Unfolding: Mixed-Used Vertical Neighborhood in Mumbai

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Abstract: *Indian metropolitan cities are shifting towards taller buildings and compact living spaces due to rapid urbanization and influx of population. Previously, cities developed horizontally but are now developing vertically. This is due to the high rate of population migration to metro cities, leading to higher population density. According to a survey by World Bank, India is expected to experience a surge in urban population by 2050. In order to improve living conditions in densely populated areas and meet future needs, steps must be taken to bring together essential human necessities in a sustainable manner, including incorporating more green spaces and urban farming into development projects.*

The goal is to create a mixed-use development that meets the essential needs of people in the future. This development will include three types of spaces: a private space for personal needs, a space for economic engagement, and a more flexible space for building social bonds and community identity. The development will be organized vertically, with multiple layers that provide easy access to all necessary resources.

The concept of a vertical city involves creating a high-end housing infrastructure that also provides a complex network of functions typically found in a horizontal city. The goal is to balance comfort and elegance in the user's lifestyle. This concept is a prototype solution for future Indian cities and can be replicated to more efficiently face upcoming urban challenges.

*Key Words***: Vertical skyline, urbanization, vertical city, multi-dimensional, housing**

1. INTRODUCTION

As Mumbai according to this research study, this research encountered many problems like traffic congestions, emergency facilities, living habitation, higher footprint, daily requirements and many more. So, to solve these problems which can make every facility by their steps. By taking vertical city steps this problem can be solved and catered in a much better and progressive way in times of pandemic and crisis over that per city population that can be said as 2000 people with 100% of citizen facilities. So, this research paper conclusion came up with a solution of vertical city that can make small solutions for this problem in this rapid urbanization in Mumbai. The future of the mega-cities is a dense, compact, mixed-use and vertical urban growth. Flexibility, adaptability, technological advancements and implementation of social, economic & ecological aspects - are major challenges for getting ideal solution of vertical city. Technology and medical advances enable people to live longer, healthier lives. However, this brings up problems and concerns with overpopulation and overcrowding. As the population increases, so does the need for living space. Increasing the number of homes and neighbourhood often results in the destruction of forests and other habitats. This limits our natural resources, endangers wildlife, and threatens to disrupt our ecosystem. This problem cannot be overlooked.

Otherwise, the destruction of the planet and its inhabitants is inevitable. The human population continues to rise at an alarming rate. If action is not taken, a critical mass will eventually be reached. In other words, the environment will no longer be able to support us. You might be wondering how to live a sustainable life. People are starting to look to the vertical city concept as a solution to this growing and unavoidable problem.

In short, a vertical city is an entire human habitat contained in a massive skyscraper. Vertical cities hold the key to solving overpopulation and overcrowding. Rather than destroying forests and swamps to build houses, shopping centres, and factories, they can be placed in a vertical tower, serving to preserve the environment. Sky high construction enhances available living and working space, which reduces the impact of overpopulation. In a vertical city, people would live, work, and go to school.

Vertical towers also hold the key to preserving natural resources. As the population increases, it will become increasingly difficult for farmers to grow enough food to feed everyone. There simply won't be enough land to farm on. But vertical towers can be used for farming and agriculture. The possibilities offered by vertical cities are absolutely stunning and breathtaking. Some people believe vertical cities are impossible, but this is untrue. With the proper planning, these towers are can easily become a reality. The key to making this concept successful is

spreading awareness. As the dangers of overpopulation become apparent, so does the demand for a solution. Unless someone discovers a better answer, vertical cities currently hold the key to sustainability.

Fig - 1: City affected by calamities.

Fig - 2: Future for vertical city

Fig - 3: Future for vertical city

1.1. Concepts v/s Reality

If vertical cities are to become a reality, it's vital to separate concept from reality. In other words, the difference between what's possible and what isn't must be distinguished. While we have no actual cities to base facts on, there is growing demand for apartments contained within skyscrapers. The biggest concern at the moment seems to be funding. Creating and maintaining a vertical city will be a costly and time-consuming project. The issue of construction finance must be addressed. Those with the resources must be convinced this solution is viable before

proceeding, which might prove difficult and challenging. But this is not an impossible task, a little planning and research is all that's needed. The next question is one of emotional well-being. A lack of sunlight can cause sadness and depression. Most people naturally enjoy the outdoors.

So, how will vertical cities affect the mood and emotional state of its inhabitants? There is not much doubt that remaining indoors can have an adverse impact on emotional well-being, but this can be solved. Open areas near the outer parameters can provide access to fresh air and sunlight. It would even be possible to install outdoor swimming pools and recreational areas. It's also important to remember living in a vertical tower does not mean you are confined to it. You will be free to come and go as you please.

In 2030, two-thirds of the world's population will live in cities.

Fig - 4: Pie chart showing rapid growth in population.

1.2. The Pros of Vertical Urbanization

Used effectively, building upwards allows you to urbanise using a smaller area of land. Urbanisation is often seen as damaging to the environment, destroying nature. While horizontal urbanisation naturally contributes to the disappearance of agricultural areas, vertical urbanisation limits the damage done by a huge margin. New York City is a prime example of a city that takes advantage of vertical urbanisation to limit the impact on the environment. Despite being one of the most popular cities in the world, Central Park can run for 2.5 miles through the centre of the city thanks to clever use of vertical urbanisation in the buildings surrounding it. The rise of global warming is one of the biggest environmental problems facing the planet at the moment, and continued horizontal urbanisation does little to solve the issue. Single-family homes are more difficult to insulate than multiple occupancy buildings, such as flats, and as such, energy loss is far higher. Vertical urbanisation allows for more efficient energy usage and conservation, at least when it comes to heating because the area is more localised. There are also economic and social benefits. It is far cheaper to build and develop on something you already have a foundation for, rather than to urbanise new areas completely.

1.3. The Cons of Vertical Urbanization

Unfortunately, vertical urbanisation does come with its share of problems too. When everything becomes closely packed together, the opportunities to maintain a healthy lifestyle become somewhat limited, when travelling becomes more vertical focused than horizontal. Walking down the road to your office may net you a few steps, but if you work on the top floor of the building, you are likely to opt to take the elevator rather than the stairs. Elevation also brings about problems with providing utilities to high-up areas. All floors of a building are going to require pipes for water usage and removal. The higher up you are, the more power is needed to pump water to the upper floors. Hygiene can also pose an issue, particularly with waterways, when hundreds of people are operating out of a single building. This puts pressure on architects and the water companies themselves to ensure the building can cope with the additional people. Plus, putting people close together may help promote social cohesion, but it reduces the amount of individual space available for people, which can impact one's quality of life.

1.4. Are vertical city feasible?

Right now, we have some very tall buildings, but nothing nearly as ambitious as a vertical city. Architects have come up with some theoretical designs, though. Italian firm Luca Curci Architects, for example, created an idea for a 180-floor vertical city that could support up to 25,000 people. The building would be zero-impact, include plenty of green spaces and let in natural light and air. It would be in the water and accessible via boat, helicopter, or a semi-submerged bridge.

For now, it is a concept—one that looks increasingly appealing as populations continue to grow and our planet's resources become more stressed. Building vertical cities would take extensive amounts of research and planning, but they could help solve some of humankind's biggest challenges, so the effort may be worthwhile. What would be the benefits of a vertical city? As populations expand, we need to find ways to house people without destroying what's left of our natural environment.

Building upward instead of outward enables us to host vast amounts of people in a small footprint, while conserving land and natural resources. We could then use the land for food production, recreation, or natural resources, or leave it as a natural area.

Vertical cities could also have other environmental benefits. Having numerous services and amenities in these mega towers would reduce the need for driving, reducing emissions associated with cars and saving residents money.

These buildings could also save energy and even generate their own electricity. These towers would have a multitude of surfaces where people could install solar panels, and their height and size make them ideal for wind turbines. The new Shanghai Tower, one of the world's tallest buildings, has already implemented this idea and has 270 wind turbines built into its facade. These buildings may also foster social connectedness by making it easier for individuals to socialize in common areas and visit friends. To do so, they would not even have to leave the building, although of course, they could if they wanted to.
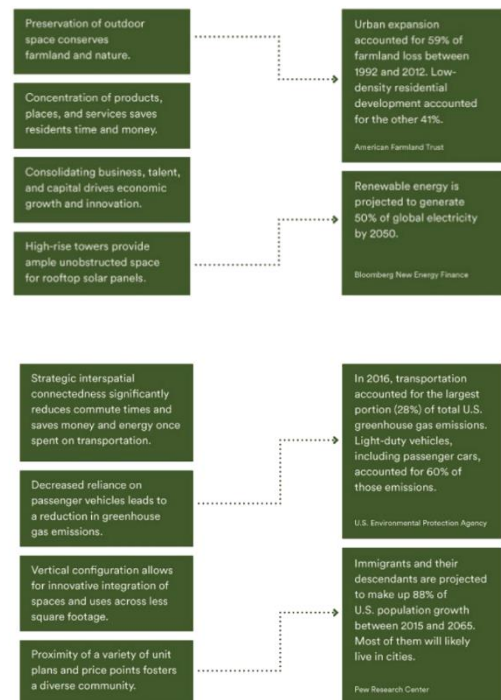
Fig - 5: Showing benefits of vertical city.

Utopian idea of 'Vertical City' is a future of modern mega-cities. By redevelopment of Mumbai as a vertical city, Mumbai's current urban problems could be resolved. The implementation of appropriate category of vertical city is important to get the expected result.
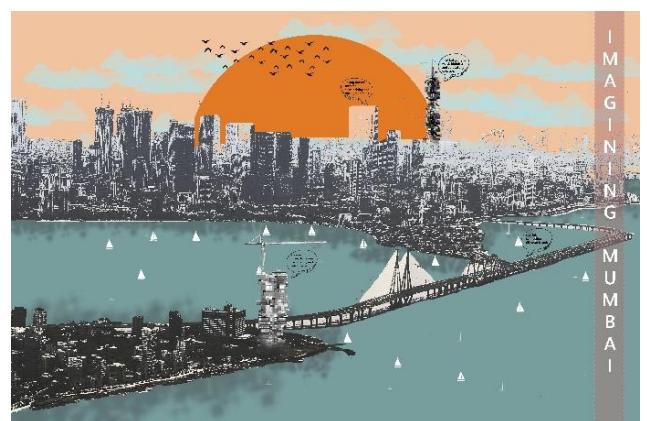
Fig - 6: Worli-sea link illustration.

2. OBJECTIVE AND METHODOLOGY

An approach to architectural innovation for vertical development in denser cities of India.

2.1. Objective

1. To fulfill all the requirements for citizens with their daily needs without moving out can give solution to many urban problems.

2. To study the diverse architectural style of the whole state and its representation.

3. To increase the economy by providing market spaces and eateries.

2.2. Methodology

Fig - 7: Working Methodology.

3. CITY NAMED MUMBAI

In this chapter of thrust study this research paper has tried to know city as Mumbai in a better vision and have closely noticed each problem faced by their citizens. Also have identified city's growth and evolution by different ruler and how architectural changes evolved during period of time.
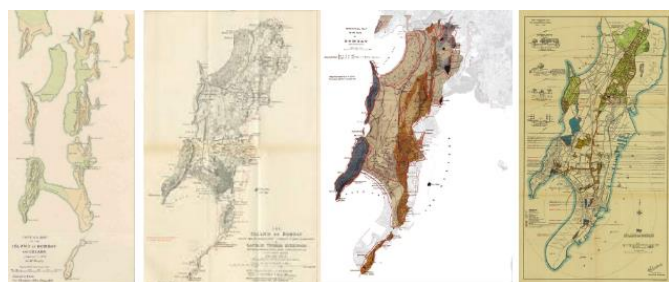

Fig - 8: *Image showing Evolution of Mumbai city according to timeline.*

3.1. Why Mumbai as urban fabric?

This offers many opportunities for discovery and exploration. There are virtually no vacant lots or surface parking. Also, as there are more intersections, traffic is slower and safer. Fine grained urban fabric is not imposed on a community like its coarse cousin.

Rather, it evolves over time in a piecemeal way, responding to what came before, and adapting to what came afterwards. This evolutionary process creates places that are not frozen in the era when they were built but are dynamic and reflective of a neighborhood's changing needs.

This creates an urban fabric that can seamlessly evolve over time from lightly developed residential areas to mixed-used retail to dense urban core if that's what the community desires. In this way, there are far more resilient than the mega projects mentioned above who, when they lose a single tenant, often fail.

3.2 Urban issue

Urban issues showing problems of Mumbai city with rapid growth of change.

Traffic congestion:

With trains arriving at the station every 3 minutes and transporting approximately 6 million people a day, the trains in Mumbai are heavily packed each day. Not only are the trains packed, but the roads are commonly seen excessively congested in peak hour traffic. Mumbai has invested in new technologies to prevent congestion. They are currently changing the lights where needed to make traffic flow smooth. Although this is preventing traffic congestion from being as bad as it has previously been, it isn't eradicating it either.

Pollution:

There are approximately 7,000 metric tons of rubbish being disposed of each day by Mumbaikars. With no mandatory recycling system in place by the government to date, Mumbai's waste is accumulating each day, and rubbish dumps are already filling up, polluting the area. On top of that, 700,000 cars are travelling on the roads of Mumbai each day. Creating air pollution with the rest of the manufacturing companies. Driverless cars have been considered to prevent air pollution, as private transport contributes to the air pollution the most. The driverless cars also prevent traffic congestion, but the cost to fill the whole of Mumbai with these cars is too large. A group called URBAIR, Urban Air Quality Management Initiative, has been created to increase the quality of air in Asia.

Poor sanitation:

It is said that most preventable diseases are spread through poor sanitation. This is due to there not being running water facilities in many houses or lavatories. As a result of

poor sanitation in slums, many children suffer from preventable diseases.

Due to diseases, mostly spread through poor toiletry sanitation, many foundations, including the Bill and Melinda Gates Foundation, have launched new campaigns to create awareness about the issue. Some campaigns have even started a competition to find a portable and affordable toilet like structure that can increase sanitation levels in India and other Asian countries.

Overpopulated slums:

Approximately 60% of Mumbai's population live in slums with no running water, electricity and gas. The shelters are made out whatever materials that can be sourced for a cheap price. The living standards in slums are very low and rubbish pollutes the area.so much that, large pipes are used as footpaths because the actual footpaths are too littered to walk on.

The Slum Rehabilitation Authority has been implementing multiple plans to rebuild slums. The current program being implemented today is rebuilding the slums into high rise buildings and offering 65% of the apartments to the previous slum residents and leasing the remaining 35% of apartments for commercial use. To go ahead with the plan, 70% of the previous slum residences have to okay the plan as they will have a housing issue in the building process.

Mumbai healthcare condition:

Doctors and healthcare workers who are responding to a global health crisis—trying to protect individuals, families, and communities in adverse situations with stretched resources, shortage of personal protective equipment (PPE) and other equipment's—have found themselves as unexpected targets in the fight against covid-19.6 There have been several reported incidences of such violence against them during this pandemic time in India. Although the exact numbers of such cases cannot be determined, there are a few glaring examples: on 8 April 2020, two trainee doctors in New Delhi were allegedly assaulted by a neighbor who accused them of spreading the disease. On19 April 2020, the burial of a neurosurgeon who had died after contracting covid-19 in Chennai was disrupted by a mob who attacked the undertakers. The citizens' opposition was due to a misconception that the contagion may spread in the neighborhood if the surgeon was buried there. A group of public health workers in Indore, a city in central India, who were trying to 'contact-trace' a person, were descended upon by a group of 100 people pelting stones and drove them away. Increasingly, reports pour in of doctors being spat on, hurled abuses at and driven away.

4. STUDY

Site analysis for area lower Parel with residence and commercial area. Detailed analysis is done for the study of urban fabric and its future growth need and usage.
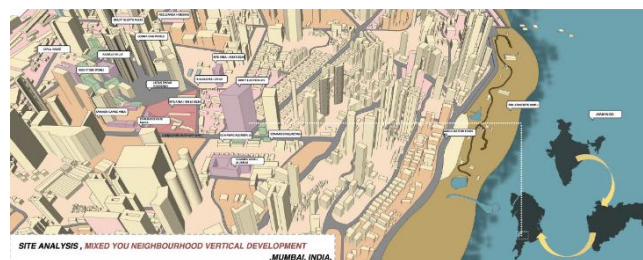

Fig - 9: Site analysis

Many mill plots have been used for Development and many structures have been developed so far and few of them are in abandoned condition which can be considered for redevelopment.

4.1. Site layout with immediate context

The site is adjoining to a busy street with a lot of commercial activities taking place. Heavy pedestrian movements are seen on the streets around the site.

4.2. Site description: why mill plot?

The site is flat land with wild vegetation and abandoned mill structures. The structures have been partly demolished by N.T.C. There are several high Rises in the lower Parel area close to site such as World one 117 story high, omkar 1973, Raheja Imperia, Lodha trump, and many more.

Connectivity from outside:

The site is very well connected by a good Road Network & it is very much reachable by both the locals & the tourists. The site is very well connected with City Level Transit Nodes, i.e., Airport, Railways & Bus Stations, from where the city welcomes its tourists. easy connectivity with surrounding and residential and commercial area with high profile offices makes site more prominent.

Fig - 10: Urban mapping for site fabric

Table - 1: Percentage for area distribution

	AREA (sq.m.)	PER. (%)
PUBLIC STREET/ROOD	TOTAL AREA	29.7%
WATER BODIES/RIVER	12,000	12%
BUILDING FOOTPRINT	50,000	50%
PUBLIC OPEN SPACES	3,300	3.3%
PRIVATE OPEN SPACE	5,000	05%
TOTAL AREA	1,00,000	100%

Strength
- Worli metro station is proposed 900-meter walk from the site.
- Considerably large site area for development.
- Easy approach to Bandra - Worli sea link.
- Aerial view of sea above 75 feet. (As per world one).
- Majorly surrounded by residential and commercial spaces.
- F.S.I availability.

Weakness
- Far from the lower Parel railway station (Central line).
- Limited approach to site from main road.

Opportunity
- Site located in the vicinity of tall structure like world one.
- Work space requirement.

Challenges
- Highly congested area.
- Lack of open green spaces.
- Strong wind force.
- Rainfall amount in Mumbai.
- High summer temperature.
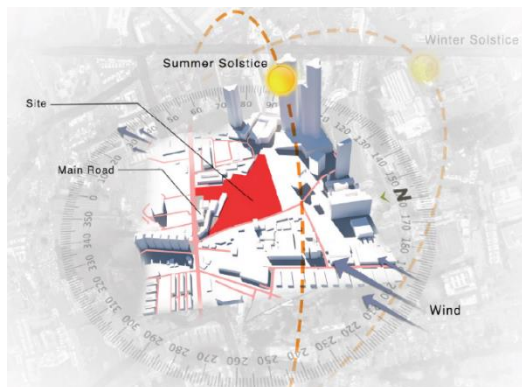
Fig - 11: Site analysis diagrams

5. DESIGN EXECUTION AND DESIGN SOLUTION.

The urban lung allows the building to breathe conceptually through a large full height atrium that is naturally ventilated by air inlets located at the sky garden levels. The gardens create natural cross and stack ventilation, along with purifying the air quality through the use of specific plant species.

Author wants to build a new environmentally friendly town, where environment is considered as an important part of everyday life. This research paper proposes Spiral Garden system: a public sustainable place like a green heart, easy to maintain and self-sufficient, coated by a joint population work that will cause a greater sociability among neighbours. Like a spiral, a light structure protected by a

transparent and suggestive mesh, raises the city to create sustainable exchange places in different ways.
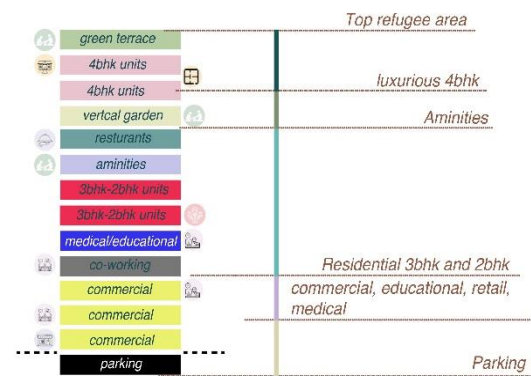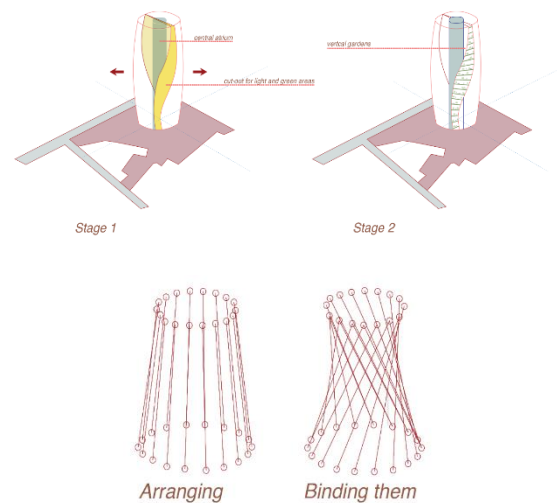

Fig - 12: Diagram for area distribution

Fig - 12: Conceptual Diagram

The author wants to build a new environmentally friendly town, where the environment is considered an important part of everyday life. This research paper proposes **Spiral Garden system**: a public sustainable place like a green heart, easy to maintain and self-sufficient, coated by a joint population work that will cause a greater sociability among neighbors. Like a spiral, a light structure protected by a transparent and suggestive mesh, raises the city to create sustainable exchange places in different ways.

This spiral contains an ascendant garden where native vegetation areas coexist with urban orchards shared and planted for the neighbors in a way to establishing a green outdoor walk and making easy the involvement of neighborhood residents in their creation and maintenance, as well as increasing social relations between people exchanging the natural products gowned and causing an environmental exchange. To sum up, we propose an ecological project in a way to give sustainable change to dally city lies, where humans and nature can coexist.
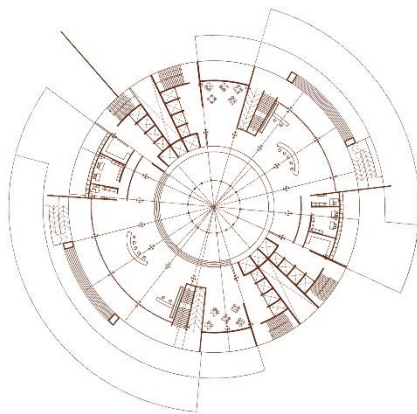
Fig - 13: Site layout

Fig - 14: Ground floor layout

The distribution of different typologies was done in a way that the lower portion was provided for offices as well as small apartments, the central portion was provided for recreational activities and the top floors were given for luxury apartments.
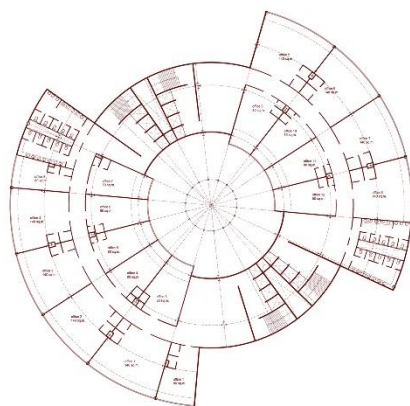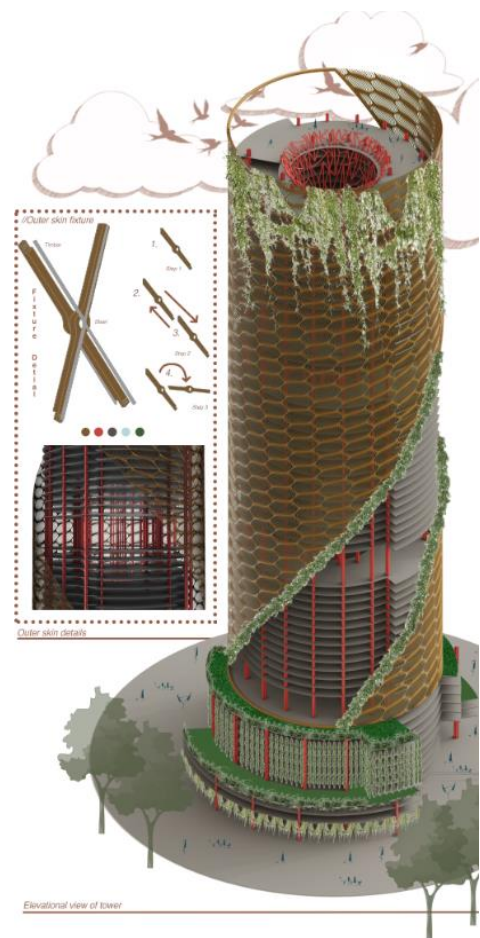

Fig - 15: Commercial floor layout

Fig - 16: Isometric view and details

An additional core was added to the building so that residential and office spaces can have different vertical movements respectively also skewing the building to get maximum view towards the sea and even creating an urban edge for the people nearby on the western side of the site.
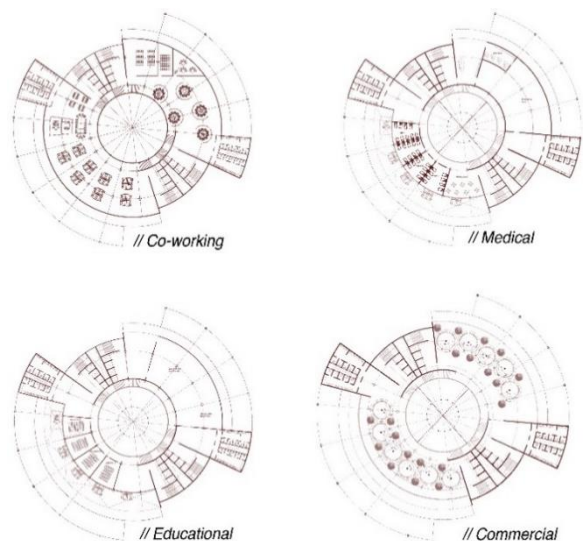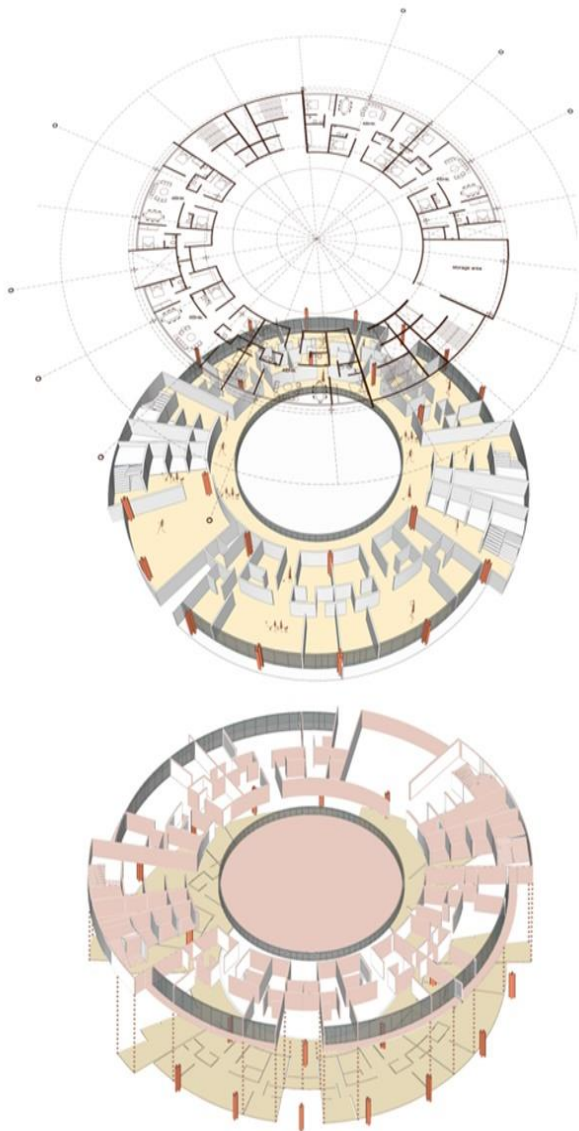

Fig - 17: Co-working, Medical, Educational and Commercial layout

Fig - 18: Axonometric view for floor

Fig - 19: Section of tower

Fig - 20: Structural details
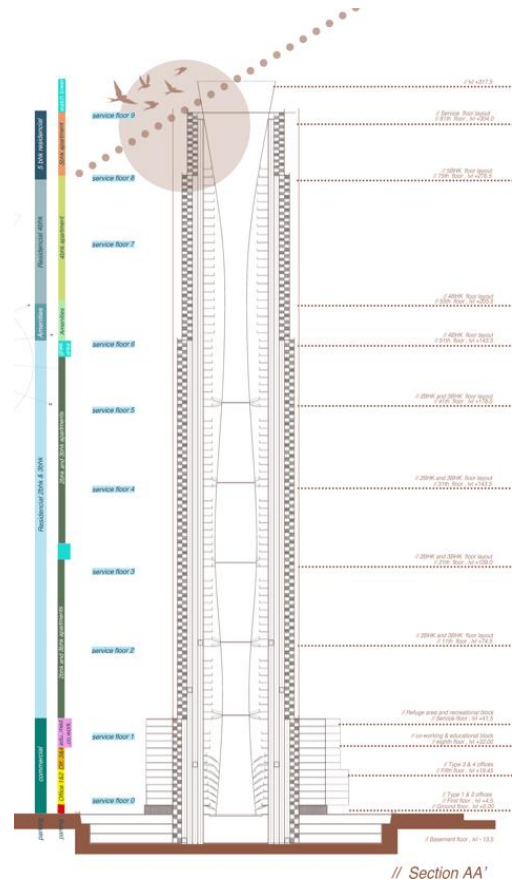
Suspended structure
- Central core with horizontal cantilevers at roof level, to which vertical hangers.

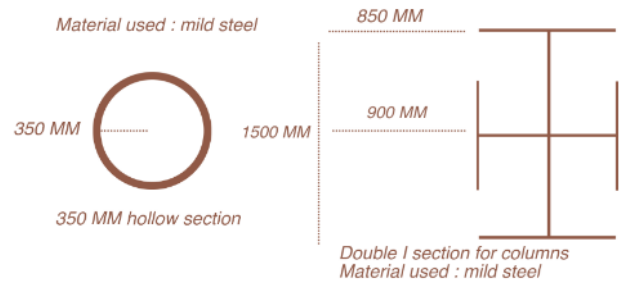- Floor slabs are suspended from hangers.

Outrigger truss
The outrigger trusses or girders are connected directly to shear walls or braced frames at the core and to columns located outboard of the core.

Tubular framework
Creating outer skin as structural element with steel sections that can hold weight of skyscraper structure. Having core type structure surrounding the building.
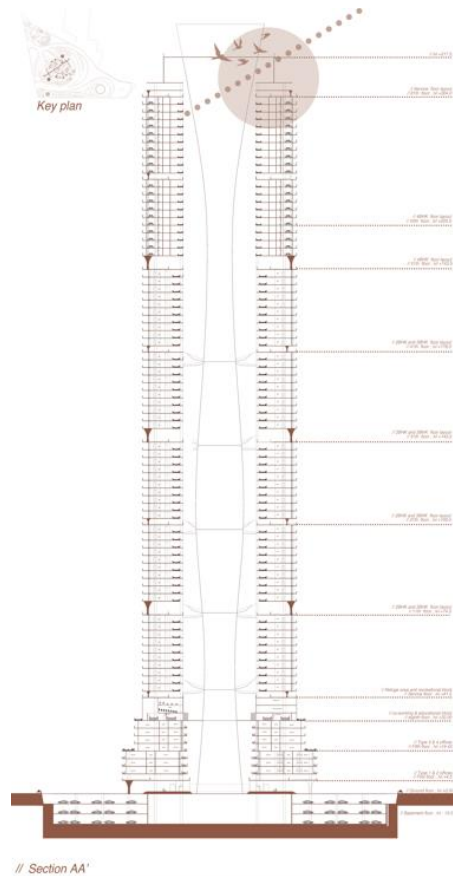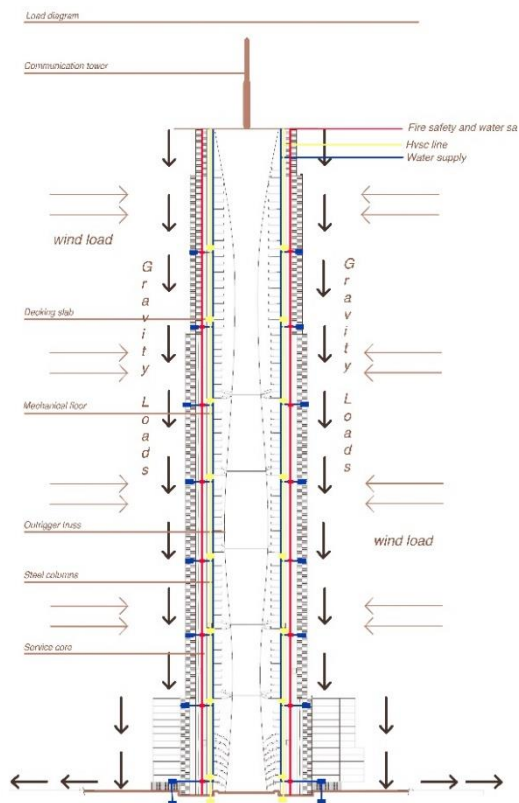

Fig - 21: Building views.

Fig - 22: Building views.

Fig - 24: Section for tower

Fig - 23: Load calculation

6. CONCLUSIONS

It is now clear that current urban problems of Mumbai are not decreasing by the luxurious single-used vertical developments, new transportation systems (like monorails), proposals of new satellite towns like Navi Mumbai or by slum relocation plans. A new city-planning strategy of vertical city for the redevelopment of Mumbai is required to protect Mumbai from further declination and decaying by urban problems.

My own approach to sustainable city form for Mumbai is - reinterpretation and reinvention of the dense, compact, three-dimensionally connected & vertical mixed-use model of a city, which not only includes luxurious lifestyle & economical sustainability for rich & middle-income groups but also includes economic growth of the poor and even socio-cultural & environmental sustainability of the city.

It is clear from the intentions of the above diagram that Mumbai as vertical city is leading towards the third category of vertical city (Series of mixed-use towers). But this category of vertical city cannot apply directly in Mumbai, by providing a singular vertical city center with gradually decreasing height due to its linear geographical area. Mumbai's geographical constraints are leading towards another category of vertical city, where

decentralized vertical nodes/clusters are linearly or irregularly generated in the whole city.

It will be feasible to develop all important areas of Mumbai as vertical nodes of mixed-use & connected towers, surrounded by factories and urban farmlands.

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