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A
PROJECT REPORT
ON

"CONSTRUCTION TECHNOLOGY AND SITE MANAGEMENT USED IN HIGH-RISE BUILDING"

UNDERTAKEN AT

"MIT School of Distance Education"

IN PARTIAL FULFILMENT OF

"CONSTRUCTION PROJECT MANAGEMENT"

MIT SCHOOL OF DISTANCE EDUCATION, PUNE.

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MIT SCHOOL OF DISTANCE EDUCATION PUNE - 411 038

YEAR 2022-24

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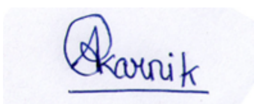
Student Sign:- 

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DECLARATION

I hereby declare that this project report entitled **"CONSTRUCTION TECNOLOGY AND SITE MANAGEMENT USED IN HIGH-RISE BUILDING"** bonafide record of the project work carried out by me during the academic year **2022-2024**, in fulfillment of the requirements for the award of **"CONSTRUCTION PROJECT MANAGEMENT"** of MIT School of Distance Education.

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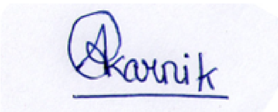
Sign:- 

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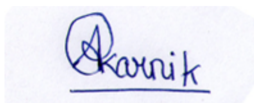
At last, but not least, I am thankful to my Family and Friends for their moral support, endurance and encouragement during the course of the project.

Sign:- 

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ABSTRACT

Urban migration, whereby populations flock to urban centers looking for work, leaves cities short on affordable housing, transport links and can either lead to inner- city poverty or urban sprawl. “CONSTRUCTION TECNOLOGY AND SITE MANAGEMENT USED IN HIGH-RISE BUILDING” offers solutions to both problems by maximizing the number of people that can live and work on a scarce, fixed amount of available land. Increasing demands for urban spaces pushed the environment to grow vertical and compact.

The traditional front-lawn houses are cut away and rearranged into skyscrapers, losing their greenness and their “neighborhood”. So, the necessity of residential use developments integrating plants and bio-climatic design principles has come up. This thesis explores the design issues and goals in high rise residential use development. The designing and planning of “CONSTRUCTION TECNOLOGY AND SITE MANAGEMENT USED IN HIGH-RISE BUILDING” involve consideration of all prevailing conditions and is usually guided by the local bye-laws. The various functional needs, efficiency, economy, energy conservation, aesthetics, technology, fire and life safety solution, vertical transportation, human comforts, operation and maintenance practices, provision of future growth are some of the main factors to be incorporated in the design.

This thesis has been emphasized on integration of plants into high-rise and applying bioclimatic design principles which play a vital role for the energy conservation by the building as well as improving the living quality into these vertical cities. Throughout the thesis work it has been studied to establish the necessity of planting to incorporate into high-rise, for the wellbeing of our economy, society and the environment. The provisions of integrating plants into high-rise by the three possible options like, green roof, green wall and Indoor potting plants were incorporated into the design

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CHAPTER 1: INTRODUCTION

High-rise housing is usually defined as a residential building with five or more stories, most of the time encountered in urban or suburban areas. Using technologically advanced construction mechanisms, high-rise housing initially emerged in the 1950s and 60s as a solution to the post-war population boom and to the increasing number of people moving into already overpopulated urban areas. Dealing both with the problem of space management and efficiency, high-rise housing, for some, epitomized the modern lifestyle.

Depending on the cultural, political and economic environment in which it was built, high-rise housing gained significantly different images in different parts of the world. In Western Europe and parts of the USA high-rise housing is often associated with welfare projects, immigrants and the poor – with a few exceptions where renovated high-rise buildings in the city center have been transformed into luxury apartments for the rich and single. By contrast, in Eastern Europe high-rise housing occupies the majority of the housing market. In Asia, high-rise housing rarely carries the same stigma that it often does throughout Western Europe and the USA, being associated with significantly improved living conditions.

Buildings are becoming higher and higher nowadays in maximizing land use and investment return. Construction of residential developments are considered as focal point of the construction industry in view of its huge labor contents and turnovers evolved due to its own nature of works and investments involved from the investors. Investors tend to build everything possible in a small piece of land to increase their return from their investment in the quickest possible manner. Practitioners in the construction industry are looking for different means and methods in enhancing efficiency and meeting requirements from the statutory bodies and the users due to high construction costs and non-availability of land at preferred locations, people opt for apartments.

It can be more environmentally friendly as it can save a lot of space and energy, much cheaper to build than independent homes and in many ways easier to manage than the chaotic buildings and complex infrastructure, or lack thereof, that currently exists in slums and shanty towns. High-rise housing is a successful housing solution when faced with the problem of population growth and urban migration. Urban migration, whereby populations flock to urban centers looking for work, leaves cities short on affordable housing, transport links and can either lead to inner-city poverty or urban sprawl. High-rise housing offers solutions to both problems by maximizing the number of people that can live on a scarce, fixed amount of available land.

Amenities are another huge advantage of high rise apartment buildings. Doormen, fitness centers, controlled entry, security systems, on-site maintenance, round-the-clock security, back-up power supply, maintenance, car-parking facilities and kids' play areas, guest housing and morning coffee are all commonly included amenities in a high-rise apartment building. Additionally, if you live in a densely populated area, many high-rise buildings will offer underground parking, either included in the rent or as a separate fee. This parking space can make maintaining a car easier and parking more efficient. Doormen and security systems are a great value in terms of safety for singles and travelers.

We can even find a number of problems in the present urban dwellings like the lack of proper planning of amenities and services stress related problems due to no proper neighborhoods and high environmental impacts like pollution, noises and low quality of air etc. Hence the

way the natural resources like ventilation and lightning and other amenities are planned for large number of people is of prime importance.
In India with incomes growing and large numbers of people moving to urban areas, the demand for housing is on the upswing. In the present context of increasing population and the land being constant, hence there arises a need for better high-rise housing developments. As we are in the scenes of the outskirts of the cities and areas lining the highways being converted into townships and housing boards, this topic in terms of social life is relevant in understanding the housing trends.

" Metropolitan areas are not just made up of people and firms, but of brick and mortar as well. The growth and decline of a region's economy is mediated by the physical Structure of the place."

Aim

To construct high rise building to make more comfortable for high income groups.

Objectives

1. To study evolution of high-rise buildings and its concepts or its reasons.

2. To know essential and requirements of vertical housings.

3. To study the planning and designing of high-rise housing developments and issues related.

4. Analyzing new materials, modern practices and techniques used in high rise buildings.

5. To understand structural solutions and services for a high-rise residential buildings

Scope

1. The main amenities that which increases the attractiveness or the value that contribute of the comfort or convenience has to be incorporated in the design process.
2. The modern construction materials and methods, the technology available like the Prefabricated construction process.
3. All the services like the security safety, water supply, mechanical, sewage, electricity, fire safety, solid waste and the way they are planned for large number of people in high rise housing developments with respecting their needs and the government complying and cosmos bylaws is also included.
4. Issues related to the urban environment like the live ability, noises, dirt, lack of neighborhoods will be given due attention.
5. Need for different group and different for A.C system is compulsory for high income group and we can save the electric consumption by using District A.C system and by using solar panels.
6. Also we will provide interior landscape to make building more healthy and natural environment.

Limitations

1. Work is limited to urban and semi urban development projects.
2. The information is mostly relying on the internet sources, a few documents published and case studies will be done.
3. The user considers is from high income group.
4. Detail drawings of various services like electrical, plumbing , HVAC (heating ventilation and air conditioning)shall not be included in final design solution.
5. Design of building shall not depend upon various factors like economy and cost of structure.
6. Estimating and Costing of Building shall not be calculated.
7. The structure calculation of building and working drawing and electrical load calculation will not include.

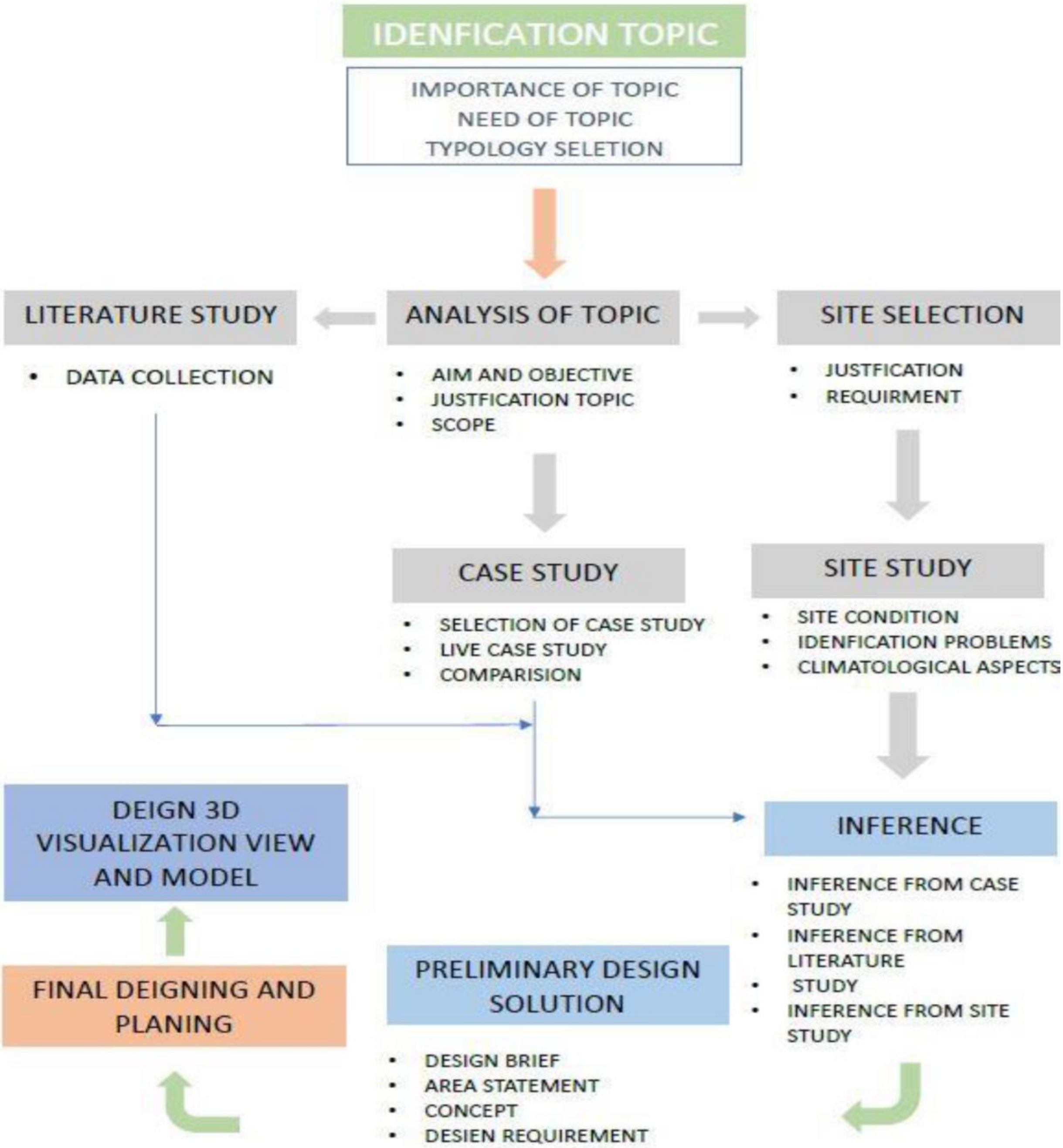
Need of High-rise Apartments.

1. To save the Urban Land.
2. We can control density population of urban area.
3. We know there are various apartments in which lack of services, amenities, luxury for high income groups (HIG).
4. And we know that higher class need a world class services like building automation systems etc.
5. We will provide deluxe rooms to make occupancy more comfortable for occupancy.

FOCUS AND SCALE OF THESIS

1. Basically main focus of building is on luxury, world class services, aesthetic and some instant of earthquake norms for high rise building.

Methodology



Chapter - 2
History and aspects of high-rise buildings

What could be a more appropriate point to begin our consideration of high-rise buildings than with the Tower of Babel and then to trace their historical development over the centuries. However, a distinction must be made between "high buildings" and "high-rise buildings": "high buildings" have only a few floors and not uncommonly.

2.1. Historical development of High-Rise buildings

Adams Street, a witness of its times. It has twelve floors – there were originally ten, but two were subsequently added – and was built in roughly eighteen months. The architect W. L. B. Jenney used an uncommon new method for the construction of his building: the weight of the walls was borne by a framework of cast-iron columns and rolled I-sections which were bolted together via L-bars and the entire "skeleton" embedded in the masonry. The early Equitable Life Building in New York, which was completed in 1872, also contributed towards the development of high-rise buildings, for it was the first tall building to have an elevator. Although it only had six floors, the edge of the roof was no less than 130 feet (roughly 38 m) above the road surface. Due to its elevator, the upper floors were in greater demand than the lower floors. Following completion of the "Equitable" building, it was the thing done to reside on one of the "top" floors. Burnham and Roof's Monadnock building, which was completed in Chicago in 1891, must also be mentioned as one of the last witnesses of a whole generation of solid masonry high-rise buildings. Sixteen floors of robust brick masonry rise skywards in stern, clear lines: an astonishing sight to eyes accustomed to the frills and fancies of the late 19th century. Standing on an oblong base measuring 59 m _ 20 m, the building is reminiscent of a thin slice and not only recalls the industrial brick buildings of the late 19th century, but also anticipates the formal simplification of the later 1920s.
The buildings rose higher and higher with the spread of pioneering construction methods – such as the steel skeleton or reliable deep foundation methods – as well as the invention and development of the elevator. The highly spectacular skylines of North American cities, particularly Chicago and New York, originated in the early years of the 20th century. Glancing over Manhattan's stony profile, the silhouettes dotting the first 12 km of the 22-km- long island bear vociferous testimony to this dynamic development:

– The World Trade Center, currently the tallest building in New York, 417 m high,

– The legendary Empire State Building, built in 1931, 381 m,

– The United Nations building erected in 1953, 215 m,

– The Chrysler Building dated 1930, 320 m,

–The former Pan Am Building completed in 1963, 246 m,

– The Rockefeller Center (1931–1940), a complex of 19 buildings,

– The Citicorp Center built in 1978, 279 m, and

– The AT&T Building opened in 1984, a pioneering building by the post-modern architect Philip Johnson, with an overall height of 197 m.

Figure 2.1 famous tall building from the past source: (ruck, 2002)

It is only recently that attention has also turned to interesting high-rise buildings outside North America: Norman Foster's Hong Kong and Shanghai Bank, Ieoh Ming Pei's Bank of China in Hong Kong and the twin tops of the Petronas Towers in Kuala Lumpur, currently the tallest building in the world at 452 m. High-rise buildings in Germany are a modern development and are concentrated particularly in Frankfurt am Main: today, Frankfurt is the only German city with a skyline dominated by skyscrapers. One of the tallest buildings in the city is the Masseter built in 1991 with a height of 259 m, which is not much more than half the height of the Sears Tower in Chicago, currently the tallest office and business tower in North America with a total height of 443 m. It was the rapid growth in population that originally promoted the construction of high-rise buildings. New York once again provides a striking example: land became scarce well over a hundred years ago as more and more European immigrants streamed into the city. From roughly half a million in 1850, the city's population grew to 1.4 million by 1899. More and more skyscrapers rose higher and higher on the solid ground in Manhattan, as buildings could only be erected with great difficulty on the boggy land to the right and left of the Hudson River and East River. In this way, New York demonstrated what was meant by "urban densification" despite the considerable doubts originally voiced by experts in conjunction with this development. The first area development code to come into force in New York was the so-called "zoning law" of 1916, according to which the height of a building must not exceed two and- a-half times the width of the road running alongside the building. The building mass was further limited by the requirement that the floor space index must not exceed twelve times the area of the site. Among other things, the zoning law stipulated that only the first twelve floors of a building were allowed to occupy the full area of the site and that all subsequent floors must then recede in zoned terraces – a requirement of major aesthetic significance, for this terraced form still dominates the silhouette of American skyscrapers today.
All doubts as to the profitability of high-rise buildings were set aside with completion of the Empire State Building, the Chrysler Building and other skyscrapers in the 1930s, for they would never have been built if they could not have turned a profit. Although rentals proceeded slowly at first when the Empire State Building was completed in the heart of the recession in the 1930s and it was therefore known as the "Empty State Building" for many years, it subsequently generated satisfactory revenues once all the premises had been let.

Cities in Europe and Asia grew horizontally and it was only when production and services acquired greater economic significance throughout the world and the price of land rose higher and higher in economic centers after the Second World War that they also began to grow vertically. Modern Hong Kong is a striking case in point: it encompasses an area of 1,037 km2 (Victoria, Kowloon and the New Territories), of which only one-quarter has been developed, but with maximum density and impressive efficiency. Almost all the new buildings, office towers and particularly residential towers in the New Territories have more than thirty floors.

2.2 Architectural aspects and urban development today

As the historical development of high-rise buildings has already shown, the construction of edifices reaching higher and higher into the sky was – and to a certain extent still is – an expression of power and strength. This is equally true of both ecclesiastical and secular buildings: the power, strength and influence of entire families – i.e. their standing in society – is mirrored in the erection of ever taller buildings culminating in a battle to build. The towers of San Gimignano are one of the best preserved examples of this development. In many North African cities, too, this attitude has molded the townscape for many centuries and will no doubt continue to do so in the future.
The names of the builders and architects have only been known since the high middle Ages around 1000 AD. They created new stylistic elements and added their "signature" to entire periods. Looking back, this makes it difficult for us today to decide whether these master craftsmen shaped the various stylistic developments or whether a number of master builders only became so well-known because their work reflected the contemporary fashion trends most accurately. That still holds true today, the only difference being that tastes change very much more rapidly and "degenerate" into short-lived fashions. A building that reflects the spirit of the times when it is finished can appear "old" within only a few years. The brevity of the various stylistic trends is one of the reasons for the inhomogeneous appearance of modern towns and cities.

Since architects must expect that later buildings will have their own, completely different formal identity, they do not see any reason why they should base their own designs on existing standards, particularly as this would merely cause them to be considered “unimaginative”.
Three points become clear if we take a closer look at modern trends in high-rise construction:

– The dictate of tastes mentioned above is expressive of the egotism prevalent in modern society with its desire for status symbols and designer brands. Unfortunately, the public not uncommonly bows to this dictate, as when town councilors set aside major urban development considerations and with seeming generosity set up public areas in the form of lobbies and plazas in high-rise buildings.
– The sheer magnitude of the projects forces all planners to adopt a scale totally out of proportion to all natural dimensions and particularly to the people concerned when planning their buildings. In the past, urban development plans were easily drawn up on a scale of 1:100 or at most 1:200, a scale which could still be directly related to the size of a human being. With today’s high-rise buildings, however, a scale of at least 1:1000 is required simply in order to depict the building on paper. This is illustrated by the example of the Sears Tower in Chicago: completed in 1974, the Tower measures 443 m in height. Drawn to a scale of 1:2000, a human being is represented by a minute dot measuring barely 0.9 mm.
– In the past, it was the master builder and architect who defined the construction and consequently the appearance of a building; today, on the other hand, technical developments determine what can and cannot be done the appropriate and basically essential symbiosis between engineering designer and artist has been abandoned. This critical discourse on the architectural, urban development and economic background is not basically to cast doubt on high-rise buildings as such, but it does illuminate some of the facets that are central to considering the risk potential inherent in high-rise buildings. This almost inevitably raises the question why high-rise buildings should have to be built in today’s dimensions.

– One reason is indisputably the need for a “landmark”. In other words, to express economic and corporate power and domination in impressive visual terms. Nothing has changed in this respect since the very first high-rise buildings were erected.
– The steadily rising price of land in prime locations and an increasingly scarce supply have made it essential to make optimum use of the air space. Prices in excess of DM 50,000 per square meter are not uncommon for land in conurbations and economic centers. Despite their height, however, high-rise buildings still occupy areas of truly gigantic proportions: the ratio of height-to-base width of the cubes in the 417-m-high World Trade Center, for example, is 6:1.
– Connections to the infrastructure are improved by concentrating so many people in such a small area. The World Trade Center alone provides jobs for over 50,000 people – that is the equivalent of a medium-sized town. All institutions of public life are united under a single roof and the distances between them have been minimized. However, high-rise buildings do little to prevent land being sealed on a large scale. The suburbs of modern American cities are a prime example: as far as the eye can see, the landscape is covered with single-family homes, swimming pools and artificially designed gardens simply to provide sufficient private residential land for all the people working in a high-rise building occupying only a few thousand square meters.
– Many of the techniques and materials which are also used for “normal” buildings today would never have been invented and would never have become established if high-rise construction had not presented a challenge in terms of technical feasibility. Rationalized, automated sequences are beneficial to high-rise buildings, at no time in the past were such huge buildings erected in such a short space of time. Short construction periods also mean shorter financing periods and consequently profits which partly compensate for the additional costs incurred in the construction and finishing of the building.

Chapter - 3 Planning and Designing of High Rise buildings

These activities concerned for any high-rise project has many stages right from the planning of the project to completion, maintenance and administration. These are described in the following chapters clearly.

3.1. Planning the project

The complexity of the trades to be coordinated has become several times greater since many disciplines and different experts are involved solely planning the high-rise housing.

- Architects
- Planning engineers for the supporting structures (engineering design and structural analyses) Construction and site management (resident engineer)
- Planning of the technical building services (particularly heating, ventilation, sanitation, cooling and air conditioning)
- Interior designers
- Construction physics and construction biology
- Planning and site management for data networks
- Planning of the lighting and materials handling
- Planning of the electrical and electronic systems
- Planning of the facades
- Surveying engineers
- Geo-technology, hydrogeology and environmental protection
- Design of outdoor facilities and vegetation
- Surveying of the actual situation in surrounding buildings

If we were to include all the contractors and specialists involved in the project as well, the list would probably be ten times longer. And if we then consider that bankers, construction authorities, legal advisers and even advertising agencies or brokers must also be coordinated in the course of the entire planning and construction of a high-rise housing project, it soon becomes clear that highly professional management is essential for such a project. Project management companies have come to play an increasingly important role in recent years as they take over the entire organization, structuration and coordination of construction projects. They act as professional representatives for the client and embody the frequently voiced desire for the entire project to be coordinated by a single partner.

CHAPTER -4 LITERATURE SURVEY

4.0 DATA COLLECTION

4.1 PLANNING AND DESIGNING OF HIGH RISE BUILDINGS

4.1.1 BASIC PLANNING CONSIDERATIONS

Basic planning considerations for high rise building design include the following parameters:

1. Planning module
2. Span
3. Ceiling height
4. Floor-to-floor height
5. Depth of structural floor system
6. Elevator system
7. Core planning
8. Parking

1. Planning module, namely the space one needs for living, changes according to the culture and the economic class.

2. Span, described as the distance from a fixed interior element such as building core to exterior window wall, is another important criterion for good interior planning. These depths change depending on the function of the space, and acceptable span is determined by office layouts, hotel room standards, and residential code requirements for outside light and air. Usually, the depth of the span should be between 12 and 18 m for office functions, except where very large single tenant groups are to be accommodated. Lease span for hotels and residential units range from 9 to 12 m.

3. Ceiling heights is also an important factor in building planning. Commercial functions require a variety of ceiling heights ranging between 2.7 and 3.7 m. While office functions necessitate ceiling heights of approximately 2.5 to 3.0 m, residential and hotel functions require ceiling heights of 2.5 to 3.0 m.

4. Floor-to-floor height, which is a function of the necessary ceiling height, the depth of the structural floor system, and the depth of the space required for mechanical distribution, determines the overall height of the building, and affects the overall cost. A small increase or decrease in floor-to-floor height, when multiplied by the number of floors and the area of the perimeter enclosure by the building, can have a great effect on many systems such as the exterior, structural, mechanical system, and the overall cost.

5.Depth of structural floor system plays an important role for planning considerations in high rise buildings, and varies broadly depending on the floor load requirements, size of the structural bay, and type of floor framing system.

6.Elevator system is another major component for good interior planning. In the design of an elevator system, waiting interval, elevator size and speed interpretation of program criteria, areas to be served, the population density of the building, and the handling capacity of the system at peak periods, must be considered. This becomes even more complicated for mixed-use projects. For preliminary planning; one elevator per 1000 m2 of gross area is a rule of thumb for estimating the number of elevators needed. Besides this, the net usable area varies from one elevator zone to another and from floor to floor, and should average from 80 to 85% over the entire building. The sky-lobby concept is an important and innovative approach in elevator system design. This concept uses high-speed express shuttle cars to transport passengers from the ground level to a lobby higher up in the building for transfer to local elevator zones so that the area used for elevator shafts and lobbies on the lower floors of the building is reduced.

7.Core planning is another significant issue for planning considerations. A typical floor in a high rise building contains a perimeter zone, an interior zone, and a core zone. While perimeter zone is described as an approximately 4.5 m or 5 m deep area from the window wall with access through the interior zone, interior zone is defined as the area between the perimeter and the public corridor. On the other hand, core zone consists of those areas between elevator banks which become rentable on floors at which elevators do not stop. Central core, which is generally used in the buildings with a rectangular plan, and split core, which is generally used in the building with a relatively square plan, is the most typical core arrangements. Cores accommodate elevator shafts, mechanical shafts, stairs, and elevator lobbies. Core elements that pass through or serve every floor should be located, so that they can rise continuously, and thus avoid expensive and space-consuming transfers.

8.Parking is another planning requirement, which varies according to different functions such as business, residential, and like. When parking facility provided within the footprint of the building, it has a great impact on the plan and the structure. If it is inevitable, the structural bay should be well arranged to obtain efficient space use for parking and functional areas, and the core elements should be effectively located to minimize interference with car parking and circulation. Mechanical ventilation is one other important concern for the user of parking facility, and pedestrians.

BASIC DESIGN CONSIDERATIONS

The basic design considerations for a high rise building include the following parameters:

1. The cultural, political, and social aspects of the city where the building will be located
2. A strong relationship with the city
3. The master plan and an appropriate site selection
4. Sustainability
5. Safety and security issues
6. Learning about the possibilities and limitations of technology
7. When a high rise building is designed, the design team should also be aware of the codes, regulations, zoning requirements, and life safety issues.

The master plan is one of the significant design considerations for high rise buildings, in which well-performed site analysis include, automobile, traffic and pedestrian impact, accessibility, minimal blockage of view, and minimizing the building shadows to neighboring buildings. Besides this, an appropriate site selection also includes the consideration of reuse or rehabilitation of existing buildings, and physical security.

The location of high rise buildings within an urban area affects the amount of day lighting, and may even create wind tunnels. Sustainability is also a key element in high rise building design. This concept is based on the following objectives: optimization of site potential, minimization of energy consumption, protection and conservation of water, use of environmental- friendly products, enhancement of indoor environmental quality, and optimization of operational and maintenance practices. Day lighting, natural shading, energy efficient and photovoltaic facades, wind power systems, and the sky garden concept are also the main parameters for a more sustainable high rise building design. Designing a safe and secure high rise building has always been a primary goal for owners, architects, engineers, and project managers.

There is an increased concern on these issues for high rise building design especially after the disastrous 9/11 incident. Natural disasters, acts of terrorism, indoor air quality, hazardous materials, and fire are very significant and immediate safety issues to be considered in the design. Learning about the possibilities and limitations of technology is critical for the success of the project. New technology and new building materials are being introduced at a fast rate; it is important to track these changes. The different demands of the ever changing nature of business and lifestyle also force us to be aware of the technological changes.

CONSTRUCTION METHODS & TECHNIQUES

1. SLIP FORM
2. JUMP FORM
3. CLIMBING FORM WORK
4. TABLE FORM/FLYING FORM
5. COLUMN SYSTEM FORM WORK
6. TUNNEL FORM

1.SLIP FORM: - The slipform process involves the continuous upward movement of formwork by means of jack rods and hydraulic jacks. The slipform system is a hydraulically operated formwork system. Hydraulic jacks are mounted on strategically located steel yoking frames to lift the formwork as the concrete is poured into the forms.

2.JUMP FORM: - Jump form or climbing formwork is used for large vertical concrete structures. Jump form systems comprise the formwork and working platforms for cleaning/fixing of the formwork, steel fixing and concreting. The formwork supports itself on the concrete cast earlier so does not rely on support or access from other parts of the building or permanent works. It can be an effective solution for buildings that are either very repetitive in form (such as towers or skyscrapers) or that require a seamless wall structure.

3.CLIMBING FORM WORK: - Climbing formwork is a system used in the construction of vertical concrete structures, such as piles, walls and high-rise buildings. It consists of a set of temporary molds that support the fresh concrete until it reaches the required strength to support its own weight.

4. TABLE FORM/FLYING FORM: - Table formwork is used to support concrete slabs during the pouring and curing process. It typically consists of a framework of horizontal and vertical supports, resembling a table, on which the concrete is poured. This formwork system is efficient for large and repetitive floor structures, providing a stable platform for workers and equipment. After the concrete has solidified, the formwork is removed, leaving behind a supported and properly shaped slab.

5. COLUMN SYSTEM FORMWORK: - The column formwork systems now available are normally modular in nature and allow quick assembly and erection on site while minimizing labor and crane time. They are available in steel, aluminum and even cardboard (not reusable but recycled) and have a variety of internal face surfaces depending on the concrete finish required. Innovations have led to adjustable, reusable column forms which can be clamped on-site to give different column sizes.

6. TUNNEL FORM:- Tunnel form is a formwork system that allows the contractor to cast walls and slabs in one operation in a daily cycle. It combines the speed, quality and accuracy of factory/off-site production with the flexibility and economy of in-situ construction and is recognized as a modern method of construction (MMC).

MAIN EQUIPMENTS

- TOWER CRANE
- CONCRETE PUMP
- PROTECTION SCREEN
- PLATFORMS, CHUTE, LIFTS
- PLUMB LAZER

ROLE OF SUBSOIL

Natural rock is the best subsoil from the point of view of its earthquake properties. Sandy soils saturated with water and artificially backfilled land are considered to be particularly critical. The widely-feared liquefaction effects (plasticization of the soil) can occur if an earthquake coincides with high groundwater levels. The building may subsequently remain at a slant or both the building and the surrounding terrain may subside.

FOUNDATIONS DESIGN FOR EARTHQUAKE

Deep foundations generally display better seismic resistance than shallow foundations. Floating foundations can prove advantageous on soft ground, since they may be better able to attenuate resonance action. The risk of subsidence is considerably greater with floating foundations than with deep foundations. “Base isolation” is an anti-seismic construction technique that uses the principle of attenuation to reduce vibrations. The building is isolated from the solid subsoil by damping elements arranged on a foundation ring or foundation plate. The building was retroactively more or less mounted on ballbearings which are intended to gently damp down the impact of a future earthquake. As in the case of wind loads, earthquakes can also give rise to resonant vibration.

Foundations

Although the foundations are out of sight once the building is completed, they are of immense importance for ensuring that the dead weight and live loads of the building are safely transmitted to the native subsoil. These loads are not inconsiderable. The dead weight of a high-rise building can amount to several hundred thousand tones. This value may be exceeded several times over by the live loads which are taken as the basis for designing the building and include the loads from equipment and furnishings, people or moving objects, as well as wind or earthquake loads. Moreover, these loads often exert different pressures on the subsoil, thus resulting in uneven settlement of the building. In order to avoid such developments where ever possible, these buildings must be erected on subsoil of high load- bearing capacity, such as solid rock. Yet even if a strong native subsoil is found near the surface, shallow foundations will frequently be disregarded in favor a system that transfers the load to deeper layers on account of the high bending moments to be absorbed from horizontal forces. This can be done in several ways. One is to produce round or rectangular caissons which are lowered to the required depth and bear the foundation structure. Pile foundations are probably the most widely used method, however. The piles can both be prefabricated and then inserted in the native soil or they can be produced on site in the form of concrete drilling piles. Which method is chosen will ultimately depend on both the structural concept and the soil conditions prevailing on site. Drilling piles in a whole variety of forms can be used when working with large pile diameters and very long piles. Modern equipment can easily ram piles measuring up to 2 m in diameter to depths of well over 50 m. The piles are then combined into appropriate pile groups in accordance with the loads to be transmitted by the building. Although the load-bearing capacity can be roughly calculated on the basis of soil characteristics, the maximum permissible pile load is determined by applying test loads to the finished piles with the aid of hydraulic presses and comparing the resultant settlement with the permissible settlement.
Diaphragm walls are another means of producing deep foundations. These walls are produced directly in the ground and are between 60 and 100 cm thick. They are produced in sections with the aid of special equipment and a stabilizing betonies slurry. The result is a continuous wall in the ground. This method is used in particular when subsoil of high load- bearing capacity is only found at considerable depth. Diaphragm walls and piles are also used to safeguard the foundation pit required for construction of the underground part of the building. The effort entailed can be considerable, particularly if the neighboring buildings are very close. Rotating drills are mostly used today to minimize vibrations when installing the retaining wall. Foundation pits can easily be produced to depths of 30 m or more using this method.

HEIGHT OF THE BUILDING

High rise buildings are more susceptible to damage from strong remote earthquakes than from weak earthquakes close at hand. They normally have a lower resonant frequency and a lower attenuation than low buildings. Short-wave oscillation components in earthquakes are rapidly damped, while the long-wave components (frequency $f < 1$ Hz) can still make themselves felt at a distance of several hundred kilometers, particularly in the form of surface waves.

SYMMETRY OF THE HIGH-RISE BUILDING

Symmetric layouts, rigidity and mass distribution lead to a considerably better seismic response than asymmetric layouts, rigidity and mass distribution. This is because asymmetric buildings are subjected to stronger torsion (twisting) around the vertical axis by horizontal seismic loads.

SHAPE OF THE HIGH-RISE BUILDING

When parts of different height are permanently connected to one another as, for example, is often found in high-rise buildings with atriums, then the various structures in the building can be subjected to considerable torsional stresses by the seismic loads. Buildings of different heights can also be subjected to a whole series of effects in an earthquake, higher buildings were literally jammed in between lower buildings, thus extensively damaging the floors at the clamping point. In some cases, the buildings simply buckled over at the edge of the lower adjacent buildings. Resonance effects can also cause buildings to oscillate so strongly that they hammer against one another. Another effect observed in high-rise buildings is the soft-storey effect: due to lobbies, atriums or glazed shopping passages, some floors – usually near the ground floor – are distinctly "softer" than those above them. These "soft" floors then collapse in an earthquake.

LATERAL LOADS ON HIGH RISE BUILDINGS

From the structural design point of view, due to its height, a high rise building could be described, as one that is more affected by lateral loads created by wind or earthquake actions compared to other building types. Thus, loads acting on high rise buildings are different from those on low rise buildings in terms of accumulation into much larger structural forces, and the increased importance of wind loading. Wind loads on a high rise building act not only over a very large surface, but also with greater amount at the greater heights, and with a larger moment arm than on a low- rise building. Even though the wind loads on a low-rise building generally have a minor effect on the design and structural configuration, they can play a vital role for the selection of the structural system in a high rise building. Depending upon the mass and shape of the building, and the region, although, the wind load is very important in the design of high rise buildings, in seismic regions, inertial loads from the shaking of the ground also play an important role. Furthermore, in contrast to vertical loads which can be estimated roughly from previous field observations, lateral loads, namely the wind and earthquake loads, on buildings are fairly unpredictable, and cannot be assessed accurately.

NATURE OF WIND

Wind, which is created by temperature differences, could be described as an air motion, generally applied to the natural horizontal motion of the atmosphere. The vertical motion, on the other hand, is termed as a current. Air close to the surface of the earth moves three dimensionally, in which horizontal motion is much greater than the vertical motion. While the vertical air motion is significant particularly in meteorology, the horizontal motion is important in engineering. The surface boundary layer concerning the horizontal motion of wind extends upward to a certain height above which the horizontal airflow is no longer affected by the ground effect. Most of the human activity is performed in this boundary layer, and hence how the wind effects are felt within this zone is of great concern in engineering.

Wind is a very complex phenomenon owing to the many flow situations resulting from the interaction of wind and structure. In wind engineering, on the other hand, simplifications are made to find meaningful predictions of wind behavior by distinguishing the following features:

• Variation of wind speed with height
• Turbulent and dynamic nature of wind
• Vortex-shedding phenomenon
• Cladding pressures

WIND EFFECTS ON HIGH RISE BUILDINGS

The wind is the most powerful and unpredictable force affecting high rise buildings. High rise building can be defined as a mast anchored in the ground, bending and swaying in the wind. This movement, known as wind drift, should be kept within acceptable limits. Moreover, for a well-designed high rise building, the wind drift should not surpass the height of the building divided by 500. Wind loads on buildings increase considerably with the increase in building heights. Furthermore, the speed of wind increases with height, and the wind pressures increase as the square of the wind speed. Thus, wind effects on a high rise building are compounded as its height increases. Besides this, with innovations in architectural treatment, increase in the strengths of materials, and advances in methods of analysis, high rise building have become more efficient and lighter, and so, more vulnerable to deflection, and even to swaying under wind loading. The swaying at the top of a high rise building induced by wind may not be seen by a passer-by, but its effect may be a concern for those occupying the top floors. Unlike dead loads and live loads, wind loads change rapidly and even abruptly, creating effects much larger than when the same loads were applied gradually, and that they limit building accelerations below human perception.

VARIATION OF WIND SPEED WITH HEIGHT

An important characteristic of wind is the variation of its speed with height the wind speed increase follows a curved line varying from zero at the ground surface to a maximum at some distance above the ground. The height at which the speed stops to increase is called the gradient height, and the corresponding speed, the gradient wind speed. This important characteristic of wind is a well understood phenomenon that higher design pressures are specified at higher elevations in most building codes. Additionally, at heights of approximately 366 m from the ground, surface friction has an almost negligible effect on the wind speed; as such the wind movement is only depend on the prevailing seasonal and local wind effects. The height through which the wind speed is affected by the topography is called atmospheric boundary layer. The wind speed profile within this layer is in the domain of turbulent flow and could be mathematically calculated.

CLADDING PRESSURES

The cladding design for lateral loads is a very significant subject for architects and engineers. Even though the broken glass resulting from the exterior cladding failure may be a less important consideration than the structural collapse during an earthquake, the cost of replacement and risks for pedestrians require careful concentration in its design. Wind forces play a major role in glass breakage, also affected by solar radiation, mullion and sealant details, tempering of the glass, double or single glazing of glass, and fatigue. Breaking of large panels of glass in high rise buildings can badly damage the neighboring properties and injure the pedestrians.

STRUCTURAL SYSTEMS FOR HIGH RISE BUILDINGS:

LATERAL LOAD RESISTING SYSTEMS

The key idea in conceptualizing the structural system for a slender high rise building is to think of it as a beam cantilevering from the earth. As a general rule, when other things being equal, the high rise building more necessary is to identify the proper structural system for resisting lateral loads, in which the rigidity and stability requirements are often the dominant factors in the design. Moreover, the selection of the structural system of a high rise building involves the following factors:

- Economic criteria related to the budget of the project;
- Function of the building;
- Internal planning;
- Material and method of construction;
- External architectural treatment;
- Planned location and routing of the service systems;
- Height and proportions of the building.

Consequently, the effect of lateral loads must be considered from the very beginning of the design process, and the structural systems need to be developed around concepts associated entirely with resistance to these load Basically, there are three main types of buildings: steel buildings, reinforced concrete buildings, and composite buildings.

STEEL, REINFORCED CONCRETE AND COMPOSITE HIGH RISE BUILDINGS

Even though the application of steel in structures can be traced back to Bessemer's steelmaking process (1856), its application to high rise structures received its stimulus from the 300 m high Eiffel Tower (1889). Furthermore, the role of steel members which used to carry only gravity loads in the early structures, has been entirely upgraded to include wind and earthquake resistance in systems ranging from the modest portal frame to innovative systems involving outrigger systems, interior and exterior braced frames, and like. Today, structural steel could be utilized in a variety of structures from low-rise parking areas to 100-story high skyscrapers.

Both steel and concrete constructions have advantages and drawbacks. Moreover, without composite construction, many of our contemporary high rise buildings may never have been constructed in their present form today. On the other hand, here, the term composite system means any and all combinations of steel and reinforced concrete elements and is considered synonymous with other definitions such as mixed systems, hybrid systems, etc.

The classification of structural systems of high rise buildings is:

- Frame (rigid frame) systems;
- Braced frame and shear walled frame systems;
- Outrigger - belt truss systems;
- Framed tube systems;
- Braced (exterior braced) systems;
- Bundled tube systems.

INSTALLATION OF SERVICE SYSTEMS

The installation for air-conditioning, ventilation, lighting and fire alarms are usually located between the load-bearing ceiling and a suspended false ceiling into which the lamps are normally integrated. Small-scale electrical installations are contained in trucking in the screed flooring. Cables can then be routed as desired in the space below the floor; the equipment is connected to sockets in so-called floor tanks. False floors are to be found almost everywhere in modern houses, since cables can be rerouted without difficulty, as is increasingly required on account of the rapid pace of change in office and communications technology. Moreover, the space below the floor can also be used for ventilation and air-conditioning installations. Particular attention must be paid to the question of fire protection in such false floor constructions. Connection of the flexible partition walls to both the suspended ceiling and the elevated false floor can pose problems. From the point of view of soundproofing and thermal insulation, it would be better to install high rise the partition walls between the load-bearing floors.

However, since the suspended ceilings and false floors normally extend over the entire area and are not confined to any single room on account of the technical installations, the partition walls must also be fitted between the suspended ceiling and false floor. This consequently makes it necessary to use soundproofing and thermally insulating floor coverings, as well as ceiling materials. Facade elements into which technical components have already been incorporated by the manufacturer are conveniently linked to the remaining network by means of screw-in and plug-in connections. However, it is becoming increasingly rare for such technical service connections to be installed in the external walls, as they do not permit as flexible use of the room as floor tanks. Due to the relatively small area available per floor, fire resistant elements (fire walls) are usually only to be found in the core areas incorporating the elevators, stairwells, service and installation shafts, sanitary and ancillary rooms. A vertical breakdown into fire compartments is mostly obtained with the aid of fire-resistant floor.

ENERGY AND WATER SUPPLY

Unlike the case with normal multi-storey buildings, the technical service components in high rise buildings must meet special requirements if only on account of the height, since the required supply of energy, water and air and the effluent volume are incomparably larger. These utilities must also be transported to the very last floor in sufficient quantities, under adequate pressure and at sometimes totally different temperatures. The planning effort required on the part of the service engineers responsible for the supply and disposal services in high-rise buildings is therefore very much greater than in the case of smaller and medium sized projects. The pressure load on the individual components is reduced through subdivision into several pressure stages with technical service centers in the basement or on the ground floor, on intermediate floors and on the roof.

VENTILATION AND AIR-CONDITIONING

The systems should be designed in such a way as to ensure flexible division of the areas (large rooms, individual rooms) so that their use can subsequently be changed without extensive conversions. A variety of ventilation and air-conditioning systems can be installed, depending on the purpose for which the building is used. The high- rise headquarters of the Deutsche Bank in Frankfurt am Main, for instance, is supplied by a two-channel high-pressure system in which the air is injected from above and discharged through corresponding exhaust air windows. A second, independent two-channel high-pressure system additionally blows air into the rooms from the false floors. Ventilation and Air-conditioning system In principle, all air-conditioning and ventilation systems must meet the same basic requirements:

- The air in the room must be continuously renewed (at three to six fold exchange of air is normally required per hour).
- The outside air flow must be guaranteed with a minimum fresh air flow of 30 to 60 m3/h per person.
- The risk of drafts must be minimized and any nuisance due to the transmission of sound eliminated.
- It must be possible to shut off individual plant segments when the corresponding parts of the building are not in use.

SANITATION

Pressure stages are also required for the sanitation, thus permitting the use of smaller pumps. Sanitary dispensing points must additionally be isolated from the building as such for soundproofing reasons. The internal heat loads (e.g. hot exhaust air, exhaust heat from refrigeration systems) accumulated in high-rise buildings are commonly used to heat water with the aid of heat pumps or heat recovery systems. Studies shown that the height does not have any effect on the flow rate and rate of fall, since fiscal matter and effluent do not simply drop to the ground under the force of gravity, but more or less wind their way downwards along the pipe walls.

CONTROL SYSTEMS

Today's complex, ultra-modern control systems are primarily based on intelligent digital controllers. This technology permits a direct link between DDC (direct digital control) substations and the centralized instrumentation and control which also takes over energy management functions, such as:

- Optimization of the overnight and weekend temperature reduction,
- Linking the heating of service water with re-cooling of the refrigeration system, operation of the external blinds.

FIRE FIGHTING

Fire is one of the greatest risks for every building and particularly for high-rise buildings. Due to the spectacular photographs and film sequences shown in the media, major fires have always made and will continue to make headline news not only during the construction phase, but above all during the occupancy phase.

FIRE FIGHTER ACCESSIBILITY

It is important for emergency personnel (e.g. fire-fighters, paramedics, police) to be able to access a building quickly in the event of an emergency. In addition, these personnel cannot be expected to scale all floors through stairwells. This need gets back to the elevator systems. The tower has service elevators that run higher than local passenger elevators. In fact, one of these service elevators runs over the tower. These are very fast, and are configured to override the local elevators to allow for the quickest and easiest transfers. The elevators themselves are fire/smoke resistant. With these, it makes accessing the building a relatively painless process.

OCCUPANT EVACUATION

Occupant evacuation is the concern of any building; however, it poses a special challenge given the height of the high rise buildings. With the tremendous climb, occupants will need information on the situation, mechanical assistance to speed the process, and stairwells and safe zones in the event of mechanical failures. It is important to note that most crises the building will experience will not require full building evacuation. However, when lives are at stake, it is still important to be sure that it is possible.

AREAS OF REFUGE

The tower design includes strategically placed areas of refuge which allow for better controlled evacuation. Represented in the typical area of refuge will have fire rated exit stairs closed off by doors to counter the spread of smoke. Building employees will be trained to direct and instruct evacuees. Also, the areas of refuge are designed to connect to various stairwells. This means that occupants can be directed down the safest path, and will almost never be trapped. As usual, the areas of refuge are encased in fire resistant concrete, are well ventilated, and can be lit by emergency lights. Typical design for area of Refuge.

FIRE EXTINGUISHERS

Hand-operated fire extinguishers must be installed at clearly marked and generally accessible points in high-rise buildings in order to fight incipient fires. These extinguishers are intended for use by the building's residents. However, teams should be present on every floor made up of the people who work and live there; they must then be instructed on what to do if a fire breaks out and also be familiarized with the use of these hand-operated fire extinguishers.

FIRE-FIGHTING WATER

The cases outlined above have shown how important it is to have an effective supply of fire fighting water when combating a fire in a high-rise building. So that the firemen can start to fight the fire as soon as they arrive on the scene, wet risers must be installed in every stairwell or in their vicinity and a wall hydrant with hose line connected to these risers on every floor. The hoses must be sufficiently long to direct fire-fighting water to every point on that floor.

SPRINKLERS

An automatic sprinkler system is the most effective protective measure for fighting and controlling a fire in a high-rise building. Care must be taken to ensure that the complete building is protected by such sprinklers. In the cases outlined above, there was either no sprinkler at all or no activated sprinklers on the burning floors. Based on past experience, the installation of sprinkler systems is in many countries prescribed by law for

high-rise buildings from a certain height onwards – as from 60 m in Germany, for example. In some cases, the statutory regulations even stipulate that sprinklers have to be installed retroactively in high-rise buildings erected before the regulations came into force.
Automatic sprinkler systems throughout the building are important since they must fight a fire as early as possible and must either extinguish the fire directly or keep it under control until the fire brigade arrives to finish off the job. However, a sprinkler system will normally be unable to control a fire in full flame, for instance if it leaps from a floor with no sprinklers to one with sprinklers. Sprinkler systems are simply not dimensioned to cope with such developments. Sprinkler systems must meet the following requirements:

- They must rapidly control a fire in the fire compartment in which it breaks out;
- They must limit the emission and spread of flames, hot fumes and smoke, they must trigger an alarm in the building, preferably also indicating to the central control panel where the seat of the fire is located, the alert must be forwarded to the fire brigade or other auxiliary forces.
- The ability of the system to indicate to the central control panel where the seat of the fire is located presupposes that a separate sprinkler system with an alarm valve is assigned to each floor and to each fire compartment.

As already mentioned in connection with fire-detection systems, the installation of an automatic fire-detection system in addition to the sprinkler system is advisable so that fires can be discovered and signalled more quickly. Sprinkler systems must be installed in accordance with the applicable directives or standards, the best known of which include NFPA, CEA, FOC and VdS. All the components used for installation must comply with the relevant standards. The various directives and standards permit a variety of solutions with regard to the water supply: Water supply from the public mains – possibly via an intermediate tank on the ground – via booster pumps on the ground to supply several groups of floors with different pressure levels intermediate tanks on various upper floors, under either normal pressure or excess pressure, to supply the sprinkler groups above or below deep tanks and pressurized tanks on the roof, as well as intermediate tanks in the middle of the building, to supply the sprinklers below with static or high pressure Tanks on upper floors can be replenished via low-capacity pumps.30 Depending on the type of supply selected, it may be necessary to install rise pressure- reducing valves on the individual floors. For a sprinkler system to operate smoothly, it must not only be correctly installed and set, but also be regularly inspected and serviced by specialist personnel.

OTHER EQUIPMENT

Other automatic fire-fighting equipment may be appropriate for certain systems in a high-rise building, such as transformers, electrical switchgear and control rooms, computer centers and telephone switchboards.

GUIDELINES FOR MAKING OF HIGH RISE BUILDING (IS 16700: 2017)

(A) CLEARANCE OF LOCAL MUNICIPAL AUTHORITY. As per Part 2 (Administration), Section 3 (11.1.3) of NBC 2017, "Specific approvals shall be obtained from Airports Authority of India, Ministry of Environment, Forest and Climate Change, Fire Services Department, Pollution Control Board, Designated Authorities under Factories Act/ Cinema Regulation Act, Urban Arts Commission, Designated Coastal Regulation Zone Authority, Archaeological Survey of India, Heritage Committee and any such other authority as may be applicable. Fire clearance for building drawings and layout will be obtained as per local byelaws and rules.
B) OPEN SPACES & FLOOR SPACE INDEX. Mandatory open space norms as per NBC and Local Byelaws to be followed. Community open spaces to be provided as per Para 5.0 Part 3 of NBC 2016.
(C) FLOOR TO FLOOR HEIGHT OF INDIVIDUAL FLOORS. The floor-to- floor height of a building is a function of required ceiling height, depth of structural floor system & material and vertical space required for Mechanical, Electrical and Plumbing distribution networks. It may vary from 3.2m to 4.8m depending upon type of building.

STRUCTURAL CONSIDERATIONS.

Height Limit for Structural System. Based on lateral loads the height for various structural systems in different seismic Zones shall be as per Table 1 of IS 16700: 2017.

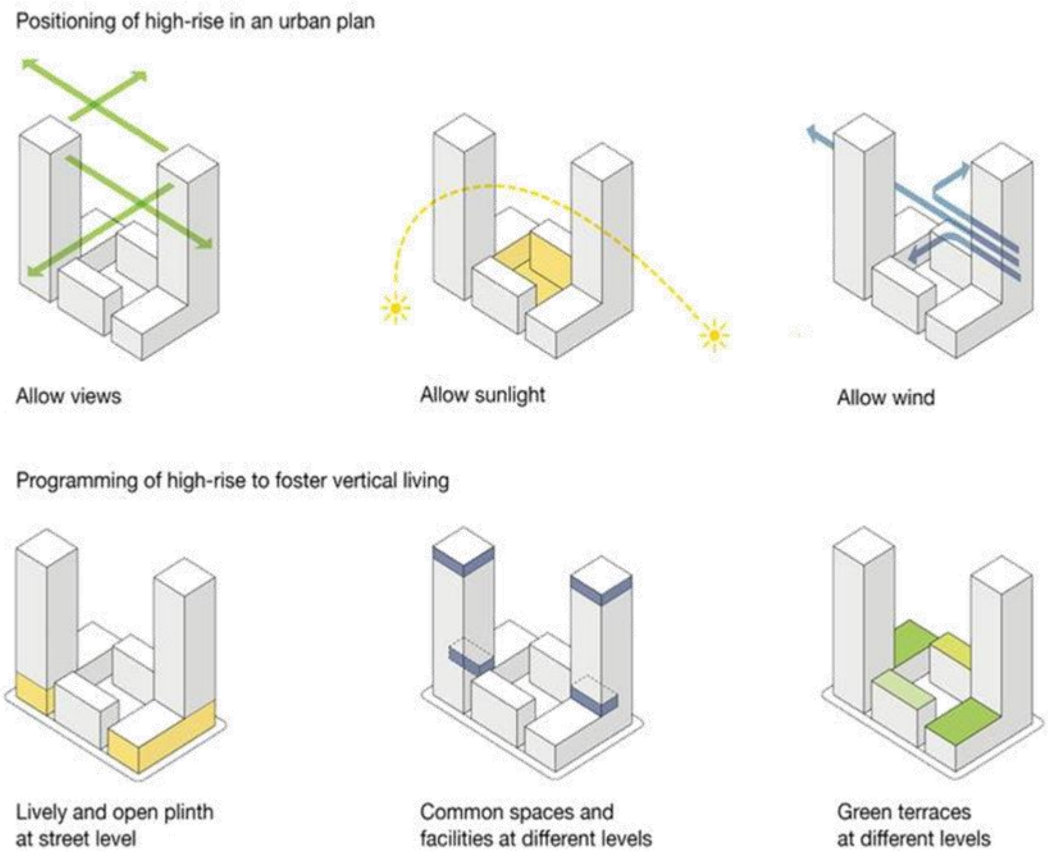


Table 1 Maximum values of Height, *H* above Top of Base Level of Buildings with Different Structural Systems, in metre
(*Clause* 5.1.1)

Sl No.	Seismic Zone	Structural System					
		Moment Frame	Structural Wall		Structural Wall + Moment Frame	Structural Wall + Perimeter Frame	Structural Wall + Framed Tube
			Located at Core	Well-Distributed[1]			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	V	NA	100	120	100	120	150
ii)	IV	NA	100	120	100	120	150
iii)	III	60	160	200	160	200	220
iv)	II	80	180	220	180	220	250

[1] Well-distributed shear walls are those walls outside of the core that are capable of carrying at least 25 percent of the lateral loads.

Slenderness Ratio. The height to base ratio shall be as per Table 2 of IS 16700: 2017.

Table 2 Maximum Slenderness Ratio (H_t/B_t)
(*Clause* 5.1.2)

Sl No.	Seismic Zone	Structural System					
		Moment Frame	Structural Wall		Structural Wall + Moment Frame	Structural Wall + Perimeter Frame	Structural Wall + Framed Tube
			Located at Core	Well-Distributed[1)]			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	V	NA	8	9	8	9	9
ii)	IV	NA	8	9	8	9	9
iii)	III	4	8	9	8	9	10
iv)	II	5	9	10	9	10	10

STOREY STIFFNESS AND STRENGTH

Parameters influencing stiffness and strength of the building should be so proportioned, that the following are maintained: Lateral translational stiffness of any storey shall not be less than 70 per cent of that of the storey above. Lateral translational strength of any storey shall not be less than that of the storey above.

NATURAL MODES OF VIBRATION

The natural period of fundamental torsional mode of vibration shall not exceed 0.9 times the smaller of the natural periods of the fundamental translational modes of vibration in each of the orthogonal directions in plan. The fundamental translational lateral natural

Period in any of the two horizontal plan directions shall not exceed 8 s, considering sectional properties as Table 6 corresponding to unfactored loads.

Unfactored load is a service load to determine the working stress of a structural concrete, steel, or wood member. Each load type is employed to meet a certain limit state. A factored load is a load multiplied by a certain factor designated by codes of practice to drermine the strength of structural members such as reinforced concrete.

Table 6 Cracked RC Section Properties
(*Clause* 7.2)

Sl No.	Structural Element	Un-factored Loads		Factored Loads	
		Area	Moment of Inertia	Area	Moment of Inertia
(1)	(2)	(3)	(4)	(5)	(6)
i)	Slabs	1.0 A_g	0.35 I_g	1.00 A_g	0.25 I_g
ii)	Beams	1.0 A_g	0.7 I_g	1.00 A_g	0.35 I_g
iii)	Columns	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g
iv)	Walls	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g

GEOTECHNICAL INVESTIGATIONS

FOUNDATIONS

1. Load paths and mechanisms shall be ensured explicitly for transferring vertical and lateral loads between structure and soil system underneath.
2. A factor of safety of 1.5 shall be provided against overturning and sliding under,
   (a) Unfactored design wind and gravity loads; and
   (b) 2.5 times design earthquake load and unfactored gravity loads.

All geotechnical investigations needed to establish the safety of the building shall be conducted including for liquefaction potential and estimation of soil spring constant and modulus of subgrade reaction.

9.3.1 For geotechnical investigation, boreholes shall,

a) be spaced at ~30 m within the plan area of the building;
b) be a minimum of 3 boreholes per tower; and
c) have a depth of at least 1.5 times of estimated width of foundation in soil and 30 m in rock.

9.4 Depth of Foundation

The embedded depth of the building shall be at least 1/15 of height of building for raft foundation and 1/20 of the height of building for pile and piled raft foundation (excluding pile length). But, this requirement may be relaxed,

a) when the foundation rests on hard rock; or
b) when there is no uplift under any portion of the raft in any service load combination, and provided the minimum competent founding strata requirement is fulfilled.

9.5 Podium/Basement roof slab should be capable of transferring in-plane shear from the tower to the foundation.

9.6 Expansion Joints should preferably be avoided in basements of tall buildings.

WIND EFFECT.

For High Rise and Tall Buildings, wind analysis shall
be carried out to evaluate the impact of wind movement and natural flow changes because of the new building proposed to be erected. Strategies may include application of cross-ventilation and thermal comfort, factoring prevalent wind patterns, seasonality, stack effect and other principles.

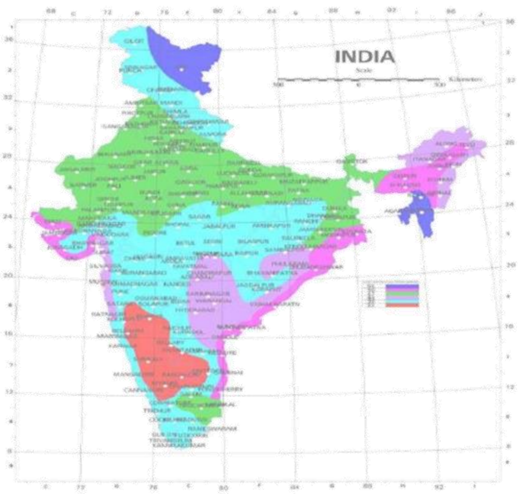


Figure 1: Basic wind speed in m/s (based on 50 year return period)

6.3 Seismic Effects

6.3.1 Vertical shaking shall be considered simultaneously with horizontal shaking for tall buildings in Seismic Zone V.

6.3.2 For buildings in Seismic Zones IV and V, deterministic site-specific design spectra shall be estimated and used in design. When site-specific investigations result in higher hazard estimation, site-specific investigation results shall be used.

6.3.3 Design base shear coefficient of a building under design lateral forces, shall not be taken less than that given in Table 5.

Table 5 Minimum Design Base Shear Coefficient
(*Clause* 6.3.3)

Sl No.	Building Height, *H*	Seismic Zone			
		II	III	IV	V
(1)	(2)	(3)	(4)	(5)	(6)
i)	$H \leq 120$m	0.7	1.1	1.6	2.4
ii)	$H \geq 200$m	0.5	0.75	1.25	1.75

NOTE — For buildings of intermediate height in the range 120 m – 200 m, linear interpolation shall be used.

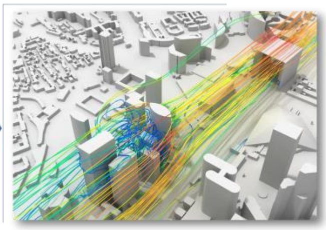
WIND RESISTANCE

Wind causes horizontal loading resulting in sway of the building. This is because high-rise buildings are susceptible to oscillation. Therefore, wind has to be considered as a static load inclusive to be considered as a dynamic load.

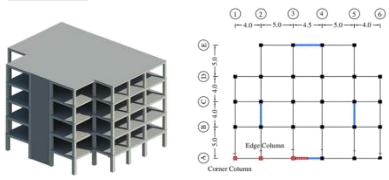
HOW WE CAN MAKE WIND RESISTANCE HIGHRISE BUILDING

SOFTENED CORNERS

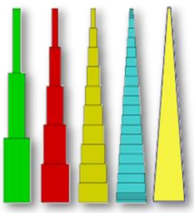
SQUARE OR RECTANGULAR SHAPES ARE VERY COMMON FOR BUILDINGS AND EXPERIENCE RELATIVELY STRONG VORTEX SHEDDING FORCES. HOWEVER, IT IS FOUND THAT IF THE CORNERS CAN BE "SOFTENED" THROUGH CHAMFERING, ROUNDING OR STEPPING THEM INWARDS, THE EXCITATION FORCES CAN BE SUBSTANTIALLY REDUCED.



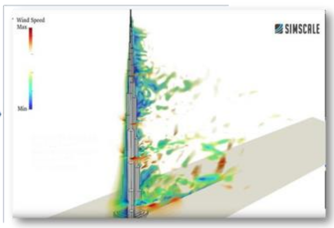
GRID PLAN

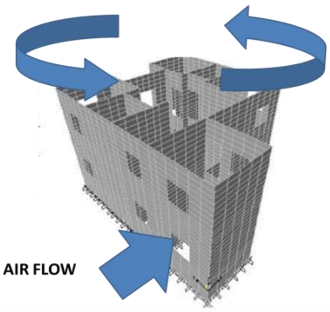


TAPERING AND SETBACKS

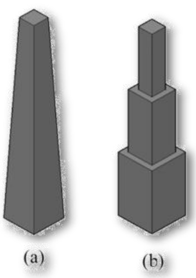


IF THE WIDTH CAN BE VARIED UP THE HEIGHT OF THE BUILDING, THROUGH TAPERING OR SETBACKS, THEN THE VORTICES WILL TRY TO SHED AT DIFFERENT FREQUENCIES AT DIFFERENT HEIGHTS. THEY BECOME "CONFUSED" AND INCOHERENT, WHICH CAN DRAMATICALLY REDUCE THE ASSOCIATED FLUCTUATING FORCESM

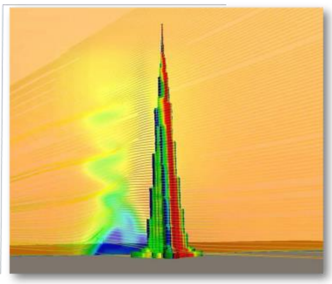




VARYING CROSS-SECTION SHAPE



A SIMILAR EFFECT CAN BE ACHIEVED BY VARYING THE CROSS-SECTION SHAPE WITH HEIGHT, E.G. GOING FROM SQUARE TO ROUND CAUSES THE SHEDDING FREQUENCY TO BE DIFFERENT AT DIFFERENT HEIGHTS. THIS AGAIN RESULTS IN "CONFUSED" VORTICES.



AS THE WIND FLOW TRYING TO ROTATE THE BUILDING FROM ONE SIDE BUT EQUAL AND OPPOSITE REACTION IS TAKING PLACE BECAUSE IT HAS SAME AMOUNT COLUMNS BOTH SIDE THIS IS NOTHING BUT ACCELERATION FORCE

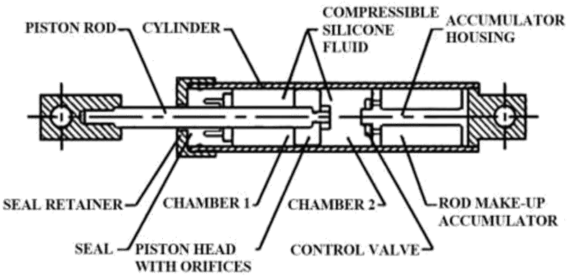
ACCELERATION IS THE RATE OF CHANGE OF VELOCITY OF AN OBJECT IN THE SAME STRAIGHT LINE OF THE UNBALANCED FORCE. WHEN FORCES BECOME BALANCED, THERE IS NO NET FORCE AND THEREFORE NO MOVEMENT.

MONITORING OF DEFORMATIONS.

Earthquake Shaking. Tall Buildings exceeding
150m in Seismic Zone III and IV as also all tall buildings in Zone V shall be instrumented with tri-axial accelerometers.

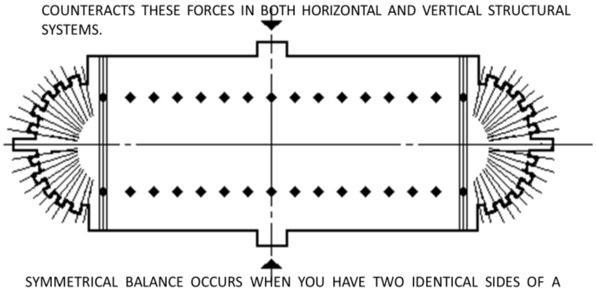
SHOCK ABSORPTION:

IT REDUCES THE MAGNITUDE OF THE SHOCK WAVES BY CONVERTING THE SEISMIC WAVE ENERGY INTO HEAT ENERGY WHICH IS THEN TRANSFERRED INTO HYDRAULIC FLUID. THIS IS THE REASON WHY THE SHOCK ABSORBERS ARE CALLED DAMPERS. THE DAMPERS FOR BUILDINGS HAVE HUGE PISTONS INSIDE OF A SILICONE OIL FILLED CYLINDER



SYMMETRY PLAN OR IN GRID

THUS ARCHITECTS DESIGN **SYMMETRICAL** STRUCTURES TO KEEP THE FORCES EQUALLY DISTRIBUTED THROUGH THE STRUCTURE AND LIMIT ORNAMENTAL ELEMENTS LIKE CORNICES, CANTILEVER PROJECTIONS ETC. ... SEISMIC DESIGNING COUNTERACTS THESE FORCES IN BOTH HORIZONTAL AND VERTICAL STRUCTURAL SYSTEMS.



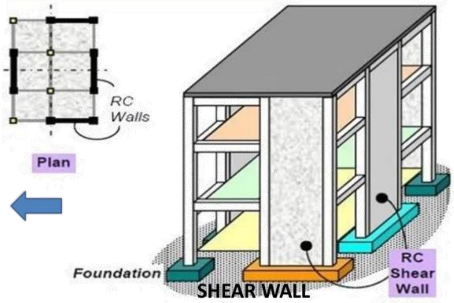
SYMMETRICAL BALANCE OCCURS WHEN YOU HAVE TWO IDENTICAL SIDES OF A DESIGN WITH A CENTRAL POINT OF AXIS -- SO IF YOU CUT THE DESIGN IN HALF, THE LEFT AND RIGHT ARE MIRROR IMAGES OF EACH OTHER. TO BE CONSIDERED PERFECTLY SYMMETRICAL, A DESIGN NEEDS TO HAVE EQUALLY WEIGHTED VISUALS ON EITHER SIDE

IN COMPARISON OF SYMMETRIC BUILDING AND ASYMMETRICAL BUILDING THE TORSIONAL MOMENT IS MORE FOR ASYMMETRICAL BUILDING THAN SYMMETRICAL BUILDING.

2. TORSIONAL MOMENT DECREASES AS THE HEIGHT INCREASES (NO. OF STOREY).

3.THE TORSIONAL MOMENT OF LOW RISE BUILDING IS MORE THAN MID AND HIGH RISE BUILDING.

SHEAR WALL IS ONE OF THE MOST COMMONLY USED LATERAL LOAD RESISTING SYSTEMS IN BUILDINGS. ... WHEN SHEAR WALL ARE PLACED IN ADVANTAGEOUS POSITIONS IN THE BUILDING, THEY CAN FORM AN EFFICIENT LATERAL FORCE RESISTING SYSTEM BY REDUCING LATERAL DISPLACEMENTS UNDER EARTHQUAKE LOADS



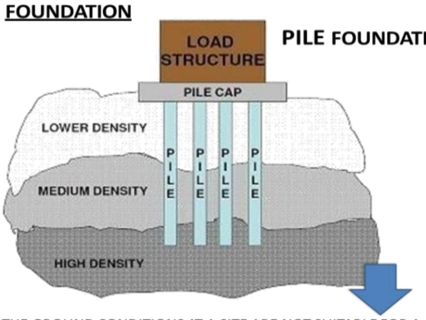
1.3.EARTHQUAKE RESISTANCE

Most parts of India are located in seismic zones, it is very important for builders and structure safety authorities to ensure that construction is being done as per the prescribed standards

TECHNIQUES FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

FOUNDATION

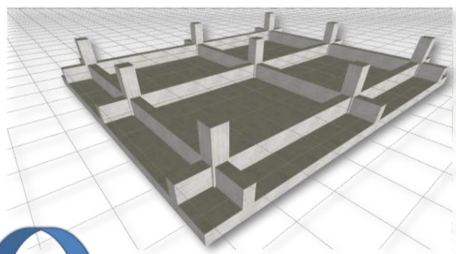
PILE FOUNDATION

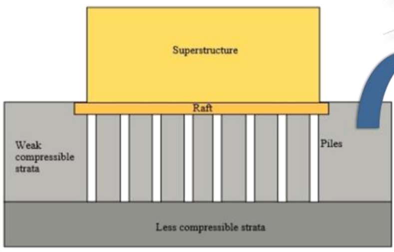


OFTEN THE GROUND CONDITIONS AT A SITE ARE NOT SUITABLE FOR A SHALLOW RAFT/MAT FOUNDATION SYSTEM, ESPECIALLY
FOR HIGH-RISE BUILDINGS WHERE THE VERTICAL AND LATERAL LOADINGS IMPOSED ON THE FOUNDATION ARE SIGNIFICANT.
IN THESE CIRCUMSTANCES, IT IS NECESSARY TO SUPPORT THE BUILDING LOADS ON PILES, EITHER SINGLE PILES OR PILE GROUPS, GENERALLY LOCATED BENEATH COLUMNS AND LOAD BEARING WALLS.

RAFT OR MAT FOUNDATIONS

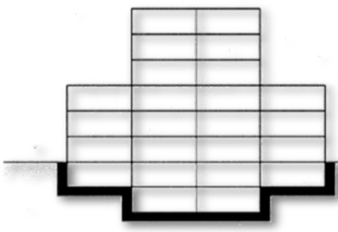
IF HIGH-RISE DEVELOPMENTS CONTAIN A MULTI-LEVEL BASEMENT, THE BASE OF THE DEVELOPMENT MAY BE FOUNDED CLOSE TO, OR EVEN INTO, COMPETENT ROCK. A RAFT (MAT) FOUNDATION EMBEDDED TO SUPPORT THE STRUCTURE MAY BE FEASIBLE FOR BUILDINGS OF MODERATE HEIGHT.





MANY HIGH-RISE BUILDINGS ARE CONSTRUCTED WITH THICK BASEMENT SLABS. WHEN PILES ARE USED IN THE FOUNDATION IT IS GENERALLY ASSUMED THAT THE BASEMENT SLAB DOES NOT CARRY ANY OF THE FOUNDATION LOADS. IN SOME CASES, IT IS POSSIBLE TO UTILISE THE BASEMENT SLAB, IN CONJUNCTION WITH THE PILES, TO OBTAIN A FOUNDATION THAT SATISFIES BOTH BEARING CAPACITY AND SETTLEMENT CRITERIA.
A PILED RAFT FOUNDATION IS A COMPOSITE SYSTEM IN WHICH BOTH THE PILES AND THE RAFT SHARE THE APPLIED STRUCTURAL LOADINGS. WITHIN A CONVENTIONAL PILED FOUNDATION, IT MAY BE POSSIBLE FOR THE NUMBER OF PILES TO BE REDUCED SIGNIFICANTLY BY CONSIDERING THE CONTRIBUTION OF THE RAFT TO THE OVERALL FOUNDATION CAPACITY

COMPENSATED RAFT FOUNDATIONS

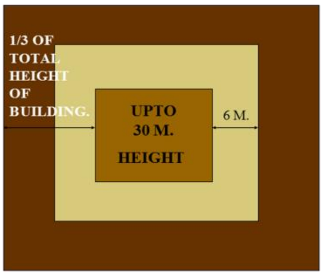


TALL BUILDINGS VERY FREQUENTLY HAVE ONE OR MORE BASEMENTS TO CATER FOR CAR PARKING AND/OR COMMERCIAL AND RETAIL SPACE. IN SUCH CASES, THE CONSTRUCTION OF THE RAFT INVOLVES EXCAVATION OF THE SOIL PRIOR TO CONSTRUCTION OF THE FOUNDATION AND THE SUPERSTRUCTURE. BECAUSE OF THE STRESS REDUCTION IN THE UNDERLYING GROUND CAUSED BY EXCAVATION, THE NET INCREASE IN GROUND STRESS DUE TO THE STRUCTURE WILL BE DECREASED, AND HENCE IT MAY BE EXPECTED THAT THE SETTLEMENT AND DIFFERENTIAL SETTLEMENT OF THE FOUNDATION WILL ALSO BE DECREASED.

OFFSET/ SET BACK AS PER DCR

SETBACK OR OPEN SPACES

Section : As per table 2 of section 8.2.3.1 of part III of N.B.C.



Sufficient open space (setbacks) around residential buildings, as indicated in the next slide, is essential to facilitate free movement and operation of Fire Service vehicles.

d) The Distance between the two building -

The distance between two buildings shall be the side marginal distance required for the higher building between two adjoining buildings.

Provided where rooms do not derive light and ventilation from the exterior open space, the distance between the two buildings may be reduced by 1 m subject to a minimum of3 m. (if necessary 6.0m. in case of special building) and a maximum of 8 m. No projections shall be permitted in this exterior space.

In case of group housing scheme or in housing scheme where building abuts on internal road or abut on recreational open space then in such cases the minimum 3.0 m. set back from internal road or distance between two buildings whichever is more shall be provided. For Development plan road or classified road or through road, passing through Group Housing Scheme, the setback as prescribed in the regulations shall be provided.

Sr.No	Height of building in Meters	Exterior open spaces/setbacks to be left on *all* sides. Minimum in meters
1.	Above 9.5 up to 12	4.5
2.	Above 12 up to 15	5.0
3.	Above 15 up to 18	6.0
4.	Above 18 up to 21	7.0
5.	Above 21 up to 24	8.0
6.	Above 24 up to 27	9.0
7.	Above 27 up to 30	10.0
8.	Above 30 up to 35	11.0
9.	Above 35 up to 40	12.0
10.	Above 40 up to 45	13.0
11.	Above 45 up to 50	14.0
12.	Above 50	16.0

SOME RULES AS PER DCR

2.2.6 Site Plan

The site plan shall be submitted with an application for building permission drawn to a scale of 1:500 or more as may be decided by the Authority. This plan shall be based on the measurement plan duly authenticated by the appropriate officer of the Department of Land Records. This plan shall have the following details:-

i) Boundaries of the site and of any contiguous land belonging to the neighbouring owners;
ii) Position of the site in relation to neighbouring streets;
iii) Name of the street, if any, from which the building is proposed to derive access;
iv) All existing buildings contained in the site with their names (where the buildings are given names) and their property numbers;
v) Position of the building and of other buildings, if any, which the applicant intends to erect, upon his contiguous land referred to in (i) above;
vi) Boundaries of the site and, in a case where the site has been partitioned, boundaries of the portions owned by others;
vii) All adjacent streets, buildings (with number of storey and height) and premises within a distance of 12 m. of the work site and of the contiguous land (if any) referred to in (i). If there is no street within a distance of 12 m. of the site, the nearest existing street with its name;
viii) Means of access from the street to the building and to all other buildings (if any) which the applicant intends to erect upon;
ix) Space to be left around the building to secure free circulation of air, admission of light and access;
x) The width of the street (if any) in front and the street (if any) at the side or near of the building, including proposed roads;
xi) The direction of north line relative to the plan of the building;
xii) Any existing physical features, such as wells, tanks, drains, pipe lines, high tension line, railway line, trees, etc.;
xiii) Overhead electric supply lines, if any, including space for electrical transformer / substation according to these Regulations or as per the requirements of the electric distribution company;
xiv) Any water course existing on site or adjacent to site;
xv) Existing alignments of water supply and drainage lines;
xvi) Such other particulars as may be prescribed by the Authority.

26.5 a)Height of Building-

(i) Height of building is allowed to the extent that is required to consume the maximum building potential on plot as given in the table under regulation no. 26.1.1 & 26.3 , subject to other restrictions as per these regulations and prior approval of Chief Fire Officer, if required under this regulation. In any case maximum height of building shall not exceeds **50 m**.

Notwithstanding anything contained in these regulations, for the building having height 24.0 mtr and more , the minimum road width shall be 12.0 mtr. and for building having height equal to or more than 50.0 m., the minimum road width shall be 15.0 mtr.

Provided further that building of greater height above 50.0 m. may be allowed in consultation with Chief Fire Officer and subject to approval of High Rise Committee.

(ii) If a building abuts on two or more streets of different widths, the height of building shall be regulated by the street of greater width.

(iii) For building in the vicinity of aerodromes, the maximum height of such buildings shall be subject to values framed by the Civil Aviation Authorities or the development permission shall be considered only after applicant produces NOC from Air Port Authority.

(iv) In addition to (iii) for Industrial Chimneys coming in the vicinity of aerodromes, it shall be of such height and character as prescribed by Civil Aviation Authorities and all Industrial Chimneys shall be of such character as prescribed by the Chief Inspector of Steam Boilers and Smoke Nuisance, and

(v) Buildings intended for hazardous godowns storage of inflammable materials and storage of explosives shall be single storied structures only.

PRECAUTION SHOULD BE TAKEN BEFORE CONSTRUCTION OF HIGH RISE BUILDING….

FIRE RESISTANCE

To mitigate fire safety risks further, buildings are required to have accessible entrances and exits, along with a capable fire control system. This is also the reason why modern high-rise projects are designed with channels for sprinklers, multiple sources of water, and more fire escapes. The goal of these elements is boosting the building's ability to withstand fire

1. CONTROL OF IGNITION

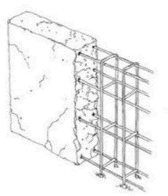
This can be done by controlling the flammability of material within the structure, by proper selection of finishes, or by safety management such as imposing restrictions on naked flames

MATERIAL

STEEL

ALUMINUM

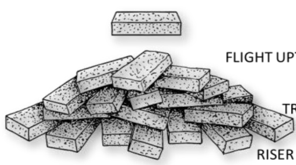
CONCRETE



WROUGHT-IRON AND CAST-IRON. .

ASBESTOS CEMENT

CEMENT BLOCKS

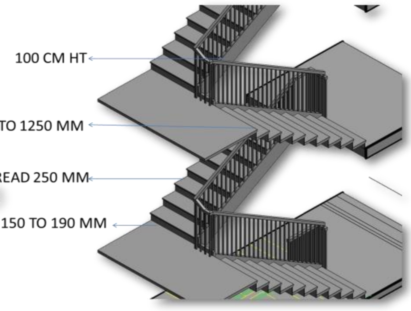


2.FIRE STAIRCASE

FIRE ESCAPE STAIRCASE IN THE MERCANTILE, BUSINESS, ASSEMBLY, HOTEL BUILDINGS ABOVE 24 M. HEIGHT SHALL BE A FIRE TOWER AND IN SUCH A CASE WIDTH OF THE SAME SHALL NOT BE LESS THAN THE WIDTH OF THE MAIN STAIRCASE. NO COMBUSTIBLE MATERIAL SHALL BE ALLOWED IN THE FIRE TOWER

FIRE ESCAPE STAIRS SHALL HAVE STRAIGHT FLIGHT NOT LESS THAN 125 CM WIDE WITH 25 CM TREADS AND RISERS NOT MORE THAN 19 CM. G) HANDRAILS SHALL BE AT A HEIGHT NOT LESS THAN 100 CM

EMERGENCY EXITS SHALL BE LOCATED IN SUCH A WAY THAT THE TRAVEL DISTANCE ON EACH FLOOR SHALL NOT EXCEED 30 METERS FOR EVERY OCCUPANCY



P-15 FIRE DRILLS AND FIRE ORDERS

P-15.1 Fire notices /order shall be prepared to fulfil the requirements of the fire fighting and evacuation from the buildings in the event of fire and other emergency. The occupants shall be made thoroughly conversant with their action in the event of the emergency, by displaying fire notices at vantage points. Such notices should be displayed prominently broad lettering.

P-15.2 The wet riser/wet riser-cum-down comers installations with capacity of water storage tanks and fire pumps shall conform to the requirements as specified in Table 30.

TABLE 30 FIRE FIGHTING INSTALLATION / REQUIREMENTS

Sr. No.	Type of the Building/ Occupancy	Requirements No.				
		Type of Installations	Water Supply		Pump Capacity	
			Under-ground Static Tank	Terrace Tank	Near the under-ground Static Tank	at the Terrace Level
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Apartment Building below 15 m. in height	Nil	Nil	Nil	Nil	Nil
2.	Apartment Buildings					
	(a) above 15 m. but not exceeding 24 m.	Wet riser Cum-down comer with provision of fire service inlet only near ground level.	Nil	10,000 liter	Nil	100 liters per minute giving a pressure not less than 1.5 kg./cm2 at the topmost hydrant.
3.	Non-apartment building :					
	(a) Industrial, storage and Hazar- dous upto 15 m. in height.	Nil	50,000	Nil	Nil	Nil
	(b) above 15 m. in height but not exceeding 24 m. excepting educational buildings.	Wet riser Cum-down comer	50,000 litres	10,000 litres	1,350 litres per minute giving a pressure not less not than 3.2 kg/Cm2 at the topmost hydrant except for institutional, Business and educational Building.	450 litres per minute giving pressure not less than 2.1 kg/Cm2 at the topmost hydrant.
	(c) Educational building above 15m. but not exceeding 24 m. in height.	Wet riser Cum-down comer.	Nil	10,000 litres	Nil	Nil

WET RISER CUM DOWN COMMER SYSTEM

Wet riser : It is a vertical pipeline (dia. depends on the floor area of the building) connected to a bottom tank(underground water tank).

Down Commer : It is a vertical pipeline (dia. depends on the floor area of the building) connected to a overhead tank.

WET RISER CUM DOWN COMMER SYSTEM

Dry riser : It is a vertical pipe which is always kept dry to avoid the freezing of water.

Hydrant : It is a horizontal pipe line with outlet of 63 mm. dia. connected to underground water tank.

WET RISER

- Wet riser cum down commer or only down commer system shall be provided for residential building.
- For commercial building only only wet-riser system shall be provided.
- For hotels wet-riser cum down commer both the systems shall be provided.
- Diameter of riser will be 150mm for all the buildings.
- For each 1000m² floor area or it's part one riser shall be provided.
- At every landing twin outlet each of 63mm dia. shall be provided (one should be connected to hose reel & another should be to hose & branch).
- Length of hose should be shall that it should reach at the last point of floor area.
- Minimum two courtyard hydrants shall be provided (courtyard hydrant will be an extention to riser).
- Hose reel hose of 12mm dia. shall be provided from landing valve to wet-riser at each floor.
- A separate fire service inlet shall be provided at the ground floor.
- Location of wet-riser shall be preferable as near to staircase.

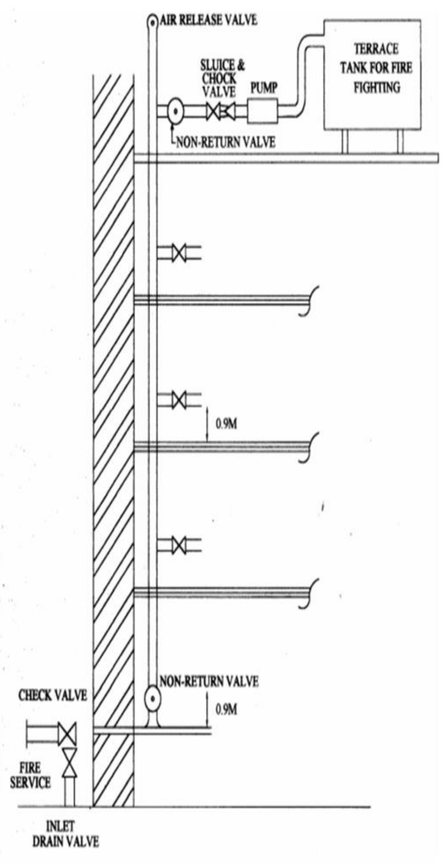
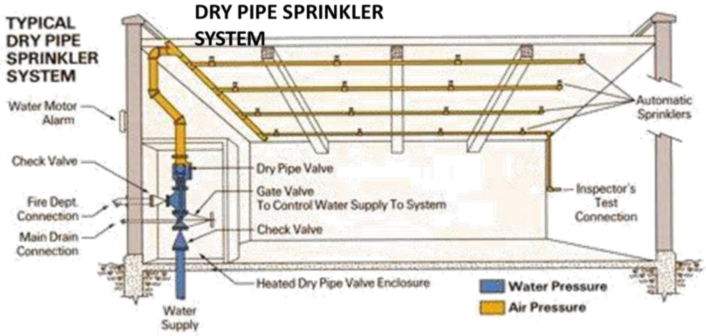


FIG:2- APARTEMENT BUILDINGS EXCEEDING 16M

3.FIRE FIGHTING

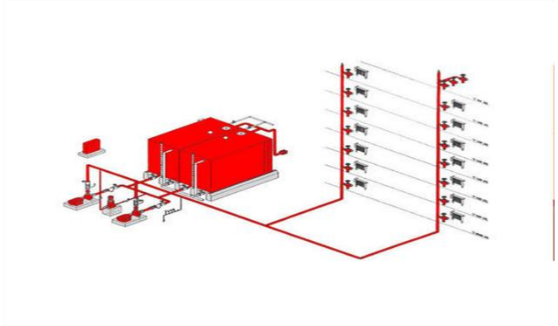
DRY PIPE SPRINKLER SYSTEM



A DRY PIPE SPRINKLER SYSTEM IS ONE IN WHICH PIPES ARE FILLED WITH PRESSURIZED AIR OR NITROGEN, RATHER THAN WATER. ... LOCATED IN A HEATED SPACE, THE DRY-PIPE VALVE PREVENTS WATER FROM ENTERING THE PIPE UNTIL A FIRE CAUSES ONE OR MORE SPRINKLERS TO OPERATE. ONCE THIS HAPPENS, THE AIR ESCAPES AND THE DRY PIPE VALVE RELEASES

FIRE HOSE REEL

WET RISER



WET RISING MAINS ARE FITTED IN TALL BUILDINGS DUE TO THE EXCESSIVE PRESSURES REQUIRED TO PUMP WATER TO HIGH LEVELS. A **WET RISER** IS ASUPPLY SYSTEM INTENDED TO DISTRIBUTE WATER TO MULTIPLE LEVELS OR COMPARTMENTS OF A BUILDING, AS A COMPONENT OF ITS FIRE FIGHTING SYSTEMS.

THEY ARE ADVANTAGEOUS TO THE FIRE SERVICE IN TWO RESPECTS. FIRSTLY THEY PROVIDE A FIXED DISTRIBUTION SYSTEM WITHIN THE BUILDING THAT REQUIRES NO FIRE SERVICE RESOURCES OR EQUIPMENT. SECONDLY IT IS DESIGNED AS PART OF, AND TO MAINTAIN, THE COMPARTMENTATION OF THE BUILDING

EQUIPMENT OF FIRE FIGHTING SYSTEM

FIRE HOSE REELS ARE LOCATED TO PROVIDE A REASONABLY ACCESSIBLE AND CONTROLLED SUPPLY OF WATER TO COMBAT A POTENTIAL FIRE RISK. THE LENGTH OF A FULLY EXTENDED FIRE HOSE IS 36 METERS WITH A DIAMETER OF 19MM (OUTSIDE DIAMETER).

INTRODUCTION

- HVAC stands for Heating Ventilating and Air-conditioning system.

HEATING:

- Heating is provided by heaters. Heaters are appliances whose purpose is to generate heat for the building. This can be done via central heating or by direct heating system.

VENTILATION:

- Ventilating or ventilation (the V in HVAC) is the process of exchanging or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, carbon dioxide, and other gases. Ventilation removes unpleasant smells and excessive moisture, introduces outside air, keeps interior building air circulating, and prevents stagnation of the interior air.
- Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings

Air-Conditioning:

- An air conditioning system provides cooling and humidity control for all or part of a building. Air conditioned buildings often have sealed windows, because open windows would work against the system intended to maintain constant indoor air conditions.
- Dehumidification (air drying) in an air conditioning system is provided by the evaporator. Since the evaporator operates at a temperature below the dew point, moisture in the air condenses on the evaporator coil tubes. This moisture is collected at the bottom of the evaporator in a pan and removed by piping to a central drain or onto the ground outside.

What is meant by AHU?

- An Air Handling Unit (AHU) is used to re-condition and circulate air as part of a heating, ventilating and air-conditioning system. ... AHUs connect to ductwork that distributes the conditioned air through the building and returns it to the AHU.

What are the advantages of AHU?

Advantages

- Prevents Dehydration and Heat strokes. Being exposed to excessive heat for long periods can cause dehydration. ...
- Improves the Quality of Air. ...
- Helps to Reduce Asthma and Allergies. ...
- Skin Dryness. ...
- Aggravation of Respiratory Problems. ...
- Respiratory Tract Infections and Allergies.

Disadvantages

- More complex installation.

What are the advantages of HVAC?

- 7 Benefits Of Installing A High Efficiency HVAC System
  - Furnace Cost Savings. Replacing an older furnace with a high efficiency one can begin saving you money on your very first bill.
  - A/C Cost Savings.
  - Comfort.
  - Air Flow.
  - Noise.
  - Environmental Impact.
  - Options.
  - Increased Resale Value.

What is the basic need of HVAC system?

The objective of HVAC are to control the temperature of air inside the designated "Air Conditioned" space along with control of moisture, filtration of air and containment of air borne particles, supply of outside fresh air for control of oxygen and carbon dioxide levels in the air conditioned space.

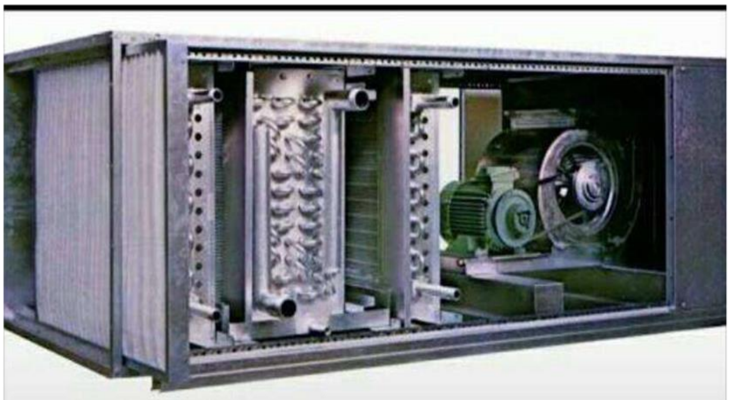
Why do we need HVAC?

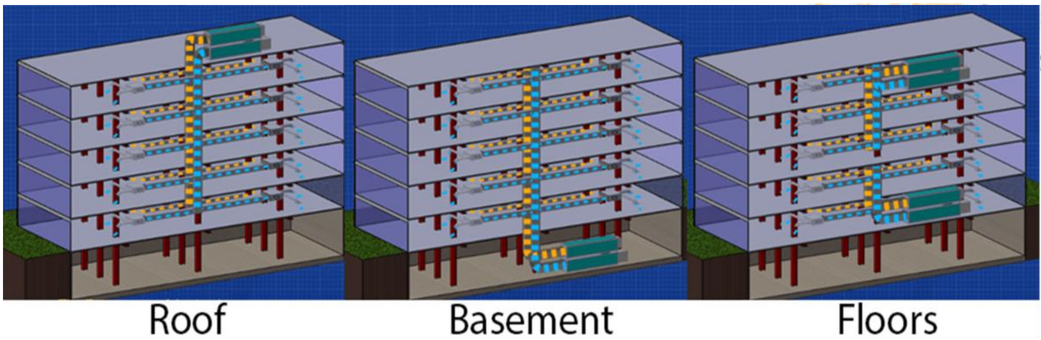
HVAC improves air quality in the building, helping make it appropriate for human breathing and comfort. It reduces humidity so occupants can enjoy a better atmosphere. This is most especially useful in buildings or underground spaces where ventilation is limited.

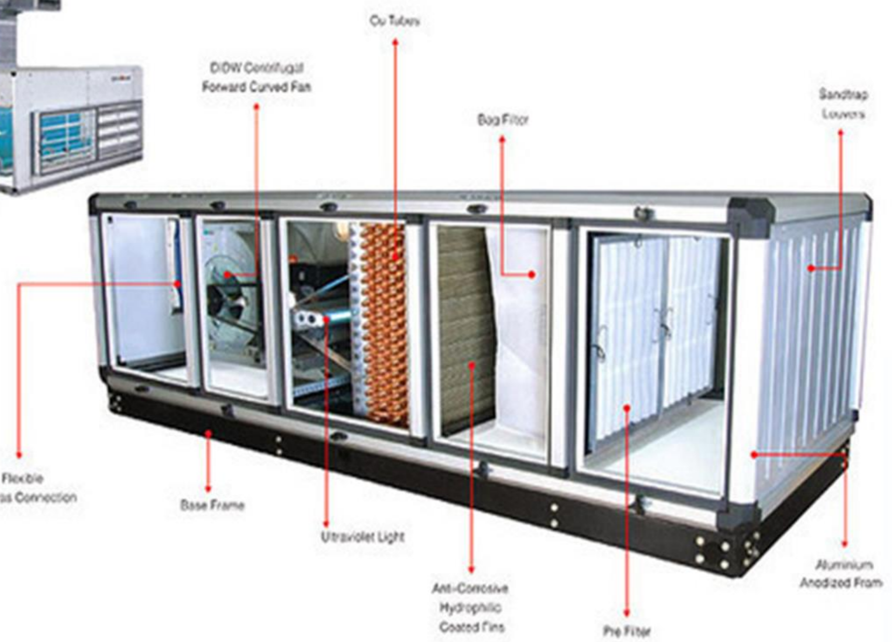
COMPONENTS OF HVAC

A. Air Handling Unit (AHU)

- The definition of air handling unit from ANSI/AHRI Standard 430-2009 states that it is "A factory-made encased assembly consisting of a fan or fans and other necessary equipment to perform one or more of the functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying and mixing of air.
- An air handler is usually a large metal box containing a blower, heating or cooling elements, filter racks or chambers, sound attenuators, and dampers. Air handlers usually connect to a ductwork ventilation system that distributes the conditioned air through the building and returns it to the AHU.
- (AHU) are the lungs of any HVAC system.
- An air handling unit is a device used to regulate and circulate air as part of the heating, ventilation and air conditioning system.
- The AHU takes in outside air, reconditions (filtered and either heated or cooled) it and supplies it as fresh air to the air conditioned room.
- Air handler that conditions 100% outside air, and no recirculated air, is known as a makeup air unit (MAU).







TYPES OF HVAC

There are two types of Air-Conditioning system.

- Ducted
- Non Ducted

- Ducted

  It includes,

  - Chilled Water System
  - Dx System (Direct Expansion)

- Non Ducted

  It includes

  - Window System
  - Split system

FUNCTIONS OF HVAC

- To Control Temperature.
- To Control Humidity.
- To Develop Differential Pressure.
- To Prevent Cross Contamination.
- To Maintain proper Air Movement.

What is generator simple words?

- one that generates: such as. a : an apparatus in which vapor or gas is formed. b : a machine by which mechanical energy is changed into electrical energy

Generator Size	Dimensions (L x W x H)	Amps 600V	Amps 480V	Amps 208V	Fuel Capacity (Litres)	Fuel Consumption (At 75% load)	Specs
48 kW*	17' x 6.0' x 6.5'	55 A	70 A	165 A	450	11 ltr / hr	Please Call
75 kW*	17' x 6.0' x 6.5'	85 A	105 A	240 A	450	18 ltr / hr	Please Call
98 kW*	17' x 6.0' x 6.5'	110 A	135 A	310 A	450	23 ltr / hr	Please Call
125 kW*	18' x 7.1' x 9.0'	150 A	185 A	430 A	700	27 ltr / hr	Please Call
140 kW*	18' x 7.1' x 7.5'	165 A	200 A	470 A	940	36 ltr / hr	Please Call
225 kW*	18' x 7.1' x 9.0'	270 A	335 A	780 A	800	54 ltr / hr	Please Call
350 kW*	21' x 8.0' x 11'	420 A	525 A	1215 A	800	68 ltr / hr	350 kW
400 kW	27' x 8.0' x 13.5'	480 A	600 A	1390 A	2250	81 ltr / hr	400 kW
500 kW	32' x 8.0' x 13.5'	600 A	750 A	1735 A	3000	90 ltr / hr	500 kW
600 kW	32' x 8.0' x 13.5'	720 A	900 A	2080 A	3600	117 ltr / hr	600 kW
750 kW	40' x 8.0' x 13.5'	900 A	1125 A	2600 A	4500	151 ltr / hr	750 kW
900 kW	40' x 8.0' x 13.5'	1080 A	1350 A	N/A	4500	180 ltr / hr	900 kW
1000 kW	40' x 8.0' x 13.5'	1200 A	1500 A	N/A	4500	200 ltr / hr	Please Call
1250 kW	40' x 8.0' x 13.5'	1500 A	1880 A	N/A	4500	252 ltr / hr	1250 kW
1750 kW	40' x 8.0' x 13.5'	2100 A	2630 A	N/A	4500	351 ltr / hr	1750 kW
2000 kW	40' x 8.0' x 13.5'	2400 A	3000 A	N/A	4500	405 ltr / hr	2000 kW

The following chart is an estimation for tonnage coverage based on the square footage of your property. You'll also want to take into consideration the climate where your property is located to ensure you have appropriate tonnage to handle the varying temperatures in your area.

1.5 tons – 600 to 1100 square feet
2-tons – 901 to 1400 square feet
2.5-tons – 1201 to 1650 square feet
3 tons – 1501 to 2100 square feet
3.5 tons – 1801-2300 square feet
4 tons – 2101 to 2700 square feet
5 tons – 2401 to 3300 square feet

Unit Size	External Width	External Height	Standard Base Height	High Volume (3m/s)	Mid Volume (2.5m/s)	Optimum Volume (2m/s)
1	750	590	74	0.51	0.43	0.34
2	750	830	74	0.84	0.70	0.56
3	1050	830	74	1.38	1.15	0.92
4	1250	950	74	1.85	1.72	1.38
5	1350	950	74	2.28	1.9	1.52
6	1350	1110	74	2.66	2.32	1.86
7	1350	1350	74	3.02	2.52	2.02
8	1350	1350	74	3.40	2.94	2.35
9	1450	1350	90	3.89	3.22	2.58
10	1550	1350	90	4.16	3.50	2.80
11	1650	1350	90	4.62	3.78	3.02
12	1750	1350	90	4.75	4.06	3.25
13	1950	1350	90	5.35	4.62	3.70
14	1950	1430	90	5.94	4.95	3.96
15	1950	1670	90	7.06	5.89	4.71
16	2550	1430	140	8.05	6.71	5.36
17	2550	1670	140	9.59	7.99	6.39
18	2550	2030	140	11.99	9.99	7.99
19	3200	2030	140	15.36	12.80	10.24
20	3200	2390	140	18.44	15.36	12.29
21	3200	2630	140	20.48	17.07	13.66
22	3800	2630	140	22.97	19.14	15.31
23	4400	2630	140	27.29	22.74	18.19
24	5000	2630	140	31.61	26.34	21.07
25	5600	2630	140	35.93	29.94	23.95
26	6200	2630	140	40.25	33.54	26.83
27	6200	2800	140	40.25	33.54	26.83

Which pump is used for high-rise buildings?

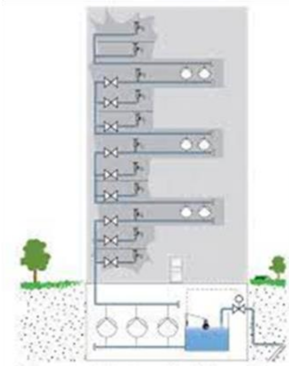
A typical developer-built, high-rise building will have a single or duplex booster pump in the basement. The pump serves the entire building with pressure reducing valves on all of the lower floors where the supply pressure will exceed 80 psi.

How does plumbing work in a high-rise?

Plumbing in tall buildings requires high pressure-rated pipes to deal with the greater water pressure that these systems require to properly function. ... Optimal design for a high-rise plumbing system uses a different booster pump for each pressure zone.

Which pump is used for high buildings?

For example, fire pumps provide a pressurized water supply for firefighters and automatic sprinklers, water booster pumps deliver potable water to upper floors in tall buildings, and hydroid pumps are used in HVAC systems that use water to deliver space heating and cooling.



Series-connected systems without intermediate break tanks

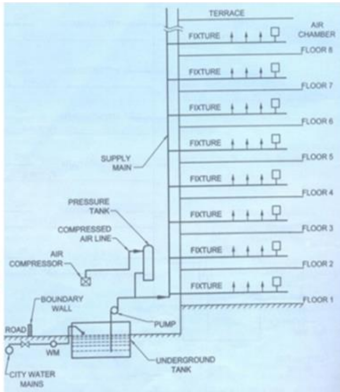


Fig. 7 Hydro-Pneumatic System

PARKING RULES AS PER DCR

Nag Vidharbha Builders Association, Nagpur.

TABLES - 8

OFF STREET PARKING SPACES

Sr. No.	Occupancy	One parking Space for every	Congested Area			Non Congested Area		
			Car	Scooter	Cycle	Car	Scooter	Cycle
			Nos.	No.	No.	Nos.	No.	Nos.
1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Residential (I) Multi family residential	(a) 1 Tenement having carpet area more than 80 sq.m.	1	2	2	1	2	2
		(b) 2 tenements having carpet area between 40 sq.m. to 80 sq.m.	..	2	4	1	4	4
		(c) 4 tenements having carpet are upto 40 sq.m.	..	4	8	1	4	4
	ii) Lodging establishme-nts tourist homes, hotels with lodging accommoda-tion.	(d) Every five guest rooms	2	2	4	3	4	4
	iii) Restaturants	(e) For Grade 1 hotel, eating houses 18 sq.m. of area of restaurant including Kitchen, pantry Hall, Dining rooms etc.	2	2	2	2	4	4
		(f) For Grade II and III hotels, eating houses etc. for an area of 80 sq.m. or part thereof	..	4	8	1	4	4

*** 16. PARKING, LOADING AND UNLODING SPACES: -**

16.1. Each off street parking space provided for Motor Vehicles shall not be less than 2.5 m. x 5 m. area, and for scooters and cycles the parking spaces provided shall not be less than 3 sq. m. and 1.4 sq. m. respectively.

16.2. For building of different occupancies off street space for vehicles shall be provided as given 16.2.1

16.2.1. Parking spaces -The provision for parking of vehicles shall be as given in Tables-8. Wherever a property is developed or redeveloped parking spaces at the scale laid down in these Regulations shall be provided. When additions are made to an existing building, the new parking requirements will be reckoned with reference to the additional space only and not to the whole of building but this concession shall not apply where the use is changed.

(1) General space requirements :-

(i) Types: The parking spaces mentioned below include parking spaces in basements or on a floor supported by stilts, or on upper floors, covered or uncovered spaces in the plot and Lock up garages.

(ii) Size of parking space:- The minimum sizes of parking spaces to be provided shall be as shown below:-

	Type of Vehicle / parking space (1)	Minimum Size/ area of (2)
(a)	Motor vehicle	2.5 m X 5 m
(b)	Scooter, Motor Cycle.	3.sq. m.
(c)	Bicyle	1.4 sq. m.
(d)	Transport vehicle	3.75 m. X 7.5 m.

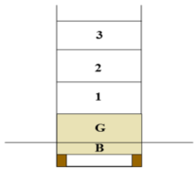
Car Parking in Setback / Open Spaces.

If the setback area / open spaces is more then 12 meter, the provision for car parking Can be done in the setback or open spaces at the periphery of the courtyard leaving the 6 meter motorable road.

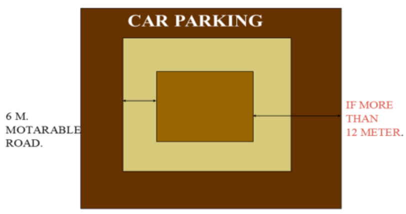
CAR PARKING

Section – As per section B/8 of appendix 'B' of part III of N.B.C

Car Parking shall have to be done at the basement with provision for minimum 2 ramps one remote to other.



Section: As per section 4.6 (b) of appendix B of part III of N.B.C.



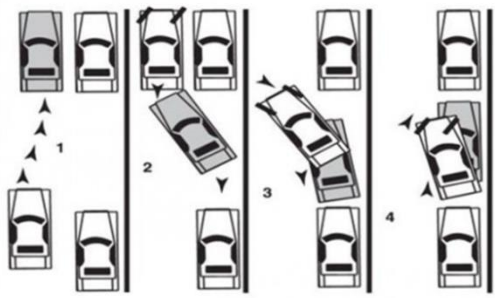
Types of Parking

1. On street parking

On street parking means the vehicles are parked on the sides of the street itself. This will be usually controlled by government agencies itself. Common types of on-street parking are as listed below. As per IRC the standard dimensions of a car is taken as 5× 2.5 m and that for a truck is 3.75× 7.5 m.

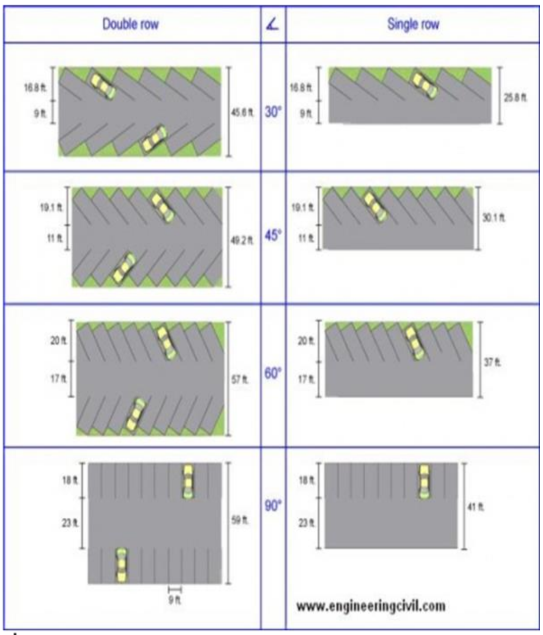
2. Off street parking

Off street parking means vehicles are parked off the street itself. This will be usually controlled by commercial agencies itself.



3. Parallel Parking

The vehicles are parked along the length of the road. Here there is no backward movement involved while parking or un parking the vehicle. Hence, it is the most safest parking from the accident perspective. However, it consumes the maximum curb length and therefore only a minimum number of vehicles can be parked for a given kerbed length. This method of parking produces least obstruction to the on-going track on the road since least road width is used.



4. 30 Parking

In thirty degree parking, the vehicles are parked at 30 with respect to the ruined alignment. In this case, more vehicles can be parked compared to parallel parking. Also there is better maneuver-ability. Delay caused to the track is also minimum in this type of parking.

5. 45 Parking

As the angle of parking increases, more number of vehicles can be parked. Hence compared to parallel parking and thirty degree parking, more number of vehicles can be accommodated in this type of parking.

6. 60 Parking

The vehicles are parked at 60 to the direction of road. More number of vehicles can be accommodated in this parking type

7. Right Angle Parking

In right angle parking or 90parking, the vehicles are parked perpendicular to the direction of the road. Although it consumes maximum width kerbed length required is very little. In this type of parking, the vehicles need complex maneuvering and this may cause severe accidents. This arrangement causes obstruction to the road track particularly if the road width is less. However, it can accommodate maximum number of vehicles for a given kerbed length.

Multiple Level Car Parking

It is a building (or part there hereof) which is designed specifically to be for Automobile Parking and where there are a number of floors or levels on which parking takes place.

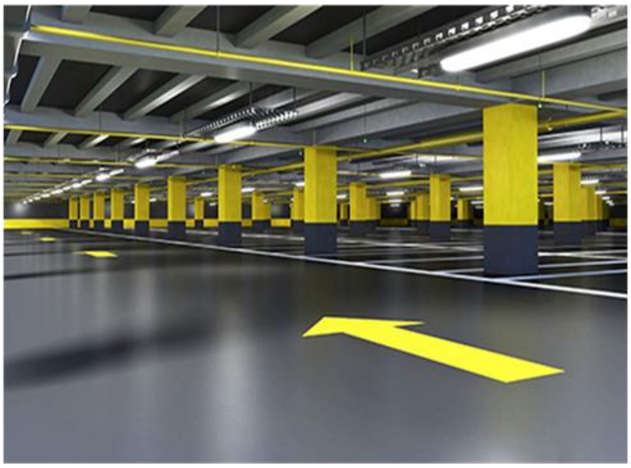
Is essentially a Stacked Car Park
"Multilevel Car Park" – Term Originated in UK, in US it is called a "Parking Structure" Types
1. Manually operated (non mechanized-with ramps)
2. Mechanized (Classified in different type based on technology)
- Mini
- Puzzle
- Tower

In order to accommodate the large volume of vehicles, small cities and towns must develop their infrastructure. One solution may be a multi-level car parking system to maximize car parking capacity by utilizing vertical space, rather than expand horizontally. With land in metros and 'a' grade cities becoming scarce and dearer, and plots getting smaller, conventional parking is proving infeasible.

The Basement

A basement or cellar is one or more floors of a building that are completely or partly below the ground floor. It generally is used as a utility space for a building, where such items as the boiler, water heater, breaker panel or fuse box, car park, and air-conditioning system are located; so also are amenities such as the electrical distribution system and cable television distribution point. In cities with high property prices, such as London, basements are often fitted out to a high standard and used as living space.

This building's design elements are incorporated into the Parking entrance, providing a safe and pleasing appearance.



Brightly painted directional arrows and columns help drivers navigate this parking structure more easily and safely.

What is the purpose of a basement ?

It generally is used as a utility space for a building, where such items as the boiler, water heater, breaker panel or fuse box, car park, and air-conditioning system are located; so also are amenities such as the electrical distribution system and cable television distribution point.

Why do tall buildings have basements?

To prevent natural forces from toppling them over, mega-tall structures need a low center of gravity, achieved by digging deep into the ground to find a soil sturdy enough to hold the weight of the building.

What is basement in a building?

The basement of a building is a floor built partly or completely below ground level

TYPES OF BASEMENT CONSTRUCTION

There are 3 basic types of basements :-

- Masonry Wall Basements
- Precast Panel Basements
- Poured Concrete Wall Basements

Which type of basement is best?

Poured Concrete Wall Basements

By far the most popular type of basement construction. Here are some of the benefits of poured concrete walls: Solid concrete is better able to resist cave-ins caused by lateral pressures of water, earth, and wind. More fire resistance-because solid concrete is dense and is joint

What is service floor in high rise buildings?

- Modern computerized HVAC control systems minimize the problem of equipment distribution among floors, by enabling central remote control ? A mechanical floor or service floor is a story of a high- rise building that is dedicated to mechanical and electronics equipment.

- A service floor is a space in a building where all the service equipment, machineries, utility lines, etc. ... A service floor has heating, water and sewage pipelines, power supply mains, and equipment, elevator engine room, supplementary rooms, building rest rooms and much more depending on the nature of the building.

Service Floor :- The floor of a building where service equipment, utility lines, and various machinery are located. A service floor can be located in the basement, on the top floor, or in the middle portion of a building. Some buildings have several such floors.

What is a Foundation in Construction?

- Foundation is the lowest part of the building or the civil structure that is in direct contact with the soil which transfers loads from the structure to the soil safely. Generally, the foundation can be classified into two, namely shallow foundation and deep foundation.

What is the main purpose of foundation?

- Foundations provide the structure's stability from the ground: To distribute the weight of the structure over a large area in order to avoid overloading the underlying soil (possibly causing unequal settlement).

What are the main requirements of foundation?

- Those requirements are the following:

Settlement. Settlement is defined as the vertical movement of the ground which is caused by stress alterations.

- Vibration.
- Lateral displacement.
- Ground heave.
- Tilt.
- Durability.

What are features of foundation?

- This legal definition contains the three essentially negotiate of the formation of a foundation. These are:
- ✓ The intention of the founder to form a foundation,
- ✓ The stipulation of the purpose
- ✓ The dedication of specific assets.

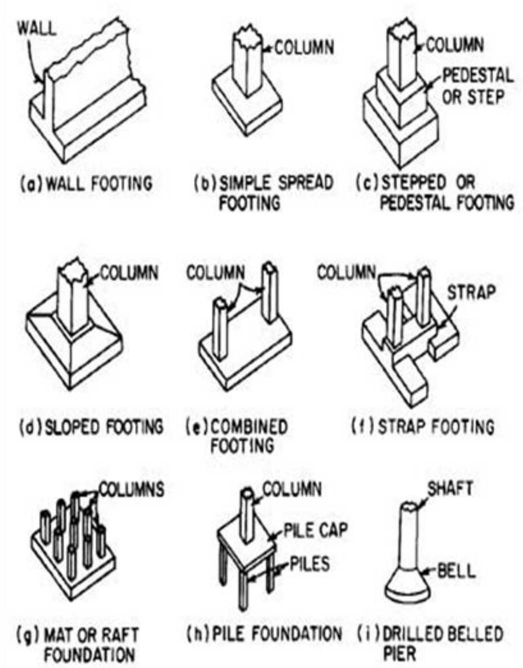


FIGURE 9.41 Common types of foundations for buildings.

- The high-rise building is generally defined as one that is taller than the maximum height which people are willing to walk up; it thus requires mechanical vertical transportation.
- This includes a rather limited range of building uses, primarily residential apartments, hotels, and office buildings, though occasionally including retail and educational facilities.
- A type that has appeared recently is the mixed-use building, which contains varying amounts of residential, office, hotel, or commercial space.
- High-rise buildings are among the largest buildings built, and their unit costs are relatively high; their commercial and office functions require a high degree of flexibility.

Foundations

- The foundations of high-rise buildings support very heavy loads, but the systems developed for low-rise buildings are used, though enlarged in scale.
- These include concrete caisson columns bearing on rock or building on exposed rock itself. Bearing piles and floating foundations are also used.

Earthquake loads

Earthquake or seismic forces, unlike wind forces, are generally confined to relatively small areas, primarily along the edges of the slowly moving continental plates that form the Earth's crust. When abrupt movements of the edges of these plates occur, the energy released propagates waves through the crust; this wave motion of the Earth is imparted to buildings resting on it. Timber frame buildings are light and flexible and are usually little damaged by earthquakes; masonry buildings are heavy and brittle and are susceptible to severe damage. Continuous frames of steel or reinforced concrete fall between these extremes in their seismic response, and they can be designed to survive with relatively little damage.

Structural systems

Wind loads

- The structural systems of tall buildings must carry vertical gravity loads, but lateral loads, such as those due to wind and earthquakes, are also a major consideration.
- The effect of wind forces on tall buildings is twofold.
- A tall building may be thought of as a cantilever beam with its fixed end at the ground; the pressure of the wind on the building causes it to bend with the maximum deflection at the top. In addition, the flow of wind past the building produces vortices near the corners on the leeward side; these vortices are unstable and every minute or so they break away downwind, alternating from one side to another.
- The change of pressure as a vortex breaks away imparts a sway, or periodic motion, to the building perpendicular to the direction of the wind.
- Thus, under wind forces there are several performance criteria that a high-rise structure must meet.

Enclosure systems

The enclosure systems for high-rise buildings are usually curtain walls similar to those of low-rise buildings. The higher wind pressures and the effects of vortex shedding, however, require thicker glazing and more attention to sealants. The larger extent of enclosed surfaces also requires consideration of thermal movements, and wind- and seismic-induced movements must be accommodated. Window washing in large buildings with fixed glass is another concern, and curtain walls must provide fixed vertical tracks or other attachments for window-washing platforms. Interior finishes in high-rise buildings closely resemble those used in low-rise structures.

Life-safety systems

- Life-safety systems are similar to those in low-rise buildings, with stairways serving as vertical emergency exits; in case of fire all elevators are automatically shut down to prevent the possibility of people becoming trapped in them.
- Emergency generator systems are provided to permit the operation of one elevator at a time to rescue people trapped in them by a power failure.
- Generators also serve other vital building functions such as emergency lighting and fire pumps. Fire-suppression systems often include sprinklers, but, if none are required by building codes, a separate piping system is provided with electric pumps to maintain pressure and to bring water to fire-hose cabinets throughout the building.
- There are also exterior connections at street level for portable fire-truck pumps.
- The fire hoses are so placed that every room is accessible; the hoses are intended primarily for professional fire fighters but may also be used by the building occupants.

Plumbing

Plumbing systems in tall buildings are similar to those of low-rise buildings, but the domestic water-supply systems require electric pumps and tanks to maintain pressure. If the building is very tall, it may require the system to be divided into zones, each with its own pump and tank.

What is ramp in construction?

- A ramp is a sloped pathway used to provide access between two vertical levels. It facilitates the movement of wheelchairs, bicycles, and other wheeled vehicles. Ramps are constructed when a number of people or vehicles have to be moved from one level to another. Determination of Slope of a Ramp.

How long can a ramp be without a landing?

- A ramp with a slope between 1:12 and 1:16 can have a maximum horizontal length of 30' (9.14 m) without a landing. A ramp with a slope between 1:16 and 1:20 can have a horizontal run up to 40' (12.19 m) before requiring a landing. A ramp is comprised of horizontal sloped runs connected by level landings between runs.

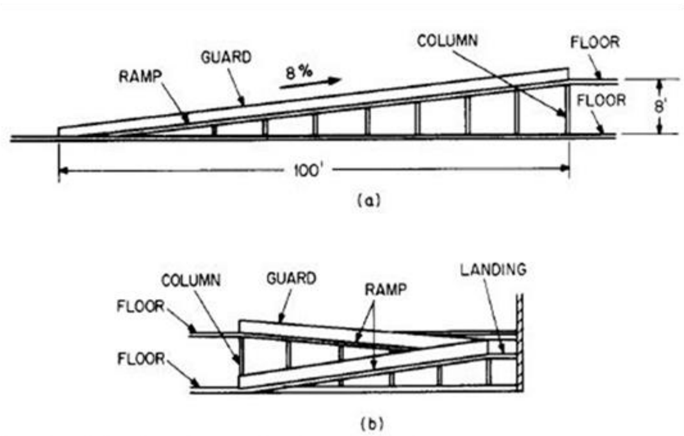


FIGURE 16.1 Types of ramps: (a) straight ramp; (b) zigzag ramp.

Is it a lift or an elevator?

- In British English, a lift is a device that moves up and down inside a tall building and carries people from one floor to another. I took the lift to the eighth floor. In American English, a device like this is called an elevator.

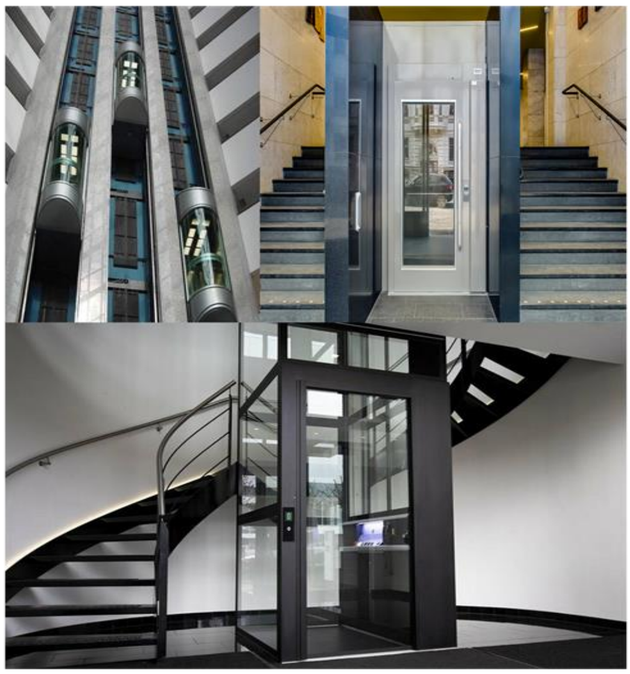
What are the different types of lifts?

There are four main types of elevators:

- Hydraulic
- Traction
- Machine-room-less
- Vacuum.

Lifts can be classified according to their use.

- Passenger lift
- Hospital or bed lifts
- Goods or freight lifts
- Service lifts or dumbwaiters
- Home elevator
- Skylab by shuttles
- Paternoster
- Stairs lifts
- Chair car
- Platform lift
- Capsule elevators



- Such lifts should be near staircase or may be provided in a shaft adjoining the building.

Methods of operation shall be one of the following or combination thereof-

- Car switch/handle operation (attendant operation)
- Automatic push button operation
- Selective collective group operation
- Group supervisory control (autotrophic)
- Signal operation
- Dual operation

What is lift load?

A load is the item or items being lifted which could include a person or people. A lifting operation may be performed manually or using lifting equipment. Manual lifting, holding, putting down, carrying or moving is often referred to as 'manual handling of loads'.

How do you calculate lift load?

Calculating the Weight of a Load
Step 1: Determine the Volume of the Load. Rectangle/Square: Volume = Length x Width x Height.
Step 2: Determine the Material You'll Be Lifting. The table below can be used for approximate weight values of common loads and materials.
Step 3: Determine the Weight of Object.

Building Security and Access Control

- **BAS system**
- A building automation system (BAS) is an intelligent system of both hardware and software, connecting heating, venting and air conditioning system (HVAC), lighting, security, and other systems to communicate on a single platform.

How does a BAS system work?

- A building automation system utilizes a control system to automate the control of various building systems (mainly HVAC). The BAS provides a user interface that allows the end user to adjust the control settings, view the system status, and detect any potential issues related to building system performance.

What are the advantages of Bas?

- A Building Automation System (BAS) can provide many benefits for you, such as higher energy efficiency, lower operating and maintenance costs, better indoor air quality, as well as greater occupant comfort and productivity.

What are the components of BAS?

- BAS is a structural system and generally consists of five components: sensors, controllers, output devices, communication protocols and a terminal or user interface. Below is a list describing BAS components how they interact and relate to one another.

- Security system components
- Lighting
- Perimeter control
- Intrusion detection
- Building access control
- CCTV Systems
- Door entry systems
- Security access systems and locks
- Biometric systems
- Fire Systems
- Gates/Moving Barriers
- Intercom& & Emergency Communication Systems











CASE STUDY 1

MAHINDRA BLOOMDALE HOUSING PROJECT

LOCATION – MIHAN, NAGPUR

INTRODUCTION

- Bloomdale is secluded from the commotion of city life.
- It is located in an expanse of natural beauty.
- With large open spaces and a green cover there is thought fulness in every aspect.
- The mid-rise apartments are planned around the periphery while the independent units run along the centralspine.
- This ensure sample ventilation in every home. So no matter where you stay, you will enjoy fresh air and a fantastic view of the acres of green.
- Bloomdale is built keeping the entire family in mind. You can enjoy conveniences of a well planned township with an array of amenities designed for a healthy lifestyle.

Need for Project

➢We know that Nagpur is developing city in stage there are various company are establing like I.T companies H.C.L, T.C.S.

➢Employees working in these company looks for shelter for thyself nearby.

➢In center of city the cost of property is very high for middle class people to offered it.

➢That's why there is a concept of high- rise building i.e. BLOOMDALE HOUSING PROJECT.

➢Also this housing project is located in the budding location of Mihan in Nagpur, Mahindra Bloomdale lies near leading I.T companies, entertainments Venus, hotels, malls a cricket stadium and an international school.

➢Experience an unparalled modern lifestyle with this they have introduces a quality Bloomdale.

➢Also Mihan or Multi-Modal International Cargo Hub &Airport at Nagpur is a fast developing area located near Dr. Baba saheb Ambedkar Airport Nagpur.

➢The Mihan project aims to convert the land around the airport into a bustling SEZ & develop the area into Cargo and industrial hub that's why for enjoy a convenient lifestyle where every need is highly accessible to bloomdale.

➢Mihan also has developed social infrastructure with educational institutions like Delhi Public School, DY. Patil, AIIMs etc. and hotels like Le Meridian.

➢Bloomdale is built in compliance with the Indian Green Building Councils (IGBC) Green Homes rating Systems.

➢But due to lack of land and surround of Bloomdale all land has been sold that's why no one can construct low rise building and also so we have good options to erect high rise building.

Building Services

➢They have also provided electrical, plumbing and mechanical systems in a building.

➢Also it includes cleaning or building maintenance work including sweeping vacuuming, floor cleaning of rest room collecting refuse or trash, window cleaning, securing, patrolling or other work in connection with the care, water treatment, storm water management and disposal, vertical transportation heating, ventilation and A.C, electrical distribution etc.

SITE CLIMATIC STUDY-NAGPUR

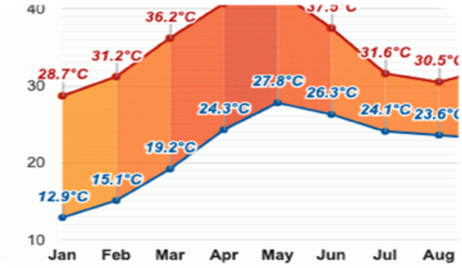
TROPICAL WET AND DRY CLIMAT

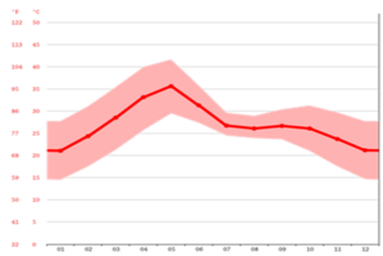
SUMMER SEASON → MID MAY TO JUNE

HOTTEST MOUNTH → 43°C TO 48 °C43°C TO 48 °C

WINTER SEASON → MID NOV TO JAN

COLDEST MONTH → 13°C TO 19°C





- **CLIMATIC ZONE**
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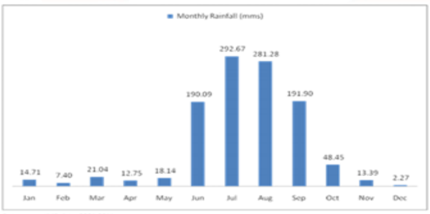

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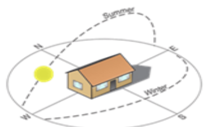
MONTHLY AVERAGE OF WIND SPEED AT NAGPUR



SUNPATH ACCORDING SUMMER AND WINTER

Built & Semi cover & Open Area

- They have also given maximum open spaces like swimming pools, tennis court, basket ball court etc.
- Also they have given entrance plaza, kids play area.
- Also they have given parks, playfields etc.

Landscape

- They have also given a spread across a sprawling 25acre landscape.

Residential Use

- It is also the first housing project to be launched in the denitrified area of the residential zone of Mihan.
- Nearby 660 homes have already been handed over at Bloomdale, which has 475 families in residence including about 100 Medical Professional.

Surrounding of Project

- It is also the first housing project to be launched in the denitrified area of the residential zone of Mihan.
- Surround of Bloomdale all land has been sold that's why now there is barren land in future might be use for constructions.

Soil Conditions

- Medium to deep clayey, black cotton soils; medium, loamy alluvial soils; shallow sandy, clayey red soils.

Structural System

- Structure is used in this project is grid form and this form is good for earthquake resistance.

Material Used

- Cement, Bricks (cement), steel, sand, composite structure.

Interior Services of Building

- They have used Building automation Systems.

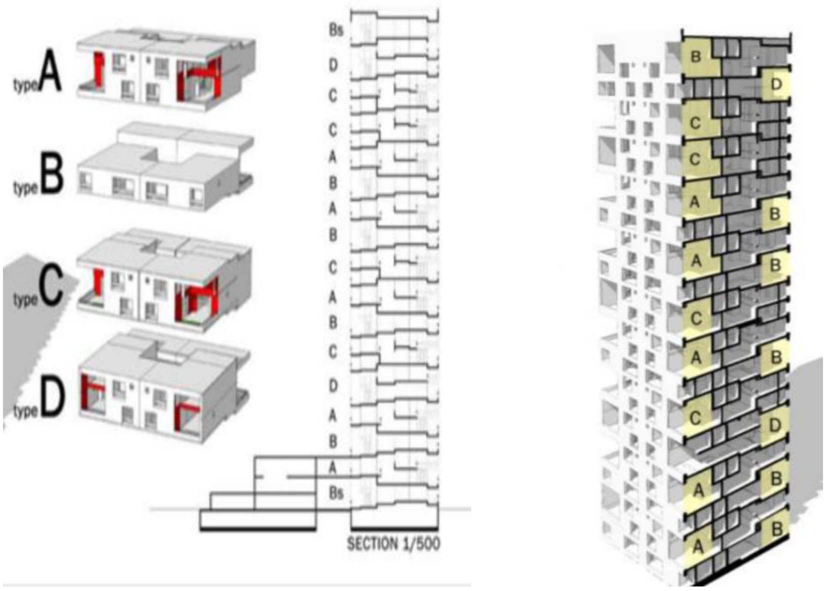
Orientation of Building

- In the outer periphery they have placed the high-rise building and in the center of it they have placed low rise that's duplex, row houses etc. and also open spaces are also given like park, kids play area etc., also for security purpose.
- Also easily access to road as you know it margin will reduce to more traffic and same req. for req. less as compared to its plot area.

Case Study 2
Kanchenjunga Apartments, Mumbai

INTRODUCTION

The Kanchenjunga apartments are a direct response to the present society, the escalating urbanization, and the climatic conditions for the region.
The Kanchenjunga apartments is a twenty eight storey building containing 32 luxury apartments ranging in size from 3 to 6 bedrooms. These apartments are built within a lower towards the east and the west to take advantage of the prevailing breezes and views of the Arabian Sea and the surrounding harbors. The orientation is also troublesome because it exposes the building to the hot sun and the monsoon rains. This was mediated through the unit design in the traditional bungalow style. The bungalow wrapped a protective layer of verandah around the main living space providing two lines of defense against the climate of the area.
 Area: 441 sq. m
 Site and situation: City landscape surrounded by mid-rise and high-rise structures.



CLIMATE - Warm and humid

Since Mumbai is a coastal city, the weather is mostly humid year round. Also as it is in tropics, it never gets very cold and the yearly extremes lie within a 30 degree Celsius range.
Mumbai's weather can be divided into 4 seasons – winter (Dec- Feb.), summer (mar- may) , monsoon (june-sept), withdrawal season(oct- Dec).
During winters the temperature goes down to the minimum of 15 degree Celsius. Summer temperature ranges from 20 degree Celsius to 35 degree Celsius. Monsoons affect the residents of Bombay with heavy showers. Water logging is a major problem in the city during this season.

ANALYSIS OF THE BUILDING DESIGN:

 Average monthly, summer period: March and April (wind direction from Northwest) & May (wind direction from northwest and southwest)
 Window to Wall ratio: The living and dining space – 48%, NW bed rm. - 34% & SE Master bed rm. - 45%.
Shading devices: Each opening is well shaded with balcony and terrace gardens.

- Building Materials and Construction: As per base condition and earlier study (U value of external facade ranges from 0.3 W/m2 0C to 3.6 W/m2 0C) Roof: 150mm Reinforced Cement Concrete (U=7.45 W/m2C), Floor/Ceiling: 150mm R. C. C + tiles (U=3.07 W/m2 0C), Additional construction materials, plaster, white paint etc. are also taken in to consideration.

Occupancy pattern, Planning and Program: By interviewing the occupants.

- The living and dining space: Occupied period (morning - 7 AM to 10 AM) and evening (6 PM to11 PM)
- North West bedroom: Occupied period (11 PM to 07 AM) at night-time only.
- South East Master bed room: Occupied period (11 PM to 07 AM) at night time only Internal Conditions:
- As per occupancy the living and dining space: Three occupants, North West bedroom: one occupant, South East Master bedroom: two occupants
- Schedule of opening: Full day ventilation: Doors and window openings are 50% open 24 hours Night-time only ventilation: Doors and window openings are 50% open during night time i.e. from evening 6 PM to morning 10 AM Night time only ventilation: Doors and window openings are increased from 50% to 75% open during night-time i.e. from evening 6 PM to morning 10AM.

ORIENTATION

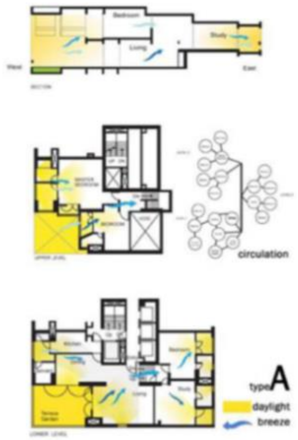
In Bombay a building has to be oriented east-west to catch the prevailing sea breezes and open up the best views in the city: the Arabian sea on one side and the harbor on the other. But these unfortunately are also the directions of the hot sun and the heavy monsoon rains.

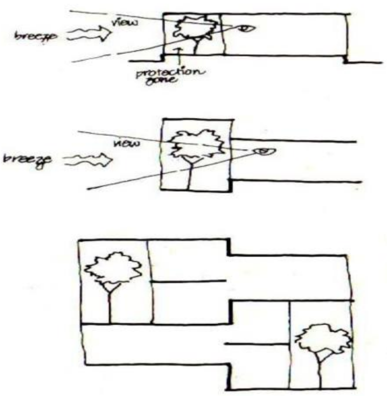
The old bungalows solved these problems by wrapping a protective layer of verandahs around the main living areas, thus providing the occupants with two lines of defense against the elements. Kanchenjunga, an attempt to apply these principles to high rise buildings is a condominium of 32 luxury apartments of four different types varying from 3 to 6 bedrooms each. The interlock of these variations is expressed externally by the shear and walls that hold up the cantilevers.

The tower has a proportion of 1:4 (being 21 meters square and 84 meters high). Its minimalist unbroken surfaces are cut away to open up the double height terrace gardens at the corners, thus revealing some hint of complex spatial organization of living spaces that lie within the tower.

MODULARITY

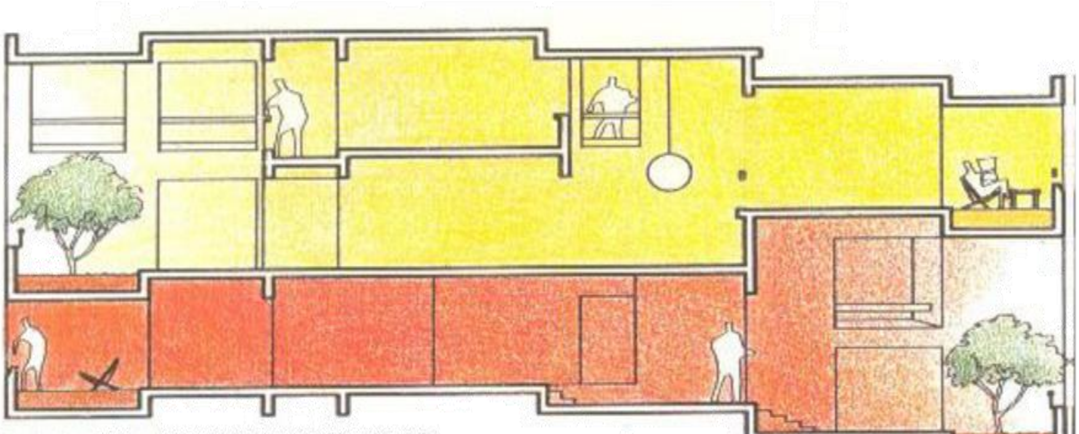
Lot size approx.: 5260 sq. m
Footprint of the tower: 441 sq. m
Number of residences: 32
Number of floors: 28
A unit 3 bedrooms x 10: 294 sq.m
B unit 3 bedrooms x 12: 242 sq.m
C unit 5 bedrooms x 8: 373 sq. m
D unit 4 bedrooms x 4: 361 sq.m
32 flats – 200 people





TRANSPARENY & CIRCULATION

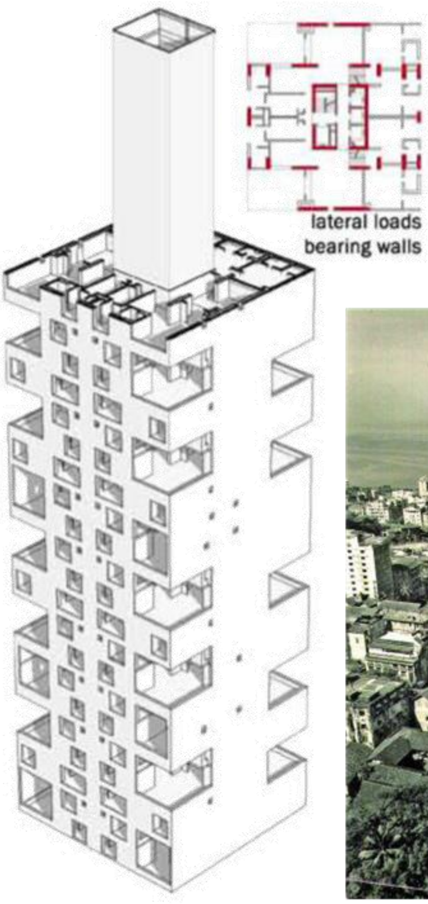
- Great deal of transparency has been achieved by use of terrace gardens and large openings on every floor.
- 10% to 15% of each floor area has been provided as common circulation.
- Max. facilities provided using min. circulation.



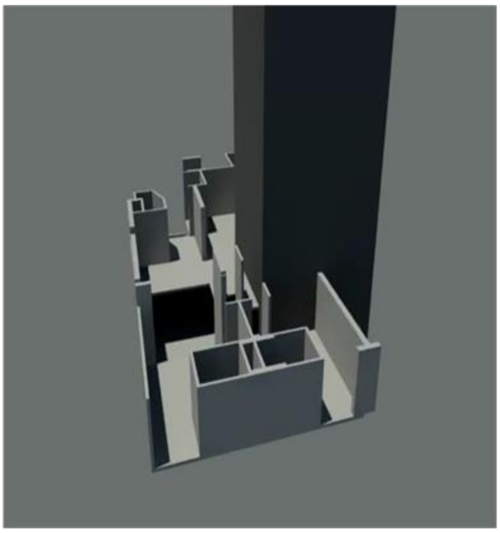
Typical section, showing interlock of basic units

STRUCTURAL OVERVIEW

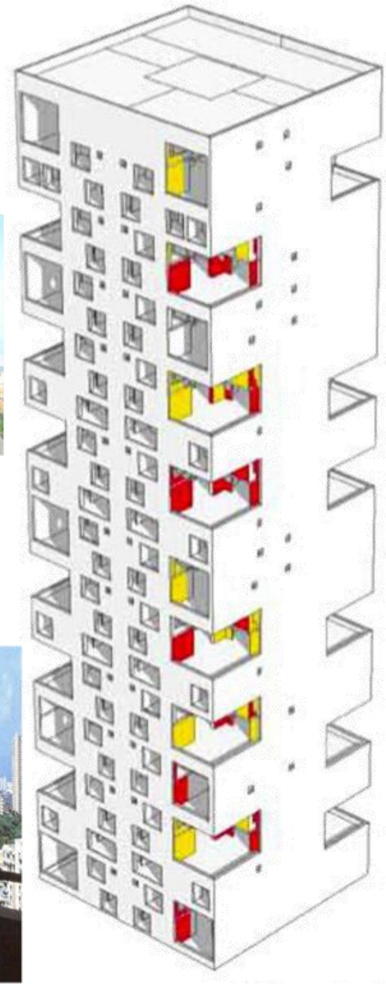
- It is made from reinforced concrete.
- 32 stories high with 6.3 m cantilevered terrace garden.
- Central core of 7.8x6.9 m house the lifts and service areas.
- This central core also acts as a main structural element in resisting lateral loads.
- Central core was const. ahead of the main structure using SLIP method of construction.



MASSING



MATERIAL AND COLORS



- With its concrete construction and large areas of white panels, it bears a strong resemblance to modern apartment buildings in the West.
- However, the garden terraces of Kanchenjunga Apartments are actually a modern interpretation of a feature of the traditional Indian bungalow: the verandah.
- In a bungalow, the verandah wraps the main living area.

- The color expert says that the quality of sunlight, climate and culture influence color choices: hence one would observe a preference for blue and its shades in the West while in India and other Asian countries one finds a pre dominance of reds and yellows.
- White panels and concrete construction ,bears a strong resemblance to a modern building while the terrace garden give a loo of that of a traditional bungalow.
- Overlooking the city from garden terrace

INFERENCES

- Due to level differences old people can't live in the premises as they have climb stairs on regular basis.
- Also for handicap people the building is not suitable for them.

CASE STUDY 3
INFINITY HEIGHTS LIMITLESS LUXURY

INFORMATION

- In one more feather in Orange City's cap, Nagpur Municipal Corporation (NMC) has given its nod for 25-floor residential building – Infinity Tower – coming up beside NMC Headquarters in Civil Lines.
- With the civic body sanctioning the plan, the Second Capital City of Nagpur is set to get the 90-structure, which will make it the tallest building in Central India.
- The Infinity Tower is being constructed by Kukreja Infrastructure.
- By sanctioning the building plant of the tallest tower, NMC has filled up its coffers with Rs 18.93 core, which is the highest ever revenue from a single building.

- The charges are for building plan as well as extra FSI (Floor Space Index) taken under Metro Rail Transit Oriented Development (TOD).

- As per RERA provisions, the developer has been directed to complete the building by 2022.
- The residential building – Infinity Tower – will also be the Orange City's first scheme to have a 7 BHK flat with an area of 8000 sq. ft. The project will also set a record for costliest ever flat with prices beginning at Rs 2.5 core and going up at Rs 7.5 core.

- Designed by a US-based architect, Infinity is coming up in 32,000 sq. ft. plot and will have built up area of 1.20 sq. ft.
- But the tower will host only 57 flats with three floors designated for parking – two in basement and ground floor, one floor for amenities including mini theatre, and top floor for lounge.
- The tallest building will also have club, swimming pool, gym among other amenities.

- Currently, the tallest building in Nagpur is Tata Capitol Heights at 70-metre in Rambagh followed by Godrej's Anandam building at Ganeshpeth at 63-metre.

NEED OF PROJECT

- Nagpur is developing in stage there are various companies are establishing like T.C.S, INFOSIS ,H.C.L.
- Some one are interested to live in posh area and center of the city.
- We know very well that civil lines area are one of the posh area of the Nagpur.
- There are various H.I.G people living their.
- And more people are interested to live in but due to lack of land no one can stay their.
- And due to lack of land no one can construct low rise buildings.
- So we have good options to construct high rise buildings.

Building Services

- They have also provided electrical, plumbing and mechanical systems in a building.
- Also it includes cleaning or building maintenance work including sweeping vacuuming, floor cleaning of rest room collecting refuse or trash, window cleaning, securing, patrolling or other work in connection with the care, water treatment, storm water management and disposal, vertical transportation heating, ventilation and A.C, electrical distribution etc.

SITE CLIMATIC STUDY-NAGPUR

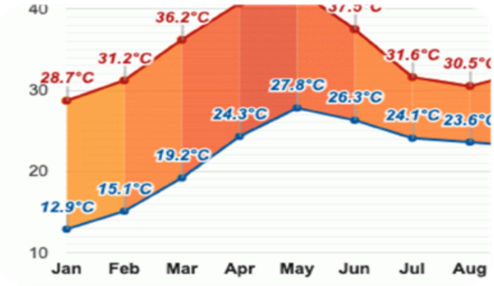
TROPICAL WET AND DRY CLIMAT

SUMMER SEASON → MID MAY TO JUNE

HOTTEST MOUNTH → 43°C TO 48 °C43°C TO 48 °C

WINTER SEASON → MID NOV TO JAN

COLDEST MONTH → 13°C TO 19°C



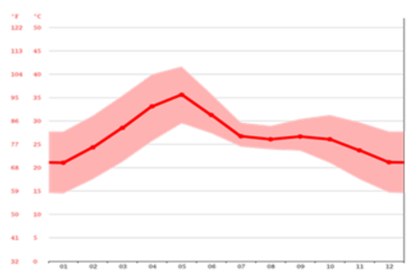


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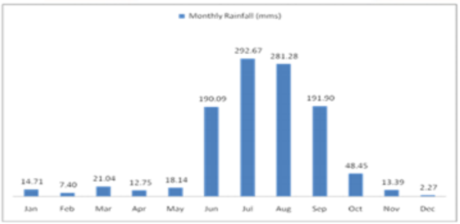
Figure 3-7: Average total monthly rainfall in the NMA (mm)



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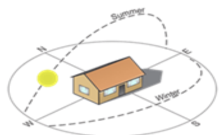
MONTHLY AVERAGE OF WIND SPEED AT NAGPUR



SUNPATH ACCORDING SUMMER AND WINTER

BUILT ,SEMI COVER ,OPEN AREA & LANDSCAPE

GROUND FLOOR PLAN

CLUB FLOOR PLAN

TYPICAL EVEN FLOOR PLAN

TYPICAL ODD FLOOR PLAN

3 BHK – SKY MANSION

4 BHK – SKY CASTLE

6 BHK DUPLEX – SKY VILLA (LOWER FLOOR)

6 BHK DUPLEX – SKY VILLA (UPPER FLOOR)

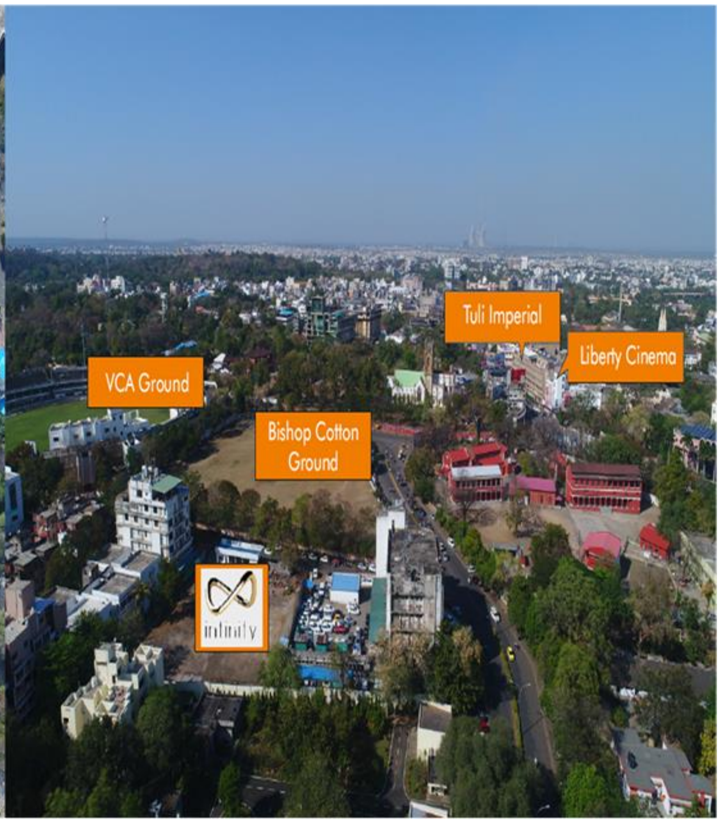
6 BHK DUPLEX – SKY CASTLE
(LOWER FLOOR)

6 BHK DUPLEX – SKY MANSION
(LOWER FLOOR)

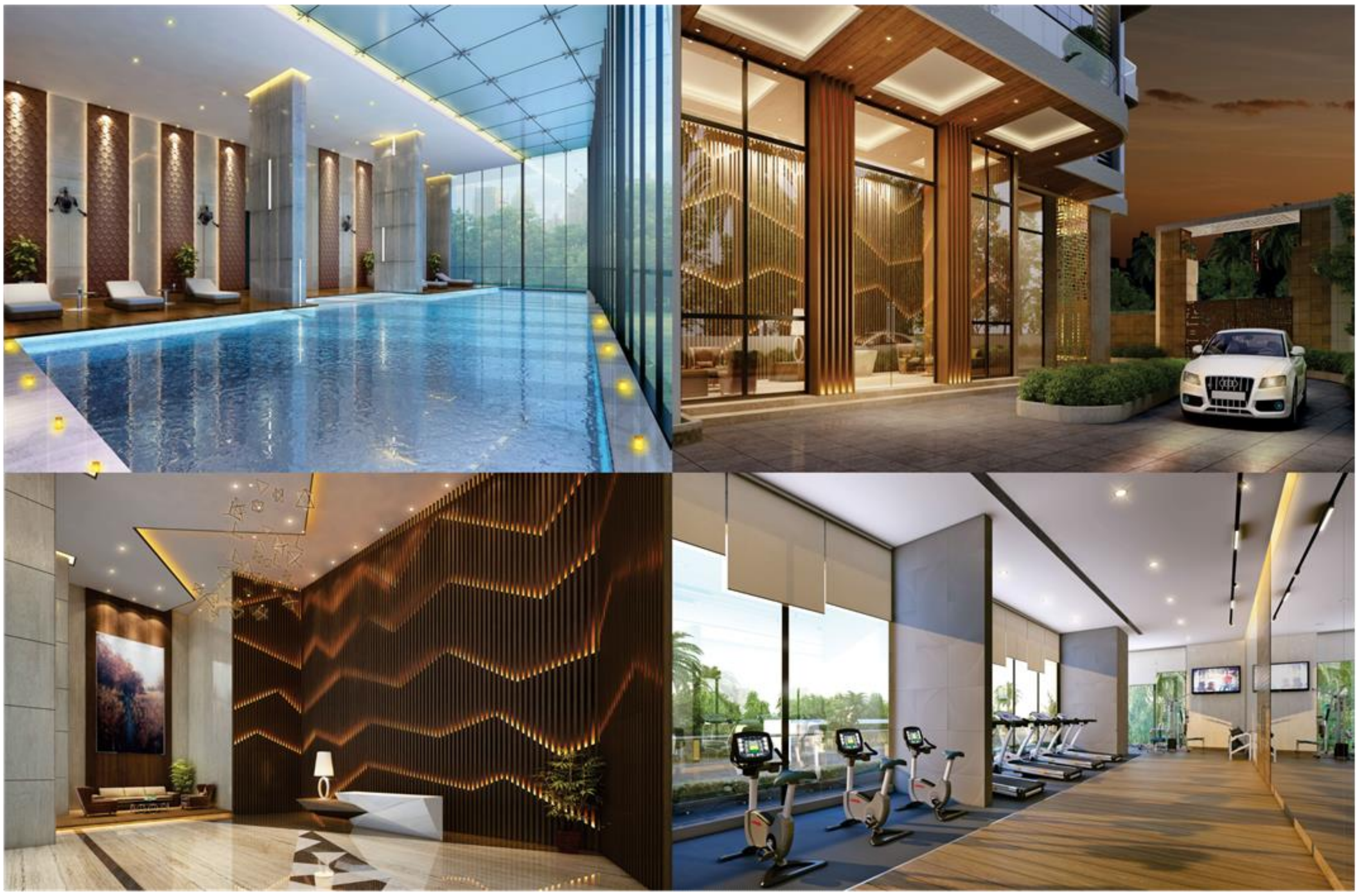
UPPER FLOOR

UPPER FLOOR

SURROUNDINGS OF PROJECT

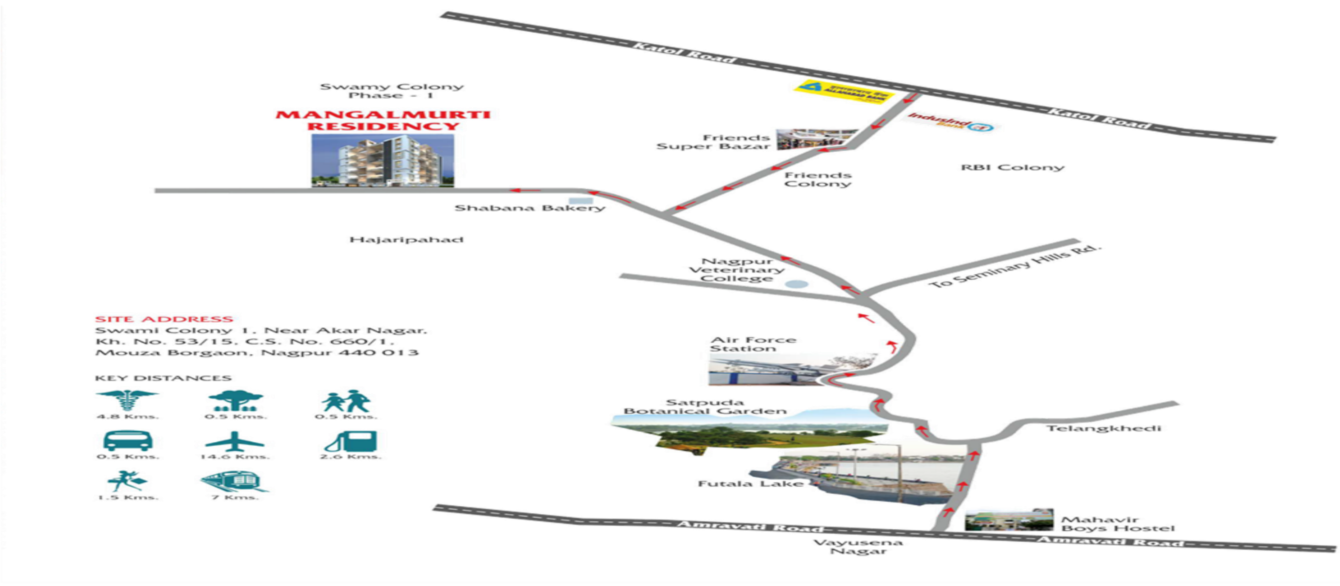


INTERIOR OF BUILDINGS



CASE STUDY 4
MANGALMURTI RESIDENCY

LOCATION OF PROJECT



Need for Project

- We know that Nagpur is developing city in stage there are various ,civil lines is near to Hazaripahad as we all know that all govt. offices are located in civil lines like INCOME TAX, G.S.T BHAVAN etc.
- Also Hazaripahad is also growing as there are many projects are running like RACHANA NAKSHATRA ASHWINI, RACHANA SAYANTARA and many more.
- Employees working in these company looks for shelter for thyself nearby.
- In center of city the cost of property is very high for middle class people to offered it.
- That's why there is a concept of high- rise building i.e. MANGALMURTI RESIDENCY.
- Also this housing project is located in the budding location of HAZARIPAHAD in Nagpur, MANGALMURTI RESIDENCY lies near leading GOVT. OFFICES, entertainments and an international schools like SANDIPANI, C.D.S, CENTER POINT etc..
- Experience an unparalled modern lifestyle with this they have introduces a quality MANGALMURTI.
- But due to lack of land and surround of MANGALMURTI RESIDENCY all land has been occupied by owners that's why no one can construct low rise building and also so we have good options to erect high rise building.

Building Services

- They have also provided electrical, plumbing and mechanical systems in a building.
- Also it includes cleaning or building maintenance work including sweeping vacuuming, floor cleaning of rest room collecting refuse or trash, window cleaning, securing, patrolling or other work in connection with the care, water treatment, storm water management and disposal, vertical transportation heating, ventilation and A.C, electrical distribution etc.

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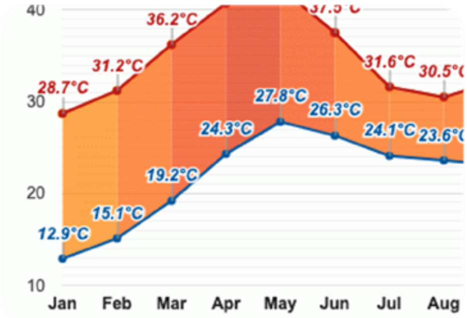

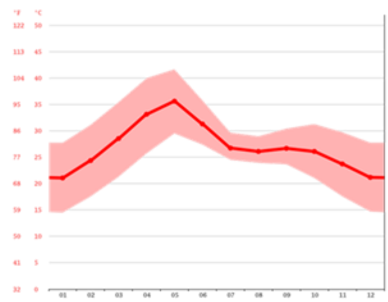

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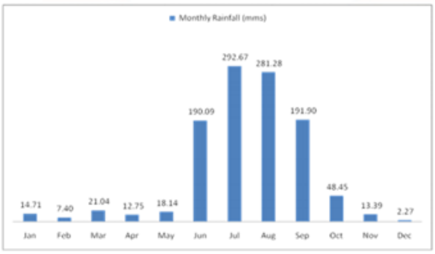

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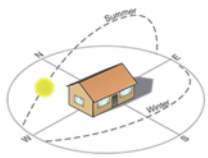


SUNPATH ACCORDING SUMMER AND WINTER

Soil Conditions

- Medium to deep clayey, black cotton soils; medium, loamy alluvial soils; shallow sandy, clayey red soils.

Material Used

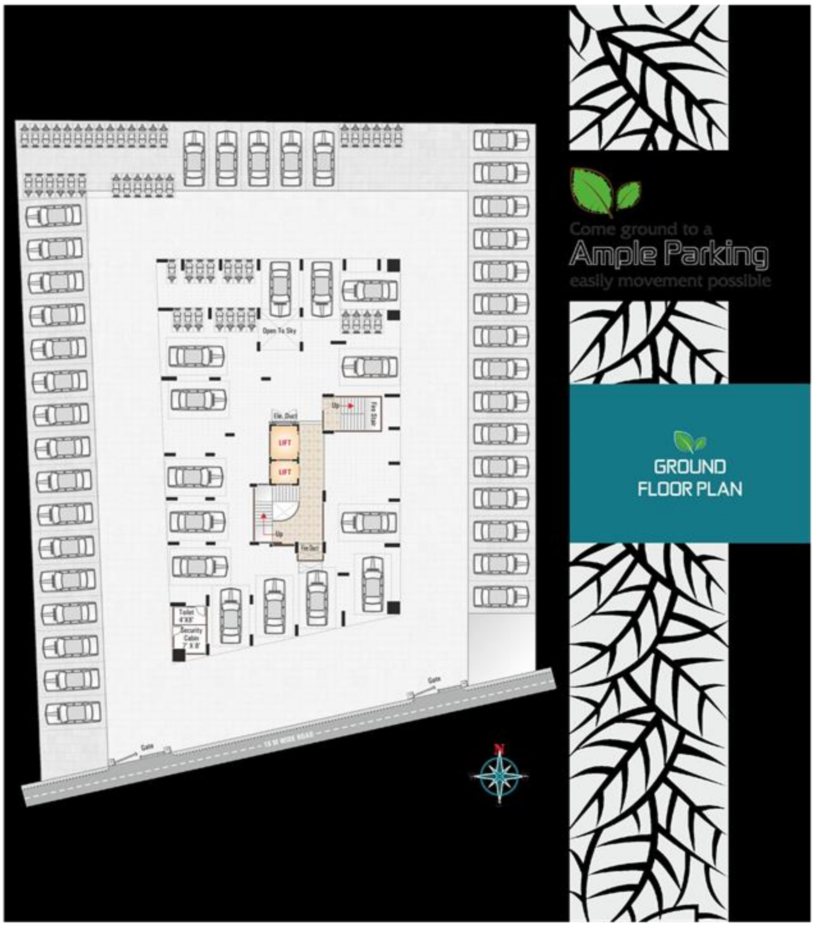
- Cement, Bricks (cement), steel, sand, composite structure.

Structural System

- Structure is used in this project is grid form and this form is good for earthquake resistance.

INTERIOR VIEW

ORIENTATION OF BUILDING



ORIENTATION OF BUILDING


Remarkable tunes,
Crafted
Exclusively for you...
2nd, 4th, 6th, 8th & 10th
FLOOR PLAN


Tuneful Imagination
Implemented
Just for you...
3rd, 5th, 7th & 9th
FLOOR PLAN

INFERENCES

CASE STUDY 1 MAHINDRA BLOOMDALE	CASE STUDY 2 KANCHANJUNGA APARTMENTS	CASE STUDY 3 INFINITY HEIGTS	CASE STUDY 4 MANGALMURTI APARTMENTS
LOCATION :- MIHAN, NAGPUR	LOCATION :- MUMBAI	LOCATION :- CIVIL LINES, NAGPUR	LOCATION :- HAZARIPAHAD, NAGPUR
HEIGHT OF BUILDING :- 24 M	HEIGHT OF BUILDING :- 83.8 M	HEIGHT OF BUILDING :- 90M	HEIGHT OF BUILDING :- 32 M
FLOORS OF BUILDING:- 8 FLOORS	FLOOR OF BUILDING :- 28 FLOORS	FLOORS OF BUILDING :- 25 FLOORS	FLOORS OF BUILDING:- 10 FLOORS
AREA PROVIDED :- 25 ACRES	AREA PROVIDED :- 3 ACRES	AREA PROVIDED :- 1 ACRES	AREA PROVIDED :- 0.5 ACRES
MATERIAL USED :- CONCRETE FORM WORK HAS BEEN DONE.	MATERIAL USED :- STRUCTURE IS MADE UP OF REINFORCED CONCRETE.	MATERIAL USED :- STONE, AGGREGATES, SAND/SOIL, CEMENT ETC.	MATERIAL USED :- CEMENT BRICKS, SAND, CEMENT ETC.
SITE CONDITIONS :- TABLE/ PLAIN SITE	SITE CONDITIONS :- MINUTE CONTOURS	SITE CONDITIONS :- PLAIN SITE	SITE CONDITIONS :- PLAIN SITE

CASE STUDY 1 MAHINDRA BLOOMDALE	CASE STUDY 2 KANCHANJUNGA APARTMENTS	CASE STUDY 3 INFINITY HEIGTS	CASE STUDY 4 MANGALMURTI APARTMENTS
PLACEMENT OF TOWERS CONS :- The placement of towers are in outer periphery that's why wind flow is less in rear side of buildings as they are low rise.	DIFFERENCE IN LEVELS CONS :- Due to level differences old people can't live in the premises as they have climb stairs on regular basis. Also for handicap people the building is not suitable for them.	LANDSCAPING AND OUTER COLOURS CONS :- Lack of landscape. Colour of building i.e silver colour may reflect the sun rays due to this the surround of building will suffer.	LANDSCAPING AND SHADING DEVICE CONS :- Lack of landscape. They have not design the building as per all aspects of climatic elements. Shading devices are missing.
PROS:- Due to shadow of towers the heating surface area is less so need of less electric consumption to make human confront.	PROS:- The orientation of building is as per climatology of Mumbai. They have design the building as per all aspects of climatic elements.	PROS:- The orientation of building is as per climatology of Nagpur. They have design the building as per all aspects of climatic elements.	PROS:- All over the building services are better like building automation systems.

CONCLUSION

- Some positive inferences point selected from case study inferences in my building's.
- Not proper landscape provided at surrounded of building.
- Providing/positioning of apartments as per climatic conditions as used in Kanchenjunga Apartments.
- The bas is provided in Mangal murti Apartments also we are providing same to reduce the human efforts.
- The building is design to make earthquake resistance by providing columns in grid forms as studied in Mangal murti Apartments.
- Also design wind resistance building by converting sharp edges to champherd edges as studied in Infinity Heights.
- Density planning , built up and unbuilt area analysis as studied in Mahindra Bloomdale.
- Also provided water body as per climatic elements as studied in Mahindra Bloomdale.
- Also follows airport authority norms i.e. NOCAS as studied in Mahindra Bloomdale.
- Also provided Visitors parking in the site itself as studied in Mahindra Bloomdale.
- Also provided Club House as studied in Mahindra Bloomdale.

SITE SELECTION AND SITE ANALYSIS

REASON FOR SITE SELECTION

A.SITE LOCATION

- THE SITE IS LOCATED RELATED TO HEART OF THE CITY.
- THE SITE IS AWAY FROM THE CROWDED PART OF THE CITY.
- SITE IS ADJECENT TO THE MAIN APPROCH ROAD.

B.SITE APPROACHES

- THE SITE HAVE MINIMAM 1 APPROACHES.
- ONE FROM FRONT WHICH GIVES ACCESS TO PUBLIC FROM MAIN APPROACH ROAD.

C.SITE SURROUNDINGS

- THE SITE IS NEAR BY THE MAIN STREAM OF THE CITY.
- THE SITE IS NEAR BY TO THE METRO STATION THAT IS SHANKAR NAGAR METRO STATION.
- HIGH CLASS PEOPLES LIVE IN SURROUNDINGS AS IN OPPOSITE OF SITE THERE IS BESIL APARTMENTS IS ALSO AVAILABLE I.E. MANGALMURTI APARTMENTS AND NAKSHATRA ENGINEERING COLLEGE.
- THE SITE IS REACHABLE DISTANCE FROM NEEDFUL AMENITIES.
- SO THAT IT WILL BE EASY LIVING FOR THE USERS OF THE BUILDING.

D.SITE AREA REQUIRED

- TOTAL SITE AREA REQUIREMENT COME FROM THE NUMBER OF ACTIVITY SPACES.
- AND SUM OF THE AREA OF ALL ACTIVITY SPACES.
- HOWEVER FOR FUTURE DOVELOPMENT, THE AREA OF THE SELECTED SHOULD BE QUITE SUFFICIENT.

E.SITE TOPOGRAPHY

- SITE TOPOGRAPHY PREFEREBLY REQUIRED TABLE LAND, BUT SOME COUNTOUR CAN BE CONSIDERED.

Hazaripahad is an Affordable Housing Township Project. This project is one of its kind value home township project from stable at Hazaripahad, near Center Point School, Dabha Ring Road, Nagpur. Project has 2 BHK and 3 BHK comfort size

WHY HAZARIPAHAD?

Hazaripahad is located within the Municipal Corporation limit. Just 200 meters from main road. Within the vicinity of prime schools& residential colony. Good connectivity for Wadi, MIDC of Amravati road, Friends colony, Kalmeshwar- Katol road, Gore Wada Park etc.10 mins drive to Dharampeth & Gokulpeth market, Gittikhadan market. In coming years Dabha & Hazaripahad area will be the next talk of the town.

Appreciation in property price every year. (Few years ago plot was available in Rs.300 psf only, now it has scale uptoRs.3500- Rs. 6000 psf.)

Project Advantage

- Affordable Housing Township Project.
- One of its kind value home townships.
- Equipped with modern amenities.
- Just 200 meters from Main Road.

Location Advantage:

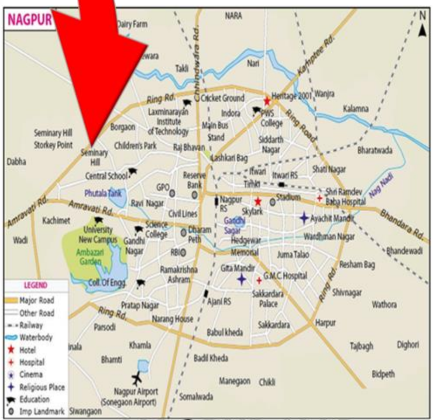
- Just 200 meters from main road.
- Within the vicinity of prime schools& residential colony.
- Good connectivity for Wadi, MIDC of Amravati road.
- 10 mins drive to Dharampeth & Gokulpeth market.
- Close to Gittikhadan market.

LOCATION

NEAR TO FIRE ENGINEERING COLLEGE, HAZARIPAHAD, Nagpur, Maharashtra.
PIN CODE :- 440007
Site Area :-
8.135 Acres
32921.177 Sq. M
3.2921 Hectares
The said site is within Municipal limits so NA (Non- Agricultural Land) not needed. Also the said land use is Commercial Cum Residential.

INDIA MAP

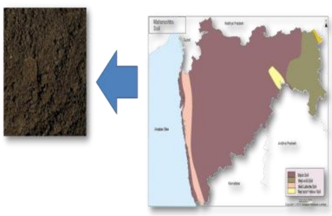
LAT :- 21. 1705
LNG :- 79. 03528



NAGPUR MAP

PROPOSED SITE

- Have hard strata after 1.2 meters
- Land configuration is flat land.



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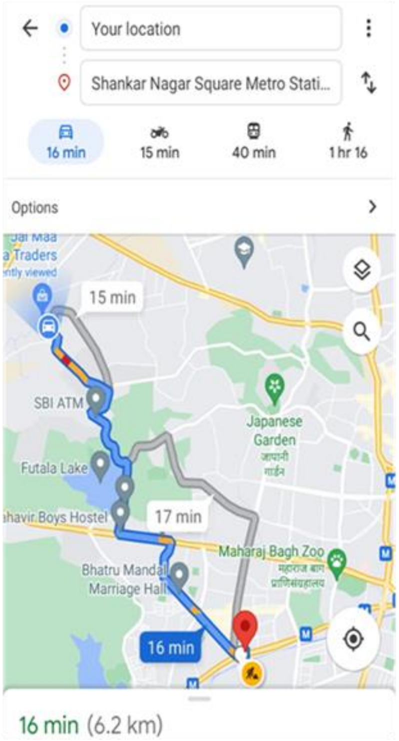
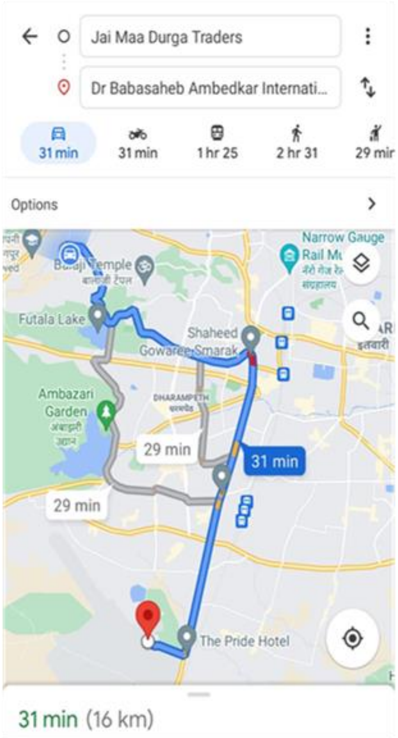
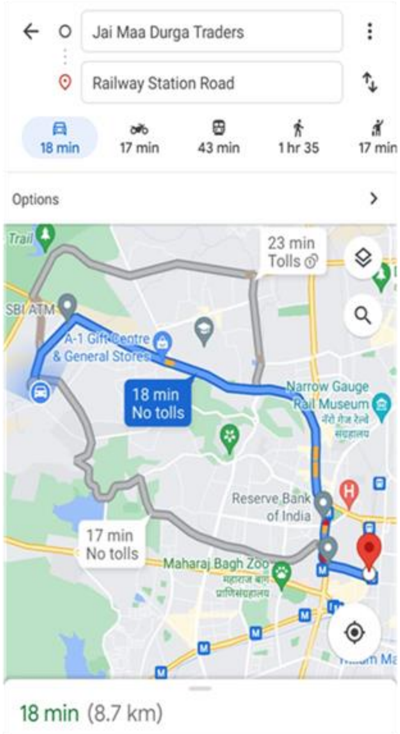
APPROCHED TO THE SITE FROM DIFFERENT LOCATIONS



THE SAID SITE IS AT 6.4 KM DISTANCE FROM SHANKAR NAGAR SQUARE METRO STATION.



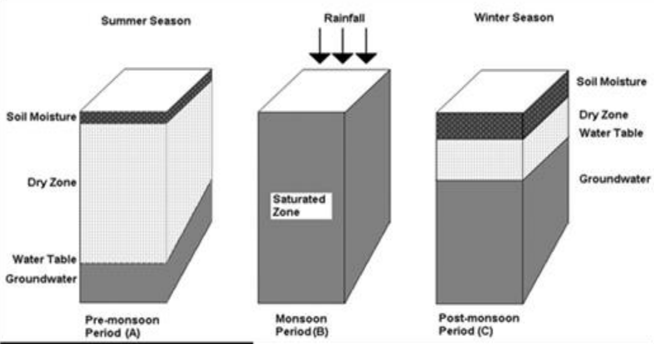
THE SAID SITE IS AT 16 KM DISTANCE FROM NAGPUR AIRPORT.

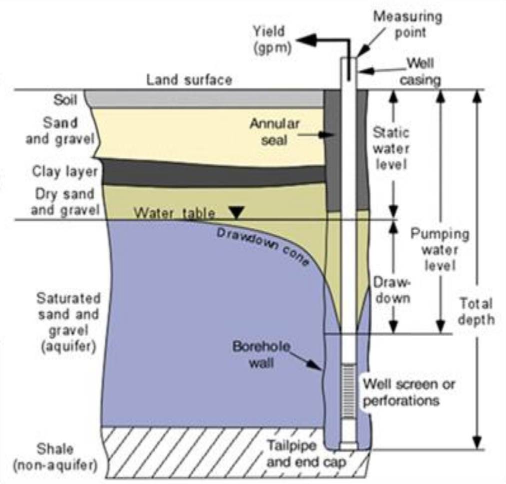


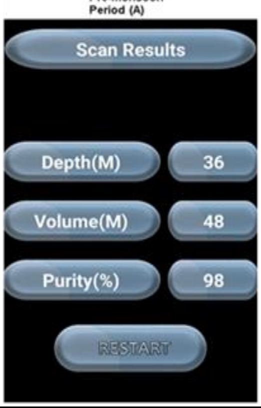
THE SAID SITE IS AT 8.7 KM DISTANCE FROM NAGPUR RAILWAY STATION.

What is the water table?

➢ The water table is an underground boundary between the soil surface and the area where groundwater saturates spaces between sediments and cracks in rock. Water pressure and atmospheric pressure are equal at this boundary. Underneath the water table is the saturated zone, where water fills all spaces between sediments.







The site from which I have taken water depth is 36 m, Volume is 48 cubic meter and water is 98 % pure.

NEAREST METRO SATION :- 6.2 KM SHANKAR NAGAR

SANDIPANI SCHOOL :- 2.2 KM
C.D.S SCHOOL :- 1.7 KM
CENTRE POINT SCHOOL :- 3.1 KM

SANJEEVANI CLINIC :- 2 KM

FUTALA LAKE :- 2.5 KM

GOREWADA ZOO AND WILDLIFE RESCUE CENTER :- 4.5 KM

RAILWAY STATION
NAGPUR RLY STATION :- 8.7 KM,AJNI RLY STATION :- 9.9 KM,ITWARI RLY STATION :- 13 KM

AIRPORT :- 14 KM

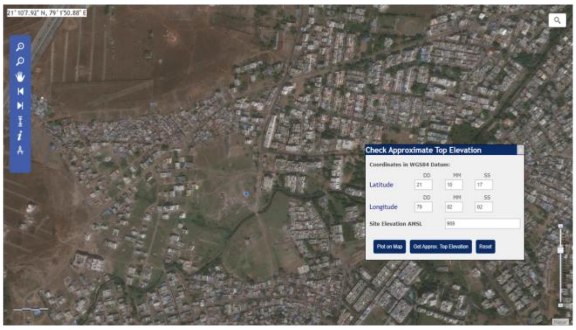
BUS STAND
GANESHPETH :- 10 KM
STAR BUS STOP :- 400 M

SITABULDI :- 8.4 KM
DHARAMPETH :- 6.3 KM
SADAR :- 5 KM
GITTIKHADAN :- 2.6 KM

HOW MUCH HEIGHT A HIGH RISE BUILDING SHOULD HAVE ON THIS SITE AS IT IS NEAR TO AIRPORT

NOCAS MAP

GOOGLE EARTH MAP



AIRPORTS AUTHORITY OF INDIA HAS INTRODUCED AN ON LINE APPLICATION SYSTEM **"NO OBJECTION CERTIFICATE APPLICATION SYSTEM (NOCAS)"** FOR THE PURPOSE OF ACCEPTING NOC APPLICATIONS FOR HEIGHT CLEARANCE FOR STRUCTURES SUCH AS BUILDINGS, MASTS, CHIMNEY, AND TRANSMISSION LINES WITH EFFECT FROM 1ST APRIL, 2011

- IT IS SHOWING 408.45 MTR FOR THIS SITE
- MEAN ABOVE SEA LEVEL OF NAGPUR IS 310.5

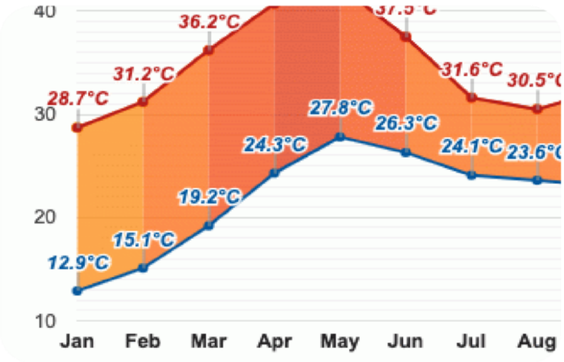
SO, 417.27– 310.5 = 106.77METER

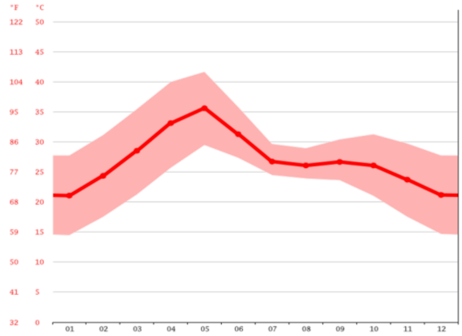
THE BUILDING CAN HAVE UPTO 33 FLOOR IF THE CLEAR HEIGHT WILL BE 3.2 METER

SITE CLIMATIC STUDY-NAGPURTROPICAL WET AND DRY CLIMATE

SUMMER SEASON → MID MAY TO JUNE
HOTTEST MOUNTH → 43°C TO 48 °C43°C TO 48 °C

WINTER SEASON → MID NOV TO JAN
COLDEST MONTH → 13°C TO 19°C



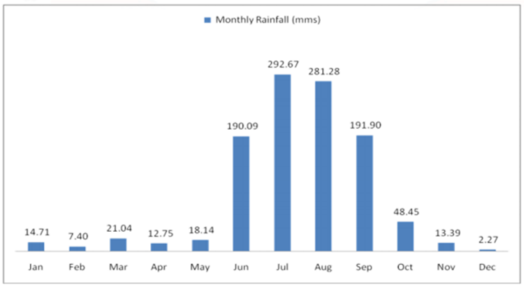


- **CLIMATIC ZONE**
  HOT AND HUMID CLIMATE FOR MOST PART OF THE YEAR.
- **SUMMER**
  ARRIVE USUALLY MARCH AND LAST TILL JUNE CHARIECTERIZED BY DRYNESS AND HIGH TEMPERATURE UPTO 45°C.
- **RAILFALL**
  THE SOUTH-WESTERLY MANSOONS SETS IN JUNE AND THE CITY GETS HEAVY RAILFALL TILL SEPTEMBER.
- **WINTER**
  TEMPERATURES FALL DOWN TO AS LOW AS 13 TO 19°C AT THE PEAK OF WINTERS.

MONSOON SEASON → MID JUNE TO SEPT
AVERAGE RAINFALL → 1028 M.M. ANNUALLY

WIND SPEED
MAX 7.5MILES/HRS IN THE MOUNTH OF APRIL TO SEPTEMBER
REST OF TIME WIND SPEED IS BELOW 5 TO 7 KM./HRS.

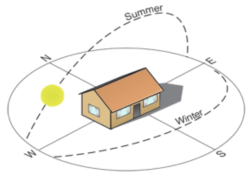
Figure 3-7: Average total monthly rainfall in the NMA (mm)



Data source: IMD data, 2001-2011

S No	Month	Average Wind Speed (km/h)
1.	January	6.6
2.	February	7.9
3.	March	8.5
4.	April	9.6
5.	May	13.4
6.	June	14.1
7.	July	12.0
8.	August	11.1
9.	September	9.5
10.	October	7.6
11.	November	7.2
12.	December	6.4

MONTHLY AVERAGE OF WIND SPEED AT NAGPUR



SUNPATH
ACCORDING SUMMER AND WINTER

IMPLICATIONS OF CLIMATE ON BUILDING DESIGN

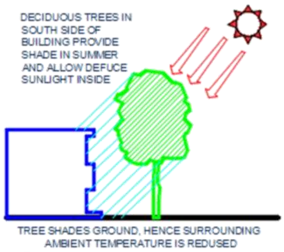
OBJECTIVES

RESIST HEAT GAIN | **PHYSICAL MANIFESTATION**

DECREASE EXPOSED SURFACE AREA → BY ORIENTATION AND SHAPE OF BUILDING
INCREASE THERMAL RESISTANCE → BY INSULATION OF BUILDING ENVELOPE (ROOF,WALLS, REFLECTIVE SURFACE)
INCREASE THERMAL CAPACITY (TIME LOG) → MASSIVE STRUCTURE
INCREASE BUFFER SPACES → PROVIDE LOBBIES / OPEN SPACES / LANDSCAPED COURTYARDS
INCREASE SHADING → EXTERNAL SURFACES PROTECTED BY OVERHANGS, FINS AND TREES
INCREASE SURFACE REFLECTIVITY → POLAR COLOUR, GLAZED CHINA MOSAIC TILES

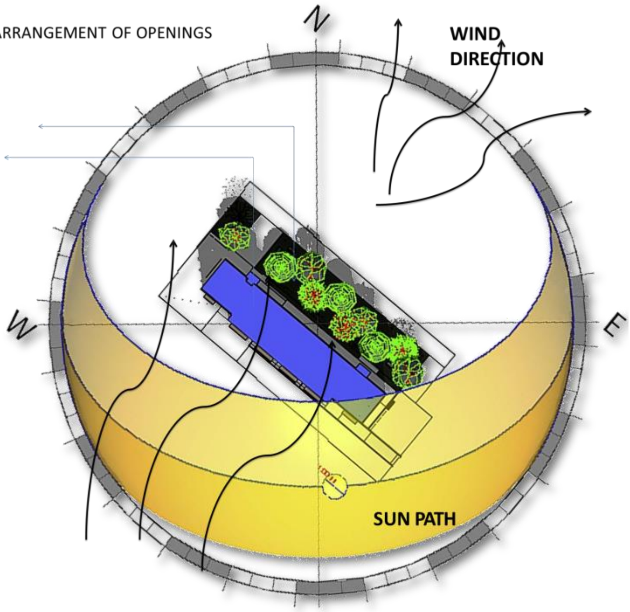
PROMOTE HEAT LOSS

VENTILATION OF APPLIANCES → PROVIDE WINDOWS / EXHAUSTS
INCREASE AIR EXCHANGE RATE (VENTILATION DURING DAY-TIME) → PROVIDE COURTYARD / WIND TOWER / ARRANGEMENT OF OPENINGS
INCREASE HUMIDITY LEVEL → TREES, WATER PONDS



PROVIDING LOBBIES / OPEN SPACES / LANDSCAPED COURTYARDS ON NORTH SIDE EXTERNAL SURFACES PROTECTED BY OVERHANGS, FINS AND TREES

- IN SUCH A CLIMATE, IT IS IMPERATIVE TO CONTROL SOLAR RADIATION AND MOVEMENT OF HOT WINDS.
- THE DESIGN CRITERIA SHOULD THEREFORE AIM AT RESISTING HEAT GAIN BY PROVIDING SHADING, REDUCING EXPOSED AREA ON THE SOUTH AND SOUTH-WEST BUILDING SURFACES.
- THE ORIENTATION OF BUILDING SHOULD BE ALONG THE PREVILING WIND DIRECTION i.e. THE MOST OF THE BUILDING BLOCKS WOULD BE ORIENTED TO THE N-W TO S-E.



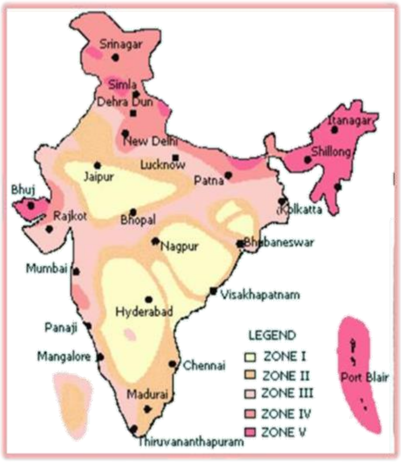
ORIENTATION OF THE BUILDING

❑ *SITE PICTURES*

DESIGN GOALS & ISSUES

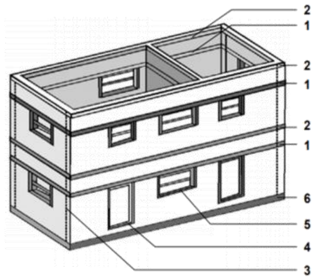
- Environment and micro-climate: surrounding environment and the micro- climate will help understand the reason of the orientation of the structure.
- User behavior and requirements: Studying the functioning of a place helps framing the design requirements.
- Form and Function: Form of building should merges with the surrounding environment. Form and Function go hand in hand. The form of the building 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.
- Horizontal and vertical circulation: Horizontal circulation consists of elements such as the corridors and lobbies. Vertical circulation includes elevators, staircases, ramps etc. The efficiency of the placement of these services should be appropriate.
- 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.
- Parking details and standards: There should be appropriate four and two wheeler parking as per the standards.

EARTHQUAKE ZONE OF NAGPUR

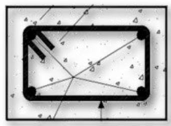


WHAT PRECAUTION SHOULD BE TAKE IN ZONE 2

NAGPUR IS NOW UNDER ZONE 2, WHICH IS THE SAFEST, EARLIER IT WAS IN ZONE 1. BUT AFTER LATUR EARTHQUAKE IN 1993 NONE OF THE AREAS COME UNDER ZONE 1.



- LINTEL SHOULD BE PROVIDED AROUND THE PERIPHERY OF BUILDING
- OUTER PLINTH BEAM SHOULD BE PROVIDED BEFORE INNER BEAM AND IT SHOULD BE AROUND PERIPHERY OF BUILDING
- INNER BEAM SHOULD BE TOP OF OUTER BEAM
- SAME CONDITION WILL BE FOLLOWED FOR TOP BEAM / ROOF BEAM

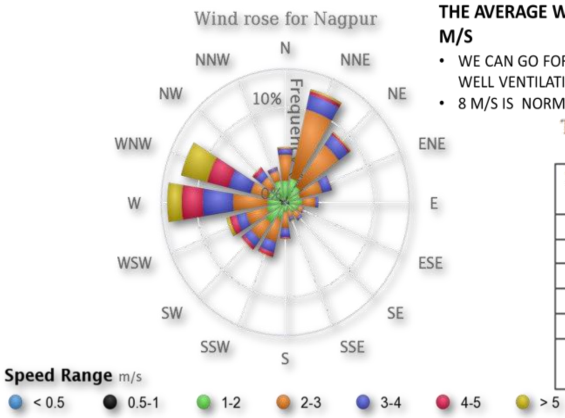


1.LINTEL BAND
2.ROOF/ FLOOR BAND
3.VERTICAL REINFORCING BAR AT CORNER
4.DOOR
5.WINDOW
6.PLINTH BAND

STIRRUPS SHOULD BEND IN 45DEGREE AS SHOWN IN FIG.
IT REDUSES THE CHANCE OF OPENING TIE DUE SHAKING OF EARTHQUAKE

FOUNDATION

FOUNDATION WIDTH SHOULD BE DECIDED BY THE LOAD COMING ON THE FOUNDATION AND THE BEARING CAPACITY



THE AVERAGE WIND SPEED IN NAGPUR IS 2.7 M/S WITH THE MAXIMUM WIND SPEED OF AROUND 8 M/S

- WE CAN GO FOR GRID AND SYMMETRIC PLAN AS IT CONTROL THE ACCELERATION OF WIND AND BY PROVIDING WELL VENTILATION
- 8 M/S IS NORMAL SPEED OF WIND NOT HARMFULL FOR HIGH RISE BUILDING

Table – 1 : Categories of Cyclonic Disturbances in North Indian Ocean

Sl. No.	CATEGORIES	WIND SPEED	
		*Knots**	*m/s*
1.	Low	< 17	< 8.75
2.	Depression	17-27	8.75-13.9
3.	Deep Depression	28-33	14.4-17.0
4.	Cyclonic Storm	34-47	17.5-24.2
5.	Severe Cyclonic Storm	48-63	24.7-32.4
6.	Severe Cyclonic Storm with a Core of Hurricane Wind	64 and more	≥ 33.0

* 1 Knot = 1.852 km/h = 0.5144 m/s

DESIGN REQUIREMENTS
APARTMENTS:
1. 2 Bedroom Unit: - 150 to 200 sq. m.
2. 3 Bedroom unit: - 250 to 300 sq. m.
3. Entrance Lobby:- Staircase, Lifts
Fire escape stairs • AHU rooms • Electrical rooms • Number of rooms [single / double / suites] / toilets • Details of public areas – • lobby /lounge,• health club, Musical Fountains .

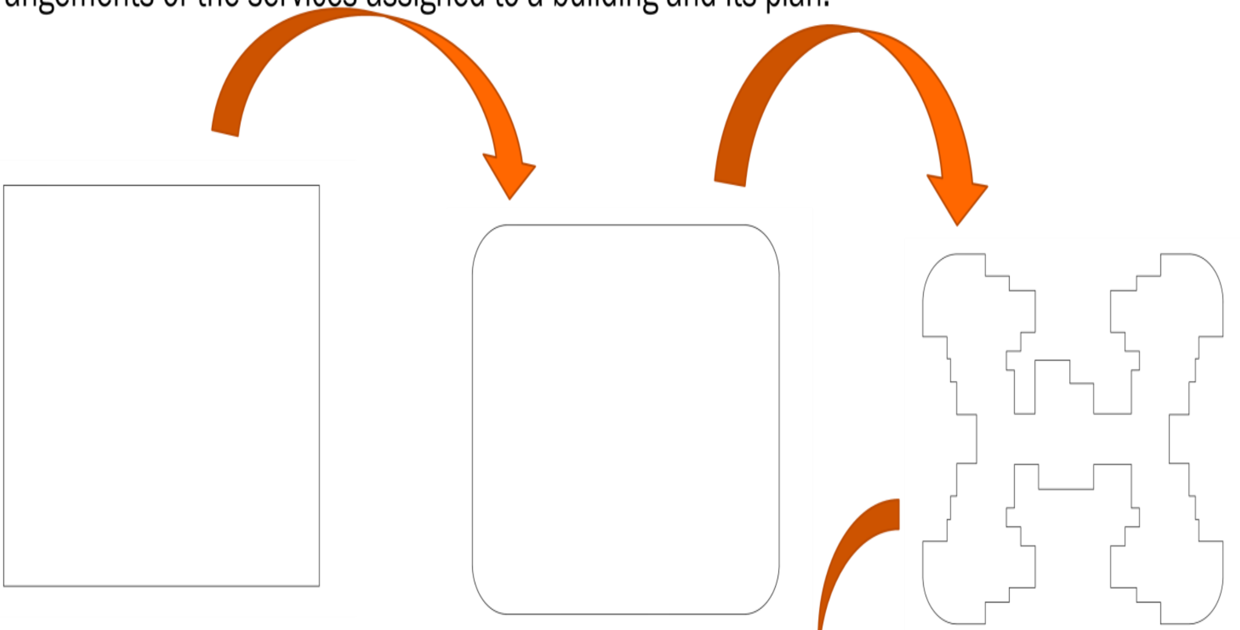
NON FSI AREAS:

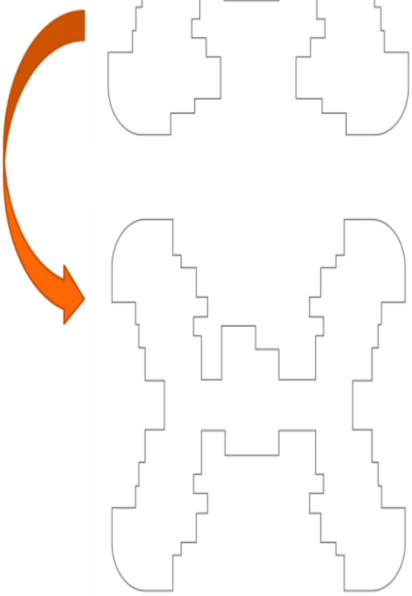
- Staircase and lift rooms
- Lift wells
- Fire escape staircases
- Cantilever fire escape passages
- Stilt parking floor
- Service ducts / garbage shaft
- AHU rooms
- Electrical room
- Pump room
- Generator room

C. PARKING DETAILS: - Parking: 1 car space for every 50 sq. m. For shopping / 100 sq. m. For office / 75 sq. m. For flats / 50 sq. m. For hotels.
• 1 two wheeler parking for every 50 sq. m. of shopping/ for every 25 sq. m. of office space / for every 75 sq. m. Of flats / for every 50 sq. m. of hotels
• Car stalls size; 2.5 x 5.0m / two wheeler 1.0m x 1.8m
• Drive way 3.0m for one way / 7.0 m for two –way • Width of entry exit gates - 3m wide • Ramp: ramp gradients 1 in 8 / turning radius 4.0 m

EVOLUTION OF DESIGN

The principle is that the shape of a building or object should be primarily based upon its intended function or purpose. A simple square form which later champherd , which follows the functional arrangements of the services assigned to a building and its plan.





- Wind engineering in general
- Several wind engineering techniques were employed into design of the tower to control the dynamic response of the tower under the wind loading by shape strategies to reduce excitation like
- Softens corners
- Varying cross-section shape
- Porosity or openings
- Tapering and setbacks
- Spoilers

- From which I have applied softens corners which will reduce wind load on towers.

AREA CALCULATION

ACRES	SQ MT	
1	4046.856422	
SITE AREA	SQ MT	
8.135	32921.177	
GORSS PLOT AREA	32921.177	
OPEN SPACES - AREA	10% OF GROSS PLOT AREA	3292.1177
AMENITY	5% OF GROSS PLOT AREA	1646.05885
FOR RESIDENTIAL USE		
NET PLOT AREA	WILL BE =GROSS PLOT AREA- AMENITTY AREA-OPEN SPACE AREA	27983.00045
PLOT AREA FOR RESIDNETIAL	100%	27983.00045
FSI FOR RESIDENTIAL	2.56	
BUILT UP AREA FOR RESIDNETIAL	71636.48114	
AMENITY FSI	0	0
TOTAL AVAILABE FOR RESIDENTIAL USE		**71636.48114**

UNIT TYPE 2BHK					
SR.NO.	**ROOMS NAME**	**AREA PROVIDED IN PROJECT**	**A (MR)**	**B (MR)**	**AXB = SQ.M**
1	ENTRANCE FOYER	2.885 X 4.00	2.885	4.000	11.540
2	LIVING HALL	5.232 X 4.00	5.232	4.000	20.928
3	BALCONY	5.232 X 2.100	5.232	2.100	10.987
4	DINNING HALL	3.885 X 3.32	3.885	3.320	12.898
5	OPEN TERRACE	2.23 X 1.90	2.230	1.900	4.237
6	KITCHEN	3.55 X 4.100	3.550	4.100	14.555
7	STORE ROOM	3.16 X1.985	3.160	1.985	6.273
8	DRY BALCONY	1.787 X 3.085	1.787	3.085	5.513
9	TOILET	2.315 X 1.20	2.315	1.200	2.778
10	FAMILY LOUNGE	5.68 X 5.200	5.680	5.200	29.536
11	MASTER BEDROOM 1	4.25 X 3.50	4.250	3.500	14.875
12	WALK IN WARDROBE	1.2 X2.38	1.200	2.380	2.856
13	TOILET	2.38 X 1.2	2.380	1.200	2.856
14	BEDROOM 1	4.25 X4.548	4.250	4.548	19.329
15	WALK IN WARDROBE	1.43 X2.38	1.430	2.380	3.403
16	TOILET	2.38 X 1.43	2.380	1.430	3.403
				TOTAL	**165.968**
			COMMON AREA LOADING FACTOR	30%	**49.790**
				TOTAL	**215.758**

UNIT TYPE 3BHK					
SR.NO.	ROOMS NAME	AREA PROVIDED IN PROJECT	A (MR)	B (MR)	AXB = SQ.M
1	ENTRANCE FOYER	2.885 X 4.00	2.885	4.000	11.540
2	LIVING HALL	5.232 X 4.00	5.232	4.000	20.928
3	BALCONY	5.232 X 2.100	5.232	2.100	10.987
4	DINNING HALL	3.885 X 3.32	3.885	3.320	12.898
5	OPEN TERRACE	2.23 X 1.90	2.230	1.900	4.237
6	KITCHEN	3.55 X 4.100	3.550	4.100	14.555
7	STORE ROOM	3.16 X1.985	3.160	1.985	6.273
8	DRY BALCONY	1.787 X 3.085	1.787	3.085	5.513
9	TOILET	2.315 X 1.20	2.315	1.200	2.778
10	FAMILY LOUNGE	5.68 X 5.200	5.680	5.200	29.536
11	MASTER BEDROOM 1	4.25 X 3.50	4.250	3.500	14.875
12	WALK IN WARDROBE	1.2 X2.38	1.200	2.380	2.856
13	TOILET	2.38 X 1.2	2.380	1.200	2.856
14	BEDROOM 1	4.25 X4.548	4.250	4.548	19.329
15	WALK IN WARDROBE	1.43 X2.38	1.430	2.380	3.403
16	TOILET	2.38 X 1.43	2.380	1.430	3.403
17	BEDROOM 2	4.655 X 4.27	4.655	4.270	19.877
18	WALK IN WARDROBE	1.43 X2.600	1.430	2.600	3.718
19	TOILET	2.600 X 1.57	2.600	1.570	4.082
				TOTAL	**193.645**
			COMMON AREA LOADING FACTOR	30%	**58.093**
				TOTAL	**251.738**

UNIT TYPE	TOTAL AREA	COMMON AREA LOADING FACTOR 30%	TOTAL	NO. OF UNITS PER FLOOR	TOTAL AREA FOR EACH CATEGORY
2 BHK	**165.968**	**49.7904**	**215.7584**	4	**863.0336**
3 BHK	**193.645**	**58.0935**	**251.7385**	4	**1006.954**

CALCULATIONS UNIT NUMBERS PURELY RESIDENTAIL					
UNIT TYPE	PERCENTAGE OF OVERALL REIDENTAIL AREA	AREA AVAILABE	AREA OF UNIT	APROX NUMBER	ROUND UP
2 BHK	50%	35818.24057	215.7584	166.0108741	167
3BHK	50%	35818.24057	251.7385	142.2835227	143
TOTAL	100%	71636.48114			

WITHOUT PREMIUM TOWER NUMBERS AND FLOORS					
UNIT TYPE	UNIT AREA	TOTAL UNIT NUMBER	UNITS PER FLOOR	NUMBER OF FLOORS	NO OF TOWER
2 BHK	215.7584	132	4	33	1
3 BHK	251.7385	132	4	33	1

UNIT TYPE	NUMBER OF FLOORS	UNITS PER FLOOR	TOTAL NO. OF UNITS	UNIT AREA	TOTAL AREA (SQ.M)	PERCENTAGE OF OVERALL REIDENTAIL AREA
2 BHK	33	4	132	215.758	28480.109	46.152
3 BHK	33	4	132	251.739	33229.482	53.848
					61709.591	**100.000**

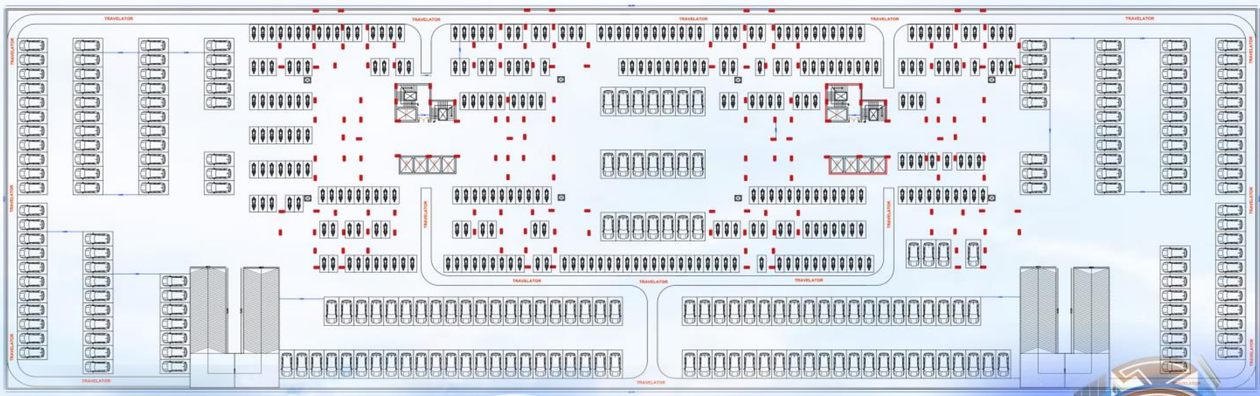
UNIT TYPE	2 BHK	3 BHK
UNIT AREA IN SQ.M	215.7584	251.7385
UNITS PER FLOOR	4	4
TOTAL AREA FOR EACH CATEGORY	863.0336	1006.954
NUMBER OF FLOORS	33	33
TOTAL NO.OF UNITS	132	132
TOTAL AREA FOR EACH CATEGORY	28480.1088	33229.482
NO. OF TOWERS	1	1
TOTAL AREA FOR 2BHK AND 3 BHK	**61709.591**	
PERCENTAGE OF OVERALL RESIDENTAIL AREA	46.152	53.848
OVERALL PERCENTAGE OF RESIDENTAIL	**100.000**	

188	PARKING CALCULATION AS PER DCR			
189	ONE PARKING SPACE FOR EVERY		CONGESTED AREA	NON CONGESTED AREA
190	CARPET AREA MORE THAN 80 SQ M	NO. OF CARS	1	1
191		NO. OF SCOOTERS	2	2
192		NO. OF CYCLES	2	2
193	CARPET AREA BETWEEN 40 SQ M TO 80 SQ M	NO. OF CARS	0	1
194		NO. OF SCOOTERS	2	4
195		NO. OF CYCLES	4	4
196	CARPET AREA UPTO 40 SQ M	NO. OF CARS	0	1
197		NO. OF SCOOTERS	4	4
198		NO. OF CYCLES	8	4
199	FIVE GUEST ROOMS	NO. OF CARS	2	3
200		NO. OF SCOOTERS	2	4
201		NO. OF CYCLES	4	4
202				
203				
204	PARKING CALCULATION AS PER MY PROJECT			
205	ONE PARKING SPACE FOR EVERY		CONGESTED AREA	NON CONGESTED AREA
206	CARPET AREA FOR 178 SQ M	NO. OF CARS	2	3
207		NO. OF SCOOTERS	2	2
208		NO. OF CYCLES	2	2
209	CARPET AREA FOR 208 SQ M	NO. OF CARS	2	3
210		NO. OF SCOOTERS	2	4
211		NO. OF CYCLES	4	4

SITE PLAN(SCALE-1:500)

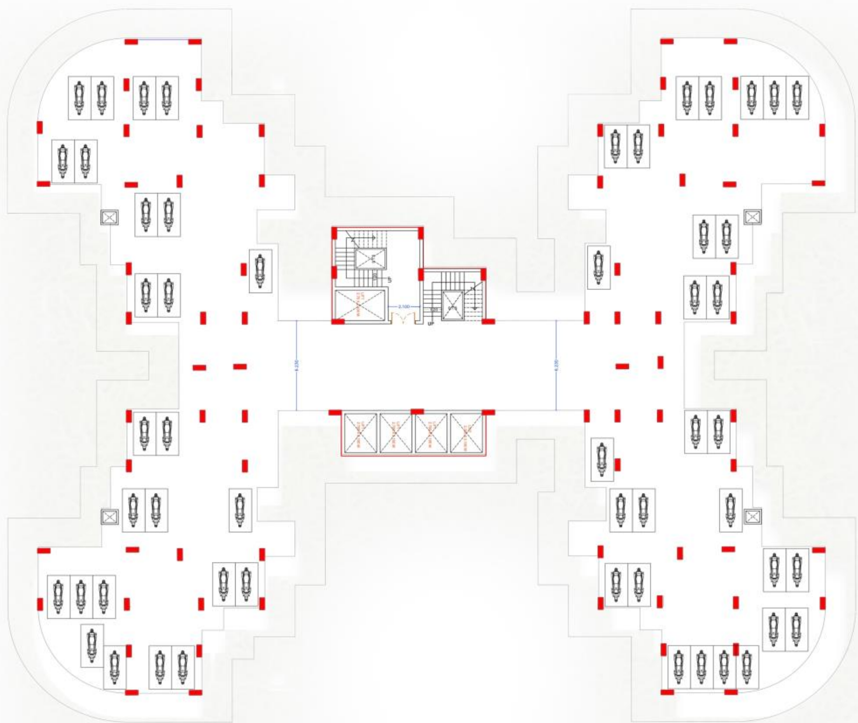
SITE PLAN

2 BHK AND 3 BHK BASEMENT PARKING (2 WHEELER N 4 WHEELER)

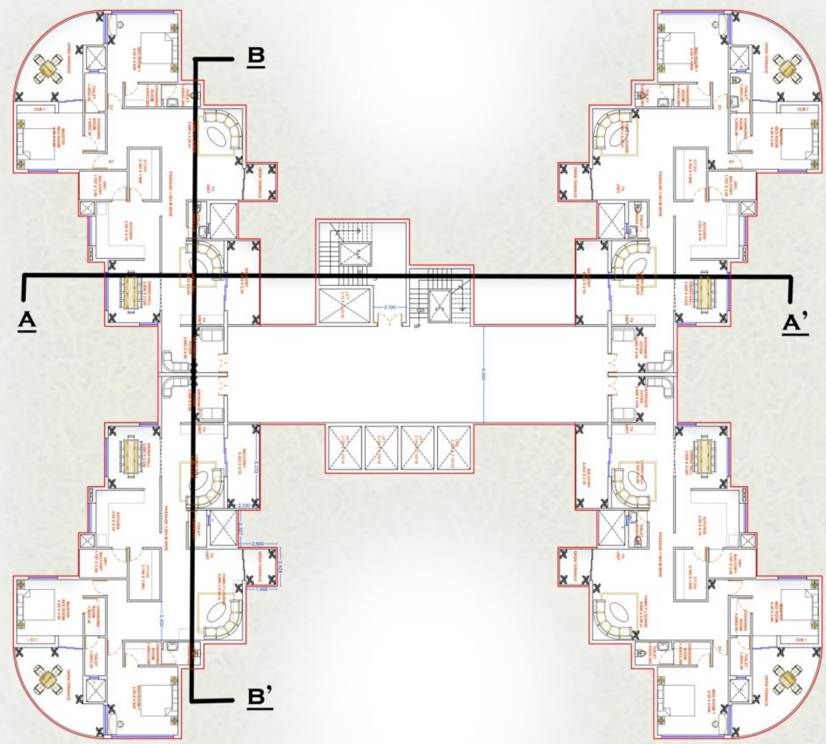


BASEMENT PARKING PLAN

2BHK STILT PARKING PLAN(SCALE-1:100)

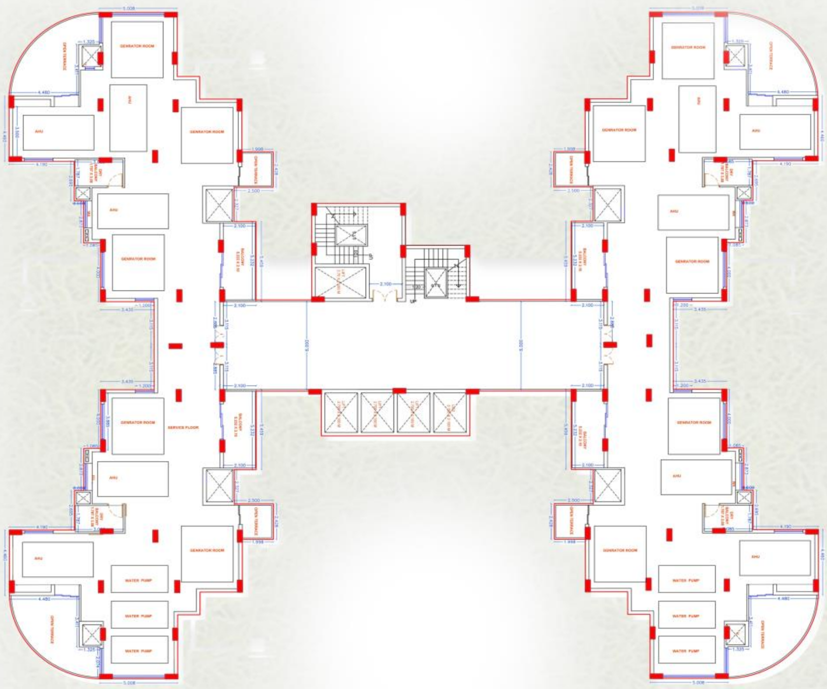


2BHK PLAN(SCALE-1:100)



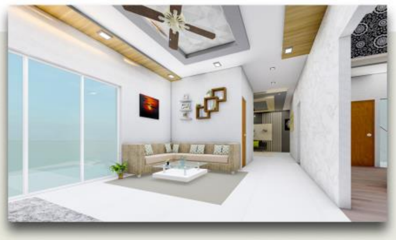
TYPICAL FLOOR PLAN UPTO 33TH FLOORS

2BHK SERVICE FLOOR PLAN(SCALE-1:100)

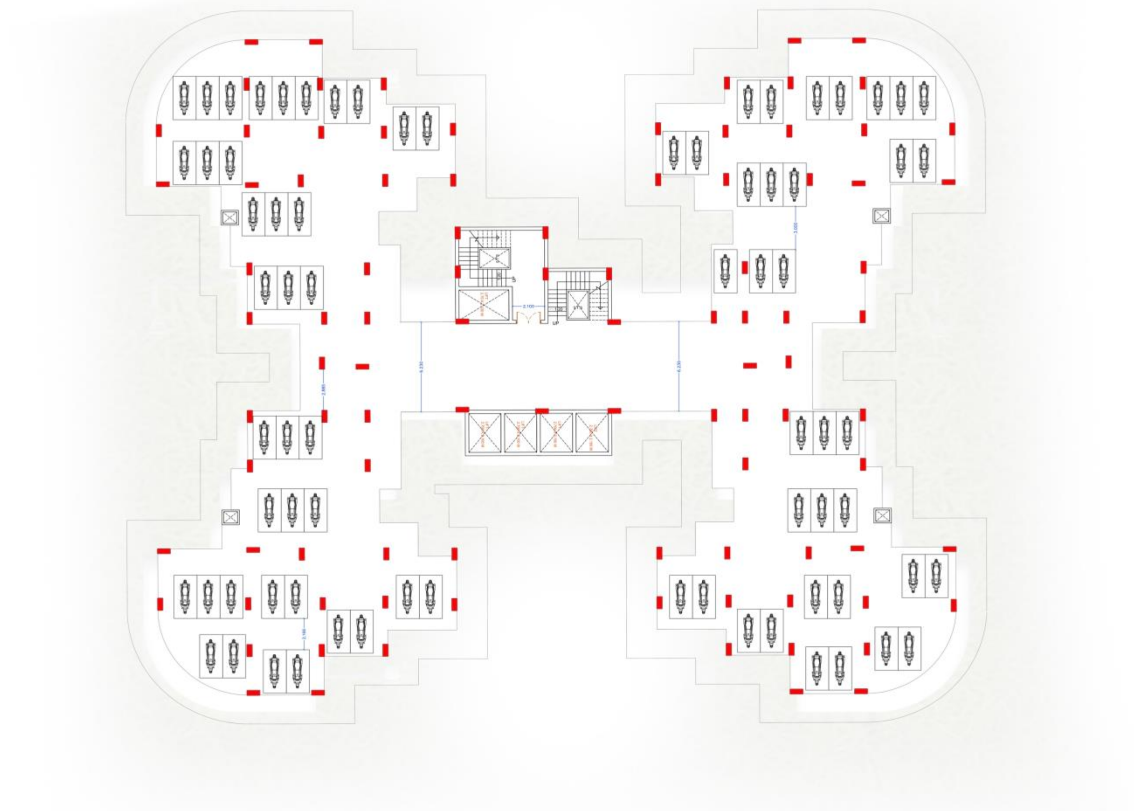


SERVICE FLOOR PLAN

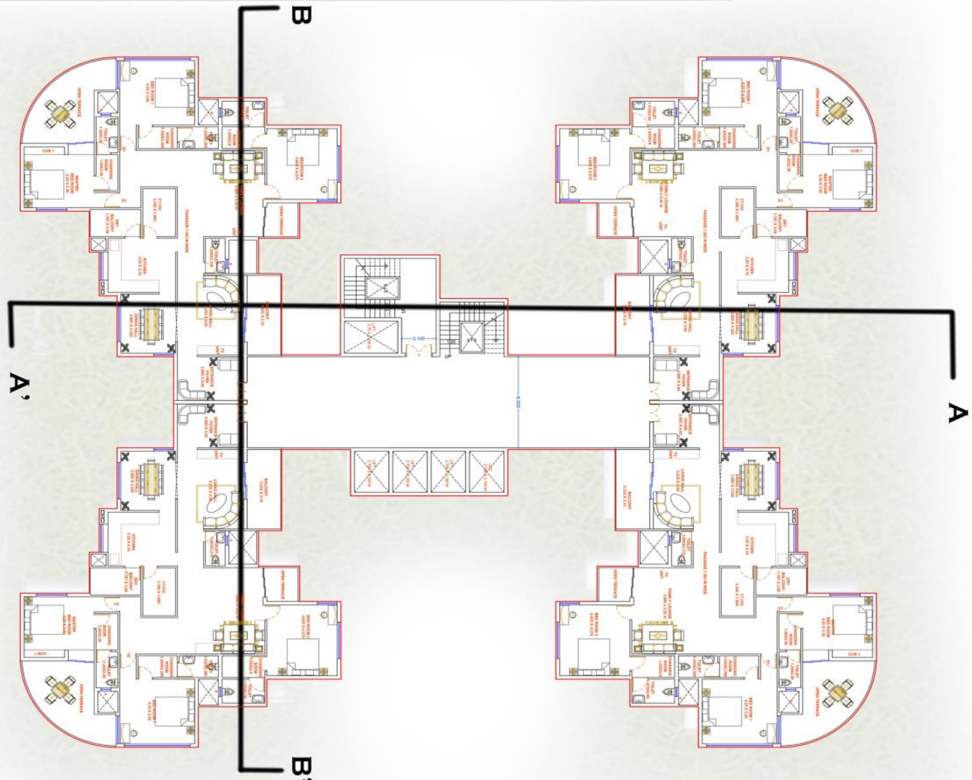
2 BHK CUT VIEW AND INTERIOR VIEW



3 BHK STILT PARKING PLAN (SCALE-1:100)

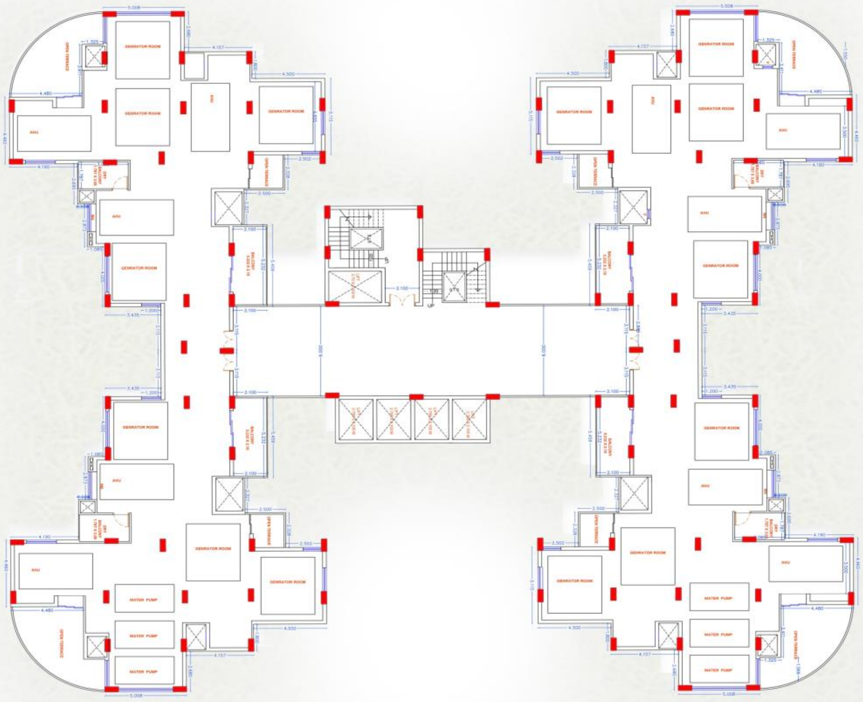


3 BHK PLAN (SCALE-1:100)

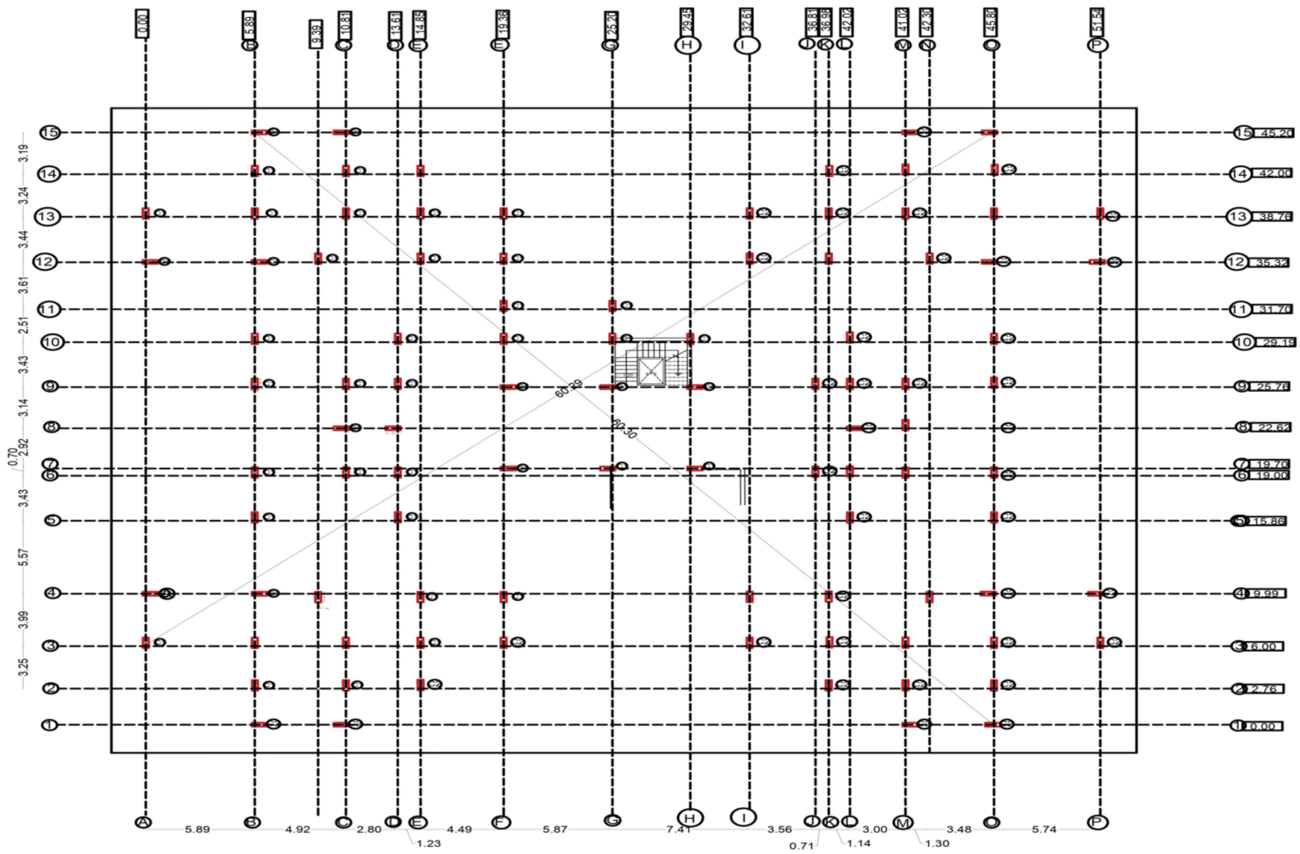


TYPICAL FLOOR PLAN UPTO 33TH FLOORS

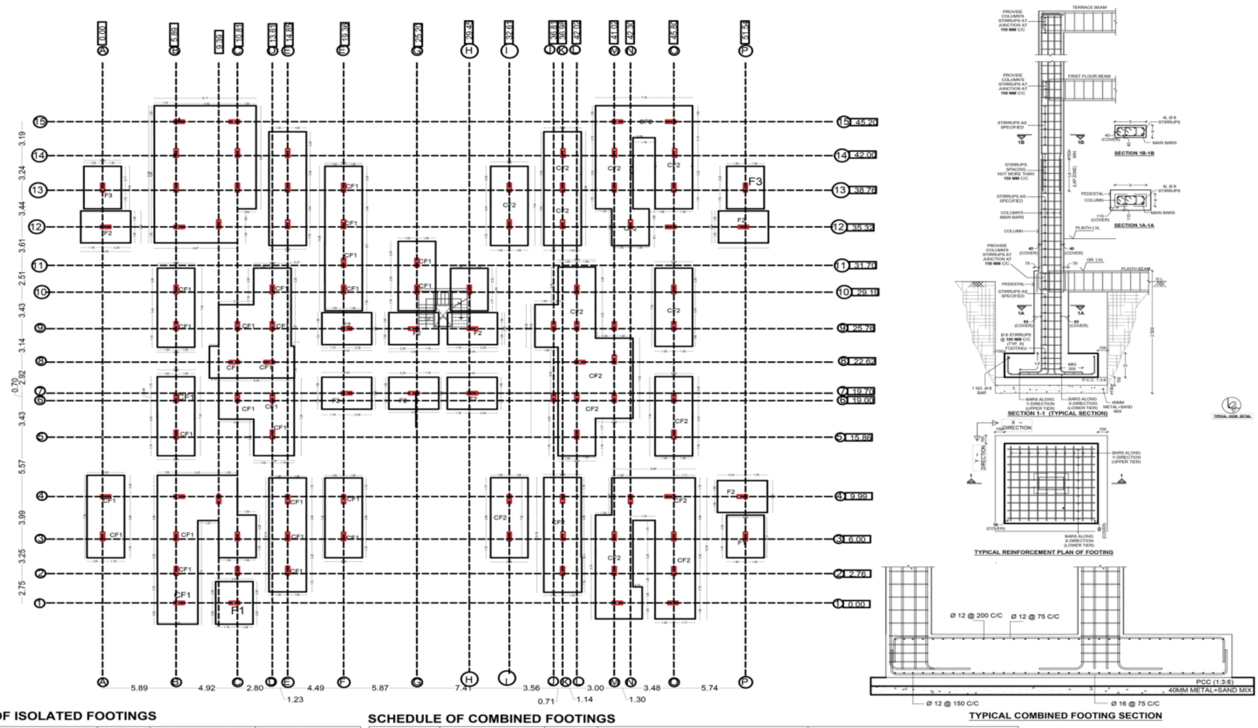
3 BHK SERVICE FLOOR PLAN (SCALE-1:100)



3 BHK CUT VIEW AND INTERIOR VIEW



CENTRE LINE DRAWING



SCHEDULE OF ISOLATED FOOTINGS

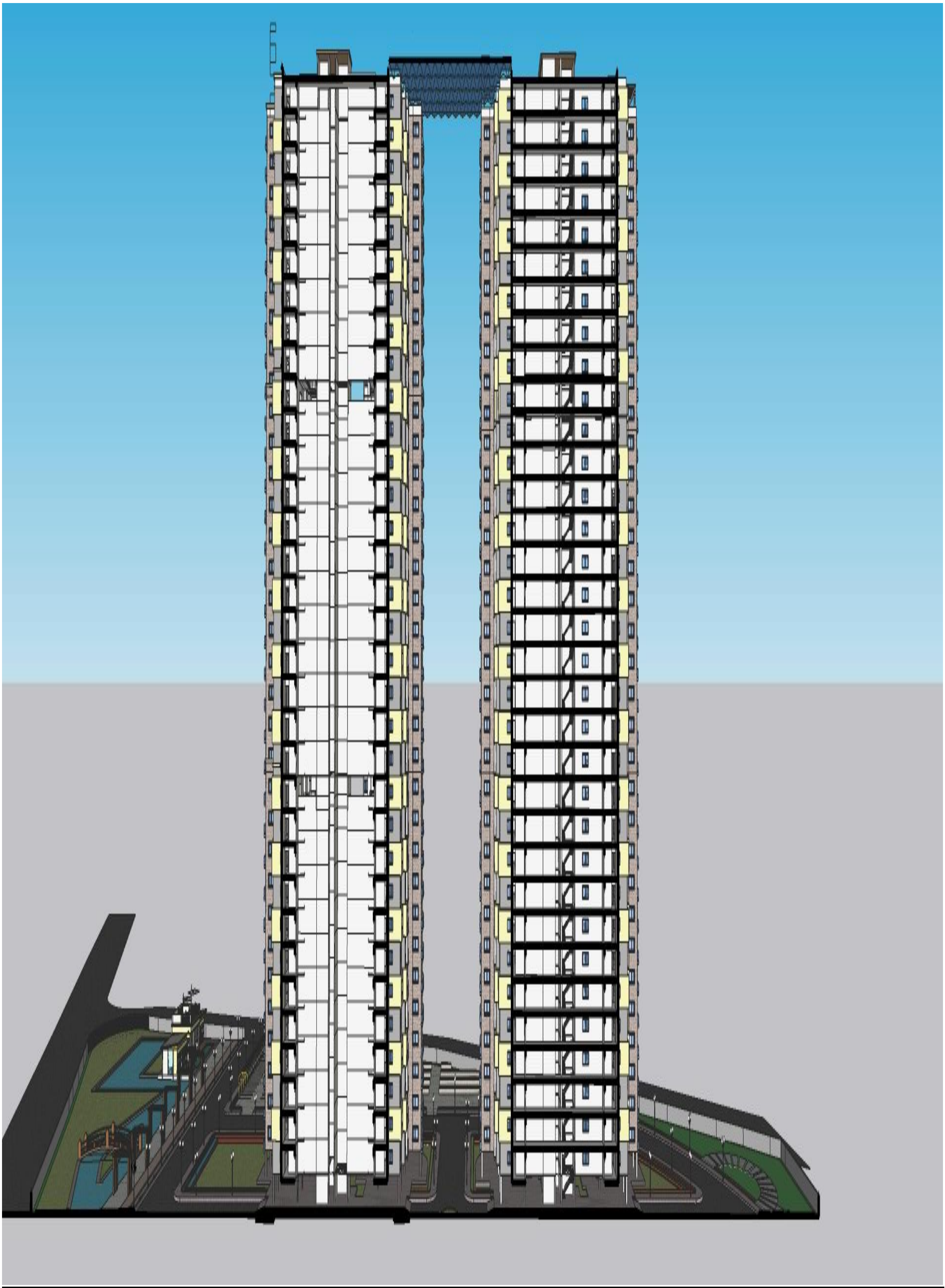
TYPE	FOOTING SIZE		DEPTH	STEEL IN X-DIR. (LOWER TIER)	STEEL IN Y-DIR. (UPPER TIER)
	A1 (X - DIR.)	B1 (Y - DIR.)	D	DIA. SPACING	DIA. SPACING
F1	3000	3780	450	Ø 12 @ 150 C/C	Ø 12 @ 150 C/C
F2	4000	3000	500	Ø 12 @ 125 C/C	Ø 12 @ 125 C/C
F3	3000	4000	450	Ø 12 @ 125 C/C	Ø 12 @ 125 C/C

SCHEDULE OF COMBINED FOOTINGS

FOOTING TYPE	FOOTING SIZE		DEPTH	BOTTOM STEEL		TOP STEEL	
				STEEL IN LONG DIR.	STEEL IN SHORT DIR.	STEEL IN LONG DIR.	STEEL IN SHORT DIR.
	A1	B1	D	DIA. SPACING	DIA. SPACING	DIA. SPACING	DIA. SPACING
CF1	7490	3000	500	Ø16 @ 75 C/C	Ø12 @ 150 C/C	Ø12 @ 75 C/C	Ø12 @ 150 C/C
CF2	7340	3000	450	Ø12 @ 150 C/C	Ø12 @ 150 C/C	Ø12 @ 150 C/C	Ø12 @ 150 C/C

FOUNDATION DRAWING

VIEWS



VIEWS

VIEWS

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3D VIEWS (PARKING SPACE)

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INTERIOR VIEWS (2 BHK)

LIVING ROOM

KITCHEN

DINNING ROOM

FAMILY LOUNGE

MASTER BED ROOM

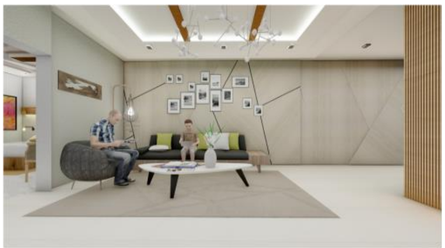
BED ROOM 1

INTERIOR VIEWS (3 BHK)

LIVING ROOM

KITCHEN

DINNING ROOM



FAMILY LOUNGE

MASTER BED ROOM

BED ROOM 1

BED ROOM 2

CHAPTER 5: REFERENCES AND BIBLIOGRAPHY

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End of Project Report