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Rethinking housing design in post COVID-19 pandemic: New integrated residential complex in Bouhannak, Tlemcen, Algeria.

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Dedications

I dedicate this thesis: to my parents ***Mr. and Mrs. Mudenda*** who have worked tirelessly and have sacrificed so much for me to be where I am today. They have shown me so much love and support which intent helped me mentally and I owe them everything.

To my two brothers -***Orlando and Blessings***- and my only sister ***Mutinta*** for their continual support. They have influenced me to aim higher and to never give up even if things get tough. They have always reminded me to remember where I come from, which is my source of strength.

I would also like to dedicate my thesis to all my exceptional friends, the friends I can count on for criticism, encouragement and inspiration.

Summary

2019 has been identified as a year of an outbreak that causes respiratory illness and leads to death. The COVID-19 pandemic originated from Wuhan, China, and it has spread to other parts of the world in a short period of time. The pandemic has crippled the world economy and it has brought a catastrophic effect on the world health care systems and our way of life.

With the society, politics, culture and the economy turned upside down because of the pandemic, the idea of reforming architectural production has escalated. Due to the effects of covid-19 pandemic, People are now looking for answers and solutions from architects so that they can feel safe in their own homes and environments.

As we try to understand the role of architecture in a post pandemic era. We need to first comprehend how we inhabit our dwellings, make use of our buildings and how we traverse through our belt space. Architects have been given the role to rethink about the future we desire now. This will equip our society to prepare for any future pandemics.

In this thesis, we look at the effects of Covid-19 on -architecture, interior design and the built environment- and provide design solutions for a healthier living space in the post pandemic era. The idea of the project is to design a *residential complex* that is affordable and incorporated with design solutions that reduce the risk of infection of any virus in the future.

Keywords: individual Housing, collective housing, COVID-19 pandemic, Health, Smart Home Technology.

ملخص

، الصين ، ووهان من الوباء نشأ .الوفاة إلى ويؤدي التنفسي المرض تفشي عام بأنه 2019 عام تحديد تم وقد وأثر العالمي الاقتصاد شل إلى الوباء هذا أدى وقد .الزمن من قصيرة فترة في العالم من أخرى أجزاء إلى وانتشر العالمية الصحية الرعاية نظم على كارثيا تأثيرا.

الإنتاج إصلاح فكرة تصاعدت ، الوباء بسبب عقب على رأسا والاقتصاد والثقافة والسياسة المجتمع انقلاب ومع حتى المعماريين المهندسين من وحلول إجابات عن الآن الناس يبحث ، covid-19 وباء آثار بسبب .المعماري وبيئاتهم منازلهم في بالأمان يشعروا.

وكيف مبانينا من نستفيد ، مساكننا نسكن كيف أولاً نفهم أن علينا .وباء بعد ما عصر في العمارة دور فهم نحاول بينما من وهذا ، الآن نريده الذي المستقبل في التفكير لإعادة الدور المعماريون المهندسون أعطي وقد .حزامنا مساحة نخترق المستقبل في أوبئة لأي للاستعداد مجتمعنا يمهد أن شأنه.

حلولا وأقدم ، المبنية والبيئة الداخلي والتصميم التخمين على Covid-19 آثار على نظرة ألقي ، الأطروحة هذه وفي تحمله يمكن سكني مجمع تصميم إلى المشروع فكرة وتهدف .الإيدز وباء بعد ما عصر في صحة أكثر بيئة لتصميم المستقبل في فيروس بأي الإصابة خطر من تقلل تصميمية بحلول وإدماجه.

والتكنولوجيا ، الجديدة والتكنولوجيا ، COVID-19 ، الجماعي والإسكان ، الفردي الإسكان : الرئيسية الكلمات البريد ووباء ، والصحة ، الذكية المنزلية

Résumé

L'année 2019 a été identifiée comme l'année de l'épidémie qui provoque des maladies respiratoires et conduit à la mort. La pandémie de COVID-19 est née à Wuhan, en Chine, et elle s'est propagée à d'autres parties du monde en peu de temps. La pandémie a paralysé l'économie mondiale et a eu un effet catastrophique sur les systèmes de santé mondiaux et notre mode de vie.

La société, la politique, la culture et l'économie ayant été bouleversées par la pandémie, l'idée de réformer la production architecturale a pris de l'ampleur. En raison des effets de la pandémie de covid-19, les gens cherchent désormais des réponses et des solutions auprès des architectes afin de pouvoir se sentir en sécurité dans leurs propres maisons et environnements.

Alors que nous essayons de comprendre le rôle de l'architecture dans une ère post-pandémique. Nous devons d'abord comprendre comment nous habitons nos logements, comment nous utilisons nos bâtiments et comment nous nous déplaçons dans notre espace. Les architectes se sont vus confier le rôle de repenser le futur que nous désirons maintenant, ce qui permettra à notre société de se préparer à toute future pandémie.

Dans cette thèse, j'examine les effets de Covid-19 sur l'architecture, l'aménagement intérieur et l'environnement bâti, et je propose des solutions de conception pour un environnement plus sain dans l'ère post-pandémique. L'idée du projet est de concevoir un complexe résidentiel qui est abordable et incorporé avec des solutions de conception qui réduisent le risque d'infection de tout virus dans le futur.

Mots clés : Logement individuel, logement collectif, Pandémie de COVID-19, Technologie des maisons intelligentes, Santé.

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General introduction

Since the creation of humankind, shelter has been the main concern. We have seen places of dwelling evolving based on time, culture, religion, climate and other factors, which determine the form of dwellings. Today (before COVID-19) housing is just a place of shelter comfort and a place of accommodation, but to others it is more than that. To others a dwelling place represents an economic power over another population. To others a dwelling place is a sacredplace; it represents their culture and values. A dwelling place is where we develop our personal habits; protect ourselves from exterior forces like; rain, wind and the scotching sun. Its place were love lives and place we find comfort in.

However, ever since the outbreak of Covid-19 started, a significant number of lives have been lost. Many areas of our lives have changed since the outbreak began - our social, economic and political lives have viciously changed. The virus it's self has mercilessly challenged the public and the food security. The economic disruption caused by the pandemic has resulted into many people falling into extreme poverty if not already in one.

Based on historical events; wars, ***pandemics,*** natural disasters and climate change-architecture always find it's way to evolve because architecture is influenced by the needs of a given population at given period of time. Architecture is never constant because the needs of people are never constant; they change on the besis of, culture, religion, climate, location and other forces acting as contributing factors that shape the form of dwelling places.

Home is our living space; everyone perceives it and lives in it in their own way. The aim of this thesis is to understand the impact of covid-19 on architecture and social life. In this research, architecture is used to improve the quality of life during any pandemic that resorts to lockdowns. However, the focus is on improving the social aspect, mental health aspect and prevention. That meets to the needs of its current occupants without compromising future generations.

The Studio problematic

The new restrictions, imposed on society by the COVID-19 pandemic, are pushing us to rethink the way we think about our built environment. The way, in which the world has adapted to this new way of life, heralds a change in standards in the practice of public and / or private space.

We cannot predict the future, but we can already examine the trends and strategies employed during the pandemic. It is clear that these new standards will have a lasting impact on how our cities will be designed in the future.

In this ATELIER we will call on creativity and imagination to think about the city of tomorrow by proposing new forms of work, of living, of mobility, of public space and of construction.

Key words: Housing, work, mobility, health, modular construction, adaptive construction, lightweight architecture, flexible building, new technology and environmental protection.

Research questions

The COVID-19 pandemic and lockdown measures have revealed the problems in existing residential buildings in terms of health and lack of personal comfort. Healthcare workers have encouraged the public to abstain from social gatherings that speed up the spread of the virus. Even though people have adapted to new forms of communication, loneliness has increased in many homes due to lockdowns.

From the 14th - 20th century, the public housing is seen to be characterized by multistory buildings because of the growing demand for accommodation and urbanization. Today, the Covid-19 is a revelation to most designers. It has shown that the housing sector is failing to adapt and protect its users from the covid-19.

Residential buildings are crucial to our health because they determine our social well-being. However, health, safety and comfort are the main aspects that have been tested during lockdowns and quarantines.

Today there has to a considerable rethinking of housing to prepare humanity for future possible outbreaks. The COVID-19 pandemic is bringing about changes, and alongside these, we have to alter the way we design our living spaces. It is our responsibility to prepare necessary actions for the future outbreaks.

This thesis is based on answering the following Research questions:

- How can we design and build our homes to reduce the probability of contamination and the spread of a contagious virus?
- How can we guarantee our buildings to preserve the mental and physical health of its users during a pandemic?
- How can we prepare for future pandemics through residential homes?

Hypothesis

Several hypotheses are put forward in response to the research questions raised:

- The application of modern technology can have a positive impact in our homes by reducing the risks of contamination.
- Sustainable architecture can improve the energy performance in buildings, promote the development of public green spaces and prevent the deterioration of the environment.
- New design solutions for the future can effectively provide a health environment that offers protection from any infectious diseases.
- Ecologcal architecture can improve the food security, air quality, nutrition and mental health of a society.

Objectives of this thesis

- To search for new design solutions that provide new forms of living and new forms of public space.
- To design a healthy and sustainable environment.
- To search for answers that offer additional security layers that help to fight future outbreaks like the COVID 19.
- To search for antimicrobial construction materials that do not support the growth of mold, fungi and bacteria.
- To meet the needs of the Themcen population by studying the lessons learnt from Covid-19

Chapter 1: Theoretical approach

Introduction.

In this chapter, we look at the concepts in relation with the research title (*New integrated residential complex)* to have a better insight of the analysis in general.

1.1 Definitions of concepts:

1.1.1 Housing :

Housing, or more generally living spaces, refers to the construction and usage of houses or buildings collectively, for the purpose of sheltering people with related meanings.

1.1.2 Integrated Residential Development

An Integrated Residential Development is defined as:

« "A residential development on sites greater than 2000m2 which includes supporting communal facilities such as recreation and leisure facilities, supporting residential care, welfare and medical facilities (inclusive of hospital care), and other nonresidential activities accessory to the primary residential use. ."[1] »

Figure 1. Integrated Residential complex in china

An Integrated Residential Development being a group of buildings, form a compound that is made up of different types of housing buildings such us: collective housing buildings, semi-collective housing buildings and individual housing buildings. Residential complex comes in different forms and shapes and heights:[2]

1.1.3 Collective housing.

[1] http://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.2.25%20Integrated%20Residential%20Developments.pdf

[2] Ali Jahanbini, Akbar Abdollahzadeh Taraf, 2016, INTERNATIONAL JOURNAL OF HUMANITIES AND CULTURAL STUDIES ISSN 2356-5926, Department of Architecture, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Also known as co-housing is defined as a group of one or more buildings that are formed by several houses. Each house is inhabited by a different family and becomes neighbors in one building. .[3]

Figure 2: collective housing.

Collective housing is mostly found in urban areas and are built at great heights of not less than R+4. Unlike individual houses that are more reserved and private, collective houses have communal spaces which are shared by the inhabitants and the surrounding community. In the collective housing, the individualization of spaces commences at the very entrance of each housing unit.

1.1.4 The components of cohousing:

Co-housing is characterized with a high density population, while offering better living conditions. It has a collective entrance to the building which gives access to the bloc and other housing units on different levels. It also has communal staircases and communal terraces which can be accessible or none-accessible to the inhabitants.

- **Public space:**

Mainly reserved for occupants, while remaining accessible to the neighboring community like the courtyard, green spaces or the parking space.

- **Semi-public space:**

These are spaces in the building that can be shared among the inhabitants, but are not part of private property. For example: corridor, hallway, terrace and stairwell…

- **Private space:**

[3] https://www.mchmaster.com/news/what-is-the-meaning-of-co-housing

These spaces belong to one family. For example: an apartment and the inside spaces and properties.

1.2 Types of collective housing according to the shape:

Collective housing can have several forms and shapes: but the general forms buildings take are continuous and discontinuous shapes.

1.3 Continuous Form:

This is a block of buildings, which is characterized by a closed form. It has a series of buildings, which encloses an interior forming a courtyard and differentiates the interior spaces from exterior space. This courtyard is the main structural element of the building, which can be used for garden purposes, green spaces and playgrounds for kids. It also acts as public space that integrates the building with the neighboring community by creating a passage through it. It is for this reason that parking spaces are built outside the courtyard or underground.[4]

Figure3: Continuous Collective Houses.

1.4 Discontinuous Form:

1.4.1 Alignment of blocks:

This is a series of identical or varied buildings, which are placed in a parallel, orthogonal or diagonal manner.

[4] Mme Imane Adimi, 2020, thèse, l'Habitat collective, universitaire ferhat abbas Sétif 1,

Figure 4: Alignment of blocks. Source**:**

1.4.2 Isolated buildings:

This form consists of high-rise buildings, located at a good distance from each other. They are often located in an urban environment with other low buildings, which resemble a large number of apartments in the same area.

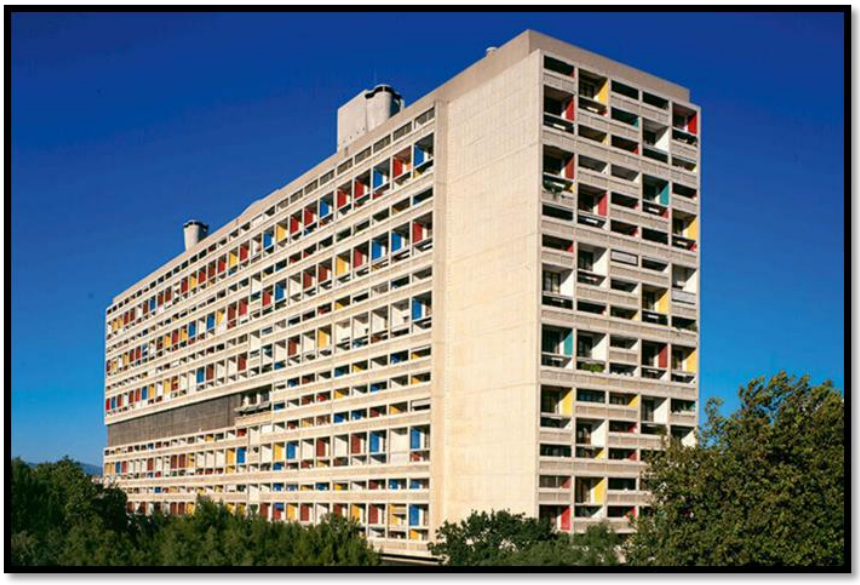


Figure 5: isolated buildings.

1.5 Semi Collective Housing:

Semi Collective houses are a form of housing that falls between individual and collective housing. Semi-collective housing are characterized by the vertical arrangement of two dwellings, each with independent access. This solution is generally adopted to combine the advantages of the individual and the collective hosing.

Figure 6: semi collective housing:

1.5.1 Characteristics of the semi-collective housing:

- Individualized access
- Users can have access to nature (gardens)
- Additional outdoor space (private outdoor space for each housing).
- Access to private Parking spaces
- Double level (no more than R + 2)

1.6 Individual housing:

This is a construction of a one single-family house, generally having a private access and private outdoor spaces like garden, terrace and parking. The housing Units can be detached (pavilions) or continuous (row houses), grouped (urban) or scattered (rural).

1.7 Types of individual housing:

1.7.1 Isolated individual housing:

This type of housing is characterized by:

- An absence of public and shared spaces
- An absence of limits in relation to urban cores
- A distance from the centers of centralities,

Figure 7: Isolated individual housing.

1.7.2 Grouped individual housing:

Characterized by:

- A construction process organized collectively.
- Common areas often occupied by the automobile.
- An often uniform appearance and repetitive.

Figure 8: Grouped individual housing.

1.7.3 Detached housing (single family home):

This is a simple housing unit that is occupied by a single family having its own entrance. This is the form of housing were only one family resides in it and located in a private space or private land which includes the extensions of green spaces, courtyards , driveways , parking spaces and gardens.

Figure 9: Detached individual housing.

1.7.4 Semi-Detached Housing:

This is a single-family house that shares one common wall with the next house.

«*Often, semi-detached houses are built as pairs in which each house's layout is a mirror image of the other's*. »[5]

Semi-Detached Houses can be one story buildings or duplex.

«*The repetition of a single model will give an impression of unity.*[6] »

Figure 10: semidetached houses.

«Garages or cars ports are often included on the side boundaries »[7]

[5] https://en.wikipedia.org/wiki/Semi-detached
[6] ARMOUCHE DARINE et BOUMAZA WISSAM, 2018, mémoire, habitat durable, universitaire de tlemcen , département d'architecture
[7] Ernst and peter neufert , 1936 , neufert architects data third edition , PP 275

Figure11: semidetachedduplexhouse:

1.8 Understanding the covid-19:[8]

Coronaviruses is a type of virus that has caused a worldwide pandemic of respiratory illness. The first case was identified in Wuhan, China, in December 2019 and since then; the disease has since spread worldwide.

1.9 How does the new coronavirus spread?

Researchers say that the coronavirus is spread through droplets that are released into the air when someone who is infected coughs or sneezes. The COVID-19 spreads mainly from person to person through several ways such as: Droplets or aerosols, airborne transmission, Surface transmission and Fecal-oral. Due to its heaviness, it has the ability to survive outside and on the surfaces such as metal, glass, clothes and plastics.

1.10 Negative impacts of Covid-19 on social life:

- **On Educational impact**
  The pandemic has had a negative effect on the educational systems worldwide that has led to the widespread closures of schools, colleges and universities.
- **Religious impact**
  The pandemic has led to cancellation of worship services of various faiths.
- **Psychological impact**

[8] www.worldhealthorganisation.com

The pandemic comes with concerns for a potential spike in suicides, due to quarantines and fear, social-distancing guidelines, and unemployment and financial factors.

- **Personal gatherings**
  The impact on personal gatherings has been strong as medical experts have advised, and local authorities often mandated stay-at-home orders to prevents gatherings of any size
- **Domestic violence**
  Many countries have reported an increase in domestic violence and intimate partner violence attributed to lockdowns amid the COVID-19 pandemic. Financial insecurity, stress, and uncertainty have led to increased aggression at home.

1.11 Smart home technologies:[9]

Smart Home technology gives you ultimate control over your dwelling place by automating the lighting system, blinds, electrical appliances, and audio and security systems. A home equipped with smart technologies that can be remotely controlled by phone or computer.

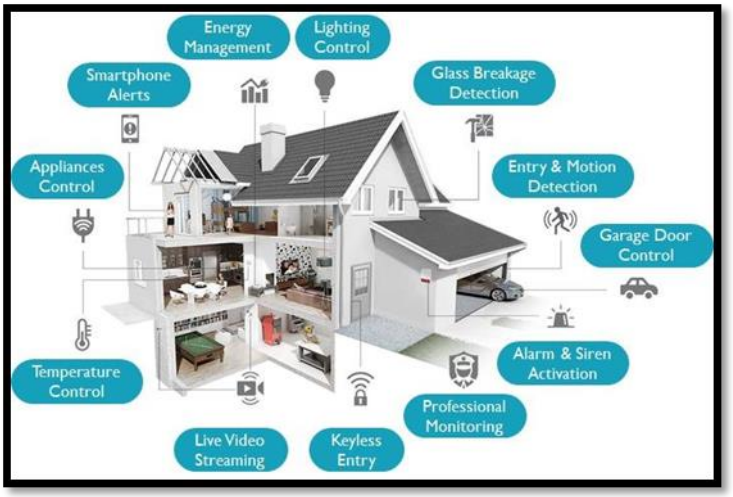


Figure 12: smart home technologies:

1.11.1 Why smart home:

Smart Home is applicable in various aspect of our home and environment to suite our different preferences such as Comfort or Ease of control and For Security reasons.

1.11.2 Comfort/Ease of Control

[9] www.enginess.io/insights

- Smart Home offers ease of controlling of devices around the home.
- These features offers automation and remote control of devices around the home from any location within such as: Automatic control of garage door , interior and exterior doors and gate(s);
- Automatic shutdown of appliance when not in use;
- Automatic setting and maintenance of right temperature for each room;
- Automatically adjust/ regulate light intensity based on room luminosity.

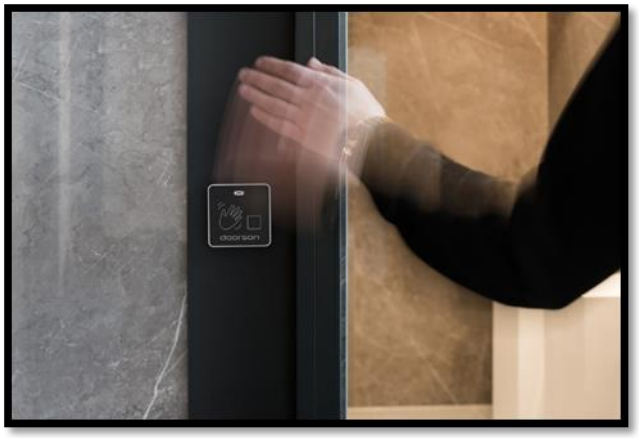


Figure 13: touchless surface door:

1.12 Security

1.12.1 Security Camera

- Controlled motion sensitive cameras which allows for observation of activities
- Capture and record video surveillance.

1.12.2 Emergency

- Initiate emergency alarm or audible intruder alert
- Activate sprinkler and fire extinguishing system in case fire emergency

1.12.3 Controlled Access

- Granting access using finger print, eye or face or voice recognition
- The System informs the user if a visitor is at the door; the owner can then grant or deny access

1.13 New technology:

We are in the 21st century, and several innovations have seen the light of day. The architectural sector has changed dramatically. The industrial revolution has greatly contributed to the emergence of new technologies in architecture.

1.14 The application of new technology in architecture:

New technologies are taking more and more place in our private and professional lives. The architectural sector is not left out in this area. Indeed, technologies seem to have become essential tools to meet increasingly numerous and severe requirements. The main points addressed by the new technology in architecture are:

1.14.1 Ecological technologies:

Ecological architecture is a method of design and construction with the concern of designing an architecture that respects the environment and ecology

1.14.2 Structural technology:

For the past 2 decades, the structural field has made many technological advances. The construction sector is currently experiencing a real transformation, increasingly technical products, the need to demonstrate the conformity of its achievements, the construction sector must meet these new challenges, find new ways of doing things and remain competitive.

Some types of structures, which have revolutionized three-dimensional structures, shell structures, membrane structures. .etc

1.14.3 Innovation in building materials:

Today, to build a project, new building materials simplify the big work, save time during implementation. In addition, they often bring real aesthetic benefit. As in fashion, building materials are subject to the vagaries of fashionable concerns and trends. They are, above all, the result of prodigious technical improvements.

1.15 Historical evolution of housing internationally:[10]

The assumption behind any historical approach is that one can learn from the past and improve the present because housing transformations worldwide are the result of major

[10] Vestbro, Dick Urban & Horelli, Liisa. 2012. Design for gender equality - the history ofcohousing ideas and realities. Built Environment. Volume 38, Number 3. pp. 315-335.

demographic and socio-economic changes in addition to technological advancements and socio-political interventions.

Housing has a fascinating history, during different periods; ideas of houses with shared services were launched by the early influential thinkers.

These models of houses were motivated by, sometimes social and political visions and sometimes by practical needs of people.

There are visions of ideal human habitats from the early European history Plato described an ideal community where everything was organized collectively.[11]

1.16 Thomas more- Utopia:

In the early 15s Thomas more published the book called "Utopia", meaning no place. His ideal community he envisioned was that people were to live in neighborhood groups with common spaces such as: dining-rooms and various shared leisure facilities.

1.17 300 years later:

Industrialization brought brutal changes to the European countries which later gave birth to the visions of an egalitarian society, were working and living are to be collectively intertwined. In the 1840s, Robert Owen (a Welsh textile manufacturer, philanthropist and social reformer, was one founder of utopian socialism and the cooperative movement) sketched such an ideal society by Thomas more, which he called the Parallelogram.

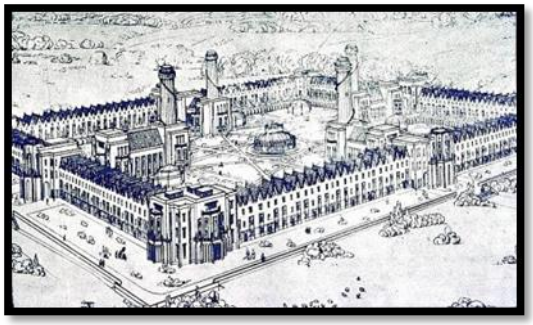


Figure 14: Parallelogram by Thomas more.

1.18 The Parallelogram:

The Parallelogram was to be characterized with:

- **Generous dining halls**

[11] Vestbro, Dick Urban & Horelli, Liisa. 2012. Design for gender equality - the history ofcohousing ideas and realities. Built Environment. Volume 38, Number 3. pp. 315-335.

- Schools and kindergartens
- Libraries and sports grounds
- With modest individual dwellings.

The Followers of Robert Owen later migrated to North America and implemented his ideal community (the Parallelogram), which was given a new name called New Harmony, but it crumbled after a few years.

1.19 Charles Fourier-Falanstere:

Charles Fourier Was one of the most famous utopian socialist during his time, he also wrote a number of books describing his ideal society, which he called **Falanstere**. It was the most famous piece of architecture at that time because it resembled the royal Palace of Versailles.

His idea was that working people should be able to live in a social environment, with facilities such as:

- Workshops
- Facilities for processing agricultural products
- A collective kitchen and dining hall
- Schools and kindergartens
- A theatre
- Beautiful gardens and
- Other collective facilities.

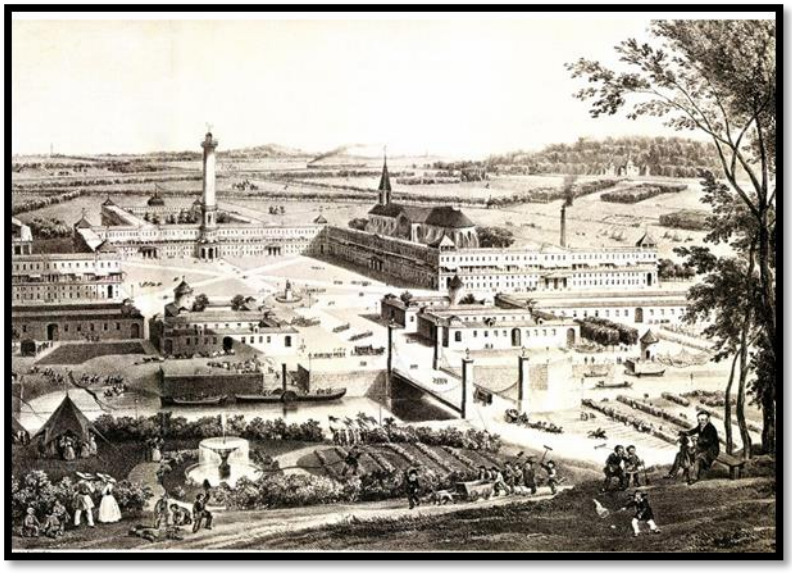


Figure15: the Falanstere by Charles Fourier.

This was a place where the workers would have the means to production and organize nearly everything collectively.

1.20 Carl Jonas Love Almqvist-Universal Hotel:

«Carl Jonas Love Almqvist was a well-known Swedish author who was inspired by the utopian socialists[12] *».* In 1835, he also envisioned a society, which he later called 'Universal Hotel'. His idea was to have all forms of housework to be done collectively, so that women could engage in other productive work. His idea was to improve the time management amongst woman who had to lose a lot of time in housekeeping.

1.21 Jean André Baptiste Godin- Familistere:

The ideas of Charles Fourier were forbidden to be realized in France, but his work did not vanish in to thin air. Jean André Baptiste Godin was inspired by the Falanstere idea and produced another project, which called the Familistere, «where everyone would live in, as in a huge family. »

Figure 16: The Familistere

1.22 The central kitchen idea:

« In the **19th century** a middle-class family was expected to have a house-maid and a children's nurse, but for the families on the way up, servants were expensive. Thus, the idea arose that a group of families could share the task of preparing food by organizing a central kitchen from which they could order meals for the family apartments. »[13]

[12] http://kollektivhus.nu/pdf/colhisteng08.pdf
[13] Vestbro, Dick Urban & Horelli, Liisa. 2012. Design for gender equality - the history of cohousing ideas and realities. Built Environment. Volume 38, Number 3

Figure 17: the central kitchen.

The idea of central kitchen buildings did not end in the 19th century, but it was adopted in the 20th century by most European capitals and similar projects were realized in Stockholm, Berlin, Hamburg, Zürich, Prague, London and Vienna.

1.23 Hemgården Central Kitchen:

In the early 19s, 60 apartments were constructed and none of the apartments had its own kitchen. Instead, there was a central kitchen in the basement, connected to the apartments by dumbwaiters.

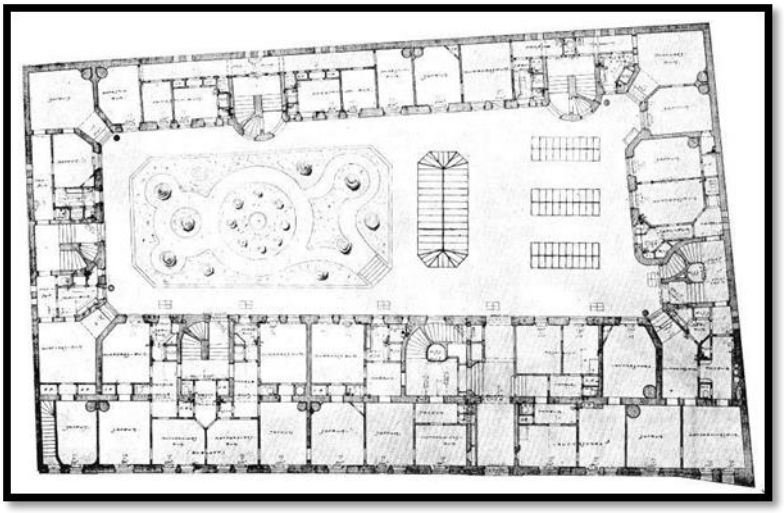


Figure 18: The floor plan of Hemgården in Stockholm, Design for Gender Equality.

figure19: Dumbwaiters for meal delivery

The idea behind the central kitchen was to unify the house cleaners because during this period, it was expensive for a middle family to hire a house cleaner. After some years passed, Kitchens were built in each apartment and the former central kitchen became a space for collaborative activities.

Figure 20: Hemgården in Stockholm.

Hemgården buildings were no longer been constructed after the integration of kitchens in each apartment.

1.24 Marieberg cohousing unit:

In a few years later after central kitchen idea, 198 apartments were constructed in Sweden. The **Marieberg unit** had many services such as:

- a reception
- dining hall
- Kindergarten and other common facilities.
- two or three rooms and a kitchenette

Unlike the Hemgården, the Marieber got rid of the dumbwaiter idea because it was constructed for people to eat from one place. In addition, this dining room was only accessible to the ones who lived in the building.

Figure 21: Marieberg dining hall.

« Although the co-housing idea was progressing, it was also meeting powerful opponents. »[14]

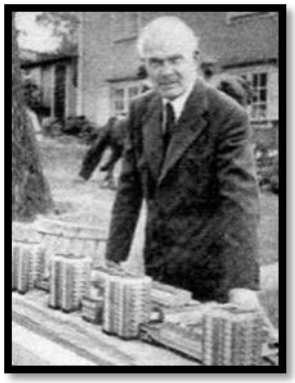
1.25 Hãsselby family hotel:

In the mid-1950s, Olle Engkvist had his own vision of an ideal society, which he named *Hãsselby family hotel*. This was one of his last biggest projects of collective houses. The family hotel had 328 apartments with:

- a restaurant kitchen and a large dining hall on several levels
- a smaller dining room
- a room for parties and a club-room with its own cafeteria
- a staffed reception
- a shop that was open in the evenings
- a kindergarten
- a laundry
- A prayer-room and a gymnastic hall.

« In other words, the family hotel was for rich and privileged families. »

[14]http://kollektivhus.nu/pdf/colhisteng08.pdf



Olle Engkvist with the model for the family hotel, 1950s

Figure 22: Hãsselbyfamilyhotel.

The family hotel building did not provide the tenants with private kitchens; instead, the tenants had to cook from other neighboring facilities. This was very inconvenient to the tenants; they were forced to start cooking their meals in the restaurant until they were thrown out by a massive police action in 1979 (because the owner wanted the premises for purposes that are more profitable). After that, the residents have gone on cooking in more primitive facilities elsewhere in the building.

Figure23: A big police force evacuating tenants who had occupied their own communal kitchen 1979.

1.26 Material feminist ideas in the USA:

Hayden wrote a book called ‘the grand domestic revolution’. In 1981, she reinvigorated the discussion of the forgotten feminist tradition movement, which started in 1868 when the housewives demanded to be paid for their work. This feminist movement ended in 1931. Hayden called these women material feminists because they demanded a complete transformation of the American homes and the spatial design of neighborhoods and cities.

Hayden contradicted the physical separation of household spaces from public spaces. The aim of her movement was to demand for a built environment that was egalitarian in production and consumption. In her book, she also argued that the built environment should reflect the equality for women and to make all domestic work visible.

The houses that were built in this period were characterized with spaces such as:

- day care centers
- public kitchens and common dinning clubs
- food services delivery

1.27 A new collaborative model:

The Hässelby family hotel was not designed so that those who lived there should cook meals or do anything else together. As the name "family hotel" implies, the objective was to support families where the mother was working outside the home. The idea of tenants working in the kitchen or restaurants to prepare their own food was entertained in 1976 as an emergency solution.

A housing expert *Brita Åkerman* saw the advantages of collective housing after she took part in several government investigations on family and housing. This led her to start writing good things about cohousing. In an investigation on single parents, the idea of cohousing was put forward that:

> *« "... There could be service buildings, accessible to all sorts of people. They would have apartments of different sizes, appropriate for single persons, for families with children, for young people and for elderly. As well as the individual apartments, there would be collective spaces where those who lived there could meet one another and help one another and in every way see to it that everyone had the help and opportunities that they needed." »*[15]

1.28 Practical experience of the BIG model:

In the late 1970s the group *Bo I Gemenskap* which means *living in togetherness*, presented similar ideas of a new collaborative model, which inspired a number of new cohousing projects.

Since the early 1960s, many married women started working outside their homes. Because they were parents, they formed a union to demand kindergartens and other forms of services, which were implemented in the BIG model.

[15] Vestbro, Dick Urban & Horelli, Liisa. 2012. Design for gender equality - the history of cohousing ideas and realities. Built Environment. Volume 38, Number 3

figure24: The residents at Stacken,

1.29 Prästgårdshagen in Stockholm:

The first building in Stockholm to implement the new collaborative model was the Prästgårdshagen. In this case the idea was taken up by the Vice-Mayor Mats Hulth. He had been impressed more by the new collaborative model.

figure25:The ground floor of Prästgårdshagen.

Following the BIG model, the apartment area was reduced by about 10% to allow generous collective spaces. The building was characterized with:

- a central kitchen, a dining hall, a laundry and a children's play-room
- a meeting-room
- a sauna, a photo-lab, a carpentry, a pottery workshop and in the cellar a music room.
- a kindergarten in the building

- Every floor had a collective room, not dedicated to any particular activity. It could for example be used for informal meetings, as a place to share magazines or as a room for young people.

1.30 Summary:[16]

The summary in the Table below shows that the main obstacle to the implementation of housing has been the patriarchal society, including both in the public and private sectors. It also shows the driving forces behind the selected communal housing models and how they have varied strongly in a course of time

Table 1: driving forces behind evolution of communal housing models :**(source:** Amos rapoport, 1969 .House form and culture)

Housing models	Driving forces for change	Housing solutions	Domestic work and impact on the labor market	Lessons for the future and obstacles
Utopists, 19th century in the USA and Europe	The utopist was driven by visions of a harmonious society and for workers to have mass production.	The forces lead to the production and reproduction spatially integrated out of the cities	Impacted the collective organization of meals and women's participation on the work production	The utopists ideas had a positive influence on the later cohousing ideas.
Material feminists in the late 19th and early 20th century	Driven by the need of economic independence of women through socialized domestic work like collective house keeping	To have neighborhoods with kitchens , less houses and public kitchens and laundry	Gender and class conflicts were not solved from this model , and there was less demand of equal distribution of domestic work	The solutions were interesting but encountered conflicts with patriarch society and corporate society
Central kitchen houses 1904-1922	The driving force was to solve the servant problems of the middle class families by collectivization of maids	Bourgeois apartments with a central kitchen in the basement that had food lifts	There was reduction in the domestic work and wives were not expected to work in production	Few for the future but there is a possibility of centralization of food production

[16] Amos Rapoport. House form and culture. New Jersey: Prentice Hall, 1969.Holly Denniston, Integrated Supportive Housing: Creating A Community Housing Network, February 2012

New everyday life	Driven by the need to integrate work and life through shared domestic work in housing between men and women	The solutions was to combine the bungalows and apartments with a community house and other shared facilities	There was an equal distribution of domestic work and equal balance of life	This is the most successful model today , this model has developed the utopia into the neighborhood
Today and the future	Housing is driven by the need to overcome isolation and a demand for sustainable lifestyle	The solution is to build models that are accessible to classes and affordable	Equal distribution of domestic work but the labour markets remain segregated by gender	Co-housing ideas are expanding today but the construction sector is slow to meet the growing demands of cohousing

1.31 Factors Influencing Integrated Housing:[17]

The habitat is conceived with a whole series of intentions; it reflects many forces, which are presented as follows:

1.31.1 The site:

Every place has potential that should be exploited and constraints that should be addressed. Architecture is dependent on the physical environment, which is factor that integrates the project, and its physical environment.

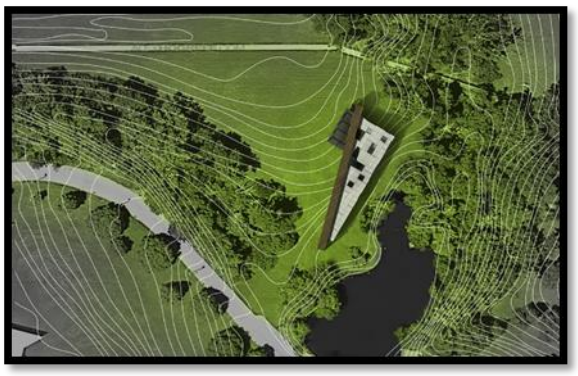


Figure 26: site Location site.

For instance, similar site conditions in an environment can result in similar forms, shapes colors and typologies.

[17] Amos Rapoport. House form and culture. New Jersey: Prentice Hall, 1969.Holly Denniston, Integrated Supportive Housing: Creating A Community Housing Network,

1.31.2 Culture:

Changing the cultural attitudes of any society has the greatest impact on the architecture. The culture defines the identity and values of the community, it reflects the way of living of individuals. The cultural architecture translates itself into physical form of a beliefs and values of the people.

Figure 27: cultural identity.

1.31.3 Privacy:

Privacy in architecture refers to design choices that give people a sense of security and privacy in a physical space[18]

It implies a degree of spatial hierarchy between private space where family life takes place and public space where community life takes place. People instinctively evaluate privacy in four ways:

- ✓ **Acoustical privacy:** Undisturbed by noise and to be able create noise of your own without disturbing others.
- ✓ **Visual privacy:** Not being seen by others (public) and to be able to flee from sight of others
- ✓ **Informational privacy:** this means that one has to be able to keep certain conversations confidential without fear of been heard.

1.31.4 Religion:

This is a System of beliefs and practices that distinguish the characteristics of one religion to another. Religion affects the spatial arrangements and orientation of houses[19]. Religious architecture is seen to be expressed in the accident days: from the likes of the great pyramid of Giza to the Parthenon of Greece and the Taj Mahal of India. We see that each religion has a different style of expression. Today in our homes, religion plays a

[18] https://www.trendhunter.com/slideshow/privacy-in-architecture
[19] Amos rapoport, 1969 .House form and culture. Philip .L. Wagner, 24p.

major role on how a house should be organized, because here, a house is not just a place of shelter but it becomes a sacred place.

1.31.5 Construction materials:

For many years, wood and brick have determined the form, shape and character of buildings[20]. However, due to evolution of materials, man begins to learn and master new technics and materials that contributed to the evolution of co-housing.

Nevertheless, one has to know that, materials and technology are modifying factors of buildings and not determinants of a shape. The choice of materials is important from an aesthetic, technical and thermal point of view for the realization of a project that meets the requirements of comfort.

1.31.6 The climate:

Architecture depends on the climatic factor that dictates the main orientations for the design. The introduction of the climatic dimension makes it possible to achieve objectives such as the desired environmental quality, a better experience for the occupant, and energy savings.

«Climate, produces certain easily effects on architectural buildings. For instance, the window proportion to the wall area becomes less as one moves toward the equator. In warm areas, people shun the glare and heat of the sun, as demonstrated by the decreasing size of the windows. In the subtropical and tropical zones, more distinctive changes in architectural form occur to meet the problems caused by excessive heat. . »[21]

1.31.7 Social practices:

Certain life practices can generate particular architectural arrangements (the need for spaces that will host domestic activities).

1.32 Problems related to housing design of today:

Safety should be our number one priority in building design. However, most of the existing buildings are not well equipped to safeguard the occupants during the disease outbreak. The COVID-19 has revealed some shortcomings in the residential buildings; it is for this reason that housing design needs to be improved for a better future. «*Since multi-*

[20] Amos rapoport, 1969 .House form and culture. Philip .L. Wagner, 40p.
[21] https://archive.unu.edu/unupress/unupbooks/80a01e/80A01E03.htm

story housing is standard in most cities, they need special attention[22] ». The problems of co-housing today are summarized into the following categories:

1.32.1 Health & Safety:

- ✓ Existing residential buildings have many surfaces of contact (e.g., elevators, doors, ladders), which leads to limited capacity to protect the occupants from virus transmission through surfaces and by air. «*Buildings are full of elements frequently contacted by numerous occupants*»[23]
- ✓ Existing residential buildings lack proper comfort that leads to a decline in both physical and psychological health. People who have adequate personal privacy in their homes are claimed to have lower stress levels compared to those who lack such comfortable accommodation.
- ✓ Lockdowns tend to increase domestic violence frequency, and most existing residential buildings lack any service or facility that could help the victims. Most victims are stuck with their abusers. The existing residential buildings are not capable of supporting victims of domestic violence because they lack emergency shelters. The WHO has recommended developing policies to implement services in post pandemic era that help with the domestic violence victims.

1.32.2 Environment:

- ✓ Increased energy usage due to global lockdowns (e.g., cooking, the use of ICTs, laundry, entertainment) creates a greater and uninterrupted need for sustainable energy sources.
- ✓ Households are not ready to manage the possibly infected waste; therefore, there is an emerging need to create a waste separation and disinfection strategy.

- ✓ Existing residential buildings lack greener spaces that can enhance the mental health of residents, decreasing stress, anxiety, and depression during lockdowns. They also lack gardens, where people could grow their own plants to increase the food security.

1.32.3 Comfort

- ✓ Households lacking comfort from personal spaces and outdoor spaces complicates the lives of occupants' lives and lead to health problems like including mental health.
- ✓ Most co-housing buildings lack access to outdoor spaces, balconies and terraces that are considerably important for those who live in apartment blocks.

[22]Galym Tokazhanov, Aidana Tleuken. 21 October 2020.How is COVID-19 Experience Transforming Sustainability Requirements of Residential Buildings?
[23] ibid

- ✓ Most of the co-housing lacks Natural ventilation and natural sunlight that can be used to decrease the chance of disease propagation indoors.
- ✓ Lack of independent local stores and pharmacies might create a crisis during lockdowns due to an insufficient amount of necessary reserves in food and medicines.
- ✓ Existing residential buildings lack home offices, staying at home for many working people has become a new lifestyle. In addition, most of the current co-housing buildings do not provide a working space or an office to adapt with the covid-19.
- ✓ Lack of access to private sanitation facilities complicates the isolation of infected occupants. WHO recommends having separate sanitation facilities in households to eliminate the risk of viruses' propagation.

1.32.4 Conclusion:

In a few years to come, we expected to see a drastic change in our houses, because people will be more concerned about designing homes for health and safety and not just for shelter.

We are going to see an increase in the use of touch-less surfaces and automotive technologies, as well as critical selection of finishing materials that do not support the survival of viruses. There has to be an increase in the development of green spaces as a way to respond to the needs of our built environment. We are also going to see a shift to Sustainable technologies for energy and communication technologies and the use automotive technologies in order regulate better comfort parameters such as lighting quality, air quality, temperature and humidity.

Future pandemics cannot be precise, but it is our duty to be ready for any possible repeating pandemics like the COVID19. Therefore, it is very important to understand the requirements when under a pandemic situation and understand design solutions. Future work has to proceed but with new building codes for the post-pandemic residential buildings.

Chapter 2: Analytical approach

1.33 Introduction:

In this chapter, we are going to study architectural projects as examples. After a complete analysis and comprehension of five examples, we will be able to project ideas of the project. This chapter aims to provide clarification and a better knowledge of the theme by drawing recommendations that will allow us to identify all the requirements related to the project.

1.34 Exemple 1: Sarvestan Garden yard:

Figure 28: sarvestan garden yard.

1.2 The idea of the conception:

The idea of the Garden yard in the body of the space has been done by transferring the inner space to create large multi-functional green spaces. The project was designed in 2020 in response to covid-19 pandemic in order to define a new lifestyle during these times of crisis.

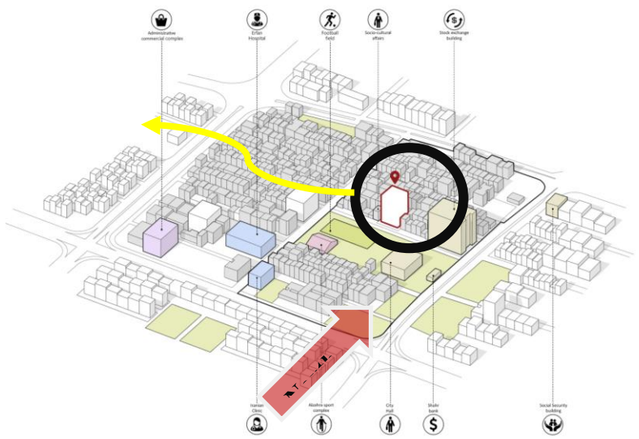


Figure 29: project location.

Table 2. Project description of sarvestan yard.

Architect :	Saffar Studio
Location :	Tehran , iran
Climatic region :	Continental climat
Housing units :	-2 units per level -apart from the ground floor with services -and 9th floor with 1 housing unit - total 20 units
Surface area :	1,606.30m²

Composition of the project: **Table 3.** Composition of the sarvestan yard.

Floor level	Composition		Total	
From 1st floor To 2nd floor	2 apartments on each floor	2 F3 and 2 F4 each floor	**4 apartments**	TO ACCOMADATE ABOUT 100 OCCUPANTS 17 apartments
From 3rd floor To 8th floor	2 apartments on each floor	5 F4 and 5 F5 each floor	10 apartments	
From 9rd floor To 10th floor	1 individual apartment on each floor	2 F5 on each floor	2 apartments	
Roof top	Roof garden, seasonal pool, gathering spaces, party room.			
Ground floor level -1 to –3	Gym , coffee shop , gaming room , clinic , indoors pool , billiard hall ,management and technical services , cinema and amphitheater , installations , balling hall			
Ground floor level –4	Underground parking of 30 spaces			

Accessibility and circulation:

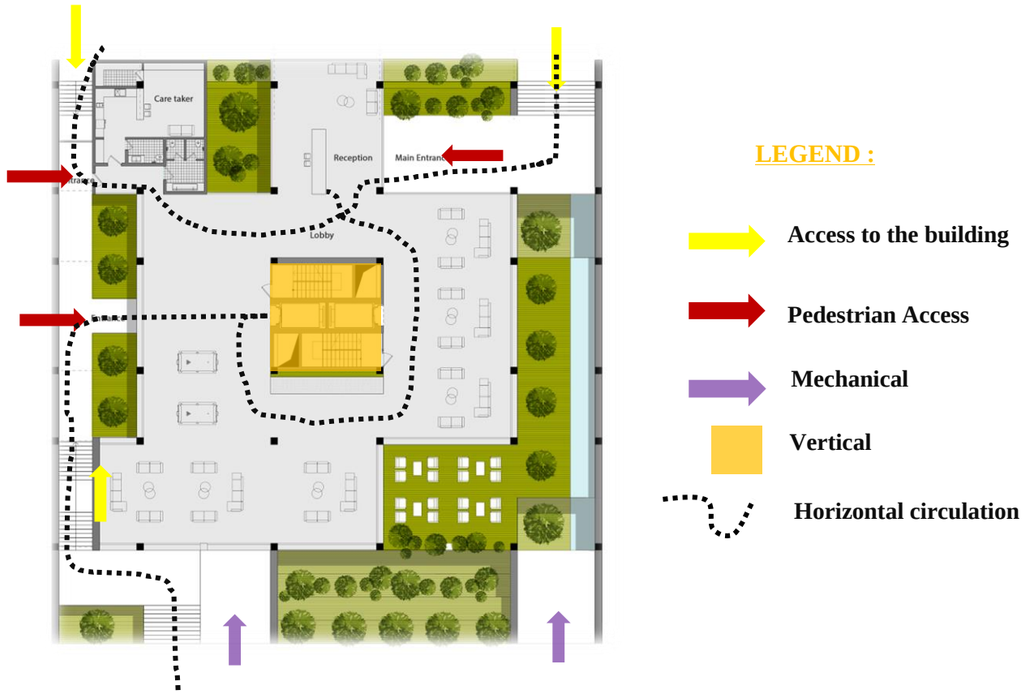
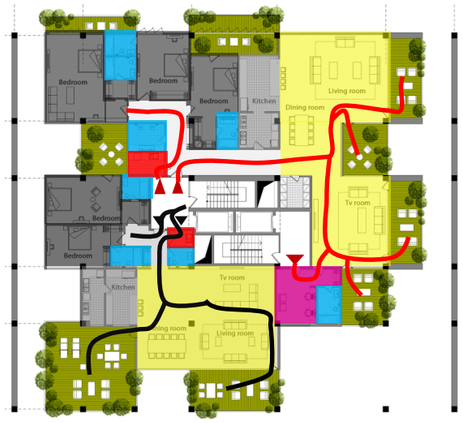


Figure 30: analysis of ground floor

First floor to second floor plan analysis



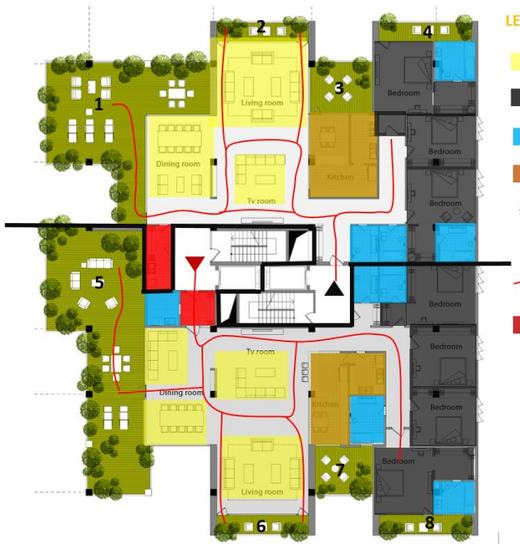
LEGEND :

- Wet spaces
- Day spaces
- Night spaces
- Transition room
- Home office
- F4 entrance
- F3 entrance

Figure 31: analysis of 1st floor to 2nd floor

The centralized stairwells gives access to the accommodation units. The first and second floor is made up of 2 housing units on each level. Each apartment has its own stairwell to prevent contact with neighbors

Third floor to eighth floor:



LEGEND :

- Day spaces
- Night spaces
- Wet spaces
- Semi wet spaces
- Access to F5
- Access to F4
- Circulation
- Désinfection room

Figure 32: analysis of 3th floor to 8th floor

•The interior is structured in a modern with an open living space and open kitchen way.
•Large accessible balconies on the facade
•The bedrooms are located on the south side with less green balconies.

Ninth floor to Tenth floor:

Figure 33: analysis of 9th floor to 10th floor

LEGEND

- Day spaces
- Night spaces
- Wet spaces
- Access to F5
- Home office
- Circulation
- Transition room

Spatial and fonctional organizational chart

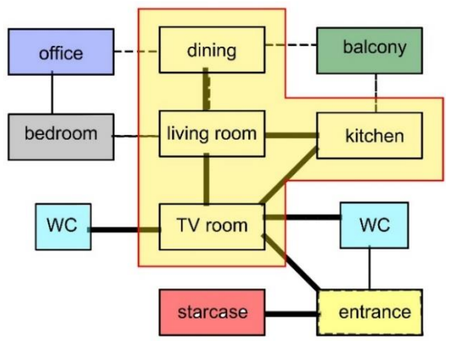


Figure 34: spatial and fonctional organisation

NOTE: The TV room becomes the central place of distribution We note that there is a hierarchy between the distribution of the different functions and a balance between the humid spaces) bathroom –kitchen (and dry) the rooms –living room (with simple and regular circulation.

Volume analysis:

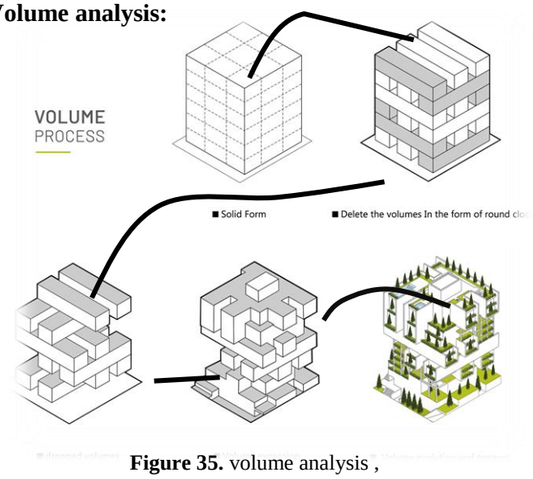


Figure 35. volume analysis ,

Figure 35 shows the volume process which takes up the solid form and translates the form into solid blocks, which are expanded and translated. The blocks are expanded to create green spaces and reduce the proximity of neighbors.

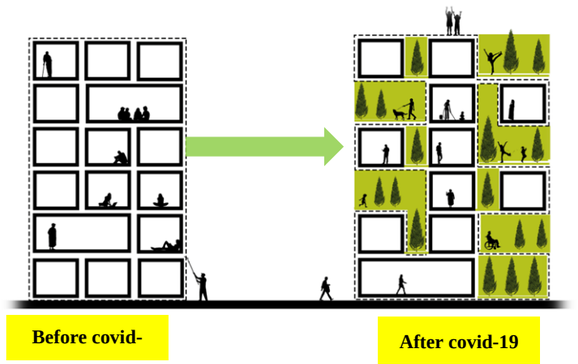


Figure 36. Project concept

Figure 36 shows the concept of the Project, residential buildings before covid-19 and after covid-19.

Before covid-19 the buildings are seen to be densely space with no regards for green spaces. The volume process show the évolution of the building to accommodate green spaces.

Analysis of facade:

Figure 37: Analysis of the facade

Vertical gardens on each level for sustainability.
Big glazed windows are used for energy saving.
the textures and color of material gives more richness and modernity to the facades.

Table 4. Architectural description of sarvestan yard.

Style	Modern
Building forme	Vertical rectangulaire
Materials used	Glass-ceramic-concrete-reinforced concrete-tiles
Colors	Cream white
Roof	Flat green roof

Analysis of interior atmospheres:

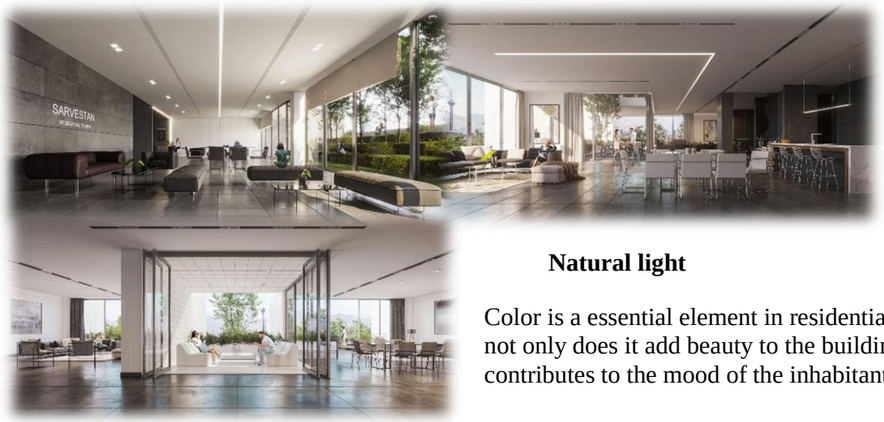


Figure 38. source : amazing architecture

Natural light

Color is a essential element in residential buildings, not only does it add beauty to the building but contributes to the mood of the inhabitants as well.

The sustainability techniques used:

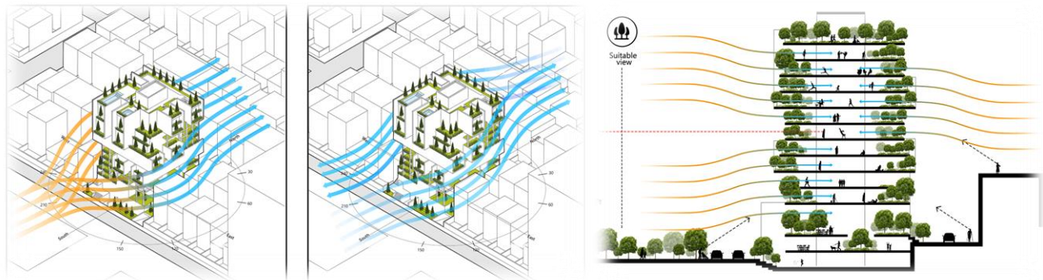


Figure 39. source : amazing architecture

The idea of the presence of the apartment yard in the body of the space has been done by transferring the inner space of the yard in the plans to the sides and the body of the building form, to create large multi-functional green spaces. The vertical garden helps to block strong winds and helps to cool the hot air from outside, this helps to save energy.

Structure analysis

The construction system to be used in this project will be *concrete frame construction* which is also called *skeleton structure system*, which is made up of reinforceed slabs, columns and beams. The stairwell will have reinforced walls to strengthen the structure.

1.35 Exemple 2: sky house

Figure 40. Source : amazing architecture

The idea of the conception:

The design team promotes the deep vertical and horizontal connection between human and human as well as between human and nature in this house.

Nature and shape of the land:

The land is rectangular in shape, It is flat land in An Urban area.

Technical sheet:

Table 5. : Project description of sky house

Architect :	MIA Design Studio
Location :	Saigon , Vietnam
Area:	352.62m2
Completion:	2019
Project type:	Individual housing
Nature and shape of plot	Rectangular shape , 68% for built space and 31ù for green spaces

Mass plan

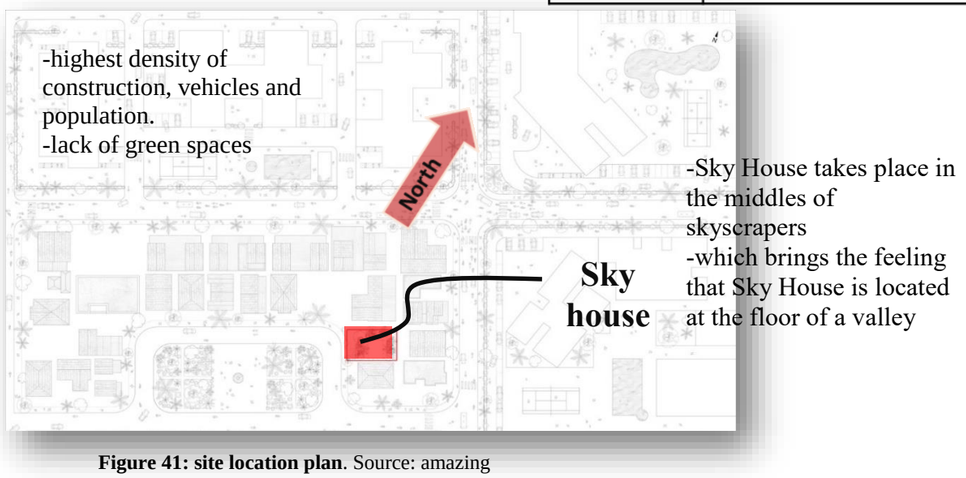


Figure 41: site location plan. Source: amazing

-Plan Analysis, Accessibility and circulation:

Ground floor plan (consist of entrance , staircase , living , dining room ,kitchen , fish pond , landry , storage , WC)

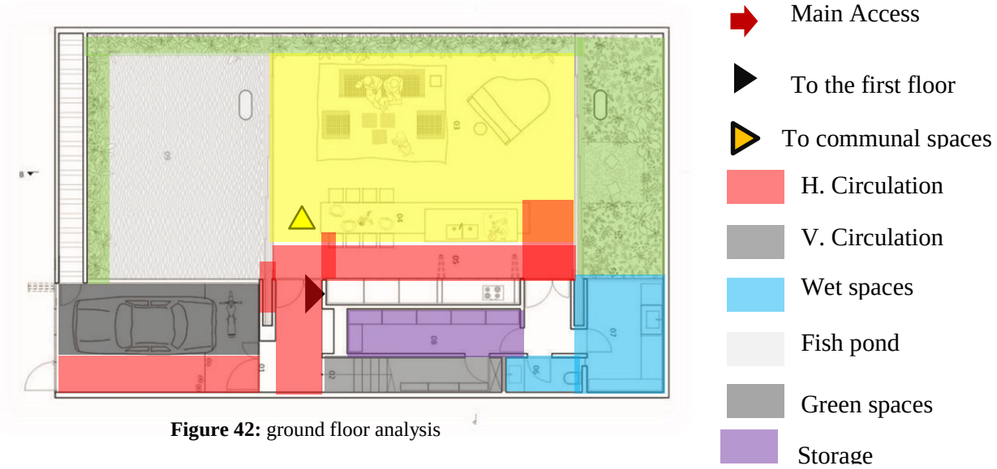


Figure 42: ground floor analysis

First floor plan (consist of staircase , WC , 2 bedrooms , terrace , void)

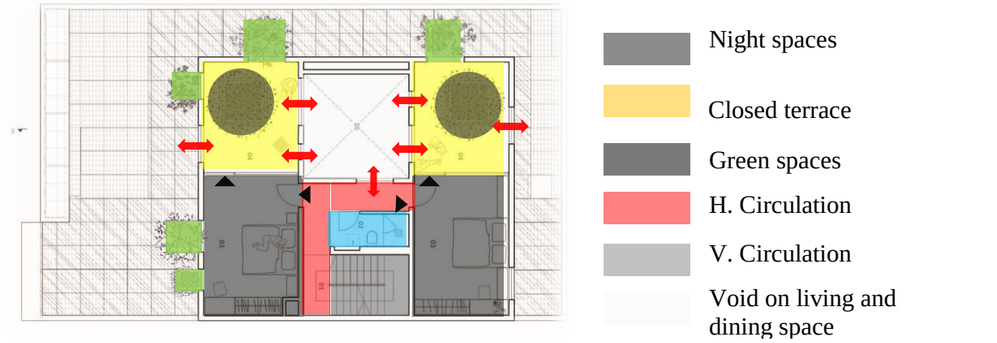


Figure 43 : 1ST floor analysis

Second floor plan (master bedroom , WC , terrace , void , walk in closet)

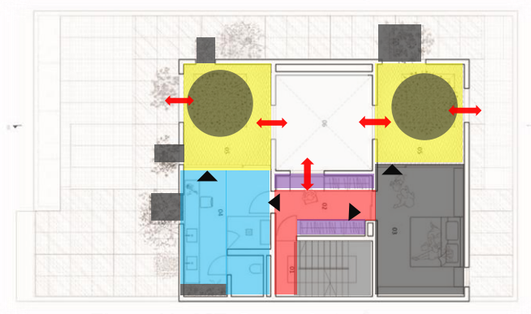


Figure 44 : 2ST floor analysis

Roof Top plan (staircase , Alter, void , horticulture Garden)

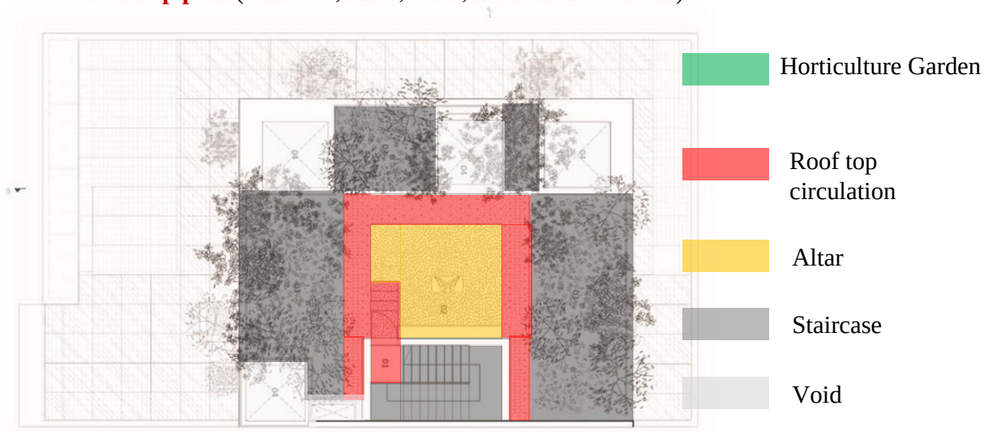
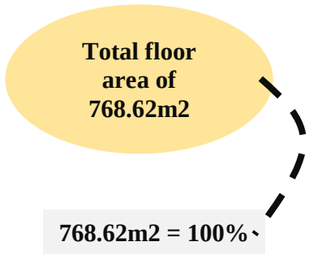


Figure 45. Rooftop analysis

Program:

Table 6. program for the sky house.

Program	Total area	%
Accommodation	135.25m2	17.8%
Relaxation	141.3m2	18.4%
Green spaces	142.6m2	18.5%
Circulation	67.9m2	8.6%
Parking	30.55m2	4.0%
Washing	15.31m2	2.0%



The connection between humans and nature has been expressed in many ways through the gaps.

Elevations:

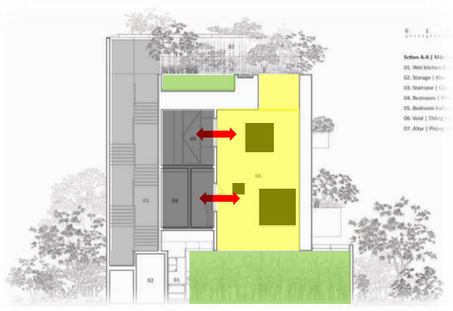


Figure 46: analysis of section

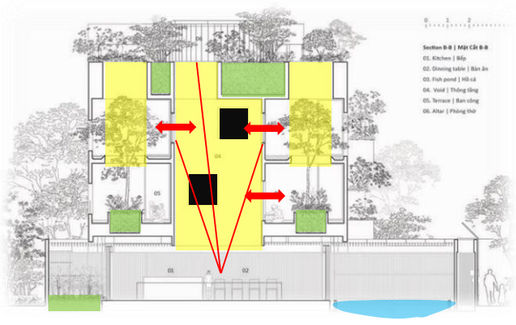
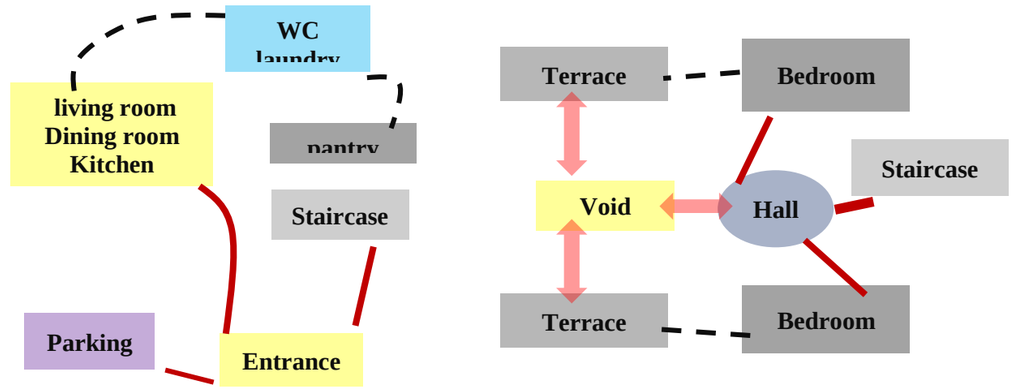


Figure 47: analysis of elevation

Spatial and fonctional organizational chart



Analysis of interior atmospheres:

Figure 48: interior atmosphere: source

Figure 49: interior atmosphere: source : archidaily

Figure 50: Gap openings for tree

Figure 51: interior atmosphere: source

Figure 52: Gap openings for communication

-White paint is used for both inside and outside which blends well with the trees.
-Wood panels giving shelter to the fish pond and around the house
-voids are used also for natiral light

Conclusion

These gaps are the main subject of the house, where parents and children can see each other from every corner. This is how architecture can heal people's soul by harmonizing with nature.

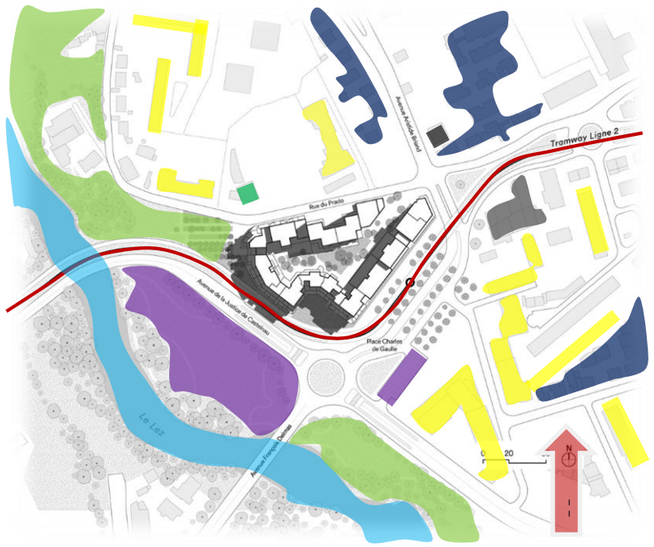
1.36 Exemple 3: Prado Concorde Apartments

Technical sheet:

Figure 53: example prado concorde:

Project name: Prado Concorde
Architects: Valode & Pistre
Lead: Valode & Pistre PUP
Program: Accommodation (private, social, student), shops, offices, retirement homes, teaching.
Project owner: Helenis (subsidiary of the GGL Group) Opalia
Floor area: 28,000 m2 on a 1 ha site
Delivery: 2019
City: CASTELNAU-LE-LEZ
Country: FRANCE

Site location plan:



LEGEND:

- Parking area
- Cohousing apartments
- Shops
- Individual houses Duplex
- Laboratory
- Restaurants
- Valley garden
- Tramway line
- Lez River

Figure 54: site analysis: source :

- Castelnau-le-Lez is a town located near Montpellier in the South of France which enjoys a very mild Mediterranean climate.
- Located near the Lez river
- The town combines collective housing with school facilities and shops in a vast urban island surrounding a garden shaped like a valley.
- a good hierarchy of spaces to Ensure proper functioning between the interior of the block and the exterior
- And Integrate additional functions to existing ones into the home.

Composition of the project:

- The program of the project includes accommodation –which can be private, social, shops, offices, retirement homes.
- Teaching facilities shaped around an internal garden.
- The project contains *336 apartments in total* , including *162 student campus rooms*
- 143 privately-owned apartments, plus 522 private and public parking spaces.

The idea of the conception:

Figure 55: idea of the conception:

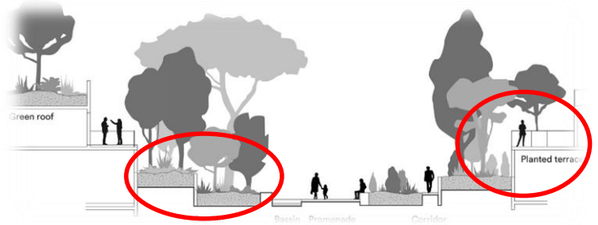


Figure 56: idea of the conception:

- The idea of the project is to exploit an innovative concept of a large balcony whose triangular geometry with variable cross-section takes up the efforts through cantilevers in line with the tree container built into its thickest part.

Nature and shape of the land:

- The plot is irregular in shape, It is overly a flat land in an urban setting but slightly slopped on the south side with valley gardens

Ground floor Plan Analysis:

Figure 57.analysis of ground floor,

Repetitive floor:

Program:

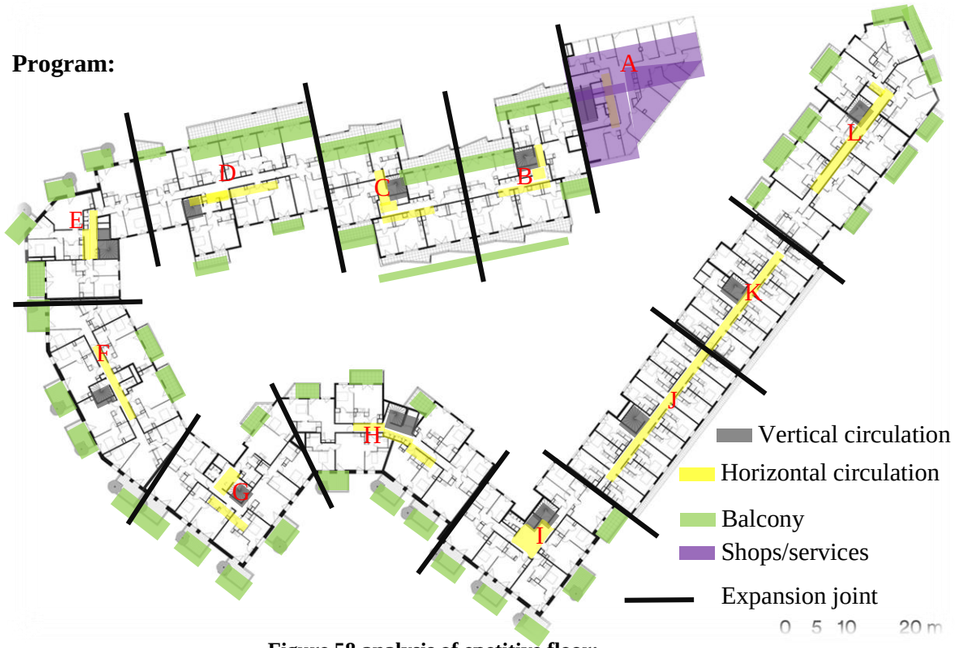


Figure 58.analysis of epetitive floor: ,

Section:

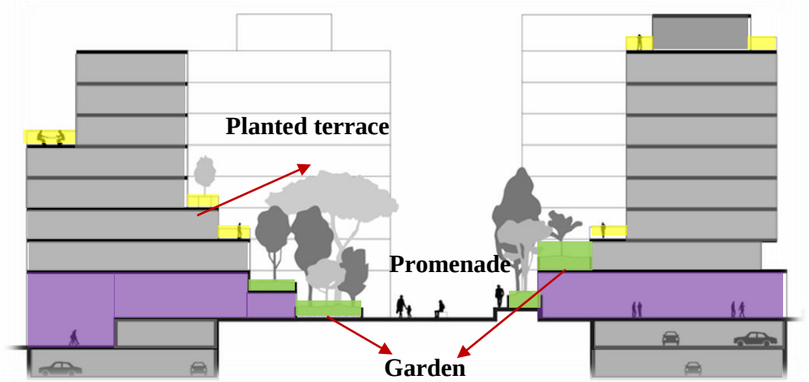


Figure 59.analysis of section:

Exterior balcony **Underground parking**

Apartments

Equipments and services

Garden

Analysis of facade:

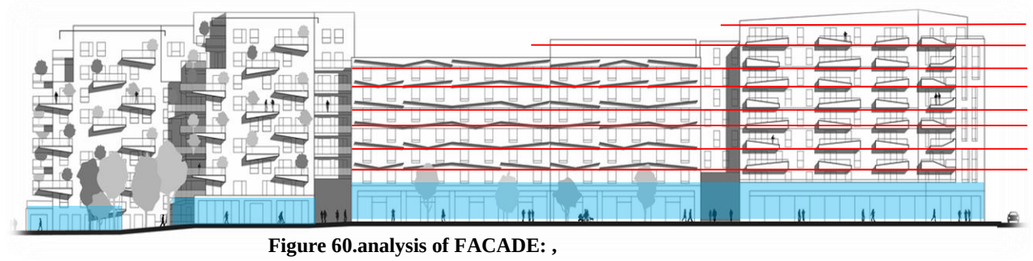


Figure 60.analysis of FACADE: ,

Spatial and fonctional organizational chart

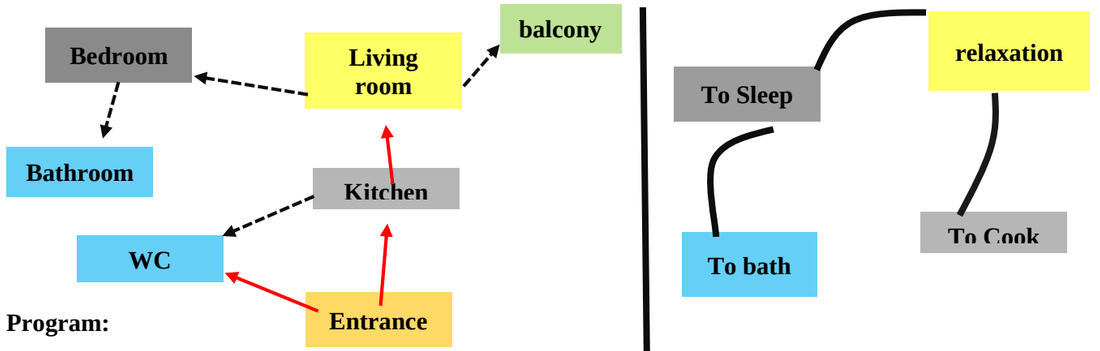


Table 7. Program for Prado Concorde Apartments.

PROGRAMM	m2	%
Accommodation	21,986.2	78%
Parking	10,244.8	36%
Equipements and services	5,650.2	12%
Green spaces /public	1,673.9	4%
Built space	5,322.9	19.1%
None built spaces	21,004.3	75%
Vertical circulation	845.3	3%
Horizontal circulation	1,652.8	5%

Total floor area of 28,000m2 on 1 hectare site

28,000m2 = 100%

2.12-Structure analysis and materials:

- Each block uses alignement of rooms creating a hamonious structure.
- Uses skeleton structural system
- Reinforced concrete , wood and white paint are used in this project
- White is the dominant color and grey. The combination of these 2 colors promotes well-being inside the accommodation and the brightness of the bedrooms. These colors are suitable with the modernity of the accommodation.

1.37 Exemple 4: House Within:

Figure 61 : example house within: ,

4.1-Technical sheet:

Table 8. Project description of house within:

Architects:	Arch.Lab
Location:	PANCHKULA, INDIA
Year:	2019
Area:	290.9m²
Client:	Clifford Beers Housing
City:	Panchkula
Country:	India
Nature and shape	Flat land , rectangular Shape

Composition of the project:

- This is an individual family house with 4 bedrooms for family members and 1 bedroom for the maid, accessible from outside.
- The house has 4 voids to ensure Natural sunlight and ventilation as the primary purpose and for communication between family members as the secondary puporse.
- It has an open kitchen with the dining area and two parking spaces

Construction Materials:

- The interiors of the house have been kept minimal with a modest material palette of exposed concrete, teak wood, ceramic tiles, glass and wall plaster.
- The exterior of the house is a composition of solid granite cuboids and wooden jaalis,

The idea of the conception:

Planning of the house is done keeping in mind the needs of a small nuclear family that sought for a private and compact living. Spaces flow into each other, in a linear arrangement, free from visual obstruction on the ground floor. To optimize daylight and heat gain, larger openings are created like the courtyard and voids.

Plan Analysis, Accessibility and circulation:

Figure 62: example analysis of ground floor: ,

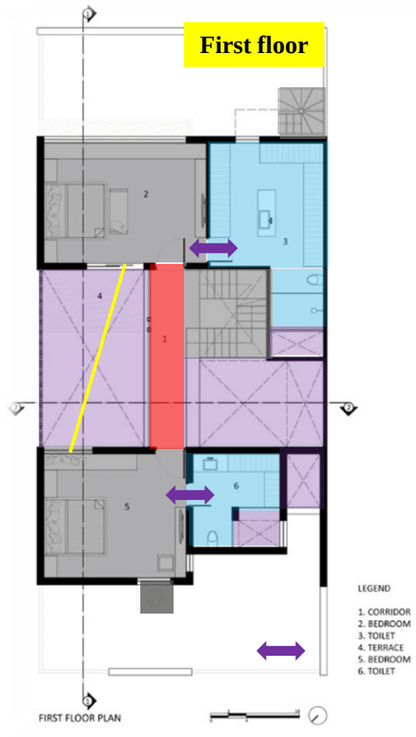


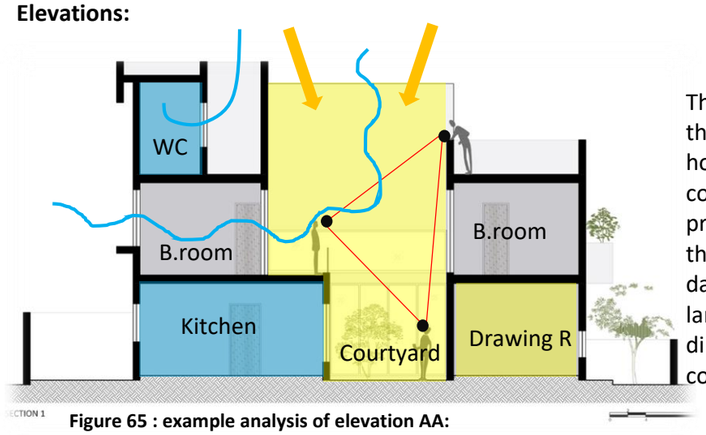
Figure 63: example analysis of 1st floor:

Figure 64: example analysis of 2st floor: ,

4.6-program:

Total floor area of 453.88m2 on 290.9m2 site

Elevations:



The courtyard becomes the central space of the house as it is well connected with all the primary living spaces of the house. To optimize daylight and heat gain, larger openings are directed towards the courtyard

Figure 65 : example analysis of elevation AA:

Table 9. architectural description of house within.

Style	Modern
Notion used	Addition and substruction
Materials used	Glass – concrete - solid granite cuboids – wooden jaalis – ceramic tiles – teak wood – wall plaster
Roof	Flat roof on different levels

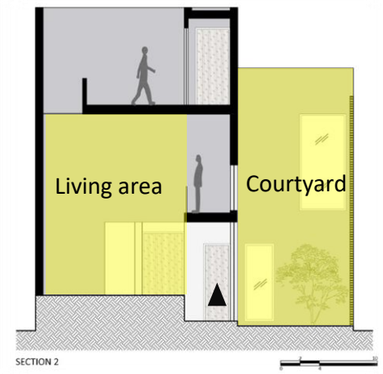
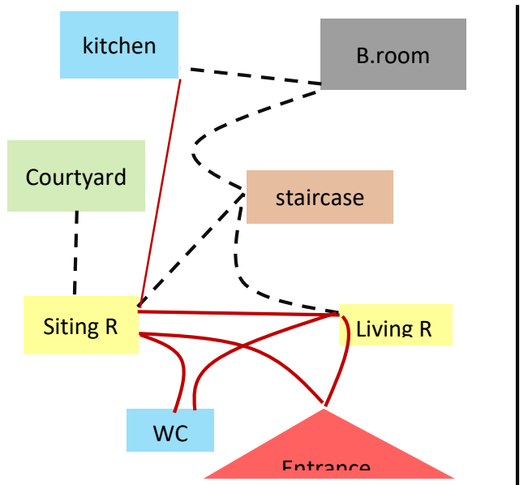
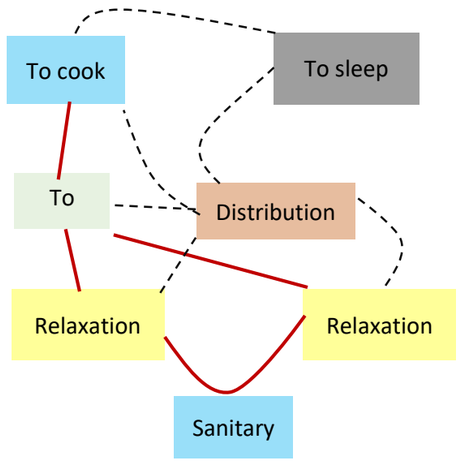


Figure 66 : example analysis of elevation BB: ,

Spatial and fonctional organizational chart





Analysis of interior atmospheres:

The colors:

Most of the house is in grey concrete walls and white interial walls and grey concrete ceiling

Figure 67 : interior atmosphere :

Natural lighting

Reduces the use of artificial light by using the courtyard and big glazzed windows are used

Figure 69 :Natural lighting :

Furniture

Figure 68 : interior atmosphere :

Figure 70 : interior atmosphere :

Volume analysis:

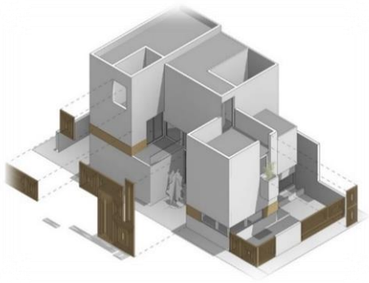


Figure 71 : Natural lighting :

1.38 Exemple 5: MLK1101 Supportive Housing

Figure 72: example supportive housng ;

The idea:

The MLK1101 Supportive Housing aims to create an environment that encourages health and togetherness of a community, acknowledging. Some design strategies are used to open the building towards the street and foster a sense of community within the neighborhood.

Table 10. Project description of supportive housing.

Architects:	Lorcan O'Herlihy Architects
3,158.7m²:	3,158.7m²
Year:	2019
Client:	Clifford Beers Housing
City:	Los Angeles
Country:	United States

Composition of the project:

The project provides 26 housing units, which are 100% affordable to the homeless veterans, chronically homeless individuals, and low-income households. Like its name, the project provides Supportive Services, Retail, and a Community Garden.

Situation plan:

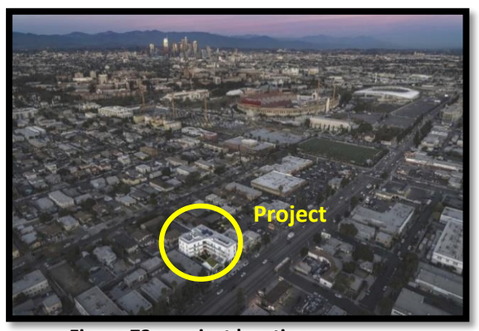


Figure 73 : project location

The project is situated in a residential area.Because of its color and height, its easly visible from a distance.

Plan Analysis , Accessibility and circulation:

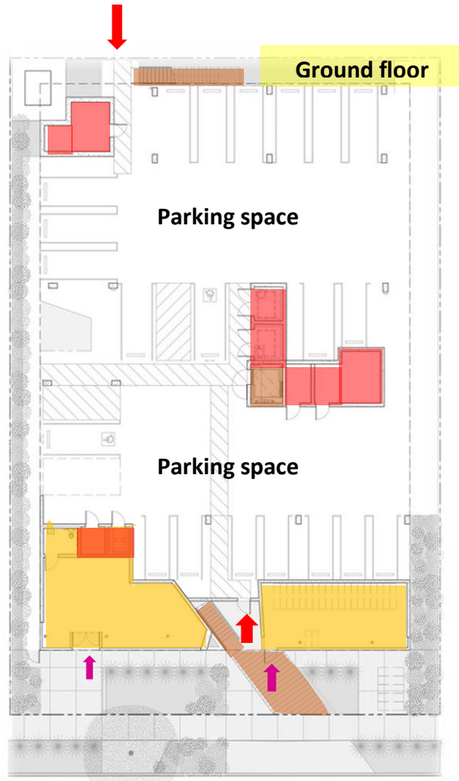


Figure 74: analysis of ground floor;

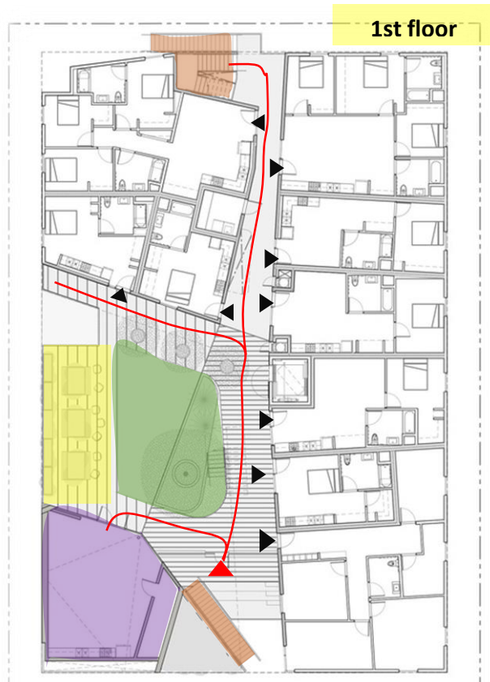


Figure 75: analysis of 1st floor ;

- All the units for MLK1101 Supportive Housing are accessed through exterior walkways.
- The tenants are provided with communal amenities, which has shared kitchen and dining areas for cooking classes, group therapy, and other planned gatherings.
- An outdoor garden with drought-tolerant plants and raised-bed with edible gardens

Technical services

V. Circulation

Retail services

Social hub services (group therapy)

Public Garden

Social gathering space

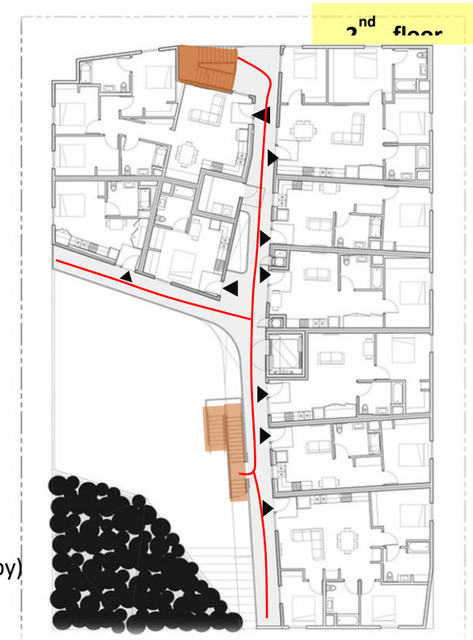


Figure 76: analysis of 2nd floor ;

Elevations:

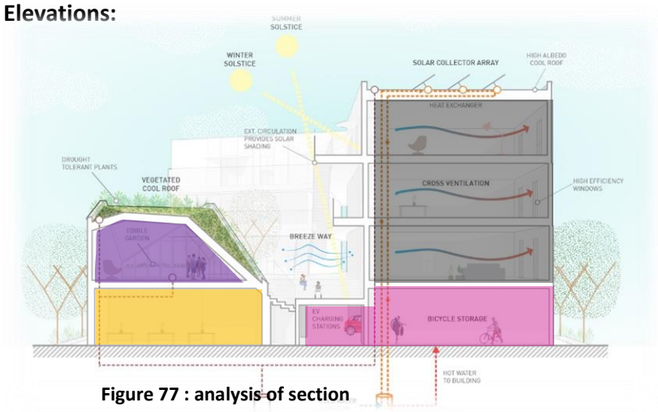


Figure 77 : analysis of section

*The L-shaped typology allows every apartment to receive sunlight and cross ventilation, which reduces the need for heating, cooling, and artificial light
*Elevated green patio for residents to relax and socialize.

Program:

Table 11. program for supportive housing

Program	Total area	%
Accommodation	1,719.2	54%
Retail	100.34	3.2%
Relaxation	89.45	2.8%
Green spaces	202.9	6.4%
Parking	783.07	24.8%
Technical services	27.9	0.9%

The units are designed for individuals and families, ranging in size from one to three bedrooms each with their own bathroom, and all are equipped with kitchens and

5.8-Volume analysis:

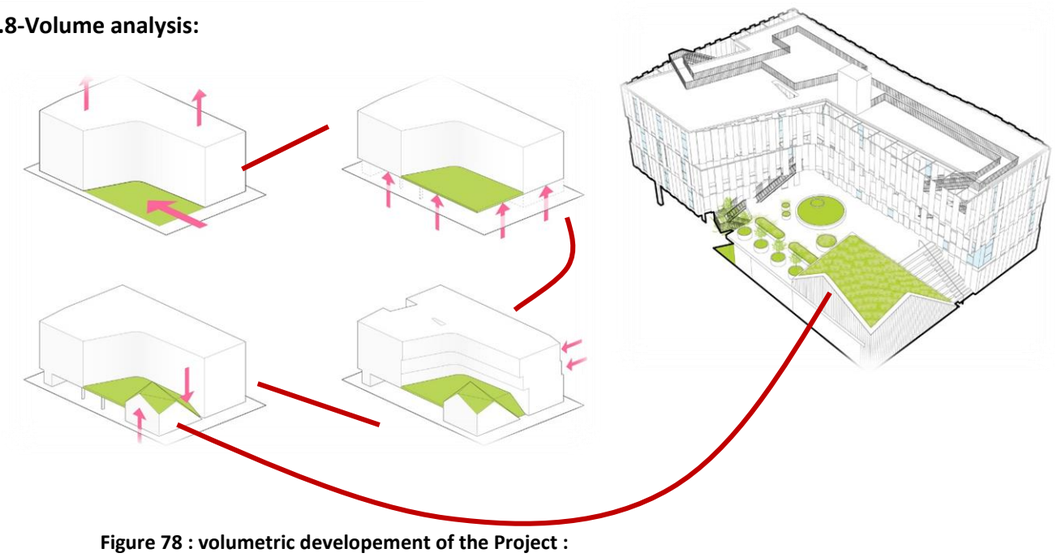


Figure 78 : volumetric developement of the Project :

Conclusion and program:

To summarize the thematic analysis, the following recommendations were made based on the examples:

- **Multifunctionality:** several Functions must be used to maximize the use of the land base. The functions will be based on the findings of site analysis.
- **Several types of accommodation:** offer a variety of accommodations with different sizes to Promote social and intergenerational diversity.
- **Accessibility:** separate the entrance to housing units from other public functions. And 2 to 3 access to the house/building and site.
- **Paysage:** vertical gardens on balconies and green spaces for the community to grow their own food. Emphasize on pedestrian pathways for walks and exercises.
- **Parking:** maximize the use of underground parking, this will help to free up space on the surface for other functions and activities.
- **Size of the land:** the site needs to be big enough or large in size for the Project.
- **Interior space organisation:** implement new design solutions in response to COVID-19 such as ; a water closet to act as a disifentioning room, use open spaces for communication and air circulation, home offices and home plants for calmness
- **Materials:** use interiror colours that improve the mood of the residents.
- Structure: implement courtyards and voids for natural lighting, communication between the residents and neighbors, heat gain and fresh air. Concrete frame work or skeleton structure system to be used.

Table 12. General program from all the case studies

Program	Space	%
Accommodation	Bedroom, WC, walk in closet, robe, Kitchen , storage , dining room , Laundry , home office	63%-70%
Relaxation	Altar, living room , Terrace , TV room, courtyard	30%-40%
Green spaces	Garden , green spaces	15%-25%
Circulation	Staircase , hallway , transition rooms , walkpath	11%-20%
Stationnary	Parking	20%-25%
Retail and equipements	Food shops , bookshoop, phamarcy , clinic , coffee shops , restaurant , gym	15%-20%

Chapter3: Urban Approach

1.39 Introduction:

In this chapter, we will do a critical reading of the planning instruments of Tlemcen province, then we will proceed with the analysis of the urban area of the city in terms of urban morphology, transport infrastructure and of displacement, of the urban economy and of the natural landscape and environment to bring out the general problematic of the area and to propose the different hypotheses that will help us in the choice of the urban project.

1.39.1 Choice of study area between Imama and Champ de Tir

Starting from the general problematic of the agglomeration of Tlemcen, the choice was made on the ZHUN (la Zone d'Habitation Urbain Nouvelles) of the Champ de Tir and more precisely on the junction zone located between Imama and Champ de Tir. The ZHUN is the second to be created after that of Kiffane –Imama to be a real new autonomous city of 35,000 inhabitants, independent and away from the central agglomerations, according to the option adopted by the PUD of 1981; this urban entity caught my attention to study it more closely and to see to what extent it could be included in the sustainable development of the project design.

1.39.2 Reminder on the conditions of realization of the ZHUN of the Champ de Tir

From the use of the archives to the administration (DUC-Subdivision-APC URBAT-ANAT), from the interviews that were granted to me by certain executives and former persons in charge of town planning, and from my own investigations in the field I was able to remember the following:

- The ZHUN of the Champ de Tir was programmed by the PUD of Tlemcen (approved in 1981), to be an autonomous entity from the central agglomerations and created at the time after that of Kiffane - Imama.
- Over time and depending on the evolution of the situation, several failures have appeared highlighting the limits of the ZHUN procedure:
    - In the context of a planned economy, the ZHUN in its production logic was essentially based on voluntarism of State.
    - The ZHUN procedure was essentially based on programming through numbers.
    - The architectural aspect was neglected which generated an urban framework of very poor quality

The ZHUN of the Champ de Tir has undergone a lot of change since its creation in 1982, either in terms of development or in terms of carrying out housing and equipment programs. With the introduction of new urban planning instruments, it was covered by a POS according to the terms of reference defined by the PDAU of the group approved in 1996.

1.39.3 Development guidelines according to the PDAU revised and approved in 2007.

- Restructuring of the “Zouad” district by opening up certain arteries and the projection of support facilities (youth center, dispensaries, etc.).
- Ensure better accessibility to public facilities and community spaces.
- Creation of a core of facilities composed of: an administrative city, a craft center, a business center, a cultural center, a shopping center, a health center , a mosque, a leisure and recreation center, 03 schools, a Civil Protection Headquarters, and a two-storey car park.
- The projection of a large number of dwellings including 590 individual dwellings and 818 collective dwellings.

1.39.4 Geographical location and delimitation:

Tlemcen provinc is located in the extreme northwest of Algeria, on a plateau at an altitude of 800m. It occupies a strategic space of 60km from the sea and 64km from the Moroccan border. Tlemcen It is geographically locked to the North by the Mediterranean Sea, to the Northeast by the province of Ain Temouchent, to the East by the province of Sidi Bel-Abbes, to the West by Morocco and to the South by the province of Naâma.

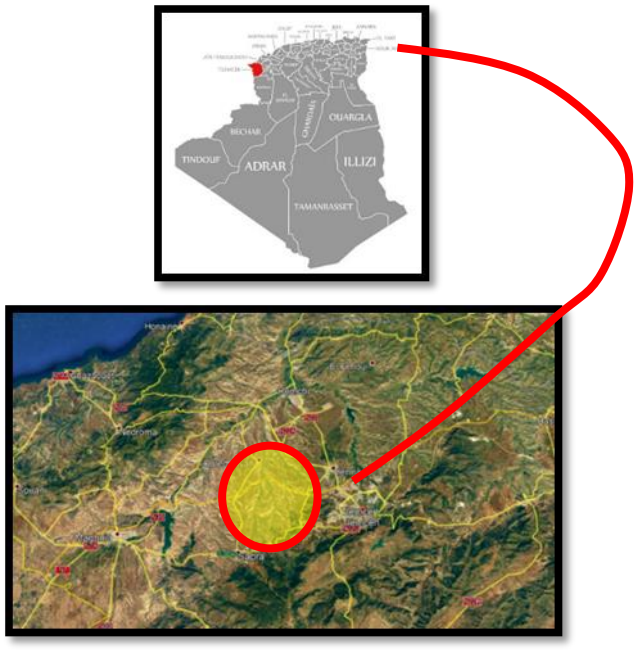
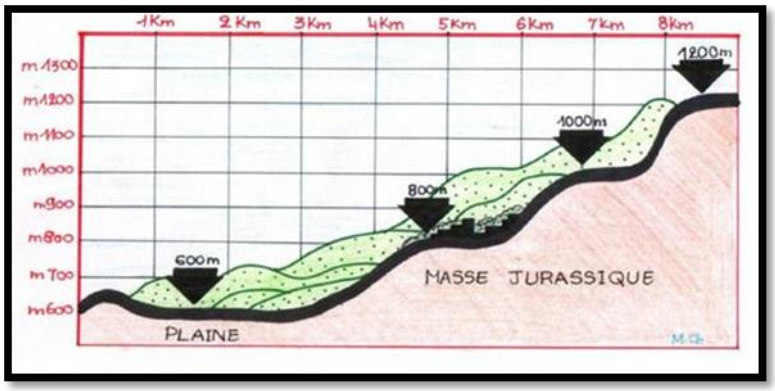


Figure79: Geographical location of Tlemcen:

1.39.5 Geographical location and delimitation:



1/ cheteouane = 600m

2/ centre-ville = 800m

3/ plateau de lalla setti = 1,200m

Longitude of : 3°38

Latitude of : 34°53

Figure 80: Longitude and latitude of Tlemcen:

1.39.6 Relief:

Tlemcen is divided into three main areas: The northern zone, which mainly consists of mountains and stretches along to the Mediterranean coast.

The central zone is divided into two sub zones:

- The first includes most of the cultivated area of the province (plains of Maghnia and Tlemcen)
- The second sub-zone is made up of the Tlemcen Mountains which include a limestone mountain range oriented from South to West and North to EAST.

The southern zone of the province, this pastoral and steppe zone which extends over 1/3 of the area of the province includes only four municipalities.

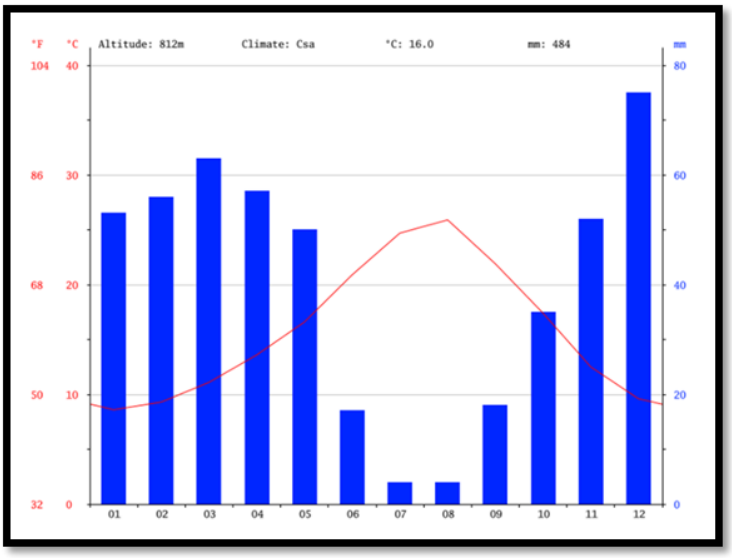
Figure 81: Relief of Tlemcen:

1.39.7 Natural Constraints:

The province of Tlemcen has a very wide variety of landscapes, foothills, plains with a very vast flat region, plateaus, mountains and steppe.

1.39.8 Climate analysis:

The province of Tlemcen has a Mediterranean climate, based on the location between an oceanic winter and a desert summer, which causes the rise of persistent heat throughout the season. The Mediterranean climate is characterized by cold and rainy winter, and a hot and dry summer.



- Has a wet season that extends from October to May, with a greatest amount of precipitation.
- A dry season from June to September

Figure 82: climatic conditions for tlemcen:

My recommendation is, 'We must opt for the use of building materials which are adaptable to the climatic constraints of the city.

1.39.9 Objectives of site analysis:

This will help to figure out the orientation of the building and spaces:

- Distinguish the state of the building heights.
- To analyze the surrounding environment
- Analysis of accessibility and traffic flow
- Climate analysis

1.39.10 Choice of land and justification:

The land has many advantages:

- Proximity to existing public services
- The land is large enough for the proposed Project
- The site is easily accessible
- Well exposed to the sun
- The land is located outside the town center and located in residential areas

1.40 Site analysis:

a Location:

The site is located in the Sector UA8 which covers an area of 270 ha, it is located on the west end from the town center of Tlemcen, and it is in a mixed fabric between residential and public facilities.

Figure 83: tlemcen town:

b Analysis of public facilities:

The site is integrated with different public facilities such as educational, religious, administrative, sport complex and cultural. There is a noticeable dominance of educational facilities such as the University of Tlemcen, Bio-Medical institute and high school (mahi boumedienne) and a primary school. We also find multiple administrative offices.

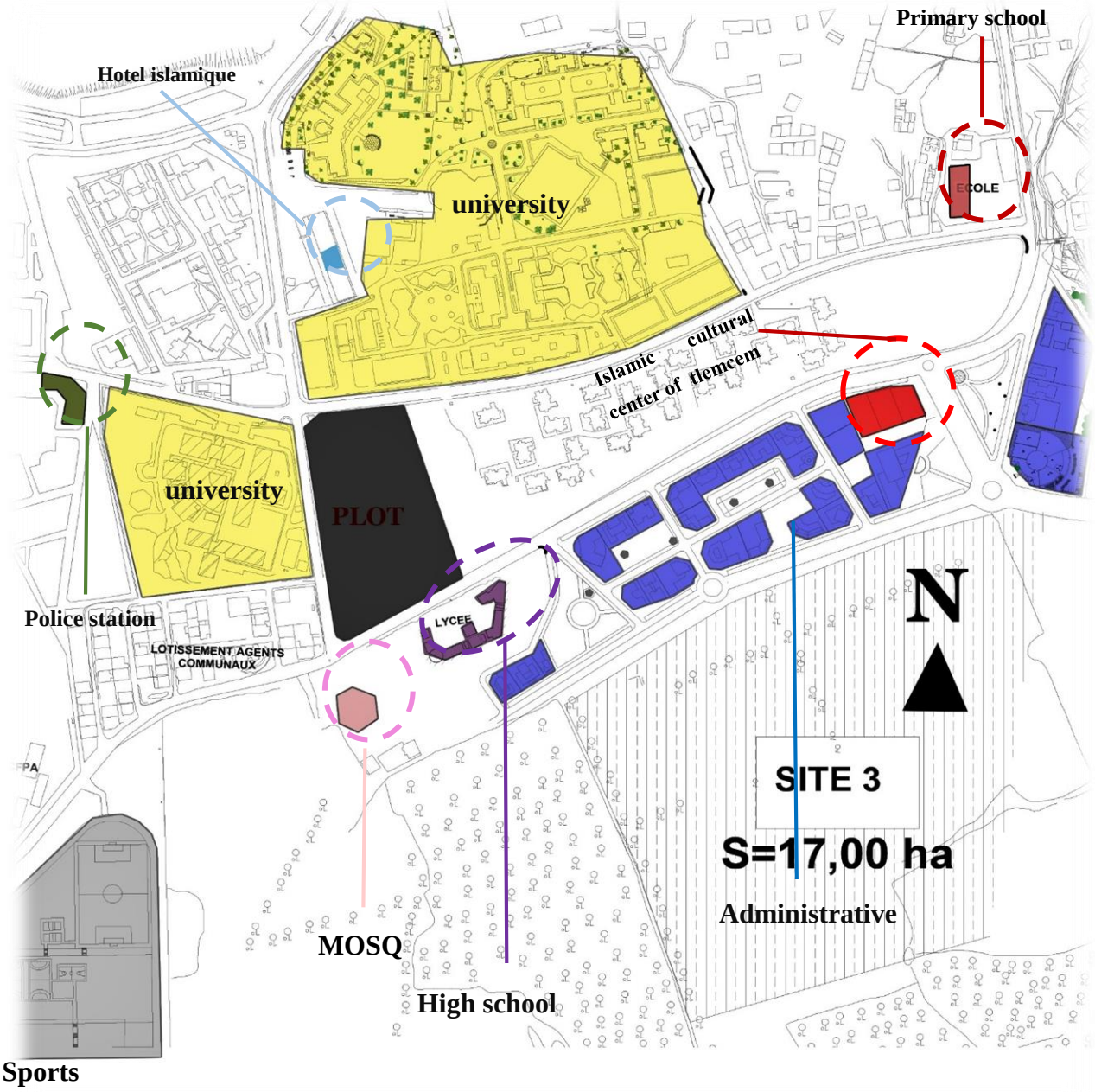


Figure 84: Analysis of public facilities:

c Accessibility:

The land is accessible from 2 sides' roads.

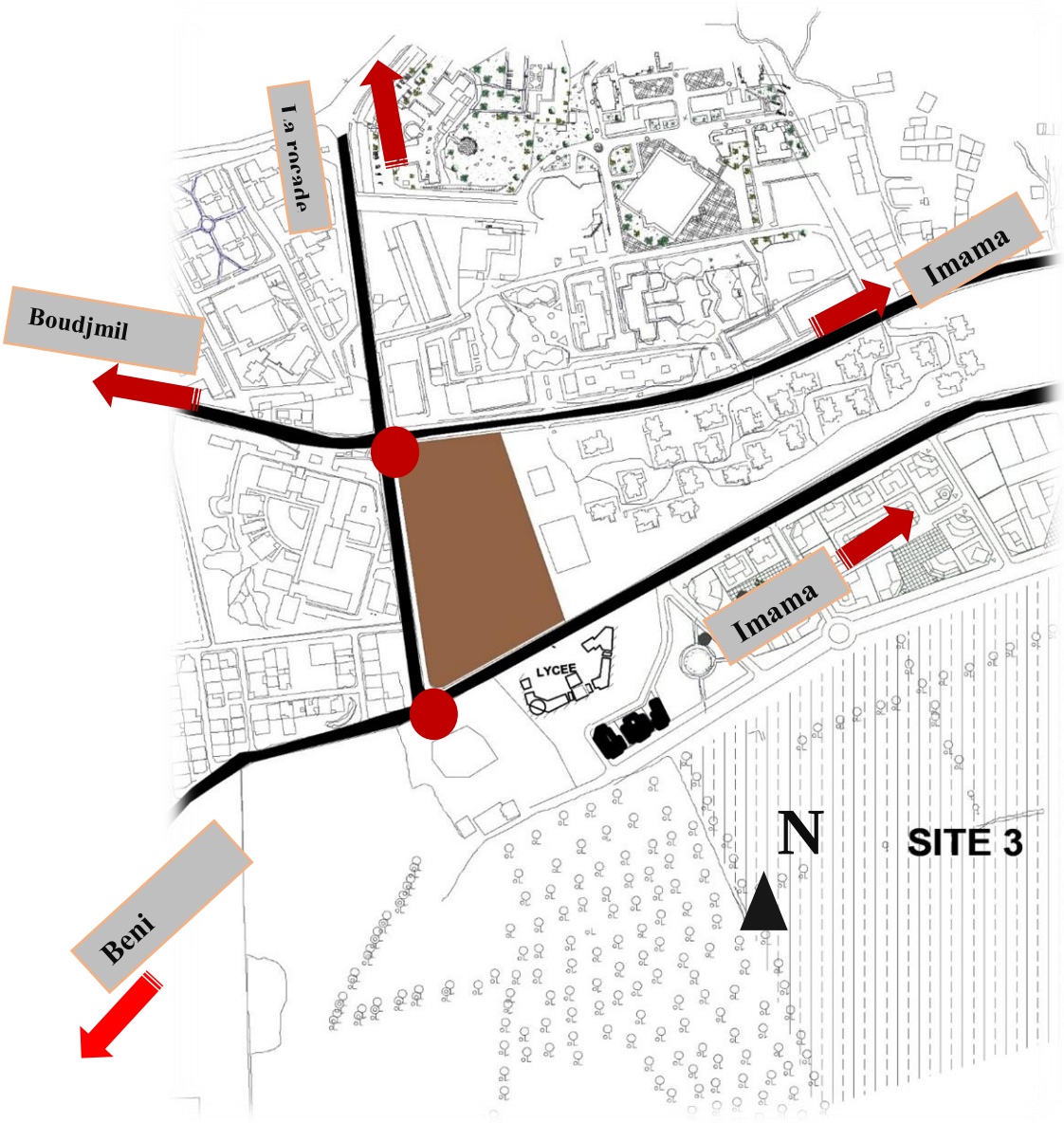


Figure 85: accessibility map:

d Traffic flow:

The land is at the end of an important boulevard, and it is bounded by a 12m road track, where there is a strong mechanical flow. There is an absence of parking spaces in housing areas, the land is easily accessible from all sides apart from the east side which has a wall fence.

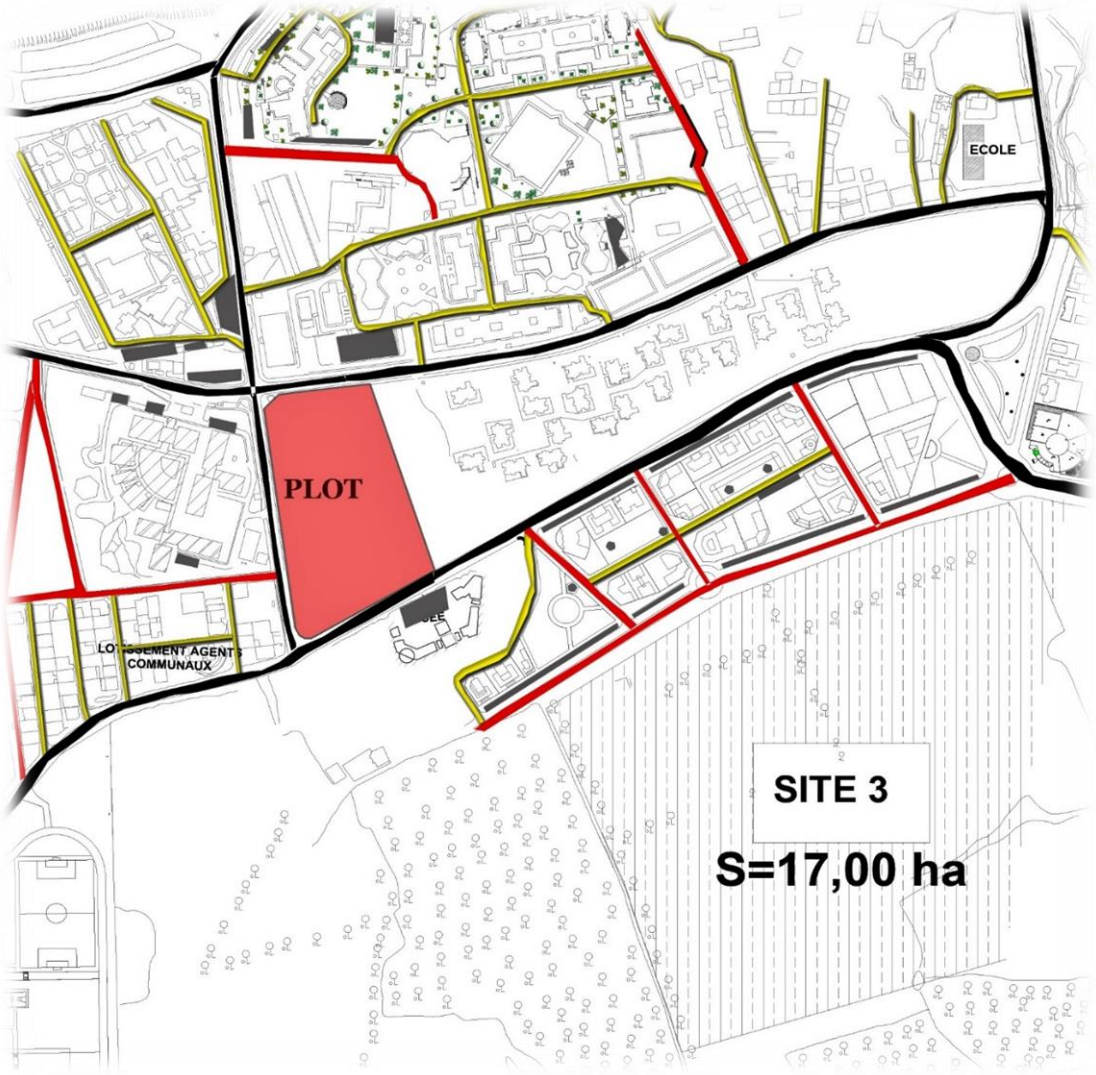


Figure 86: Traffic flow:

Strong strong flow	Average traffic flow	Low traffic flow

e Built and Unbuilt spaces:

The site is mostly made up of empty spaces on private plots and there is an absence of homogeneity and linearity of buildings. The percentage of a none built environment is higher than that of the built environment.

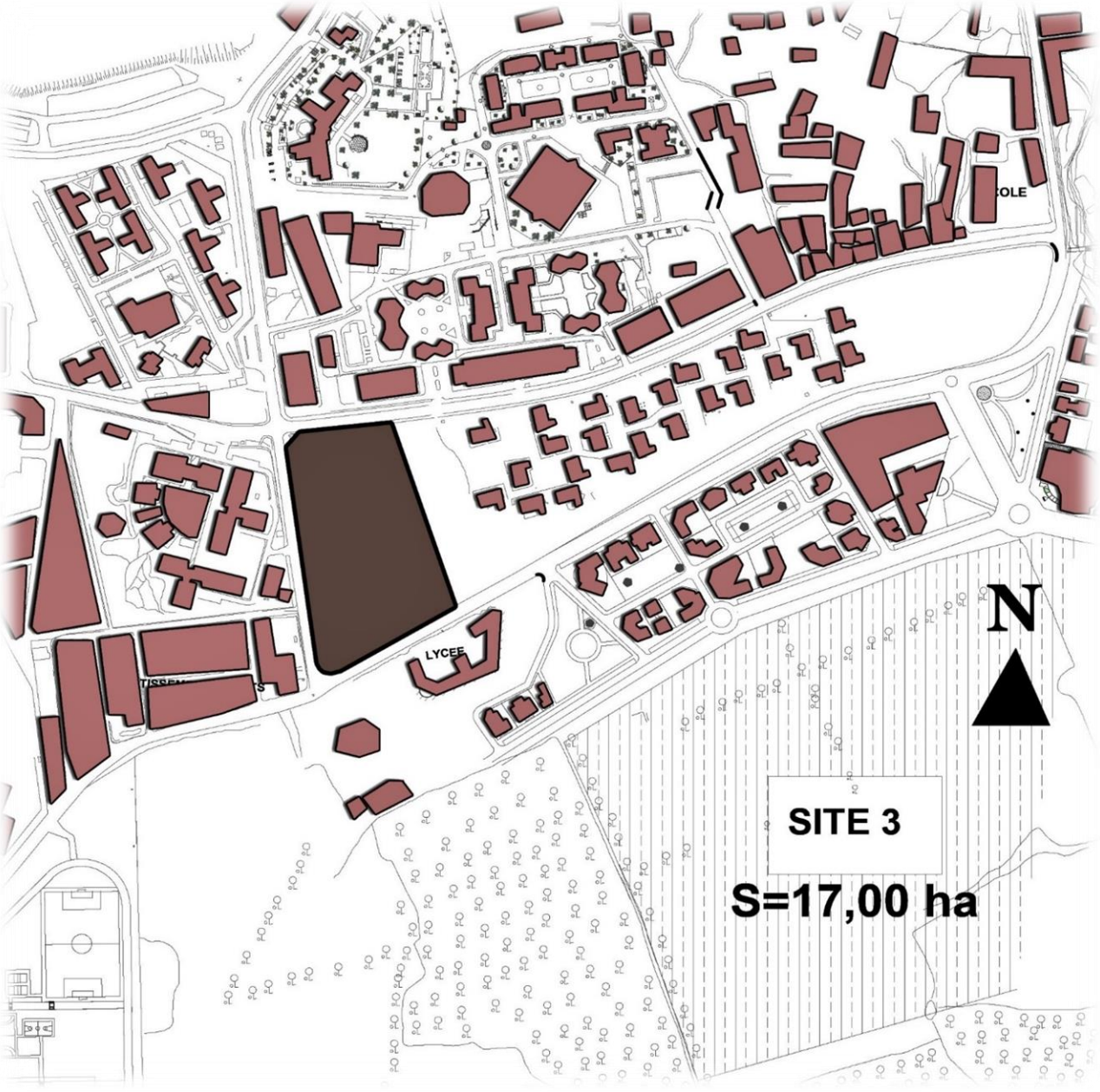


Figure 87: Built and Unbuilt spaces:

Building space | **Empty space** | **Plot 15%**

f Typology of habitat:

The site has a low percentage of housing buildings….

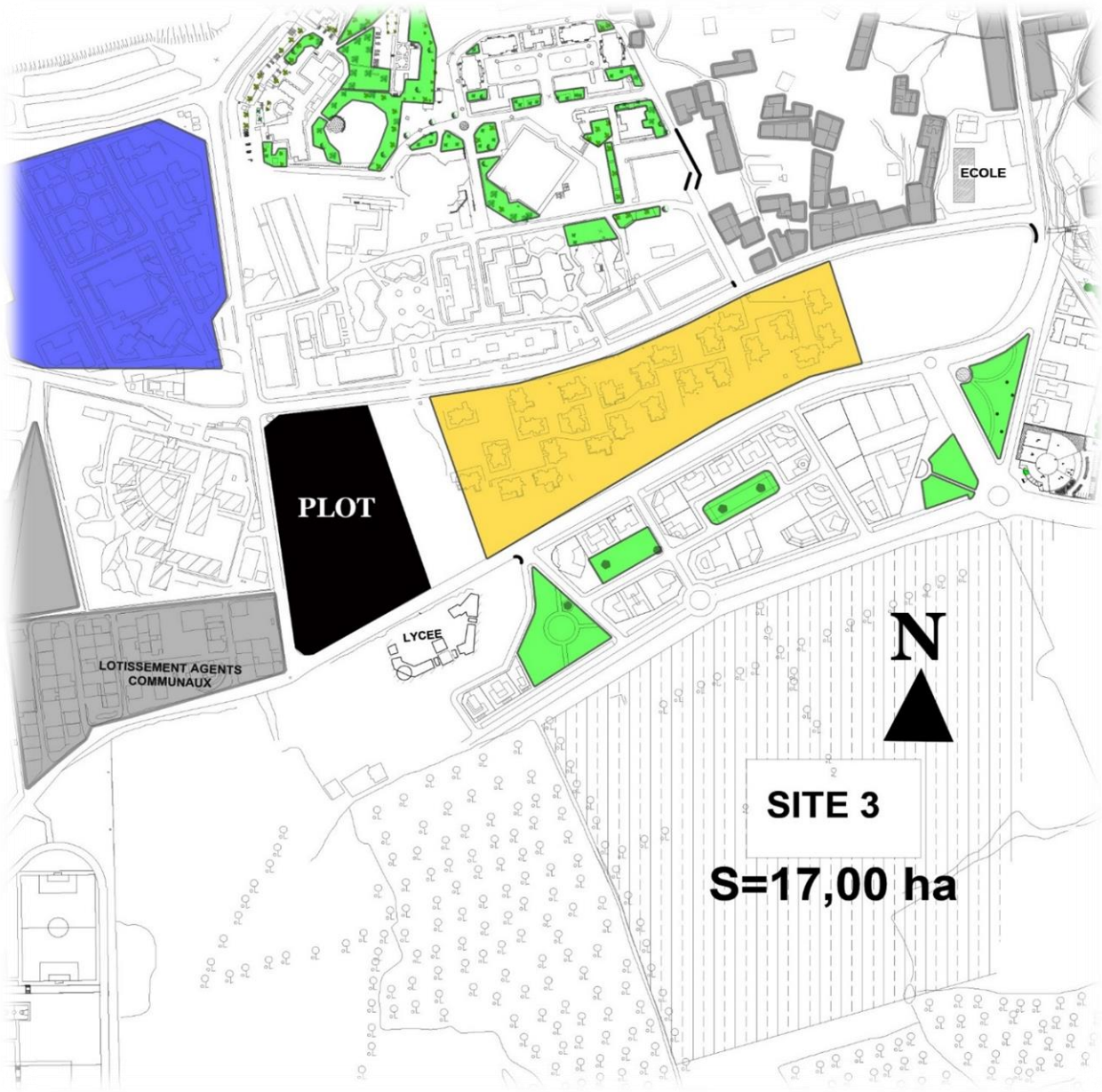


Figure 88: Typology of habitat:

Individual houses **University residence** **Military houses** **Green space**

g Height state of buildings:

The height of buildings varies from the ground floor to 4th floor depending on the function of the building and also according to the evolution of needs. There is a dominance in height of R+2 and R+3.

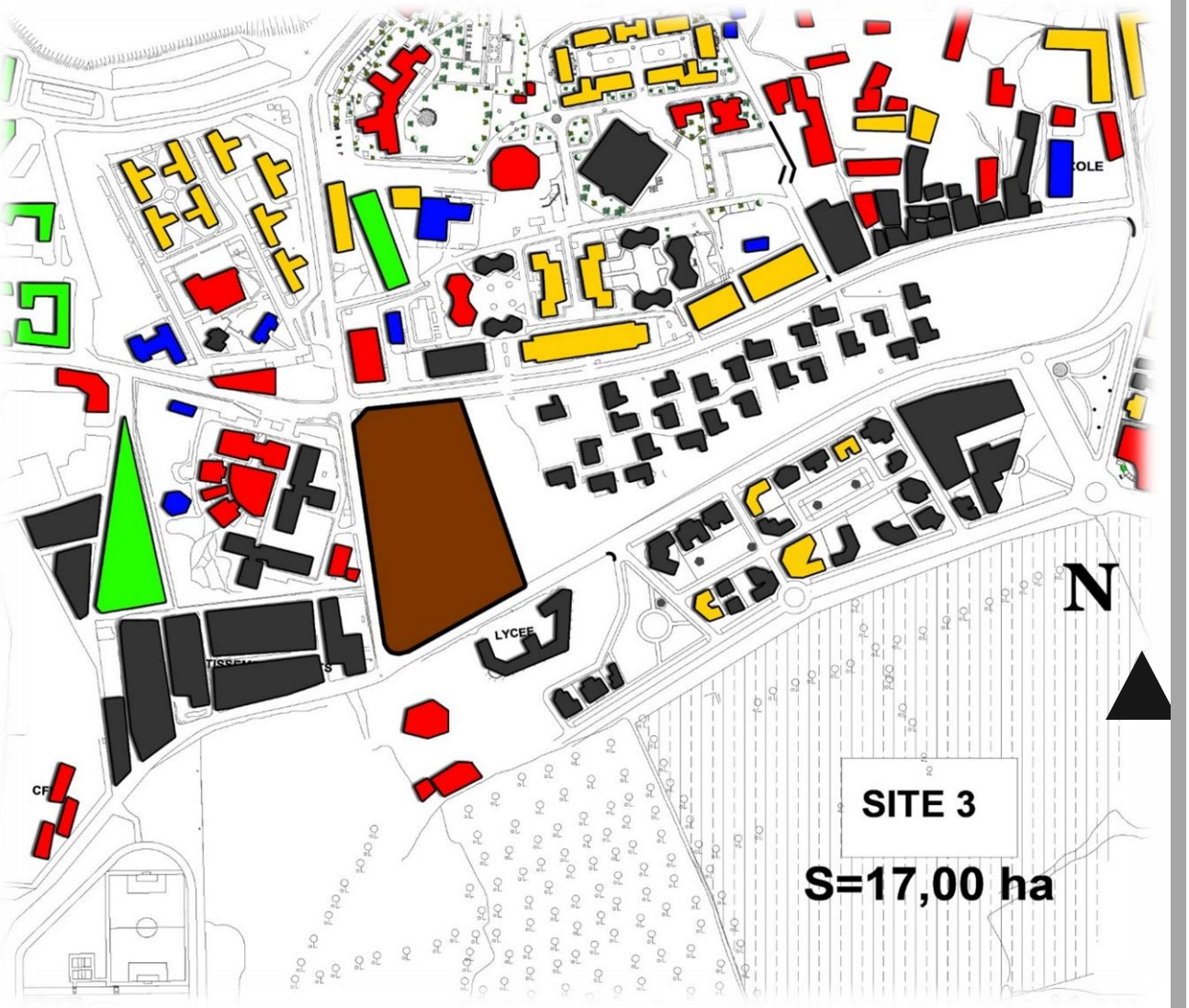
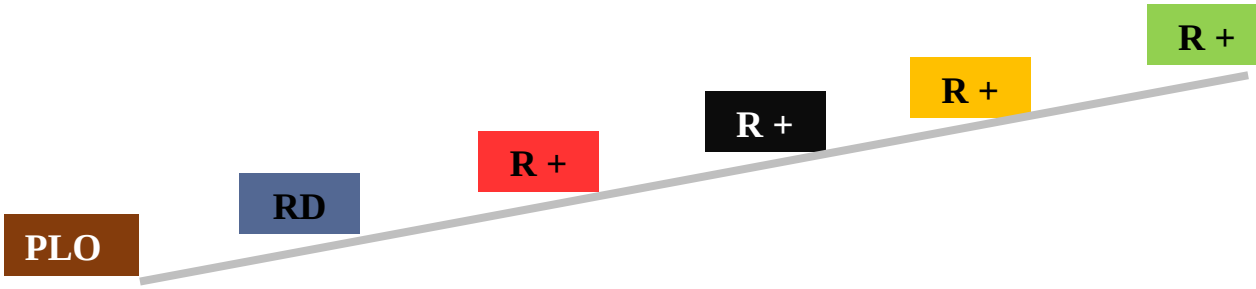


Figure 89: Height state of buildings:



h Analysis of public transport

The proposed site has two bus lines that pass through from all open sides of the plot. The bus lines 14 and 44 are public buses that leads to the town center of Tlemcen and other communities that are easily accessible from the proposed land.

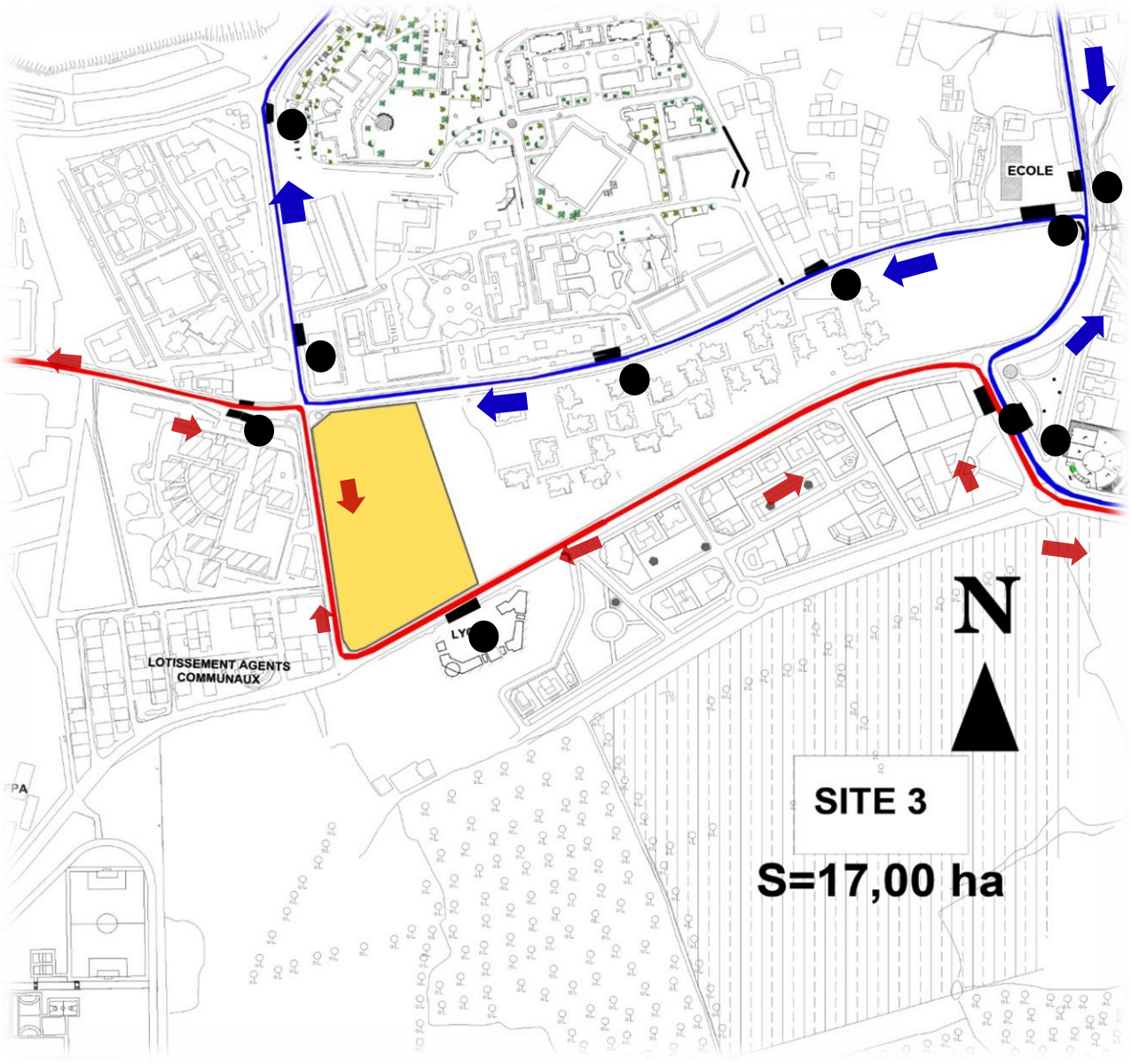


Figure 90: Analysis of public transport:

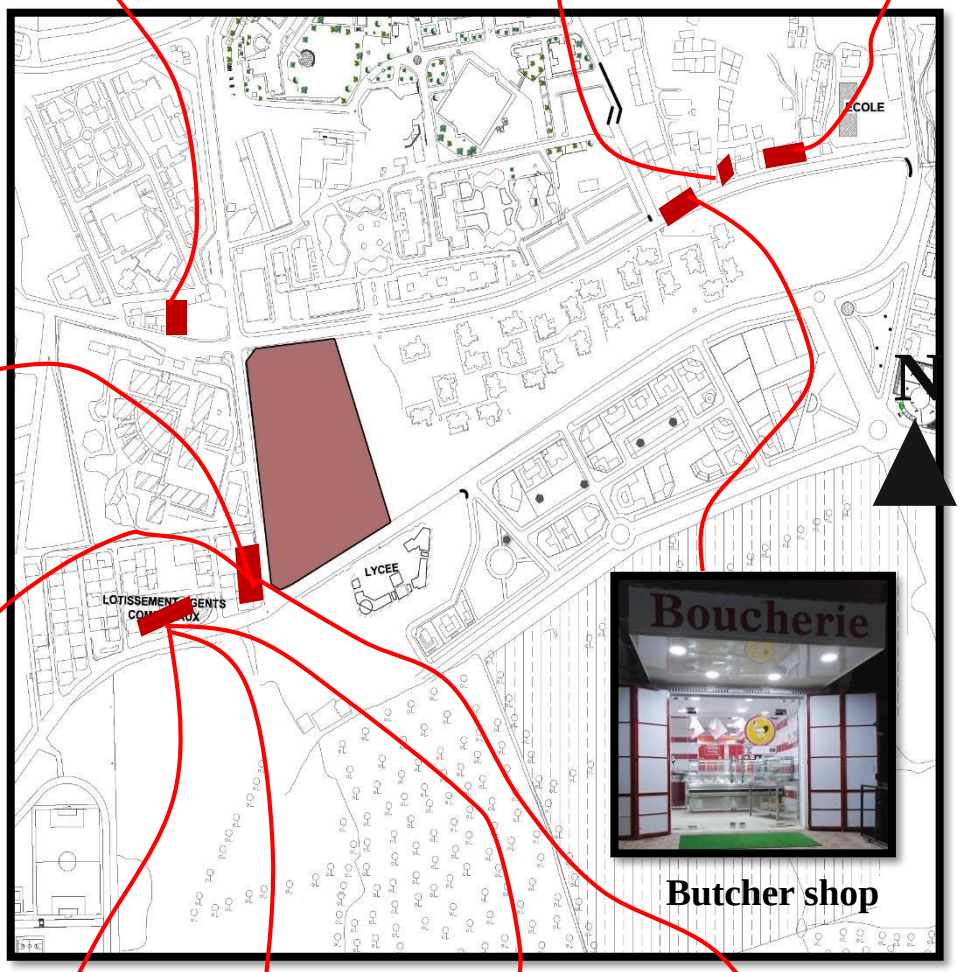
2.9 Surrounding features: there is a variety of shops which gives a great importance for the land

Grocery shop, restaurant

Pharmacy

Grocery shop and Butcher shop

Bakery



Grocery shop

Butcher shop

Pastry

Pharmacy

Grocery shop

Coffee shop

i Orientation and prevailing wind:

Prevailing winds from north west which become strong and dangerousn winter.

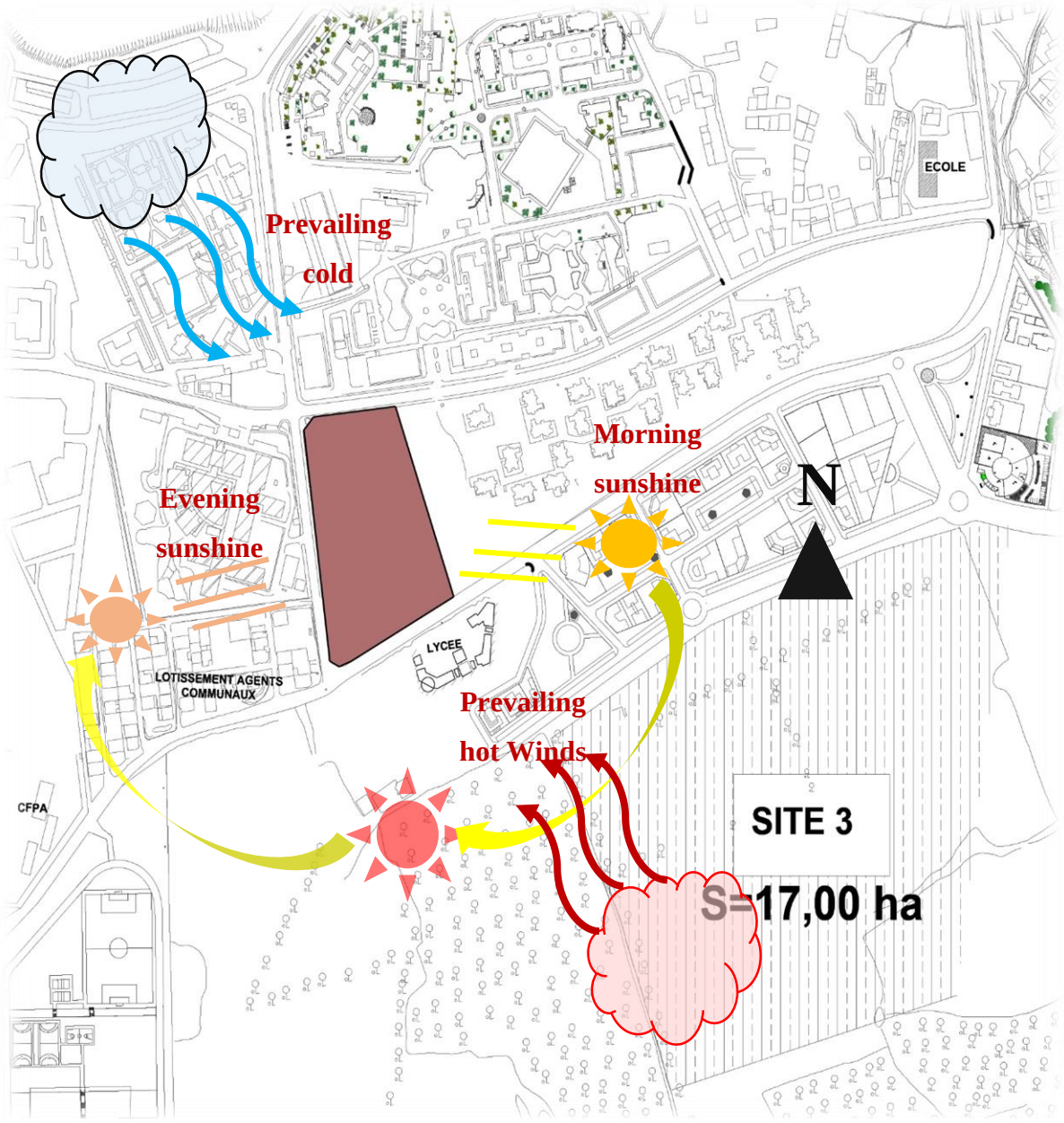


Figure 91: Orientation and prevailing wind:

j Conclusion:

Each part of the site was carefully studied in order to bring out the advantages and disadvantages of the surrounding environment and find ways to enrich them.

Table 13: advantages and disadvantages of site analysis

Merits	Demerits
Strategic location that offers different public facilities	Strong traffic floor which contributes to noise and air pollution
The site is located in an expanding urban area	Poor architectural style of housing buildings and educational facilities
Agricultural activities on the south that improves the air quality	Absence of public spaces for parking and green spaces
good visual connectivity	The neighborhood lacks playing ground for kids
Presence of police station in the area for security	Street parking on the sides of the road
Wide pavements	
Proximity of food retails and pharmacies	
Availability of Sports complex which encourages a healthy life style	

k Recommendations after typo-morphological analysis:

- The height state of the project should range from first floor to firth floor.
- The project must have a playground for kids.
- The main façade of the project should face southwest to benefit from the sun and for a good visual perception.
- Have multiple retail shops (restaurant , mini market , coffee shop ,) , post office , pharmacy , boutique shops , and a public library .
- The project has to be an open place were pedestrians could pass through by creating a pathway through the project.

1.41 Terrain analysis

a Limits of the plot:

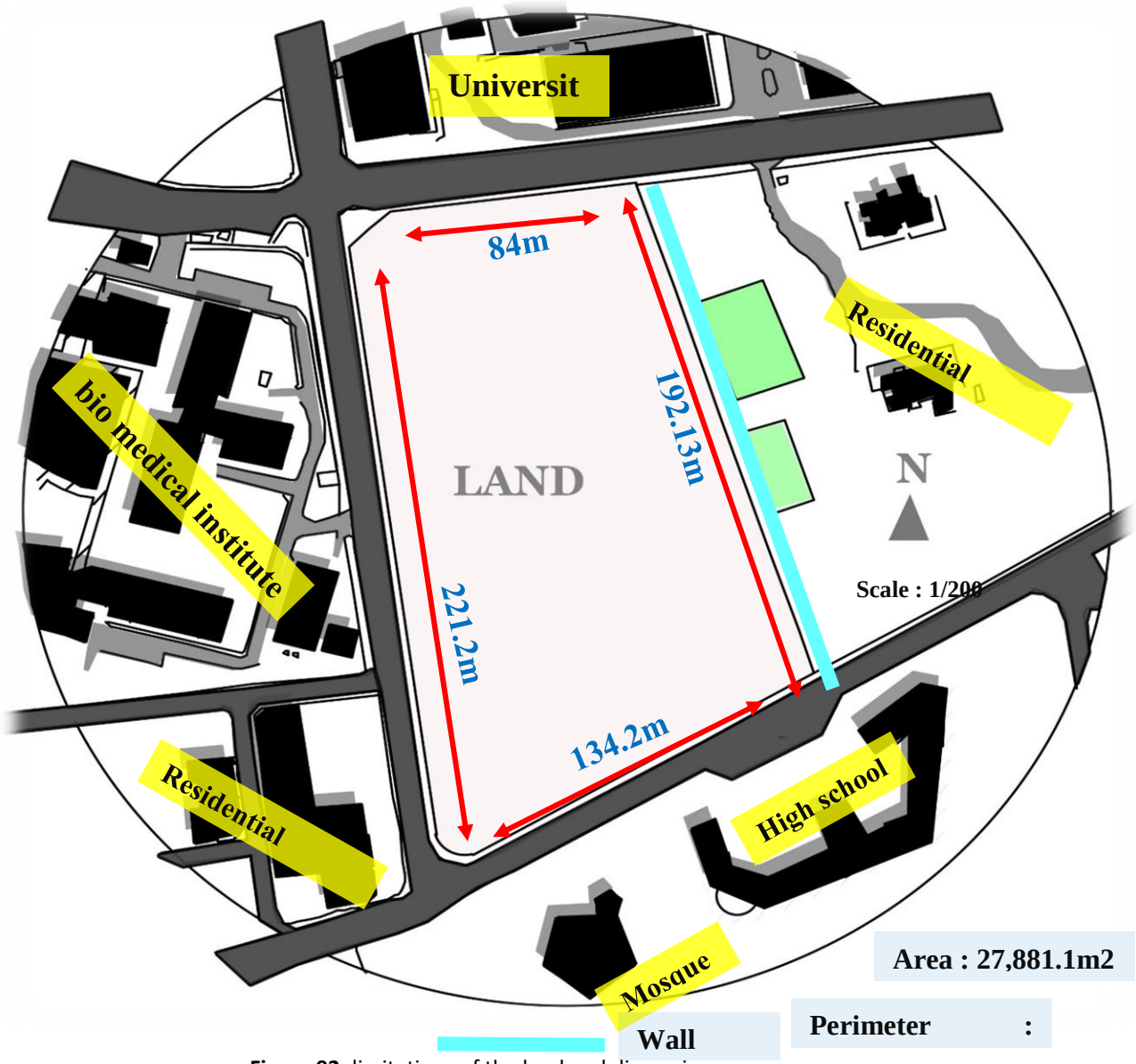


Figure 92: limitations of the land and dimensions:

The land is limited on the north side by the University Tlemcen, the east by a residential wall fence and the west side by the bio medical institution and individual houses. All sides except the east are limited by traffic and pedestrian roads which gives the land it's a rectangular shape.

b Accessibility, Visual connectivity and Circulation:

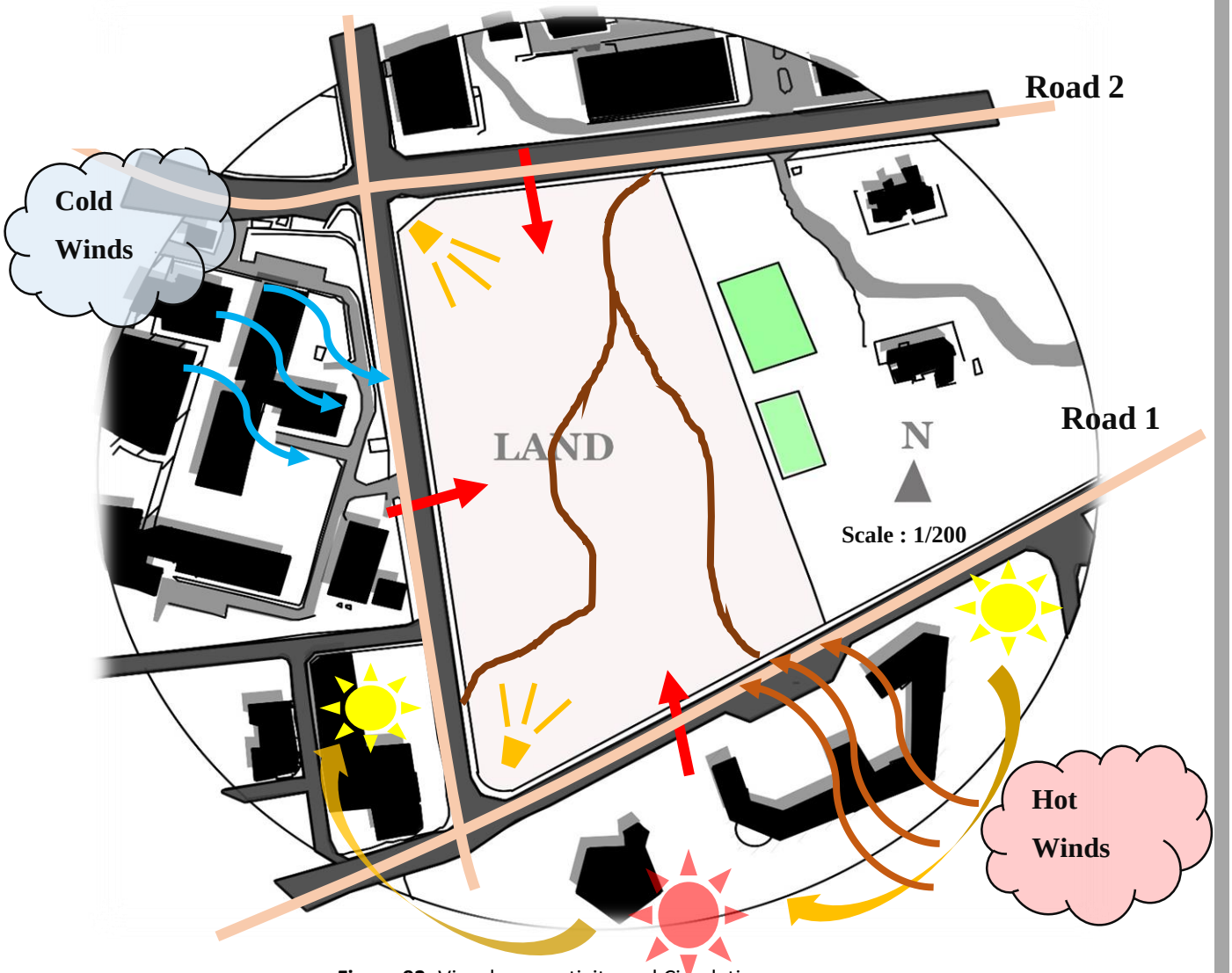


Figure 93: Visual connectivity and Circulation:

Legend:

Strong Visual connectivity

Accessibility to the land

Trafic circulation

Pedestrian Access

- The land is easily accessible from two sides
- It has a pedestrian path used as a shortcut
- A strong traffic flow from road 1 and 2
- The land has a good visual connectivity

c Skyline (silhouette):

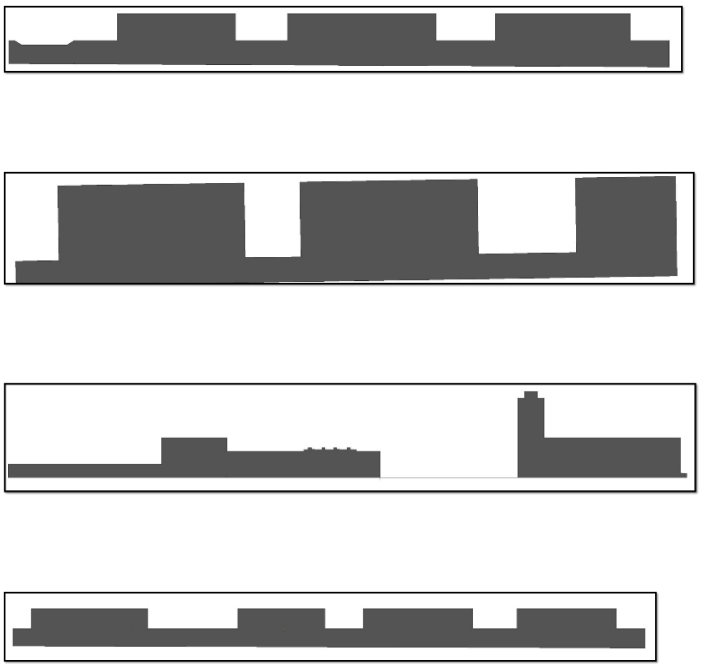


Figure 94: Skyline (silhouette):

d Analysis of Urban Elevation:

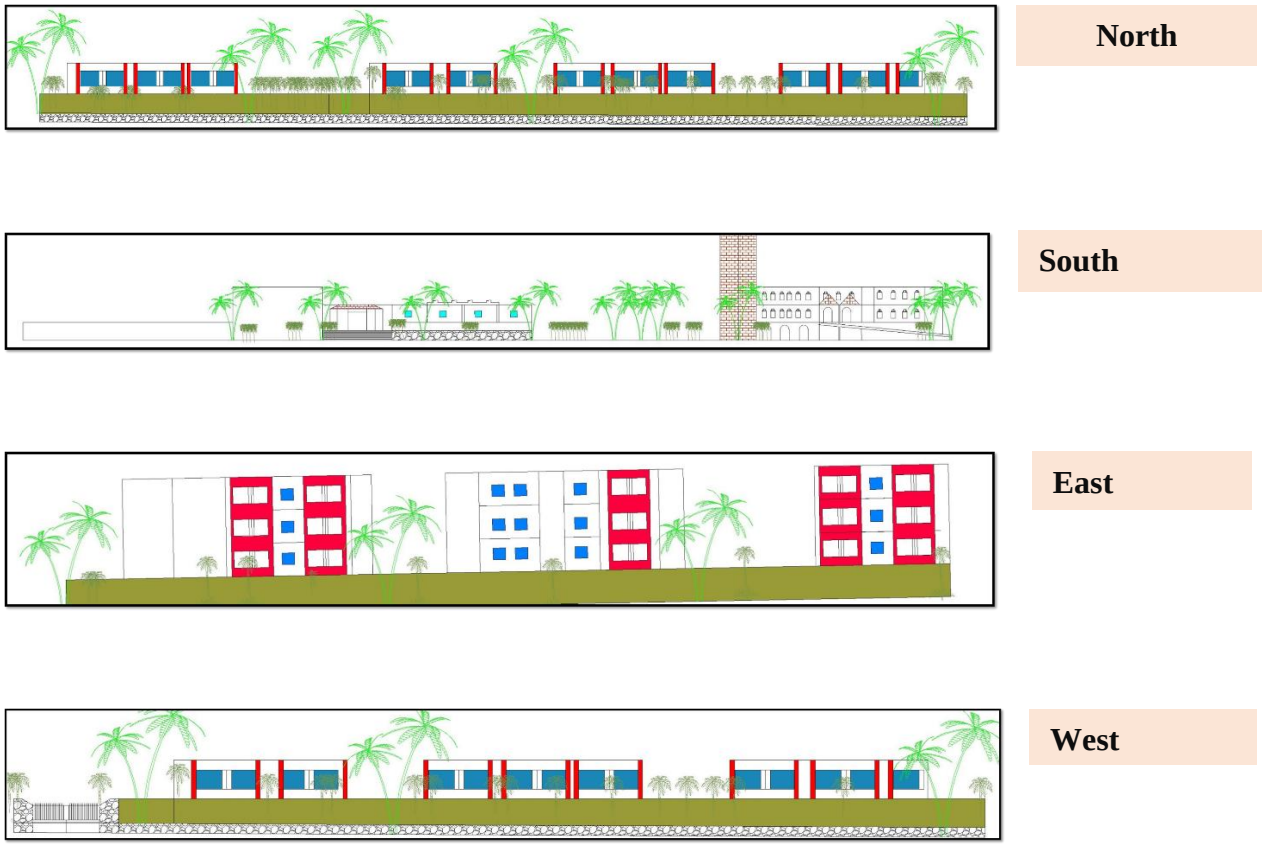


Figure 95: analysis of elevetions:

Analysis	North elevation	South elevation	East elevation	West elevation
Style	Modern + traditional	Modern + traditional	Modern + traditional	Modern + traditional
Color	Red and cream	Red , cream white and grey	Red and cream	Red and cream
Structural system	Skeleton structural system	Skeleton structural system	Skeleton structural system	Skeleton structural system
Windows	Rectangular shaped	Arched windows and rectangular	Rectangular shaped	Rectangular shaped
Type of room	Flat roof	Flat roof	Flat roof	Flat roof

Table 14: architectural description of the site chosen

e Morphology and topography of the plot:

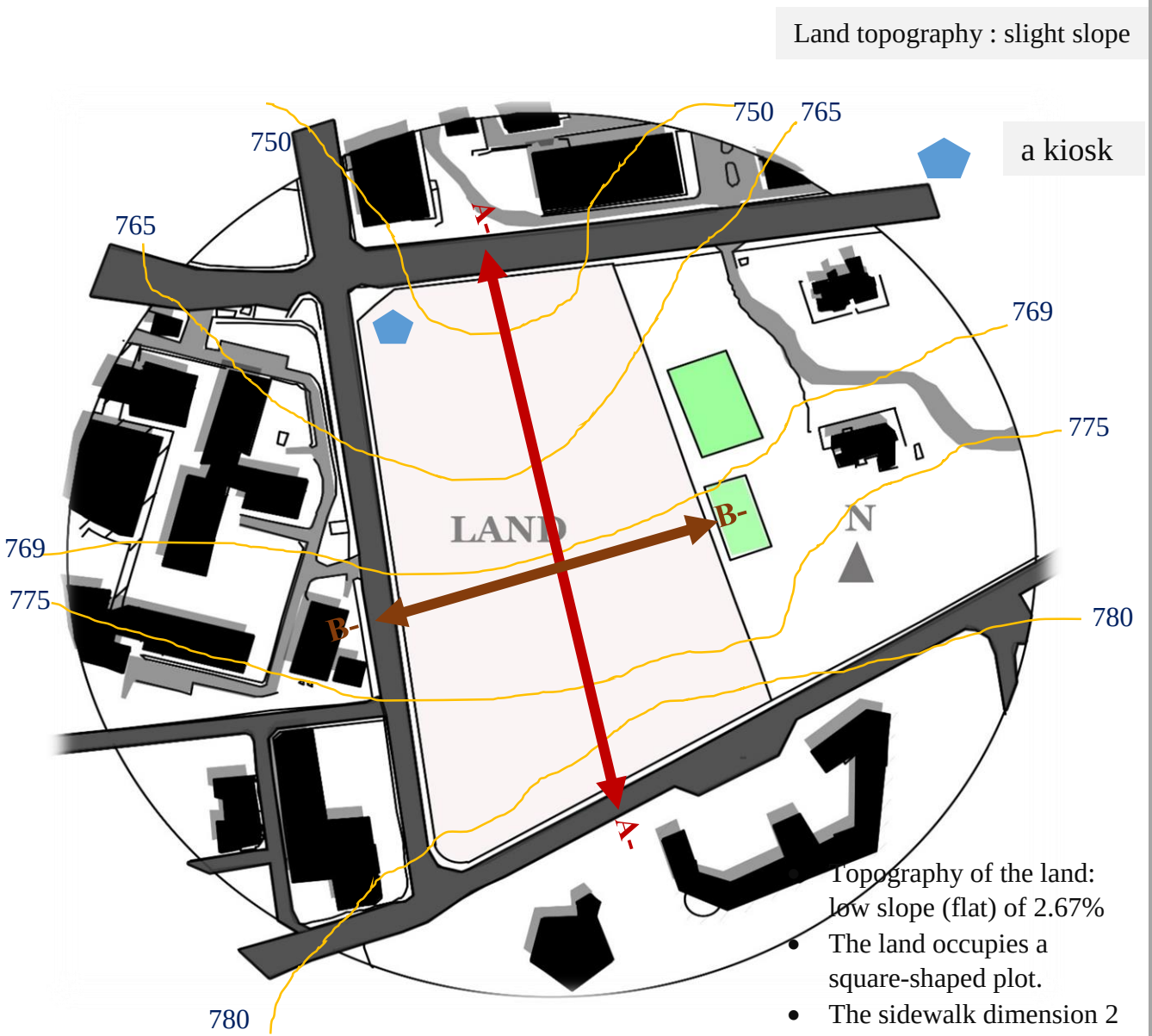
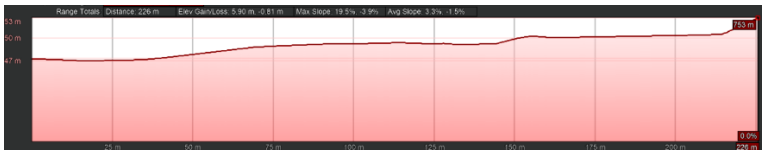
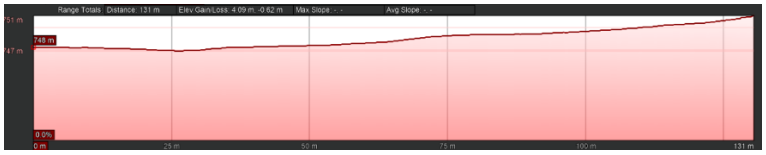


Figure 96: Morphology and topography of the land:



Section A-A



Section B-B

Figure 97: section of the plot:

f Roads and various networks:

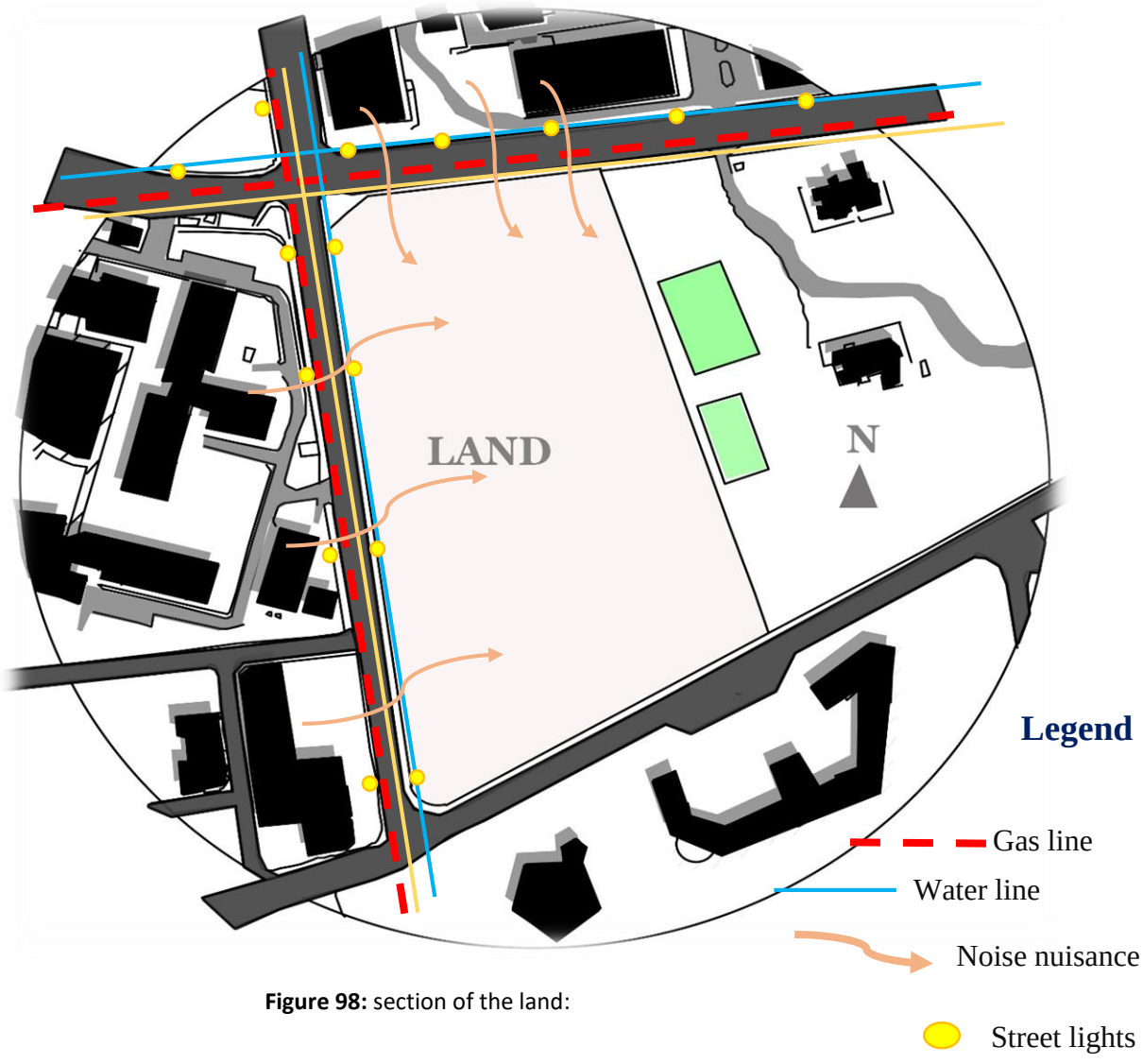


Figure 98: section of the land:

Chapter4: Architectural Response and programming

1.42 Introduction:

In this chapter, we are going after an intensive study and research of problems facing housing design. In this section, solutions are given that respond to the research questions in the first chapter. In this chapter, we will define the functions and activities of the equipment and their prioritization, and translate the need into a program of spaces and surfaces; from theoretical data and examples to create a basic program to determine the final program.

"A project is a living space such as a human body, which means that the spaces that Constitute must be complementary and functional such as the vital organs" ***Louis Kahn***

1.43 Using Technology:

Using a smart home system to promote touchless surfaces and appliances such as automated doors and sinks that respond to movements and automated lights which respond to sound.

Figure 99: touchless sink technology:

Figure100: touchless door technology:

1.44 Coat rack:

A wall mounted coat rack for your outdoor clothes to be hang. This is a good feature to add to each house in order to prevent the dirt and dust from outside coming in.

Figure101: interior coat rack

1.45 Space organization and proportions:

- Bigger windows, larger entrance doors, wider case and corridors
- Each house should have two or more entrances to prevent the dwellers from colliding.
- Each house should have and a bathroom at the entrance so that the inhabitants can clean themselves before entering the common areas.

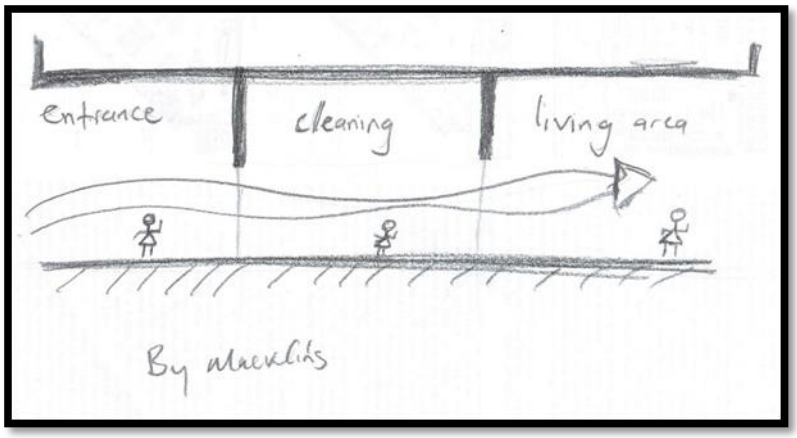


Figure102: transitioning concept:

1.46 Home office

To help companies operate, some have been fortunate to work from the comfort of their homes. A good office should be enclosed in each house with enough sound insulation. Therefore, a separate room should be ideal.

Figure103: home office:

1.47 House plants and flowers:

Houseplants are good for our health. They clean the air by filtering the polluted air and boost healing and breathing. Plants are good for our mental wellbeing, there is a good sense when we take care of plant and nature it and see grow .this will be possible by providing garden spaces to grow their own food.

Figure 104: interior flower pots:

1.48 Cross ventilation

« "Cross ventilation (also called Wind Effect Ventilation) is a natural method of cooling. The system relies on wind to force cool exterior air into the building through an inlet (like a wall louver, a gable, or an open window) while outlet forces warm interior air outside (through a roof vent or higher window opening)." »[24]

Benefits of cross ventilation:

- Helps to moderate internal temperatures.
- Helps to reduce the accumulation of moisture, odours and other gases that can build up during occupied periods.
- Creating air movement that improves the comfort of occupants.

[24] https://www.moffittcorp.com/wind-effect-cross-ventilation/

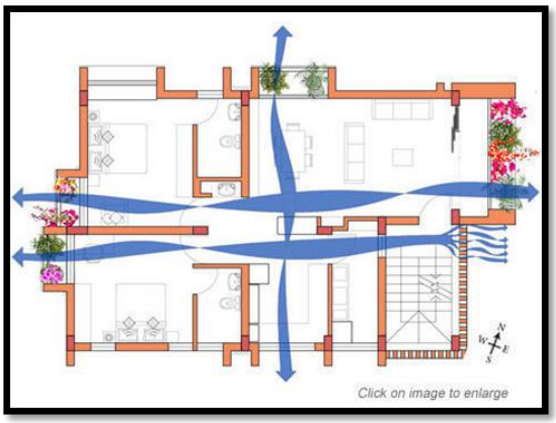


Figure 105 : cross ventilation.

1.49 Using Skylight

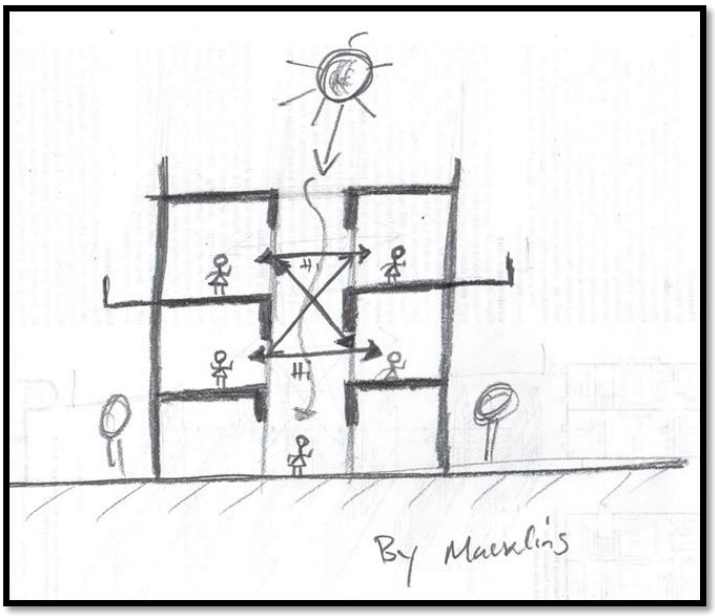
« "A skylight (sometimes called a roof light) is a light-transmitting structure or window, usually made of transparent or translucent glass that forms all or part of the roof space of a building for day lighting and ventilation purposes." »[25]

This will be beneficial to the inhabitants, as direct sunlight can eliminate bacterial and reduce energy consumption.

Figure 106: skylight on terrasse:

1.50 Through Communication:

[25] https://en.wikipedia.org/wiki/Skylight



Implement the use of voids to ensure Natural sunlight and ventilation as the primary purpose and for communication between family members as the secondary purpose.

Figure 107: individual house conception:

1.51 Construction Materials

In this case, we are talking about materials and finishes that offer antimicrobial protection or stop the growth of bacterial or vingus. These materials also reduce the survival rate time of viruses on an inhospitable.

1.51.1 PAINTS

Paint can be used for walls, ceilings and floors. Can we find hygienic and antibacterial paints? Most paint manufactures often offer an additive that is simply mixed into any color or finish making it antimicrobial. The additives are responsible for making the paint resistant to mold, fungus and bacteria. Even after repeated clear cleanings, its resistant remains strong. A surface treated with antimicrobial paints repelled contamination up to 90%.

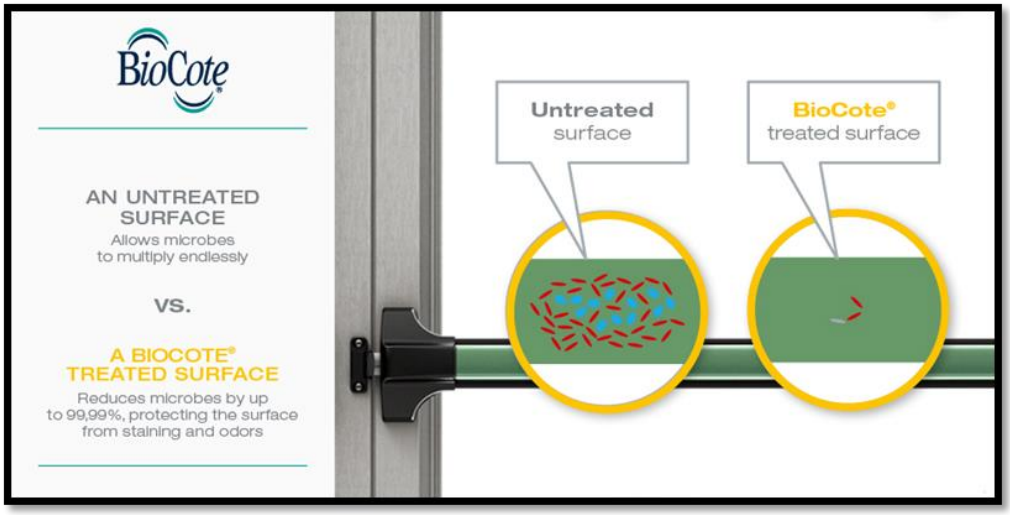


Figure 108 : biocodes paint :

1.51.2 BIOCODES

Antimicrobial paint additives are specific acts of ingredients that can be introduced into a paint coating during manufacturing process to make it resistant to microbes. These paints are recommended in the fight of viruses. 2.2 SURFACES:

1.51.3 SURFACE :

a NON-POROUS MATERIALS

What are non-porous surfaces?

To answer this question we first need to know what porous surfaces are. Porous materials are materials with more holes in them, which allow air and liquid to flow through just like a sponge. Because of their molecular structure, there is more space to allow absorption and air flow.

So non-porous materials are more dense and do not absorb water and do not allow air to pass through them more easily.

The commonly known non-porous materials in our homes include ceramic tiles, metal sinks, glass, metal cabinets, door handles etc….Porous materials in our homes include drywall (gypsum), carpeting, wall paper, bricks, ceiling tiles, acoustic materials etc….

The porosity of materials is not the main criteria of choosing material for hygiene purposes, but it is something we must pay attention to in selecting materials for furniture, flooring, walls, ceiling and something to consider when dealing with maintenance. I

believe that by selecting the right materials you can keep the luxuries and still live in a healthier home environment.

When people think about selecting furniture and materials for a project, esthetics are an important topic and from a designer's point of view, specifications should be safe to use, durable, functional and meet the sustainability.

b ANTIMICROBIAL PROTECTION

There are certain materials and finishes that offer antimicrobial protection. Meaning that, they kill microorganisms or stop their growth.

Figure 109: antimicrobial surface protection :

You can find viruses , molds and bacteria on countertops , floorings and on textile fixtures . there are materials that offer antimicrobial protection against these problems . and they are available to use in our homes , offices , restaurants , hotels and health care centers.

1.52 MATERIALS THAT OFFER ANTIMICROBIAL PROTECTION

Preventing the growth of mold, bacteria and other microorganisms is the most vital consideration of all in order to provide the interior with an effective antimicrobial protection. A hygienic coating for internal walls and floors must provide a surface that is easy to clean, sustainable and free from features that might harbor dirt and bacteria.

The main criteria for choosing hygienic coatings and coverings are:

- They must be resistant to chemicals and heat aging
- The ability to be scrubbed
- They must be resistant to crocking
- Cold cracking resistant

1.53 FLOORING OPTIONS

To decide what the best material would be for hygienic flooring would have to depend on its purpose. There are different types and a variety flooring options:

- Carpet vinyl
- Stone
- Wood tiling
- Cork flooring
- Epoxy

Among them, we have some that offer an additional protection of antimicrobial:

- Bamboo which has antifungal agent
- Cork flooring which comes from oak tree stops the bacteria growth
- Epoxy and rubber floors

1.54 FLOOR FINISHES

Terrazzo, epoxy and linoleum are all equally good flooring materials options for your home.

1.54.1 Terrazzo

Is a composite material, put in place or precast which is used for floor and wall treatments. It consists of chips of marble, quartz, granite, glass or rather any suitable materials. Because of its non-porous quality. Terrazzo is prominently used in food restaurants as well as laboratories and hospitals.

Figure 110: terrazzo flooring:

Terrazzo surfaces can improve the overall indoor air quality for the public space. However, it is not recommended for countertops in bars, restaurants and kitchens. Because it not resistant to water.

1.54.2 EPOXY FLOORS

Epoxy floors are resistant to a large number of chemicals, such as solvents and acids. Epoxy floors are decorative and available in many different colors and designs. However, epoxy floors combine well with the under floor heating and they are also quite sustainable. They are suitable for heavy use and this option works well in warehouses, workshops and production areas. They are not good for office spaces because it can make noise when you walk on them.

Figure 111: epoxy flooring: source:

It is recommended using epoxy for hospital floors and restaurants as it is a non-porous material. It will not support the growth of bacteria and mold and it can withstand harsh cleaning procedures without damage. In addition, of an anti-slip additive, an epoxy floor also creates a safe working environment for fast moving employees that are likely to slip and get hurt. This promotes production and reduces liability.

1.54.3 LINOLEUM

Linoleum is made from natural materials which means it is eco-friendly and inexpensive. It is an antimicrobial material, which protects the floor from microorganisms.

Figure 112: linoleum flooring :

It also comes in many various styles and colors. Keep in mind that it does not do well with moisture and it is not recommended for use in bathrooms, laundry rooms or other areas that might expose splashes or even high humidity.

1.54.4 QUARTZ

Quart is a chemical compound that has silicon and oxygen (silicon dioxide SiO_2). Its unique properties makes it a useful natural material in construction. Quartz is among the hardest non-porous stones. A non-porous option that is scratch resistant and antimicrobial protection. Quartz can be a great choice for countertops. It has strong properties that makes it stain and scratch resistant.

Figure113: quartz countertops:

They come in different Patterns of colors such as; Amethyst, Blue quartz, Dumortierite quartz, Citrine, Milky quartz, Rose quartz, Smoky quartz, Prasiolite etc… In addition, some semi porous stones used for countertops such as agates, tigereye and petrified wood all sustain scratch resistant and are some of the most beautiful surfaces you can ever use.

Figure 114: types of Quart:

1.55 SECTION 2: Programming

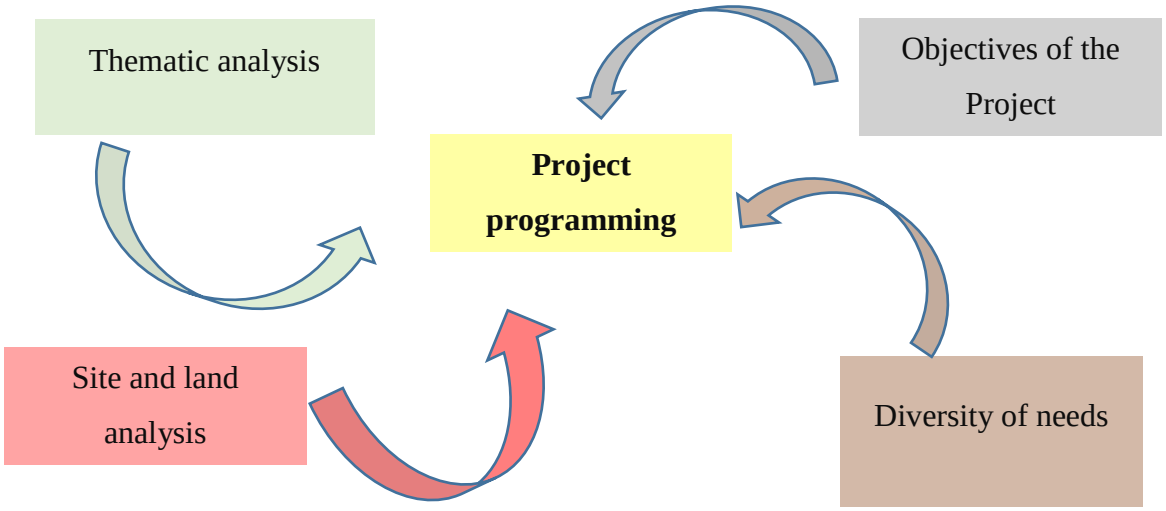
"... Programming is not a simple process but it is a source of inspiration and information for the designer ..."

Jean Nouvel

Architectural and technical programming is a professional practice which is part of the studies prior to architectural production and which aims to allow a project owner to express the objectives[26]

The program serves as a reminder throughout the operation and ensures that all the specifics of operation have been taken into account.

This phase is the presentation of the developed program in response to the requirements already mentioned in the previous chapter, in order to control the quality of spaces, their functioning and arrangement. Thus, the choice of program is based on:



1.55.1 The objective of the programming:

- To define the functions and activities of different buildings and relation of building blocks.
- To translate the needs into a program of spaces and surfaces.
- To Study the functional relationships.
- To define a gensperal atial organization plan for the project.
- Study required surfaces of room

1.55.2 Capacity :

According to the comparative case studies: the capacity of the aquatic centers is between 40 to 50 houses**.**

[26] https://fr.wikipedia.org/wiki/Programmation_architecturale

1.55.3 The program is based on the following activities:

- Administrative
- Commerce
- Accommodation
- Sportif
- Services
- Health
- Leisure

1.55.4 Program Development :

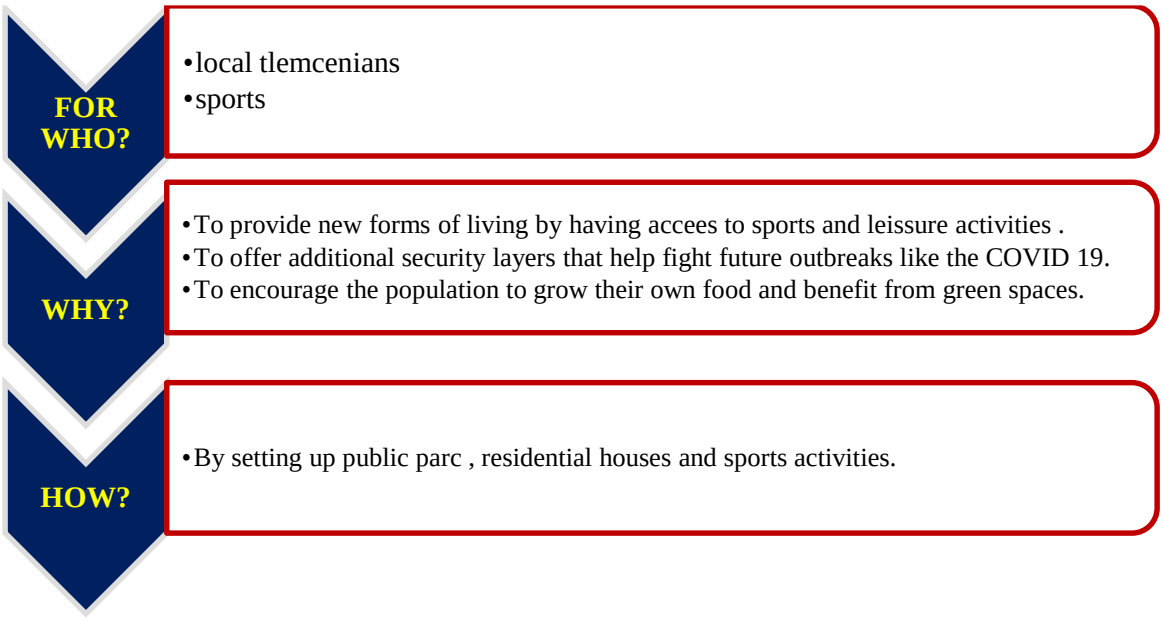


Figure 115: program development:

1.55.5 Identifying the Functions :

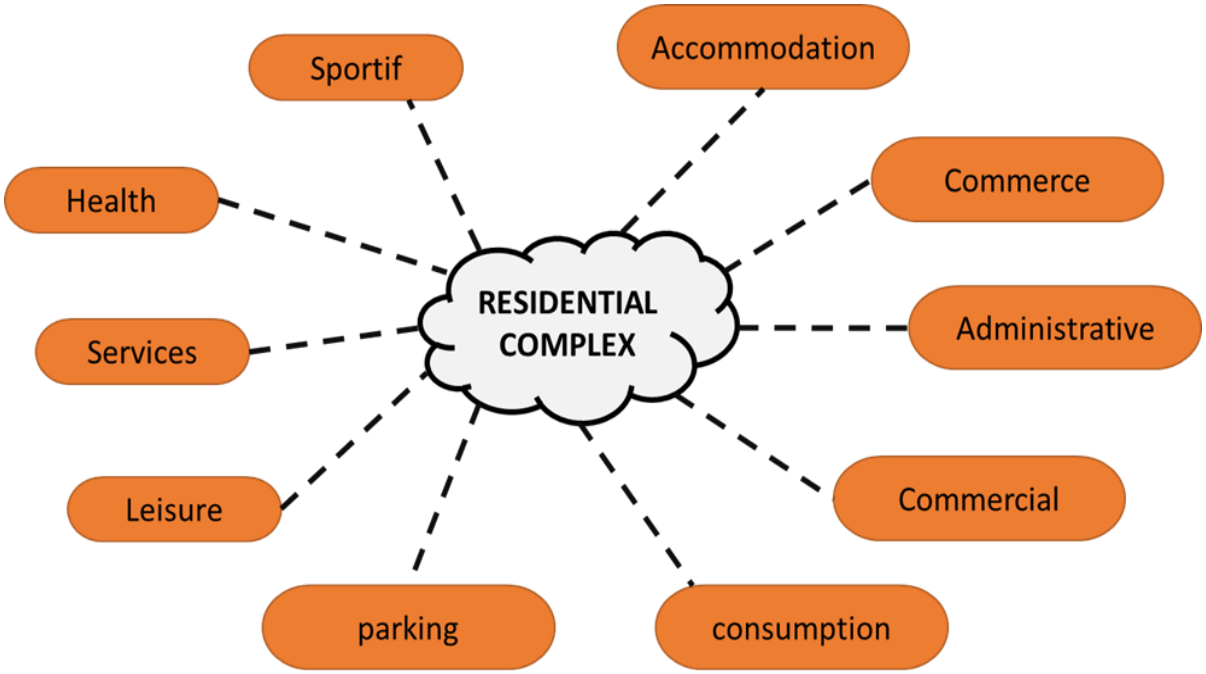


Diagram of residential complex functions:

- **For who?**

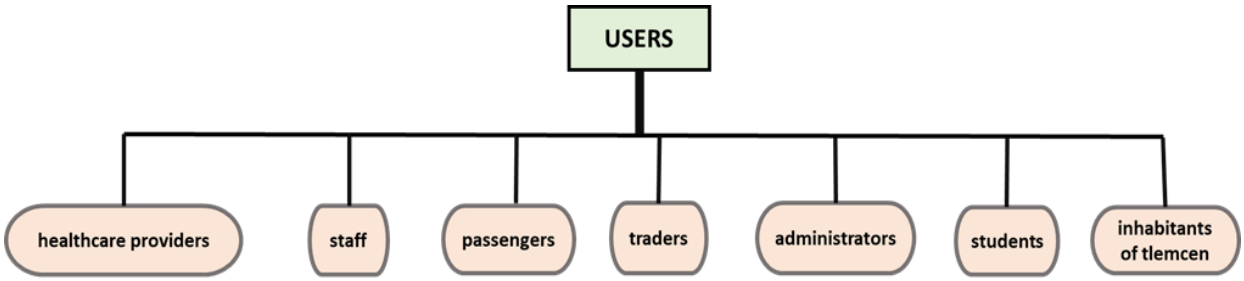
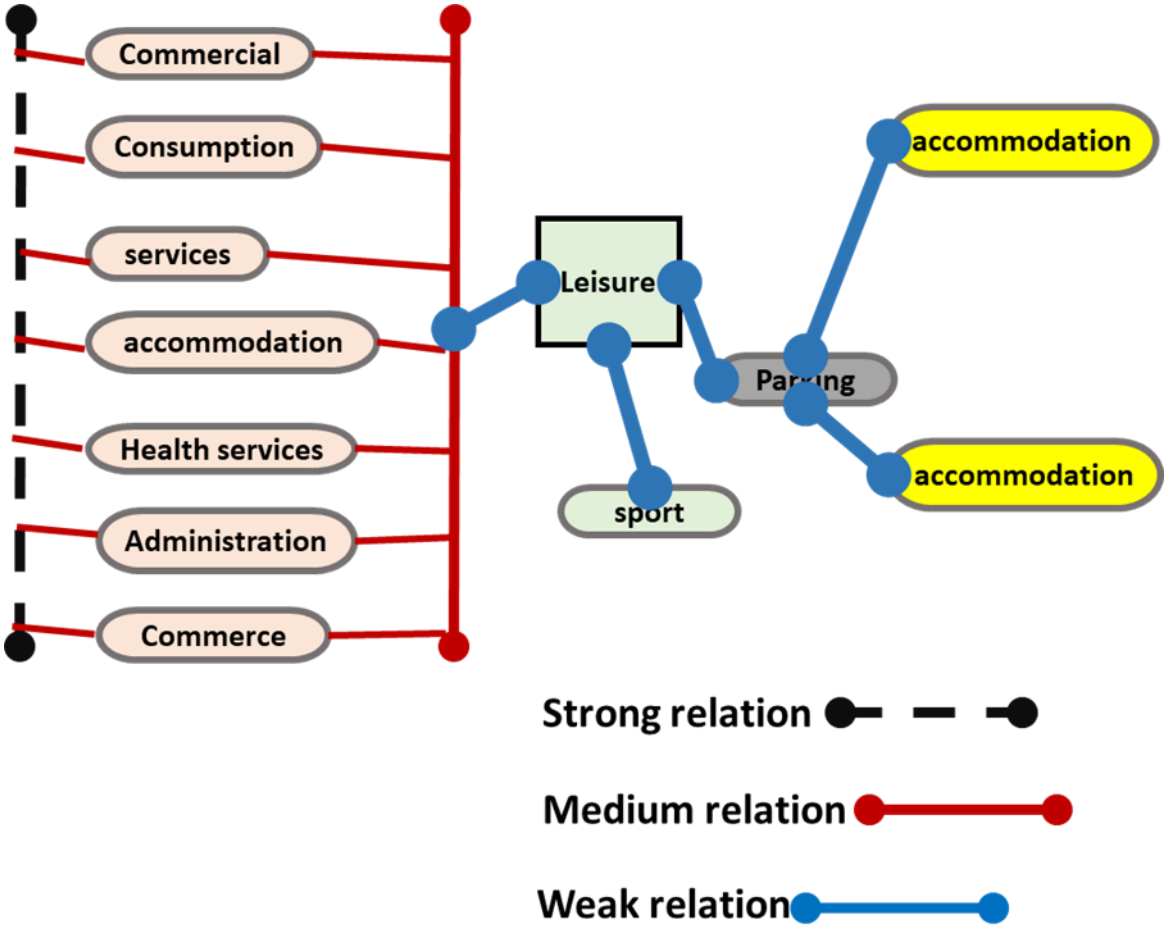


Figure 116: project users:

1.55.6 Identifying the Functions:



1.55.7 Fundamental program :

Table 15: fundamental program (basis)

FONCTION		ESPACE
Internal admin	Distribution and coordination	Reunion , reception , tele-survellance, archive, office
Accommodation	26 collective unites	Bedroom, transition , balcon , tv room, kitchen , dining ,
	8 Individual unites	
Health	Private clinit	Lab, x-ray , CT-scan , triage , consultation , OR, maternity ward , pedriatrician
Consumption	Restaurant	Dining , kitchen , tea room , office, staff room , storage

Leisure	Gym , game room , cooking class, multi purpose room ,	Kitchen , storage , wc , office
Services		Post office , travel agency , libray , photoshop , barbershop , saloon , stationery , driving agency , electronics reperation , internet café , tailor , laundry , childrens day care , group therapy
Parking		Public parking , private parking , underground parking
Commercial	Buying and selling	Super market , boutiques , pastry , backery , cosmetiques , butchery , electronics , home utilities , ice crème, optic shop, deco shop , perfumery , kiosque ,jewery
Sportif	Exercising	Football field , playing ground , running track

1.55.8 Developed program :

Table 16: Specific program for collective housing

34 Collective housing program					
Function	**Type**	**Space**	**Content**	**Surface**	**Total surface**
Accommodation	**T4=10**	Masters Bed room	Bathroom	$6m^2 – 10m^2$	$20m^2 – 30m^2$
			Walking closet	$6m^2 – 10m^2$	
			Office	$12m^2 – 16m^2$	
			Green Balcony	$6m^2 – 12m^2$	
		Bedroom 2	Bathroom	$6m^2 – 10m^2$	$16m^2 – 20m^2$
			Balcony	$6m^2 – 12m^2$	
			Robe	$2m^2 – 4m^2$	
		Transitioning room	Toilet ,shower and sink	$4m^2$-$9m^2$	$4m^2$-$9m^2$
		Toilet	Toilet , sink , shower	$2m^2$-$6m^2$	2m2-6m2
		Siting room	Open space	$16m^2 – 25m^2$	$40m^2 – 60m^2$
		Dining room		$16m^2 – 20m^2$	
		kitchen	Storage	$12m^2 – 20m^2$	$12m^2 – 20m^2$
		Family study room	Book shelves – table – chairs	$9m^2$-$12m^2$	$9m^2$-$12m^2$
		Circulation	Hall	$8m^2 – 12m^2$	16m2 – 24m2
			transition room	$8m^2 – 12m^2$	

		Green Balcony	trees ,flowers	$6m^2 – 16m^2$	$6m^2 – 16m^2$
		Home plants	Vegetables, plants		
		TOTAL =120m2– 180m2			
	T5=14	Masters Bed room	Bathroom	$6m^2 – 10m^2$	$20m^2 – 30m^2$
			Walking closet	$6m^2 – 10m^2$	
			Office	$12m^2 – 16m^2$	
			Balcony	$6m^2 – 12m^2$	
		Bedroom 2 ,3	Bathroom	$6m^2 – 10m^2$	$32m^2–40m^2$
			Balcony	$6m^2 – 12m^2$	
			Robe	$2m^2 – 4m^2$	
		Transitioning room	Toilet ,shower and sink	$4m^2$-$9m^2$	$4m^2$-$9m^2$
		Toilet	Toilet , sink , shower	$2m^2$-$6m^2$	$2m^2$-$6m^2$
		Circulation	Hall	$8m^2 – 12m^2$	16m2 – 24m2
			transition room	$8m^2 – 12m^2$	
		Family study room	Book shelves – table – chairs	$9m^2$-$12m^2$	$9m^2$-$12m^2$
		Siting room	Open space	$16m^2 – 25m^2$	$40m^2 – 60m^2$
		Dining room		$16m^2 – 20m^2$	
		kitchen	Storage	$12m^2 – 20m^2$	$12m^2 – 20m^2$
		Green Balcony	trees ,flowers	$6m^2 – 16m^2$	$6m^2 – 16m^2$
		Home plants	Vegetables, plants		
		TOTAL =140m2– 200m2			
	T6=5	Masters Bed room	Bathroom	$6m^2 – 10m^2$	$20m^2 – 30m^2$
			Walking closet	$6m^2 – 10m^2$	
			Office	$12m^2 – 16m^2$	
			Balcony	$6m^2 – 12m^2$	
		Bedroom 2 , 3 , 4	Bathroom	$6m^2 – 10m^2$	$48m^2–60m^2$
			Balcony	$6m^2 – 12m^2$	
			Robe	$2m^2 – 4m^2$	
		Siting room	Open space	$16m^2 – 25m^2$	$40m^2 – 60m^2$
		Dining room		$16m^2 – 20m^2$	
		kitchen	Storage	$12m^2 – 20m^2$	$12m^2 – 20m^2$
		Green Balcony		$6m^2 – 16m^2$	$6m^2 – 16m^2$
		Transitioning room	Toilet ,shower and sink	$4m^2$-$9m^2$	$4m^2$-$9m^2$

		Toilet	Toilet , sink , shower	$2m^2$-$6m^2$	$2m^2$-$6m^2$
		Circulation	Hall	$8m^2$ – $12m^2$	16m2 – 24m2
			transition room	$8m^2$ – $12m^2$	
		Family study room	Book shelves – table – chairs	$9m^2$-$12m^2$	$9m^2$-$12m^2$
		Home plants	Vegetables, plants		
		TOTAL =160m2– 260m2			
TOTAL = 6,000m^2– 9,000m^2					
Services	-Buy and sell -To eat -relax	Coffee shop	Tearoom	50m2	$50m^2$ – $80m^2$
			Bar	2m2	
			Storage	16m2	
			Toilets	12m2	
		Barbershop	Working space	12m2	$20m^2$ – $25m^2$
			Storage room	9m2	
			WC	4m2	
		Mini market	Cold storage	16m2	140m2-160m2
			Dry foods storage	16m2	
			Display area	100m2	
			Maintenance	9m2	
			Counter	6m2	
			Rest room	9m2	
		Saloon	Working space	16m2	25m2 – 30m2
			Storage room	9m2	
			WC	4m2	
		Restaurant	Kitchen	15m2	$85m^2$ – $100m^2$
			Counter	6m2	
			Men’s WC	4m2	
			Storage	16m2	
			Women’s WC	4m2	
			Eating room	40m2	
		Bakery	Kitchen	12m2	$35m^2$ – $40m^2$
			Storage	9m2	
			WC	3m2	
			Counter and display area	16m2	
		Butcher shop	Display area and counter	16m2	$30m^2$ – $35m^2$
			Deep freezer	9m2	
			WC	3m2	
			Cutting area	2m2	
		Libray	Storage room	40m2	$200m^2$ – $210m^2$
			Reception	6m2	
			books	50m2	
			Study area	70m2	

			Computer room	30m2	
			Toilet	8m2	
		Pastry	Kitchen	12m2	35m^2 – 40m^2
			Storage	9m2	
			WC	3m2	
			Counter and display area	16m2	
		Vegetable shop	Cold room	12m2	25m^2 – 30m^2
			Counter	6m2	
			Display area	16m2	
		Cosmetics and perfumery	Storage	12m2	30m^2 – 35m^2
			WC	3m2	
			Display area	20m2	
		Stationery shop	Storage room	12m2	30m^2 – 38m^2
			Cashier counter	6m2	
			Display area	20m2	
		Photo shop	Storage room	12m2	30m^2 – 38m^2
			Cashier counter	6m2	
			Display area	20m2	
		Electronic shop	Storage room	12m2	30m^2 – 38m^2
			Cashier counter	6m2	
			Display area	20m2	
TOTAL = 400m^2 – 600m^2					
Administration	- Management - coordination	housing management office	Reception	12m2	50m^2 – 70m^2
			Archive	15m2	
			WC	3m2	
			Surveillance office	18m2	
			Office	18m2	
		Travel Agency	Reception	12m2	30m^2 – 50m^2
			Archive	15m2	
			WC	3m2	
			Office	18m2	
		Post office	Reception	20m2	30m^2 – 50m^2
			Archive	12m2	
			WC	3m2	
			Office	18m2	
		Doctors office	Waiting area		90m^2- 100m^2
			office		
			Storage		
			Treatment room		
			Laboratory		
			Reception		
			WC		

TOTAL = 85m² – 135m²					
Logistics	Maintenance	Waste Disposal area ext		10m² – 20m²	60m² – 95m²
		Power room		16m² – 25m²	
		water pump room		16m² – 25m²	
		heating room		16m2 – 25m²	
TOTAL = 60m² – 100m²					
Circulation	Distribution	Hall		8m² – 12m²	45m² – 60m²
		Staircase		25m² – 35m²	
		transition room		8m² – 12m²	
TOTAL = 45m² – 60m²					
Parking		underground parking 2 levels		30 to 60 lots	
		Surface parking		10 to 20 lots	
TOTAL = 500m² – 1,000m²					

Table 17: Specific program for individual housing

8 Individual housing program					
Function	**Type of housing**	**Space**	**Under-spaces**	**Surface**	**Total surface**
	T6=8	Masters Bed room	Bathroom	6m² – 10m²	20m² – 30m²
			Walking closet	6m² – 10m²	
			Office	12m² – 16m²	
			Balcony	6m² – 12m²	
		Bedroom 2 , 3 , 4	Bathroom	6m² – 10m²	48m²– 60m²
			Balcony	6m² – 12m²	
			Robe	2m² – 4m²	
		Siting room	Open space	16m² – 25m²	40m² – 60m²
		Dining room		16m² – 20m²	
		kitchen	Storage	12m² – 20m²	12m² – 20m²
		Green Balcony		6m² – 16m²	6m² – 16m²

accommodation		Green terrace and Home garden	Vegetables, plants		
		Transitioning room	Toilet ,shower and sink	$4m^2$-$9m^2$	$4m^2$-$9m^2$
		Technical room		$16m^2$-$20m^2$	$16m^2$-$20m^2$
		Circulation	Hall	$8m^2$ – $12m^2$	25m2 – 40m2
			Staircase	$9m^2$ – $16m^2$	
			transition room	$8m^2$ – $12m^2$	
		Family study room	Book shelves – table – chairs	$9m^2$-$12m^2$	$9m^2$-$12m^2$
		Courtyard		$16m^2$ – $20m^2$	$16m^2$ – $20m^2$
		TOTAL =160m2– 250m2			
Parking		Surface parking		10 to 20 lots	10 to 20 lots
TOTAL = 1,500m2 – 2,300m2					

Table 18: Specific program for public shared activities

Public shared activities			
Type	**Space**	**Content**	**Total area**
Public spaces	Gym	Fitness room	$200m^2$
		Men's changing room	
		Women's changing room	
		Storage room	
		Men's bathroom	
		Women's bathroom	
	Football field	Wire fence – street lights	364m2
	Game room	-WC - Tables – walk way area -Long benches - TV area -stools – Stairs , pool table , table tenis	370m2
	Children's day care	Office	150m2
		Kitchen	
		Staff	
		Babies changing	
		Storage room	

		Rest rooms	
		Reception	
		Class room1: age 0-12 months	
		Class room2: age 19-36 months	
		Class room3: age 3-6 years	
	Multipurpose room	Stage	140m2
		Grand hall	
		Reception + lobby	
		WC	
		Office	
		Kitchen	
	Group therapy Party room	Class room (desks , tables)	140m^2
		Storage	
		Reception	
		Office	
		WC	
		Storage	
		WC	
	Cooking workshop (Open space)	Demonstration area	100m^2
		Lecture space	
		Lockers	
		Cooking stations	
		Prep tables	
		Storage	
		Cold rooms	
		Dish wash area	
TOTAL = 1,400m2 – 1,500m2			

1.55.9 Conclusion :

The programming phase is the most important element for the identification of the project. This study results from a program that presents an architectural concept containing the various elements that will be used for the development of each component of the project.Through this chapter, we see that all functions and spaces have been described and it is necessary to respect all the dimensions, surface areas and the standards of spaces arrangements.

1.56 SECTION 3: conception phase of the project:

The conceptual phase is the process that shows the sequence of finding the needed concept through specific steps, this process helps people to understand what lead to the final idea.The idea is to come up with a design that responds to the research questions and objectives of this thesis. The design should give an image that promotes green spaces and public activities.

1.56.1 The design process :

Many things had to be considered in the design process:

- Vehicle and pedestrian access to the land
- Form and surface area of the land
- Parking (public and private)
- Creation of public park
- Building heights
- Visibility and visual connectivity
- Continuous elevetation

a Step 1: choice of the form (rectangular)

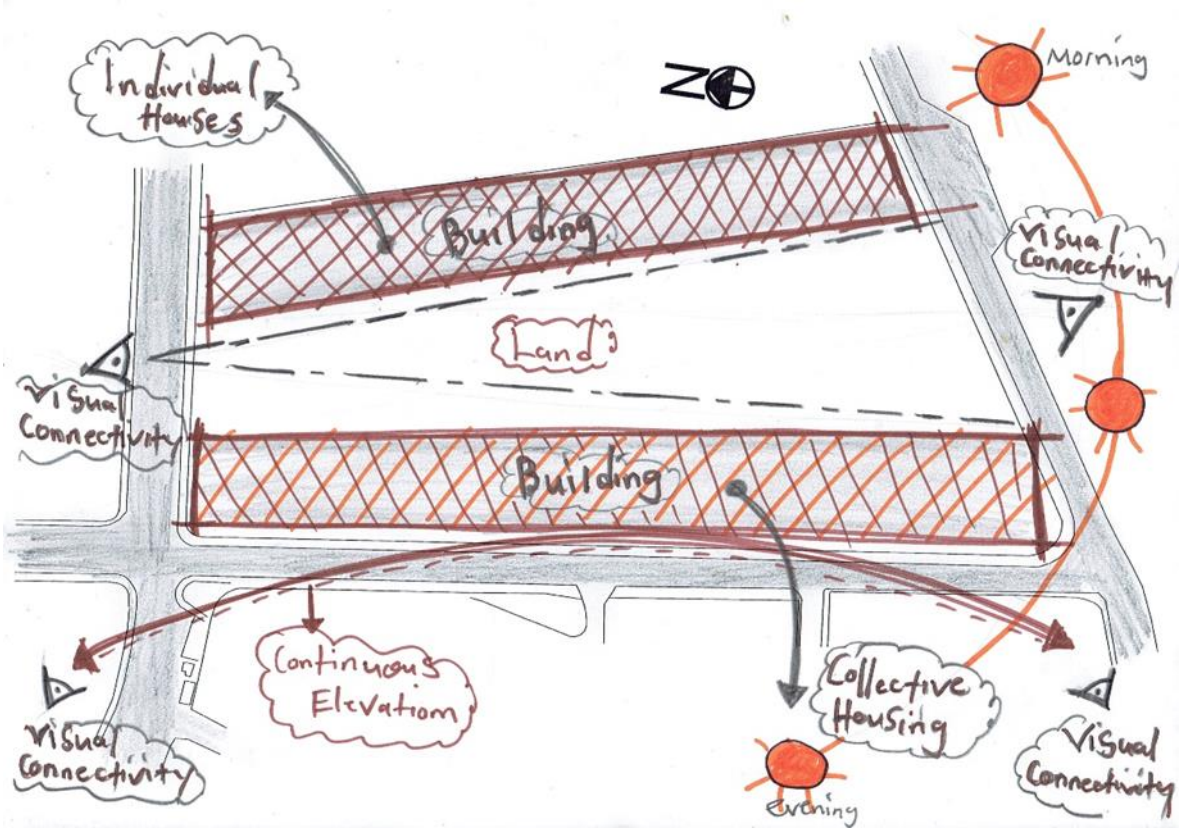


Figure 117: step 1: choice of the form:

b Step 2: transformation of the form into smaller blocks.

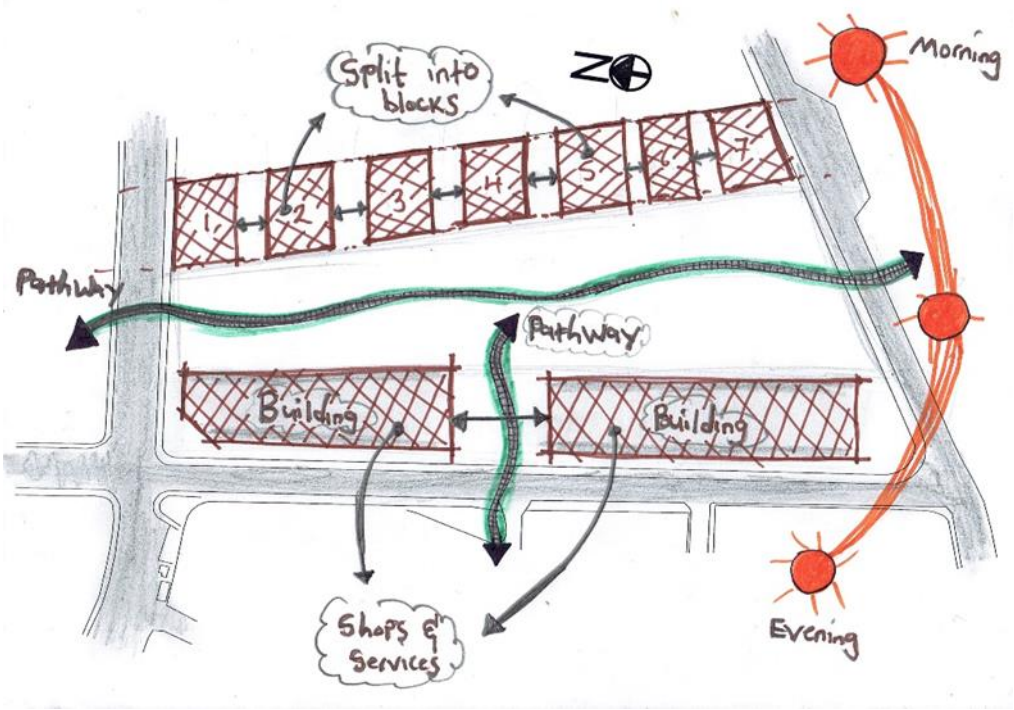


Figure 118: step 2: transformation of blocs:

c Step 3: massing of spaces and accessibility

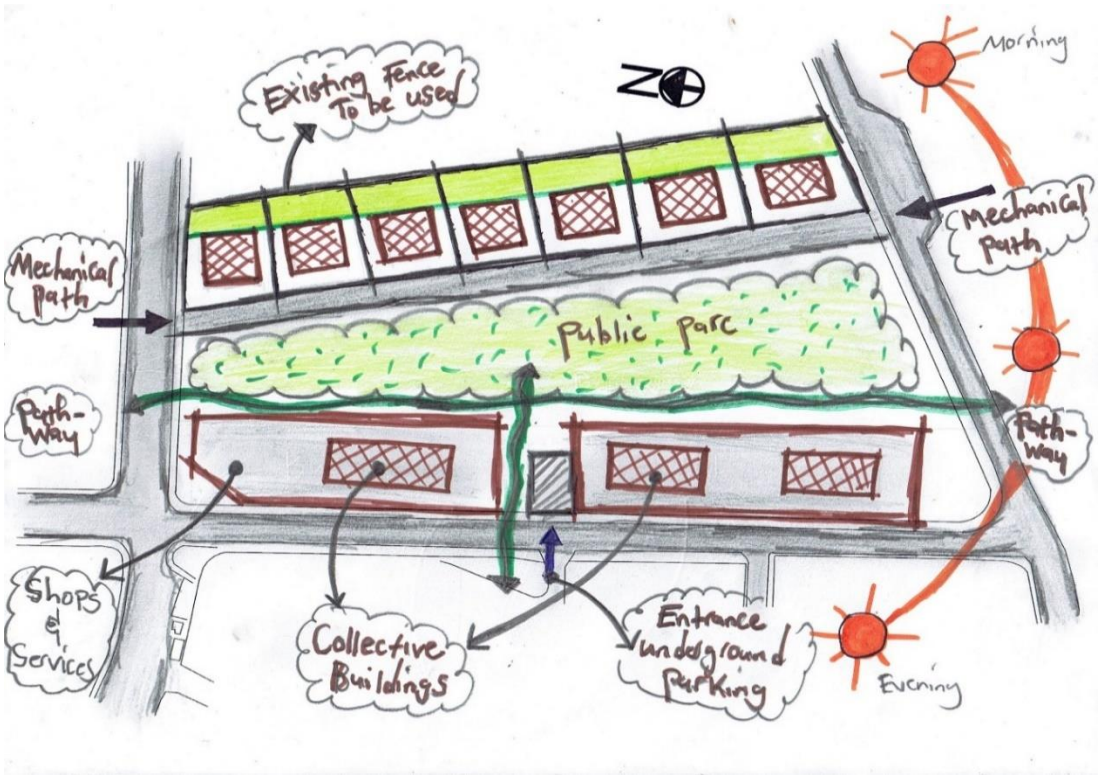


Figure119: step 3 massing of spaces:

1.56.2 Volumetric development :

a Collective housing

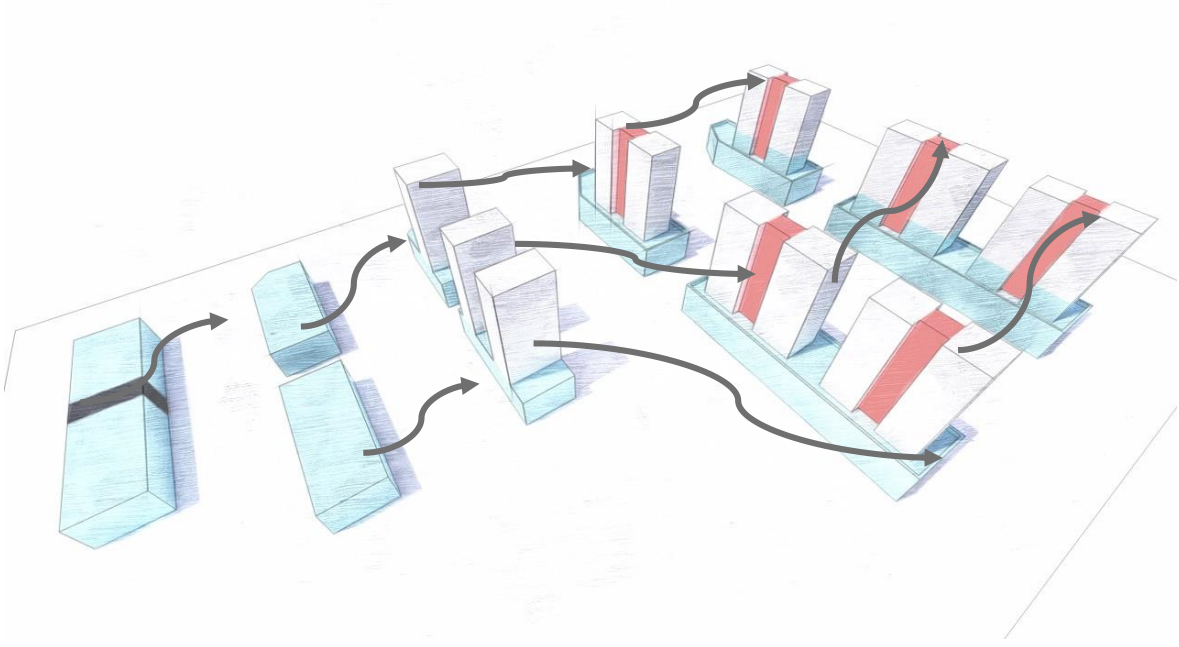


Figure 120: volumetric development of collective Housing:

The composition starts with a linear block, which is divided into two linear blocks. Three tower blocks are added on top. The three blocks are each divided into halfs to create room for stairwell.

b Individual housing

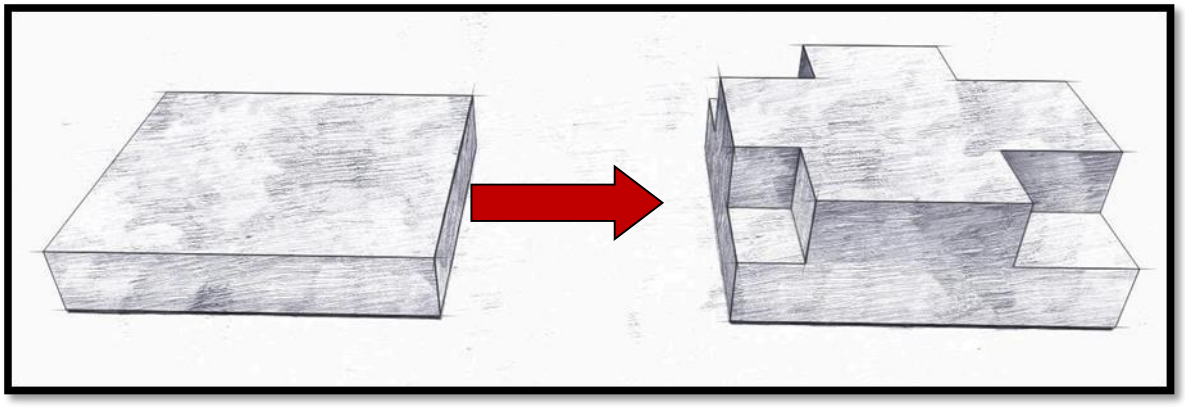


Figure 121: volumetric composition of individual housing:

A rectangular block is used which gives a composition resulting from modification of the block. The modifications are used to create green spaces and balcons.

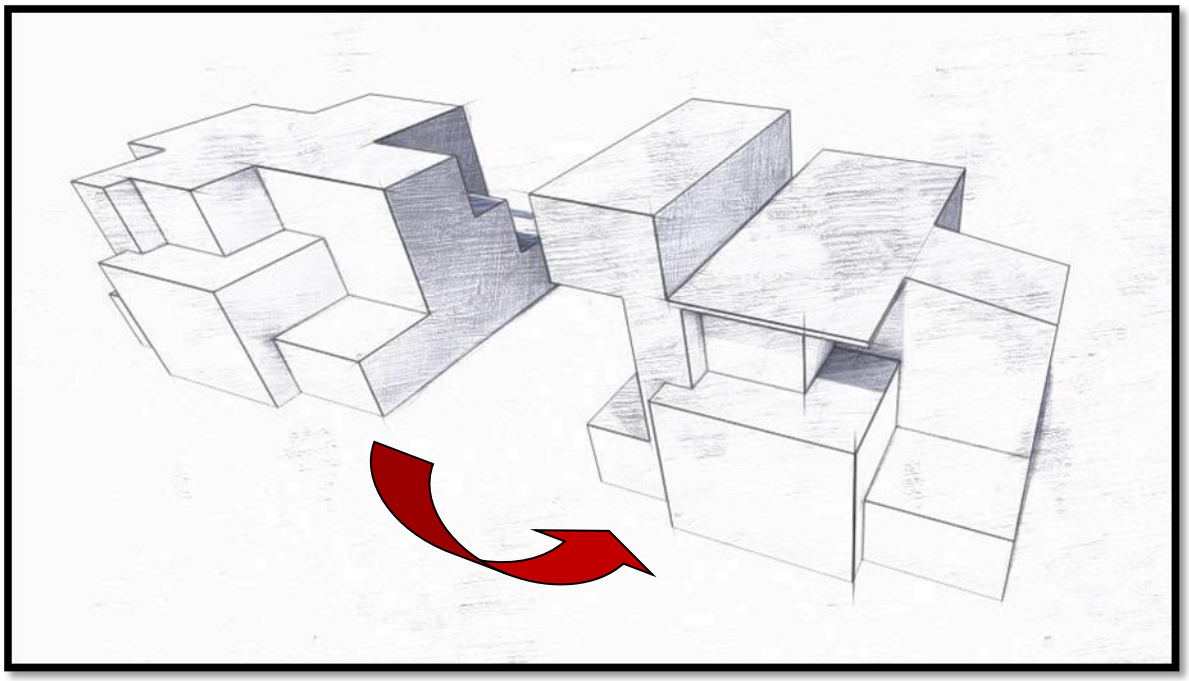


Figure122: volumetric composition of individual housing:

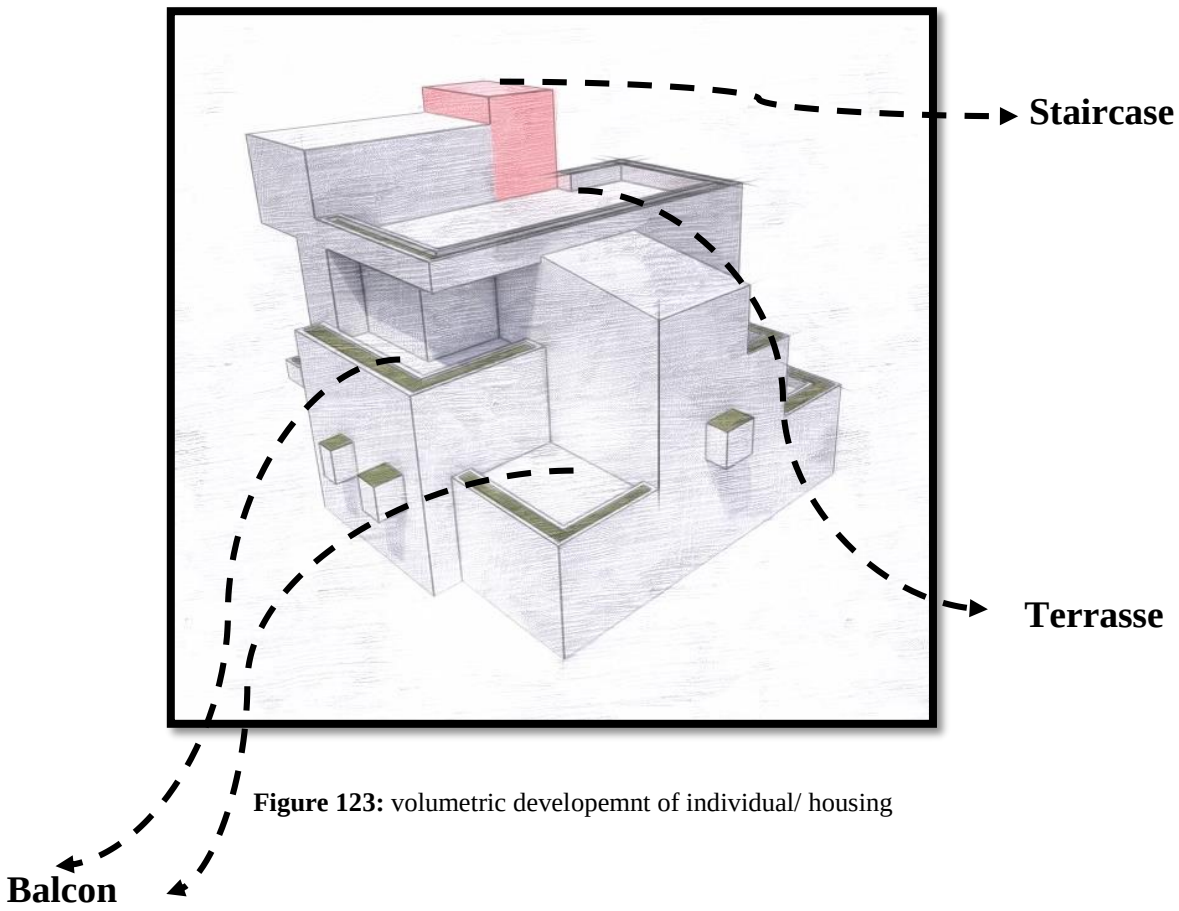


Figure 123: volumetric developemnt of individual/ housing

1.56.3 Conclusion :

The various stages of the programming and the conception phase of the project guide us in our final concept; we could say that the search for originality in architectural design is an important aspect, but not an end in itself. We must obviously include the other variables of the project in its design process and reinforce the design with techniques that make it more original in order to meet the various needs of life.

1.57 SECTION 4: Project description:

1.57.1 Situation plan :

The situation plan is a representation of a perpendicular aerial view, the situation plan is a general view of the project which is used to represent it in the entirety of the site, its configuration and its orientation, before the creation of the detailed plans.

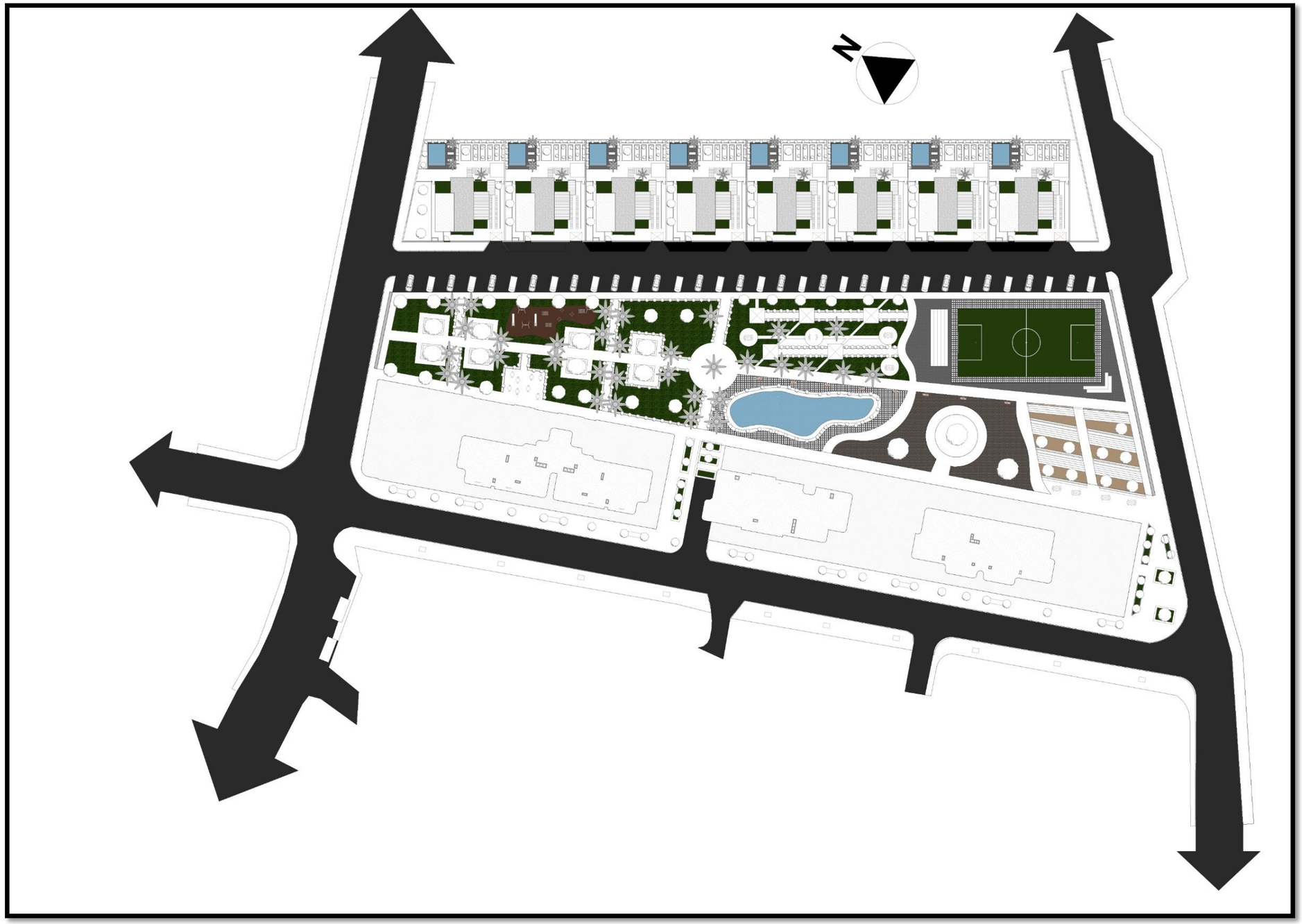


Figure 124: situation plan

1.57.2 Outdoor landscaping

Following the shape of the land, I took the liberty to create a central park, which is an extension of the interior features and activities. The outdoor space include areas that are projected according to their relationship with the different functions of the equipment:

- **a.** a play ground for the children
- **b.** a small football field
- **c.** natural pond
- **d.** picnic area
- **e.** gazebos which provide shelter and a place of rest
- **f.** outdoor study area near the libray for the students
- **g.** Public parking lot for the inhabitatnts in a linear position.
- **h.** Pergola: outdoor cafeteria extension

Figure 125: situation plan

1.57.3 COLLECTIVE HOUSING BLOCS :

1.57.4 Ugerground parking :

The underground parking has two levels, which is reserved only for the collective housing inhabitants. The underground parking has special rooms for technical purposes of electrical, sanitary, water, maintenance and maintenance.

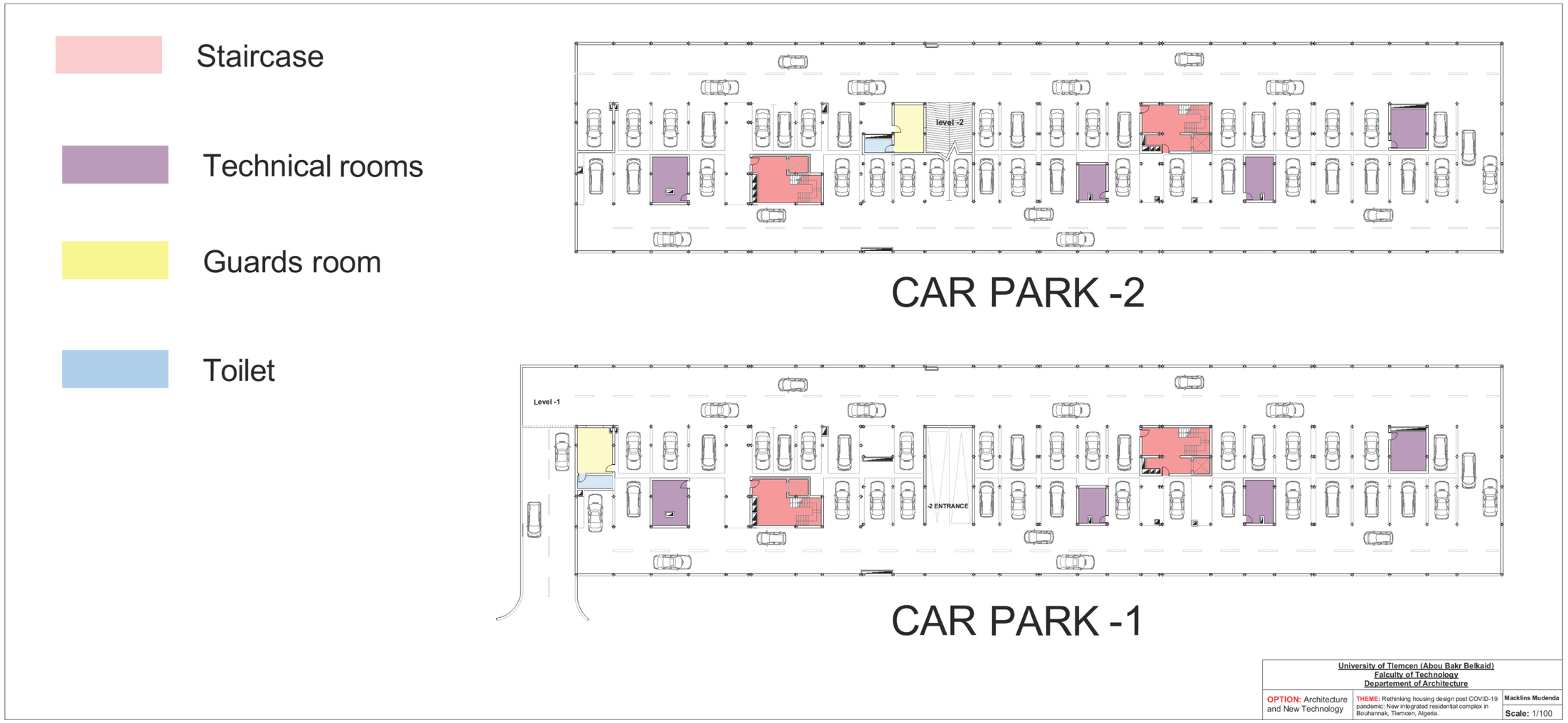


Figure 126: underground parking for collective apartements:

1.57.5 Ground floor and first floor plan:

The ground floor is made up of different functions and activities. In this project, there are two parts to considere, the collective housing and individual housing unites.

a SERVICES :

Is made up of different zones on the ground floor such as: commercial zone, Clinical zone, Administrative zone, Educational zone, Private 3 Staircases that are only accessible to the inhabiatants. The first floor has similar functions with ground floor: commercial zone, Clinical zone, Administrative zone, Educational zone.

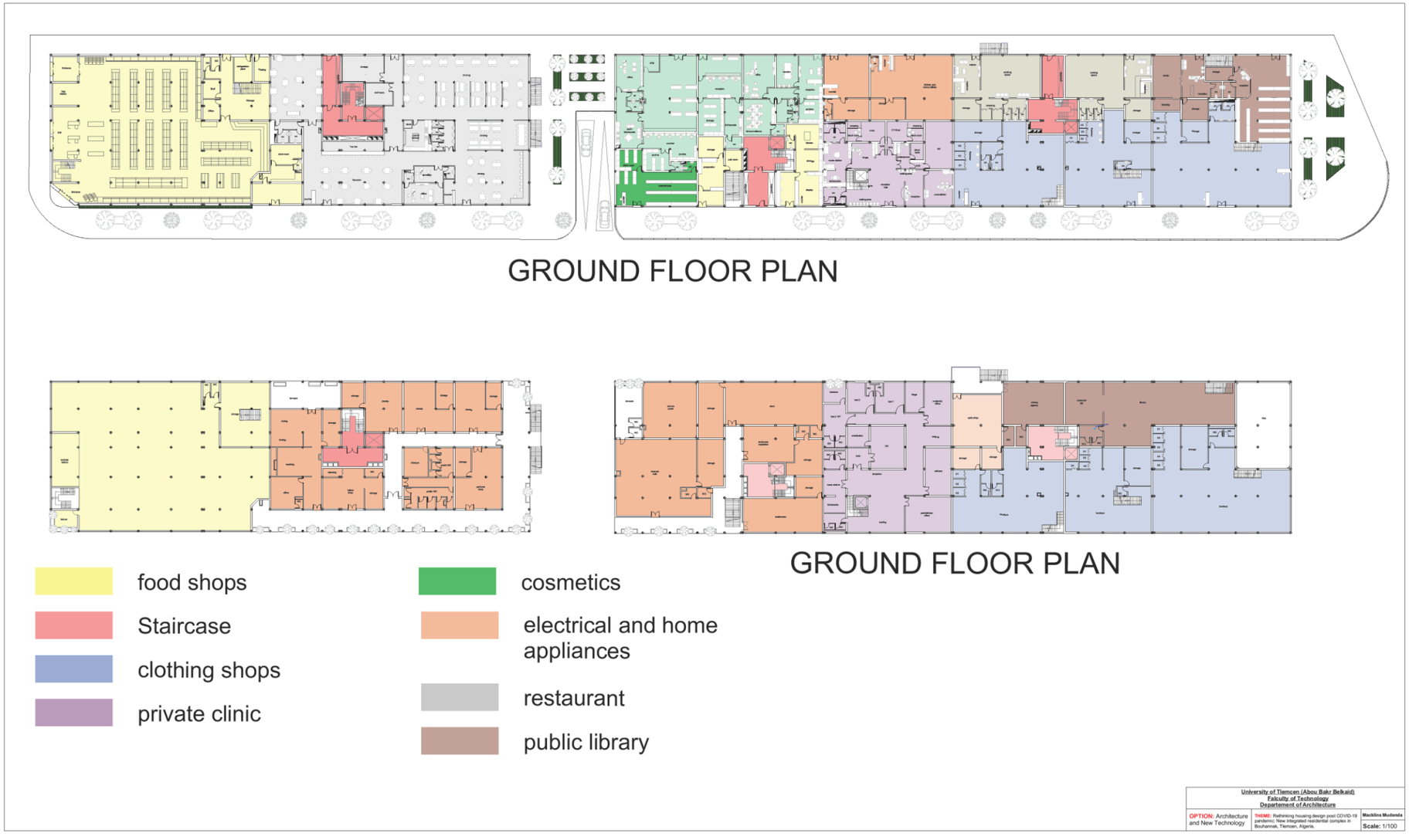


Figure 127: ground floor and first floor plan, organisation of services:

1.57.6 Second, third and fourth floor:

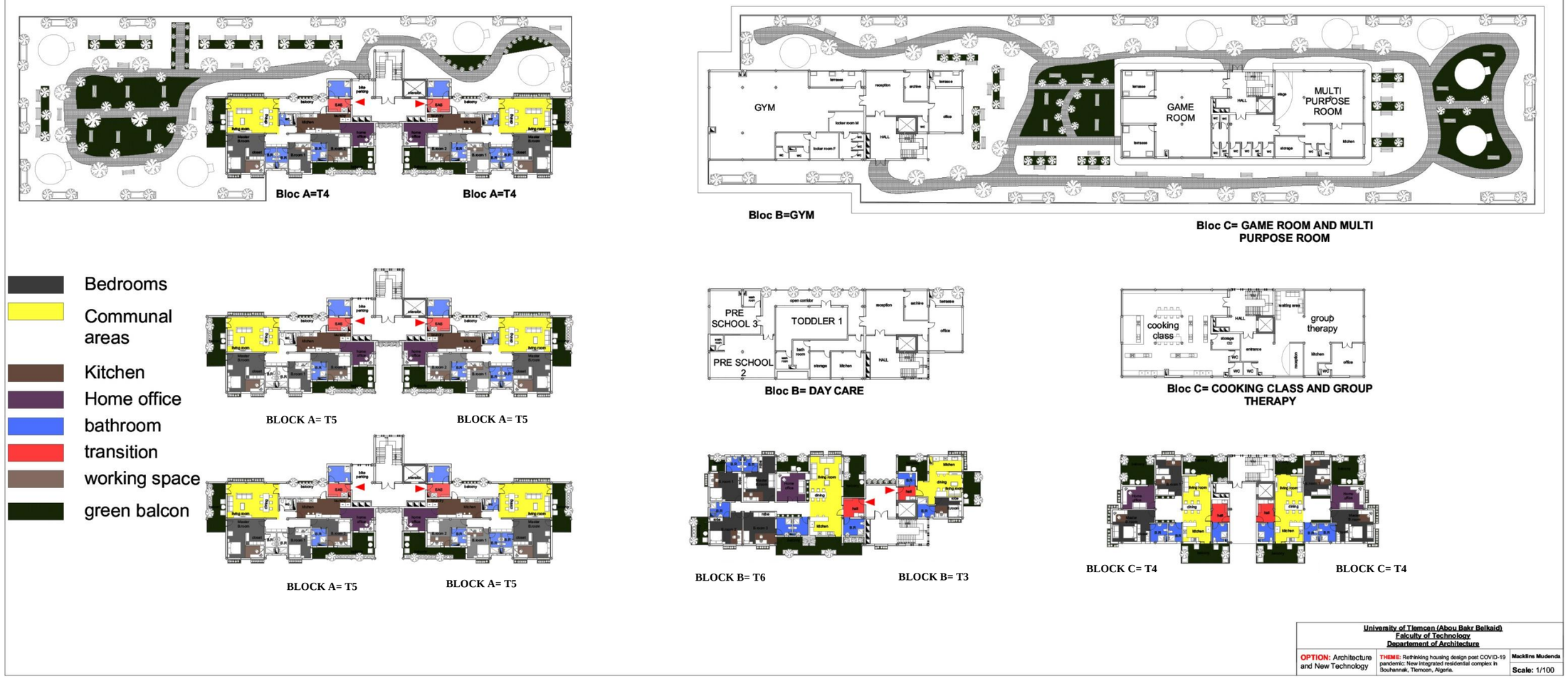


Figure 128: Second, third and fourth floor of collective housing containing services and apartements:

1.57.7 Elevations and section:

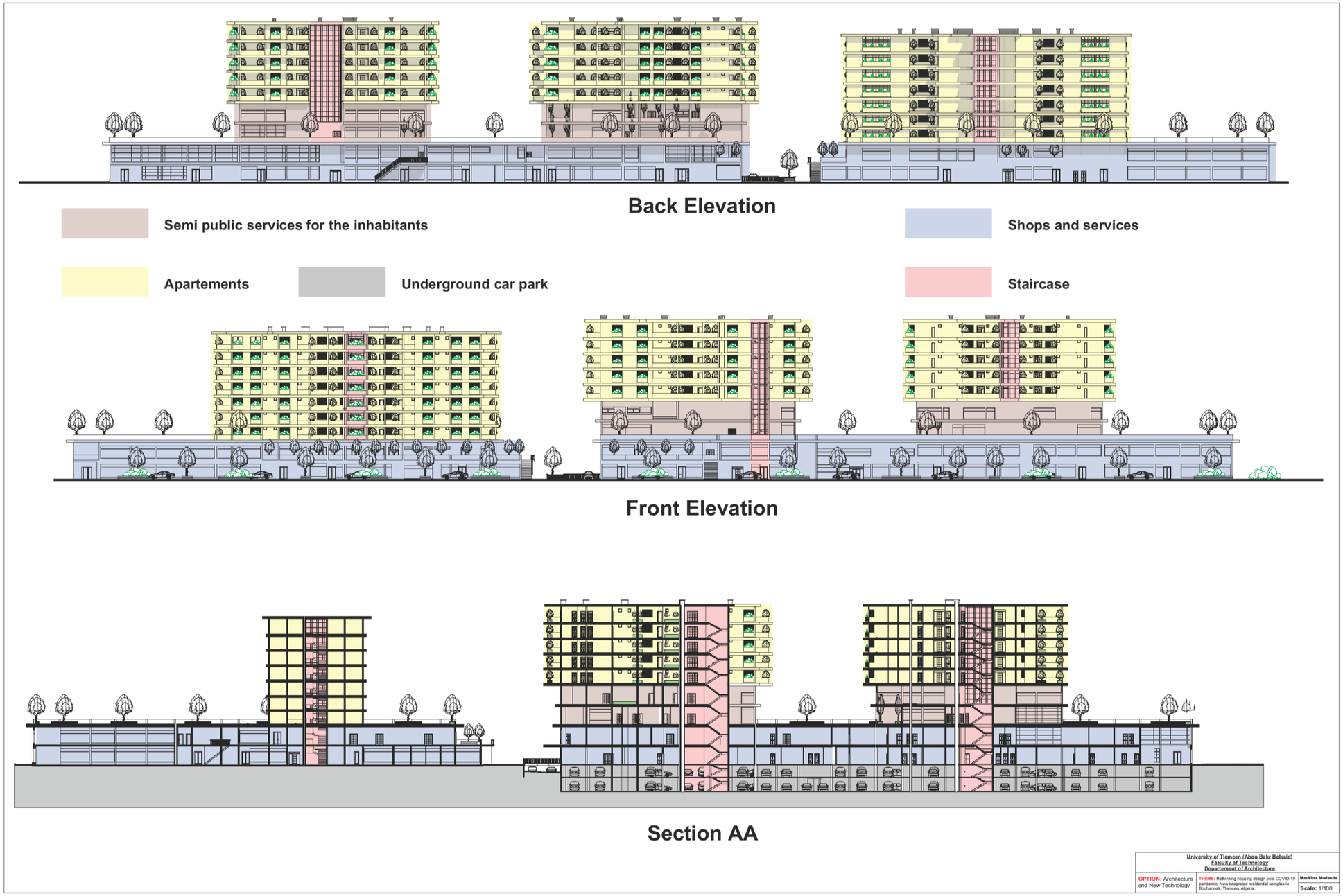


Figure 129: Elevations and section for collective housing blocs:

1.57.8 (3D RENDERS) for collective housing blocs:

1.57.9 Second, third and fourth floor:

a Bloc A

Is made up of twin apartements. These aprtments like the others are special interms of circulation and organization of spaces. Before entering the house, one has to pass through the transitioning room were you can clean yourself and a coat rack to hang one's dirty clothes. New green spaces are created from window openings and interior green walls, this helps to clean the interior air. These apartements have bigger balcons and a bike station in the hall.

b Bloc B

Is made up of services such as gym (mixed) with separate locker rooms, the gym has a reception and an office for the fitness trainer and a childfren's day care with 3 classrooms.

- Toodler 1: aged 0-12 months
- Toodlee 2: aged 19-36 months
- Toodler 3 : aged 3-6 years

The upper floors are reserved for accommodation is made up of T5 and T2 apartements wich are separated by a staircase. Each home has a home office/work station and a trasnsition room were one can clean before going to living spaces. The apartements have an open kitchen for cross ventilation.

c Bloc B

is similar to bloc B , this space is reserved for services such as game room (pool , table tennis) and multifunctional space which can be used for parties , diplomatic meetings etc….

d Bloc C :

Is made up social activities such as a cooking studio for the inhabitants. Bloc C is also reserved for a group therapy; this is an office for a therapist who organizes social events of group sections. This bloc is similar with Bloc B in the functional sense and space organization. The upper floors have twin apartements with T4 sizes.

1.57.10The circulation

- A central staircases leading to all levels for the collective housing and one staircase for the individual house.
- Stairwells in boutiques, supermarket, libray and private clinic to access only the first floor.
- A stairwells outside to access services on the first flow

a INDIVIDUAL HOUSING UNITES:

These are grouped private homes that are separated from each other by a wall fence, the ground floor of each house has a pool, garden area , home office , family spaces with green walls and 2 parking lots.

1.57.11Situation plan:

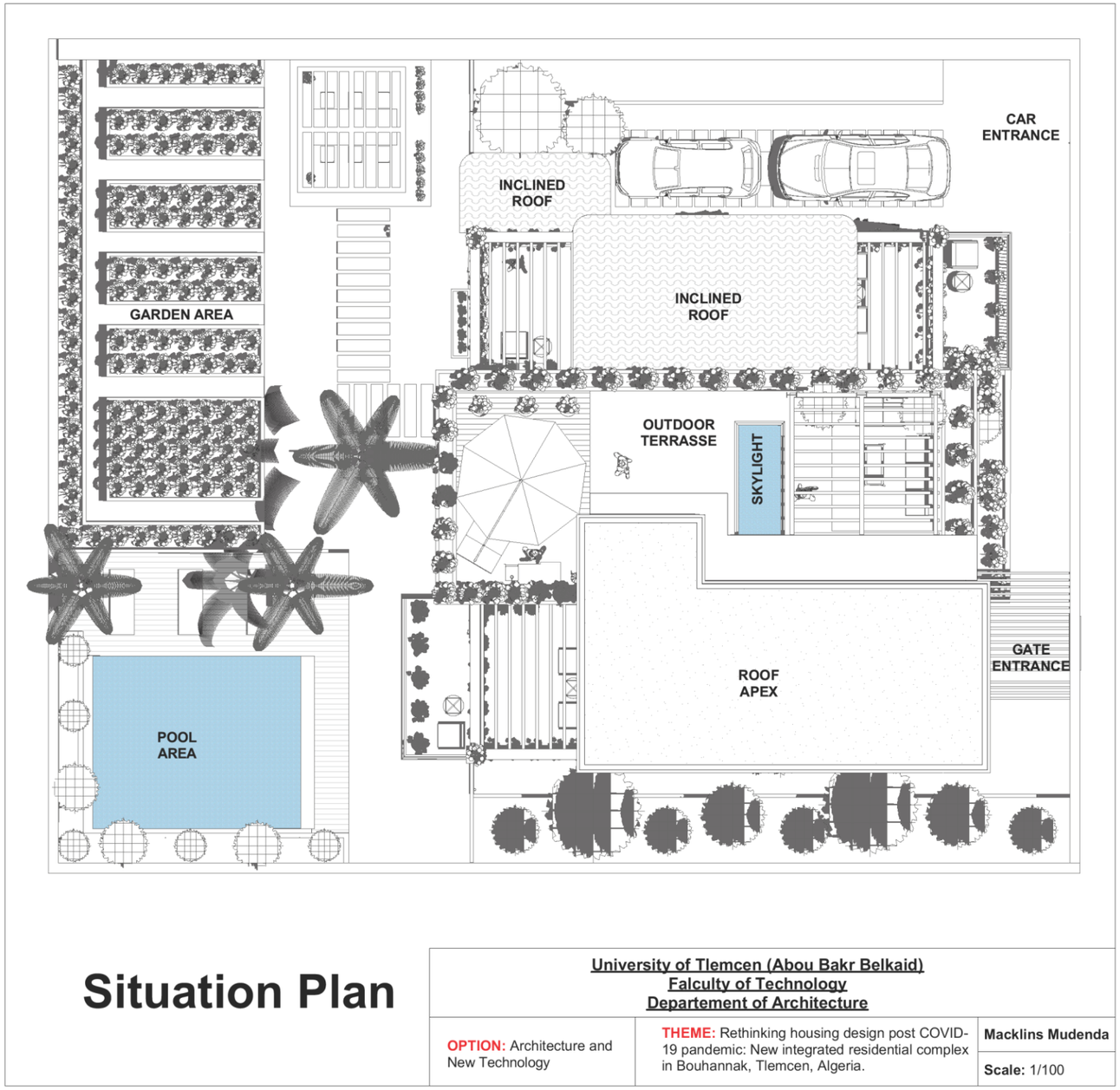


Figure 130: situation plan for one individual house:

1.57.12Ground floor plan :

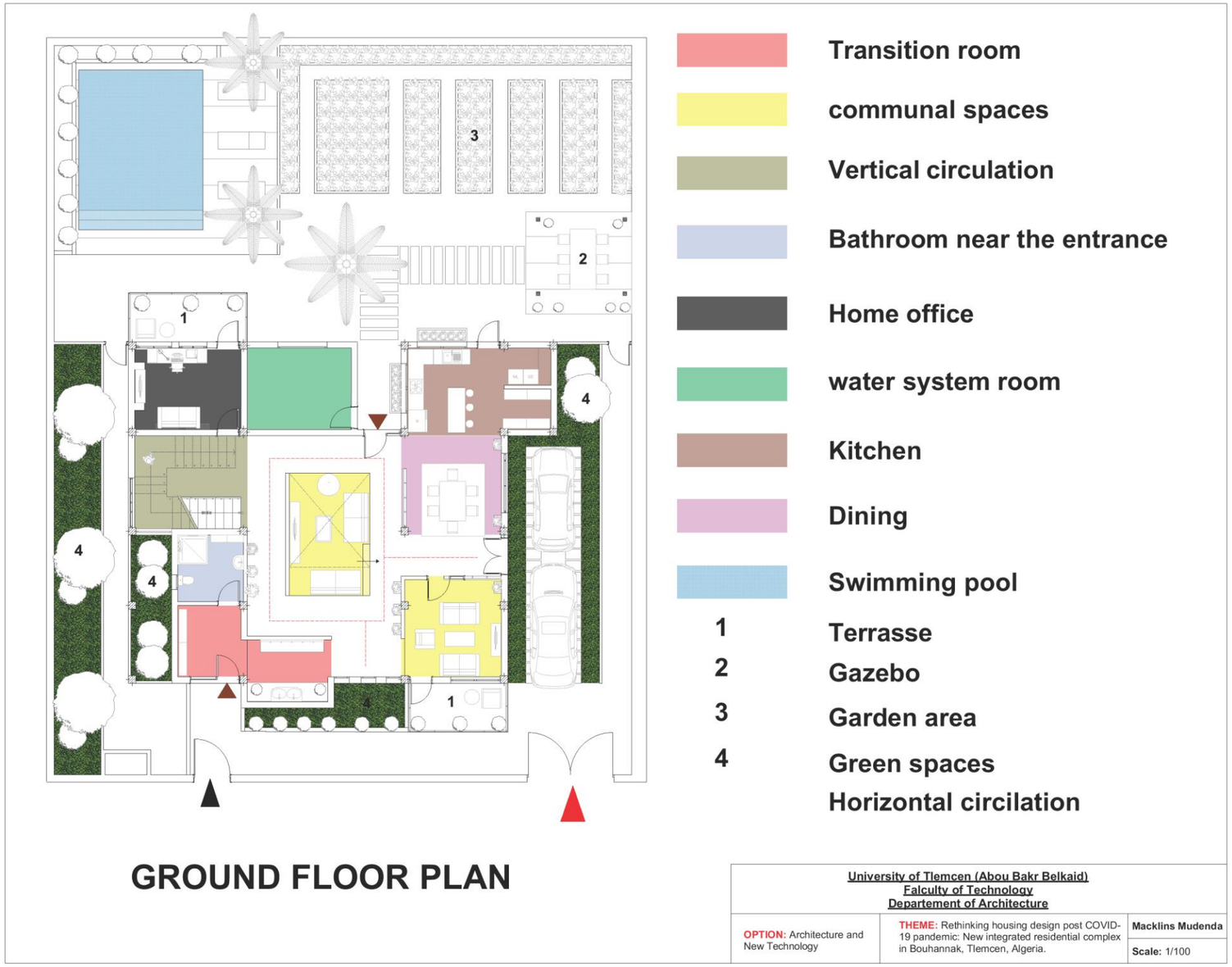


Figure 131: ground floor plan for individual house:

1.57.13 First and Second floor plan:

Accessible through the staircase, which is composed of a game room, master bedroom, bedroom 1 and balconies.

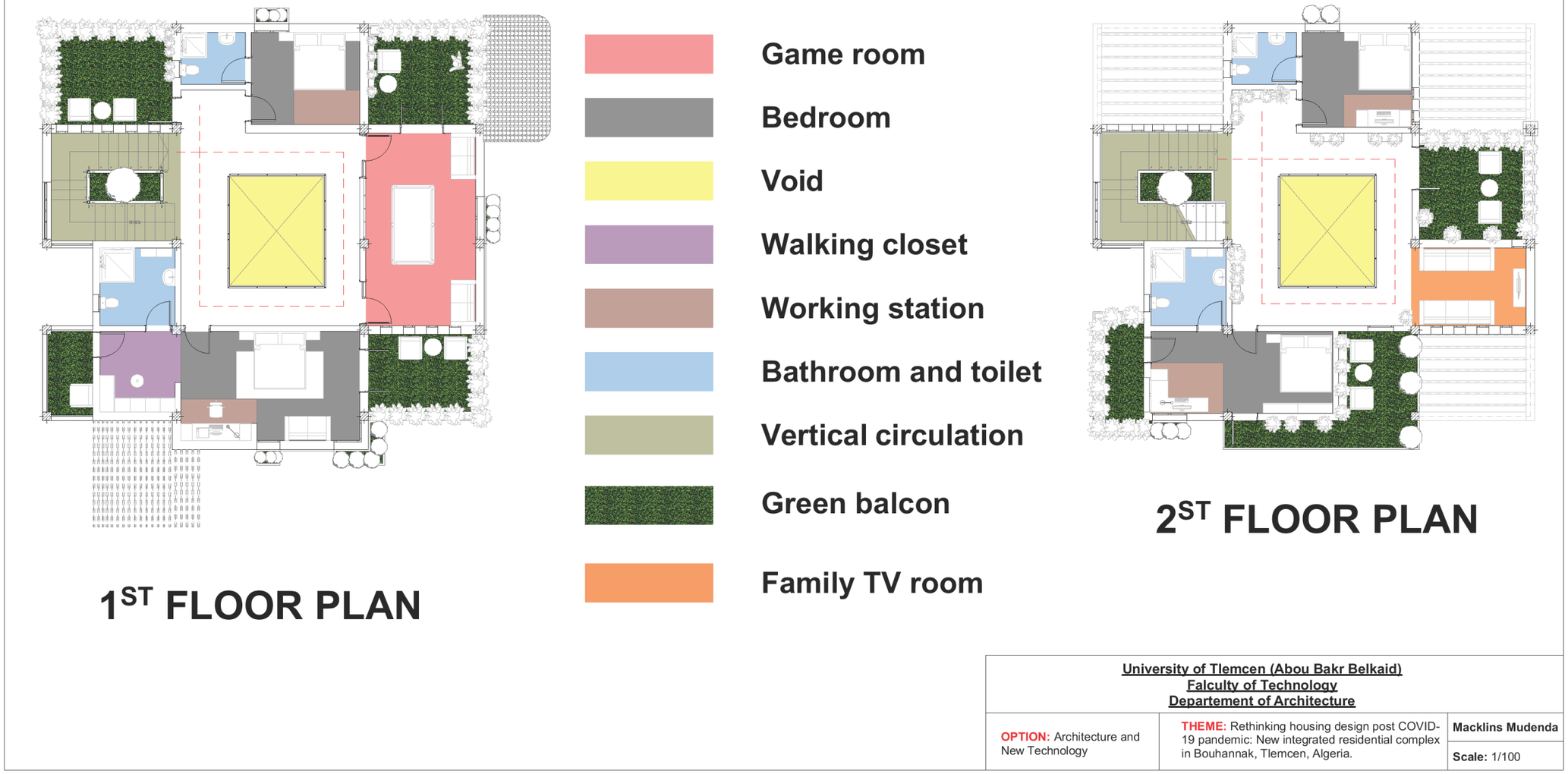


Figure 132: First and Second floor plan for individual house:

1.57.14 LAST FLOOR FOR INDIVIDUAL HOUSE:

Thanks to the void, which acts as the central place of distribution. The second floor has a family room, bigger balcons, bedroom2 and bedroom3 (self-contained) and each bedroom has a working station.The last floor of an individual house has less functions, the third floor maximizes the use of terrasse for patios, grilling area, tools room, terrasse garden and WC.

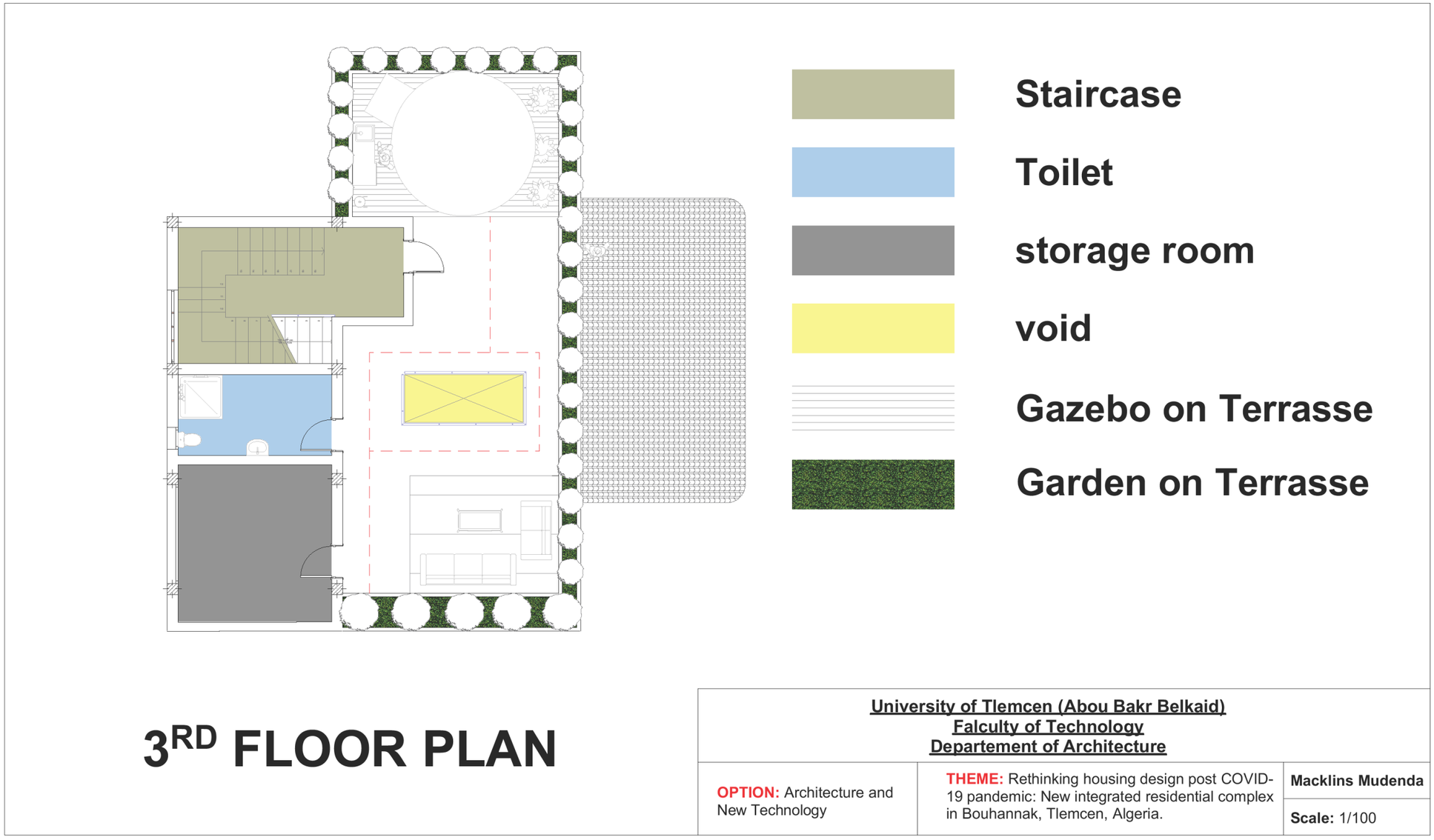


Figure 133: LAST FLOOR FOR THE INDIVIDUAL HOUSE:

1.57.15 Elevations:

Figure 134: Elevations for individual house:

1.57.16 Sections:

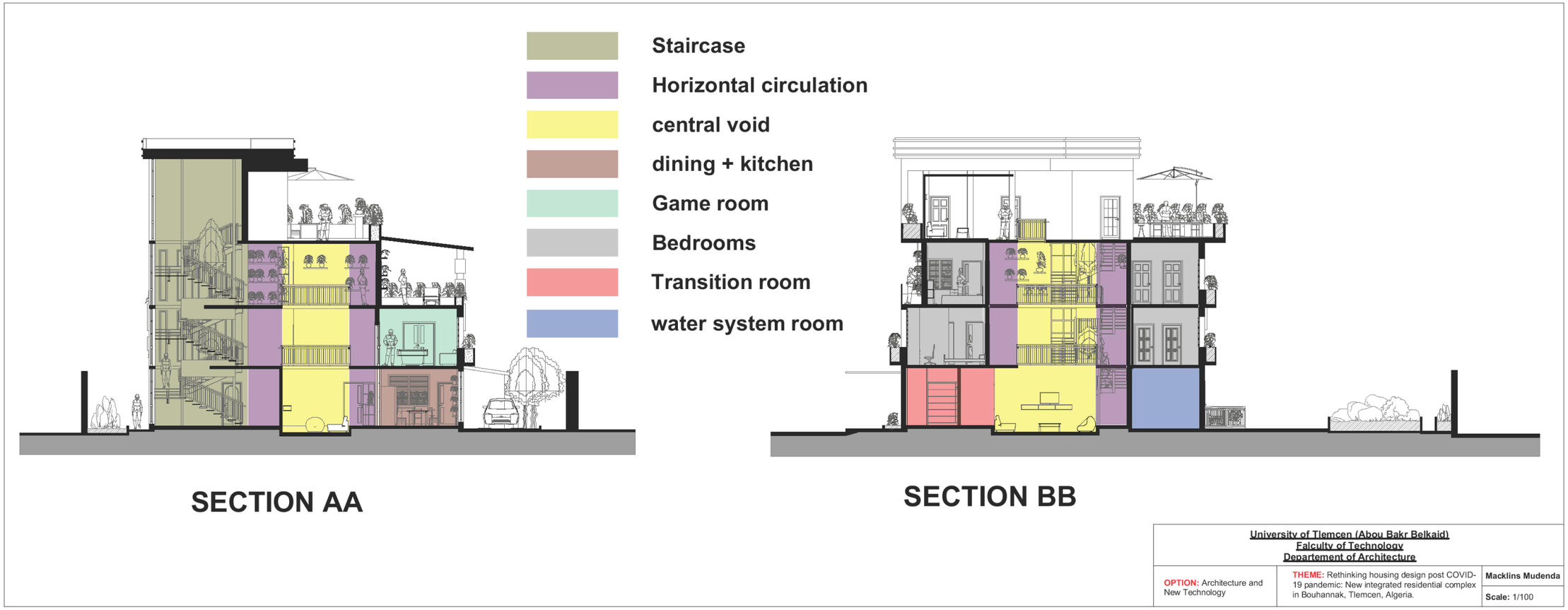
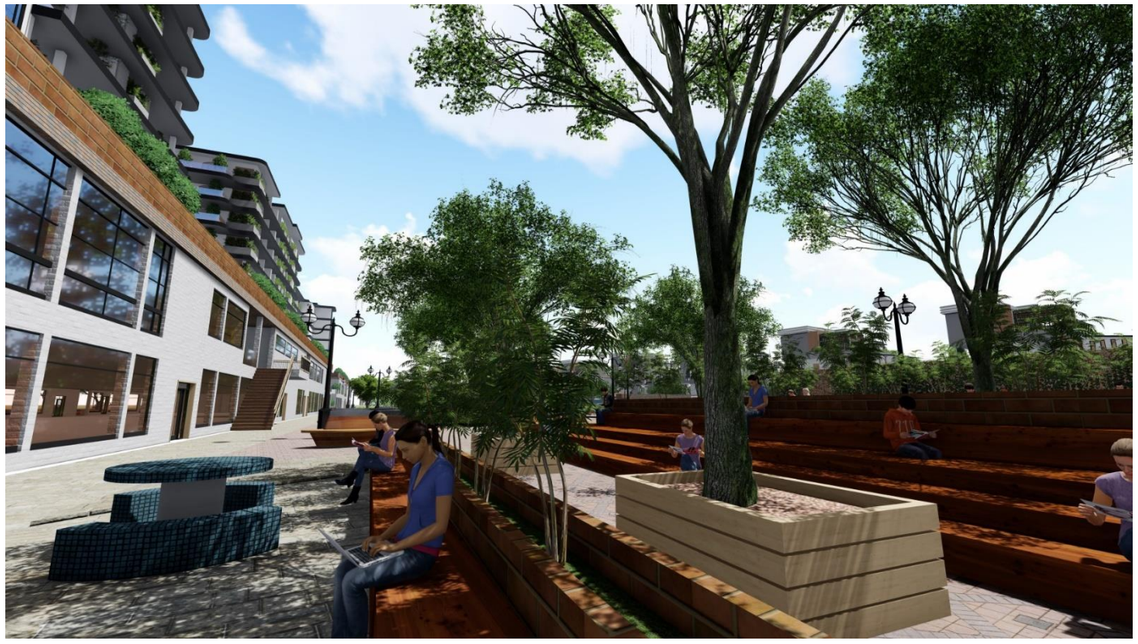


Figure 135: sections for individual house:

1.57.17 (3D RENDERS) for individual house:

1.57.18(3D RENDERS COLLECTIVELY)



Chapitre 5:The technical approach

Introduction.

The role of the structural system is to ensure the stability of a work, it takes part in the architectural composition, the organization and the spatial quality of the architectural project is carried out through three frameworks: functional, formal and structural.

In this chapter, the project is presented in terms of materials, construction techniques and technology in order to meet the following criteria:

- The stability of the structure
- Comfort and economy
- Safety and aesthetics.

1.58 Choix de la structure:

I opted for the reinforced concrete skeleton structural system. A concrete frame is a common form of structure, comprising a network of columns and connecting beams that forms the structural 'skeleton' of a building. This grid of beams and columns is typically constructed on a concrete foundation and is used to support the building's floors, roof, walls, cladding and so on.[27]

Figure136: skeleton structural system:

1.58.1 The Sustructure :

The infrastructure forms the base or foundation of the building .This is a set of interconnected structural elements that provide a framework to support the entire structure from the bottom using elements such as foundations[28]

[27] https://civiljungle.com/reinforced-concrete/
[28] WEB : https://fr.wikipedia.org/wiki/Infrastructure

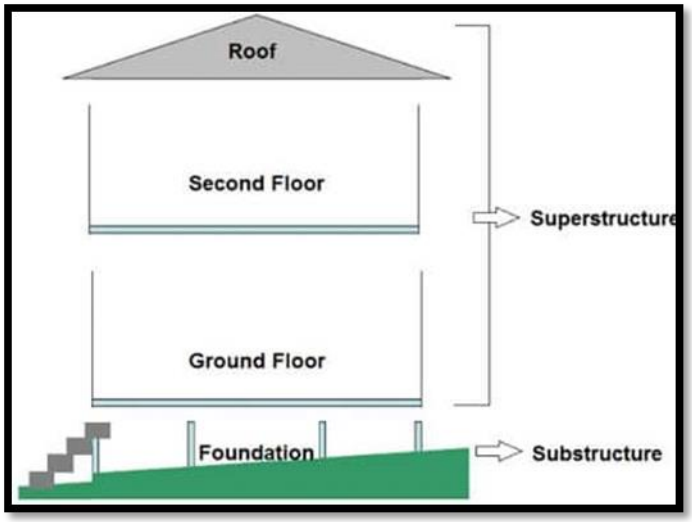


Figure 137: superstructure and substructure in a building:

1.58.2 Foundations :

There two types of foundations used in this project: spread footing (shallow foundation) for the individual houses and pile foundation (Isolated or column footing) for the collective housing.[29]

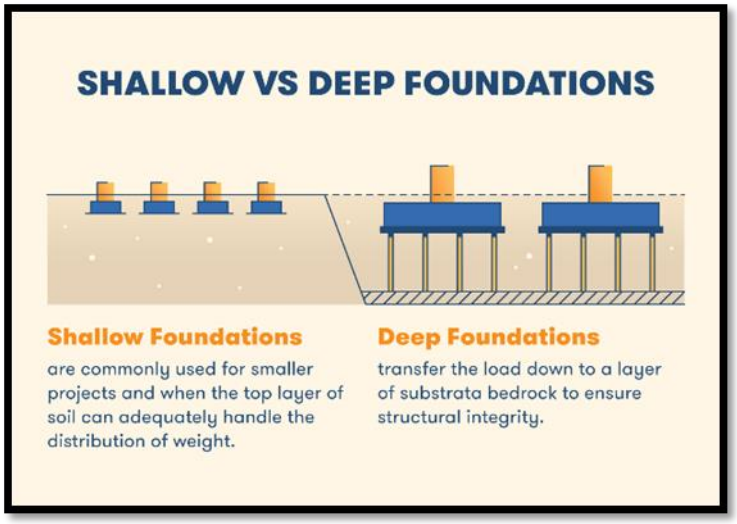


Figure 138: types of foundatios:

a Pile Foundation

[29] https://www.bigrentz.com/blog/types-of-foundations

Pile foundation, a kind of deep foundation, is actually a slender column or long cylinder made of materials such as concrete or steel which are used to support the structure and transfer the load at desired depth either by end bearing or skin friction.[30]

Figure 139: pile foundation:

Pile foundations are deep foundations. They are formed by long, slender, columnar elements typically made from steel or reinforced concrete, or sometimes timber. A foundation is described as 'piled' when its depth is more than three times its breadth.[31]

b Isolated or column footing:

In this project, the spread footing are used to support individual columns. They can either be of stepped type or have projections in the concrete base. In the case of heavily loaded columns, steel reinforcement is provided in both the directions in a concrete bed.[32]

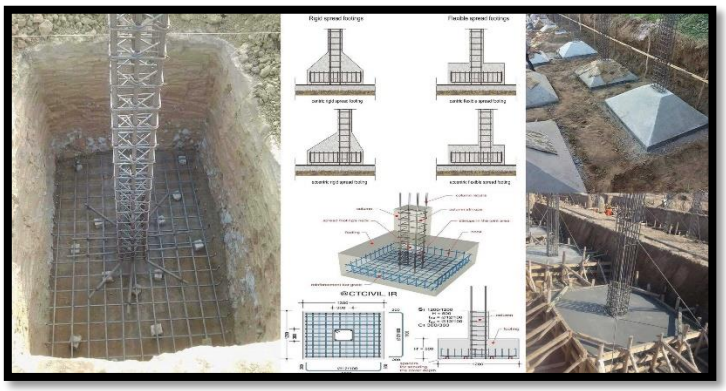


Figure 140: spread footings:

1.58.3 Superstructure :

[30] https://civiltoday.com/geotechnical-engineering/foundation-engineering/deep-foundation/176-pile-foundation-definition-types
[31] https://paddyengineering.blogspot.com/2015/12/pile-foundation-need-and-functions.html
[32] https://www.civilknowledges.com/spread-foundation/#Strap_footing_or_cantilever_footing

The project was divided into several blocks separated by expansion joints not exceeding 25 meters, the columns and beams dimensions are variable according to the spaces, ranging from 2.00 to 8.00 m

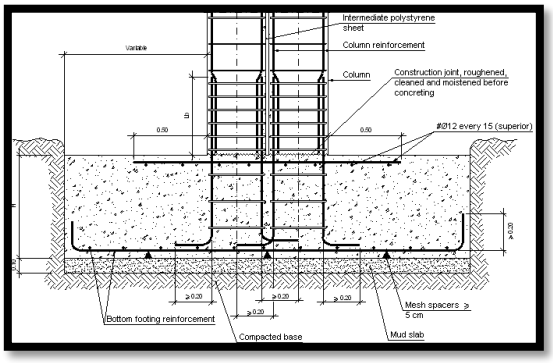


Figure 141: footing at expansion joint:

1.58.4 Vertical circulation :

a Stairwells :

For the stairwells, it will be made of reinforced concrete dosed at 350kg / m3 of CPA cement and coated with available materials that match the type of architecture chosen.

Figure 142: reinforced concrete stairwells:

b The elevators :

Figure 143: the elevator:

1.58.5 Tied Column :

Square columns with reinforced concrete of dimension (40 x 40 cm), the square shape gives a better resistance because the inertia is equal on all sides. Longitudinal reinforcement are confined within closely spaced tie reinforcement. [33]

Figure 144: tied column:

1.58.6 The beams: (reinforced concrete beams)

Reinforced concrete beams are structural elements, designed to carry transversal loads. These loads can cause bending moments, shear forces and in some cases torsion across their length. Furthermore, beams support the loads from slabs, other beams, walls, and columns.[34]

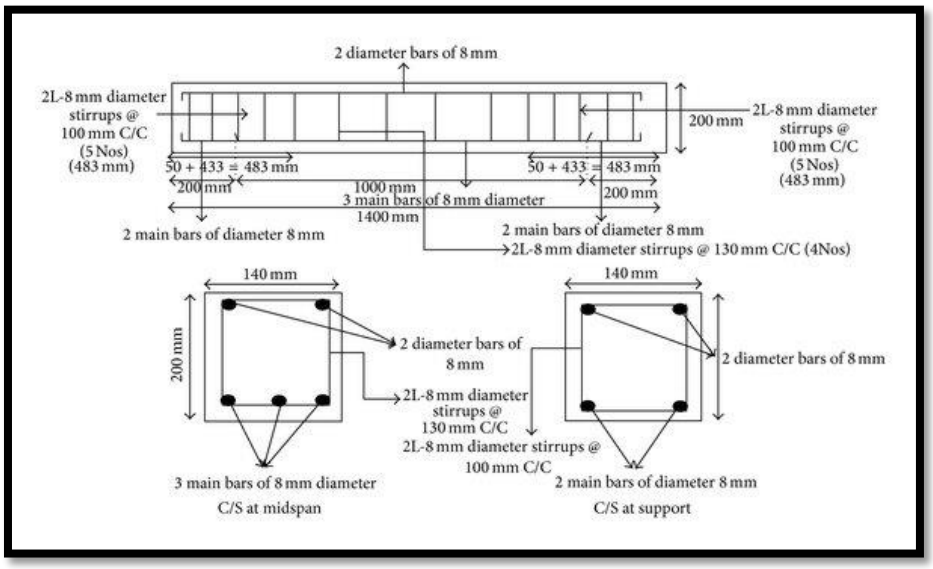


Figure 145: details of reinforced concrete beam:

1.58.7 Concrfete floor Slab:

[33] https://theconstructor.org/tips/types-columns-building-construction/24764/
[34] https://theconstructor.org/tips/rectangular-reinforced-concrete-beam-design/7472/

Slabs are constructed to provide flat surfaces, usually horizontal in building floors, roofs, bridges, and other types of structures. There are Different types of floor slabs, different types of concrete slabs may be more suitable to a particular site and climate zone than other Slab. The slabs should be 15cm thickness.

1.58.8 Structural Joints:

Concrete, like most materials, reacts to changes in temperature and humidity by expanding or contracting. Therefore, this reaction creates a movement that must be imperatively compensated if we want to preserve the integrity of the building.[35] Expansion joints have to be placed every 25 meters. Since building expansion joints are designed to isolate sections of a building, they inevitably cut through floors. Copper and copper alloys can be used in floor expansion joints as trim and cover plates to prevent the flow of water through the expansion space.[36]

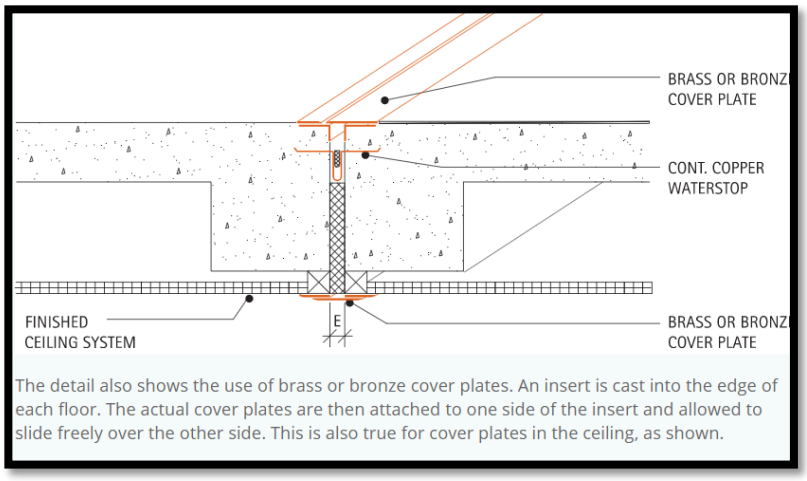


Figure 146: Structural Joints:

1.58.9 Ceilings:

They are made with conventional ceiling .The simplest type of ceiling is often finished with drywall and then painted. These ceilings are made of lower-cost materials, requiring easy installation.

[35] https://www.plus-que-pro.fr/P-980-440-B1-tout-savoir-sur-le-joint-de-dilatation.html
[36] https://www.copper.org/applications/architecture/arch_dhb/arch-details/building_expansion/floor_conditions.html

Figure147: conventional ceiling:

1.58.10 Ceilings:

These are the room control systems: heating, ventilation, air conditioning and Lighting.

a Electricity:

An electrical room is a room or space in a building dedicated to electrical equipment. This room is situated under ground with Generator to remedy any cut in the urban network.

Figure 148: electrical room:

b Electricity:

This Installation is aimed at homogenizing the temperature by removing heat and controlling the humidity of air in an enclosed space to achieve a more comfortable interior environment.[37] Central air conditioners system is used in this project to circulate cool air through a system of supply and return ducts. The supply ducts and registers (i.e., openings

[37] https://www.lowes.com/c/Air-conditioners-fans-Heating-cooling

in the walls, floors, or ceilings covered by grills) carry cooled air from the air conditioner to the home.[38]

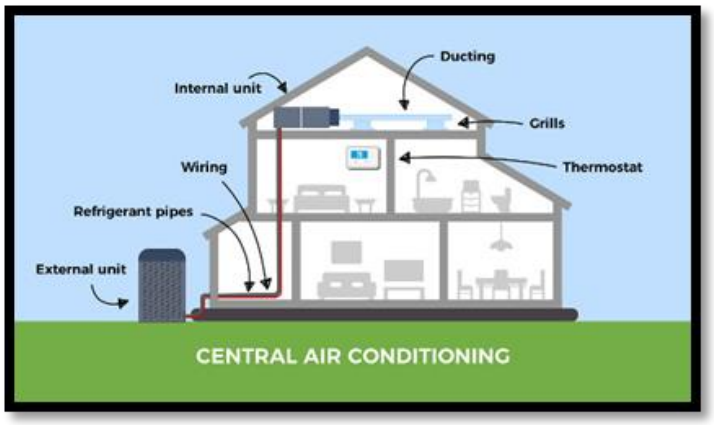


Figure 149: central air conditioning:

c Hot water radiator system:[39]

Zone control works best in homes designed to operate in different heating zones, with each zone insulated from the others.

The system works by Hot water entering the radiator, and cooler water leaves the other side of the radiator and travels around the pipework to end up back in the boiler, where it is re-heated. Radiators have valves that can control the heat output of the radiator.[40]

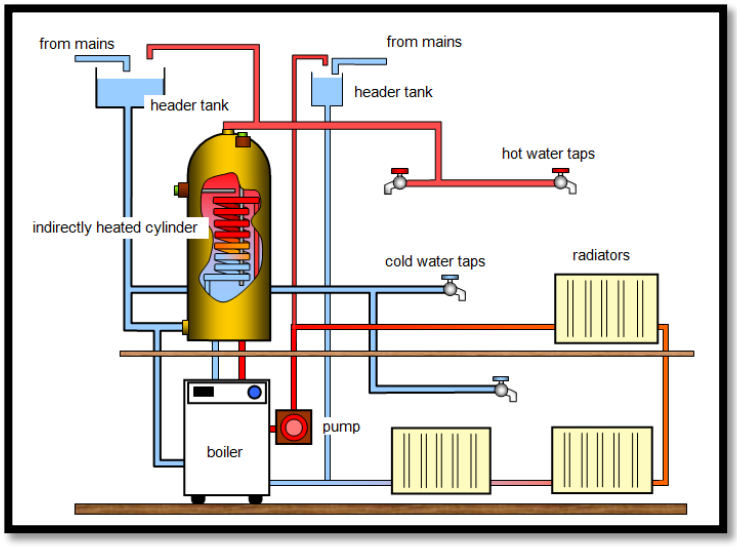


Figure 150: hot water radiator system:

[38] https://www.energy.gov/energysaver/central-air-conditioning
[39] https://www.energy.gov/energysaver/heat-distribution-systems
[40] https://www.mrcentralheating.co.uk/blog/central-heating-systems

d Fire protection:

In order to protect users against the fire, it is essential to set up some protection systems to ensure the stability of the structure in the event that a fire breaks out. Among the protective and firefighting equipment to be used include:[41]

- Smoke detectors.
- Alarm triggering devices.
- Fire hydrants
- Fire extinguishers.
- Fire Sprinklers

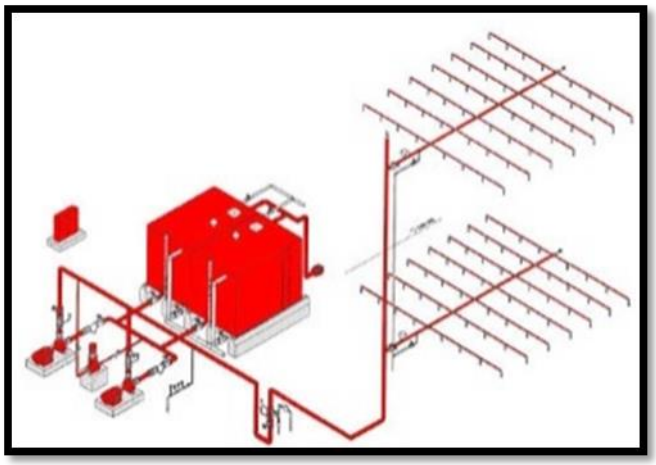


Figure 151: firesystem Protection:

e Water supply system:

Drinking water will be supplied by connecting to the city's main water supply network. This water goes direct into underground reinforced concrete water tank.

1.58.11Double-glazed curtain wall:

Double glazed curtain walls has there are two layers of building envelop, and has one more air cavity than single layer curtain wall system.

[41] https://dir.indiamart.com/impcat/fire-fighting-equipments.html

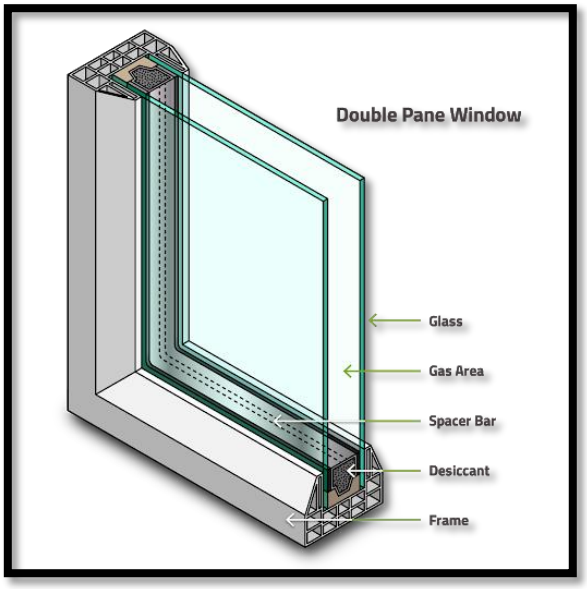


Figure 152: double glazed curtain wall:

The cavity reduces the effect of cold walls, reduces heat loss and improves sound insulation and protects from the sun's rays by avoiding overheating during the day.these walls are only applied in the staircase spaces.

1.58.12Double walls:

A double wall improves sound and thermal insulation. Between the new wall and the existing wall or in the structure. All exterior walls should have double walls.

1.58.13 Internal walls:

Should have the thickness of 15cm. Interior walls sorounding the home office should be insulated.

1.58.14Construction materials:

Local natural materials are to be used, recycled, recovered and reused in relation to: economic cost, thermal inertia that measures its capacity to accumulate heat. The materials chosen are wood, rockwool, glasswool, reinforced concrete and brick.for more materials see chapter 3. Windows:

1.58.15 Windows:

Shutters should be used, these type of window treatment consisting of wood or faux wood louvers mounted in a solid frame. The louvers are manipulated by a tilt rod hidden at

the back or in the middle of the shutter.With Double glazed windows in waterproof aluminum joinery with thermal break and glazing, ensuring good sound insulation.

1.58.16 Roof insulation:[42]

To properly insulate the roofs, a green roof system is to be used on the collective housing blocs .The green roof is covered with extensive vegetation.

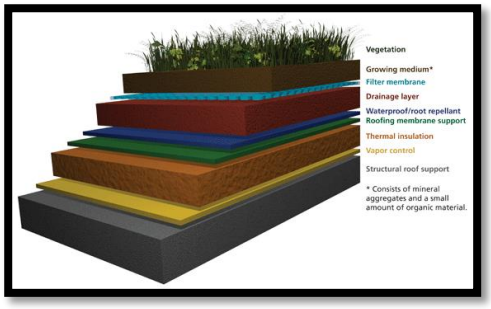


Figure 153: roof insulation:

1.58.17 Lighting:

It is necessary to ensure good lighting for the accommodation, for this we have chosen:

- Natural lighting provided by large opening windoors
- Wall lighting with energy saving lamps
- Street lights

1.58.18 Flooring:

White marble in the living rooms shops, living rooms and halls and LINOLEUM flooring in the bedrooms. In bathrooms and toilets, Terrazzo floors are used.

1.58.19 Exterior colors:

Off white plaster and gray off white plaste for the facades

1.58.20 Rainwater recovery:

[42] https://www.flint-immobilier.com/comment-faire-une-toiture-vegetalisee.html

The recovered water is treated and distributed for different uses; the water reserved for watering mainly green spaces on the central parc. The water undergoes a series of filters, which allows the elimination of organic waste (leaves, stones, etc.)The water will be channeled from the roofs and the soil then accumulated in tanks. This water will also be used to clean private, watering gardens and public spaces.

1.58.21 Waste management:

Movable Waste containers should be placed outside intended for the pre-collection of waste as part of selective sorting of household waste. This makes it possible to group and organize waste collection in a single point, which is later collected by garbage collection trucks from the city.

Figure 154: waste management:

General conclusion

1.58.22 Conclusion:

This project serves an accomplishment of my journey from the school of architecture. During this period of intensive training, I have acquired knowledge, which is expressed in this thesis, knowledge that is vital in the architectural production with a logical and technical approach.

In order to come up with the final stage the project, I had to undergo various steps in order to have a clear understanding of what is required from this research. The first step I had to study was the analytical approach: this includes the site analysis and case studies of various examples that relate to the research title. Architectural response and programming is the second step to be studied, which resulted into finding giving solutions to the problems raised and producing a specific program for the project.

The project is mainly designed for the post pandemic era with an intention to minimize the spread of the virus. This is possible because architecture is an expression of civilization; hence, with the help of technology, it is used to fight the pandemic.

The problems that came with the pandemic had to be studied interms of: how it affects the social life of the inhabitants, how long the virus stays on surfaces and finally, how the COVID is spread from one person to another.

I hope this work responds to the urgency and demand of building homes that minimize the spread of any virus and improves the social life of inhabitants during lock downs. Nevertheless, this work stand to be corrected improved and finished.

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