesis

To design a cultural centre that can be considered functional in the first place, this program has been proposed after reviewing examples and systemic standards programs for good and effective design.

METHODOLOGIE

A complete tool for the analysis of sustainable design from concept to detail, providing a powerful visual and detailed environmental simulation of building performance.
Ecotect Analysis offers a wide range of simulation and analysis functionality energy building that can improve the performance of existing and new buildings.
Energy, water and CO2 are integrated with the instruments of visualization and simulation in the operation of a building within the context of their environment. (www.asidek.es)

Ecotect Analysis sustainable design analysis software is a comprehensive concept-to-detail sustainable building design tool. Ecotect Analysis offers a wide range of simulation and building energy analysis functionality that can improve performance of existing buildings and new building designs.

The outputs of Ecotect Analysis: Solar analysis, Shadow analysis, Daylighting and Lighting, Thermal performance, Whole building energy analysis, Weather data visualization, acoustic comfort.

CONCLUSION

This chapter points to several points in the analysis of examples studied (real and written), where the examples were addressed in terms of:

-Environment city scale; which included:

- urban/natural: It is better if the building is in areas where people can reach and be the locality.

and building city rapport: The shape and texture defined whether the project adds a landmark to the city or not.

-Immediate environment; which included:

- Spotting: The center can be spotted easily if it has a unique shape and design or different texture.
- Integration/contrast: the texture gives the integration or contrast sign to the building.
- Identity: Using local material or symbolizing form related to the culture of the city in order to express the identity of the local.
- Identification: To identify the cultural centre; its interface might include an art inspiration or sense.
- Interior /exterior rapport: The cultural must have interior/exterior rapport and it can be visual or direct and indirect.
- Accessibility: The cultural centre must have a good accessibility by providing at least two mechanic road and pedestrian flow.

-The project in its context; which included:

- Location: The location of the cultural centre characterized by its exposed to the sunlight.

-Organisation; which included:

- Organisation of spaces sectors: The spaces are either linear, centrality or symmetry organized.

- Activity/zoning: The separation between the spaces according to the activity in order to provide acoustic isolation and privacy.
- Functions study: The lobby is the centre and the connecter between the spaces.
- Activity study: It is preferred to create a direct relation between the spaces that have the same activities.
- Circulation/ functions/ activity rapport: Function/activity rapport create and control the circulation type.

-Ambiances selective mode; which included natural light, sunshine/shadow, ventilation to ensure comfort: In the design of the cultural centre considering the lighting and ventilation is so important and the porous façade can help in achieving this objective.

-Envelope and material; which included materiality to find out some suitable materials for the porous interface: The material used can be local and can be used for the porous façade.

And by analysing the ground that should benefit from its positives and trying to reduce its negatives.

- Site advantages:

-the site is in the front of road which give it a good accessibility.
-the site near to education buildings and habitation that means functionality.
-the site is well exposed to the daylighting.

- Site disadvantages

-the site is covered in December.

CHAPTER III:PRATICAL STUDY

III.1. INTRODUCTION:

This chapter concerns the application side of the project. the various stages of project development will be presented. From the birth of the first idea to the final project passing by the objectives and intentions of the concept.

Simulation selected as the methodology to verify the hypothesis of the study using Ecotect program that allow us to test the cell temperature, cell pressure, airflow rate, flow vector.

III.2. PASSAGE ELEMENTS

Objectives		**intentions**
Good accessibility	→	2 access mecanique and assure pedestrians flow.
Achieving natural ventilation	→	Orient the building against the dominated winds (north- south)
	→	Protect the southern facade with trees.
	→	Libre plan to assure accrossing wind movement.
Achieving a good natural light	→	Transparent interface (north façade).
	→	Patio for interior lighting access.
Identification building	→	pattern of porous façade.

THE IDEA

The idea was inspired from the wind rose

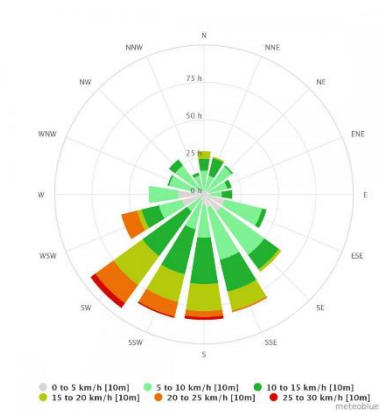


Fig78: Wind rose Pistol River, Oregon (USA) - 2016-03-01 to 2016-03-03(https://content.meteoblue.com/ro/access-options/history/wind-rose)

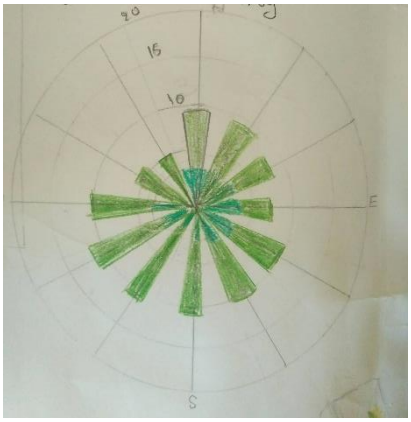


Fig79: Wind rose of batna (author 2020)

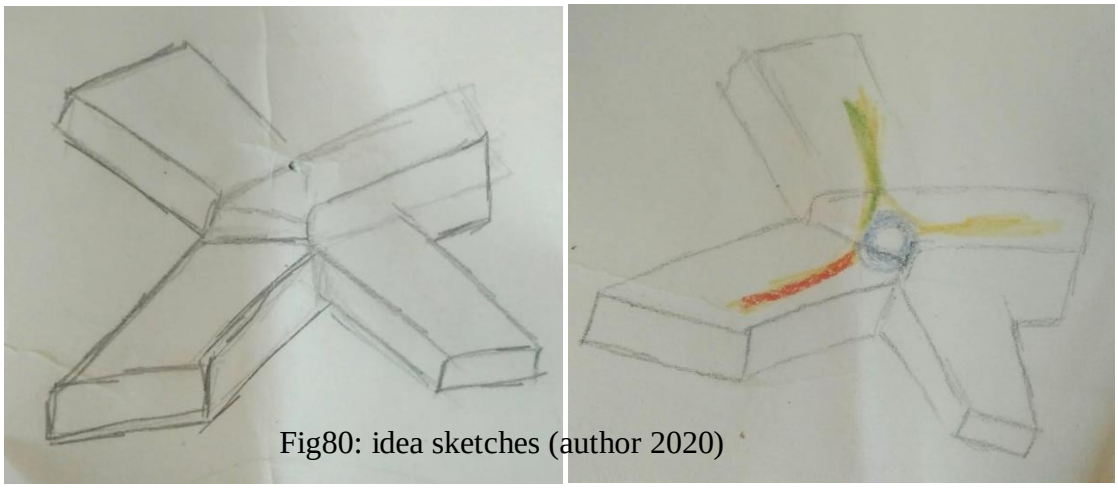


Fig80: idea sketches (author 2020)

Materiality:

- Using the aluminum panels for the porous.

II.3. SIMULATION

In order to verify the hypothesis of this research, the part shown in the figure was tested using the WinAir tool of the Ecotec program.

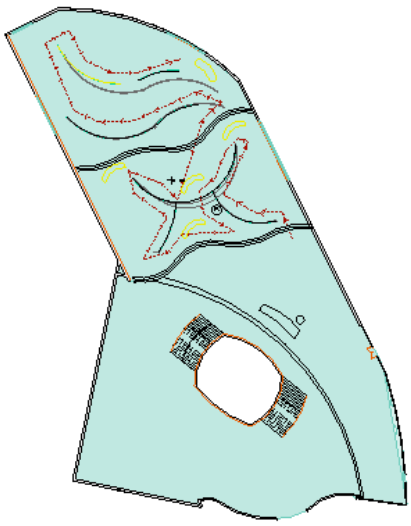
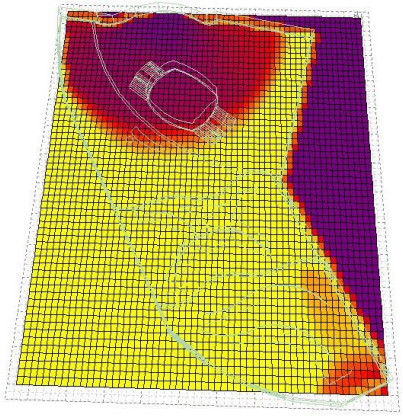
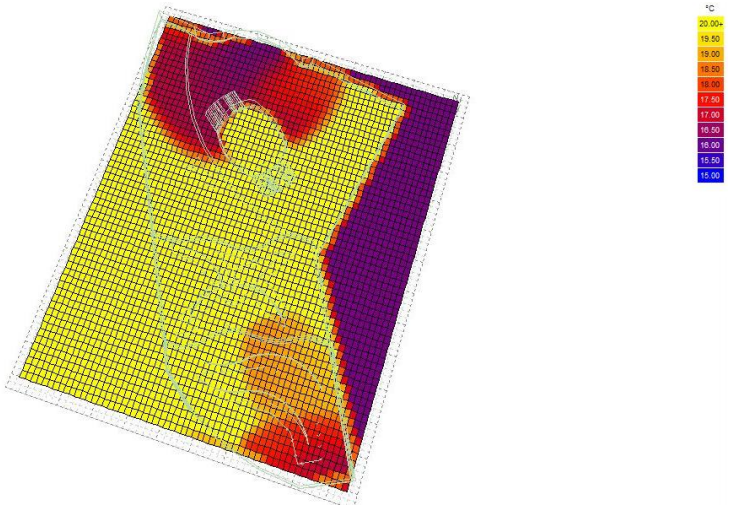
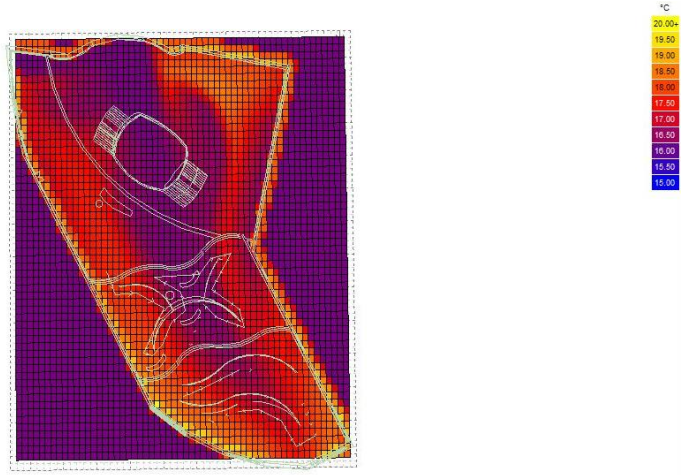


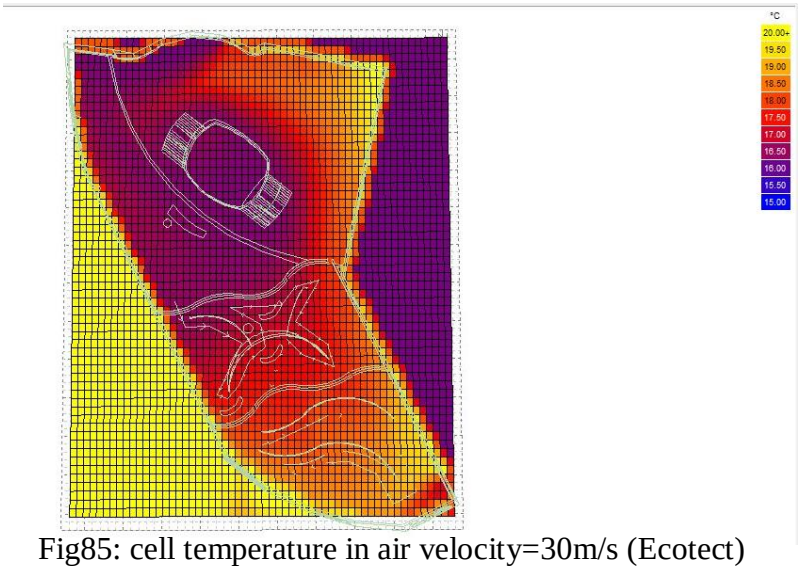
Fig81: the tested space (author 2020)

III.3.1. SIMULATION RESULTS

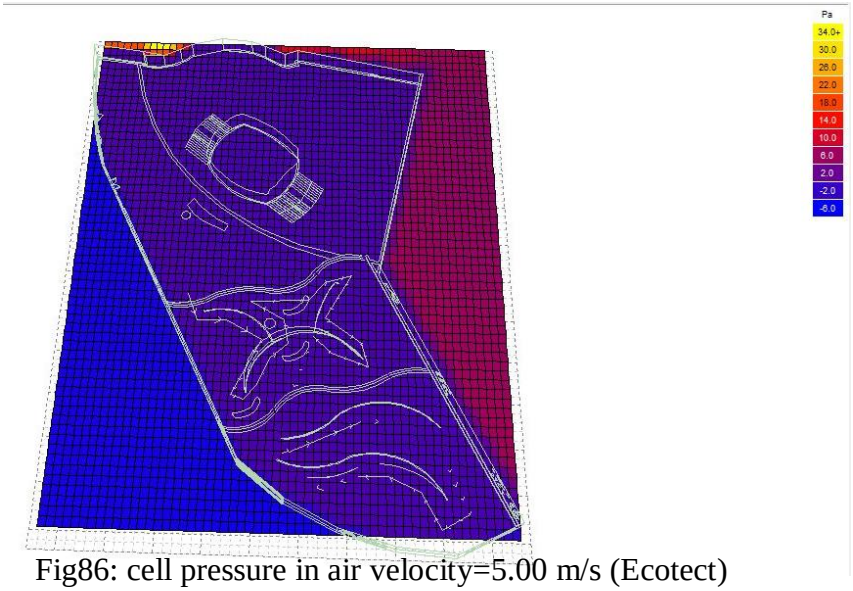
The results obtained after entering the outdoor air velocity, the direction of the wind, Batna weather data.

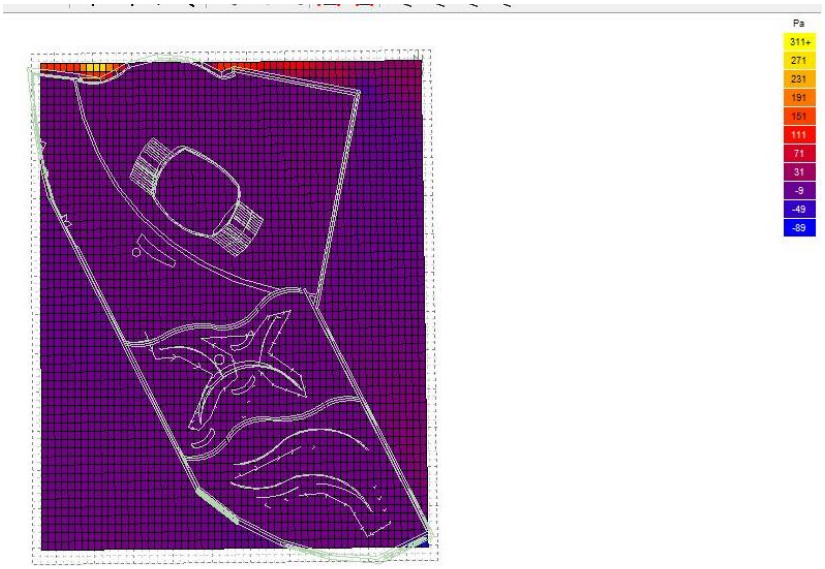
	Cell temperature
5.00 m/s	 Fig82: cell temperature in air velocity=5.00 m/s (Ecotect)
	-the range of cell temperature is betweeen 15°-20°c -the hottest cell is near of the façade porous.

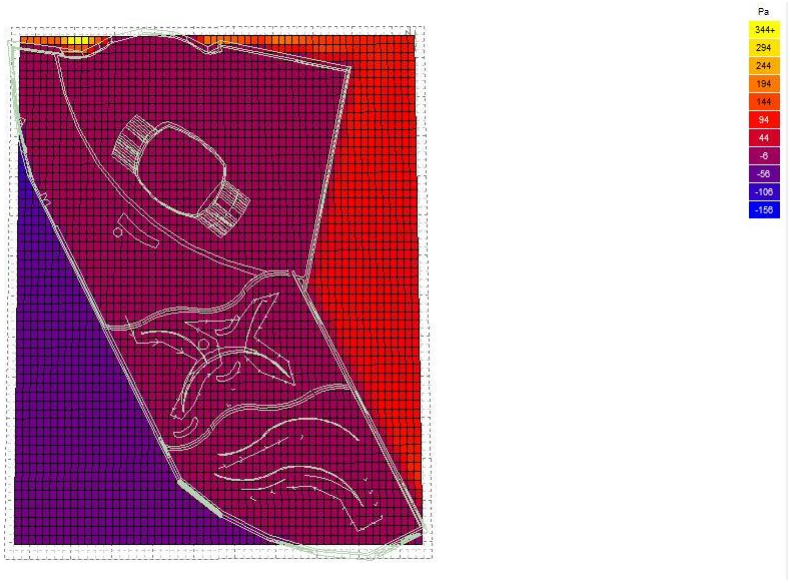
10m/s	 Fig83: cell temperature in air velocity=10m/s (Ecotect)
	-the range of cell temperature is betweeen 15°-20°c -the porous façade side is a little colder then the center of the space .
20m/s	 Fig84: cell temperature in air velocity=20m/s (Ecotect)
	-the range of cell temperature is betweeen 15°-20°c -the porous façade side is a little hotter then the center of the space. .

30m/s	 Fig85: cell temperature in air velocity=30m/s (Ecotect)
	-the range of cell temperature is betweeen 15°-20°c -the porous façade side is a little hotter then the center of the space.
interpretations	-the range of cell temperature stayed the same in all air vitess changes (15°-20°)
Synthesis	-the north-west porous façade is the most cold spot , in adition of the patio in the air vitess studied cases.

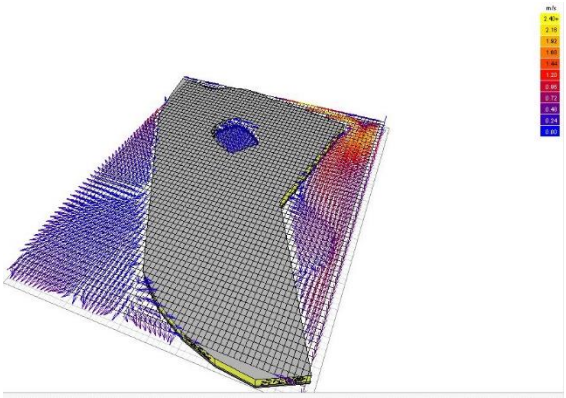
TAB29: Cell temperature

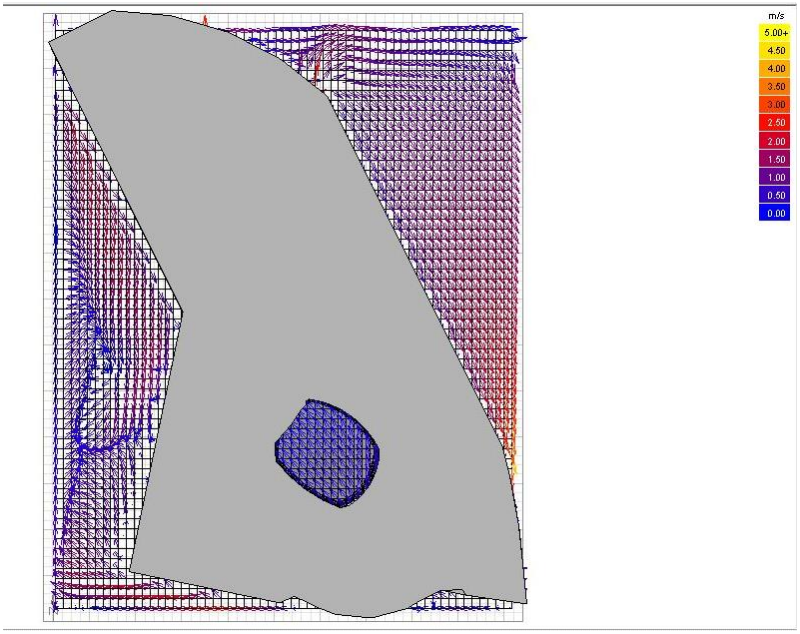
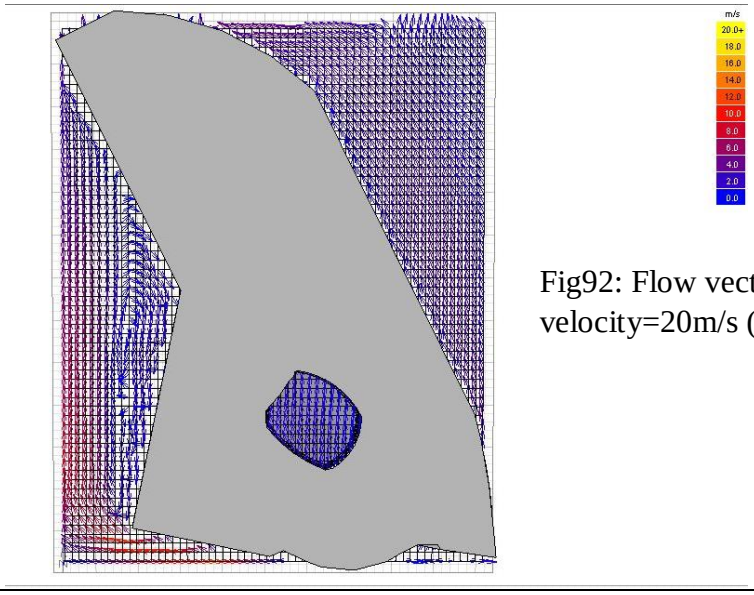
	Cell pressure
5.00 m/s	 Fig86: cell pressure in air velocity=5.00 m/s (Ecotect)
	-the cell pressure range is between -6 to +34 Pa - the space pressure is equal (2Pa).

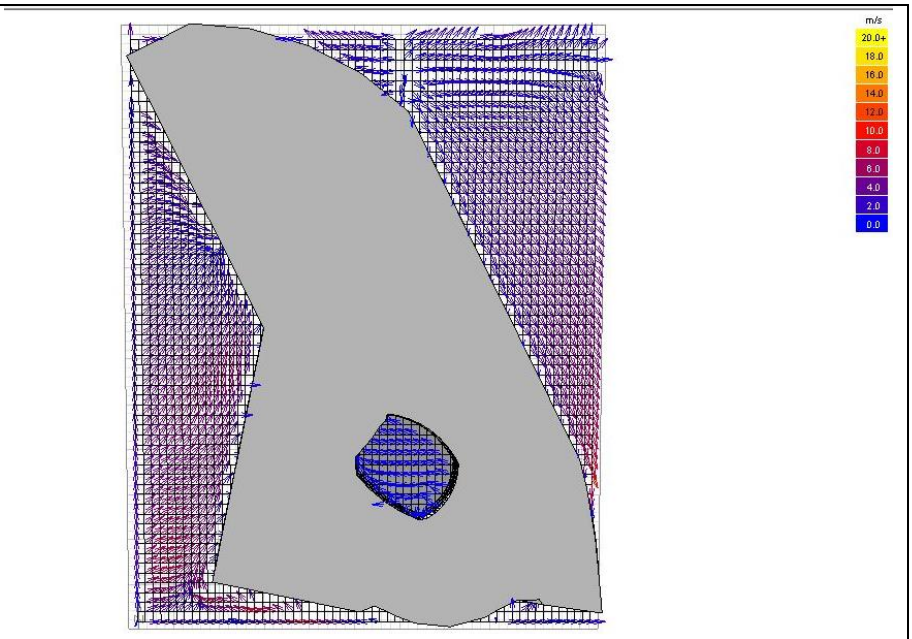
10m/s	 Fig87: cell pressure in air velocity=10m/s (Ecotect)
	-the cell pressure range is between -28 to +32Pa - the space pressure is equal (2Pa).
20m/s	 Fig88: cell pressure in air velocity=20m/s (Ecotect)
	-the cell pressure range is between -98 to +311Pa - the space pressure is equal (-9Pa).

30m/s	 Fig89: cell pressure in air velocity=30m/s (Ecotect)
	-the cell pressure range is between -195to -344Pa - the space pressure is equal (-9Pa).
Synthesis	-the porous façade does not affect in the cell pressure in all the Outdoor air velocity studied.

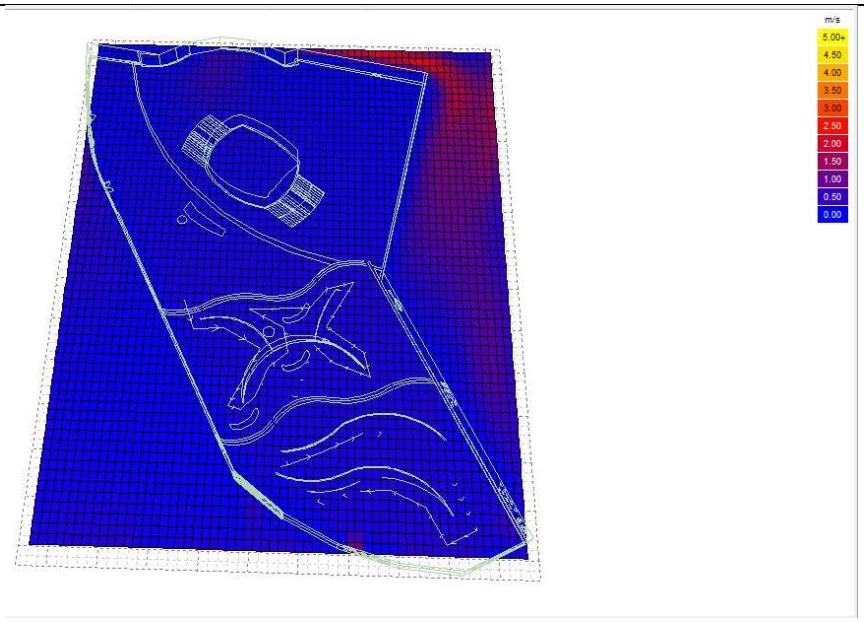
TAB30: Cell pressure

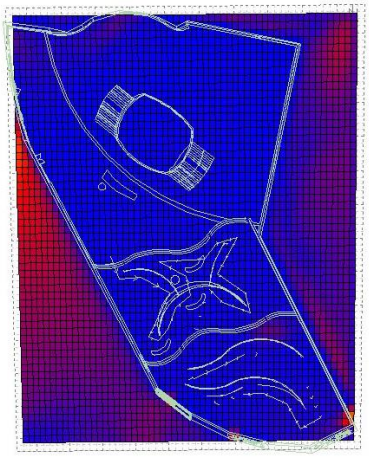
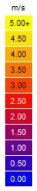
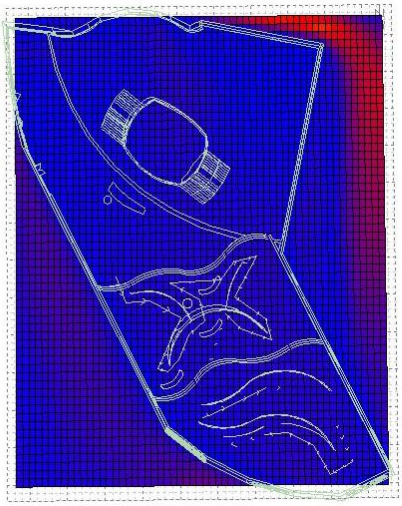
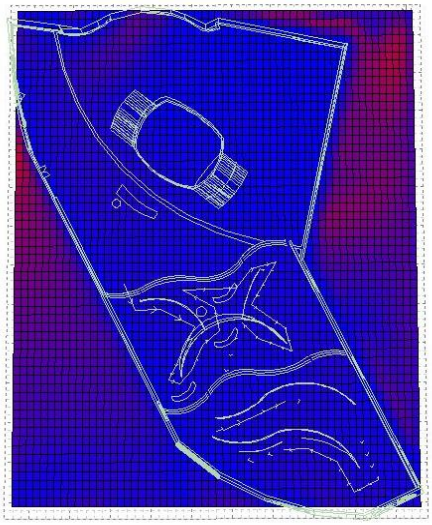
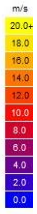
	Flow vector
5.00 m/s	 Fig90: Flow vector in air velocity=5.00 m/s (Ecotect)
	-the value range of air vector is 0 to 2 m/s. -a simple air movement near to porous façade.

10m/s	 Fig91: Flow vector in air velocity=10m/s (Ecotect)
	-the value range of air vector is 0 to 5 m/s. -A noticeable air movement near to porous façade.
20m/s	 Fig92: Flow vector in air velocity=20m/s (Ecotect)
	-the value range of air vector is 0 to 20 m/s. -A simple air movement near to porous façade.

30m/s	 Fig93: Flow vector in air velocity=30m/s (Ecotect)
	-the value range of air vector is 0 to 20 m/s. -A noticeable air movement near to porous façade. - a simple air movement in the patio.
Synthesis	-the value range of air vector is 0 to 20 m/s. - A noticeable air movement near to porous façade in high wind velocity.

TAB31: Flow vector

	Air flow rate
5.00 m/s	 Fig94: Air flow rate in air velocity=5.00 m/s (Ecotect)
	-the air flow rate in spaces near the porous façade is about 1m/s

10m/s	  Fig95: Air flow rate in air velocity=10m/s (Ecotect)
	-the air flow rate in spaces near the porous façade is about 1 to 2.5m/s
20m/s	  Fig96: Air flow rate in air velocity=20m/s (Ecotect)
	-the air flow rate in spaces near the porous façade is about 4m/s
30m/s	  Fig97: Air flow rate in air velocity=30m/s (Ecotect)
	-the air flow rate in spaces near the porous façade is about 4m/s.
Synthesis	-the air flow rate in spaces near the porous façade is increasing as the velocity of outdoor air increases.

TAB32: Air flow rate

THE PROJECT

Fig98: MASS PLAN, cultural center, student 2020

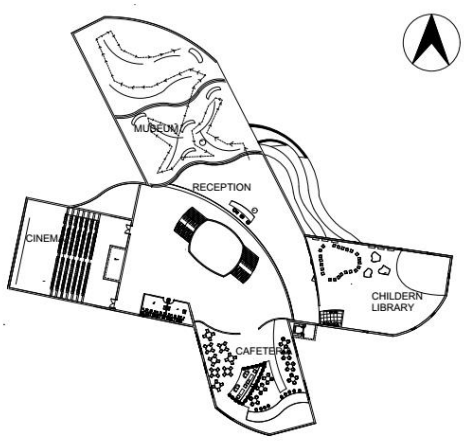


Fig99: Ground Floor PLAN, cultural center, student 2020

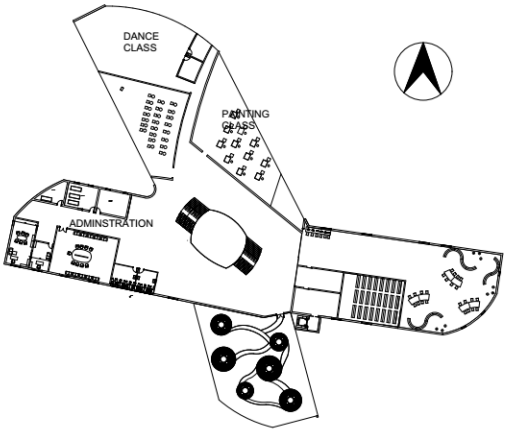


Fig100: 1st Floor PLAN, cultural center, student 2020

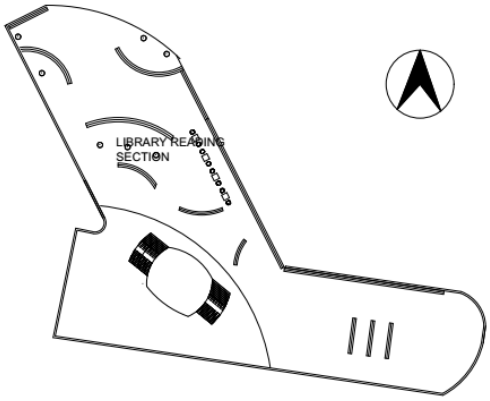


Fig101:2nd Floor PLAN, cultural center, student 2020

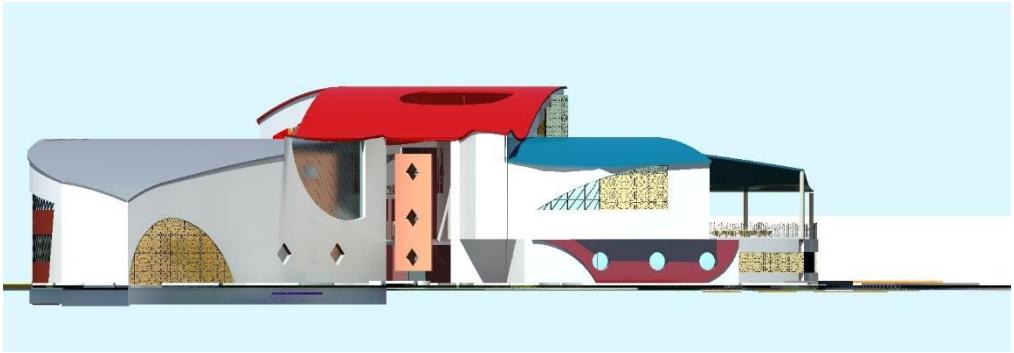


Fig102: the side facade, cultural center, student 2020

Fig103: the background facade, cultural center, student 2020

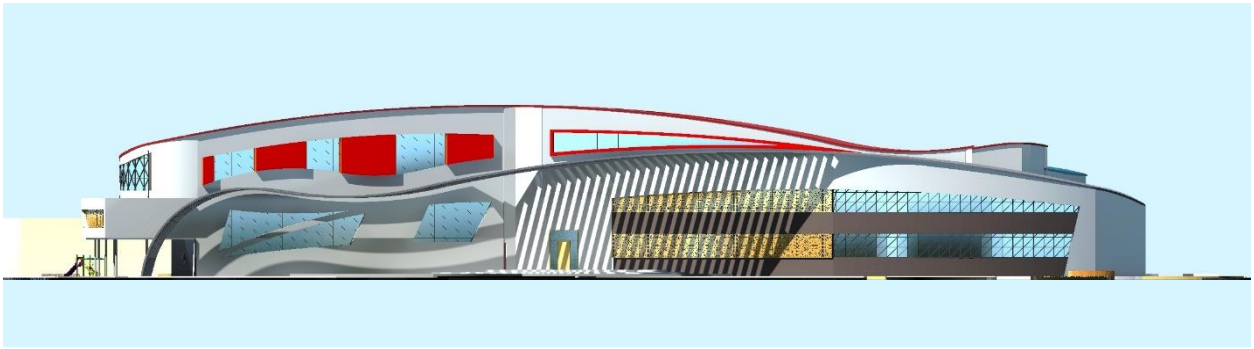


Fig104: the main facade, cultural center, student 2020

Fig105: Views of the project, cultural center, student 2020

Fig106: Close-up Views of the project, cultural center, student 2020

CONCLUSION

in this chapter, the process of the designing the cultural center have been exposed by mentioning the objectives (good accessibility**,** achieving natural ventilation, achieving a good natural light, identification building.) and the intentions:

- 2 access mecanique and assure pedestrians flow.
- Orient the building against the dominated winds (north-south)
- Protect the southern facade with trees.
- Libre plan to assure accrossing wind movement.
- Transparent interface (north façade).
- Patio for interior lighting access.
- pattern of porous façade.

as well the first lines of the project which is the concept idea.

The results of the simulation of the project shows the next responding to the hypothesis of this research

- the porous façade does not affect in the cell pressure in all the outdoor air velocity cases studied.
- A noticeable air movement near to porous façade in high wind velocity.
- the air flow rate in spaces near the porous façade is increasing as the velocity of outdoor air increases.

GENERAL CONCLUSION

The purpose of this research is mainly to provide natural ventilation through the porous interface which is still a new concept to date and this was the hypothesis of the research that natural ventilation can be achieved through the porous interface considering some factors in cultural center.

natural ventilation can be achieved by three different strategies:

- Single-sided ventilation
- Cross-ventilation.
- Stack-ventilation.

and its benefit: much less energy, essential to human health, comfort, and well-being, removes heat, providing fresh air, remove heat that has built up or was emitted by occupants, cool down the building fabric overnight and increasing occupant's productivity.

As for the porous façade, its importance lies in providing more light and aesthetics to the project. It can also give the project a definition through the façade pattern, temperature regulation, humidity control, visual privacy and airflow regulation.

Porous façade can affect natural ventilation by:

Temperature setting; In the summer, the place is soothing, which helps the place users to lose heat from their bodies. The relatively cold air enters the rooms. In winter, its openings are facing the sun's rays, and thus this increases the interior temperature and the residents feel warm.

As the façade allowed large openings in the walls, it became possible for a steady stream of air to pass through the openings into the rooms, which helps to soften the internal environment of the building, and the design of the bars and openings allows sunlight in winter to enter the internal architectural void where these are designed The openings and taking into account the angles of the fall of the sun in winter, as it is closer to the ground and thus increases the air temperature in winter.

Accordingly, it can be said that the cultural center can be given a definition through the porous façade, which in turn helps direct natural ventilation and control airflow.

analysis of examples studied (real and written), where the examples were addressed in terms of:

-Environment city scale; which included:

- urban/natural: It is better if the building is in areas where people can reach and be the locality.

and building city rapport: The shape and texture defined whether the project adds a landmark to the city or not.

-Immediate environment; which included:

- Spotting: The center can be spotted easily if it has a unique shape and design or different texture.
- Integration/contrast: the texture gives the integration or contrast sign to the building.
- Identity: Using local material or symbolizing form related to the culture of the city in order to express the identity of the local.
- Identification: To identify the cultural centre; its interface might include an art inspiration or sense.

- Interior /exterior rapport: The cultural must have interior/exterior rapport and it can be visual or direct and indirect.
- Accessibility: The cultural centre must have a good accessibility by providing at least two mechanic road and pedestrian flow.

-The project in its context; which included:

- Location: The location of the cultural centre characterized by its exposed to the sunlight.

-Organisation; which included:

- Organisation of spaces sectors: The spaces are either linear, centrality or symmetry organized.
- Activity/zoning: The separation between the spaces according to the activity in order to provide acoustic isolation and privacy.
- Functions study: The lobby is the centre and the connecter between the spaces.
- Activity study: It is preferred to create a direct relation between the spaces that have the same activities.
- Circulation/ functions/ activity rapport: Function/activity rapport create and control the circulation type.

-Ambiances selective mode; which included natural light, sunshine/shadow, ventilation to ensure comfort: In the design of the cultural centre considering the lighting and ventilation is so important and the porous façade can help in achieving this objective.

-Envelope and material; which included materiality to find out some suitable materials for the porous interface: The material used can be local and can be used for the porous façade.

And by analysing the ground that should benefit from its positives and trying to reduce its negatives.

- Site advantages:

-the site is in the front of road which give it a good accessibility.
-the site near to education buildings and habitation that means functionality.
-the site is well exposed to the daylighting.

- Site disadvantages

-the site is covered in December.

Utilizing the simulation method to verify the hypothesis of the research using Ecotect program.

The results showed that

- the porous façade does not affect in the cell pressure in all the outdoor air velocity cases studied.
- A noticeable air movement near to porous façade in high wind velocity.
- the air flow rate in spaces near the porous façade is increasing as the velocity of outdoor air increases.

In the light of these results, the hypothesis of the research that says the porous façade can influence in natural ventilation by controlling in the quantity of entering air through pore's ratio, dimensions, material has been confirmed.

After achieving the objectives of this research, we make a number of recommendations to summarize below:

- use the porous façade in the north interface, as the results of the simulation showed that the north interface poroused façade has a noticeable affect on the airflow rate in case that the wind was coming from the southwestern side at a speed exceeding 10 meters per hour.

Search limits

The study was applied in an area considered cold and dry and only dominated winds from the south west were considered.

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