VERTICAL SPACE MAKING IN DEVELOPING URBAN BLOCK

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Socio-Environmental Inquiry into VERTICAL SPACE MAKING IN DEVELOPING URBAN BLOCK SUBMITTED BY SHOEB ZIAULLAH KHAN A REPORT Submitted in partial fulfillment of the requirements for the degree of Bachelor of Architecture. 2020-2021

Socio-Environmental Inquiry into

VERTICAL SPACE MAKING IN DEVELOPING URBAN BLOCK

SUBMITTED BY

SHOEB ZIAULLAH KHAN

A REPORT

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Architecture.

University of Mumbai

2020-2021

AIKTC
SCHOOL OF ARCHITECTURE

CERTIFICATE

This is to certify that the Design Dissertation titled **Vertical Space Making in Developing Urban Block** is the bonafide work of the student **SHOEB ZIAULLAH KHAN** from Final Year B. Arch of AIKTC School of Architecture and was carried out in college under my guidance.

Sign of the guide:

Name of the guide: **Prof. ABHISHEK.KADAM**

Sign of the Dean: **Prof. RAJ. MATRE**

Date: 12/12/20

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I hereby declare that this written submission entitled

"Vertical Space Making in Developing Urban Block"

represents my ideas in my own words and has not been taken from the work of others (as from books, articles, essays, dissertations, other media and online); and where others' ideas or words have been included, I have adequately cited and referenced the original sources. Direct quotations from books, journal articles, internet sources, other texts, or any other source whatsoever are acknowledged and the source cited are identified in the dissertation references.

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Signature of the Student:

Name of the Student: **SHOEB.Z. KHAN**

Roll No: 16AR11

Date: 12/12/20

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Shoeb.Ziaullah. Khan

Abstract

As populations expand, Urban migration, whereby population flocks to urban center looking for work leaves cities short on affordable housing, transport link and can either lead to inner city poverty or urban sprawl. Increasing demands for urban spaces pushed environment to grow vertical and compact.

The customary front yard houses are removed and revamped into vertical housing, losing their greenness and their area. We need to find ways to house people without destroying what's left of our natural environment. Building upward rather than outward empowers us to have tremendous measures of individuals in a little impression, while rationing area and regular assets. We could then utilize the land for food creation, amusement or normal assets, or leave it as a characteristic zone

Urban sprawl is basically another word for urbanization. It refers to the migration of a population from populated towns and cities to low density residential development over more and more rural land. The end result is the spreading of a city and its suburbs over more and more rural land. In other words, urban sprawl is defined as low density residential and commercial development on undeveloped land.

Migration and urban sprawl aren't something that is just now becoming popular, as it has been around for quite some time. Cities and their suburbs are now becoming overcrowded because of this.

The effects of urban sprawl are even more problematic. The increase in public expenditure, health issues, increased traffic, environmental issues. These issues can be reduced in dense living. The cities that are denser perform the best. The cities like Manhattan, Hong Kong are less in environmental issues compared to other cities.

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CHAPTER 1

Introduction

"From the great pyramid of Giza to the Tower of Babel, brick by brick and stone by stone, mankind has been consumed by one singular desire, to touch the sky" – (Skyscraper – 2018)

Man has consistently constructed amazing structures for the divine beings, including sanctuaries, pyramids and houses of prayer which highlighted the sky; in any case, the present landmarks, for example tall structures, represent influence, lavishness, power, prestige, richness, and greatness. The evolution, from the old endeavors to arrive at paradise with the Tower of Babel to the world's tallest structure Burj Khalifa, has been to conquered the restrictions of nature with human creativity.

Before Industrial Revolution stone and brick walls were used for carrying out building loads as it was all load bearing structure and each floor were very heavy, therefore it was impossible to build very high houses. In mid 90s steel was discovered and became an integral part of the building. It was light and can take heavy loads. Architects could now use this material to construct steel skeleton to support tall structures. High- rises could have totally useless if users had to walk up and down so many stairs daily. In 1853 a safety elevator was invented to carry users which was a historic invention in the construction field. These mechanical developments were first used in the Home Insurance Building (1885). Today, it is basically difficult to envision a significant city without tall structures. Tall structures are the most well-known milestones of urban areas, images of intensity, predominance of human resourcefulness over regular world, trust in innovation and a sign of public pride; what's more these, the significance of tall structures in the contemporary metropolitan improvement is without question actually expanding in spite of their few verifiable negative impacts on the nature of metropolitan life.

Fig.1. Burj Khalifa (Source – Google Image)

1.1 Background study

Mumbai city the Financial capital of India. Mumbai city is the second most crowded metropolitan city, wealthiest city with generally number of very rich people and tycoons in India. Mumbai is a significant center point for transport. The Demographic insights of Mumbai, as of to the Census report on 2011 - the number of inhabitants in Mumbai city was 1.38cr and 2020 population is now estimated at 2.04cr the territory of 603sqkm

The living space per individual is 4.5sqm per individual. Mumbai experiences a significant urbanization emergency like neediness, helpless general wellbeing, and land accessibility.

Mumbai is as of now home to the biggest number of supertalls and high rises under development on the planet. The city is going through an enormous development blast, with 6 supertalls (structures taller than 300 meters), 40+ of a lot a greater amount of elevated structures under development notwithstanding the mid-ascents existing as of now. The greater part of the high rises is private. Mumbai positions 33rd in the worldwide positioning in no. of 150m+ skyscraper, 21st in Asia and 1st in the India.

Fig.2. Mumbai skyline (Source – Google Image)

1.2 Definition of High Rise

- The Council on Tall Buildings and Urban Habitat (CTBUH) defines a high-rise building as “a building whose height creates different conditions in the design, construction, and use than those that exist in common buildings of a certain region and period” (CTBUH, 1995)
- “A high rise is a structure whose height is between 35 and 100 meters. A structure is automatically listed as high rise when it had minimum 12 floors, whether or not its height is known.” (Emporis Standard)
- “Any structure where height van has a serious impact on evacuation” (The International Conference of Fire Safety)
- “A structure having a comparatively large number of stories and equipped with elevators.” (oxford dictionary)

There is no absolute explanation of what constitutes a “High rise building;” the definition is subjective, measured against one or more of the following categories:

Height Relative to Context:

A 14-story structure may not be measured a tall building in a high-rise metropolitan such as Chicago or Hong Kong, but in a regional European city or a suburb this may be noticeably taller than the urban standard.

Fig.3. Relative height (Source – CTBUH)

Proportion:

There are many structures that are not predominantly high, but are lean enough to give the presence of a tall building. Contrarywise, there are several big/large-footprint structures that are moderately high, but their size/floor area rules them out of being categorized as a tall building.

Fig.4. Proportion (Source – CTBUH)

Embracing Technologies Relevant to Tall Buildings:

A building comprising technologies which may be attributed as being a invention of "tall". (e.g., specific vertical transportation technologies, structural wind bracing as a product of height, etc.).

Fig.5. Technologies. (Source – CTBUH)

1.3 Aim - TO RECOGNIZE & UNDERSTAND THE NEED OF VERTICAL DEVELOPMENT IN URBAN CITIES.

1.4 Objectives-

1} TO ESTABLISHING AND SCRUTINIZING THE EVOLUTION OF HIGH-RISE BUILDING THROUGH HISTORY.

2} TO ESTABLISH AND STUDY THE CO-RELATION BETWEEN URBANITY, DEVELOMENT AND HIGH-RISE BUILDING.

3} TO MEASURE THE IMPACT OF HIGH-RISE BUILDING ON GLOBAL CITIES.

4} TO COMPREHEND THE HIGH-RISE BUILDING – STRUCTURALLY, ARCHITECHTURALLY, BEHAVIOURALLY

5} UNDERSTANDING AND ANALYZING TRENDS IN ARCHITECTURE WITH RESPECT TO HIGH-RISE BUILDING.

1.5 Scope-

1} ANALYZING A SOLUTION FOR THE FUTURE URBAN CONTEXT AND DEVELOPING A SKYLINE OF A CITY.

2} DESIGNING A HIGH-RISE STRUCTURE BLENDED WITH NEW TECHNOLOGY THUS SOLVING THE PROBLEM OF HORIZONTAL EXPANSION LEADING TO LESS SPACE AVAILABLE.

3} DESIGNING A STRUCTURE WHICH WILL PROVIDE MIXED USE DEVELOPMENT WITH RECREATIONAL FACILITIES WHICH WILL REDUCE SPRAWL, REDUCE TRAVEL FOR WORK USE, LOW TRAFFIC MOVEMENT.

1.6 Limitation-

1} WORK IS LIMITED TO THE CORE URBAN DEVELEPMENT PROJECTS AND DOES NOT TAKE INTO CONSIDERATION OF LOW-INCOME GROUP.

2} THE PROJECT IS LIMITED TO SPECIFIC URBAN CONTEXT AND CANNOT BE DEVELOPED IN RURAL CONTEXT.

1.7 Methodology -

The process starts by identifying aims and objective followed by the literature study and reviews about high rise. The literature gives away from of the historical backdrop of skyscraper and the utilization of skyscraper in a metropolitan region later on, the issues of even denser urban communities. The impacts of elevated structure socially, natural and ecologically can be noted. Inferences from the case studies can be made. Byelaws, design considerations of the high-rise mixed use can be studied. Comparison of all these data and conclusions can be derived.

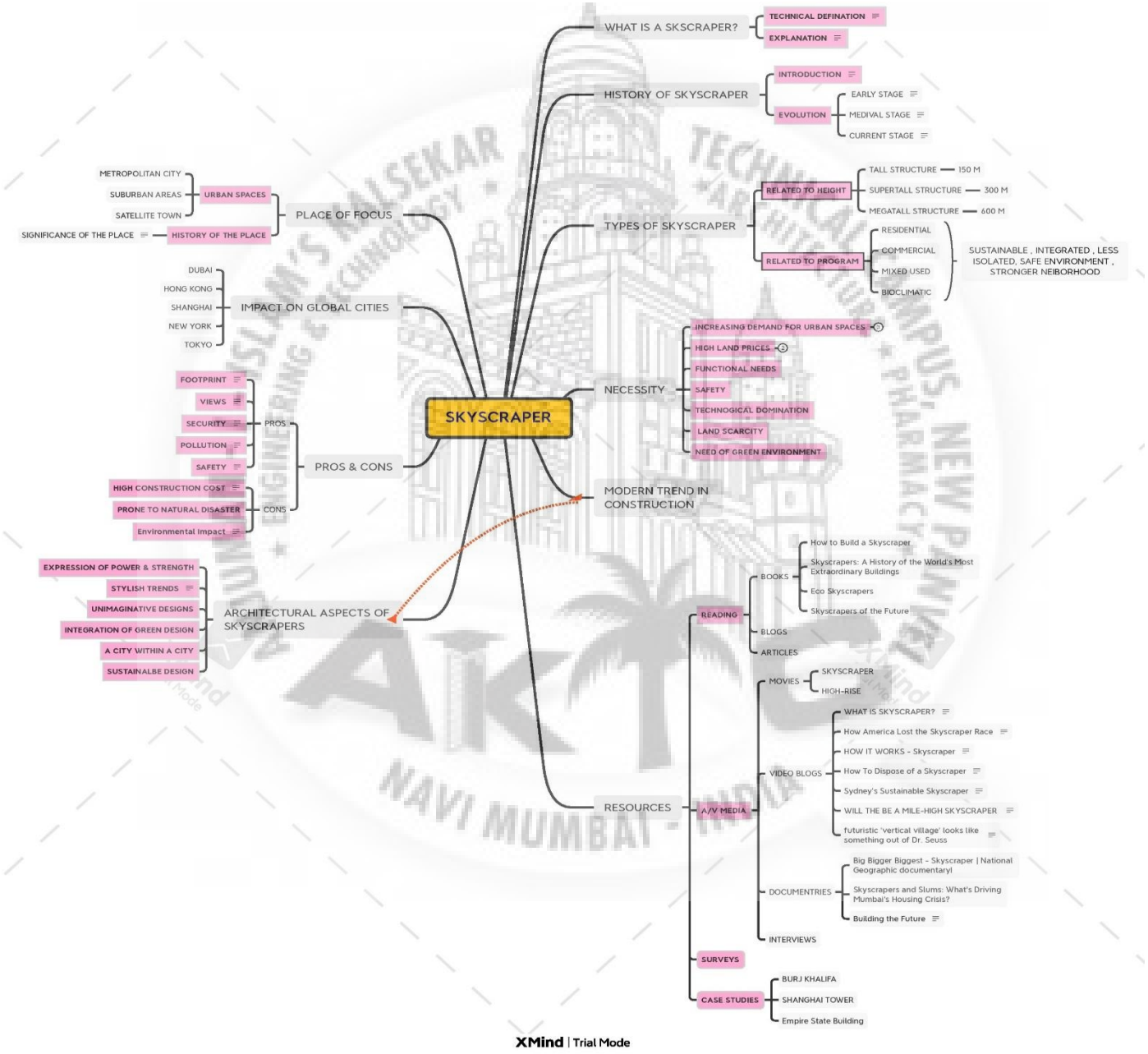


Fig.6. Mind map.

LITERATURE STUDY

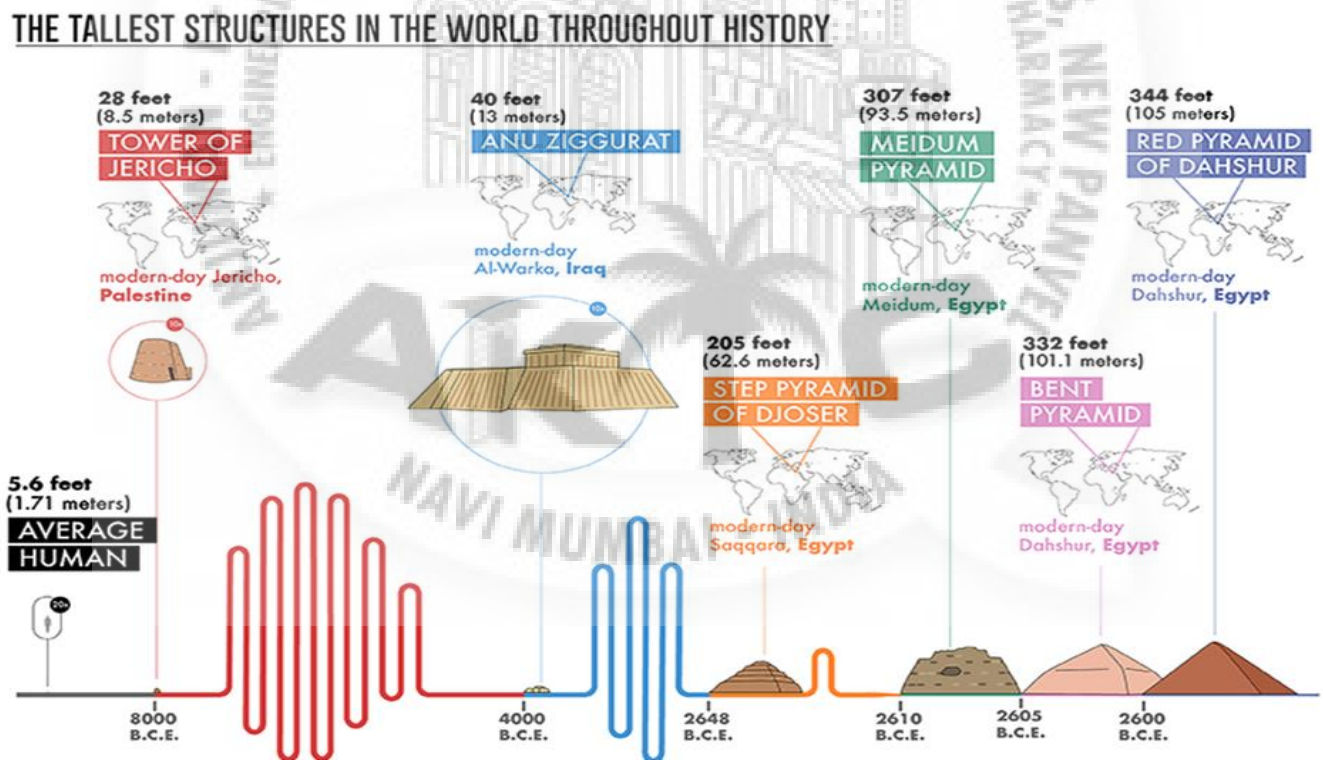
CHAPTER 2

2.1 History and Aspects of High-rise buildings

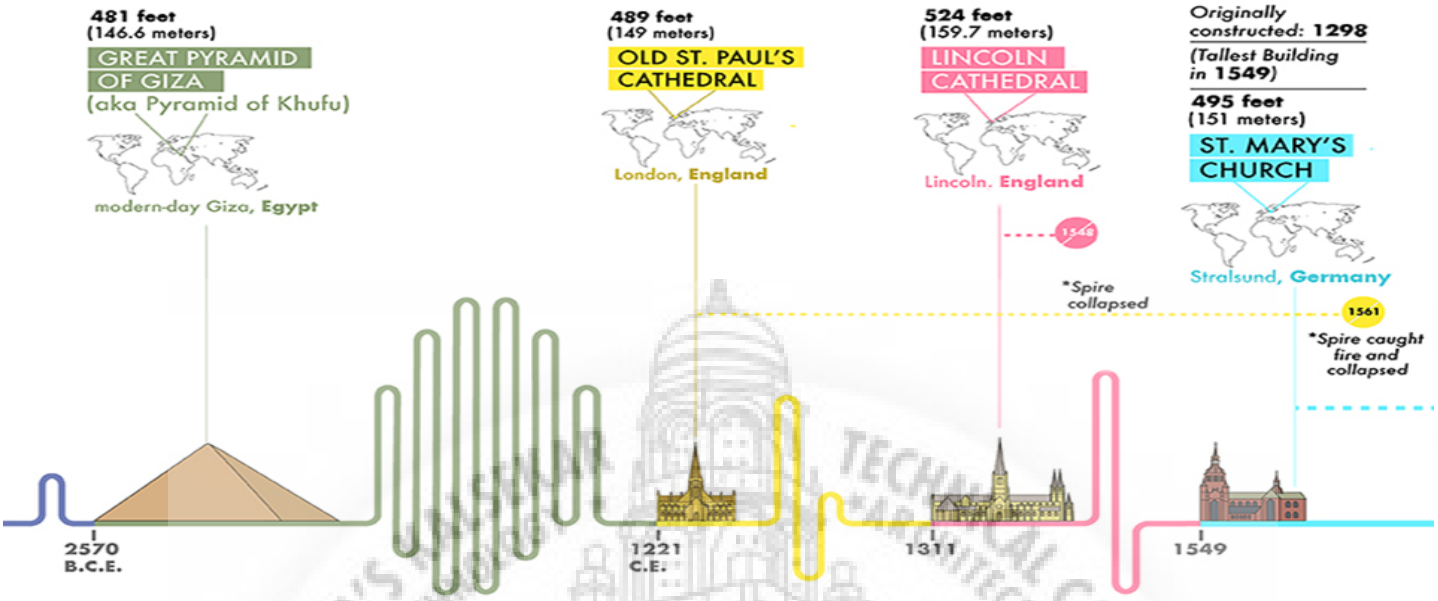
Evolution of HIGH-RISE discusses the history vertical structures are constant in meaning & stability in form where envelope determines time of origin. In comparative with vertical signifies human notion of God, who residence is associated to sky, so all sacred structures are directed upwards towards the sky. Though sacred structures, during time loses their prime and being substituted those which established human power.

The early Egyptians perhaps were the foremost to apply practical knowledge to the creation of structures; in any case, their astonishing buildings remain the best-understood earliest huge structures. Not only did their architects use astrology and geometry to design the pyramids, but also, they had to comprehend and apply much basic knowledge about the properties of materials to design the huge yet precisely constructed tombs that include intricate rooms and passageways.

The below time-line shows the Evolution of high rise through time.



THE TALLEST STRUCTURES IN THE WORLD THROUGHOUT HISTORY



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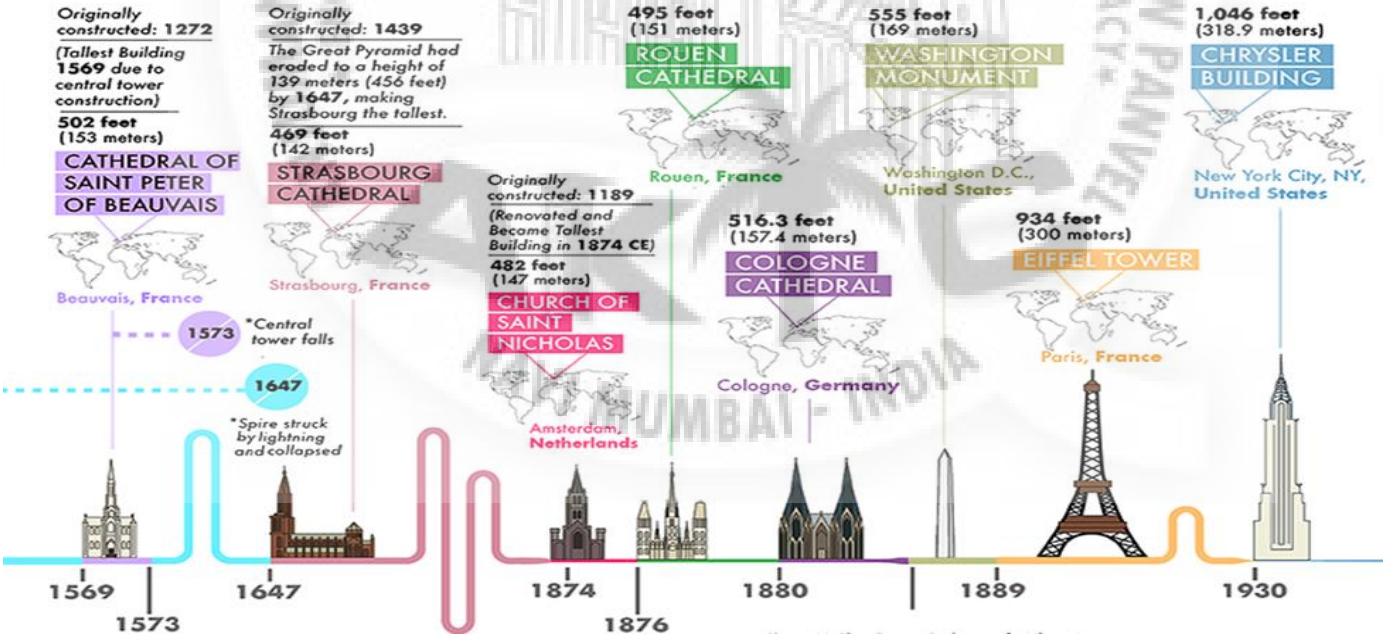


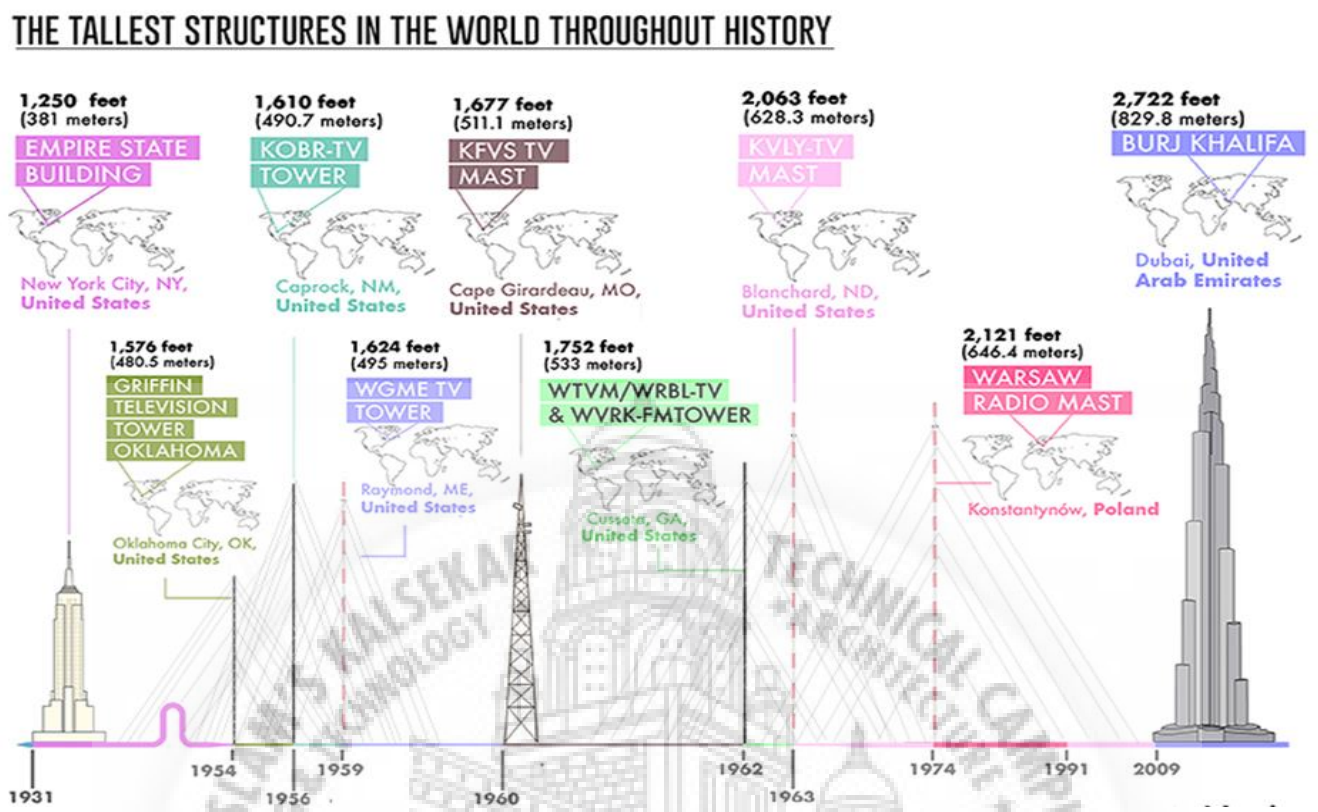


Fig.7. Time line (Source – Alansfactoryoutlet)

The modern high-rise building is generally considered to be an American invention. Both Chicago and New York claim they once hosted the world's first skyscraper, and even though the tallest buildings are now being built outside the United States, many American companies are involved in the architectural and structural design of today's world's tallest buildings.

The origin of the High-Rise Structure as the early Equitable Life Building in New York, which was completed in 1872, was the foremost high structure to have an elevator. Although it only had six floors. Due to elevator, the upper floors were in great demand than the lower floors. The home insurance building completed in Chicago in 1885 was the first to incorporate iron an iron skeleton structure to bear the load of the building. This building paved the paved way for the city's early skyscraper boom. The buildings rose higher & higher with the spread of pioneering construction methods as well as the invention & development of the elevator. The highly spectacular skylines of North American cities, particularly Chicago & New York, originated in the early years of 20th century.

Fig.8. Home insurance building. (Source – Britannica)

The famous skyscrapers of New York during early start:

- Equitable life assurance building, year 1870, 43m height, 8 stories
- Western union building, year 1875, 70m height, 10 stories
- Tribune building, year 1875, 79m height, 10 stories
- Home Insurance building, year 1885, 44m height, 10 stories
- Marshall Field building, year 1892, 83m height, 12 stories

2.2 Evolution of High Rise through Technology and Structurally

Elevators

Evolution of Multistorey through discovery of elevator is what started the word 'Tall'. The whole thing that came after that was affected. In 1853, Elisha Otis designed the world's foremost "safety elevator" with a catch mechanism that could keep users protected if the cable broke. On due course of time elevator came into existence. The upper floors used to be for the poor, but the notion of elevator overturned everything around. The upper floor swiftly became most striking as they boasted better natural light, cleaner air & less traffic noise.

Elevators are a complicated endeavor and require a separate design professional as a specialist elevator consultant on the design team (Yeang, 2000). Different orientations of the service core, elevator banks, sky lobbies, elevator zones and elevator systems must all be taken into account. The elevator is the life blood for a tall building, for without it the skyscrapers we know today would not be fathomable. The following is a brief early historical timeline of the elevator

- 1853 – Elisha Otis Graves unveils 1st safe passenger elevator (Bascomb, 2003)
- 1871 – 1st passenger elevator installed at 120 Broadway in New York City (Abramson, 2000)
- 1887 – 1st electric elevator in use
- 1904 – 1st gearless traction elevator installed
- 1924 – Variable voltage elevator introduced allowing quick movement without jerking and speeds of 1,100 feet per minute (Jencks, 1980)

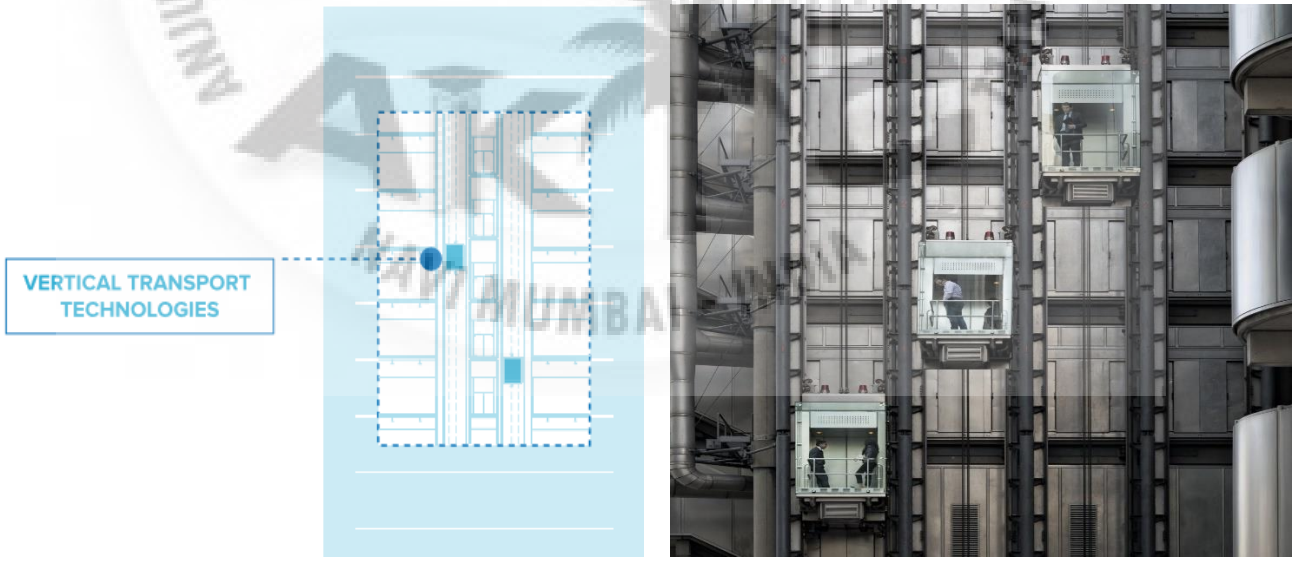


Fig.9. Vertical transport (Source – CTBUH)

Structural System

First generation (1780- 1850)

1. The external walls of these structures comprised of bricks and stones, though sometimes cast iron was added for enhancing purpose
2. The columns were built of cast iron, often vulnerable; steel and wrought iron were used for beams, and the floor were finished of woods.

Second generation (1850- 1940)

1. The second generations of high structures, which comprises the Metropolitans Life Building (1909), the Woolworth Building (1913), and the Empire State building (1931), are the framed structures, in which the skeleton of welded- or riveted-steel columns and beams, often enclosed in concrete, runs through the entire building.
2. This kind of construction makes a tremendously durable structure, but not such attractive floor space. The internal is full of hefty, load-bearing columns and walls.

Fig.10. Evolution of Structural System (Source - constrofacilitator.com)

Third generation (1940- Present)

1. Structures made from after World War-II till today make up the most recent generation of high-rise buildings.
2. Within this generation, here are those of steel-frame construction (core-construction and tube construction), reinforced concrete construction (shear wall), and steel-framed reinforced concrete construction.
3. Hybrid system also grown through this time. These structure uses more than one type of structural system in a building.

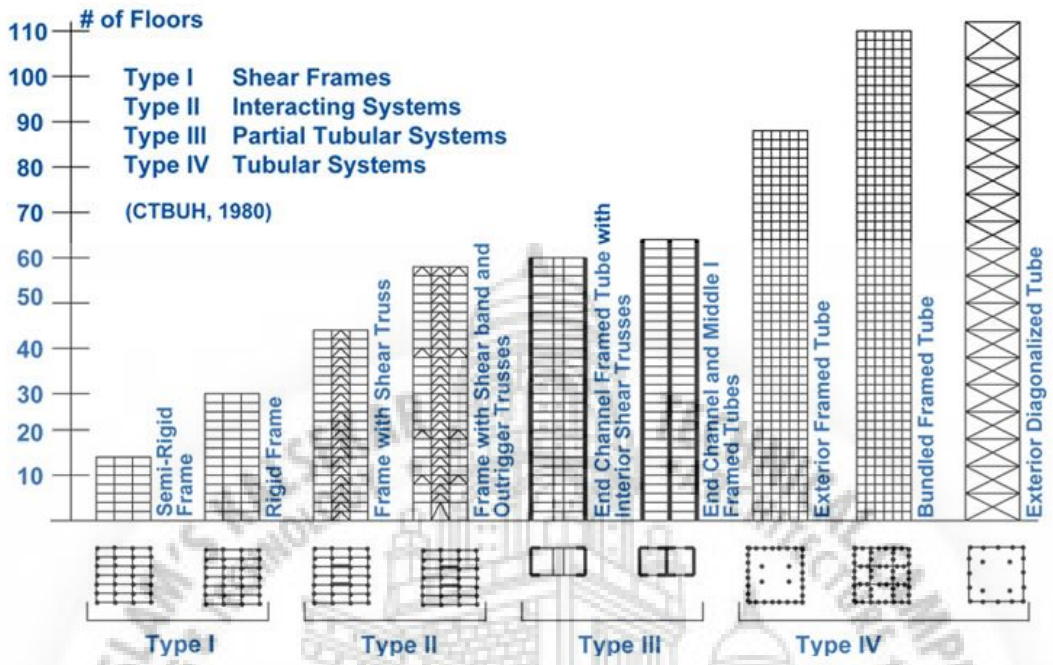


Fig.11. Types of Structural System (Source -Wikipedia)

Steel-Framed Core Construction – These buildings are constructed of reinforced concrete or lightweight steel frames, with exterior all-glass curtain walls. The so-termed curtain walls of our multistorey structures comprise of thin, vertical metal struts or mullions, which enclose the large glass boards constituting most of the wall surface. The curtain wall, constructed for lighting and temperature habituation purposes, ensures not to have the strength to stand by itself and is reinforced by a frame of steel or concrete, which constitutes the construction of the building.

Steel-Framed Tube Construction – Tube structures represented a change in the design of steel-framed buildings to enable them to be built tall and yet remain strong enough to resist the lateral forces of winds and the possible effects of an earthquake

Reinforced Concrete Construction – Concrete that has been solidified onto imbedded metal (generally steel) is called reinforced concrete, or ferroconcrete. The strengthening steel, which may take the form of rods, bars, or mesh, contributes tensile strength.

Steel-Framed Reinforced Concrete Construction – These buildings are a blend of reinforced concrete structure and steel-framed structure, henceforth the term steel-framed reinforced construction

Foundation

Underneath these mammoth structures lies an entire web of foundation systems that really is a mega structure under a mega structure. A problem facing early skyscraper designers, engineers and contractors were how the weight of the tall buildings was going to be transferred into the ground which supported the structure.

The esteemed architecture and engineering firm of Burnham and Root in Chicago had an answer and implemented a steel grillage design that was a reaction to the realization that former pyramid stone and cement structures were no longer practical, nor were they feasible for such loads as were required under tall buildings Rail-road ties laid at right angles were embedded in concrete with steel I-beams at the upper courses. In essence, The Rookery Building in Chicago was the first modern floating foundation using Burnham and Root's design (Starrett, 1928). Today's foundations are now filled with rebar and concrete which is very emblematic of foundations of old. The modern foundations found under today's skyscrapers are decedents of the original answer to securing

high-rise buildings and include

- Pad foundations
- Deep foundations
- Raft foundations
- Caisson foundations
- Pile and raft foundations
- Pile, raft and slurry wall foundations

Fig.12. Types of foundation (Source – Google)

Curtain Wall

Escalation of curtain wall through early 1950s led to a innovative practice of floor to ceiling glass, joined with better lightning & ventilation, intended distinct floors could be much immense, the architectural style of rectangular tower of glass developed the typical of global style high-rise building. The non-load bearing, glass curtain walls maximized usable floor space by refining external light penetration. This architectural style of rectangular towers of glass converted the standard of Global Style high-rise building. The non-load bearing, glass curtain walls maximized usable floor space by improving external light penetration.

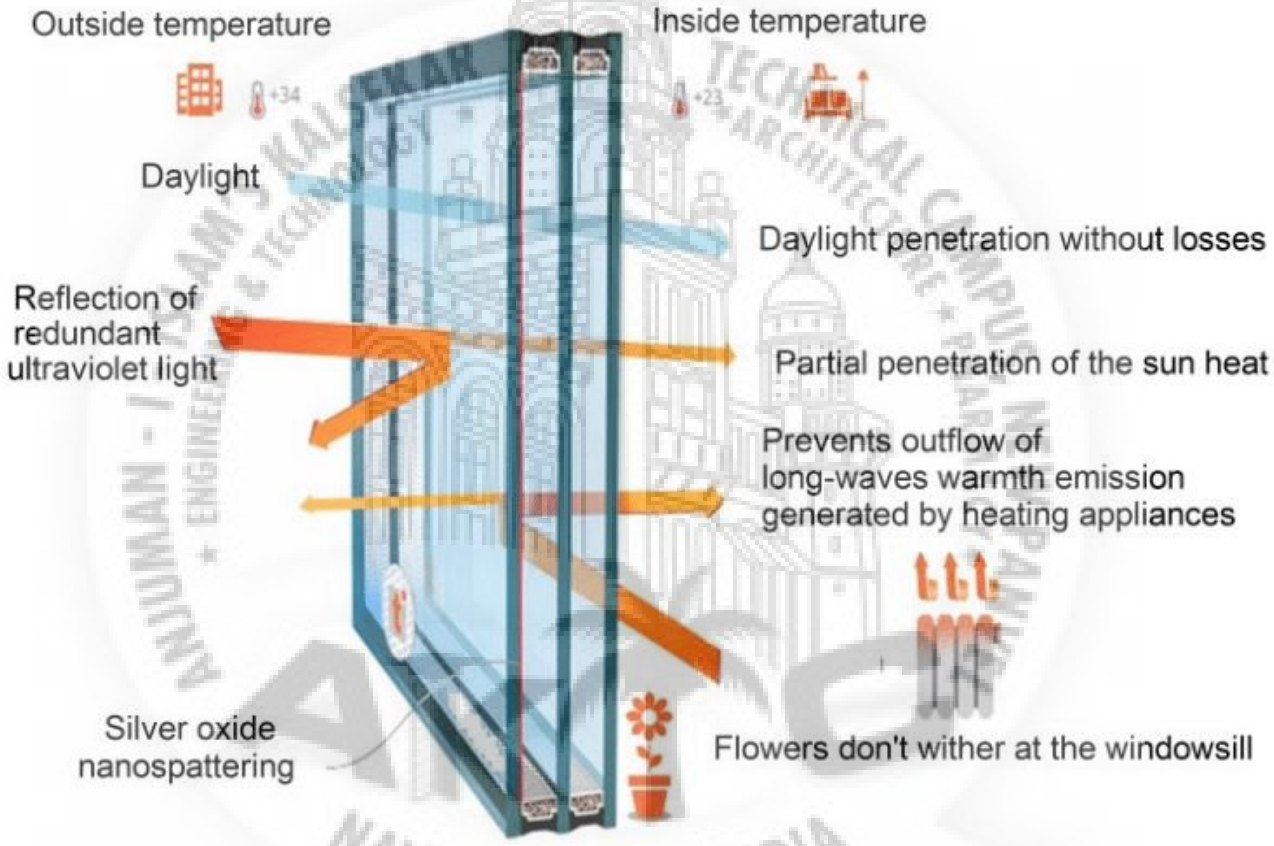


Fig.13. Floor to floor glass panel (Source – Google)

2.3 Need of High Rise

First, the exploding people, mainly city, generates a collective demand for high-rise structures. The constantly growing inhabitants and rising economies in major cities of the world mean increasing development internationally and the ongoing upsurge in population density in urban areas. Arable land areas are continuously being plagued away by urban spreading through suburban expansions. The high-rise structure can accommodate many more people on a smaller land than would be the case with low-rise building on the same land. A tall building is in effect a vertical transformation of horizontal expansion.

Fig.14. Migration (Source-Times of India)

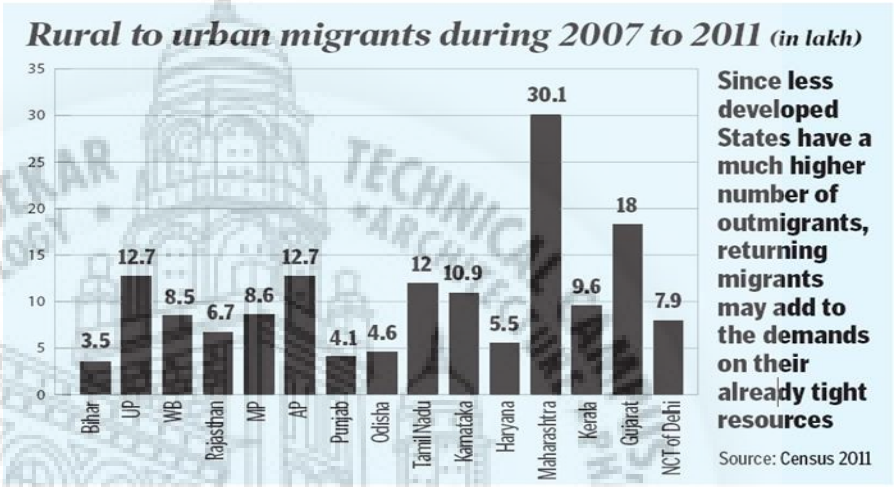


Fig.15. Migration table (source- Census 2011)

There has been obvious negligence of the human factors in urban proposal at the cost of livability and value of life. The outward development of cities into the suburbs has caused in amplified travel time and traffic congestion. The prospect of traveling for a long time, to and from work, is damaging to social comfort of the commuter and marks in losses of fuel and efficiency.

Fig.16. Need of High Rise

Clustering of structures in the arrangement of high-rise buildings in densely built-up areas is the prospect for creating open spaces like outdoor play area, plazas, gardens, and other public spaces by freeing of space at the ground level. Also, the influence on the city skyline, tall buildings thus impact the city fabric at the level where they meet the ground. The improvement of the “public realm” has become a necessity exerted by planning authorities in major cities.

Fig.17. Urban Sprawl (Source- Hindustan times.)

Vertical growth means they can accommodate additional inhabited / marketable space per square meter of ground floor than single storey buildings which take up additional ground floor or land. They are appropriate for highly occupied or overpopulated countries where there is a shortage of land.

2.4 Advantages of High-Rise over Low-Rise

Advantages of High Rise Apartments

- They Offer the Finest Views

If you need spectacular views of, say, the Manhattan skyline, you're only going to get that in a tall structure. They also get more natural light.

- They are Situated in the City

If you work in a urban city or simply love shopping and partying there, living in a high rise is the relaxed way to cut down on your travel.

- They Offer a Doorman/Security

Additional benefit of highrise living is a door guard, safety, and other staff that are there to make your life easier – and safer.

- They Always Have fast Elevators

If the idea of climbing 5+ stories of stairs makes you cringe, don't worry, because multistorey apartments always have elevators. Most buildings have more than one, to cut down on wait times.

- They Offer More Leasing Options and Vacancies

If you're looking for a flexible occupancy, like a month-to-month arrangement, you're much more likely to find it in a high rise. Equipped flats are another choice often offered in highrise buildings.

- They Have Easier Utilities and Maintenance

Most high-rise apartments are already wired for cable, internet, and the like, so getting set up is as easy as a phone call. Maintenance requests are often faster too, since they usually have an on-site property management office.

2.5 Transition of Mumbai

From a group of seven islands to a strategic port and eventually the financial capital of world's largest democracy. The 18th century marked the rapid growth of the city, when vicinity was connected to Mumbai by rail. Many construction projects were started due to the need of flourishing markets and economic opportunities. Various business communities from different part of the nation set up their businesses in this island.

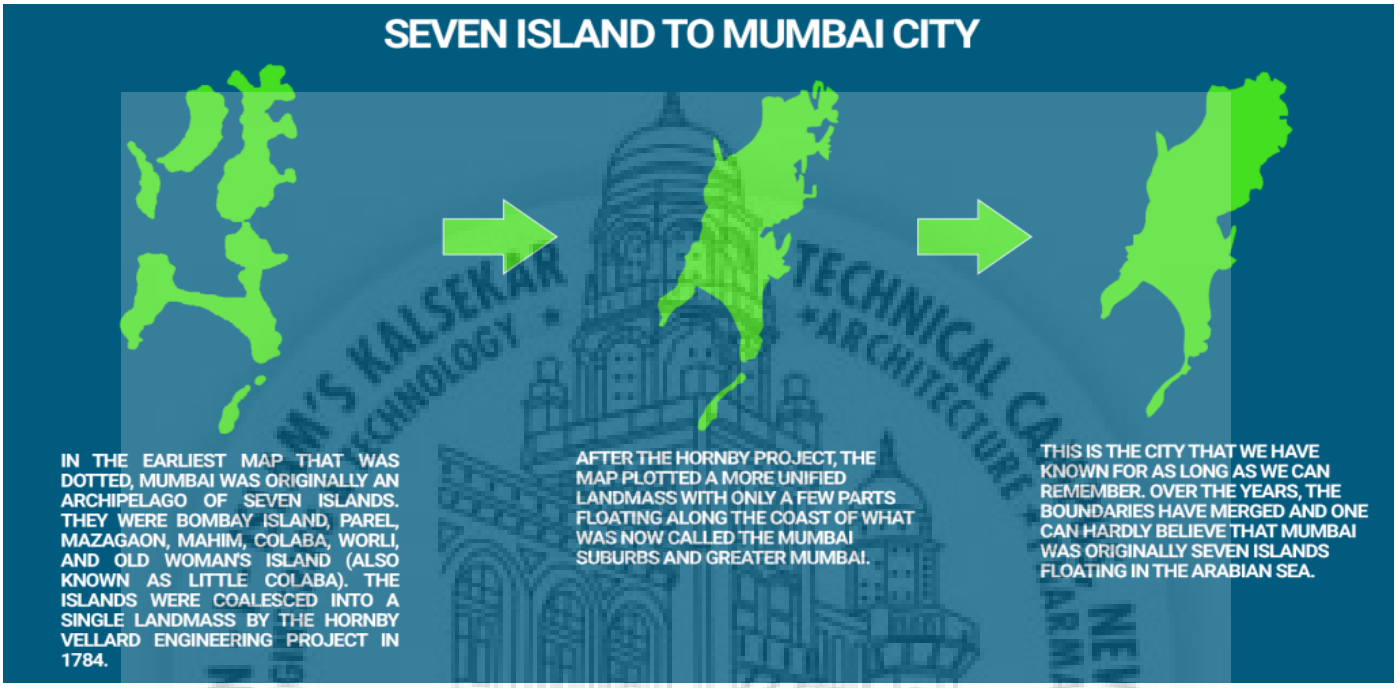


Fig.18. Transition of Mumbai (Source- Insideiim)

These laborers lived in settlements that grew parallel to the docks. The landowners and factor owners constructed rental dormitory. Eventually the immigrants brought their families in these single-room rooms, radically growing the density of the area. 'Rent control Act' was introduced which rendered these Chawls lossmaking for the landlords. The damaged Chawls were not restored and sustained. In 1969, there were about 20,000 chawls in ruined conditions housing two million people.

At present, Mumbai is the entertainment, fashion and commercial center of India. It is also one of the world's top 10 centers of trade in terms of international monetary flow. Mumbai, also called Bombay, is the capital city of the state of Maharashtra in India, and it's the most crowded city in India. Mumbai is 4th most crowded city in the world and one of the crowded urban regions.

The populace density of Mumbai is roughly 73,000 per square mile, which makes Mumbai one of the most densely inhabited cities in the world. Because land is at such a premium, residents of Mumbai frequently live in inexpensive, overcrowded housing far from work, leading to long commutes on the city's busy mass transit system.

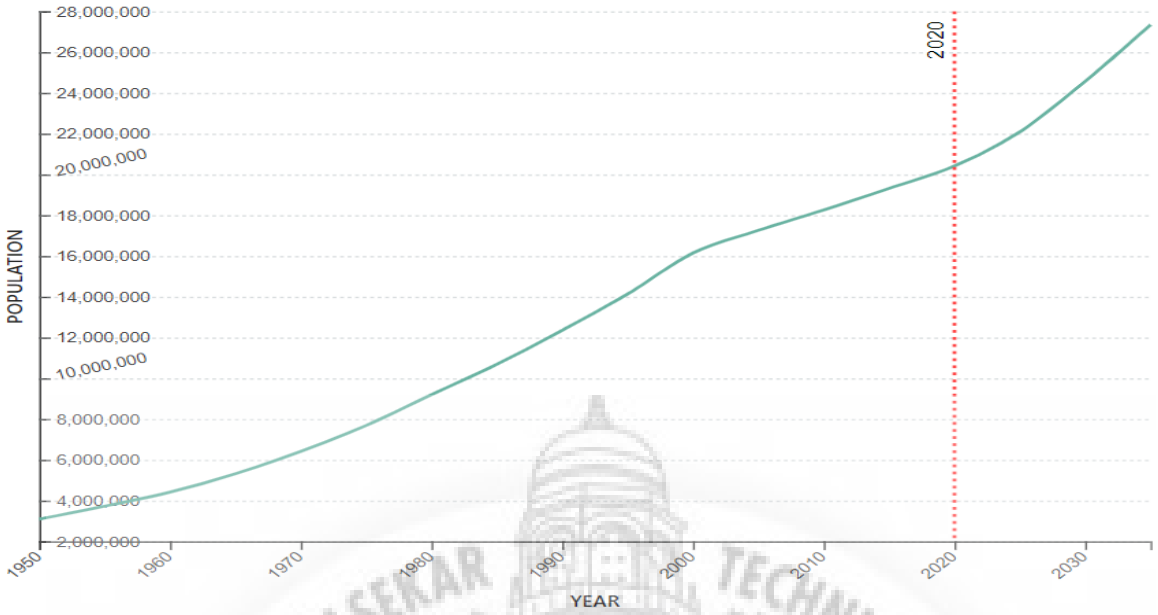


Fig.19. Mumbai current population (Source -Worldpopulationreview)

Mumbai's demographics relate to us that the city is considered a melting pot due to all of the migrants that relocate to the city for employment opportunities. Mumbai, like most metropolitan areas of India, has a large population of polyglots, and 16 major languages of India are spoken here, including Gujarati, Hindi and Marathi, along with a colloquial form of Hindi called Bambaiya.

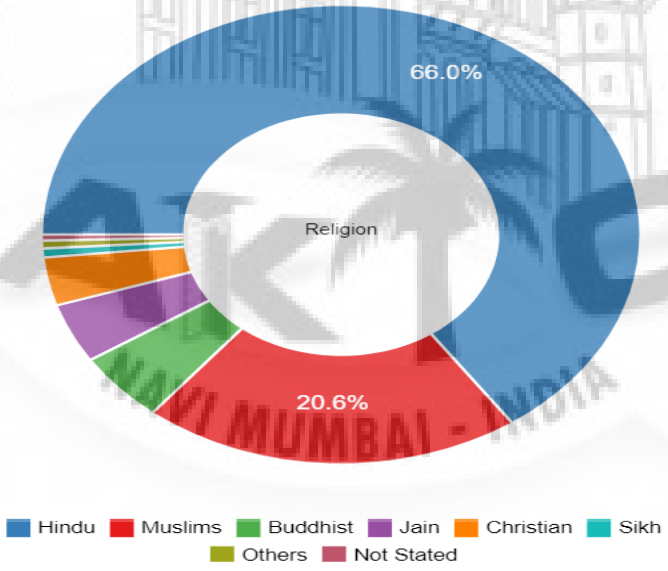


Fig.20. Demographic of Mumbai (Source- worldpopulationreview)

2.6 News Paper Article

8 hours just to get to & from work — why despite opening up, travel in Mumbai is a nightmare

While the Mumbai local train service resumed from 15 June, only essential service providers are allowed to use it. Others mostly have to depend on buses now.

MANASI PHADKE 29 September, 2020 10:19 am IST

'Buses always run full, travel much costlier'

Salimbhai, who works as a daily wager in Mumbai and has to travel to any part of the city where there's work, said he could cover short distances within 15-20 minutes by the local train. "I have to travel wherever there's work — Sion, Bandra, Santacruz, Andheri. I used to travel by train and it would take me just 15-20 mins to cover short distances," he told ThePrint. "The same travel by bus takes up to an hour. I have to wait a lot for a relatively empty bus, or spend from my pocket and take a taxi."

Currently, services of the Brihanmumbai Electric Supply & Transport (BEST) undertaking are the only mass-transit public transport options for commuters.

The BEST undertaking resumed services in June but with norms for social distancing. Only 30 passengers are permitted in a bus, including five who can stand. The normal sitting capacity of a BEST bus is generally 54. Pre-Covid too, Mumbai's BEST bus service was catering to 30 lakh passengers a day. Now, with the additional strain of regular rail commuters and limited capacity due to social distancing norms, BEST bus services are overburdened.

Ganesh Jadhav, who works as a caregiver for an 89-year-old ailing woman, said, "It takes me two hours to reach my workplace in the morning. While heading home in the evening, I have to first wait at the bus stop for 2-2.5 hours. Some buses don't even halt at the bus stop. After I get a bus, there's a lot of traffic. The commute by train was much better. The government should restart local train services."

With bus tickets costlier than railway train tickets, people are also having to spend more on their commute. John, for instance, said he used to spend Rs 500 a month on a train season pass. "Now, I am spending Rs 4,500-5,000 a month. I have to wait for a bus for 1.5 hours, and then change midway to another bus route," he said.

Inference

- Urban sprawl leads to overcrowded housing far from work, leading to long commutes on the city's busy mass transit system.

2.7 Co-relation between Urbanity, Development and High-rise

For high-rise development to be a accomplishment the governmening body needs to bring foremost policy modifications and guidelines required to be relooked at. Utmost significantly rise in the existing FSI restrictions will benefit in skyscrapers going even higher. There is no substitute but to go vertical if we are really thoughtful about solving the scarcity of land in a city like Mumbai. Most of the skyscrapers constructed in Mumbai or other metro cities are being built in association with local and worldwide structural engineers and designers who bring international technology and quality construction.

The Indian construction industry is going through a changing phase, the need of the hour for developers is to employ latest construction techniques, but at the same time it should be cost effective and safe to the final home buyer. Deploying latest technology also needs trained and skilled workers who can be highly productive. One of the successful approaches adopted to address these problems is lean construction. Slender construction is fast gaining eminence in the building industry. The profits to corporation are enormous. Executing lean developments in construction aids reduce costs to a substantial extent. It is all about doing extra with less period, inventory, space, labor, and currency. Lean production is a systematic elimination of waste like overproduction, waiting, transportation, inventory, and over-processing. There are five attributes that drive lean construction that is cost, quality, delivery, safety, and morale.

Fig.21. Co-relation between Urbanity & Development

The city's economic boom attracts migrants in search of opportunities from across the country. This has led to severe deficiency in low income/mid-income housing resulting in slums and roadway dwellers. Due to the deficiency of space most of the new developments are growing vertically on insignificant plates of land with no attention for the wider infrastructure. **'Pencil Towers'** Have cropped up at random, leaving inadequate infrastructure. These unplanned and scattered constructions aggravate the urban blight and dd to the burden to anal ready stressed infrastructure. The governing bodies lack the resources to undertake large scale redevelopments on their own. The above-mentioned problems force the urban planning to be sustainable and that is the need of the hour.

2.8 To comprehend High-Rise

(Behaviorally by human-notion)

A substantial part of Mumbai's population are transferring from low-rises to high-rise buildings, be it residence-commercial- work space- hospitality as wellas slum rehabilitation projects. An individual residing in 3 rd floor suddenly adjusts the thrill of 13 th floor. Thus a psychological change is experienced in the Mumbai city. The psychological variation can be sensed from equally high-end luxury high-rises as well as low- income housing for those rehabilitated fromthe slum area. The middle income group is left out from the scrutiny as tall buildings are yet a luxury high-priced to this section of the society.

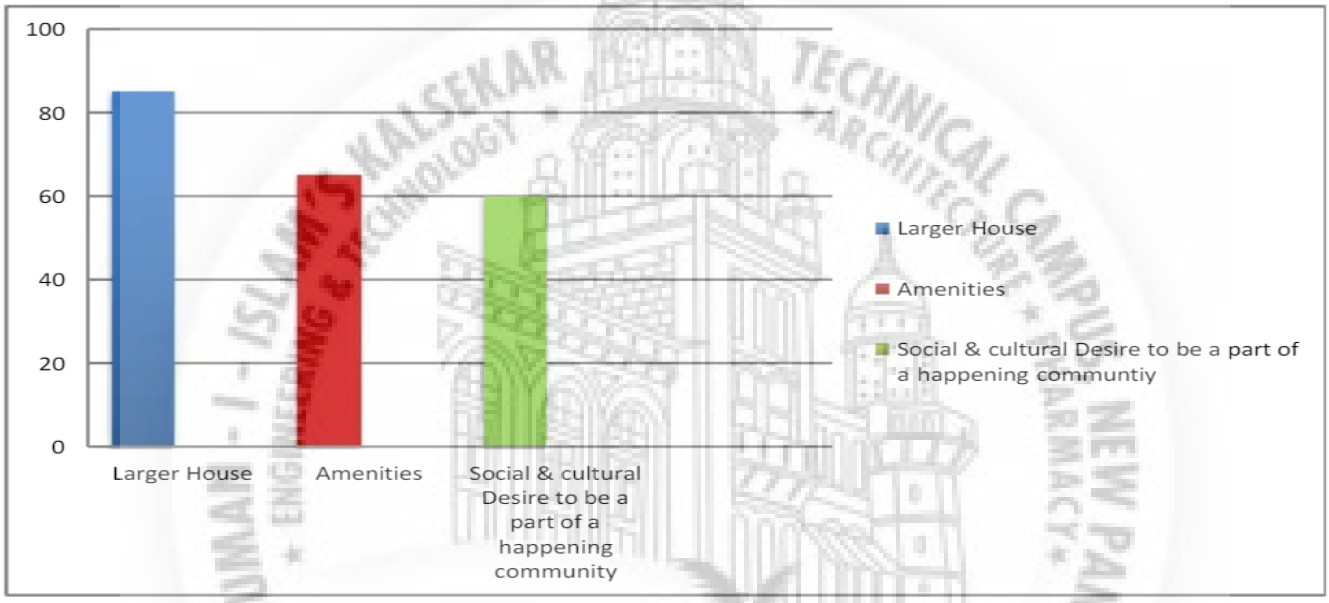


Fig.22. Reason for purchasing a house in a tall building

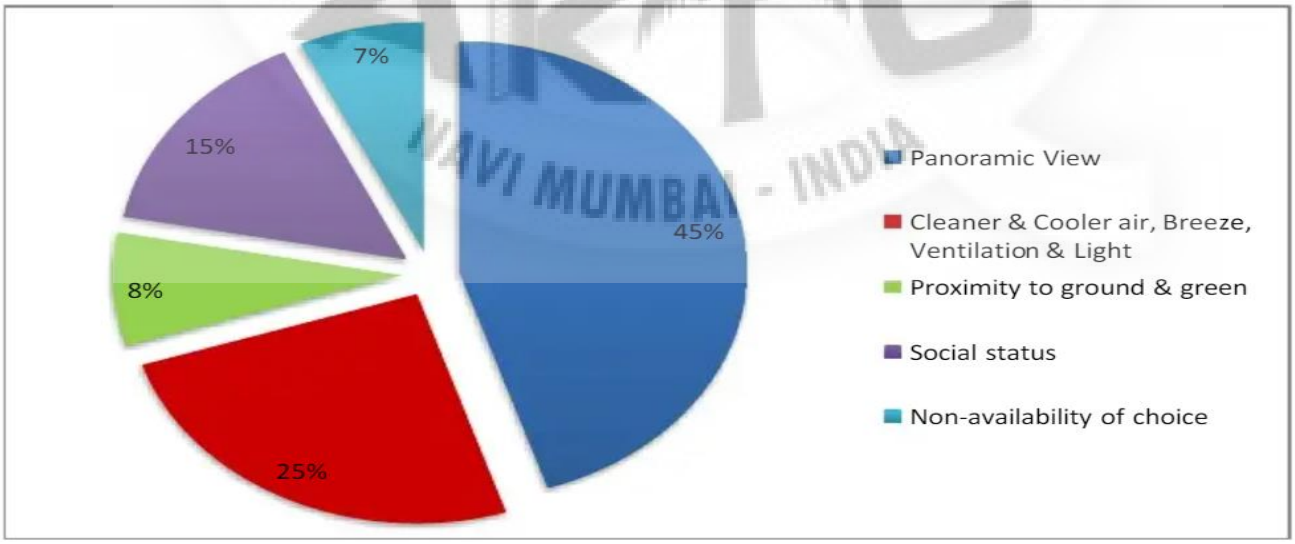


Fig.23. Reason for selecting a floor in a tall building

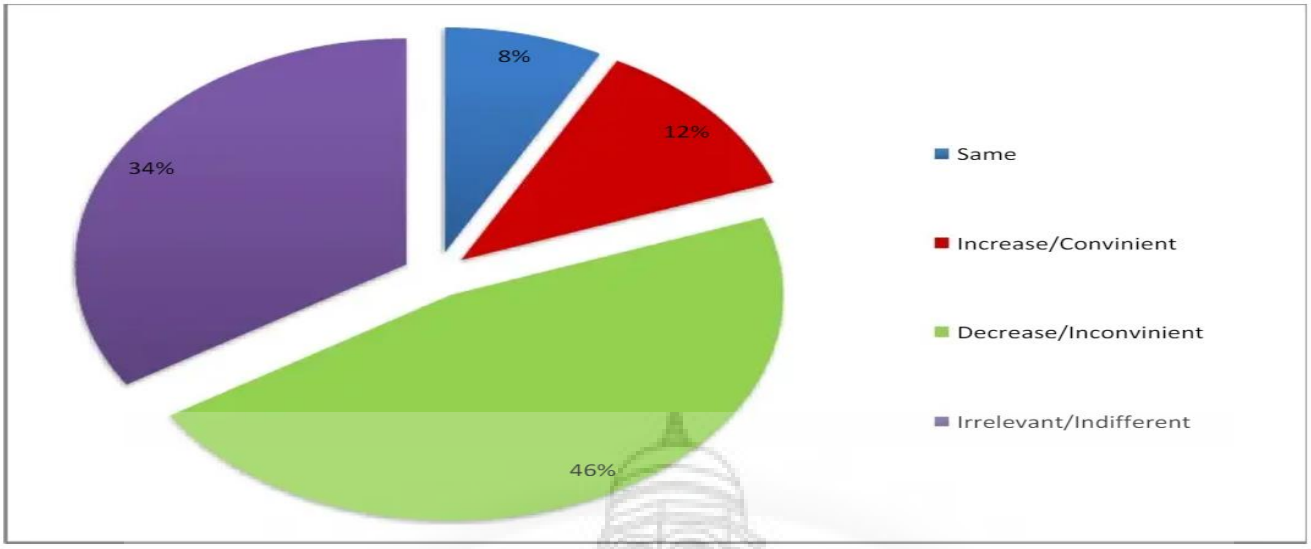


Fig.24. Interaction with neighbors in comparison to a low-rise development

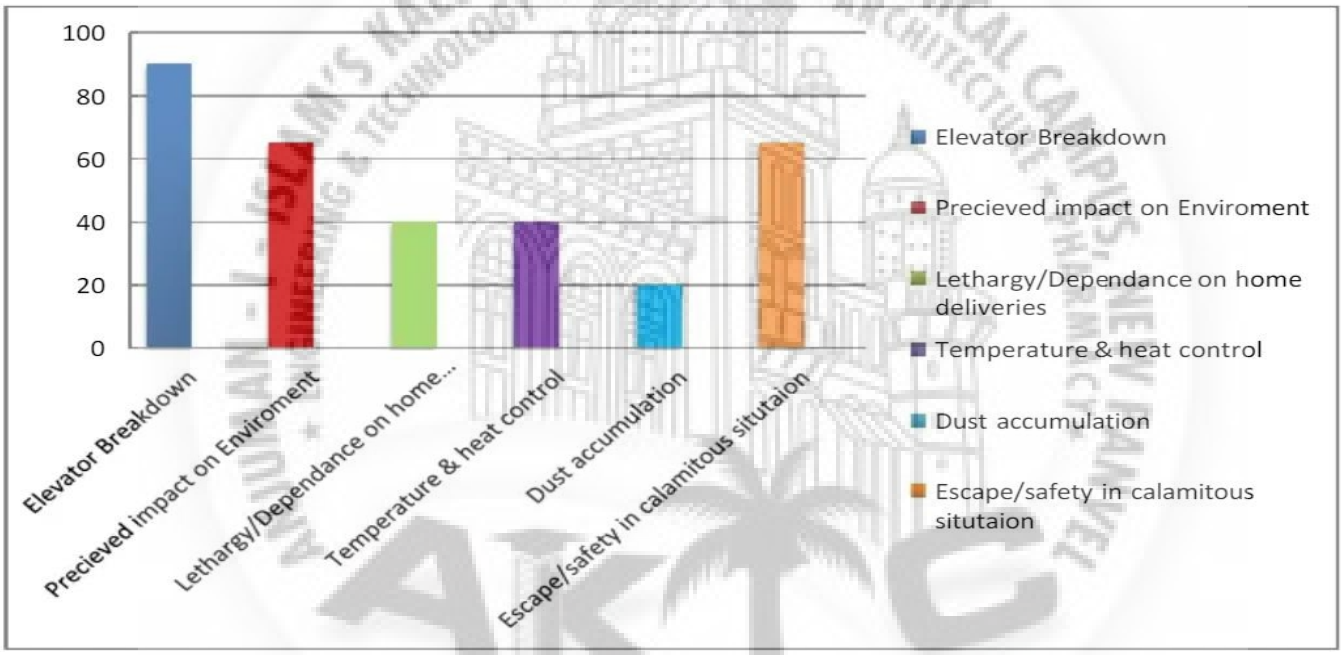


Fig.25. Most common concerns in a High-rise residence

High rise building should not only have housing unit but also sports,recreational amenities, retail market, common public space for people for the purpose of leisure, entertainment. The taller the building the more isolated itshould be from the surrounding developments due to high density. The heavy vehicular movement and the road access should be studies carefully. People afford high rise for the View. Green spaces can come in handy for several problems in a high rise building. Slightly more than 28% of the country's urban population is urbanized. Almost 22% of the urban population lives in slum. Out of the 21 million inhabitants ofMumbai, almost 55% live in slums. SRA has many rehabilitation projects forthe slum to live in high rise housing complexes for LIG.

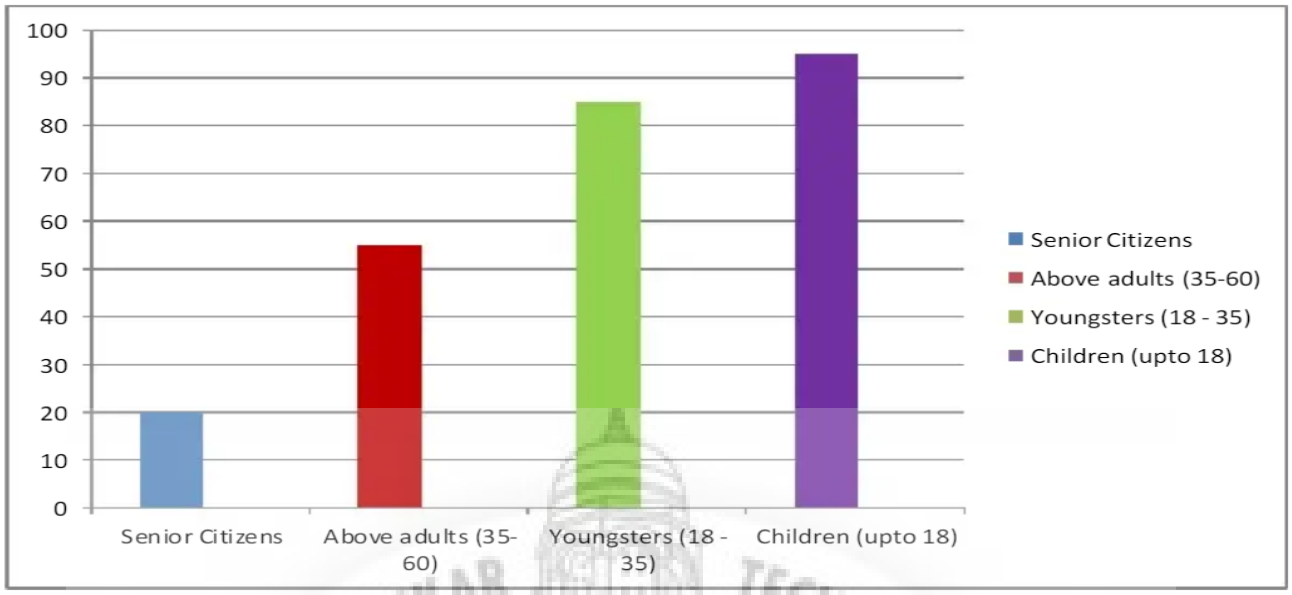


Fig.26. Percentage of People wanting to move

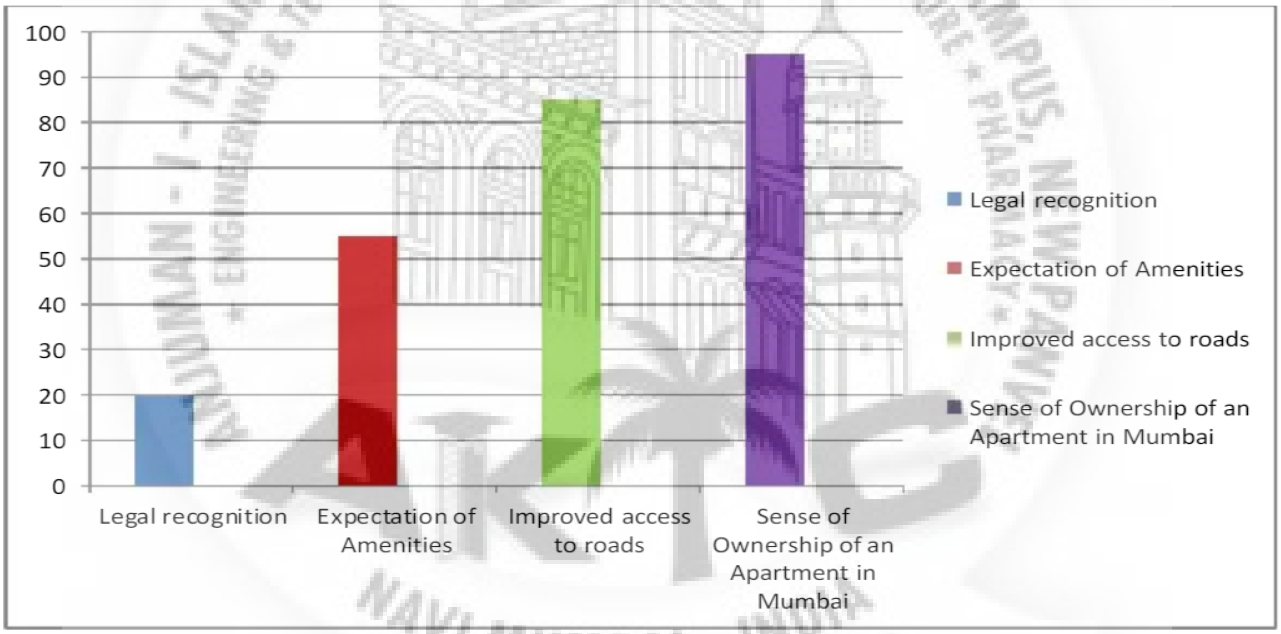


Fig.27. Primary reason for wanting to move

High-rise building has been respondent of causing many hostiles out-comes. Amid those scrutinized in this are anxiety, frustration, trauma, behavior problems, suicide, poor public relations, reduced helpfulness, and stalled child development. There are few points listed below:

1. The first is that the inhabitants themselves, an important one, or a neighbor will fall or jump from a high opening.

2. Second, perhaps illogically, some inhabitants fear that they may be stuck inside during a fire; it generally takes longer to reach the road from a high-rise residence than from residences of a limited storeys

3. Third, inhabitants in spaces with active tectonic plates concern about the whole structure tumbling because of an earthquake

4. Fourth, in the post-McVey, post-911 era, inhabitants cannot help harboring at least a minor distress that their structure might be attacked.

5. Fifth, the absolute quantity of individuals who exist in One Big Dwelling means that, in a sense, strangers share your residence, at least the semi-public areas of it

6. Sixth, the absolute sum of individuals in one structure may upsurge the fear of becoming ill from infectious diseases generated by others.

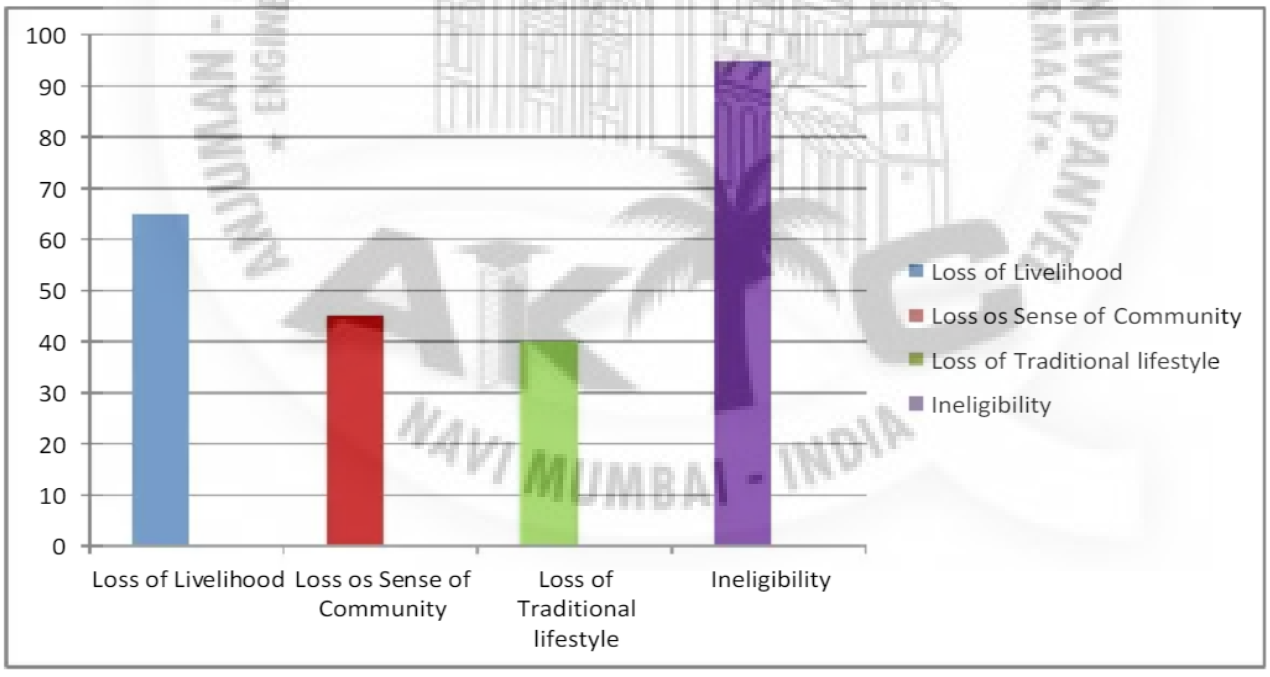


Fig.28. Primary reason for not wanting to move

CHAPTER 3

List of Case Studies

Context	Experiential	Innovation in program	Aesthetic / Form	Innovation in technology
1) Kanchenjunga Apartment 2) magic breeze villa	1) Bosco Verticale 2) Link hybrid	1) Petronas Tower 2) The forest school	1) Osia downtown	1) Burj Khalifa
ARCHITECT 1) Charles Correa 2) Penda	ARCHITECT 1) Boeri Studio 2) Steven Holl	ARCHITECT 1) Cesar Pelli 2) Nudes	ARCHITECT 1) WOHA	ARCHITECT 1) Adrian Smith
LOCATION 1) Peddar Road, Mumbai, Maharashtra, India 2) Hyderabad, Telangana, India	LOCATION 1) 20124 Milan, Metropolitan City of Milan, Italy 2) Dongsheng District, Beijing, China	LOCATION 1) Jalan Ampang, Kuala Lumpur, Malaysia 2) Pune, Maharashtra, India	LOCATION 1) Tanjong Pagar, Central Business District, Singapore	LOCATION 1) Dubai, UAE

Table.No.1. List of Case Studies

3.1 Case Study 1

KANCHENJUNGA APARTMENT

Fig.29. Kanchenjunga Apartment (Source- Arcdaily)

KANCHENJUNGA APARTMENT

BASIC INFORMATION

Architect: Charles Correa

Type: residential

Height: 84 m

Building footprint - 432 m

Floors: 27

Lifts - 3 + 1

Opened: 1974

Plot Area - 2900 m

Height: 84m

Status – Constructed

Architectural styles: Brutalist architecture, Modern architecture

INTRODUCTION

Kanchenjunga is a cooperative of 32 luxury flats of three to six bedrooms each. The building is 28 storeys (85 meters) high and square in plan. The basic interlock is that of a three- and four-bedroom apartment with the larger flats formed by the addition of another half level.

LOCATION

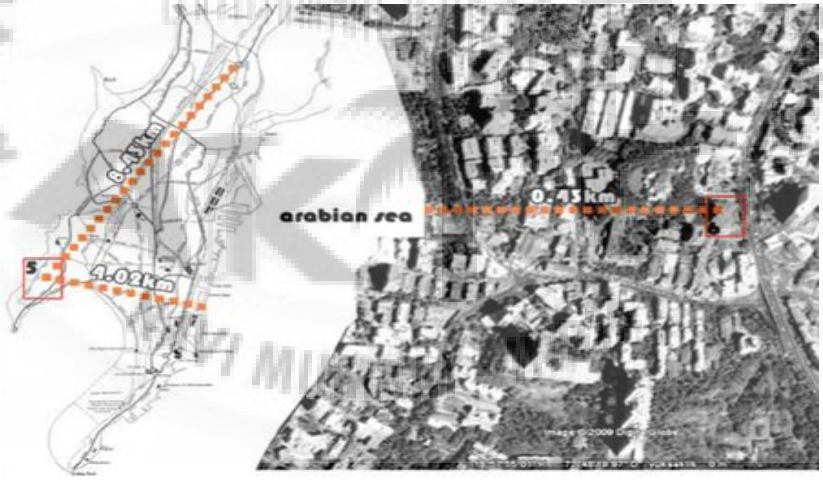


Fig.30. 72 Peddar Road, Mumbai, Maharashtra, India.

CONCEPT

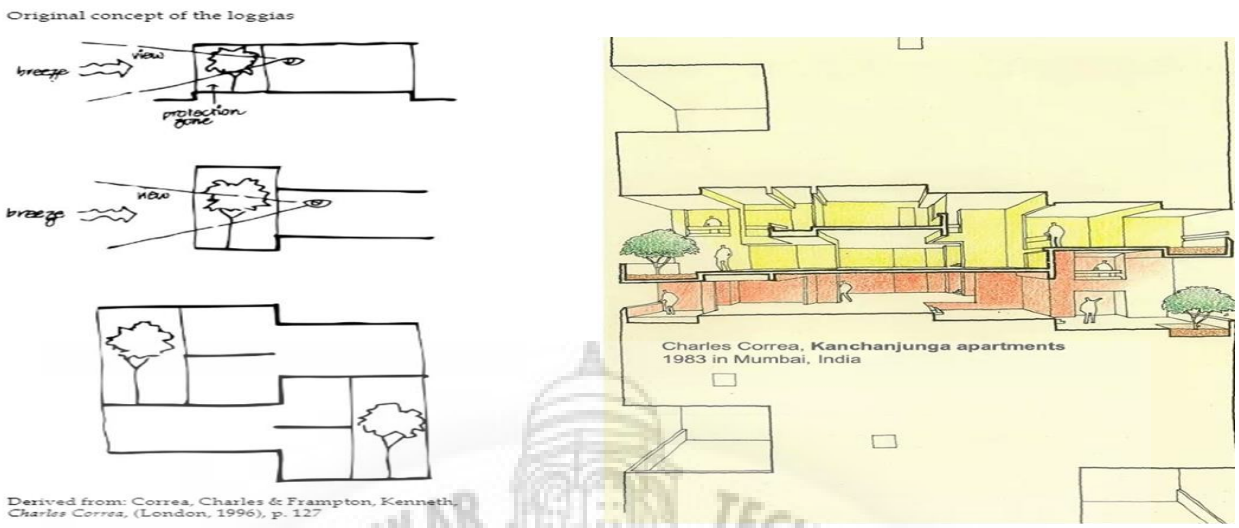


Fig.31. Concept Kanchenjunga Apartment (Source- issuu)

The Kanchenjunga Apartments are a straight response to the contemporary ethos, the ever-increasing urbanization, and the climatical circumstances for the region. They pay respect to the vernacular architecture that once stood on the place before the expansion in a number of ways.

Resourceful cellular arrangement to the limit, as is evident from the interlock of four different apartment typologies varying from 3 to 6 bedrooms each.

SITE PLAN

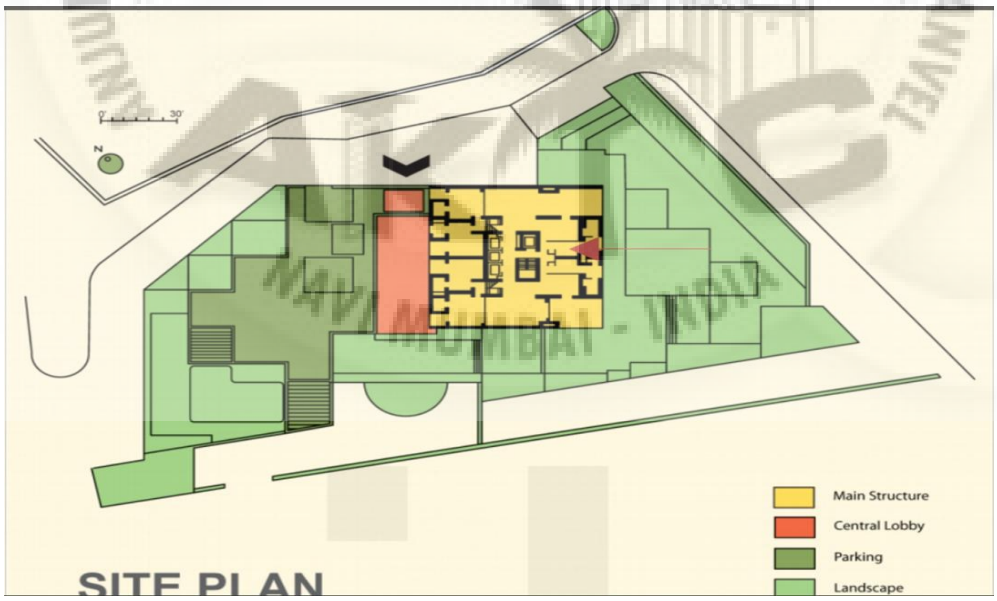


Fig.32. Site Plan Kanchenjunga Apartment (Source- architectopedia)

ORIENTATION

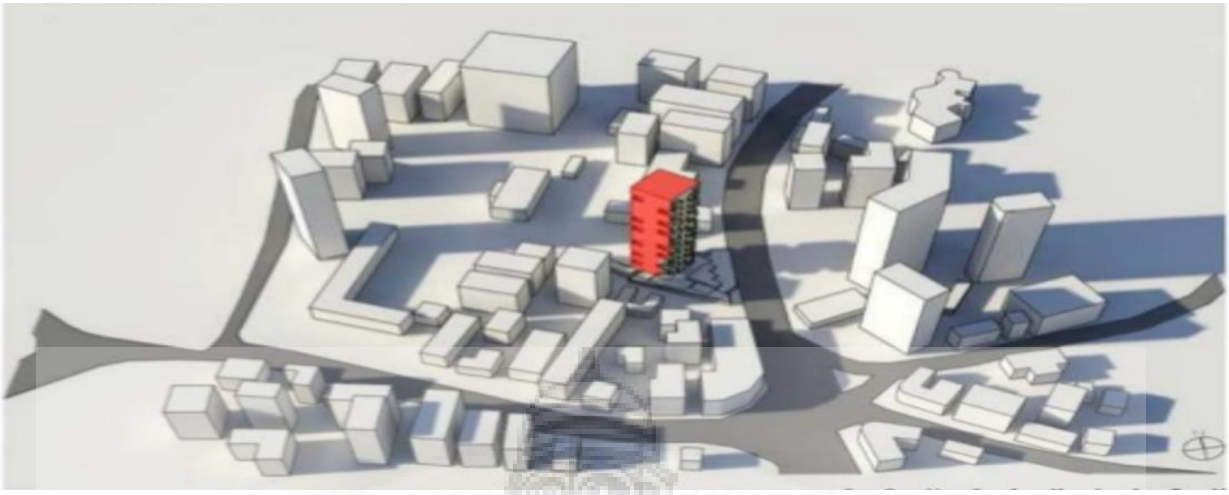


Fig.33. Orientation Kanchenjunga Apartment (Source- issuu)

In Mumbai, a structure has to be oriented east-west to catch dominant sea winds and to open up the finest views of the city. Inappropriately, these are also the directions of the hot sun and the hefty monsoon rains. The longstanding bungalows solved these problems by wrapping a defensive layer of verandas round the main living areas, thus providing the inhabitants with two lines of protection against the elements

DEVELOPMENT OF FORM

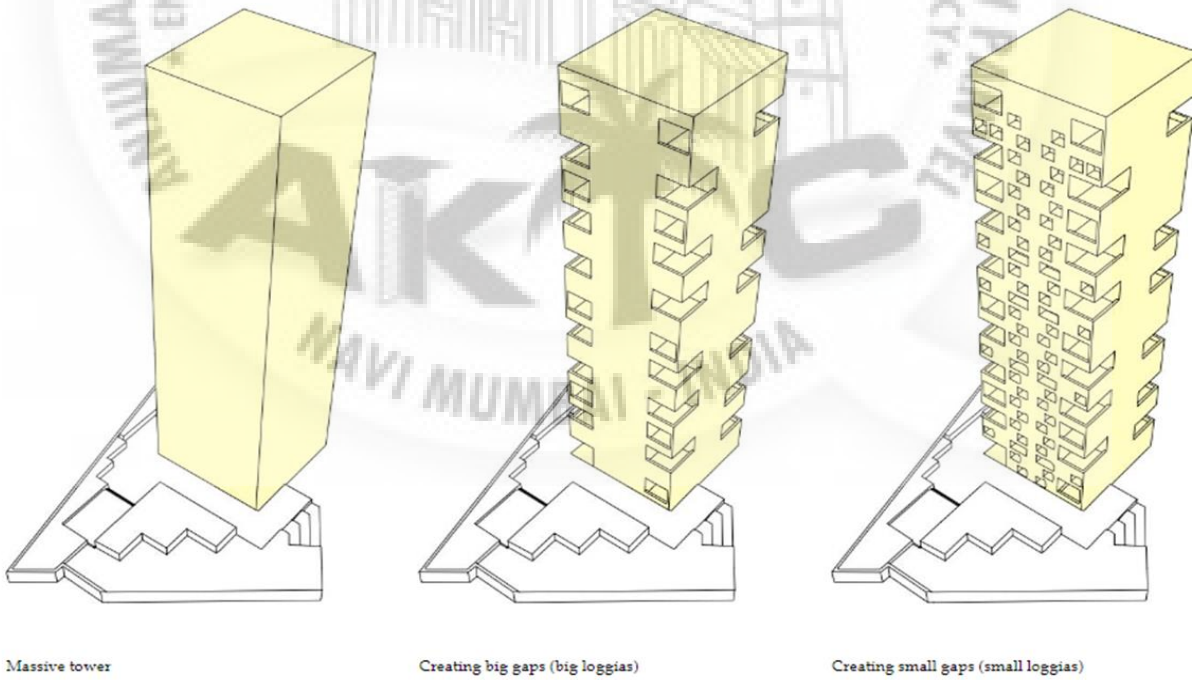


Fig.34. Development Kanchenjunga Apartment (Source- issuu)

STRUCTURAL SYSTEM

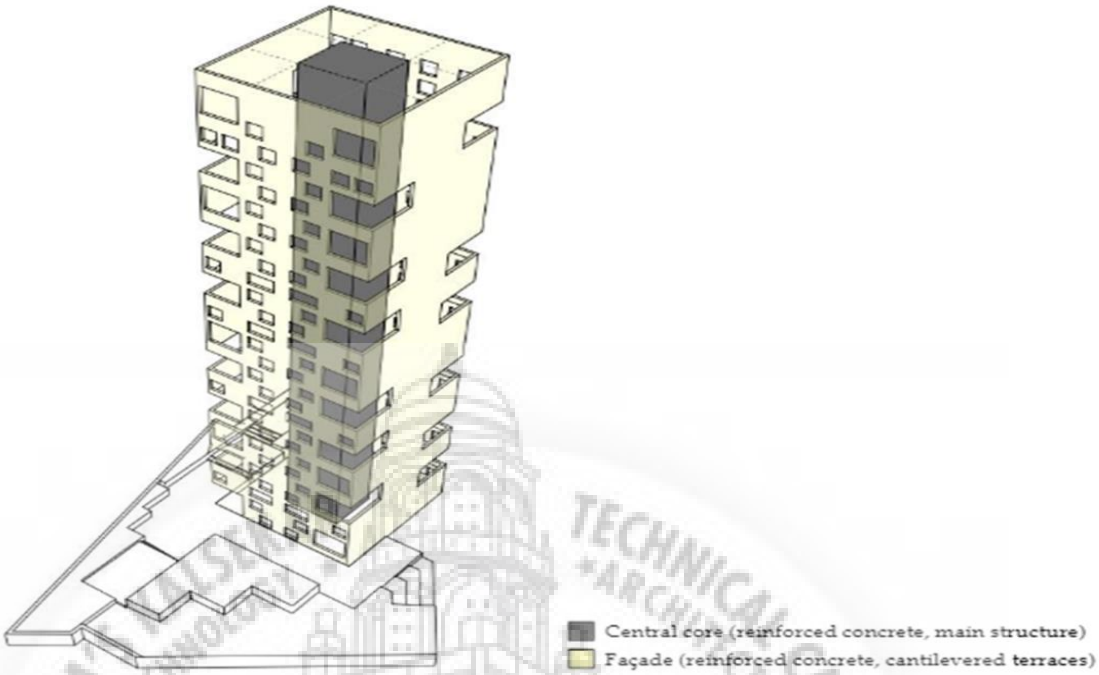


Fig.35. Structural system Kanchenjunga Apartment (Source- issuu)

The building is constructed around a central service core which was built first. Each of the flats have big functioning garden-terraces which have dramatic city sights. In section, there is a constant distinction of internal spaces best expressed as shear walls on the north and south elevations of the building.

FLOOR PLATES

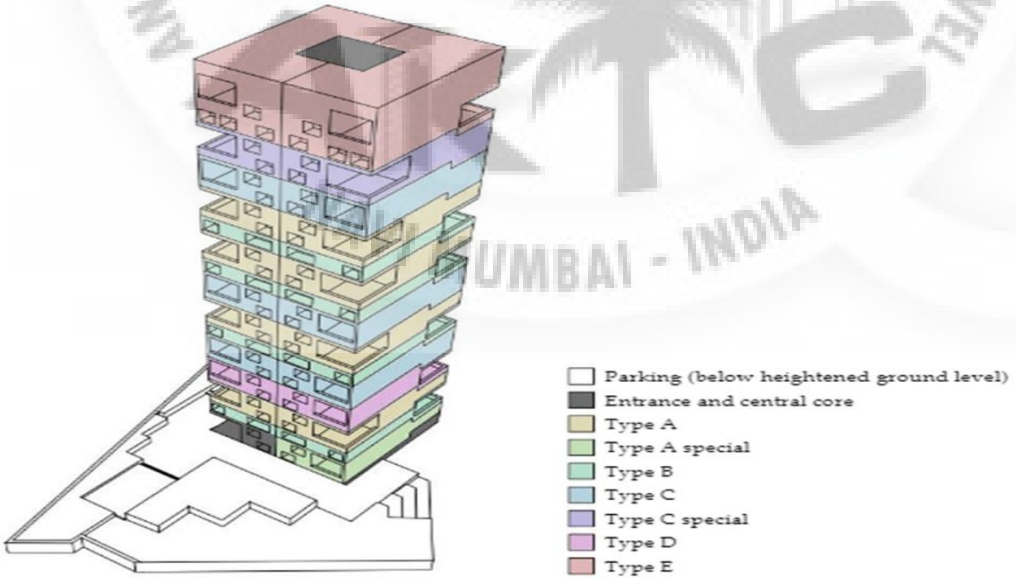


Fig.36. floor plates Kanchenjunga Apartment (Source- issuu)

SECTION OF INDIVIDUAL TYPE RESIDENTS

Fig.37. Kanchenjunga Apartment Building section (Source- architectopedia)

SECTION OF INDIVIDUAL TYPE RESIDENTS

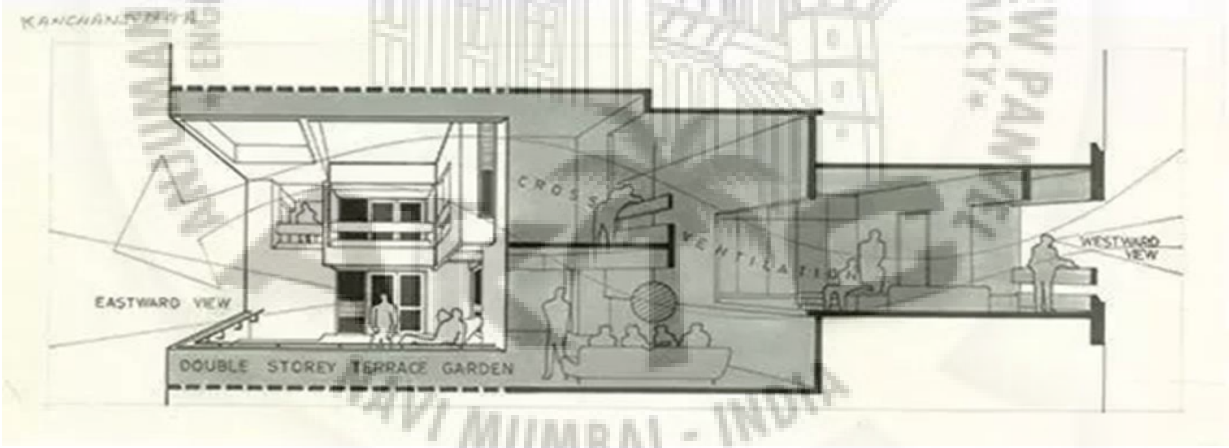


Fig.38. Kanchenjunga Apartment flat section (Source- architectopedia)

Correa's strong design signature of sectional displacement where appropriate by changes in floor surface is most elaborated in this project. The complexity of internal spacial organization to create level changes and interlocking four types of units was pushed to an extreme in this project.

SPATIAL RESPONSE

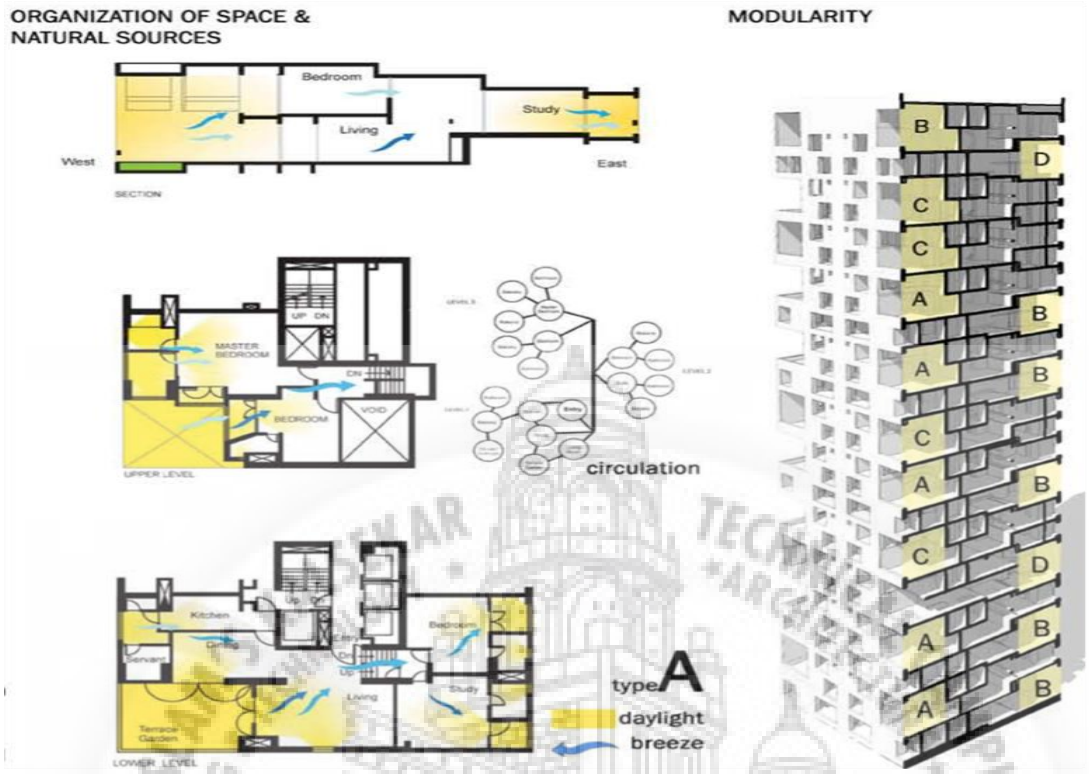


Fig.39. Kanchenjunga Apartment Spacial Responce (Source- issuu)

INFERENCE

- The Kanchanjunga Apartments are a direct response to the present culture, the escalating urbanization, and the climatic conditions for the region
- Building is oriented east-west to catch prevailing sea breezes and to open up the best views of the city
- These are also the directions of the hot sun and the heavy monsoon rains. The old bungalows solved these problems by wrapping a protective layer of verandas around the main living areas, thus providing the occupants with two lines of defense against the elements.
- The building is a 32-story reinforced concrete structure with 6.3m cantilevered open terraces. The central core is composed of lifts and provides the main structural element for resisting lateral loads
- The central core was constructed ahead of the main structure by slip method of construction. This technique was used for the first time in India for a multistory building.

3.2 Case Study 2

BURJ KHALIFA

Fig.40. Burj Khalifa (Source – Arcdaily)

BURJ KHALIFA

BASIC INFORMATION

Architect - Adrian Smith

Architecture firm - Skidmore, Owings & Merrill

Structural system – R.c.c, steel, aluminum

Floor count - 154 + 9 maintenance

Status - Completed

Height - 828 m

Type - Mixed-use

Floor area - 309,473 m2

INTRODUCTION

The most magnificent man-made structure in the recent times has to be the Burj Khalifa. Situated in Dubai, United Arab Emirates, Burj Khalifa which is also recognized as the Khalifa Tower, is 830 meters high. The Burj Khalifa, which is the tallest building in the world as of now, is mainly recognized for its height, location and fascinating architecture.

LOCATION

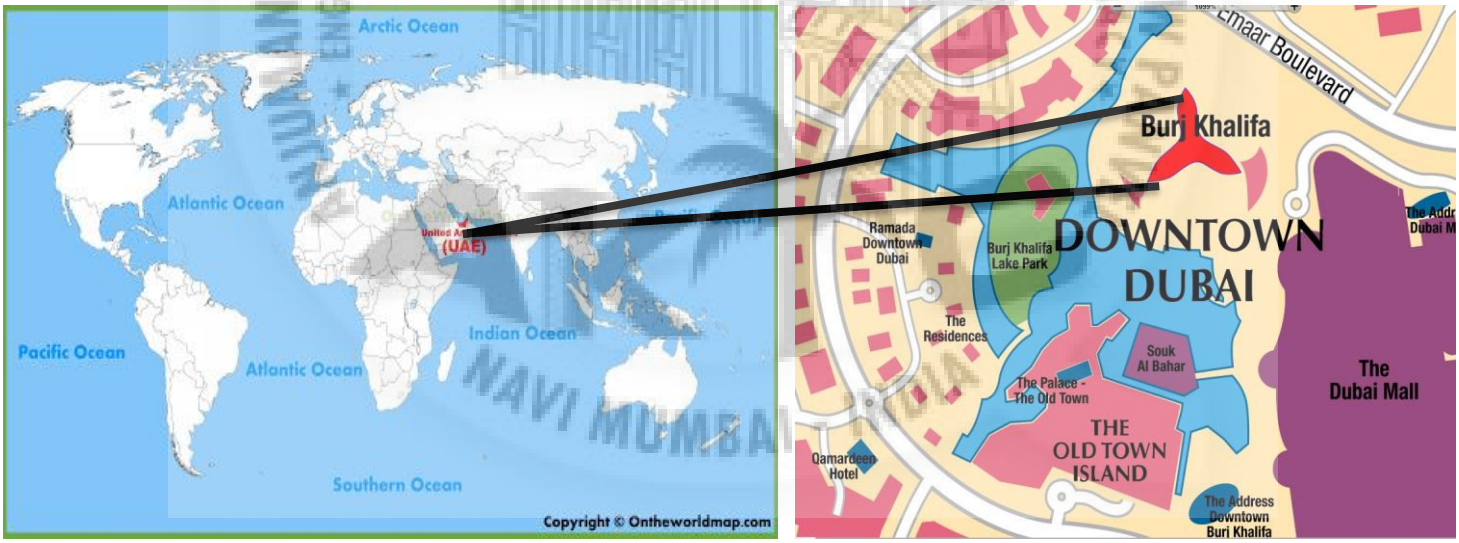


Fig.41. Sheikh Mohammed bin Rashid Blvd - Downtown Dubai - Dubai - United Arab Emirates

CONCEPT

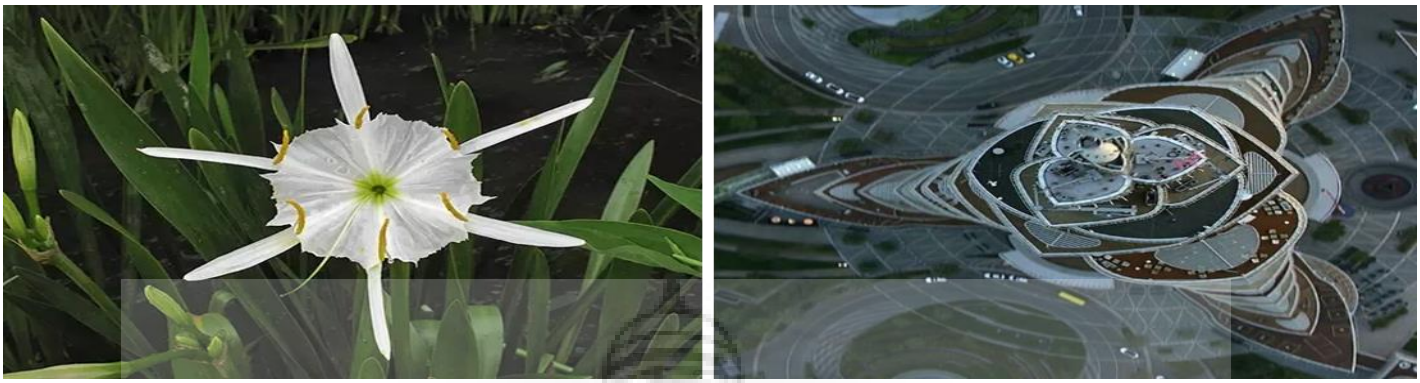
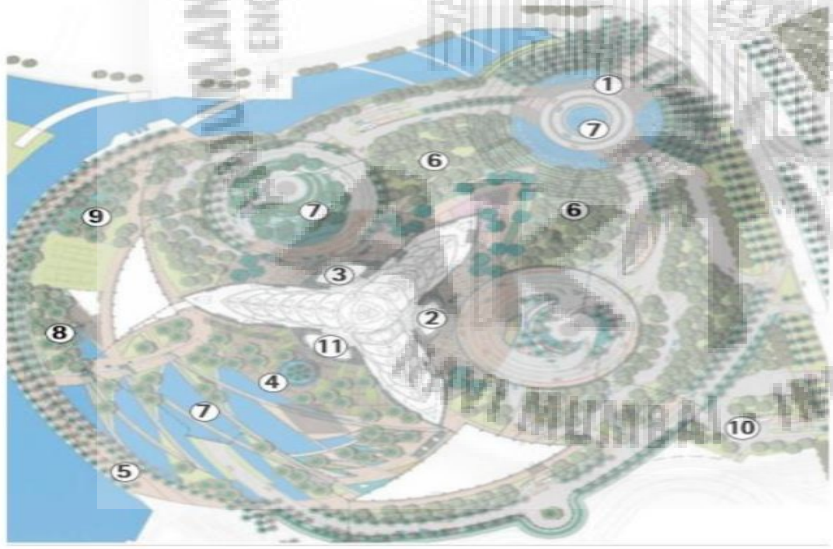


Fig.42. Concept Burj Khalifa (Source – archinomy)

Burj Khalifa's architecture has embodied references to Islamic architecture and yet reflects the modern global community it is designed to serve. From eco sustainable methods to amazing art work, the Burj Khalifa is a blend of an amazing depiction of the old Arab tradition and modern-day architecture. Hymenocallis Flower The concept of the Burj Khalifa is based on the orientation of this flower.

SITE PLAN



1	Burj Khalifa arrival court
2	Armani hotel entry
3	Residential entry
4	Viewing deck
5	Lake front promenade
6	Tower garden
7	Water feature
8	Children's play area
9	Recreation area
10	Service yard
11	Office entry

Fig.43. Site Plan Burj Khalifa (Source – archichoong)

Burj Khalifa was designed to be the centerpiece of a large-scale, mixed-use development to include 30,000 homes, nine hotels (including The Address Downtown Dubai), 3 hectares (7.4 acres) of parkland, at least 19 residential skyscrapers, the Dubai Mall, and the 12-hectare (30-acre) artificial Burj Khalifa Lake.

VERTICAL ZONING

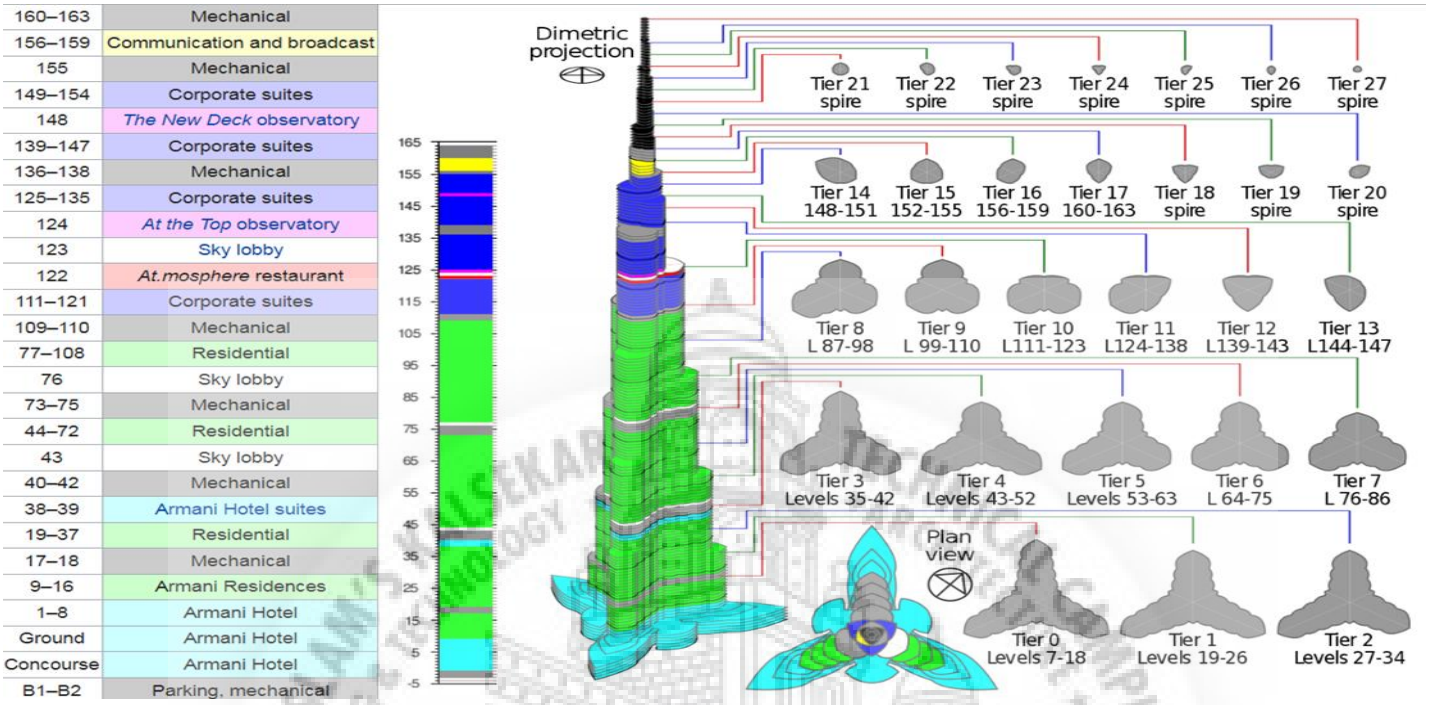


Fig.44. Vertical Zoning Burj Khalifa (Source – Wikipedia)

FOUNDATION

Fig.45. Foundation Burj Khalifa (Source – archichoong)

Burj Khalifa uses a deep foundation design, consisting of both a 3.7-meter-thick raft foundation and 192 bored piles. The purpose of this design is to allow the weight of the building to be spread over a larger volume of soil, decreasing the load in any given portion. Bored piles are piles cast into drilled holes in the ground on site

PODIUM

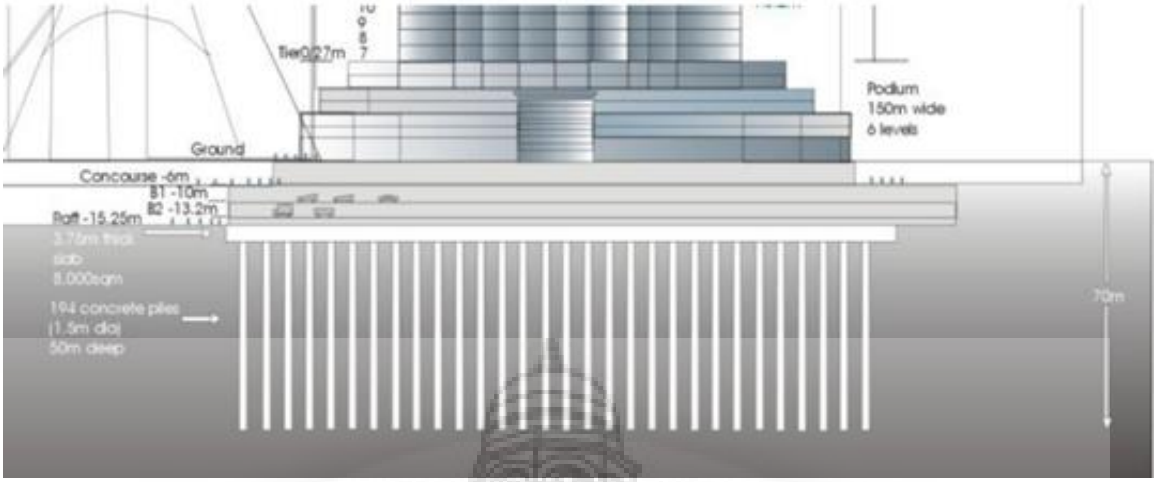


Fig.46. Burj Khalifa podium (Source – archinomy)

The Podium provides a base anchoring the tower to the ground, allowing on grade access from three different sides to three different levels of the building. Fully glazed entry pavilions constructed with a suspended cable-net structure provide separate entries for the corporate suites at B1 and Concourse levels, the Burj Khalifa residences at ground level and the Armani Hotel at Level 1.

STRUCTURAL SYSTEM

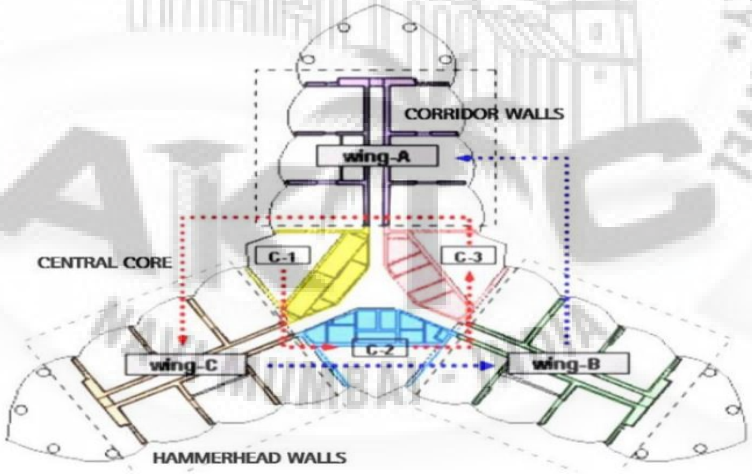


Fig.47. Structural system Burj Khalifa (Source – archichoong)

A simple Y-shaped plan to reduce wind forces, as well as to foster constructability. Each wing, with its own high-performance concrete core and perimeter columns, buttresses the others via a six-sided central core, or hexagonal hub. The result is a tower that is extremely stiff torsional.

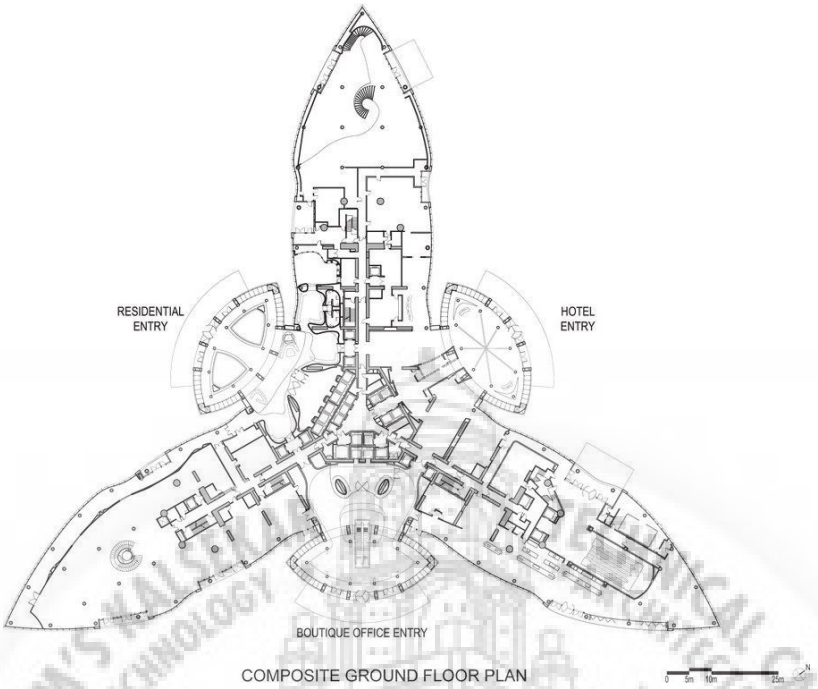


Fig.48. Ground floor plan Burj Khalifa (Source – archichoong)

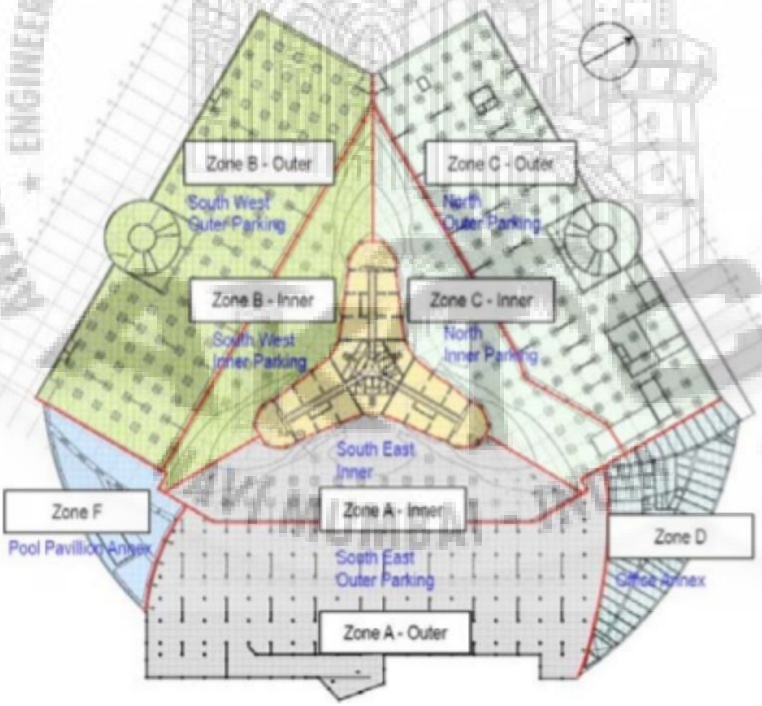


Fig.49. Zoning Burj Khalifa (Source – archichoong)

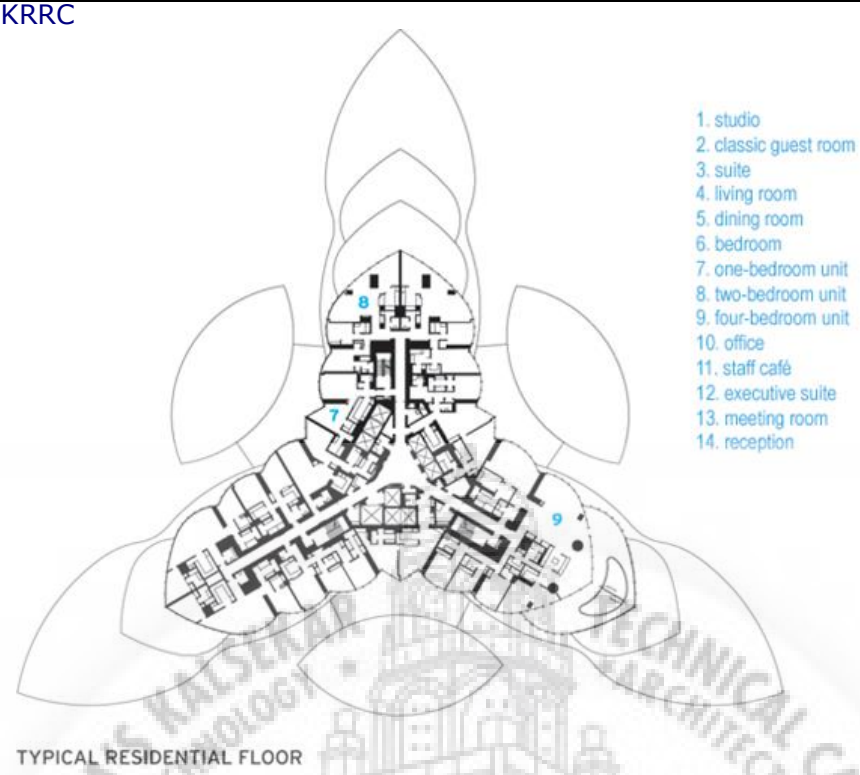


Fig.50. Plan (1) Burj Khalifa (Source – archichoong)

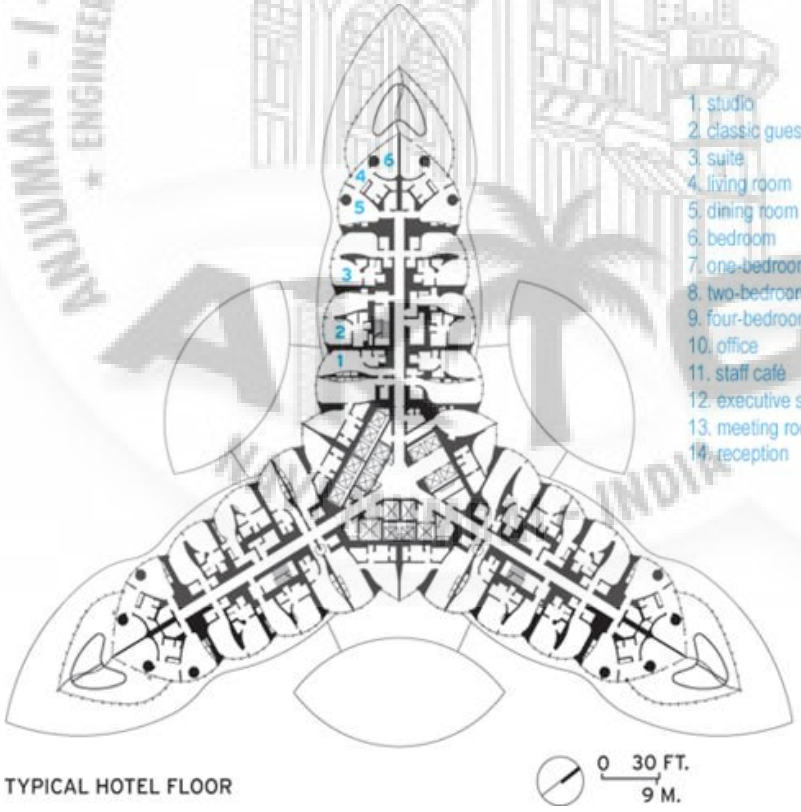


Fig.51. Plan (2) Burj Khalifa (Source – archichoong)

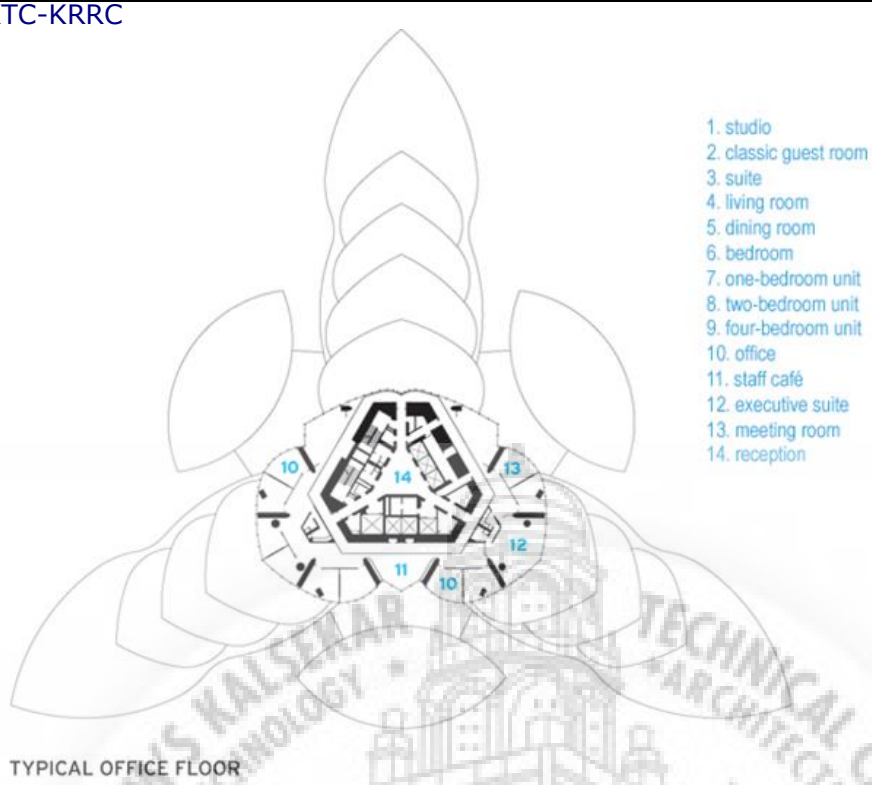


Fig.52. Plan (3) Burj Khalifa (Source – archichoong)

EXTERIOR CLADDING

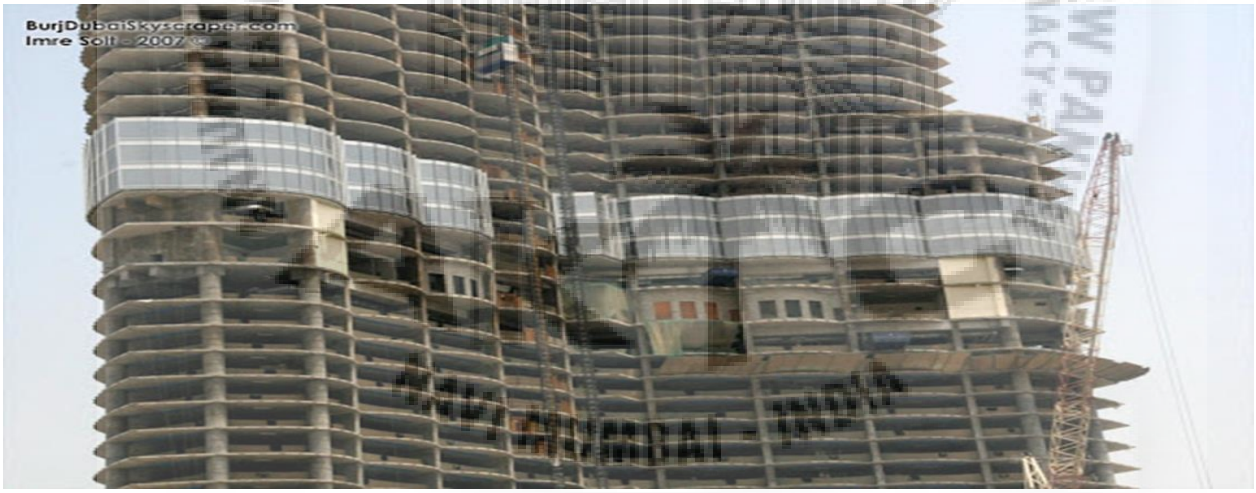


Fig.53. Burj Khalifa Cladding (Source – archinomy)

The exterior cladding is comprised of reflective glazing with aluminum and textured stainless-steel spandrel panels and stainless-steel vertical tubular fins. Close to 26,000 glass panels, each individually hand-cut, were used in the exterior cladding of the tower.

SERVICES

ELEVATOR

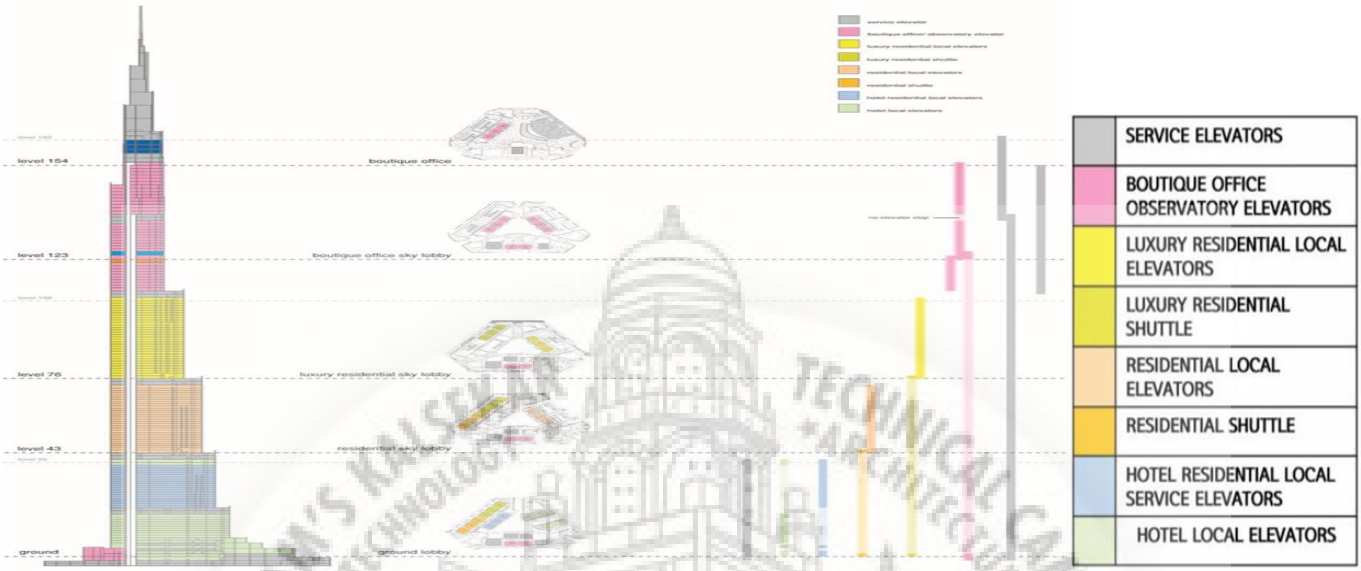


Fig.54. Burj Khalifa elevators (Source – archdaily)

WATER SUPPLY

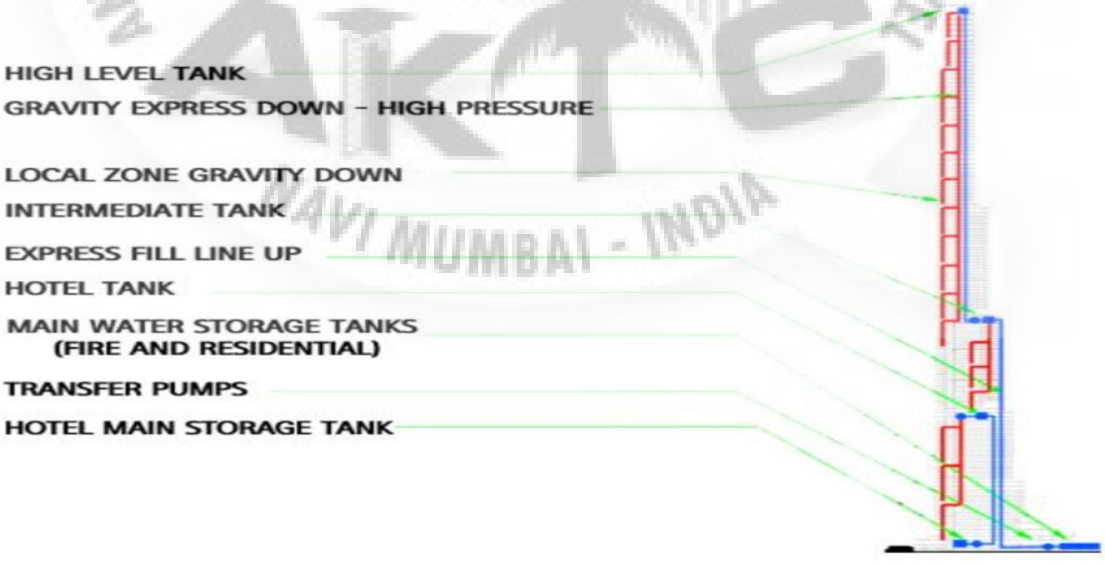


Fig.55. Burj Khalifa water supply system (Source – archdaily)

AIR SUPPLY SYSTEM

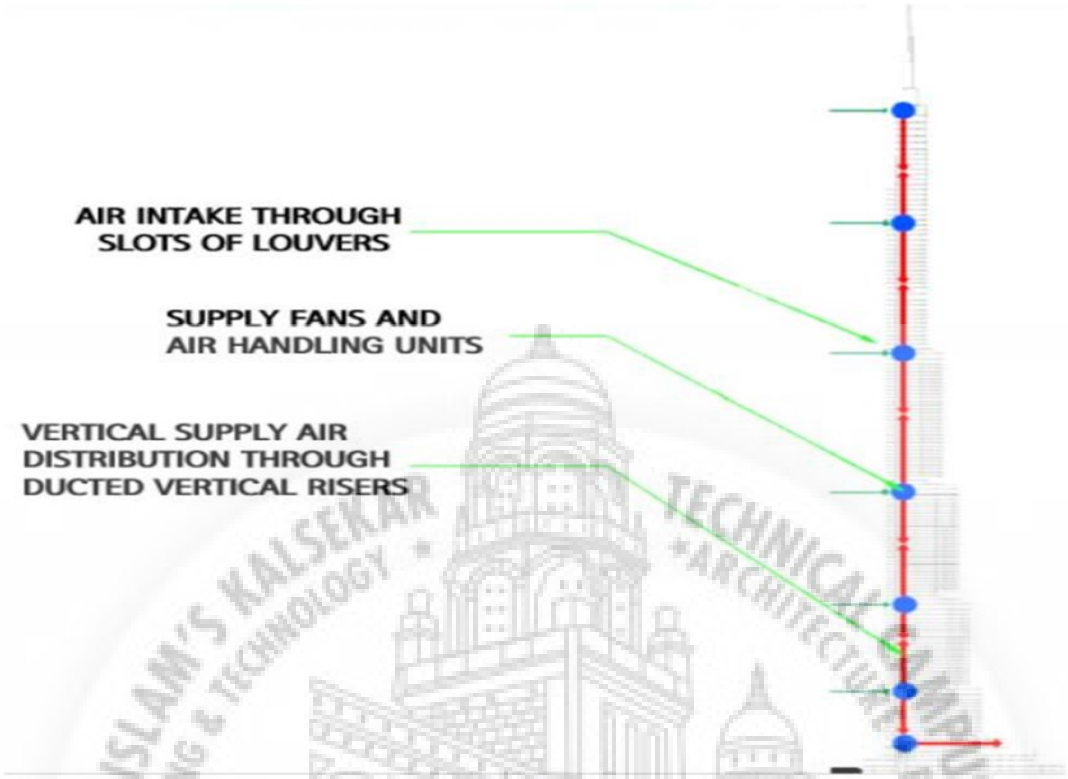


Fig.56. Burj Khalifa air supply system (Source – archdaily)

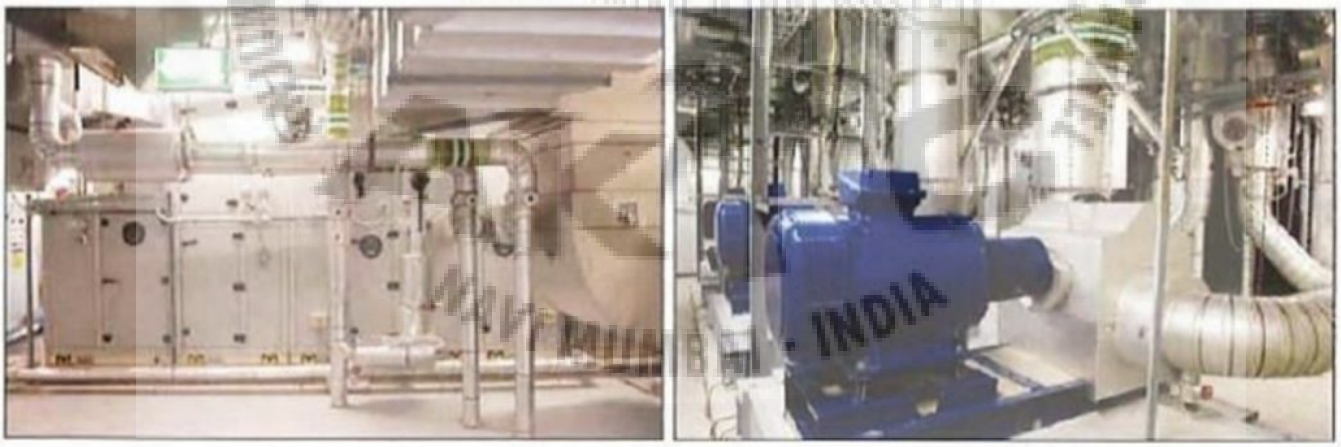


Fig.57. Burj Khalifa Air supply system (Source – archdaily)

INFERENCE

- The Burj is not only the tallest building in the world, it's also home to the highest observation deck, swimming pool, elevator, restaurant, and fountain in the world.
- Once at the top, visitors can enjoy temperatures that are nearly 15 degrees cooler than at the building's base.
- Burj Dubai has no helipad.
- All windows were fixed windows, no scope for natural ventilation
- A simple Y-shaped plan to reduce wind forces, as well as to foster constructability. Each wing, with its own high-performance concrete core and perimeter columns, buttresses the others via a six-sided central core, or hexagonal hub. The result is a tower that is extremely stiff torsional.

3.3 Case Study 3

BOSCO VERTICALE

Fig.58. Bosco Verticale (Source – Arcdaily)

BOSCO VERTICALE

BASIC INFORMATION

Architect - Boeri Studio

Floor area - 360,000 square meters

Status – completed

Height – 111m & 76m

Developer - Developer Hines Italia & COIMA

INTRODUCTION

The first example of a 'Vertical Forest' (il Bosco Verticale) was inaugurated in October 2014 in Milan in the Porta Nuova Isola area, as part of a wider renovation project led by Hines Italia. Milan's Vertical Forest consists of two towers of 80 and 112 meters, hosting 480 large and medium trees, 300 small trees, 11,000 perennial and covering plants and 5,000 shrubs. The equivalent - over an urban surface of 1,500 m2 – of 20,000 m2 of forest and undergrowth.

LOCATION

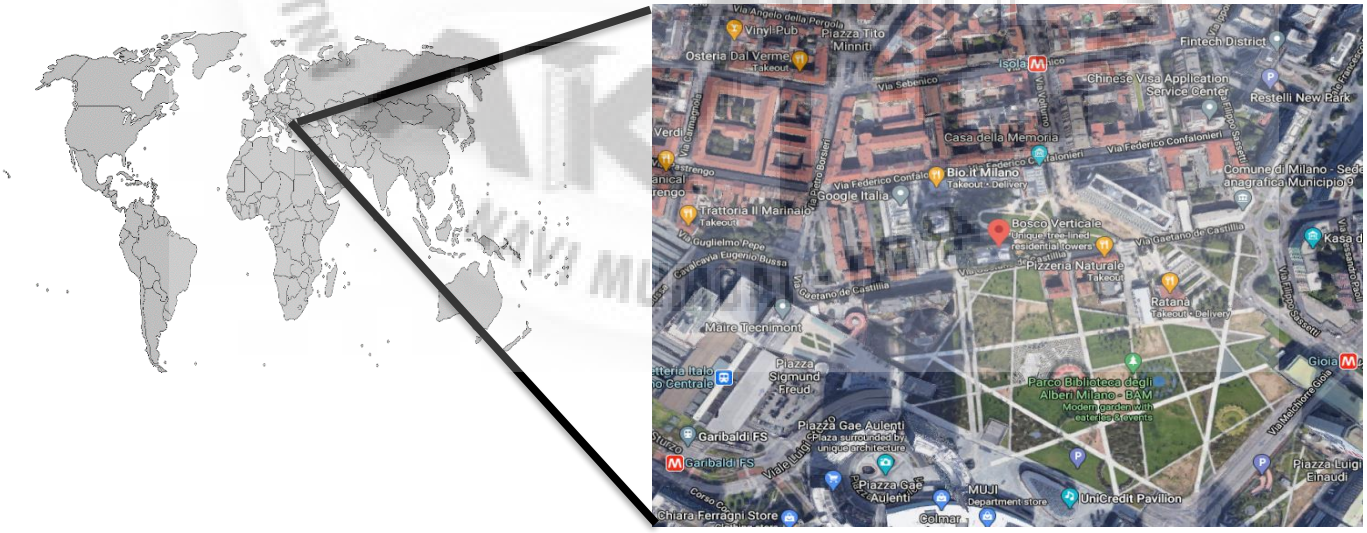


Fig.59. 20124 Milan, Metropolitan City of Milan, Italy

CONCEPT

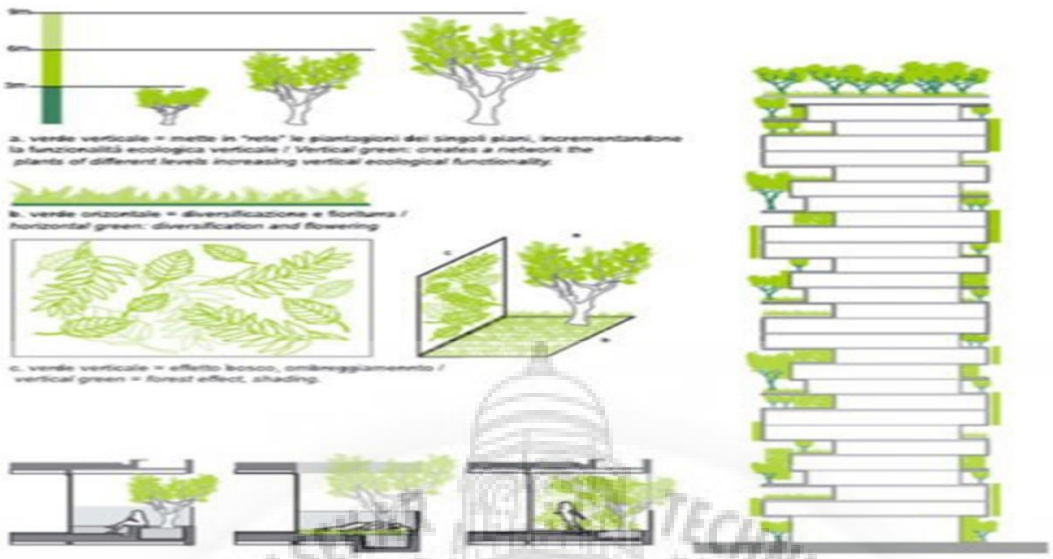


Fig.60. Bosco Verticale Concept (Source – Arcdaily)

Bosco Verticale was aimed at creating a biological habitat and increasing biodiversity. It created an urban ecosystem linking urban life and nature. The project serves as a means for the survival of European cities such as Milan, which are facing the problem of increasing pollution.

SITE PLAN

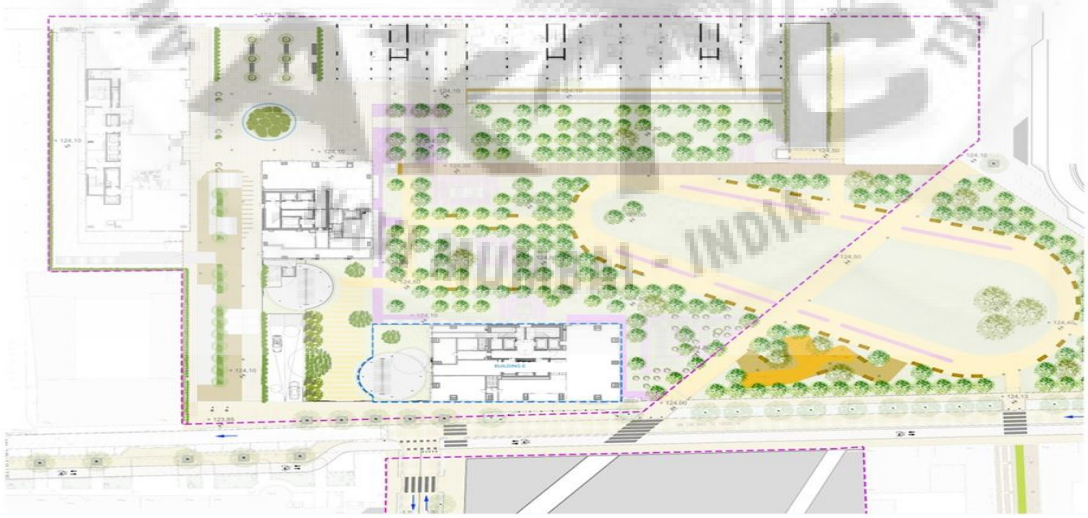


Fig.61. Bosco Verticale Site Plan (Source – Arcdaily)

FLOOR PLAN

Fig.62. Bosco Verticale Floor plan (Source – Arcdaily)

STRUCTURAL SYSTEM

Fig.63. Bosco Verticale Structural System (Source – Arcdaily)

The two high-rise towers of Bosco Verticale form part of the Porta Nuova project in Milan's Isola district and are aiming for LEED Gold certification. The building form and the location and extent of its glazing have been optimized to reduce heat loss and solar gain. Balconies, terraces and glazing performance all contribute to controlling solar gain. Wall insulation surpasses the local code. Windows have thermally broken aluminum frames with argon-filled, low-e double glazing.

CLIMATIC RESPONSE

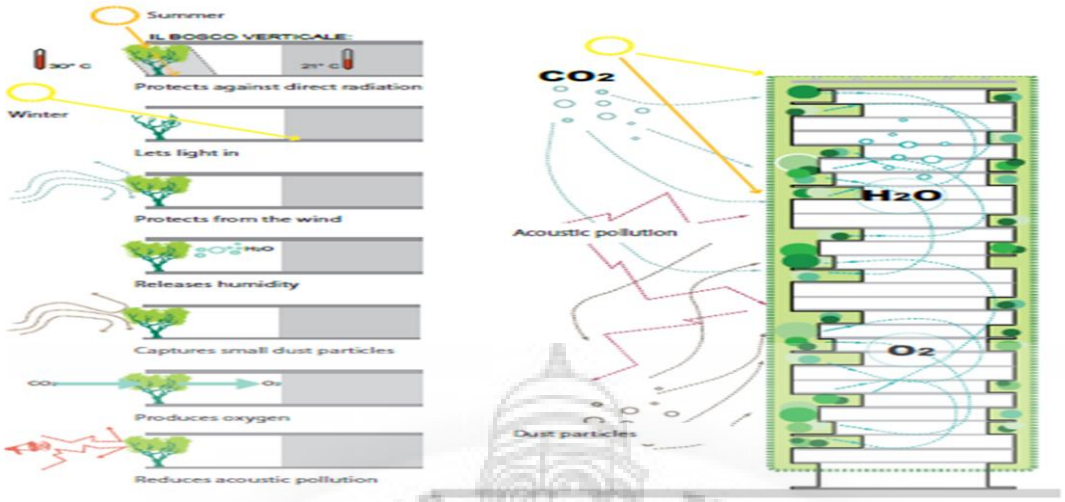


Fig.64. Bosco Verticale Climatic Response (Source – Arcdaily)

The Vertical Forest helps to build a microclimate and to filter fine particles contained in the urban environment. The diversity of plants helps to develop the microclimate which produces humidity, absorbs CO2 and particles, produces oxygen, and protects against radiation and noise pollution

SERVICES

WATER SUPPLY SYSTEM

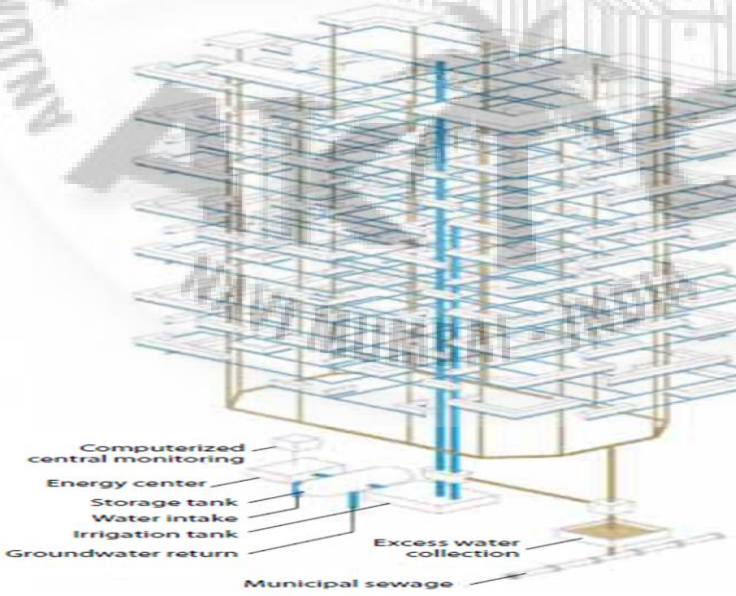


Fig.65. Bosco Verticale Water Supply System (Source – Arcdaily)

SECTION

Fig.66. Bosco Verticale section (Source – Arcdaily)

ELEVATION

Fig.67. Bosco Verticale Elevation (Source – Arcdaily)

VIEW

Fig.68. Bosco Verticale View (Source – Arcdaily)

DESIGN INTENT

The Vertical Forest is an architectural concept which replaces traditional materials on urban surfaces using the changing polychromic of leaves for its walls. The biological architect relies on a screen of vegetation, needing to create a suitable microclimate and filter sunlight, and rejecting the narrow technological and mechanical approach to environmental sustainability

Increasing carbon sequestration through nature-based solutions

Enhancing sustainable urbanization

Developing climate change mitigation

Fig.69. Bosco Verticale view (Source – Arcdaily)

INFERENCES

- Bosco Verticale was aimed at creating a biological habitat and increasing biodiversity
- The building form and the location and extent of its glazing have been optimized to reduce heat loss and solar gain
- It created an urban ecosystem linking urban life and nature. The project serves as a means for the survival of European cities such as Milan, which are facing the problem of increasing pollution.
- The Vertical Forest is an architectural concept which replaces traditional materials on urban surfaces using the changing polychromic of leaves for its walls

3.4 Case Study 4

OSIA DOWNTOWN

Fig.70. Oasia Hotel Downtown (Source – Arcdaily)

OSIA DOWNTOWN

BASIC INFORMATION

Architect - WOHA

Engineer - KTP Consultants Pvt ltd

Status – Complete

Type - Mixed-use Office Hotel

Lifts/elevators -13

Floor area - 19,416 m2 (208,990 sq. ft)

Floor count - 27

INTRODUCTION

A verdant tower of green in the heart of Singapore's dense Central Business District (CBD), Oasia Hotel Downtown is a prototype of land use intensification for the urban tropics. Unlike the sleek and sealed skyscrapers that evolved out of the temperate west, this tropical "living tower" offers an alternative image to the sleek technology of the genre.

LOCATION

Fig.71. Tanjong Pagar, Central Business District, Singapore

CONCEPT

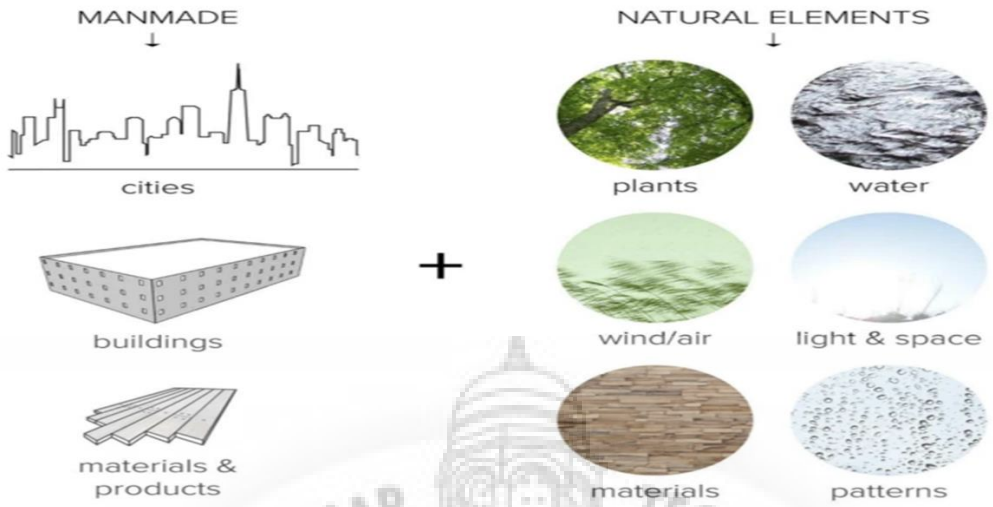


Fig.72. Oasia Hotel Downtown (Source – Google)

Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes. It suggests that we all have a genetic connection to the natural world built up through hundreds of thousands of years of living in agrarian settings

Ground floor PLAN

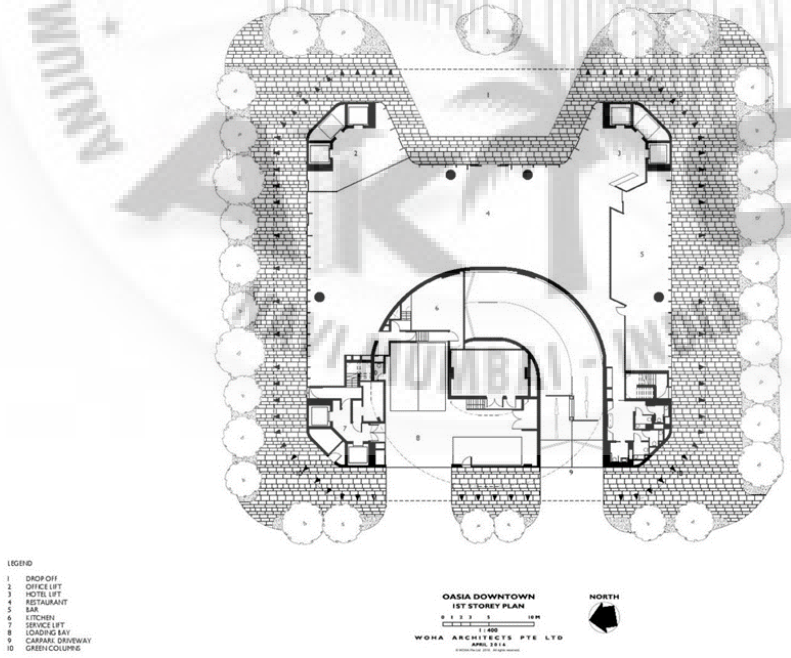


Fig.73. Oasia Hotel Downtown ground floor plan (Source – Arcdaily)

The site is located within the Tanjong Pagar area, which is a prominent gateway leading directly into the main financial and business areas of Shenton Way, Raffles Place and Marina Bay. It is also home to several hotels which have been established to serve the business community and tourist visitors. These include business hotels like the Amara and M Hotel, as well as award winning hotels like Berjaya Hotel and The Scarlet.

FLOOR PLANS

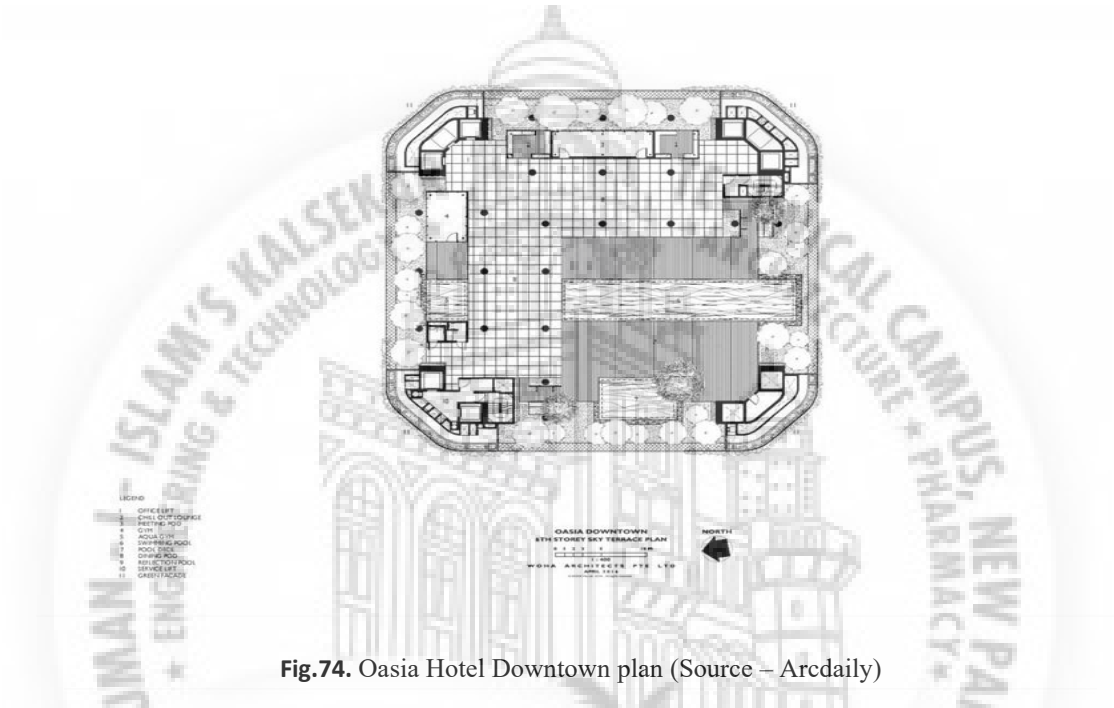


Fig.74. Oasia Hotel Downtown plan (Source – Arcdaily)

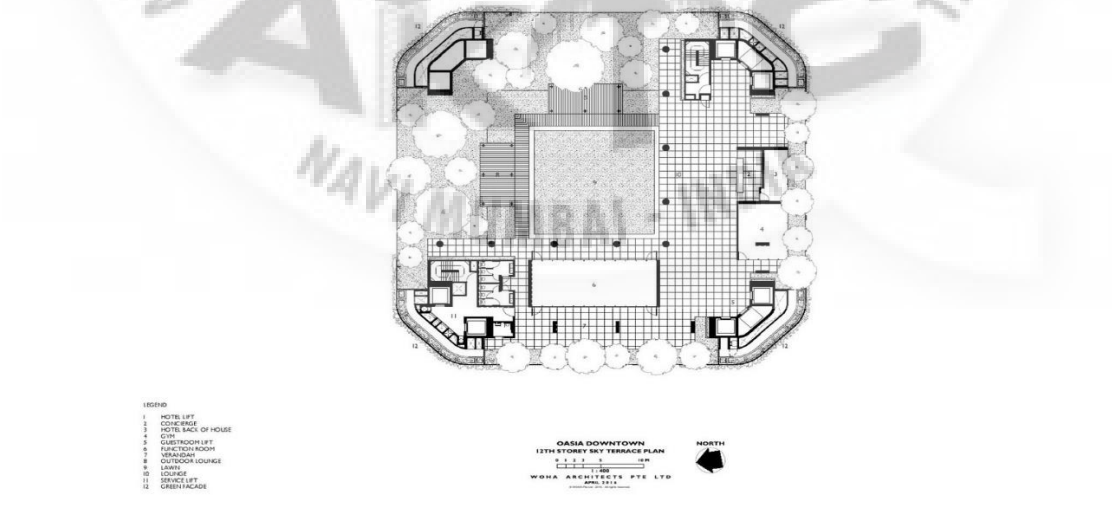


Fig.75. Oasia Hotel Downtown plan (Source – Arcdaily)

DEVELOPEMENT OF FORM

Fig.76. Oasia Hotel Downtown Form Development (Source – Arcdaily)

Fig.77. Oasia Hotel Downtown section (Source – Arcdaily)

ELEVATION

Fig.78. Oasia Hotel Downtown Elevation (Source – Arcdaily)

DESIGN INTENT

Oasia Hotel Downtown is a prototype of land use intensification for the urban tropics. Unlike the sleek and sealed skyscrapers that evolved out of the temperate west, this tropical "living tower" offers an alternative image to the sleek technology of the genre.

Vertical landscaping

Urban habitat

Garden city

Sky terraces

SECTION AND VIEWS

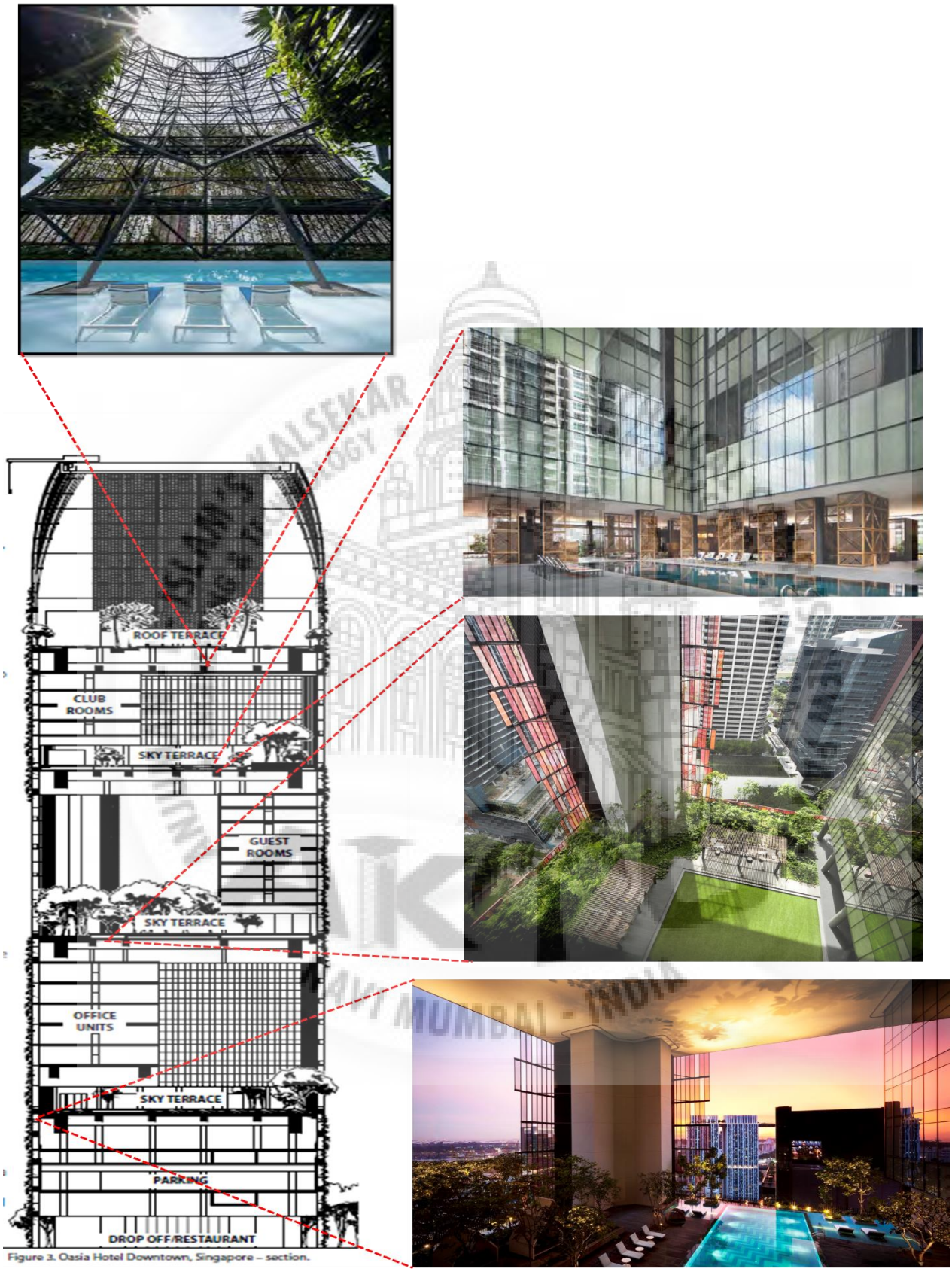


Fig.79. Oasia Hotel Downtown Section and Views (Source – Arcdaily)

3.5 Case Study 5

MAGIC BREEZE VILLA

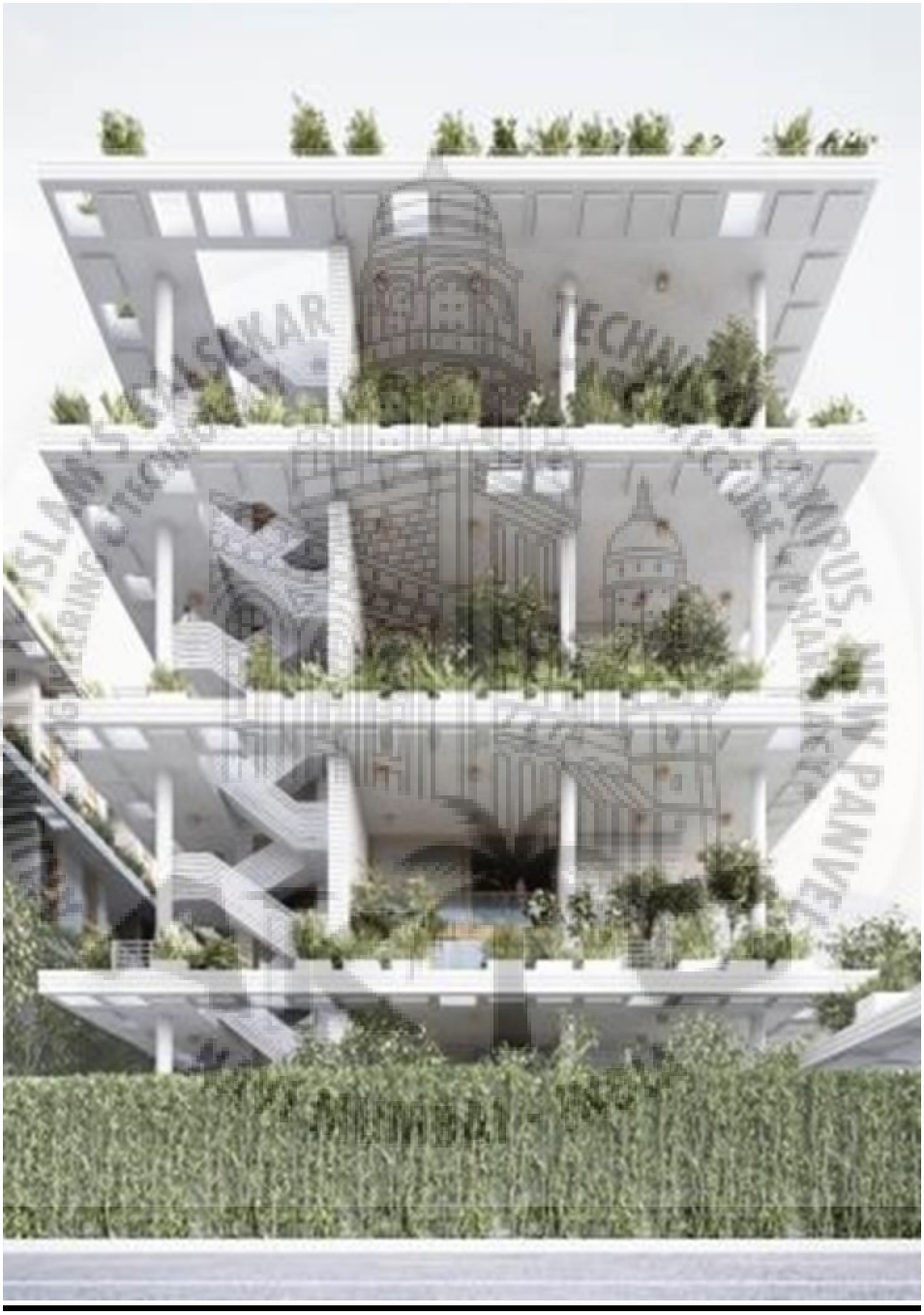


Fig.80. Magic Breeze Villa (Source – Arcdaily)

MAGIC BREEZE VILLA

BASIC INFORMATION

Architects: penda

Project Team: Chris Precht, Sun Dayong, Yu ZiZhi,

Xue Bai, Anna Andronova, Sun Mingxue, Xie Kerry

Type: Residential

Status: Ongoing Area: 450000.0 ft2

Year: 2016

INTRODUCTION

The entire complex was designed in accordance with the traditional Hindu architectural system of Vaastu, which prescribes principles of design, layout, orientation and spatial geometry, as well as an importance of creating architecture in harmony with nature. Vaastu remains an esteemed practice in modern Indian real estate development, being employed by famed Indian architect Charles Correa in many projects throughout his career. Penda responded to this need by giving as much space as possible back to nature in the form of garden terraces.

LOCATION

Fig.81. Hyderabad, Telangana, India

CONCEPT

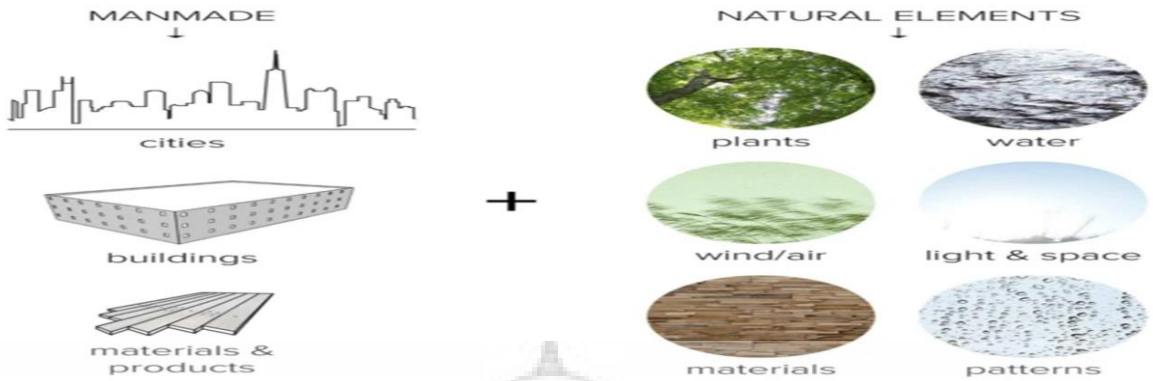


Fig.82. Magic Breeze Villa Concept (Source – Google)

Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes. It suggests that we all have a genetic connection to the natural world built up through hundreds of thousands of years of living in agrarian settings

SITE PLAN

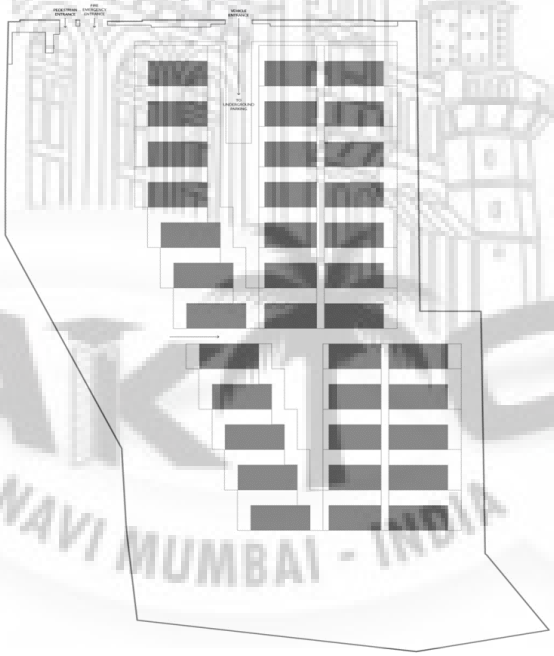


Fig.83. Magic Breeze Villa site plan (Source – Arcdaily)

The 450,000 square foot (42,000 square meter) development will include 127 duplex sky villas, ranging in size from 2,600 to 4,000 square feet (240 to 370 square meters), each separated by a double-height private garden terrace. The structure will be integrated into the landscape design, turning the park on its side to continue vertically up the side of the building

STRATEGIES

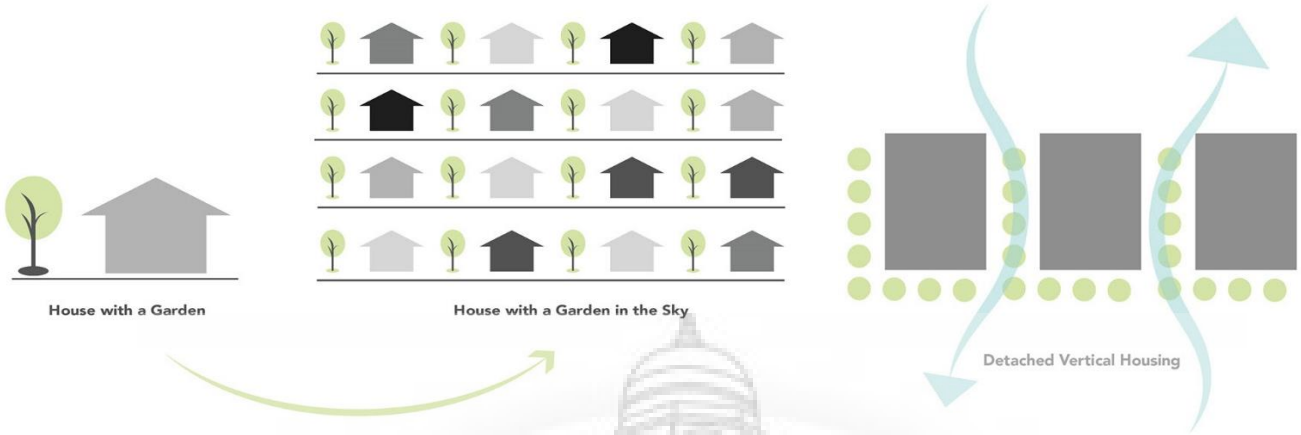


Fig.84. Magic Breeze Villa strategies (Source – Arcdaily)

Penda looked to the architectural typology of "private house with a garden," surrounding each 2-story unit with a 500 square foot (46 square meter) balcony containing a ribbon of lawn and a modular planter system. By giving each villa a spacious green-space, even when the units are stacked, the complex retains a sense of lightness and openness.

FLOOR PLAN

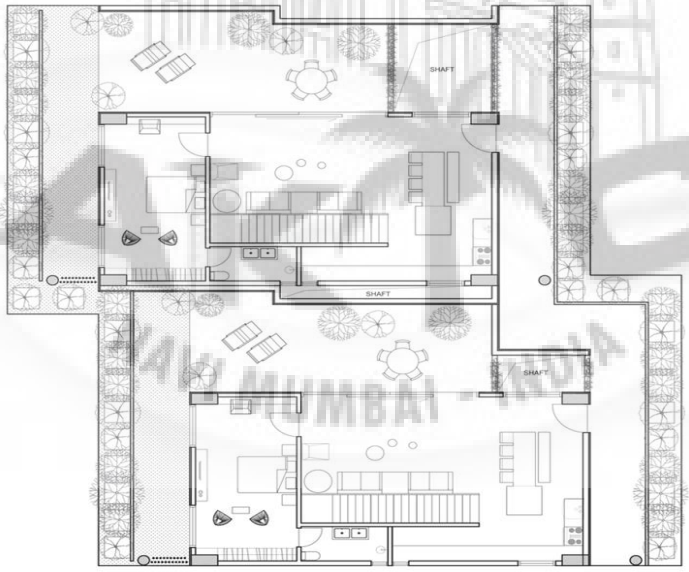


Fig.85. Magic Breeze Villa floor Plan (Source – Arcdaily)

DEVELOPMENT OF FORM

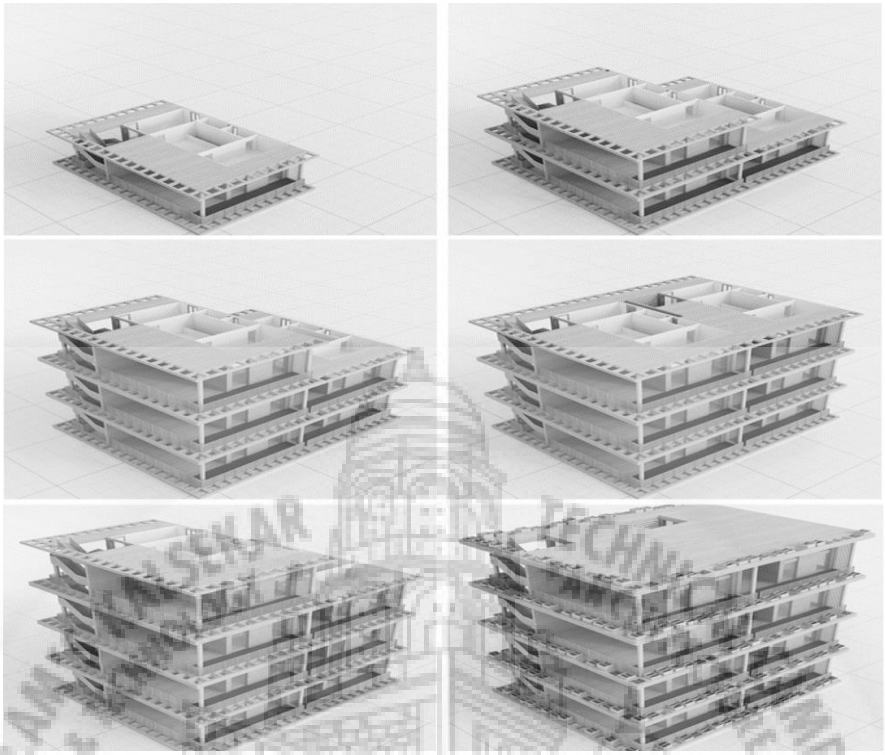


Fig.86. Magic Breeze Villa Form development (Source – Arcdaily)

ELEVATION OF AN APARTMENT

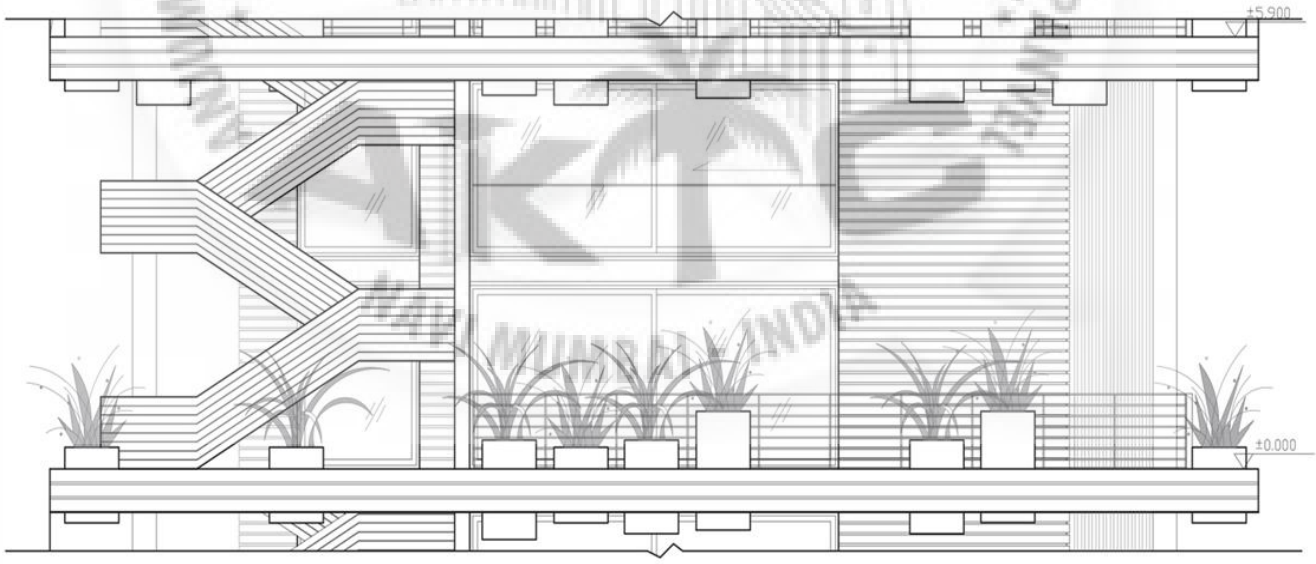


Fig.87. Magic Breeze Villa Elevation (Source – Arcdaily)

DETAILED SECTION OF THE BALCONY

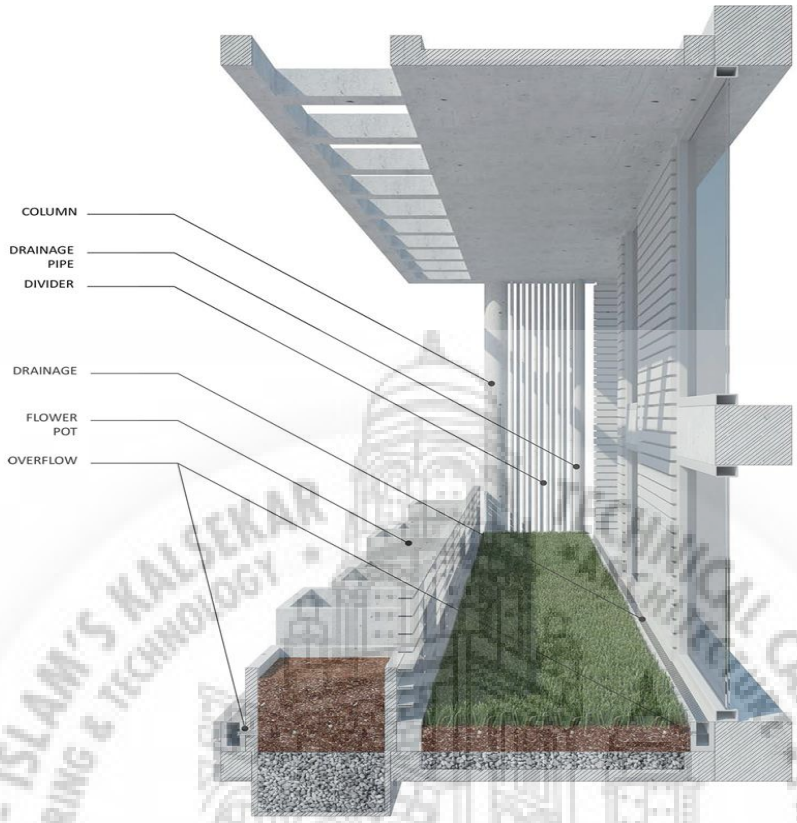


Fig.88. Magic Breeze Villa Detailed Section (Source – Arcdaily)

VIEWS

Fig.89. Magic Breeze Villa Views (Source – Arcdaily)

INFERENCE

- The entire complex was designed in accordance with the traditional Hindu architectural system of Vaastu
- Principles of design, layout, orientation and spatial geometry, as well as an importance of creating architecture in harmony with nature
- Penda looked to the architectural typology of “private house with a garden,” surrounding each 2-story unit with a 500 square foot (46 square meter) balcony containing a ribbon of lawn and a modular planter system

3.6 Case Study 6

PETRONAS TOWER

Fig.90. Petronas Tower (Source – Arcdaily)

PETRONAS TOWER

BASIC INFORMATION

Architect - Cesar Pelli

Developer - KLCC Holdings

Structural engineer - Thornton Tomasetti & Ranhill Bersekutu

Status - Complete

Type - Commercial offices and tourist attraction

Architectural style - Postmodern Islamic architecture

Floor count - 88 Floor area - 395,000 m2

Lifts/elevators - 38

INTRODUCTION

Once considered the tallest building in the world from 1998 to 2004, the Petronas Towers designed by Cesar Pelli stand as a cultural and architectural icon in Kuala Lumpur, Malaysia. Completed in 1998, the Petronas Towers are a reflection and homage to the dominant Islamic culture of Malaysia. The Petronas Towers have not only put Kuala Lumpur, Malaysia on the architectural radar, but it evoked the richness of the country's culture. The towers are not simply recognized for their height, but it was Pelli's conceptual efforts to incorporate Islamic motifs and symbols into the design process that would influence the design and the detailing of the building

LOCATION

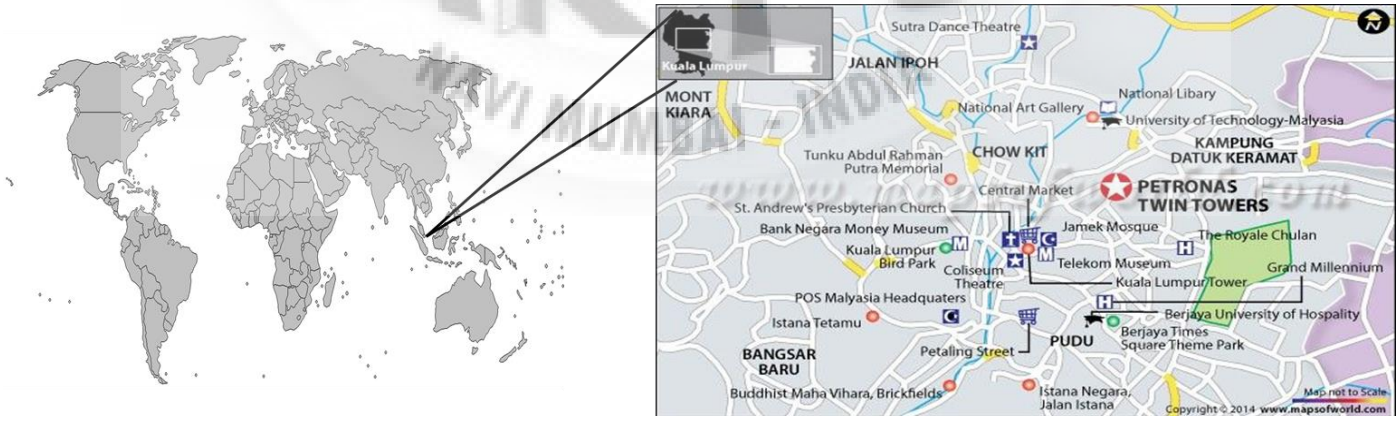


Fig.91. Kuala Lumpur, Malaysia

CONCEPT

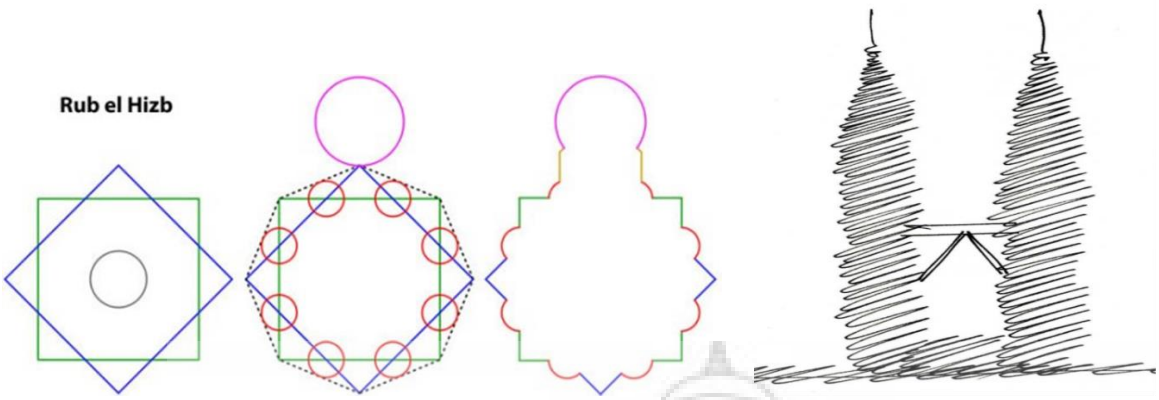


Fig.92. Petronas Tower (Source – archute)

Pelli used the Rub el Hizb, an important symbol found in many Islamic cultures, as a way to generate the plan of the building. The Rub el Hizb is characterized by two overlapping squares, one rotated 45 degrees, with a circle inscribed in the center. Pelli used the symbol as the footprints to both towers resulting in two extruded 8-point towers that reflected Islamic art. Rather than just leaving the building as a simple extrusion of a preexisting symbol found in Islamic art and culture, Pelli "scalloped" the points of the start to create a more elegant and delicate aesthetic that is found in most Islamic motifs.

SITE PLAN

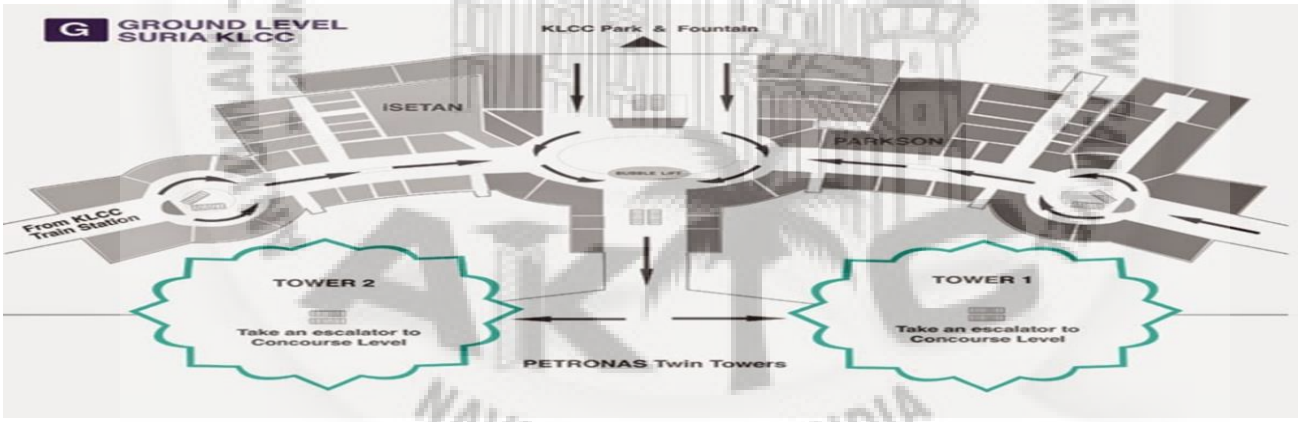


Fig.93. Petronas Tower Site Plan (Source – CTBUH)

Each tower: 88 storeys

Tower 1: Petronas head quarters

Tower 2: Local and international private, Tenants, Klcc holdings

Smaller circular bustle or annex added to each tower rising 44 storey

Towers connected by sky bridge at 41st & 42nd storey

DEVELOPMENT OF FORM

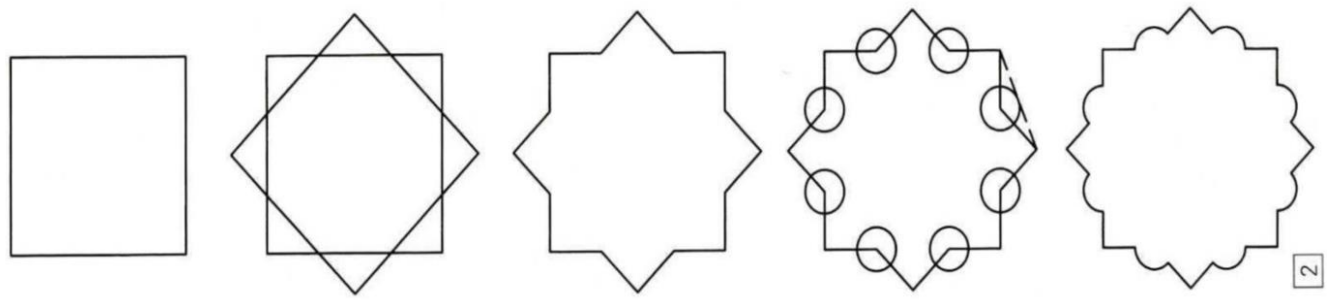


Fig.94. Petronas Tower Site Plan (Source – Wikipedia)

The towers are figurative and symmetrical and create a figurative space between them. Towers are tapered and set back five times in its ascent. The 88-floor towers are constructed largely of reinforced concrete, with a steel and glass façade designed to resemble motifs found in Islamic art.

FONDATION

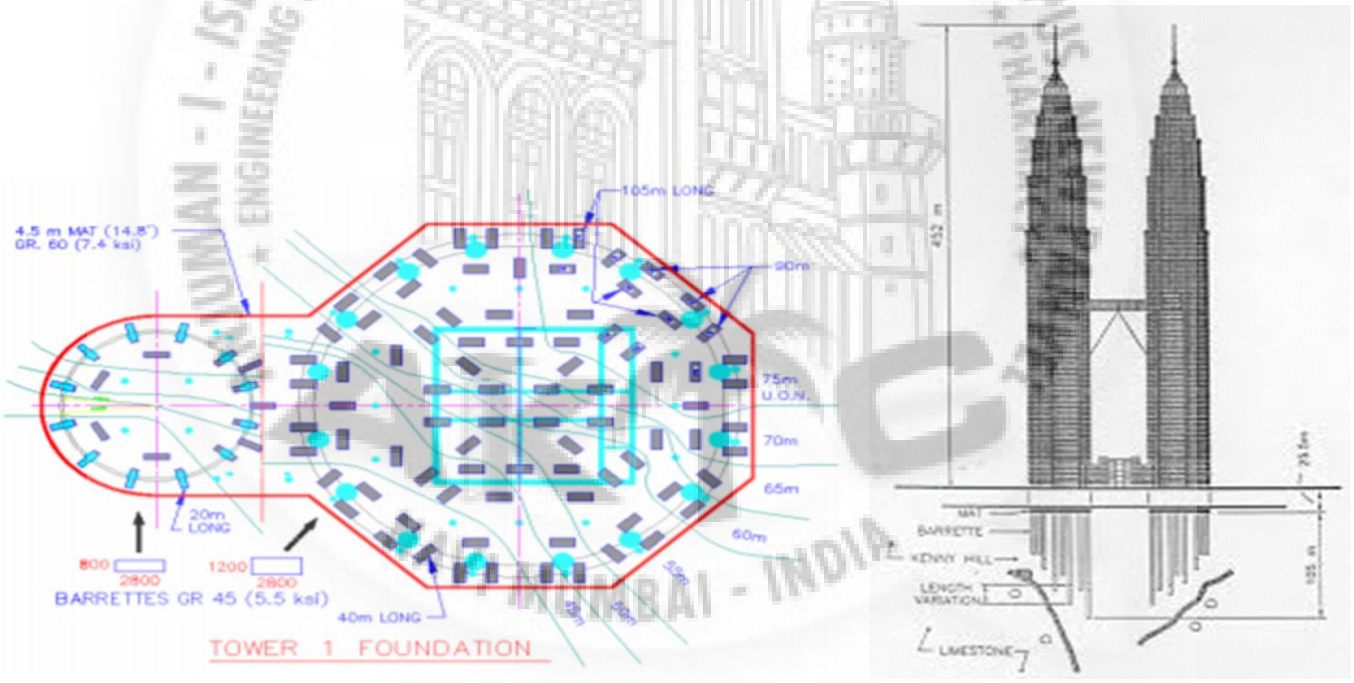


Fig.95. Petronas Tower Foundation (Source – CTBUH)

Early excavation problem: limestone bedrock

300000 metric ton weight of each tower to be spread on mat foundation

Pressure exerted by each tower: 1140 k-pa (more than twice bearing cap. Of soil available) Also bed rock was sloping – may lead to failure

GROUND FLOOR PLAN

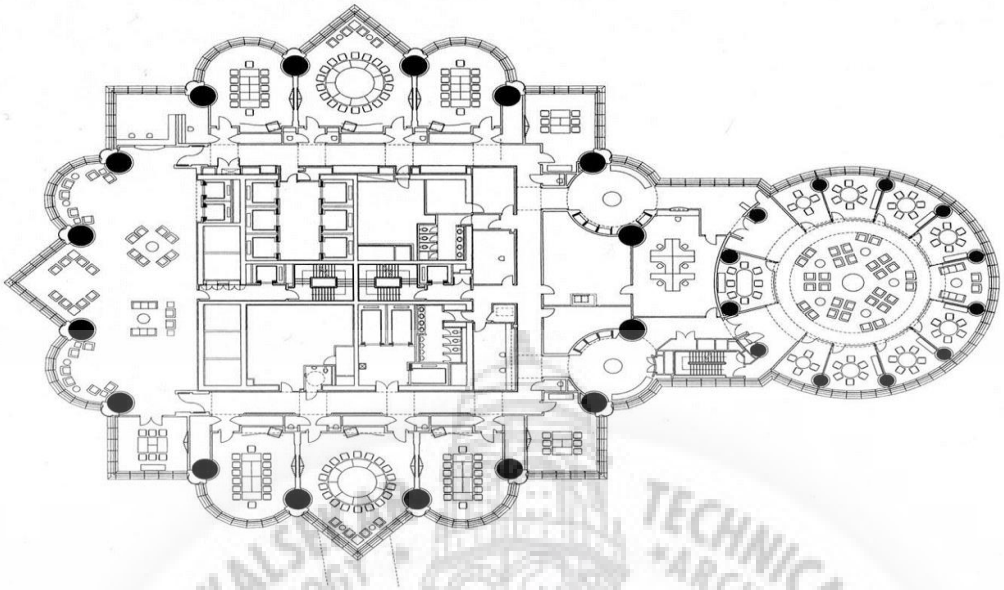
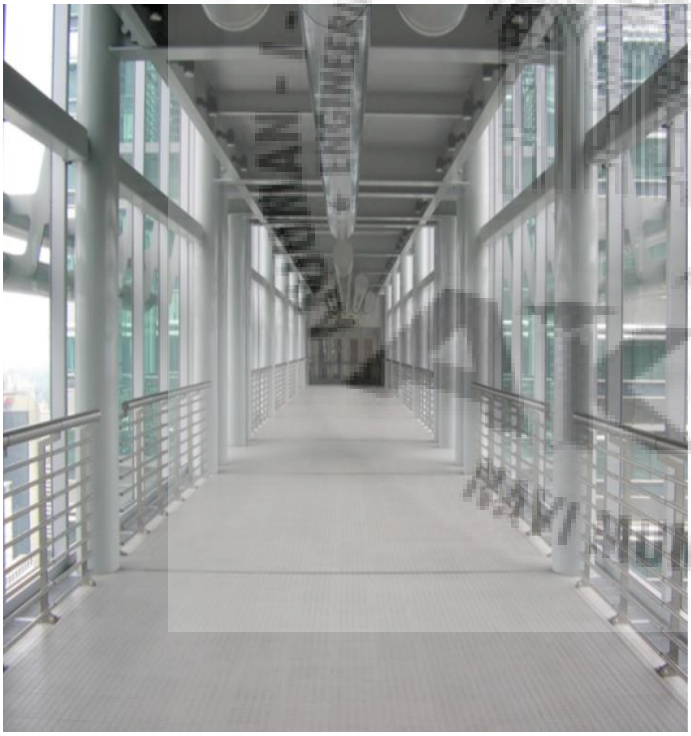


Fig.96. Petronas Tower Ground Floor Plan (Source – archute)

SKY BRIDGE VIEW AND DETAIL



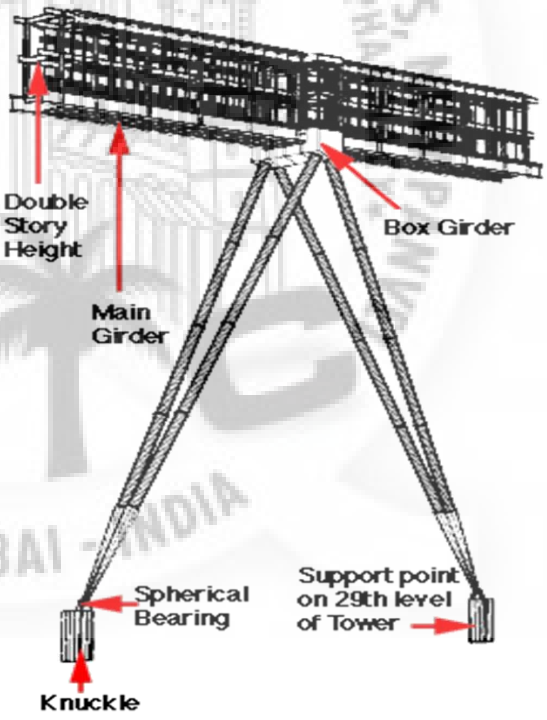


Fig.97. Petronas Tower Site Plan (Source – CTBUH)

LOAD DIAGRAM

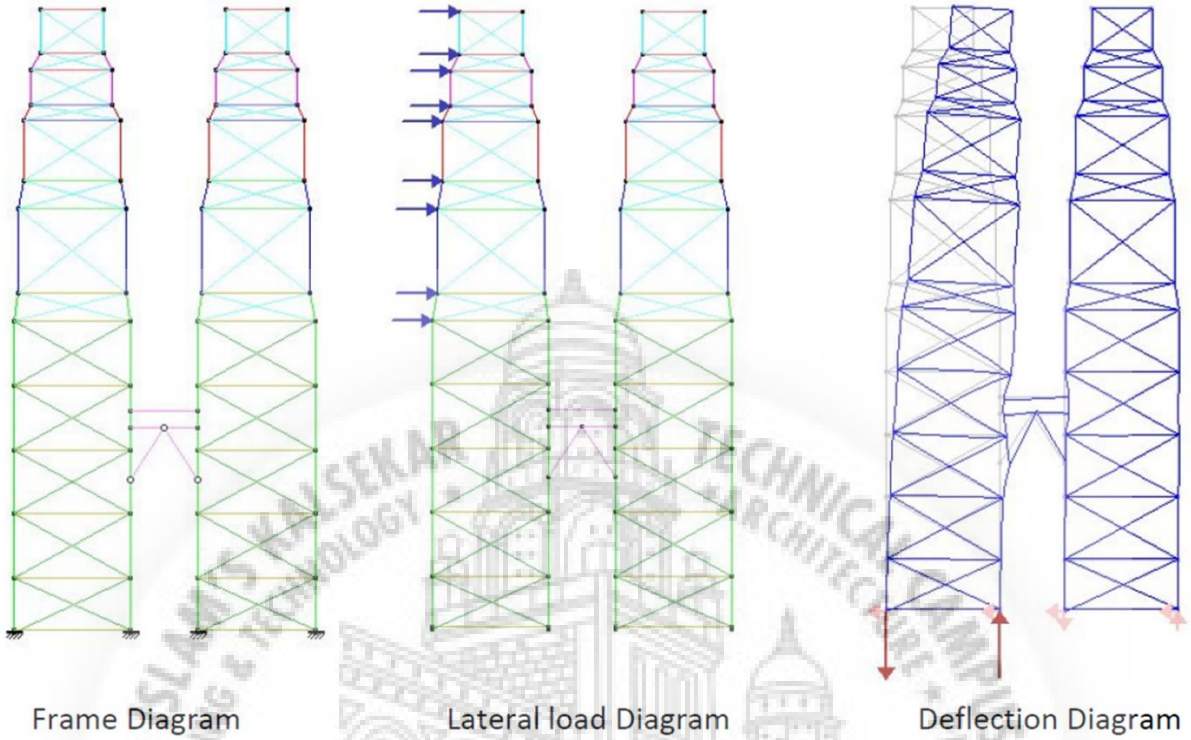


Fig.98. Petronas Tower Site Plan (Source – CTBUH)

INFERENCE

- Petronas Towers are a reflection and homage to the dominant Islamic culture of Malaysia
- The Petronas Towers have not only put Kuala Lumpur, Malaysia on the architectural radar, but it evoked the richness of the country's culture
- Pelli used the Rub el Hizb, an important symbol found in many Islamic cultures, as a way to generate the plan of the building.

Case Study 7

THE FOREST SCHOOL

Fig.99. The Forest School (Source – Dezeen)

THE FOREST SCHOOL

BASIC INFORMATION

Project name: the forest

Typology: School

Site area: 2.5 acre

location: Pune, Maharashtra, India

Architect: NUDES

Project Status: Not built

INTRODUCTION

NUDES has designed the mass of the building as two 'green' cylindrical volumes that are connected by a rooftop 'infinity' cycle track. each cylindrical volume represents a stage of phased construction with planned programmatic activities. the entire built-up construction of the school is approximately 125,000 ft2 and houses learning environments from early childhood education to 12th grade. the curved elevations are defined by a series of uniform protrusions and the lush vegetation that occupies them. This element of the project is intended to form a 'live skin' that will improve air quality and overall student health

LOCATION

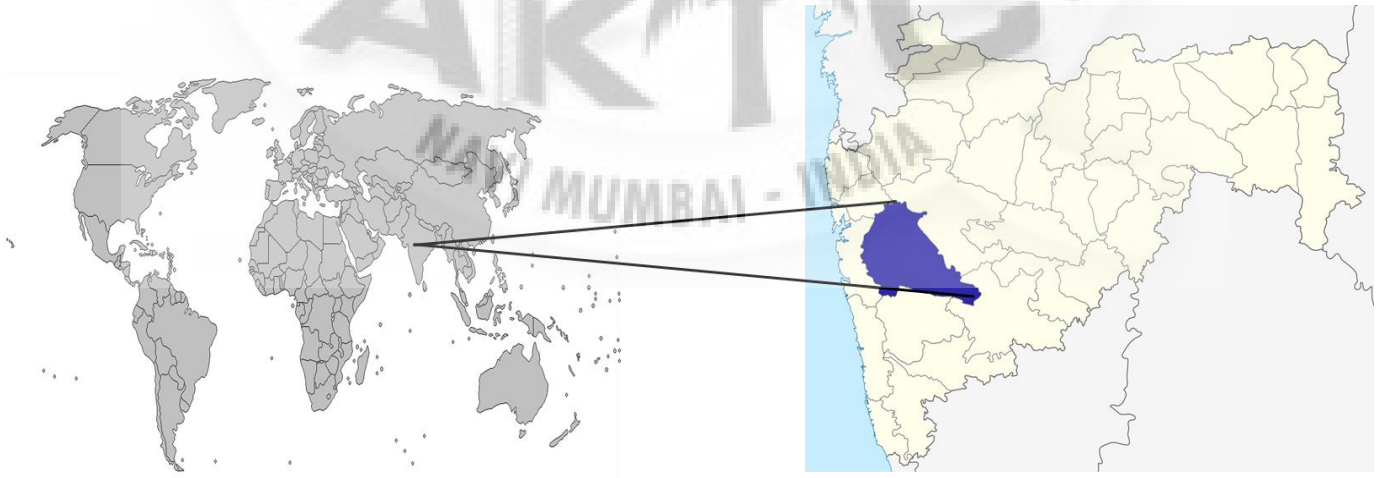


Fig.100. Pune, Maharashtra, India

CONCEPT

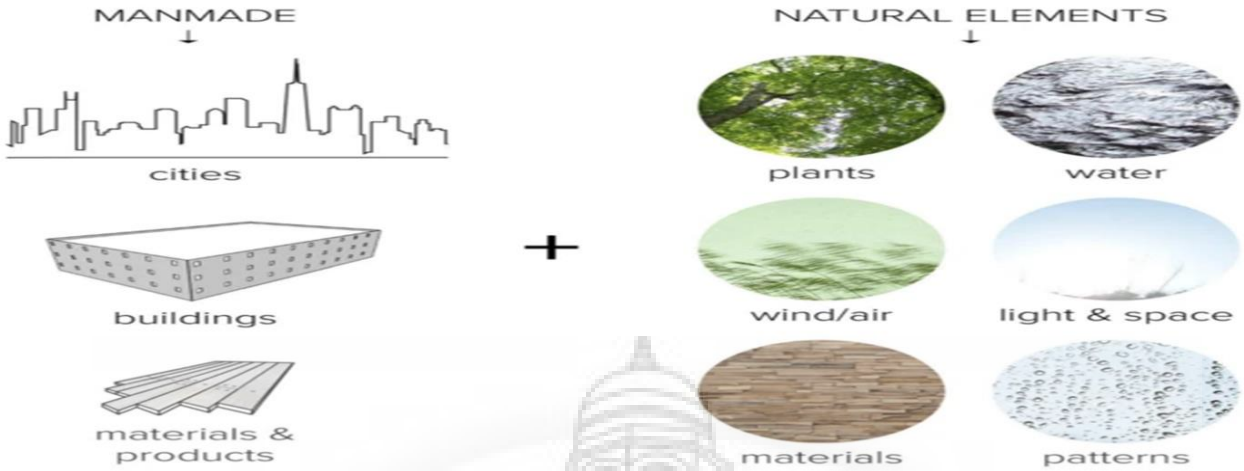


Fig.101. The Forest School Concept (Source – Google)

Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes. It suggests that we all have a genetic connection to the natural world built up through hundreds of thousands of years of living in agrarian settings

GROUND FLOOR PLAN

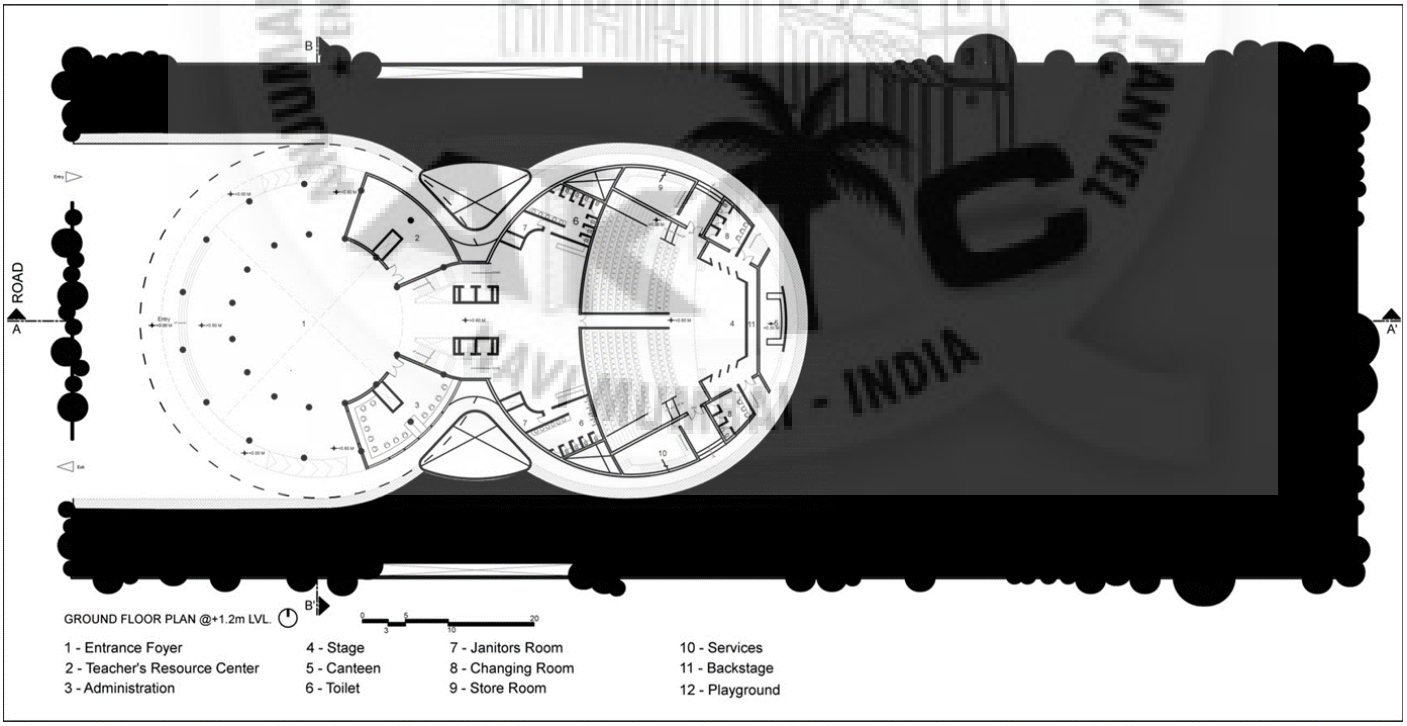


Fig.102. The Forest School Ground Floor Plan (Source – Dezeen)

FIRST FLOOR PLAN

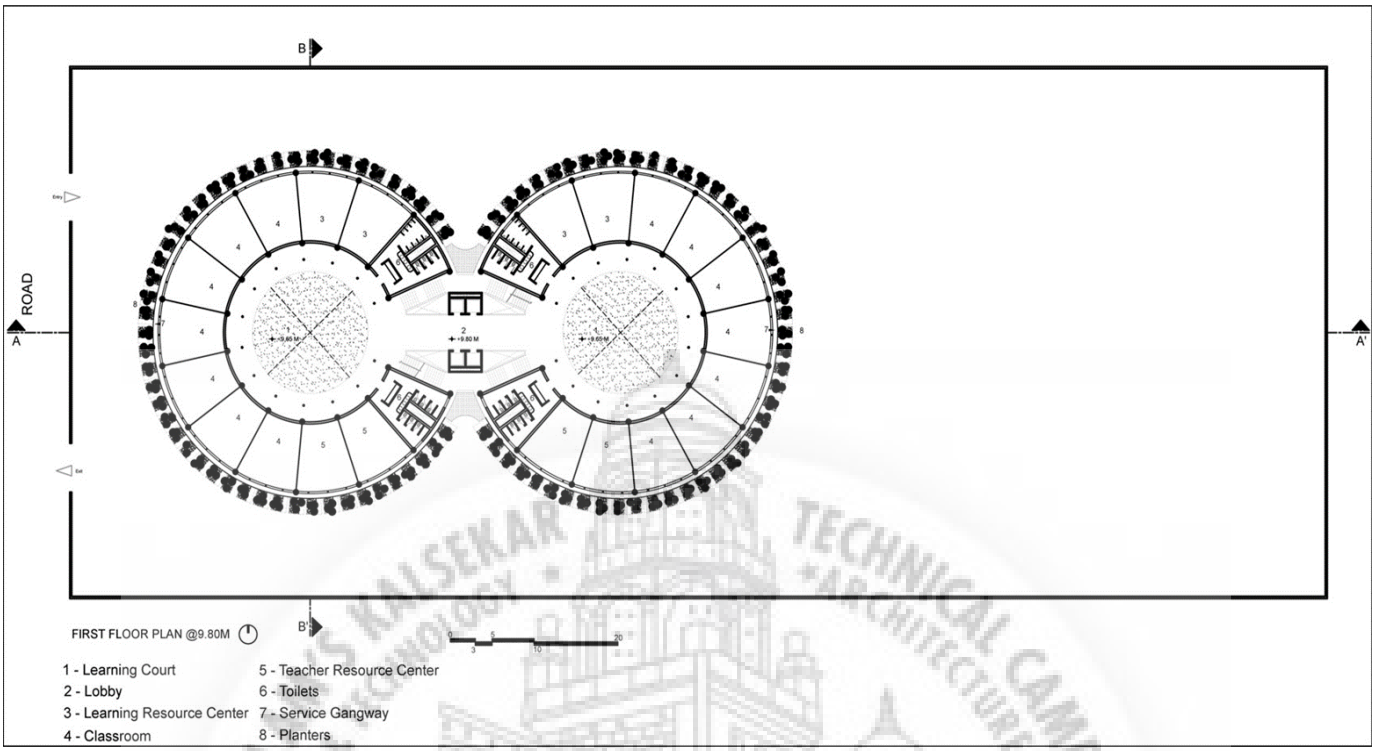


Fig.103. The Forest School plan (Source – Dezeen)

The round form of the plan also harnesses the idea of facilitating student centric interaction and learning. On the ground level, a central atrium draws in light and provides a social, gathering space, in addition to cross ventilation across classroom corridors. designed for a site of approximately 2.5 acres, the school building occupies the front end of the rectangular linear plot to create an open space for play and sport towards the rear.

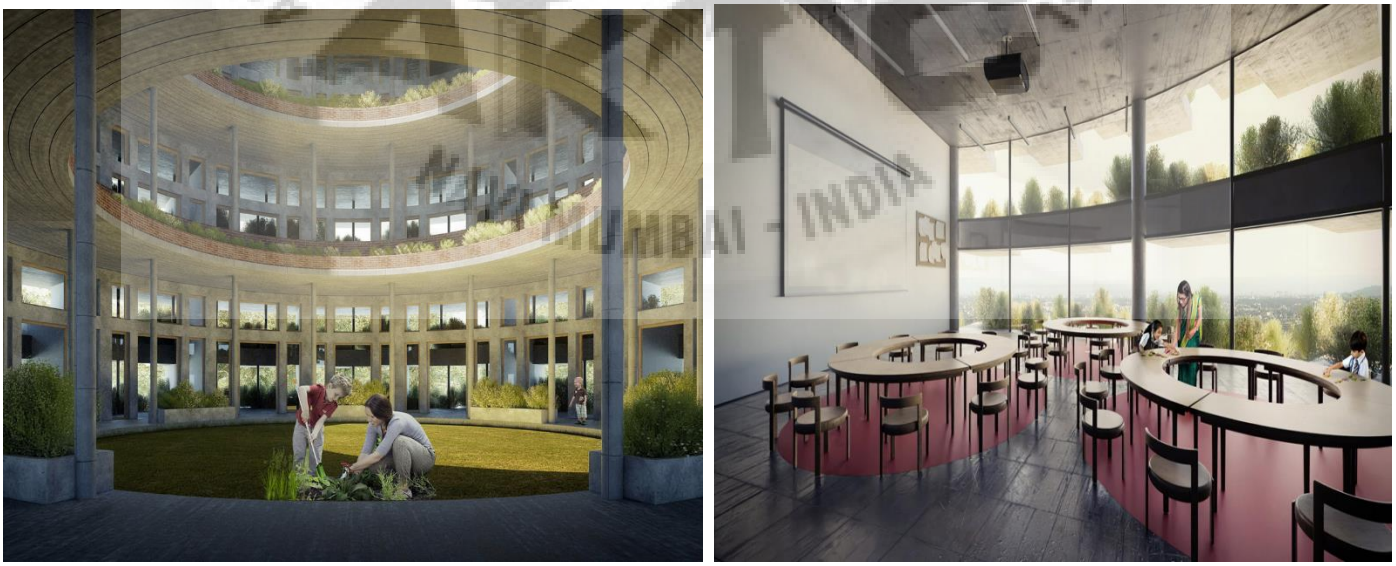


Fig.104. The Forest School views (Source – Designboom)

SECTION

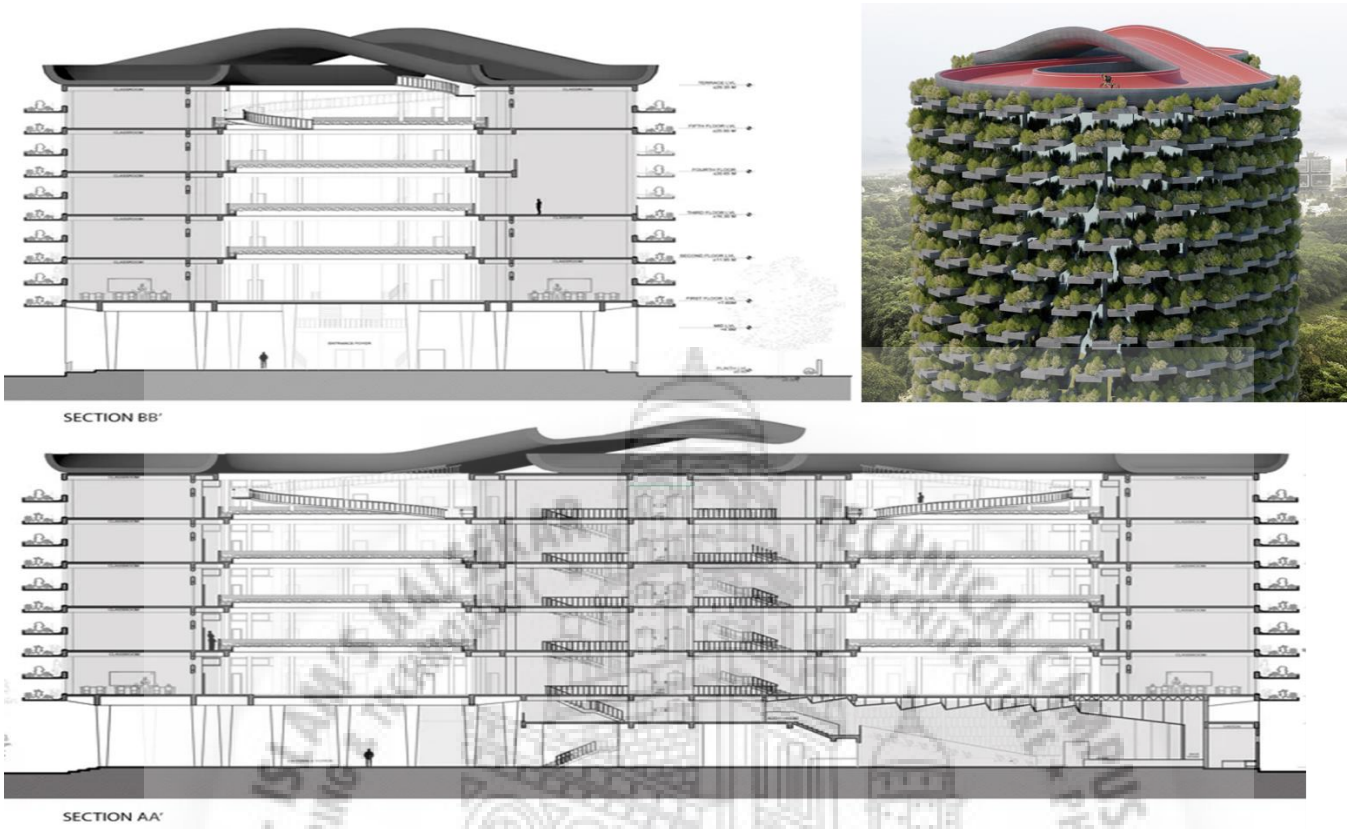


Fig.105. The Forest School Section (Source – Designboom)

DEVELOPMENT OF FORM

Fig.106. The Forest School Form Development (Source – Designboom)

INFERENCE

- The project is intended to form a 'live skin' that will improve air quality and overall student health
- The round form of the plan also harnesses the idea of facilitating student centric interaction and learning
- On the ground level, a central atrium draws in light and provides a social, gathering space, in addition to cross ventilation across classroom corridors

Case Study 8

LINKED HYBRID BUILDING

Fig.107. Link Hybrid (Source – Arcdaily)

LINKED HYBRID BUILDING

BASIC INFORMATION

Architect: Steven Holl Architects

Location: Beijing, China

Year: 2003-2009

Status: Completed

Program: 644 apartments, public green space, commercial zones, hotel, cinematheque, kindergarten, Montessori school, underground parking.

Client: Modern Green Development Co., Ltd. Beijing

Size: 221,426 sqm

INTRODUCTION

Linked Hybrid projects a renewed thinking about the public space within largescale high-rise projects. Holl shows us in this project how his ideal vertical city should work. It is his ideal city within a city. The horizontal traditional urban structure, continuous plinth with services, is combined with the vertical city, disrupted plinth. Living is combined with commercial program in various towers. The commercial program is located in the plinth and living above. An 'urban' ring of commercial and cultural public activities links the towers on the twentieth floor. This sky-high public space provides a cinematic experience of the whole complex and the city surrounding it.

LOCATION

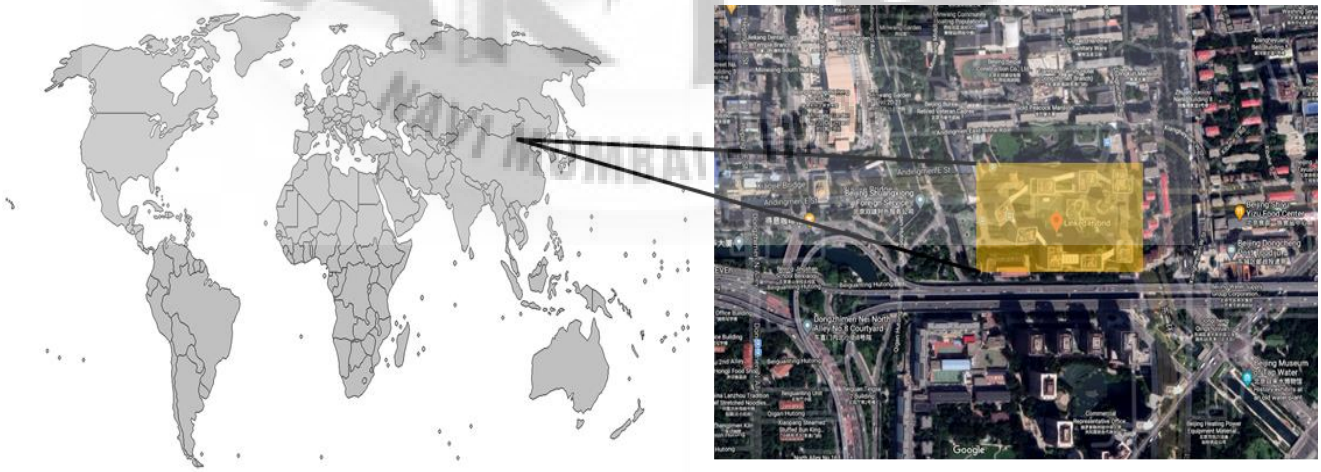


Fig.108. Dongzhimen Subdistrict, Dongcheng District, Beijing, China

CONCEPT

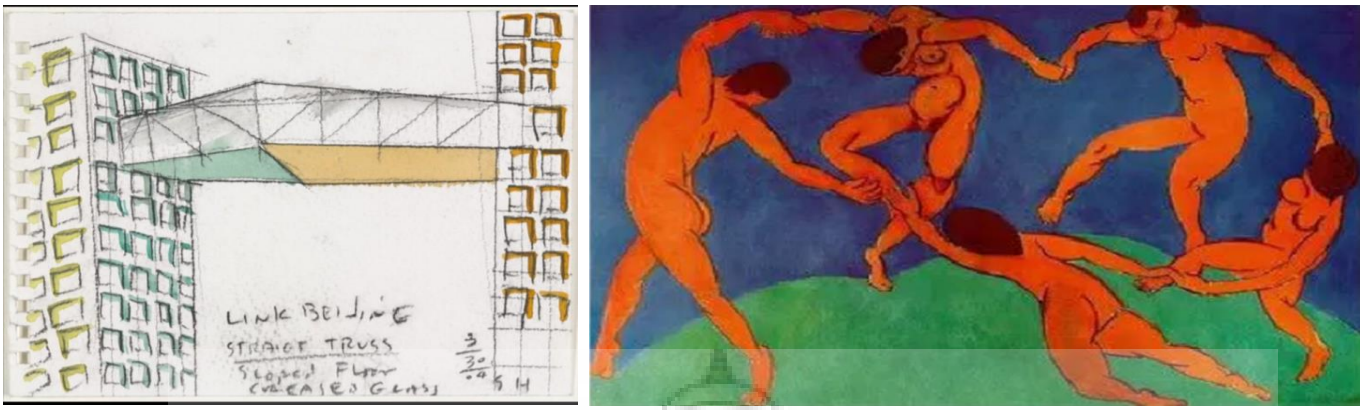


Fig.109. Link Hybrid concept (Source – Scribd)

Pedestrian-oriented Linked Hybrid complex: Public space (vary from commercial, residential, and educational to recreational.

Private urban development in China. Porous urban space.

Because of the many passages through the project, this project called "open city within a city.

SITE PLAN

Fig.110. Link Hybrid site plan (Source – Arcdaily)

Apartments towers -14 to 21 stories and are connected by 1 and 2 story bridges 8 Connecting Steel bridges (Sky Loop) serve as circulation while allowing space for cafes, retail, galleries etc. 2 level underground parking garage. Green Roof open to the public. Grass covered pavilion along the building perimeter houses a Montessori school and kindergarten 2.4 million sq. foot (220,000 sq. Meters) development. Located 15 minutes from a subway station

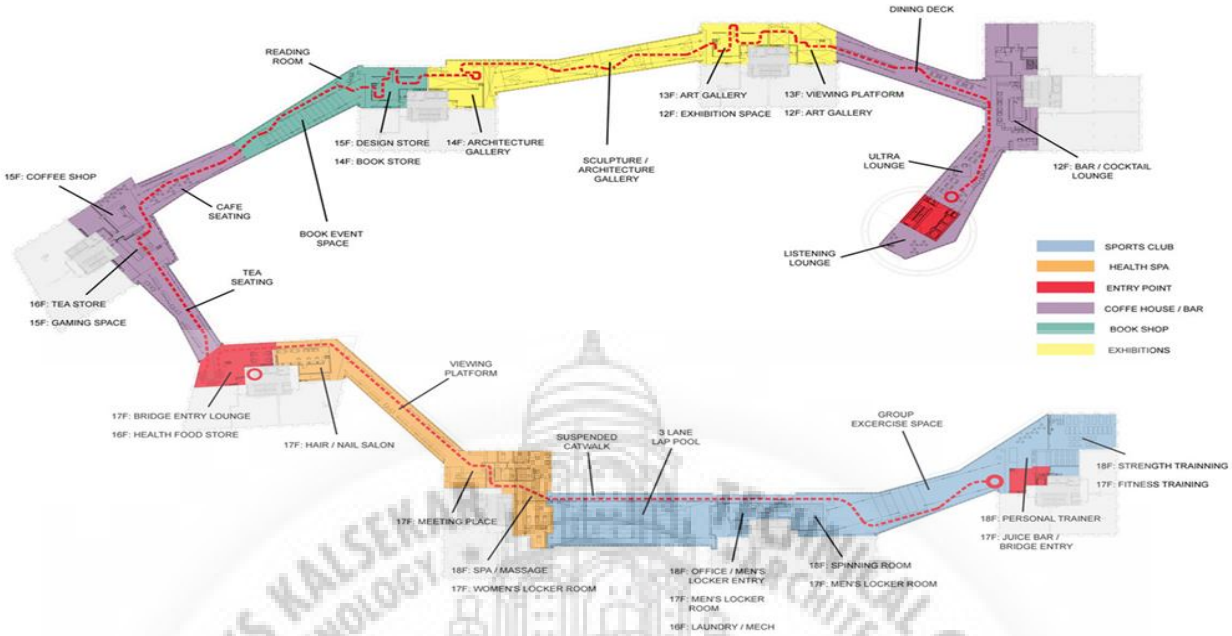


Fig.111. Link Hybrid building layout (Source – Arcdaily)

Open passages on the ground level surrounded by shops. There are some roof gardens on the intermediate. At the top of the residential towers, these roof gardens are connected to the penthouses. There are a number of skybridges from 12th to 18th floor. The largest green residential projects in the world

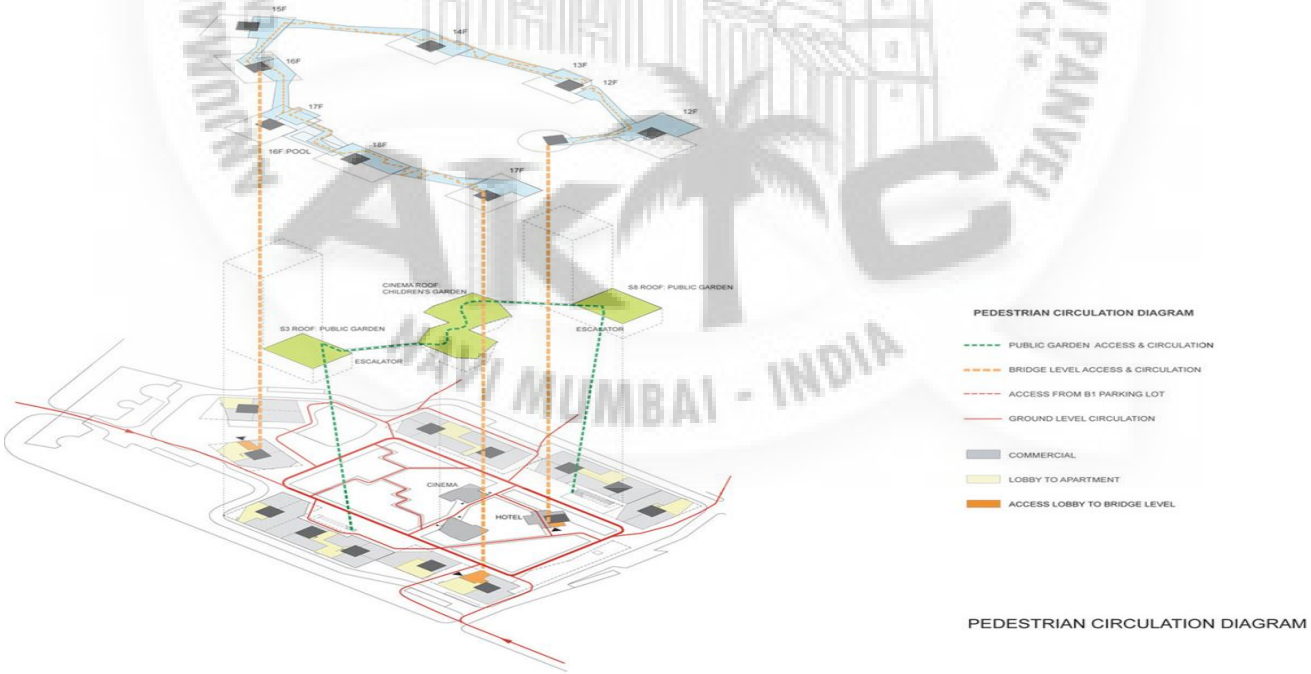


Fig.112. Link Hybrid layout (Source – Arcdaily)

SECTION

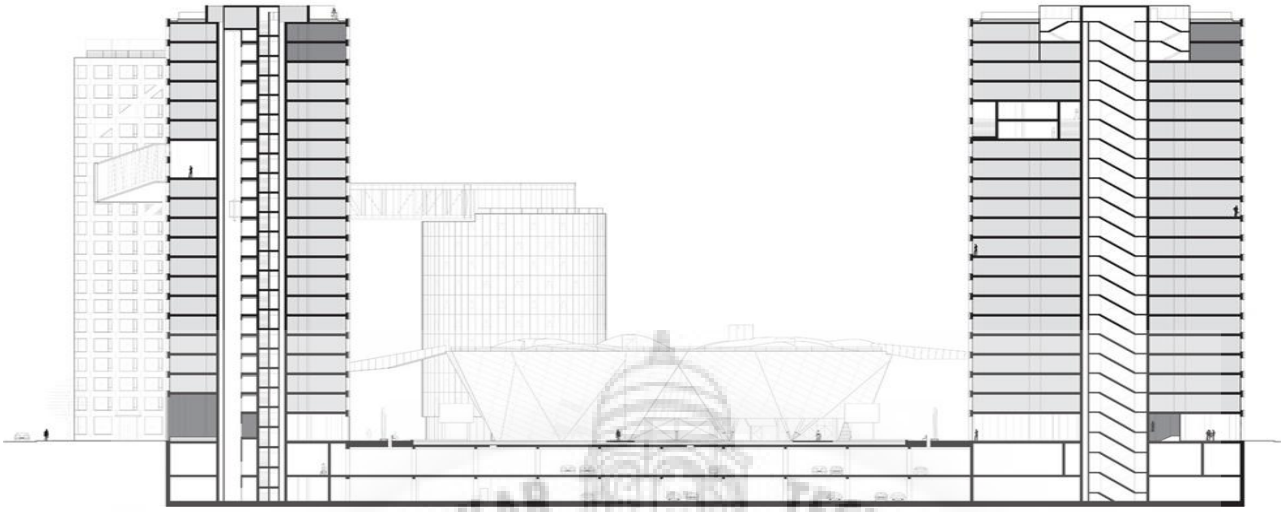


Fig.113. Link Hybrid section (Source – Arcdaily)

FUNCTION IN THE RING

1. Reading room 2. Design/book store 3. Architecture gallery 4. Sculpture gallery5. Art gallery 6. Viewing platform 7. Dinning deck 8. Ultra lounge9. Bar/cocktail 10. Listening lounge11. Fitness 12. Juice bar 13. Group exercise space 14. Spinning room15. Office, locker rooms 16. Lane lap pool 17. Suspended catwalk 18. Spa/massage 19. Meeting place 20. Viewing platform 21. Hair/nail salon 22. Health food store 23. Tea seating 24. Tea store/gaming place 25. Coffee shop 26. Café seating 27. Book event space 28. Book store

SECTION THROUGH THE LINK BRIDGE

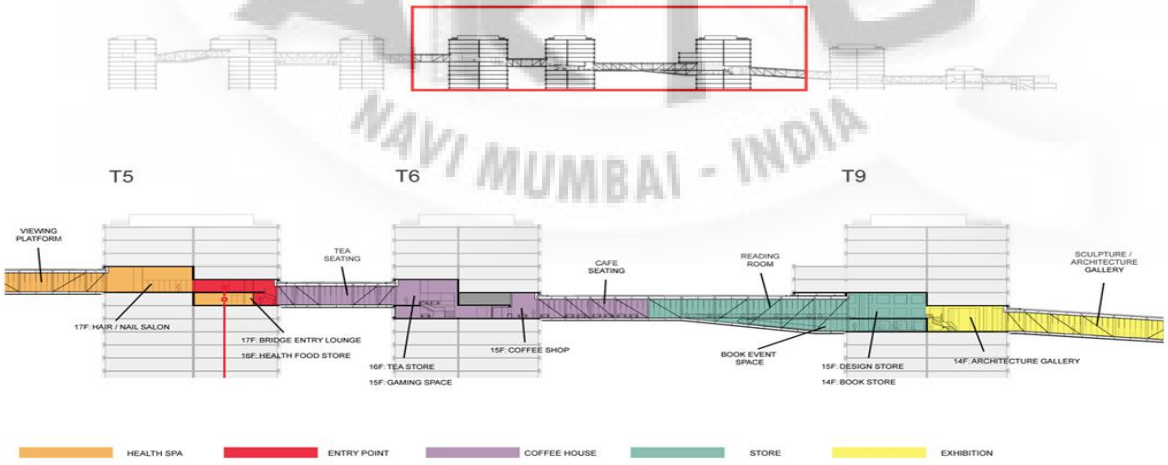
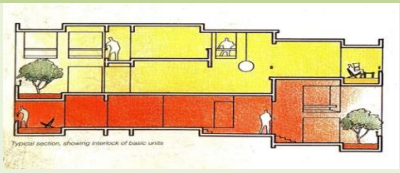
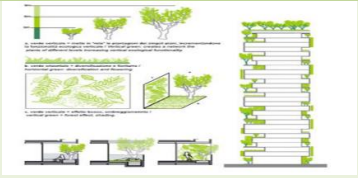


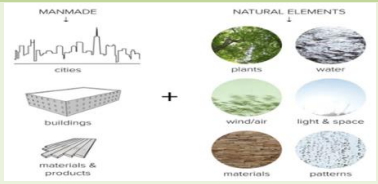
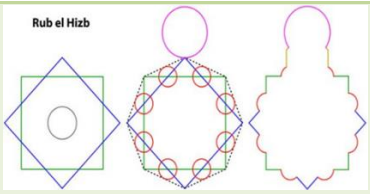
Fig.114. Link Hybrid section (Source – Arcdaily)

COMPARITIVE ANALYSIS

Criteria	Kanchenjunga	Burj Khalifa	Bosco Verticalle
Concept	 The Kanchenjunga Apartments are a direct response to the present culture, the escalating urbanization, and the climatic conditions for the region. They pay homage to the vernacular architecture that once stood.	 Burj Khalifa's architecture has embodied references to Islamic architecture and yet reflects the modern global community it is designed to serve	 Bosco Verticale was aimed at creating a biological habitat and increasing biodiversity. It created an urban ecosystem linking urban life and nature.
Area	2900 sqm	309,473 sqm	360,000 sqm
Building typology	Residential	Mixed used	Mixed used
Height	84 m	828 m	111m & 76m
Program	5 type of residential unit	Residence, commercial, malls, parks, aquarium	Residential
Plant integrated facade	Yes	No	Yes
User	Residents of the apartment	Residents, Tourists, Shop keepers, visitor,	Residents of the apartment
Sustainable Approach	Yes	Yes	Yes

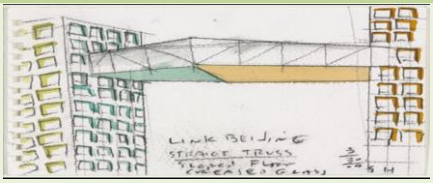
Material	RCC	Rcc, Metal rebar GLASS	RCC
Intend	The Kanchenjunga Apartments are a direct response to the present culture, the escalating urbanization, and the climatic conditions for the region. They pay homage to the vernacular architecture	Burj Khalifa was designed not with the intention of gaining accolades for the tallest building in the world but with the intention of having almost everything within one single building. The Burj Khalifa, a true masterpiece, is an incorporation of more than 20,000 homes, various hotels, corporate suites, residential towers and shopping centers within one building	The studio led by Italian architect Stefano Boeri came up with the concept of Bosco Verticale, or Vertical Forest, as a way to combine high-density residential development with tree planting in city centers

Table.No.2. Comparative Analysis 1

Criteria	Osia downtown	Petronas tower	Magic breeze villa
Concept	 Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes.	 Biomorphic Postmodern Islamic architecture	 Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes.
Area	19,416 sqm	395,000 sqm	41806 sqm
Building typology	Commercial	Mixed Used	Residential
Height	207 m	452 m	-
Program	hotel and offices	Residence, commercial, malls, parks, aquarium	3 type of residential unit
Plant integrated facade	Yes	No	Yes
User	Visitors, tourists	Residents, Tourists, Shop keepers, visitor,	Residents of the apartment
Sustainable Approach	Yes	Yes	Yes

Material	RCC	RCC, STEEL, GLASS	RCC
Intent	Injecting a strong presence within the rapidly growing skyline of Singapore's central. The verdant tower, which is bursting with greenery, detracts from the typical sleek and sealed skyscraper to offer an image that capitalizes on the tropical climate to form a 'living tower'.	The Petronas Towers have not only put Kuala Lumpur, Malaysia on the architectural radar, but it evoked the richness of the country's culture. Islamic motifs and symbols into the design process that would influence the design and the detailing of the building.	The structure will be integrated into the landscape design, turning the park on its side to continue vertically up the side of the building double-height private garden terrace.

Table.No.3. Comparative Analysis 2

Criteria	Link hybrid	The forest school
Concept	 Pedestrian-oriented Linked Hybrid complex • Public space (vary from commercial, residential, and educational to recreational).	 Biophilia (meaning love of nature) focuses on human's innate attraction to nature and natural processes.
Area	221,426 sqm	10117 sqm
Building typology	Mixed use	Institution
Height	68 m	-
Program	Residence, schools, offices, commercial, parks	School
Plant integrated façade	No	Yes
User	Residents, Tourists, Shop keepers, visitor,	Teachers, students
SUSTAINIBLE APPROACH	Yes	Yes
Material	R.C.C, Steel, Glass	R.C.C

Intent		The project is intended to form a 'live skin' that will improve air quality and overall student health

Table.No.4. Comparative Analysis 3

4. DESIGN BRIEF

VERTICAL SPACE MAKING IN DEVELOPING URBAN BLOCK

- The design involves creating safe, habitable spaces. The buildings must support their weight, resist wind and earthquakes, and protect occupants from fire. Yet they must also be conveniently accessible, even on the upper floors, and provide utilities and a comfortable climate for the occupants
- Design will focus on creating healthy and walkable neighborhoods, reducing traffic congestion and promoting public transportation, while also minimizing pollution and energy consumption.
- Environmental performance has been central to the design, with integrating plants and features such as green roofs, and high-efficiency fixtures.
- The design should also meet the ground at a" pleasant human scale" with vibrant, pedestrian-friendly neighborhood with thriving retail, welcoming open spaces, and world-class amenities.
- The design should include indoor public spaces such as an semi open urban space with shops, restaurants, and activities that would make the complex a revitalized and exciting destination.
- Orientation of the structure should have direct response the climatic conditions for the region.
- Technology and safety should be integral part of the design
- Form and Function: Form of building should combine with the immediate environment. Form and Function go hand in hand. The form of the structure should be able to convey the function of the building
- Site Planning and Landscape detailing: In such a way, there should be a clear traffic movement and easier pedestrian access
- Building Services: such as Fire Alarm system, HVAC, Water supply systems: The working of Fire Alarm system, HVAC and Water supply systems should be examined and their space requirements are to be appropriate
- Design detailing considering the Barrier-free environment: Implementation of the Barrier-free architecture for comfortable access to disabled people.

5.TENTATIVE ARCHITECTURAL SPACE PROGRAM

Sr no	PURPOSE	NAME OF THE SPACE	CHARACTERISTIC OF THE SPACE
1	Entry to The Structure	Entrance Lobby/ atrium	Double heighted space, connected to major amenities & services.
2	Public Utility	Toilets, Staircase	Easily accessible, easy to maintain, public space
3	Vertical Transportation	Escalators, Elevators	Easily accessible, easy to maintain
4	Space to live	Housing unit	Habitable, naturally ventilated, Well lit, Less circulation, Sustainable
5	Social interaction	Recreational Spaces	Interactive, Open/Semi open spaces, visually connected
6	Parking	Parking	Open semi open spaces
7	Revenue Generation	Shops, Restaurant	Easily accessible, Interactive space
8	Amenities	Terrace Gardens	Naturally ventilated, Well lit, Interactive
9	View from the structure	Viewing Deck	Naturally/Artificially ventilated, Well lit, Interactive

Table.No.5. Space Program

Shops – Large & Small – Range from 100 sq.m to 500 sq.m, Lobby, Atrium, Staff area – BMS room, Service area, Toilets, Parking, Stairs, Lifts /Escalators.

OFFICE COMPLEX: Offices Large & Small: 3000 sq.m to 6000 sq.m, Lobby, Atrium, Staff area, BMS room, Service area, Toilets, Parking, Stairs, Lifts /Escalators

APARTMENTS: Bedroom Unit: 200 to 250 sq.m. Bedroom unit - 300 to 400 sq.m. Entrance Lobby, Staircase, Lifts, Fire escape stairs, AHU rooms, Electrical rooms.

SERVICED APARTMENTS: Rooms toilets, Details of public areas, lobby /lounge, restaurants bars, shopping, banquet/ conference halls, health club, Swimming pool.

6. SITE

6.1 SITE Selection

High-Rise mixed-use structure at Thakkar Estate, Byculla, Mumbai, Maharashtra.

Ownership of the land: Atlas mill

Site Area: 23000 sq.m. approx.

Governing Body: Municipal Corporation of Greater Mumbai (MCGM), commonly known as the Bombay Municipal Corporation (BMC). Mumbai Metropolitan Region Development Authority (MMRDA).

Why Byculla?

Byculla is neighbored by Nagpada and Mumbai Central and Mahalaxmi on the west; Agripada, Jacob Circle on the north-west: Chinchpokli to the north; Madanpura in the center, Reay Road and Ghodapdeo on the north-east; Mazagaon and Dockyard Road to the east; and Sandhurst Road and Bhendi Bazaar to the south.

Byculla falls under "E" Ward within the municipal limits of Brihanmumbai Municipal Corporation or BMC.

Traditionally, Byculla has been inhabited by Parsis, Christians, Jews, Hindus and Muslims. Byculla, like many other locations of Mumbai have witnessed strong real estate growth.

Byculla is well connected by Central Railway line of the Mumbai Suburban Railway via Byculla railway station, as well as bus routes serviced by BEST.

Most of the bus routes servicing South Mumbai, South-Central Mumbai, Central Mumbai and North-East Mumbai pass through Byculla. The resulting heavy traffic prompted city planners to develop major fly-overs in Byculla

Almost all local trains halt at Byculla railway station - meaning it is a halt station for the 'Fast' local trains on Mumbai's Central Railway line. Mumbai Central and Mahalakshmi on the Western Railway line and Dockyard Road and Reay Road stations on the Harbor Line of Mumbai Suburban Railway also lie close to Byculla

6.2 SITE Location

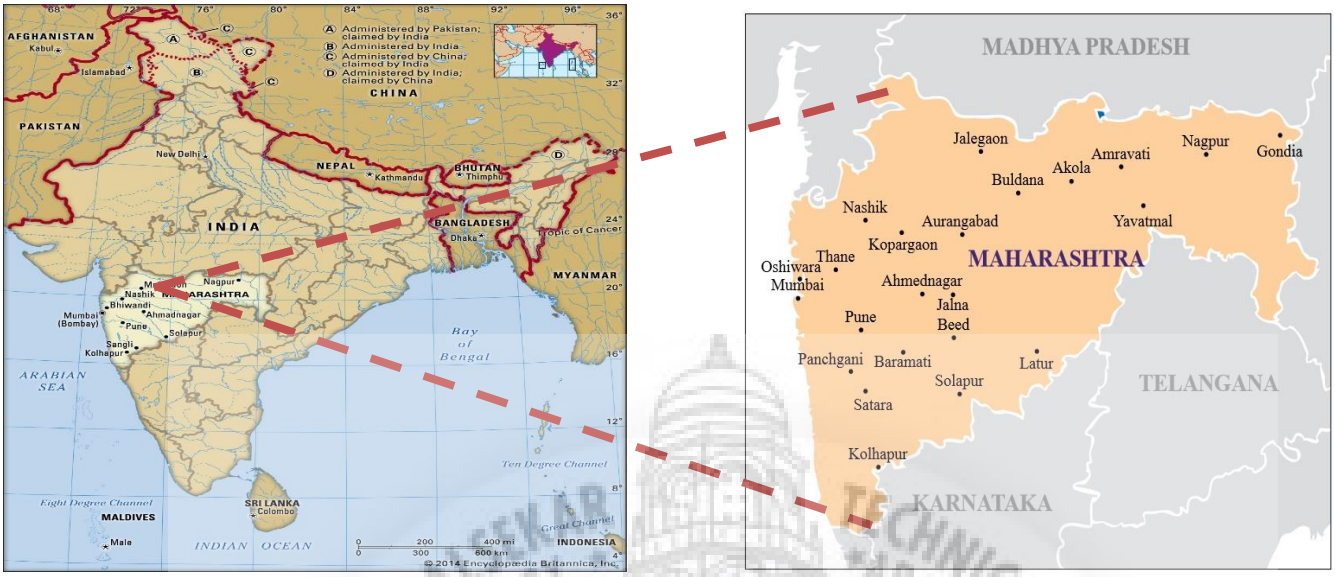


Fig.115. Map of INDIA (a) Map of Maharashtra(b)

Fig.116. Map of Mumbai (a) site on map(b)

Site Location: Thakkar Estate, Byculla, Mumbai, Maharashtra 400010

Proposed Land Use Map

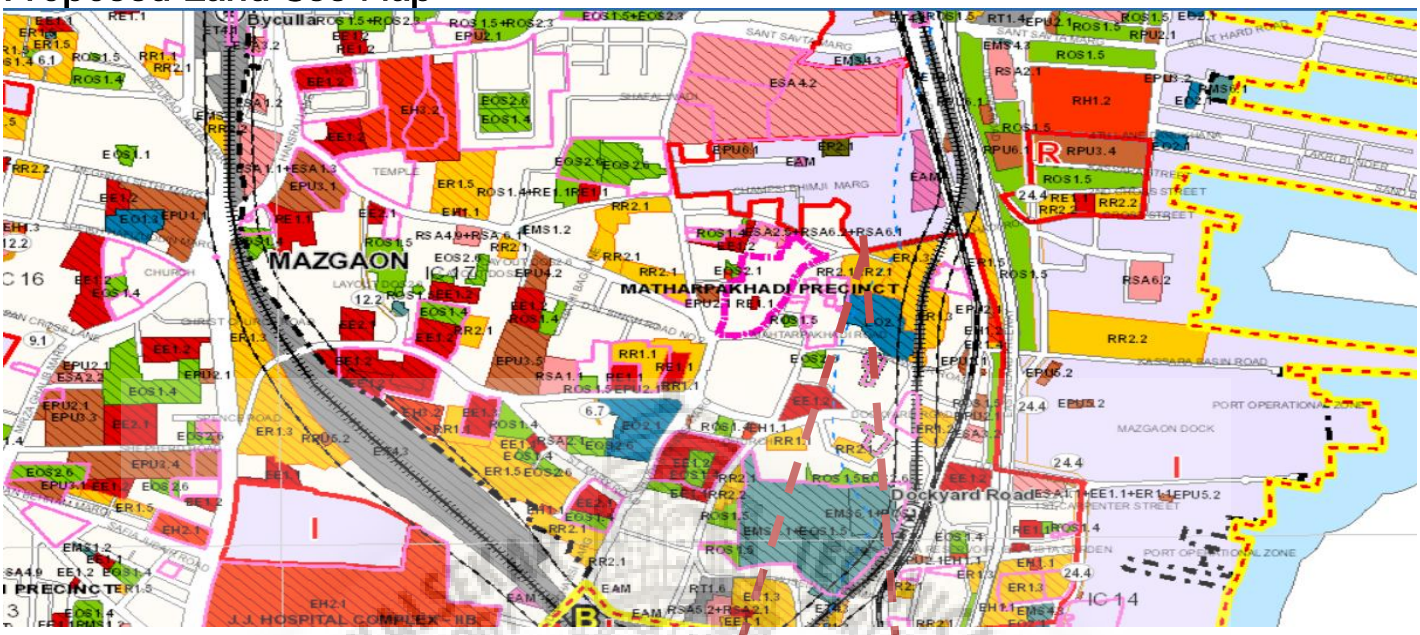
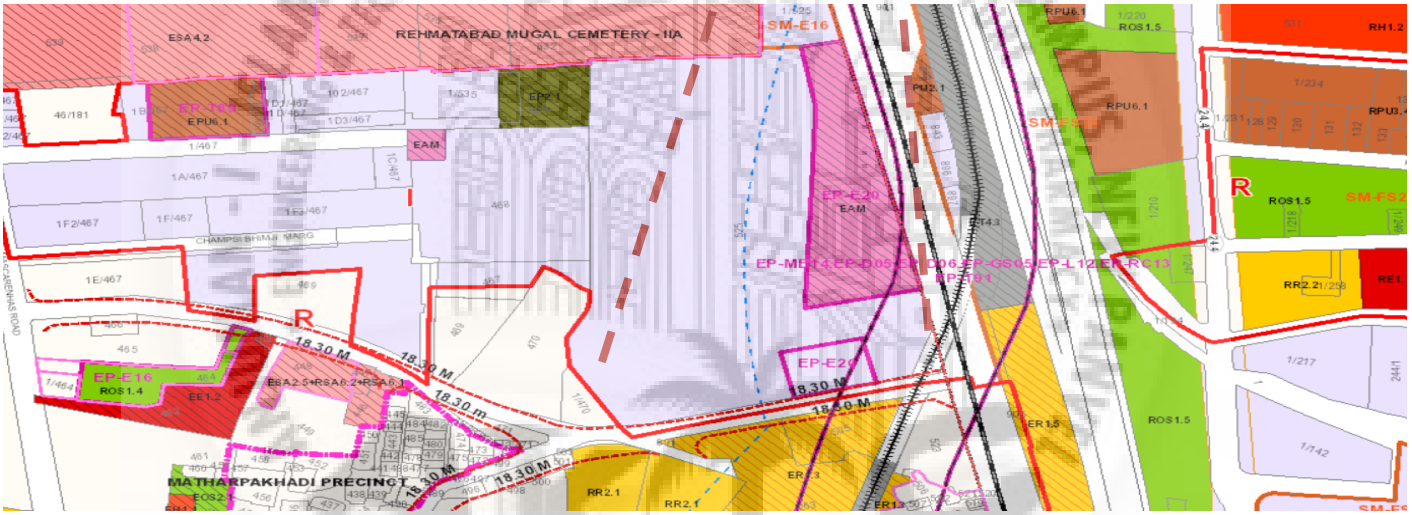


Fig.117. Proposed Land Use Plan



LEGENDS

- Education
- Social Amenities
- Municipal Services
- Offices
- Health
- Open Spaces
- Primary Activities
- Housing
- Public Utility
- Transport
- SPA
- Amenity Plot
- Education
- Health
- Housing
- Social Amenities
- Municipal Services
- Offices
- Open Spaces
- Primary Activities

Neighborhood Context & Accessibility

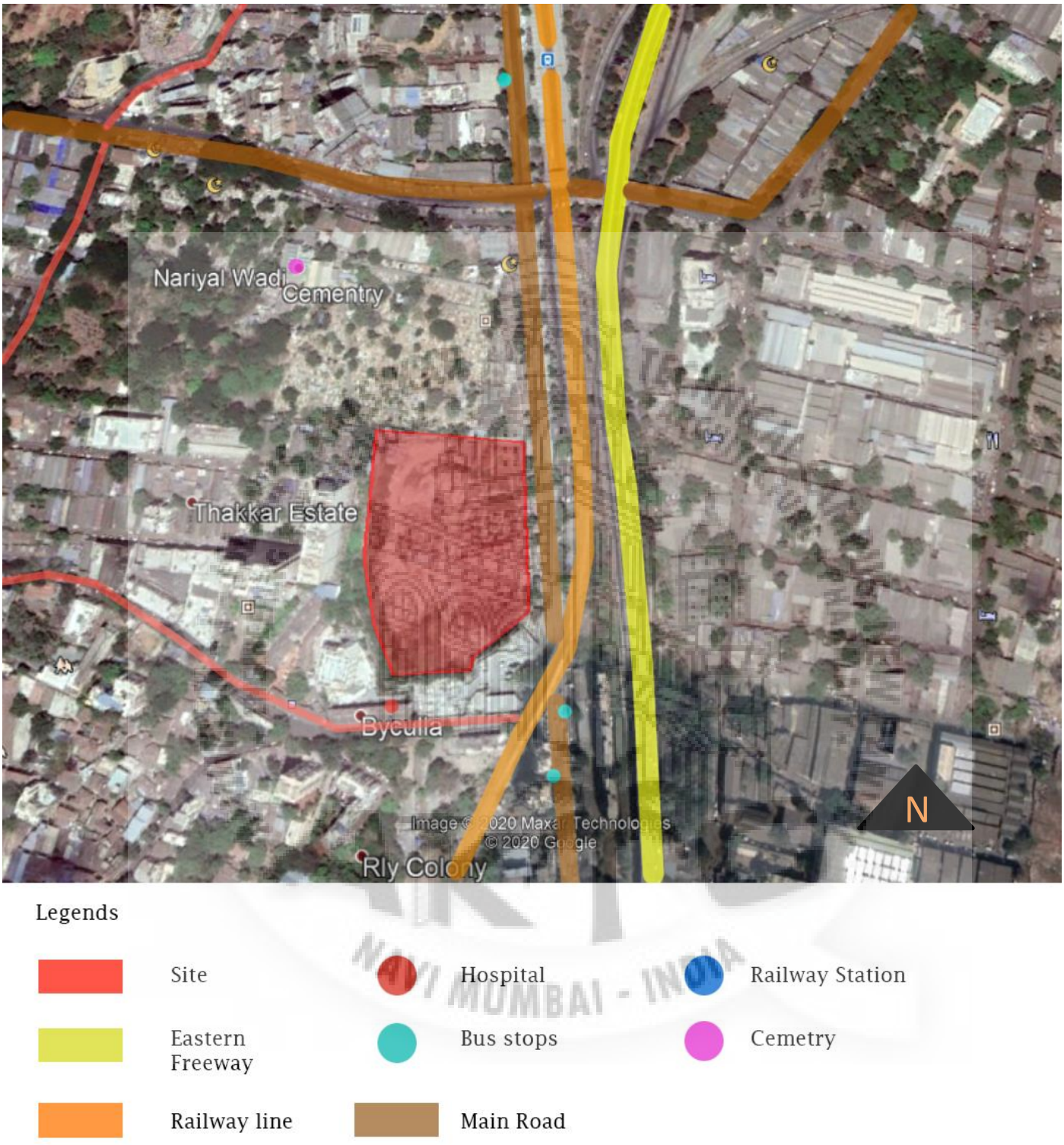


Fig.118. SITE Context

SITE AREA

Fig.119. SITE Measurement

About Site

Site Area: 23000 sq.m. pprox..

Land Type: Flat

Approach: 17 M wide road at the front side

Flora & Fauna: Trees on periphery

Fig.120. SITE adjacent Road

SITE PICTURES

Fig.121. SITE picture

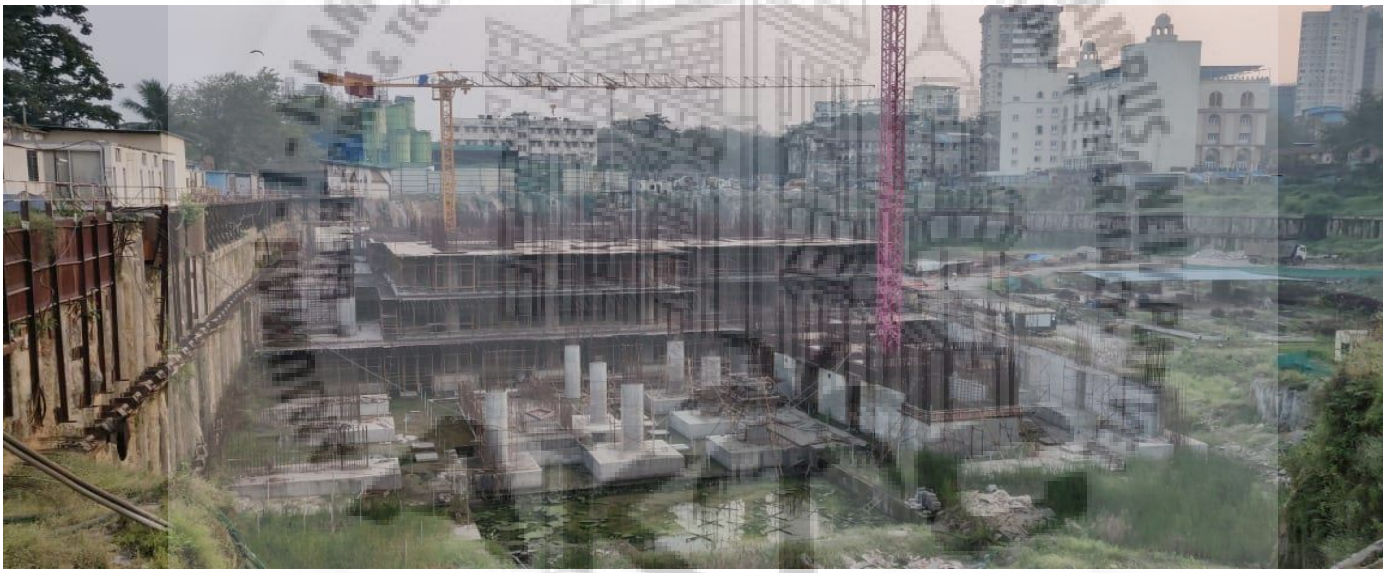


Fig.122. SITE picture

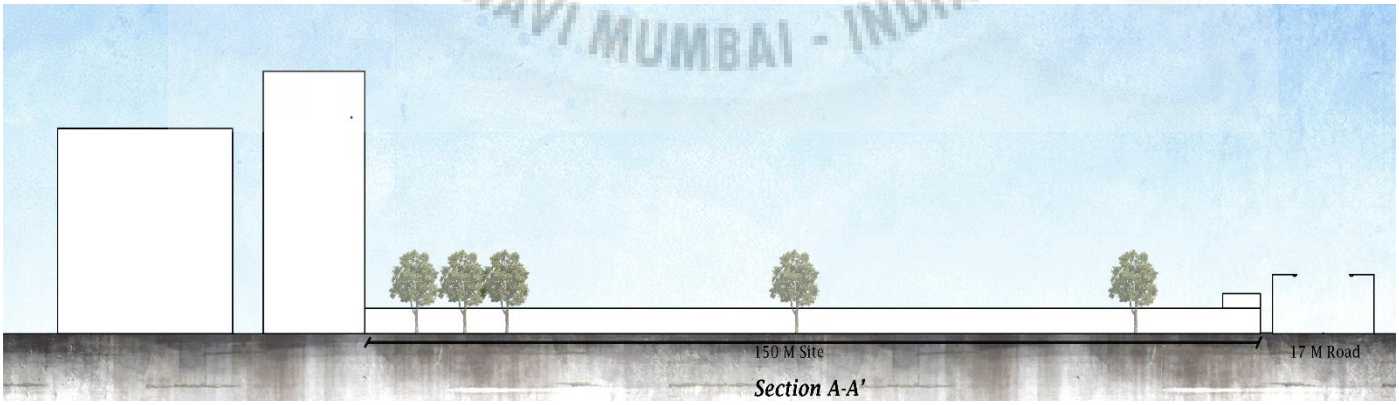


Fig.123. SITE Section

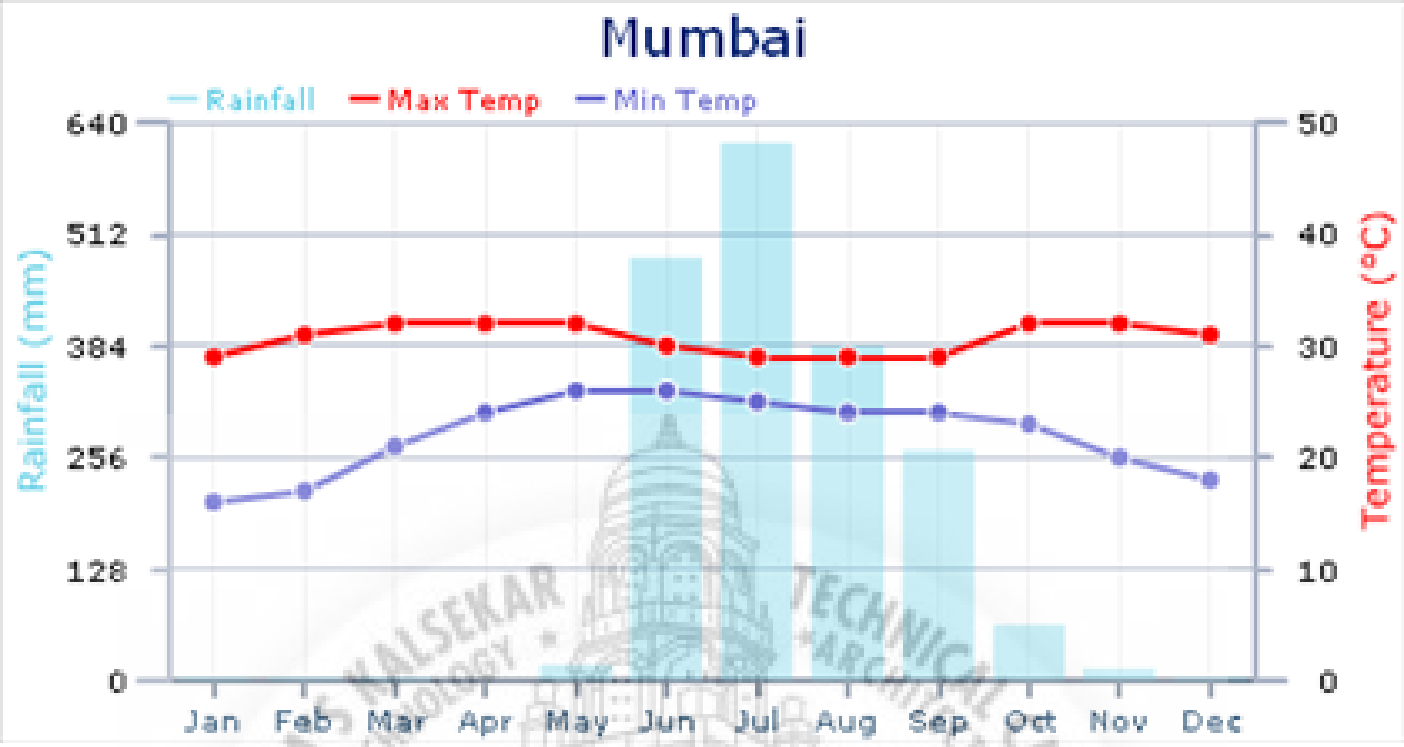


Fig.124. Climate

The Climate of Mumbai is a tropical, wet and dry climate. Mumbai's climate can be best described as moderately hot with high level of humidity. Its coastal nature and tropical location ensure temperatures do not fluctuate much throughout the year.

The mean average is 27.2 °C and average precipitation is 242.2 cm. The mean maximum average temperatures is about 32 °C (90 °F) in summer and 30 °C (86 °F) in winter, while the average minimums are 25 °C (77 °F) in summer and 18 °C (64 °F) in winter.

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9. Bibliography

- 2011, P GERARD, CTBUH JOURNAL, THE ORIGIN OF THE SKYSCRAPER, ISSUE 1.
- 2006, Robert Gifford, The Consequences of Living in High-Rise Buildings
- 2016, D Trabucco, Beacon of urban sustainability
- 2017, C&A Magazine, Vertical Development the Need of the Hour
- 2018, Visual Capitalist, The height of social values
- 2018, Nadia Balint, High-Rise vs Low-Rise Apartments: Pros and Cons
- 2006, Robert Gifford, The Consequences of Living in High-Rise Buildings
- 2015, Abbas Master, Girish David: Ambitious Mumbai Project, Cluster development for large scale redevelopment of Urban Habitat.
- 2014, Vinda Dravid, CTBUH Shanghai Conference, Psycho-Analysis of Tall building Habitants in Mumbai.
- 2020, Constro Facilitator, High rise building, An Analysis of development, types and importance
- 2009, Hakki Can uzkan, Charles Correa, Kanchanjunga Apartments, Cumballa Hill, Mumbai.
- www.archdaily.com
- www.ctbuh.org
- www.scribd.com
- www.designboom.com
- www.dezeen.com
- Www.issuu.com
- www.google.com
- www.architectopedia.com
- https://www.googleearth.com
- https://architecturelive.in/