THESIS REPORT ON

THE COMMERCIAL MIXED USE SKYSCRAPER

" THE DIAMOND TOWER", GIFT CITY,GUJRAT"

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF:

BACHELOR OF ARCHITECTURE

BY

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1150101093

THESIS GUIDE

AR. AANSHUL SINGH

SESSION

2019-20

TO THE

SCHOOL OF ARCHITECTURE AND PLANNING

BABU BANARASI DAS UNIVERSITY

LUCKNOW.

SCHOOL OF ARCHITECTURE AND PLANNING
BABU BANARASI DAS UNIVERSITY, LUCKNOW (U.P.).

I hereby recommend that the thesis, entitled **" THE DIAMOND TOWER", GIFT CITY,GUJRAT"**, prepared by Ms **Neha Kumari** under my supervision, is the bonafide work of the student and be accepted as a partial fulfillment for the award of Bachelors Degree in Architecture, School of Architecture BBDU, Lucknow.

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Prof. Mohit Kumar Agarwal Dean of Department	Prof. Sangeeta Sharma Head of Department

Recommendation

Accepted

Not Accepted

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External Examiner	External Examiner

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TABLE OF CONTENT

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- I would like to take this opportunity to thank my beloved thesis guide **AR.AANSHUL SINGH**, who have always helped me and have give me brilliant ideas. I highly appreciate all the help they have given to me. Their concerns about the many problems involved in acquiring land for **SKYSCRAPER** or for the expansion of existing ones have encouraged me to conduct this study as a means of presenting more explicitly the difficulties of **COMMERCIAL MIX-USE SKYSCRAPPER**

- I would like to thank the Dean **Prof. Mohit Kumar Aggarwal** and thesis coordinator **Ar. Arpit kumar** without whose help and co-ordination this thesis may not have been possible. I also want to thank all my faculty members for the guidance that helped successfully integrating the research aspects of the project throughout this thesis.

- I am grateful to my family for standing with me throughout and finally my heartiest thanks to my friends**:** **RATNAKAR UPADHYAYAY, DEERGHA PATEL,PANKHURI SAXENA, SUMIT KUMAR** who have been helpful throughout this stage of my graduation.

- NEHA KUAMRI

INTRODUCTION

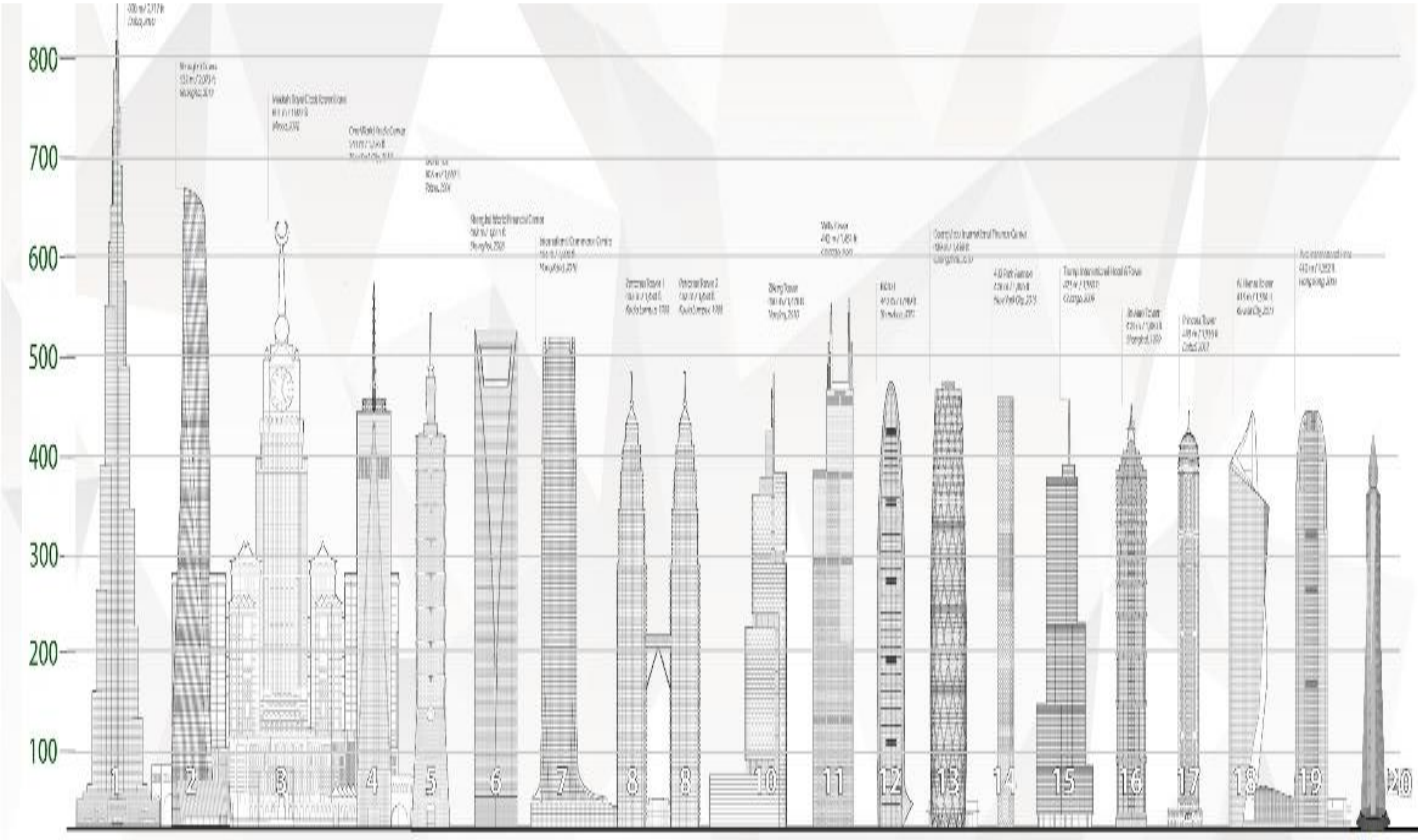
1.1 ABSTRACT

Looking into the future of India 2050 as a superpower, we can clearly see its Metropolitan cities like Mumbai, Guragaon, Ahmedabad, Bangalore as technology based, economy generating mammoths having tall vertical skylines. The future of the Indian cities can be envisioned as a collection of utopian settlements with tall skylines and self-efficient ecological living systems comprised majorly of skyscrapers. The country needs to address its shortcomings in order to achieve a higher pace on the journey towards a superpower which can be produced by unfolding the potentials of Skyscraper Architecture into a VERTICAL CITY itself. Imagining the Vertical City, is a concept aiming to develop a system which is not just a high end housing infrastructure but is a vessel that houses a justified complex network of functions present in a horizontal city hoisted vertically so as to create a similar ambience with a balance of comfort and elegance in the user's lifestyle.

The Vertical City aims in becoming an ideal integrated city contained within a massive vertical structure, allowing maximum conservation of the surrounding environment. Mumbai, being the most congested city of India, has to inevitably face the boom of skyscraper construction. Build on a site located in Mumbai required an intensive project response to its urban environment and innovative solutions to resolve the existing urban issues before moving towards a healthy lifestyle of users. Addressing the urban issues of Indian cities like Population Explosion, Scarcity of Housing, Less land for horizontal expansion is the path chosen for developing an ideal integrated high rise model which could be implemented in the upcoming boom of skyscraper construction. The resulting structure depicts the chaos and commotion of a busy city inside a controlled and simple environment.

The design holds certain features like high density modular housing, transit hub, public spaces which are not seen in typical skyscrapers of Mumbai but are the core essence of a city. The design aims at being a modulated prototype solution for the future of Indian cities which can be multiplied to face the upcoming future urban challenges more efficiently. The daily life of a commutator in a horizontal city can be easily traced into this vertical dimension which doesn't hamper the daily routine but improves the standard of living with a sense of responsibility towards the environment.

Tall, Super-Tall and Mega-Tall Buildings



1.2 DEFINITION OF SKYSCRAPER

As the notion of size or appearance of tallness is a relative matter, and not consistent over time and place, it is difficult to define or distinguish the 'tall building', 'high-rise building' or 'skyscraper' just in tens of size. Unfortunately, there is no consensus on what comprises a tall building or at what magical height, or number of stories, buildings can be called tall. The terms all mean the same type of building which is built extremely high in which skyscraper IS a more assertive term, Although the high-rise building has been accepted as a building type since the late 19th century, tall buildings have been constructed since ancient times for several purposes and, therefore, the history of tall buildings is much older than a century.

"A building whose height creates different conditions in the design, construction, and use than those that exist in common buildings of a certain region and period."

-The Council of Tall Buildings and Urban Habitat (CTBUH)

Consequently, the use of the terms 'tall building', 'high-rise building', and 'skyscraper' have common associations, and depending on time and place, the concept of height varies in relation to the progress of technology and the desires of society.

1.3 BENEFITS OF MIXED USE DEVELOPMENT

- Reduced distances between housing, workplaces, retail businesses, and other amenities and destinations
- More compact development
- Stronger neighbourhood character, sense of place
- Walkable, bike-able neighbourhoods, increased accessibility via transit, both resulting in reduced transportation costs.

1.4 THE THESIS

AIM

To design a bioclimatic architecture and integrating plants into sky scrapers for a high rise mixed use development.

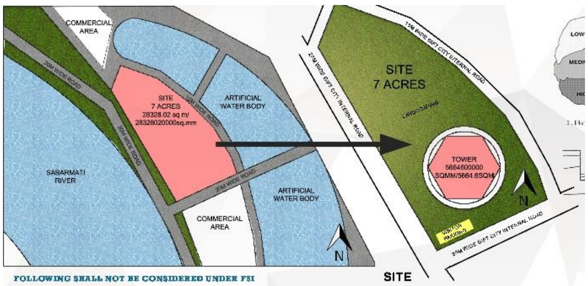
1.5 SCOPE OF THE THESIS

- Analysis and Incorporating bioclimatic design principles for high rise mixed use development.
- Analyzing and using new design techniques

1.6 OBJECTIVES

1. To study how architecture contribute to the mixed use development
2.To design spaces which enhances the physical and visual interaction and reduce isolation.
3.To design spaces which bring closer to nature and harmony.
4.To bring transparency, openness and fluidity of space.
5.Priority to sustainable materials and functional requirements in design, while integrating services to it.

1.7 THE SITE



FOLLOWING SHALL NOT BE CONSIDERED UNDER FSI

Areas covered by staircases, lift room, mechanical room, fire room Lift wells, architectural features, elevated tanks, etc. Area of fire escape stairways and cantilever fire escape passage Area of basement parking Area of mechanical floor and refuge floor Area of balconies not exceeding above 1.8m

Floor Space Index(FSI) - 8

Marginal open Space

Front - 12m

Side -6m

Height width ratio(slenderness ratio) must not exceed - 1:13.5

Height width ratio achieved - 1:5

(Calculation for slender ratio – height of tower/maximum width of tower)i.E (476/68.8)Open space around the building for the building height above 60m should be 12m

REFUSE AREA=4% OF FLOOR PLATE AT EVERY
7TH HABITABLE FLOOR.

TOTAL SITE AREA=7 ACRES/28322 SQ.M
TOTAL BUILTUP AREA=226576 SQ.M
GROUND COVERAGE
PODIUM 20% = 5664. SQ.M ,TOWER 15% = 4248.3 SQ.M
TOTAL DESIGN CAPACITY=9110 PEOPLES

FIRE EXITS (AS PER PART 4 OF NBC, 'FIRE AND LIFE SAFETY')
BUILDING TYPE: COMMERCIAL
LOCATION: I 8M IN ONE DIRECTION AND 45M IN MORE THAN ONE DIRECTION
Number of exits based on number of user:
500 people - 2 Exits 1000 people - 3 Exits
2000 people - 4 Exits

CORRIDOR WIDTH AND FIRE DOORS
Subdivide corridor if length exceeds 12m giving access to alter-nate route. Provide fire door if dead end exceeds 4.5 m

STAIRCASE (source- GIFT SEZ DCR)
The two staircases provided in a high-rise building with an area more than 500 sqm shall be of enclosed type; at least one of them shall be having opening for light and ventil-ation on external walls of buildings and shall open directly to the exterior or interior open space or to an open place of safety.
Minimum width: 1.5m for commercial
Minimum Tread: 300 mm
Passage/corridor: 1.5m for commercial
Minimum Riser: 190 mm

VENTILLATION SHAFT

Height (m)	Size(Sq.m)	Min Size (sq.m)
9.0	1.5	1
12.5	3.0	1.2
15 & above	4.0	1.5

Table 5 Recommended Nominal Travel Time for office, commercial or Hotel Buildings
(*Clause* 4.2.8)

Level	Nominal Travel Time
Excellent	15 to 25 seconds
Good	> 25 to 35 seconds
Satisfactory	>35 to 45 seconds

LIFT (AS PER PART 4 OF NBC 2016 VOL. I PAGE NO.99)
Minimum 60 min fire resistance and must be an enc-losed space. Acoount for no more than 50% of the required egress capacity. one lift reserved for Fire Service.
SHAFT: 120 min fire resistance and separate machine room for max. of 2 lift serving for fire service

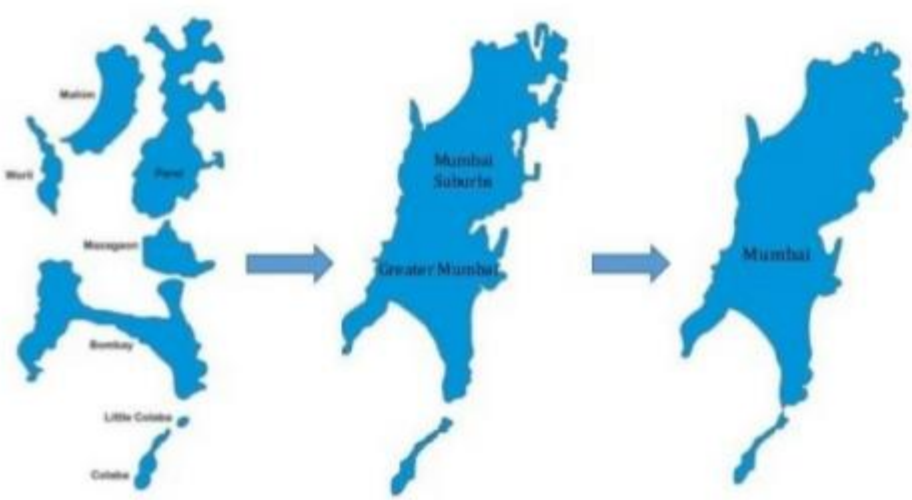
PARKING (GIFT AREA GDCR PG:22)
1 SPACE OF CAR PARKING FOR EVERY 100SQM OF BUA.
TOTAL BUA=226576
TOTAL PARKING=2265

HISTORY AND ASPECTS OF HIGH RISE BUILDINGS

The notion of size or appearance of tallness is a relative matter and not a consistent one over time and space. It is always difficult to distinguish the “tall building, high rise building or skyscraper” just in terms of size. Unfortunately, there is no standard or criteria to call a building on its height. The terms all mean the same type of building which results in extremely high. Skyscraper is the most assertive term. 2.1 Historical development & Origin of Skyscrapers 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. In 1871, the great first accident in Chicago destroyed much of the city’s office space and it gave a chance to rebuild a modern, fireproof business district. The Home insurance building completed in Chicago in 1885, was the first to incorporate an iron – skeleton structure to bear the load of the building. This building paved way for the city’s early skyscraper boom. Architects and engineers who “cut their teeth” in Chicago skyscrapers were later called to work in New York as well. Chicago and New York were the two great superpower of American architecture.

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.. 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, the tallest building at the ti
construction in the world at 452 m. High-rise buildings in Ger
development and are concentrated particularly in Frankfurt am Main: today, Frankfurt is the only German city with a skyline dominated by skyscrapers. 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. 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 2.2 Transition - Seven islands to Mumbai city From a group of seven islands to a strategic port and eventually the financial capital of world’s largest democracy. The 18th century marked the rapid growth of the city, when hinterland was connected to Mumbai by rail. Many construction projects were started due to the need of flourishing markets and economic opportunities. Various business communities from different part of the nation set up their businesses in this island. These laborers lived in settlements that grew parallel to the docks. The landowners and factor owners constructed rental dormitory. Eventually the immigrants brought their families in these single – room accommodations, drastically increasing the density of the area. ‘Rent control Act’ was introduced which rendered these Chawls unprofitable for the landlords. The damaged Chawls were not repaired and maintained. In 1969, there were about 20,000 chawls in dilapidated conditions housing two million people.



4.1 DESIGN PROCESS

The process of generating concepts varies from designer to designer; however, the process of concept generation should encompass a handful of important steps. Understanding the project and then consolidate ideas and choose a direction to go with.

Fig. Design process flow chart

4.2 CONCEPT

Developing the Concept:
Keywords: mixed-use, mass, tramc flow, vertical movement
Interconnections = Form Follows the circulation Movement"
Concept = Form follows movement Design Considerations:
-site context
-architectural character -crowd dynamics -flexible spaces
-natural illumination -technology
-vertical circulation

REQUIREMENTS

A. SHOPPING COMPLEX

- Shops —Large & Small Range from 100 sq.m to 500 sq.m
- Lobby
- Atrium
- Staff area — BMS room
- Service area o Toilets o Parking o Stairs o Lifts (Escalators

Source: case study / literature study.

B. OFFICE COMPLEX

- Offices — Large & Small — 3000 sq.m to 6000 sq.m
- Lobby
- Atrium   Staff area —BMS room
- Service area o Toilets o Parking o Stairs o Lifts (Escalators

Source: case study / literature study.

C. APARTMENTS:

single and double occupancy unit of service apartments.

Entrance Lobby

Staircase   Lifts

Fire escape stairs

AHU rooms

Electrical rooms

Source: case study / literature study.

C. HOTELS:

Delux and Luxury rooms

Entrance Lobby

Staircase   Lifts

Fire escape stairs

AHU rooms

Electrical rooms

Source: case study / literature study.

CAR PARKING CALCULATION

A. SERVICE APARTMENT CAR PARKING

Core ratio 1:6

Single suit – 1cars per 2 unit

Double suits-1 cars per 2 unit

12 Suits per floor in single suits

Total single occupancy suits=12x7=84 suits

Therefore no.of parking = 42

12 Suits per floor in double suits

Total single occupancy suits=12x4=48 suits

Therefore no.of parking = 24

B. OFFICE CAR PARKING

For office car parking:-

Offices not providing on-site customer service shall have one space per 100 square meter

Total office area=123534 sq,m

No.of parkings=1235

C. HOTEL

According to the norms of 5star hotel in city with population density 50lack and above we consider one car over two room.

34 Suits per floor in delux

Total rooms=34x5=170 suits

Therefore no.of parking = 85

20 Suits per floor in luxury

Total rooms=20x4=100 suits

Therefore no.of parking = 50

D. MALL/OBSERVATORY

For public spaces we consider 2 cars for every 100sqm

Total numbers of cars = 500

DEVELOPMENT CONTROL RULES

Floor Space Index(fSI) - 8
Marginal open Space
Front - 12m
Side -6m
Height width ratio(slenderness ratio) must not exceed - 1:13.5
(Calculation for slender ratio – height of tower/maximum width of tower)

Open space around the building for the building height above 60m should be 12m

FOLLOWING SHALL NOT BE CONSIDERED UNDER FSI

Areas covered by staircases, lift room, mechanical room, fire room
Lift wells, architectural features, elevated tanks, etc.
Area of fire escape stairways and cantilever fire escape passage
Area of basement parking
Area of mechanical floor and refuge floor
Area of balconies not exceeding above 1.8m

FIRE EVACUATION NORMS

- Refuge area upto 4% of habitable floor is not considered under Fsi
- Fire check floors/brick floor min height -1.8m
- Entrance lobby in stilted floor not exceeding 7.2m
- Area below swimming pool floor shall not decrease 1.5m of clear height
- For buildings above 70m to enclose type staircases each having width of flight not less than 1.8m
- Both the staircases shall open and terminate at ground level or at podium

REFUGE AREA

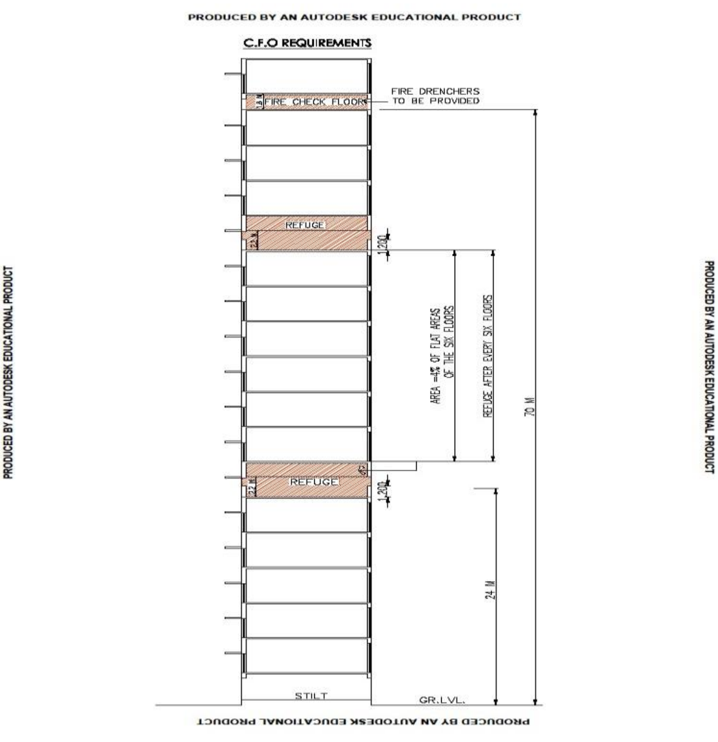
- In case of highrise bldg more than 30 m then first refuge floor shall be Provided at 24 m or first habitable floor whichever is higher. Thereafter at Every seventh habitable floor. If there are six floors or less above the floor where refuge area is provided the terrace floor shall be treated as refuge area.
- A building having height upto 30 m , terrace will be treated as refuge area.
- Refuge area shall be provided at the rate of 4% of the habitable floor Area it serves the floors above and will be free of fsi. Area more than 4% shall have to counted in fsi. Marginal cantilever may be permitted to achieve the area of 4% as stipulated.

FIRE ESCAPE CHUTE

- High rise bldg having height more than 70 m shall be provided with fire escape chute for every wing adjacent to staircase.
- The dimension of the shaft not less than 2.5 m x 1.50 m
- The access shall be done at alternate floor lvl from staircase midslanding with self closing door having fire resistance of at least 1 hr
- it shall be staggered type with landing of each section at the vertical height of not more than 21m.

FIRE CHECK FLOOR

- High rise bldg having height more than 70 m shall be provided with fire check floor (entire floor) at every 70 m level.
- Height of the fire check floor shall be not more than 3.6 m
- The pheriphery of the fire check floor shall not be enclosed.
- Fire drenchers shall be provided at the pheriphery of the each fire check floor externally



PODIUM

- Podium may be permitted in plot admeasuring 1500 sq .Mts or more
- Podium provided with ramps may be permitted upto a height of 24 m from ground level.
- Podium not provided with ramps but provided with 2 car lifts may be permitted with total height not exceeding 9m above ground.
- The podium shall be used for parking
- Podium shall not be permitted in required front open space. Other side
- Can be extended beyond building line as per cfo rules and other sides can be 1.5 m . from plot boundary 50% ground coverage to be restricted for moef.

BASEMENT

- Compartization of basements upto an maximum area of 1125 sq.Mts to be done with a separate staircase for each compartization.

Basement setbacks

- The basement shall not be constructed in the required front open space where the plot is abutting the road
- Open space from other boundaries of the plot shall not be less than 1.5 m In case of tree cutting required on the pheriphery of the plot , then the basement open space from plot to be 3m.
- The minimum height   required below beam is 2.4m
- The maximum height permissible of basement is 3m   without stack parking and 4.2m with stack parking.

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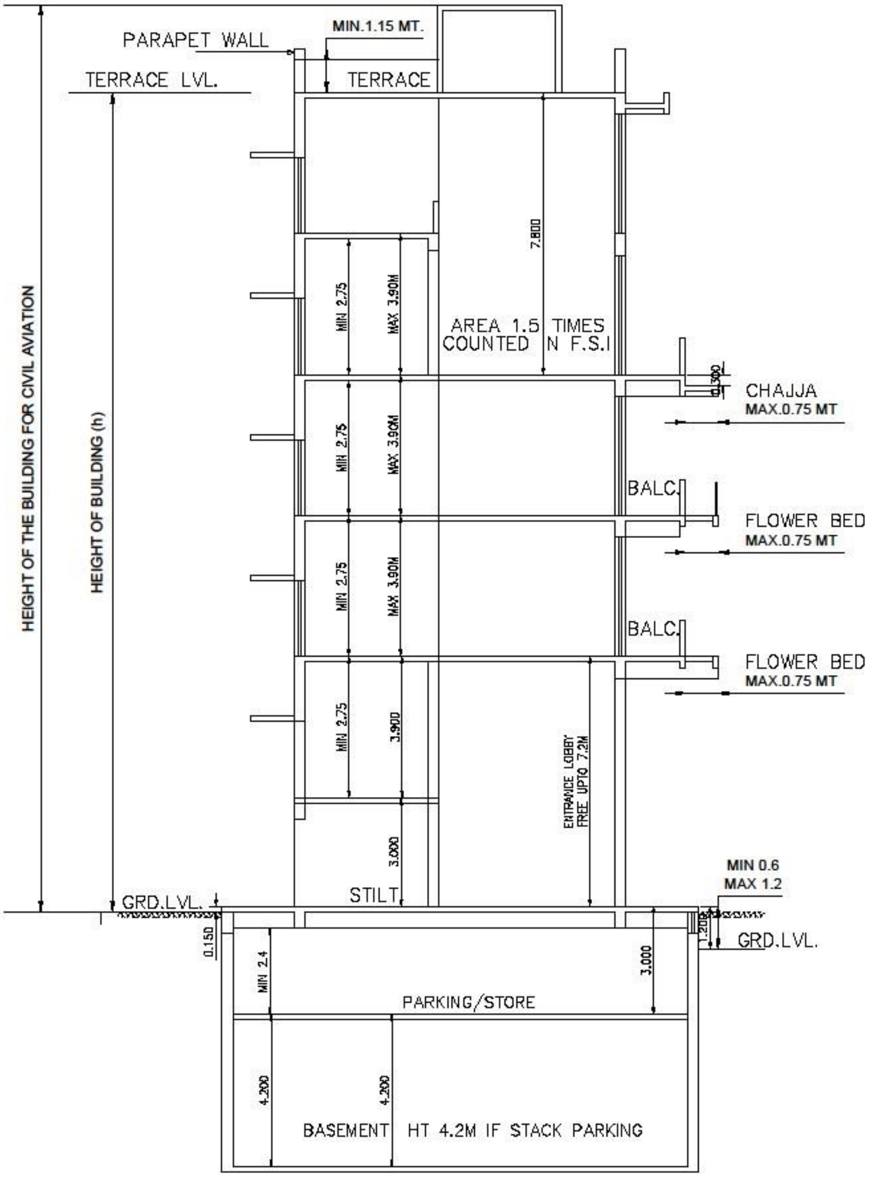
HEIGHT OF HABITABLE RMS. & BASEMENT



SECTION

DEVELOPMENT CONTROL RULES

A. BUILDING NORMS

Minimum Road width for building above 60m is 30.5m
Maximum F.s. 8
Premium F.S.I. 40% of normally allowable FSI
OSR - OPEN SPACE RESERVATION -10% of the plot extent
Maximum plot coverage =
Maximum Height above ground leve is 60m
Further every increase In height of 6m, minimum extent of setback left additionally shall be 1m.
Spacing between blocks WII] be 7m.
Vehicular access within the site 7.2m
Height of basement floor 1, 2m

B, NONFSI 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

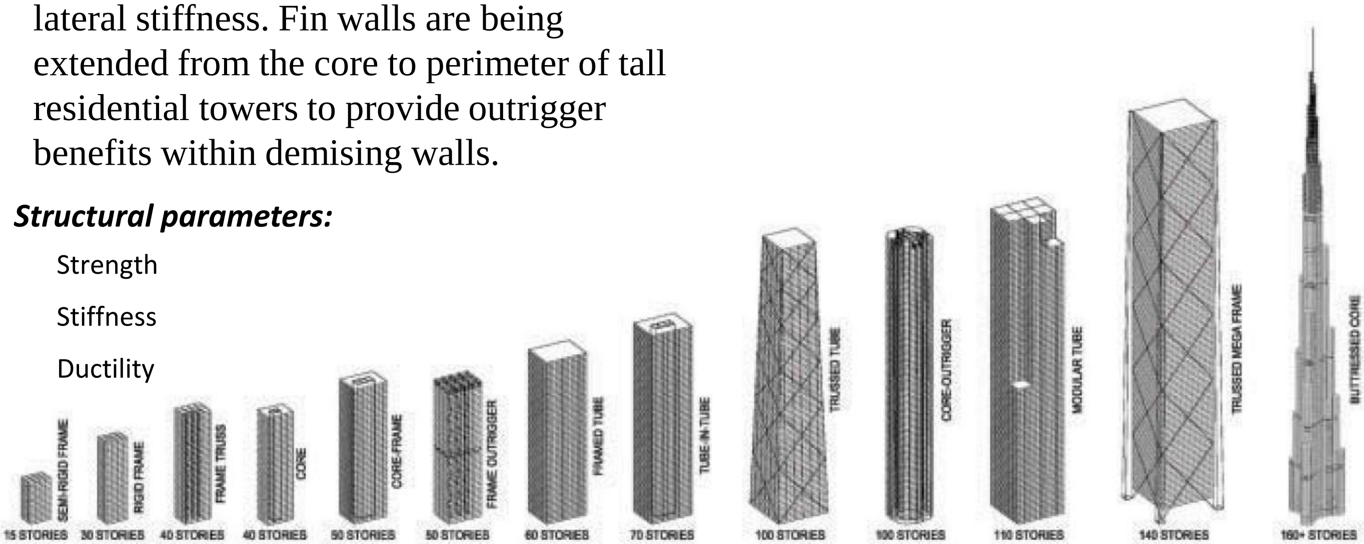
Parking: 1 car space for every 50 sq.m, for shopping / 100 sq-m. for office / 75 sq.m. for flats / 50 sq.m. for hotels. I Two wheeler parking for every 50 sq.m. of shopping/ for every 25 sq.m, of office space / for every 75 sq-m. of flats / for every 50 sq.m, of hotels
Car stall size ; 2.5 x 5.5m / two wheeler 1.0m x 1.8m
Drive way 3.0m for one way / 6.0 m for two —way
Width of entry exit gates - 3m wide
Ramp: ramp gradients I in 8 / turning radius 4.0m

The chart-1, developed by Fazlur khan and published by CTBUH in 1980 optimal height ranges for different structural system . It still applies for many design , although for the tallest towers newer building technology has overtaken it: Outrigger system are used for super tall towers much higher than 60 stories indicated on the chart. This was made possible by stiffness being provided through the use of high –strength concrete shear walls, made economically attractive by the lower relative construction costs of simple steel framing to shear walls compared to moment frames. This approach was made popular by architectural and leasing preferences for wider, column free spaces with open, glassy facades. These designs typically include belt trusses which transfer all perimeter gravity loads to a few massive outrigger columns to minimize their net uplift and extract maximum strength benefits from members used for lateral stiffness. Fin walls are being extended from the core to perimeter of tall residential towers to provide outrigger benefits within demising walls.

Fin walls are being extended from the core to perimeter of tall residential towers to provide outrigger benefits within demising walls. The 2,716 foot(828m)Burj Khalifa is an extreme example, with the central core of a “Y” floor plan buttressed by corridor walls along each leg and demising walls across each leg. Exterior diagrids replace exterior vertical columns and sloping braces with diagonal members that resist both gravity and lateral loads. This differs from the exterior diagonalized tube in the old chart. Dual- functional diagrid members make more efficient use of material but require that members remain elastic in earthquakes: otherwise, both lateral and gravity support would be lost upon member yielding or buckling. The original design for Tameer Tower in Abu Dhabi is a good example.

Structural parameters:

- Strength
- Stiffness
- Ductility



17.5 Tall building systems
Graphic: Skidmore, Owings & Merrill LLP

LATERAL LOAD RESISTING SYSTEM:

1.The tower’s lateral load resisting system consists of high performance, reinforced concrete ductile core walls linked to the exterior reinforced concrete columns through a series of reinforced concrete shear wall panels at the mechanical level.

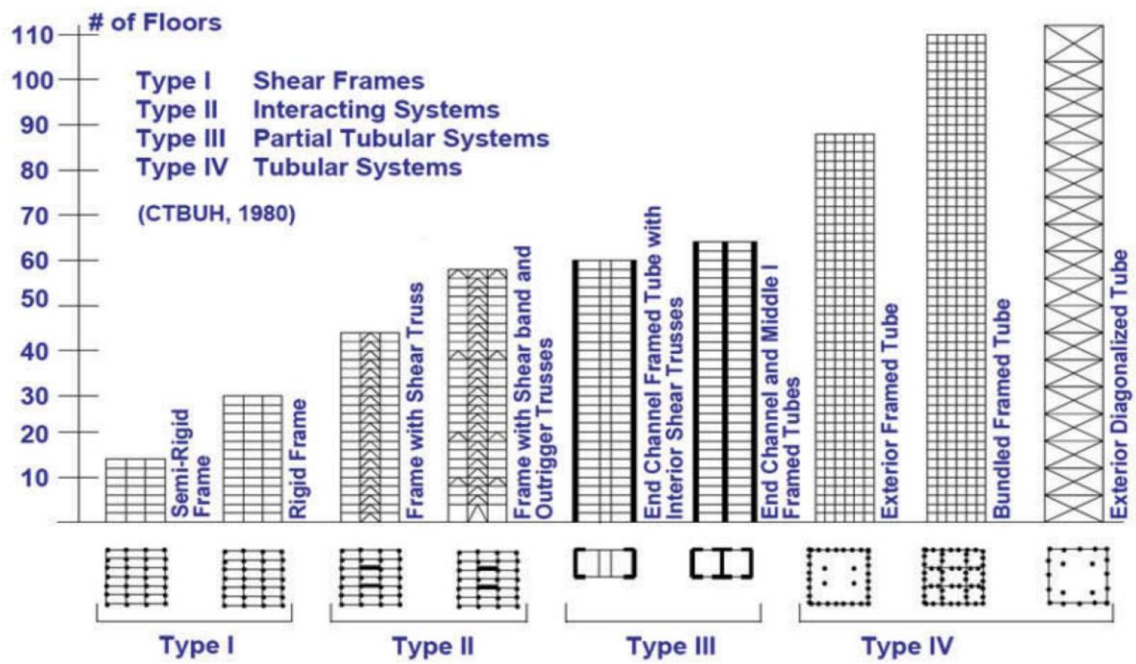
2.The core walls vary in thickness from 1000mm to 800mm.The core walls are typically linked through a series of 800mm to 1100mm deep reinforced concrete link beams at every level.

3.These composite ductile link beams typically consist of steel shear plates ,or structural steel built-up I shaped beams, with shear studs embedded in the concrete section.

4.The link beam width typically matches the adjacent core wall thickness.

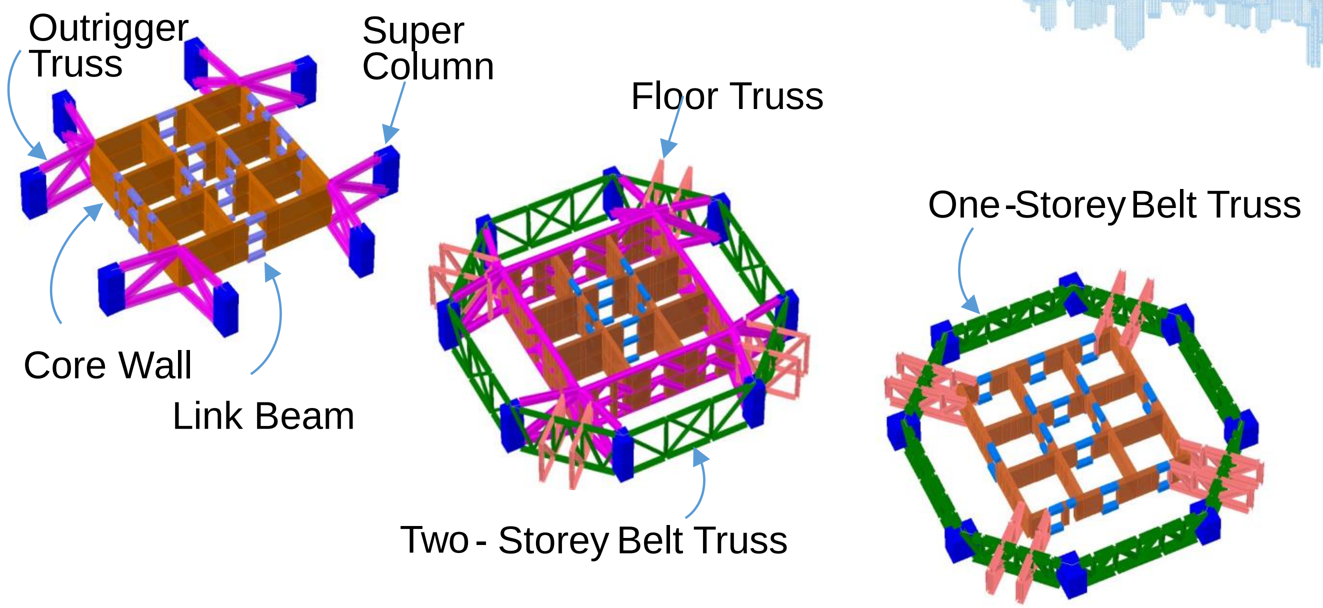
5.At the top of the center reinforced concrete core wall , a very tall spire tops the building. The lateral load resist system of the spire consist od a diagonal structural steel bracing from level 101to the top of the spire at approximately 400meter above the ground.

6.The pinnacle consist of structure steel pipe section varying from 2100mm diameter x60mm thick at the base to 1200mm diameter x 30mm thick at the top.

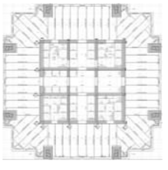


16.9 General limits of structural systems
Graphic: CTBUH

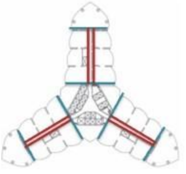
LATERAL RESISTING SYSTEM



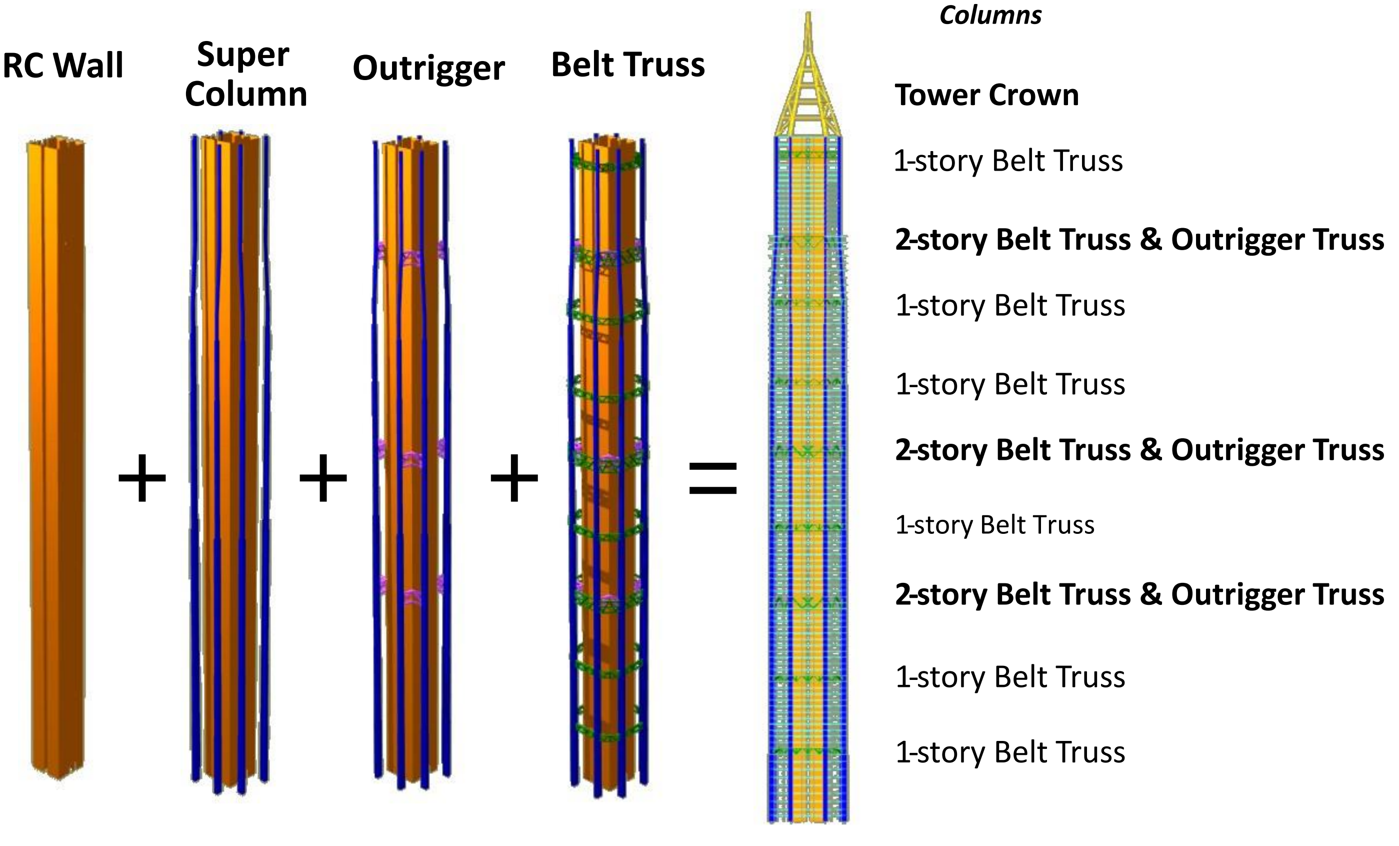
1. Core Wall + Super Column (SC) + Outrigger Truss
2.Core Wall + SC + Outrigger Truss + Belt Truss
3.One-Storey Belt Truss



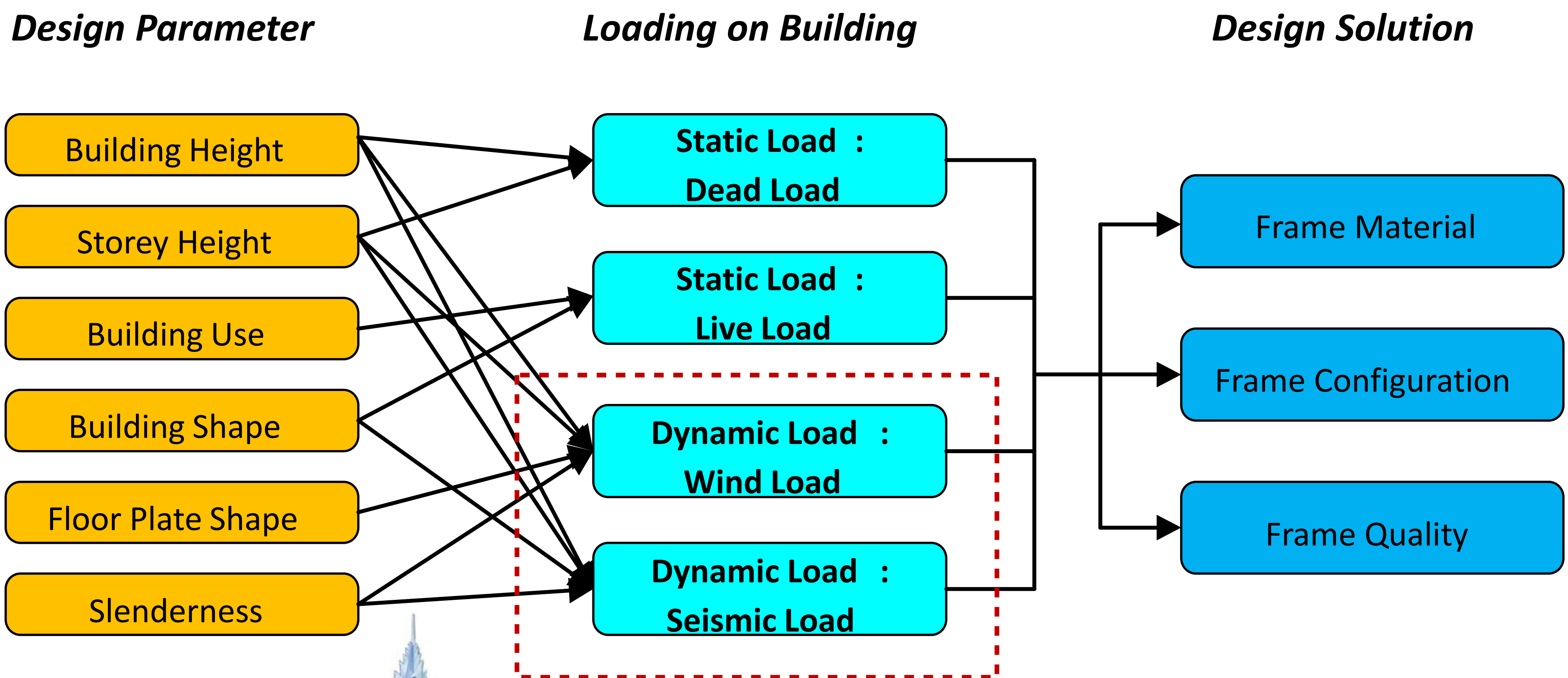
Mega Structure Columns



Buttressed Core



LOADINGS:



Inter -connection within Tall Buildings
(source: Arcadis)

STEEL COMPOSITE FLOOR PANELS

The weight of floor construction is always an issue in tall building design, with lightweight concrete and composite steel solutions having been adopted to reduce the loads that the gravity and seismic load resisting system need to deal with.

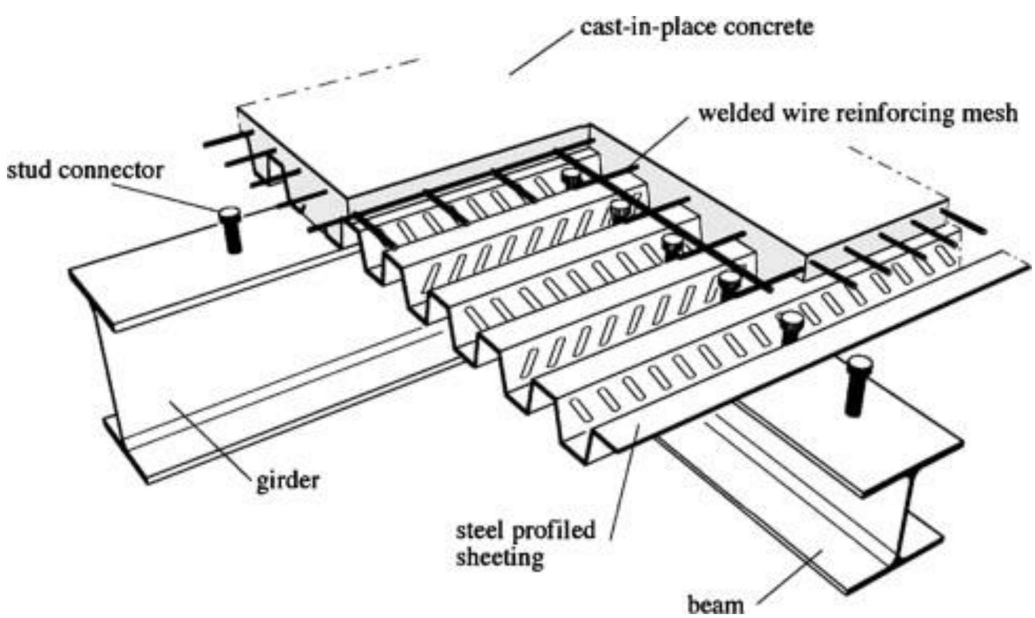
Another form of floor structure which has been used in stadia projects and which has potential benefits for high rise construction in SPS floor system.

SPS structure

conventional stiffened steel

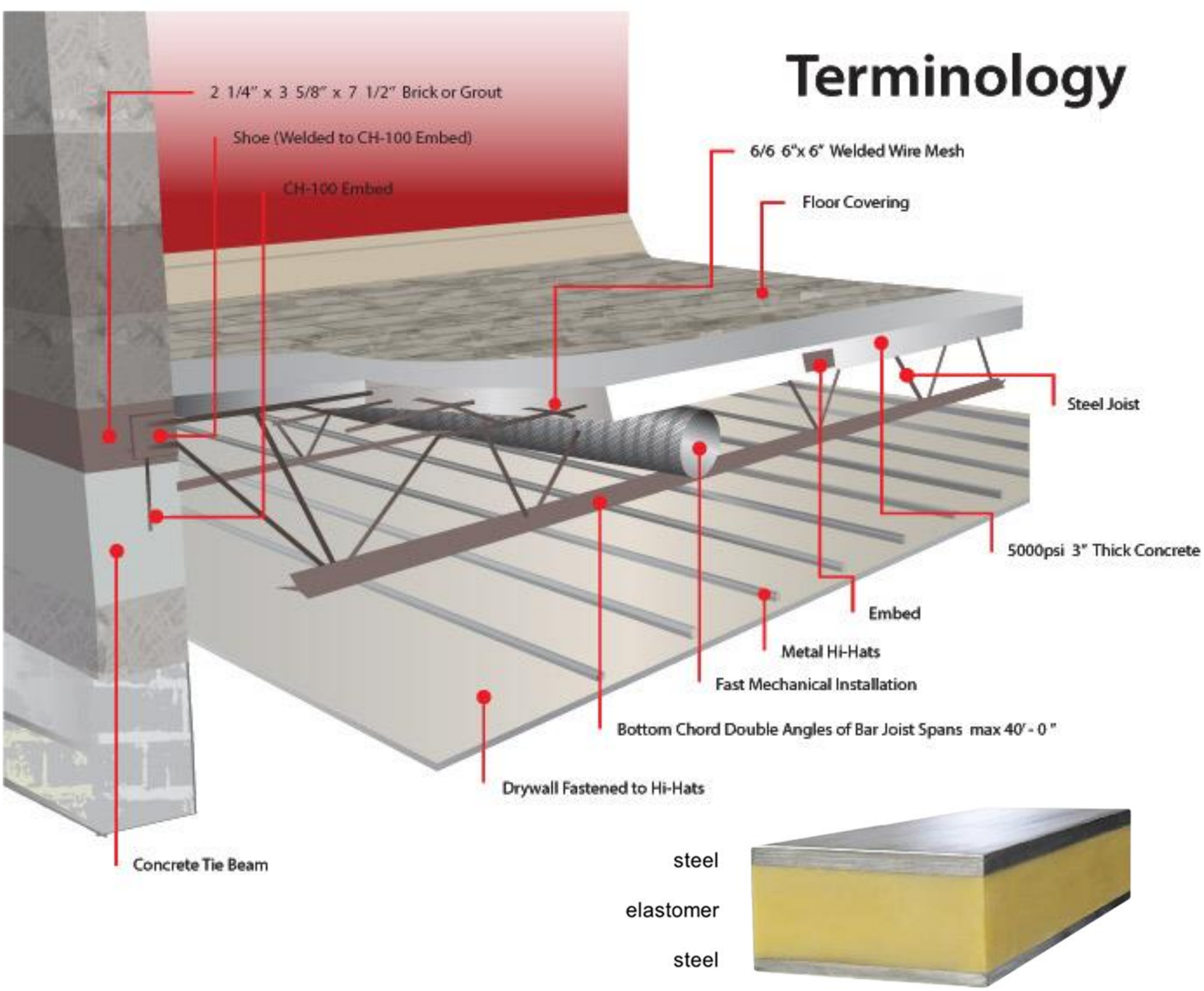
This consist of two steel plants bonded with a polyurethane elastomer core – efficiently a steel composite floor panel. this has the advantages associated with off site fabrication and also reduced weight compared to conventional reinforced concrete floor slab ,particularly for locations where steel buildings are economic and where the self weight is particularly critical. Major properties of the SPS floor system are-

1.SPS floor are 70% lighter, permitting lighter frames and foundations



STEEL COMPOSITE FLOOR PANELS

2. SPS provides diaphragm action. SPS floor comparable structural capacity and stiffness to concrete floor.
3. SPS floor and cores are designed to act compositely with steel frames .The all steel bolted construction with SPS floor are cores provides excellent resistance to seismic loads.
4.SPS panels are prefabricated, highly accurate allowing faster and safer building construction
5.Thiner material can allow additional floor to be built and increase ne lettable are per floor key benefit of SPS floor system is to eliminate concrete above ground level to reduce self load of the building and to minimize the cost and maximise the construction speed.

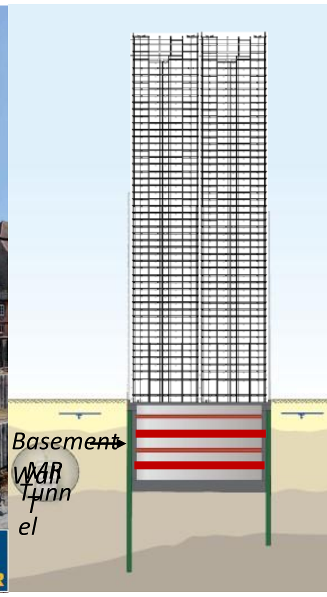


FOUNDATION AND BASEMENT WALL

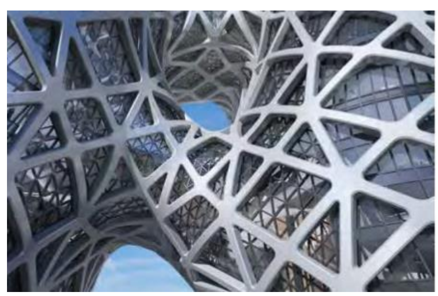
Bored piles are used most often for high rise buildings with some advantages:

•Large carrying capacity based on end bearing and also side friction
•Constructability in almost any site type
•Concrete is cheapest material -Flexible diameter up to 3800 mm

Another Foundation types: Bored pile type with rectangular shape is called **Barrettes**; driven piles, a mat foundation alone or even footing which is depend on the soil properties below the tower







FACADE AS STRUCTURAL ELEMENTS

Basement Wall

***Diaphragm Wall**, **Secant Piles**, **Contiguous Bored Piles** or **Soldier**

***Piles** are used for deep basement excavations

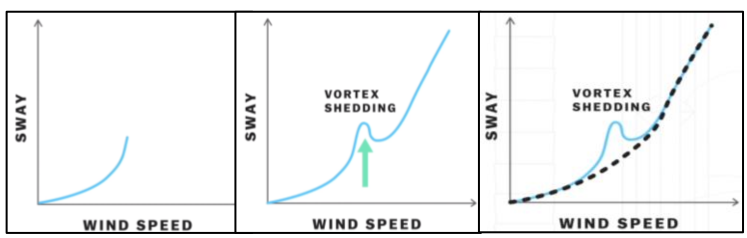
WIND LOAD

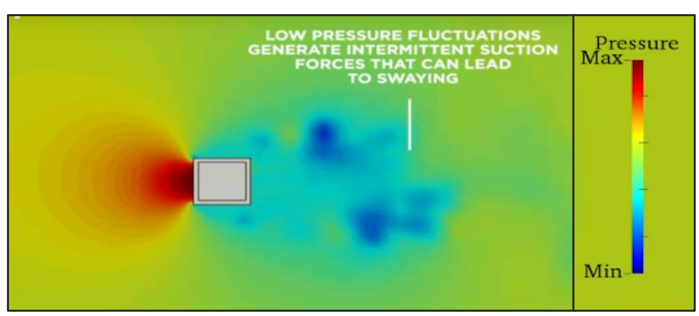
wind load is a special kind of load on buildings, as it is actually capable of creating many types of forces with varied effects based on the height and the shape of the building. the forces consist of shear, twisting, bending and uniform loads. wind exert dynamic and static load on a building, and the major types of loads can be classified into shear, moment and deflection. depending on the shape of the building, different loads will have different degrees of effect on the building.

static loads creates elastic bending and twisting on the building, while dynamic loads creates fluctuating forces all over the structure that creates motions, most commonly oscillations (thus dynamic.) taller, slender structures are impacted more significantly by dynamic wind load.

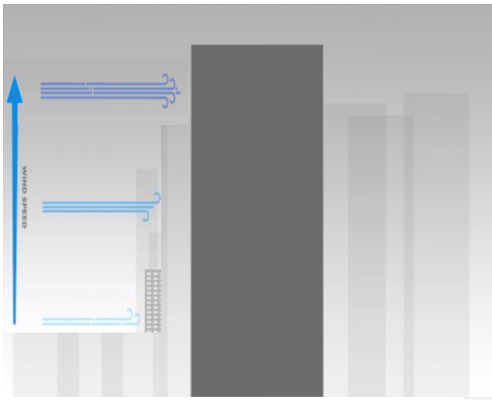
wind torsional moment twists a high-rise on a vertical axis, while bending moment "curls" the building at two ends on two parallel horizontal axis at both ends. shearing wind force pulls the building on two countering directions on two parallel horizontal axis. wind pressure is exerted uniformly on all the faces on the building, just as conventional pressure, with exception for the wind-ward side which is affected differently based on the height..

vortex shedding happens when wind hits a structure, causing alternating vorticies to form at a certain frequency. the frequency of the vortices is dependent on the shape of the blunt body, and the velocity of the fluid flow or wind hitting this body. the vortices create low pressure zones on the downwind side of the object on alternate sides. as the fluid flows to fill the low pressure zone, it produces a vibration at a specific calculable frequency. this vibration is only a major concern if it happens to coincide with the natural frequency of the structure. for structures that are tall and uniform in size and shape, the vibrations can be damaging and ultimately lead to fatigue failure.

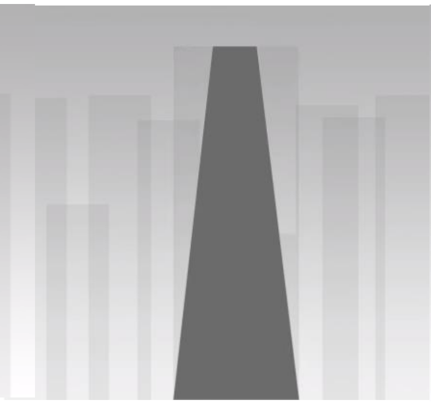




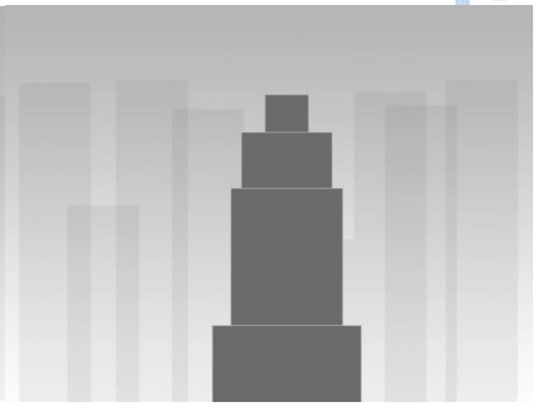
WIND LOAD DESIGN SOLUTION



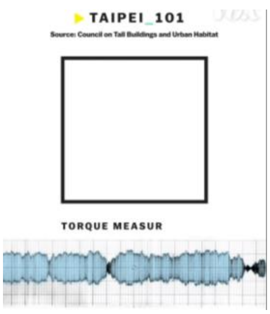
AT HIGHER ALTITUDE
WIND LOAD INCREASES

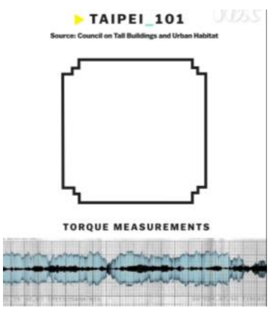


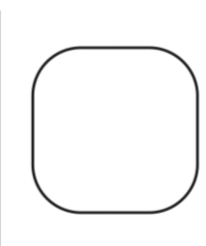
TAPERING



As it is taller. higher up you build, the stronger the wind forces gets so, to reduce the vortex shedding we should reduce surface area where the wind is stronger and make the building skinnier.



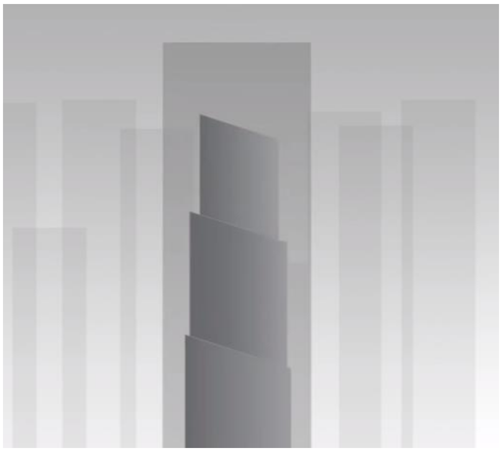




SOFTENING OF THE EDGES

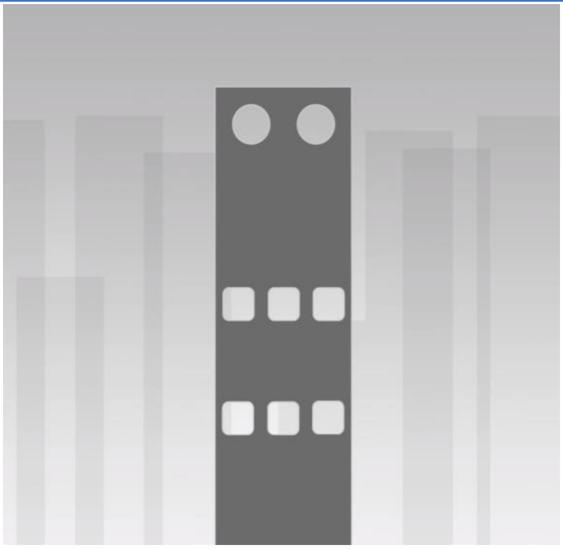
SHARD,LONDON

WILLIS TOWER,CHICAGO



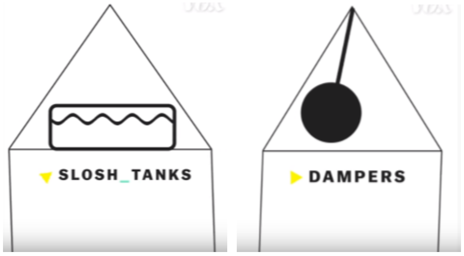
Twisting is a wind resistance technique. Dynamic spirals redirects the wind, guiding it upward and off the building. twist reduces wind load by 24% and also the use of structural material.This wind resistance trick was used in industrial chimney and car antennas.

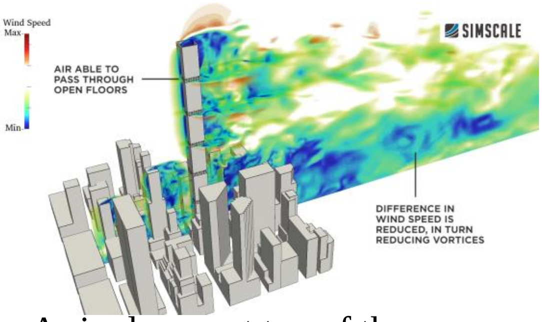
WIND LOAD DESIGN SOLUTION



OPENINGS IN BUILDING REDUCE VORTEX SHEDDING

BAHRAIN WORLD TRADE CENTER





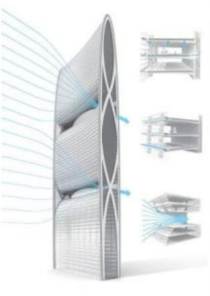
A single gap at top of the building allows the wind to bleed right through where the blow is strongest

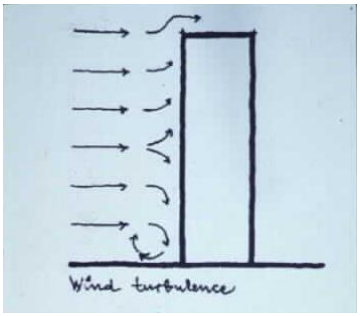
432 PARK AVENUE, NEW YORK

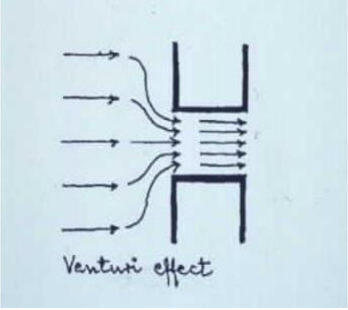
dampers are mechanised design to absorb the energy from a building's movement counteracting the effect of the wind.

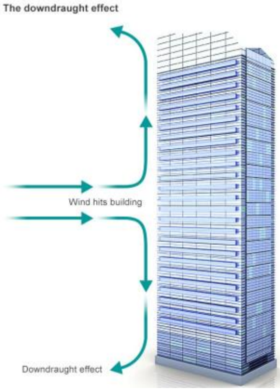
1)**slosh tank-** containers filled with several tons of water.the water sloshes back and forth and its weight displacement keeps the building from swaying.

2)**tuned mass dampers-**massive weight is suspended in the middle of the building









as downdraught happens most where buildings are square-on to wind & where buildings stand face-on to the prevailing wind there is also an acceleration of wind around the side of the buildings if it has completely square corners. As long ago as 1983 in new york, engineering consultant lev zetlin called for laws to counteract the effects of buildings on street wind.

if several towers stand near each other, there is an effect known as "channelling", a wind acceleration created by air having to be squeezed through a narrow space. this is a form of the venturi effect.

WIND LOAD RESISTANCE:

APPLIED STRETERGIES TO REDUCE LOAD:

1.Varying the building shape along the height while continuing with out interruption, the building gravity and lateral load resisting system.

2.Reducing the floor plan along the height , thus effectively tapering the building profile.

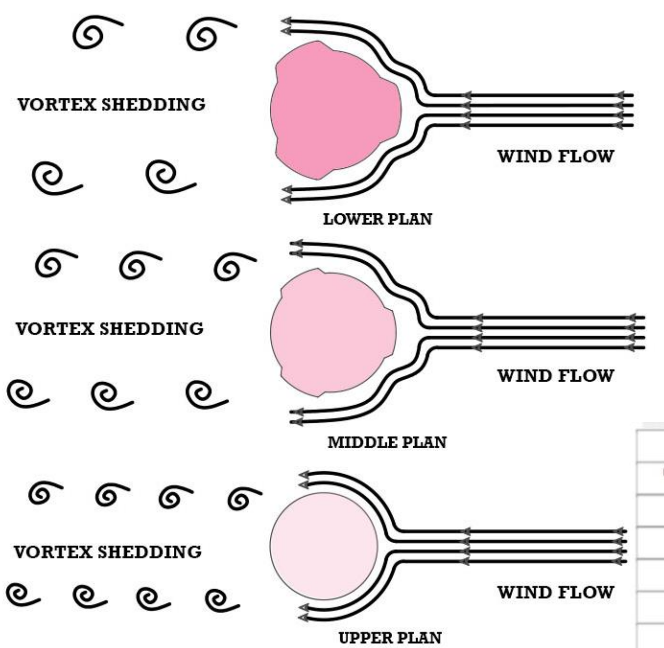
3.Using the building shapes to introduce spoiler type of effects along the entire height of the tower, including the pinnacle ,to reduce the dynamic wind excitations.

4.The orientation of tower in response to wind directionally, thus stiffening the structure normal to the worst wind direction.

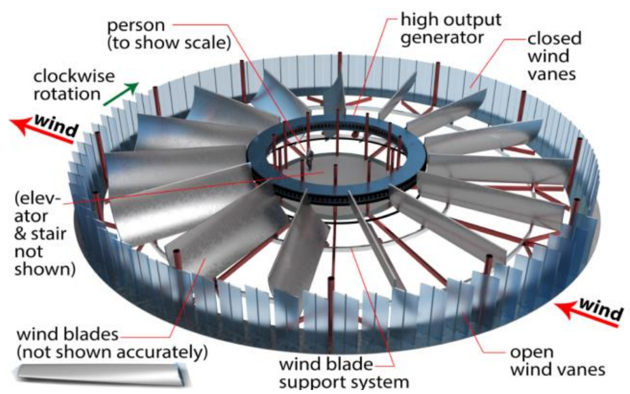
VORTEX SHEDDING

- Another phenomenon which affects the design of a tall building is **vortex shedding**.
- Tall buildings are bluff bodies and when the wind blows against the building **vortices** are created which result in an alternating force perpendicular to the wind direction
- When vortex shedding frequency approaches the natural frequency of the building resonance occurs.
- When the vortex shedding phenomenon takes place along a large part of the height of the building it can result in large forces and amplitudes.

WIND TURBINE INTEGRATED BUILDING



DISORGANIZED VORTEX SHEDDING BEHAVIOR



Rotor Size and Maximum Power Output	
Rotor Diameter (meters)	Power Output (kW)
10	25
17	100
27	225
33	300
40	500
44	600
48	750
54	1000
64	1500
72	2000

Table 3-10: Expect payback time of wind turbines [50]

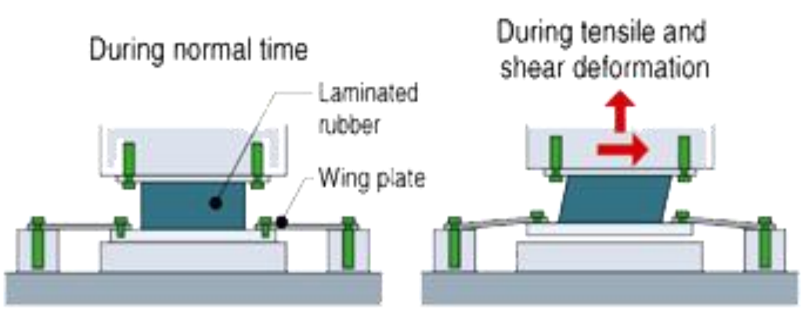
Turbine type	AEP (kWh)	Economic payback time (Year)	Carbon payback time (Year)
3 kW	5460 - 9800	5 - 11	0.4 – 0.7
5kW	10920 - 21100	4 - 10	0.2 – 0.4
10 kW	18200 - 41800	3 - 9	0.1 – 0.2

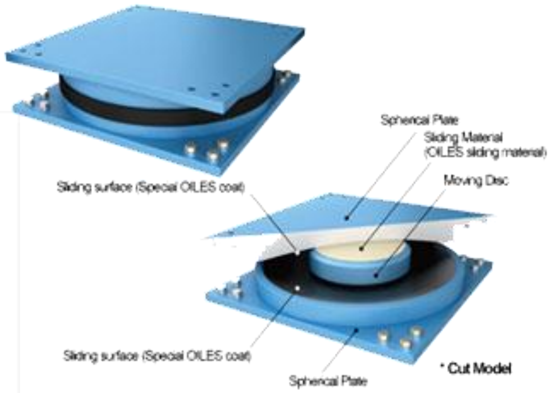
Through its position in aerodynamic design of the tower,the prevalling on shore breezeis funnled into the path of turbines, 17openings provided above every mechanical floor.
The wind turbine will deliver approximately 25 -30%of the energy needs of the bulding.2000 to 2300mgh per year enough to light 400 homes for over a year. Doubling the wind speed delivers 8 times the power

EARTHQUAKE RESISTANT STRUCTURE

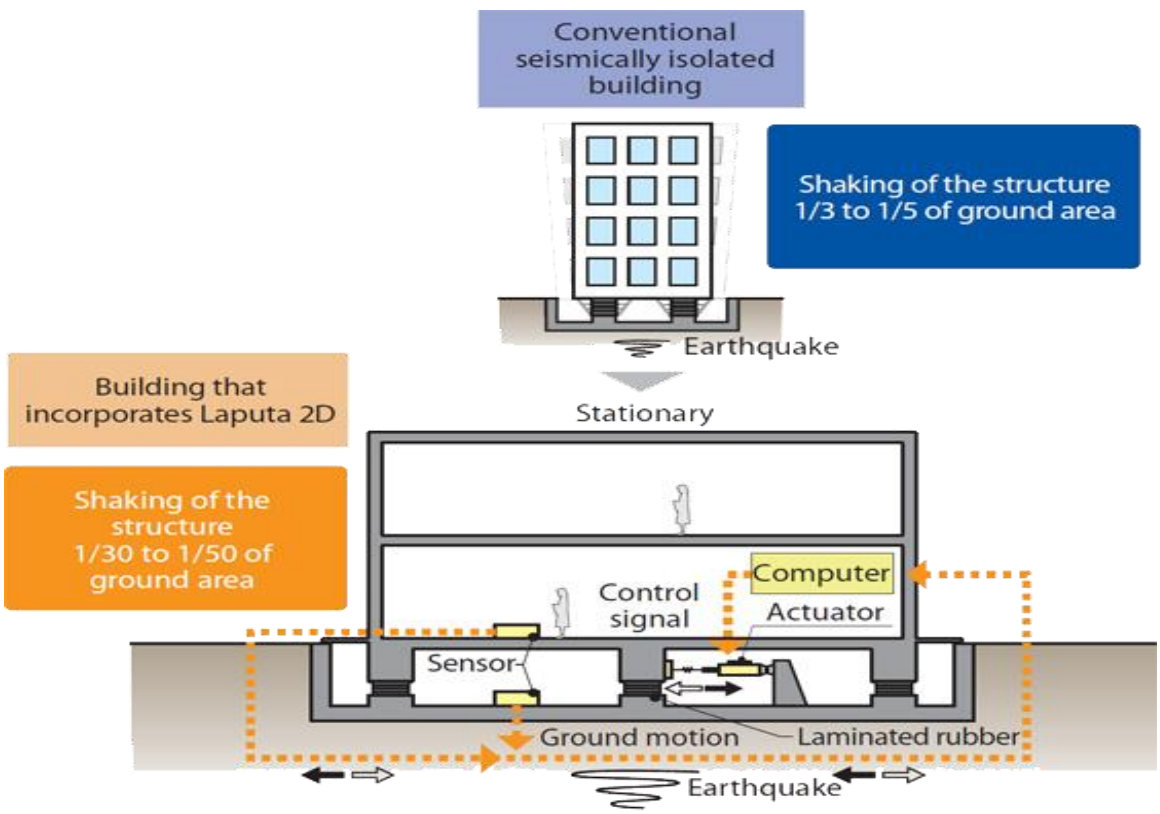
Base insolation, also known as sesmic base isolation or base isolation system,is one of the most popular means of protecting a structure agaisnt earthquake forces. it is a collection of structural elements which should substantially decouple a super structure from its substructure resting on a shaking ground thus protecting a building or non building structure’s integrity.

Base insulationalso known as sesmic base insolation system, is one of the most popular means of protecting a structure against earthquake forces.

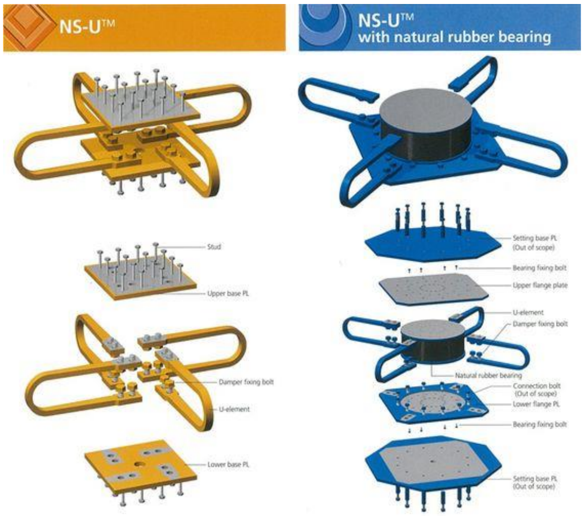




Flat Friction pendulum section cut

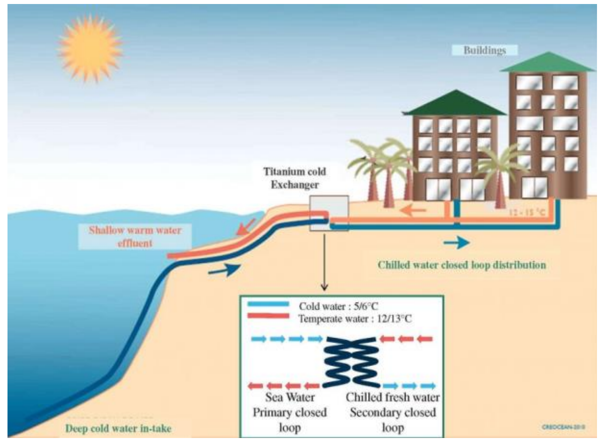


EARTHQUAKE RESISTANT STRUCTURE



Sesmic resistivity of tall buildings is of prime importance. But the structural frame work is required to ensure this often poses problems in architectural effects. and in realizing wide views from the building .the super flex wall frame system ensure excellent earthquake resistance with fewer limitations by the columns and beam.

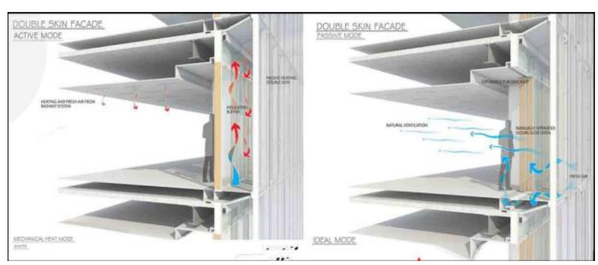
SEA WATER AIR CONDITIONING



seawater air conditioning (swac) takes adavntage of available deep cold water from the ocean. a river or lake to replace conventional ac systems. such a system can also utilize cold sea water as the cold source.

swac feasibility studies indicate that electrical consumptions is typically reduced by 80-90%. simple payback can be from three to seven years, and long term costs can be half that of conventional air conditioning system.

DOUBLE SKIN FACADE



The cavity between the two skins may be either naturally or mechanically ventilated. in cool climate the solar gain with in the cavity may be circulated to the occupied space to offset heating requirements. while in hot climate the cavity may be ventilated out of the building to mitigate solar gain and decrease the cooling load.

What is Diagrid Structural System?

The diagrid structural system can be defined as a diagonal members formed as a framework made by the intersection of different materials like metals, concrete or wooden beams which is used in the construction of buildings and roofs.
Diagrid structures of the steel members are efficient in providing solution both in term of strength and stiffness. But nowadays a widespread application of diagrid is used in the large span and high rise buildings, particularly when they are complex geometries and curved shapes

1. Diagrid Optimal Angle

The diagonal member of the diagrid carries both shear and moment. So the optimal angle of placing of the diagonals is dependent of building height. The optimal angle of the columns for maximum bending rigidity in the normal building is 90 degree and for the diagonals for shear rigidity is 35 degree. It is assumed that the optimal angle of the diagrid falls in between the both. Usually adopted range is 60 -70 degree. As the height of the building increases the optimal angle also increases.

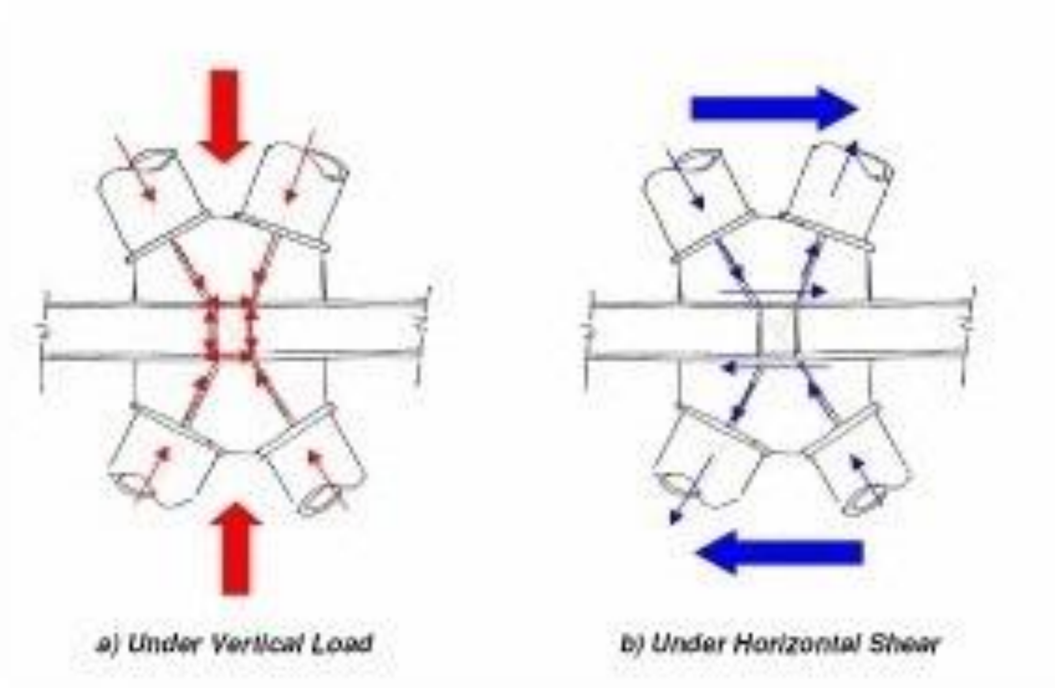
2. Diagrid Module Dimensions

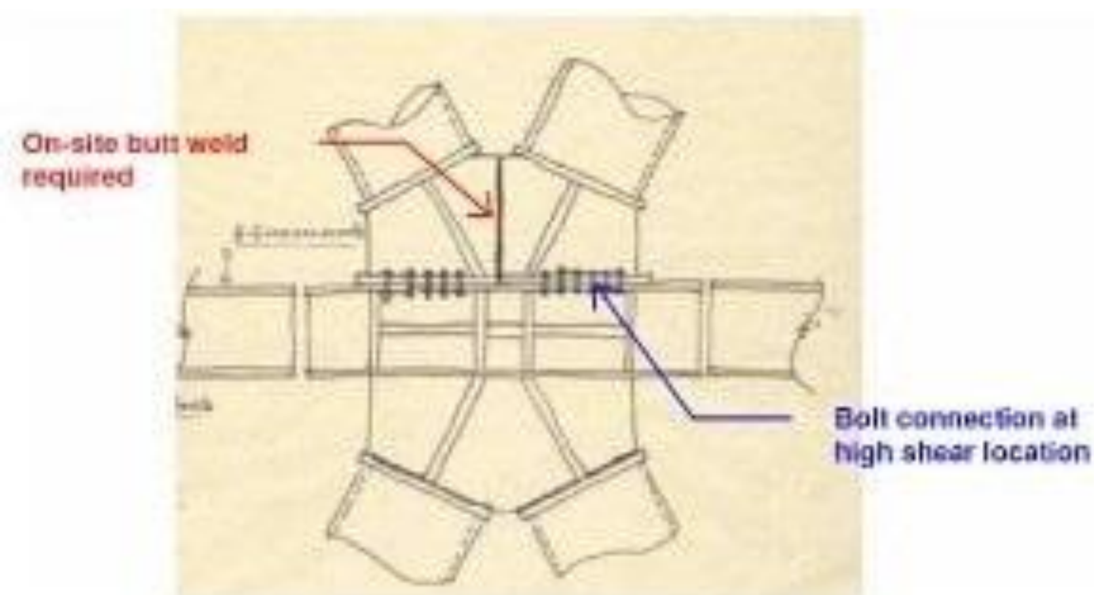
The module dimensions are majorly two:
1.Height: The height of the diagrid depends on the number of floors stacked in one module of diagrid. The common number of floors stacked for module of the diagrids are 2 to 6.
2.Base of the module: The base on which the diagrid is formed usually depends on the height and the optimal angle of the diagrid

Diagrid Structural System Node Design

The nodes are the important part of the design of the diagrid system. All the diagonal sections are connected to each other by the help of nodes. These nodes are designed for two types of loads, vertical load and horizontal shear. These nodes are joined to the other sections by welding or bolting.
It is made sure that very less amount of weld is to be used in the joining. The vertical load is transferred in the form of axial loads from the diagrid members that are placed above the nodes to the gusset plate and stiffeners, then to the diagrid members below the nodes.
The horizontal shear is also in the form of axial loads in the diagrid above the nodes, but here one is in compression and another is in tension. The transfer of load is from above the node member to the gusset plate and stiffener and then from gusset plate and stiffener to the members below the node in pair of compression and tension.

Due to this load transfer path, the shear forces developed at the location of bolt connection is very high under the time of lateral loads. This may be the shear zone or weak zone of this structure during the earthquakes, the designing of the bolt connections is to be done carefully.





The materials that are used in the diagrid construction are based on the following factors.
1.Availability of material
2.Erection time
3.Flexibility
4.Durability
5.Unit weight of the material
6.Labor cost
7.Lead time
8.Fire resistivity

Advantages and Disadvantages of Diagrid Structural System

Advantages of Diagrids

The advantages of the diagrid in the construction of the structure majorly improves the aesthetic view of the building. The use of diagrid reduces the steel up to 20% compared to brace frame structure. It doesn't need technical labor as the construction technology is simple.

The diagrid makes the maximum use if the structural material is used. When glass material is used with the diagrid, it allows generous amount of light inside the structure. These structures have majorly column free exterior and interior, free and clear, unique floor plans can be implemented.

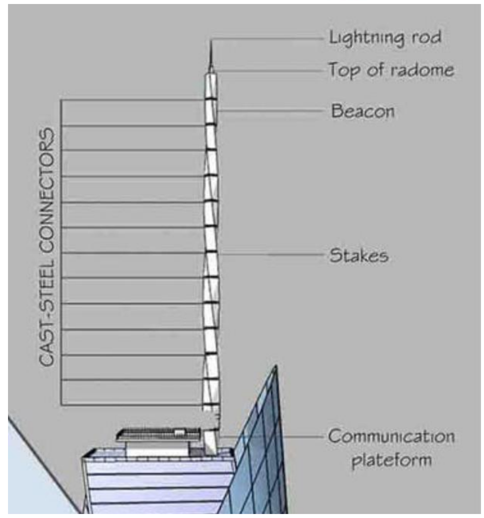
Disadvantages of Diagrids

The major disadvantages of diagrid system are that it is still not completely explored. This construction needs a skilled labor and the present crew has no idea or the experience in installing diagrids. As the diagrid completely takes over the aesthetic appearance of the building, the design is limited only to diagrid.

The common language of floor to floor design is effected as a single diagrid stacks over 2 to 6 floors in it. Only high rise building can install diagrids. If diagrids are not properly designed or installed, it effects the economy and safety of the structure.

What's the Purpose of Spires on Skyscrapers

A large number of skyscrapers have spires built on the top, particularly in some cities like New York City, Dubai, Chicago, etc., in which buildings with spires are more commonly seen. Many of these skyscrapers are among the tallest buildings in the world, like Burj Khalifa, One World Trade Center, Taipei 101.



1.Increase height

Adding spire is a cheaper way to increase height of the building, the cost for a skinny mast is much cheaper than solid concrete core and habitable floor. Developers build skyscrapers is not only for its functionalities, they also want their buildings higher than others, so that to show prestige and draw more attention.

The developer of Shanghai World Financial Center had ever intended to build spires atop the building to make it higher than Taipei 101, so that their building will become the tallest building in the world by any measurement by that time. However the plan was not permitted by the local authorities due to the concern of aesthetic aspects.

In 2017, US Bank Tower's title of tallest building in Western America being replaced by Wilshire Grand Center is all because of the spire on the latter building. Wilshire Grand Center's spire makes it taller than US Bank Tower, which has a higher roof.

2. Ornamental purpose

Most skyscrapers have spires installed on the top is for ornamental purpose. For many buildings, spire is a necessary architectural element, these skyscrapers will look weird once the spire is removed, for example, what would it be if the Chrysler Building had no spire built on it? It would appear incomplete and kind of strange Other buildings, like Petronas Towers, Taipei 101,featuring spire at top is all because of the same reason.

3. Lightning rod

Besides the aesthetic purpose, spires can function as lightning rod, for this every tallest cathedral constructed in Middle Age has a distinctive spire built on the top.However, being the lightning rod is not the main purpose of spires, today rods do not need to be built in the shape of a distinctive spire any more. It can be seen that many tallest buildings in the world don’t have spire-like rods, they can still withstand lightning strikes, some noted examples are Ping An Finance Center(a tower originally designed to have a spire, but removed later in response to the aviation law), Goldin Finance 117, Lotte World Tower.

4. Broadcasting

Antennas and masts can be used for broadcasting radio waves or television signals. Buildings like Willis Tower and Empire State Building all have signal transmitters installed on their antennas.

SERVICES CORE

ARCHITECTURAL AND STRUCTURAL REQUIREMENTS ARE THE BASIC DECISION MAKING PARAMETERS IN THE DESIGN OF HIGH RISE BUILDINGS , AND DEDICATE THE FLOOR SLAB SIZE AND SHAPE,LEASING DEPTH ,STRUCTURAL FRAME ,FLOOR TO FLOOR HEIGHT VERTICAL TRANPORTATION AND CORE LAYOUT .

THE RELATED FINDINGS OF THE SELECTED BUILDINGS FROM THE WORLD ARE PRESENTED AND DISCUSSED BELOW.

HYPOTHESIS

SERVICES CORE DESIGN CAN MAKE A BUILDING EARTHQUAKE RESISTANT.

AIM

TO STUDY THE IMPORTANCE OF SEVICE CORE IN BUILDING IN BUILDING IN TERMS OF STRCUTURAL STABLITY & TO STUDY THE SERVICE CORE DESIGN IN SEISMIC ZONE.

FUNCTION

SERVICE CORE PROVIDES STRUCTURAL ELEMENT
FOR GRAVITY & LATERAL LOAD & PROVIDE STIFFNESS TO RESTRICT DEFLECTION & ACCELERATTION TO ACCEPTABLE LEVELS AT TOP OF BUILDING.

ANALYSIS OF CORE

THE RELATED FINDINGS OF THE SELECTED BUILDINGS FROM THE WORLD ARE PRESENTED AND DISCUSSED BELOW.

THE CORE OF THE BUILDING COMPRISE ALL OF THE VERTICAL CIRCULATION ELEMENTS SUCH AS ELEVATORS ,FIRE STAIRCASE ,MECHANICAL SHAFTS,TOILETS, AND ELEVATORS LOBBIES.

- TRYING THE BUILDING TOGETHER TO ACT AS UNIT
- TO MAXIMIZE FLEXIBLITY IN LAYOUT
- SHEAR WALL SYSTEM TO PROVIDE NECESSARY LATERAL STABLITY FO THE BUILDING.
- RESIST LATERAL FORCES FROM ANY DIRECTION CARRIES GRAVITY LOADS

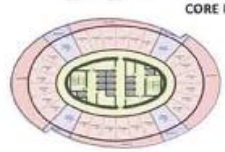
ELEMENTS

ELECTRICAL & TELEPHONE
PIPING AND RISERS
TRANSPORTATION
FANS ROOM
TOILETS

TAIPEI 101
CENTRAL CORE

BURJ DUBAI
CENTRAL CORE

MENARA MESINIAGA
(SIDE CORE)



SUPER NOVA
(CENTRAL CORE)

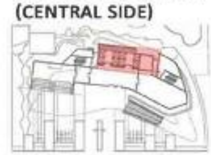
DELHI-ONE (OFFICE)
(CENTRAL SIDE)

PETRONAS TOWER
(CENTRAL CORE)

EMPIRE STATE
(DISTRIBUTED CORE)

DELHI -ONE
(CENTRAL CORE)

MILLENIUM TOWER
(SIDE CORE)



SPIRAGE TOWER
(SIDE CORE)

INFRENCE

CENTRAL

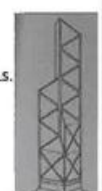
ADVANTAGES
- ALLOWS ALL WINDOW ALL WINDOW SPACE TO BE UTILIZED AS RECEIVE NATURAL LIGHT
- SIMPLIFIES AREA DIVISION & PROVIDES GOOD FLEXIBILITY FOR TENANT- HORIZONTAL UTILITY EQUIDISTANT FROM THE CORE & IDEAL FOR OFFICE LAYOUT

DISADVANTAGES
THE CENTRAL INTERIOR LOCATION LIMITS THE DEPTH OF OFFICES IN THE MID-ZONE OF EACH FLOOR
IT REQUIRES AN ACCESS CORRIDOR AROUND ITS PERIMETER

OFF CENTER

ADVANTAGES
MORE FLEXIBILITY IN MAXIMUM DEPTH AND ARRANGEMENT OF SPACES AFFORDS THE OPPORTUNITY OF DEVELOPING SMALL SECLUDED SPACE IN THE RELATIVELY NARROW PORTION OF THE FLOOR PLAN WHERE THE CORE IS CLOSES TO THE EXTERIOR WALLS.

DISADVANTAGES
PRESENT SOME PROBLEMS OF ACCESS
LESS FLEXIBILITY OF TENANT DISTRIBUTION
REMOTE AND THUS LESS CONVENIENT TO THE FAR SIDES AND CORNERS OF THE BUILDING
LESS LIGHTED SPACE WITH RESPECT TO CENTRAL CORE

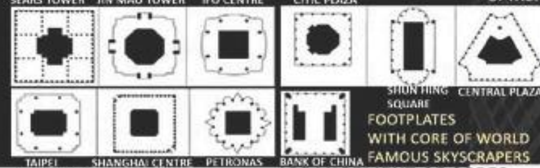


OBJECTIVES

- TO STUDY THE FUNCTION & PLACEMENT OF SERVICE CORE.
- TO IDENTITY TYPES OF SERVICES
- STRUCTURAL & CONSTRUCTIONAL ASPECTS
- TO STUDY THR REQUIREMENT OF BUILDING DESIGN IN SEIMIC ZONE .

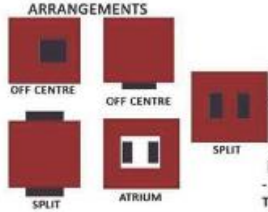
SCOPE

- TO STUDY THE REQUIREMENTS OF BUILDING IN SEISMIC ZONE .
- ARE SERVICE CORE LOCATION MEETING THE REQUIREMENT OF SEISMIC ZONE

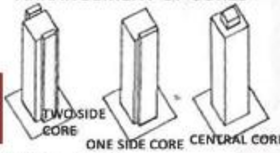


FOOTPLATES WITH CORE OF WORLD FAMOUS SKYSCRAPERS

COMMON CORE ARRANGEMENTS



ARRANGEMENT OF CORES



INTERFRENCE

- CORE PLACEMENT DEPENDS ON BUILDING TYPE
- ENERGY EFFICIENCY MAJORLY DEPENDS ON CORE LOCATION

METHODLOGY

THE FIRST PHASE- COLLECTION OF LITREATURE REGARDING SERVICE CORE.

THE SECOND PHASE - COLLECTION OF DATA ABOUT SERVICE CORE THROUGHCASE STUDIES & LITERATURE STUDIES OF DIFFERENT BUILDINGS.

THE THIRD PHASE - CONSISTING OF ANALYSIS & COMPARISON BETWEEN CAE STUDY ,THIS WILL LEAD TO FINAL FINAL LISTING OF FACTORS REGARDING SERVICE CORE

DATA ANALYSIS OF FAMOUS BUILDING

	Name of Building	City	Year of Completion	Height (m)	Number of Floors
WORLD	Taipei 101 Tower	Taipei	2004	509	101
	Shanghai World Financial Center	Shanghai	2008	492	101
	Petronas Tower 1-2	Kuala Lumpur	1998	452	88
	Sears Tower	Chicago	1974	442	110
	Jin Mao Tower	Shanghai	1998	421	88
	Two International Finance Center	Hong Kong	2003	415	88
	CITIC Plaza	Guangzhou	1997	391	80
	Shun Hing Square	Shenzhen	1996	384	69
	Central Plaza	Hong Kong	1992	374	78
	Bank of China	Hong Kong	1989	367	70

	Name of Building	GFA (m²)	NFA (m²)	Space Efficiency (%)	Interior Columns: Single	Interior Columns: Multiple
WORLD	Taipei 101 Tower	2650	1920	72	No	
	Shanghai WFC	2500	1750	70	No	
	Petronas T. 1-2	2150	1290	60	No	
	Sears Tower	4900	3780	77	Yes	
	Jin Mao Tower	2800	1940	69	No	
	Two International Finance Center	2800	1904	68		Yes*
	CITIC Plaza	2230	1500	67	No	
	Shun Hing Square	2160	1450	67	No	
	Central Plaza	2210	1460	66	Yes	
	Bank of China	2704	1865	69	No	
	Average			68.5		

INFERENCE

Number of Stories	Efficiency (%)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

1) SHAPE OF CORE
2) NUMBER OF CORE
3) LOCATIO OF CORE
4) GEOMETRY OF CORE
5) ARRANGEMENT OF CORE

	Name of Building	Number of cores	Location of core: [illegible]	Location of core: [illegible]	Core integrity: Yes	Core integrity: No	Core Area (m²)	Core/GFA (%)
WORLD	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]		[illegible]		[illegible]	[illegible]
	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]		[illegible]		[illegible]	[illegible]
	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]			[illegible]	[illegible]	[illegible]
	[illegible]	Single	[illegible]		[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]

	Name of Building	Leasing Depth (m)	Floor-to-floor height (m)	Floor-to-ceiling height (m)	Structural [illegible] material
WORLD	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	[illegible]	[illegible]	[illegible]	[illegible]	Reinforced concrete
	[illegible]	[illegible]	[illegible]	[illegible]	Composite
	Average	[illegible]	[illegible]	[illegible]	

CONCLUSION

SEARS TOWER HAVE MAXIMUM EFFICIENCY WHICH IS 77%SO WE TRY TO DESIGN IN SUCH A WAY TO ACQUIRE MAXIMUM EFFICIENCY.

SERVICE CORE DESIGN CAN MAKE A BUILDING EARTHQUAKE RESISTANT

CENTRAL CORE & SIDE CORE IS PREFERRED OVER HYBRID CORE & DISTRIBUTED CORE IN SEISMIC ZONE

PLUMBING SYSTEM IN SUCH A WAY THAT EVERY 10-15 FLOOR HAVE SEPREATE STACK SYSTEM & FIRE FIGHTING SYSTEMS HAVE PROPER DISTRIBUTION WITH PRESSURE CONTROLER AT MECHANCAL FLOOR.

CORE IN BRACING STRUCTURE CAN CARRY GRAVITY & HORIZONTAL LOAD.

TYPES OF CORES

LAYOUT OF THE CORE IS CRITICAL TO THE DEVELOPEMENT EFFICEINCY OPERATIONAL EFFECTIVNESS OF HIGH RISE BUILDING PROVIDE SHEAR WALLS THAT PROVIDE LATERAL STABLITY.

ARRANGEMENT OF CORES
1) OUTER STRUCTURE
ADVANTAGE - PERIMETRE FOR LIGHT & VIEW
2) BUILDING WITH CORE ON ALL SIDE
ADVANTAGE - HOMOGENEOUS WORKPLACE

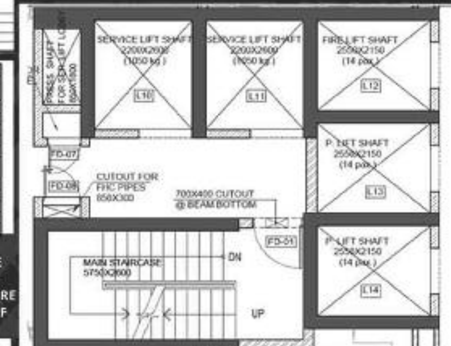
MATERIAL FOR CORE

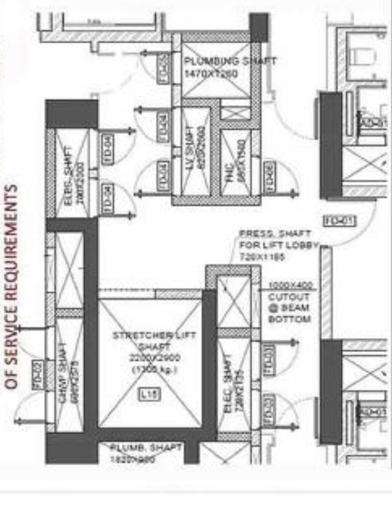
REINFORCED CONCRETE

- LARGE NET TENSION FORCES EXIST CAN NEGATE THE INHERENT EFFICIENCY OF CONCRETE IN COMPRESSION RESISTANCE WALLS BECOME THICK CONCRETE -FIRE-RESISTANCE.
- FORCES CAN BE TRANSMITTED EMPLOYING THE SURROUNDING SKELETON SUFFICIENT STIFFNES

STEEL

ASSEMBLAGE OF THE PREFABRICATED MEMBERS & IT IS USED IN CORE GENERALLY ABOVE 100M IN CORE.





SERVICE ANALYSIS OF RESIDENTIAL TOWER (45 STORIES) FOR FINIDING TENTATIVE ANALYSIS OF SERVICE REQUIREMENTS

Sustainable buildings are “causing as little environmental interference as possible, such as, the use of friendly environmental materials that do not constitute a health hazard, low energy requirements, renewable energy use, high-quality and longevity as a guideline for construction, and last but not least, an economical operation” [8]. In sustainable architecture, the building interacts with the environment and adapts itself to the climate conditions. As Richard Rogers said, the buildings are similar to the birds that they dress their feathers in winter to adapt to the new condition and to regulate their metabolism. The benefit of sustainable construction to the natural environment and human health is undeniable. It has been shown that increasing about 2% in the initial investment cost (in order to support sustainable design) leads to nearly 20% saving in overall building cost [9]. As Kim JJ, Rigdon B stated there are three fundamental levels of sustainability in architecture: reducing resource consumption that deals with reusing and recycling natural resources used in construction, designing based on life cycle which presents a way to analyze construction process and its impact on environment, and finally human design that focuses on the interaction between human and the natural world [10].

The basic principles of sustainable architecture

- Locational, functional, and structural solutions need to be selected in harmony with the local conditions, such as topography, microclimate, soil composition, water surfaces, flora etc.
- Size must be limited, including the footprint, i.e. the reduction of used green areas.
- Natural features must be enhanced and it is advisable to use renewable energy resources such as solar energy, wind, biomass etc.
- The daily use must be carefully planned and organized, otherwise the building cannot be considered ecological.
- Building structures, sanitary engineering systems, alternative ways of construction are to employ environment-friendly building materials and consider ecological construction theories.
- Environment-conscious ventilation, energy, material consumption must be observed in the functioning of the building as well [11].
- Recycling materials, conserving water in different ways such as harvesting rainwater, and recycling gray water

BIOCLIMATIC ARCHITECTURE

Five elements of a green building projects.

- Sustainable Site Design
- Water Conservation and Quality
- Energy and Environment
- Indoor Environmental Quality
- Conservation of Materials and Resources

Bioclimatic is a sector of architecture that dominated by the principles of ecology and sustainability. The term "bioclimatic design" implies design which aims to protect the environment and natural resources.

Aspects of bioclimatic design

Green balconies

The west side of a building can be made with small openings, be blind or be protected by appropriate shading (deciduous trees, awnings, plant hedges, etc.). The choice of plant species, the size at maturity, the way of pruning and the exact sitting of solar light trajectory is important for effective protection.
Evergreen vegetation layout can be designed, with a preference for trees with dense foliage in combination with deciduous trees, in order to direct winter winds out of the building while achieving cooling in summer.

Green roofs

By implementing a green roof on the roof of a building reduces significantly the cost of heating the building, because the multi layered stratification reduces heat loss, depending on its thickness. Vegetation as well, acts as extra insulation depending on the coverage and density of foliage. Simultaneously reduces cooling costs by saving energy, as the temperature inside the building during the summer months, may be kept up to IO15 degrees below the outside.

figure 5: shades system for south side

BIOCLIMATIC ARCHITECTURE

Vertical Gardens

The term "vertical garden or green walls" means the planting on a vertical surface of a building. This is achieved by specialized systems and a particular variety of plants which are vertically attached to them.

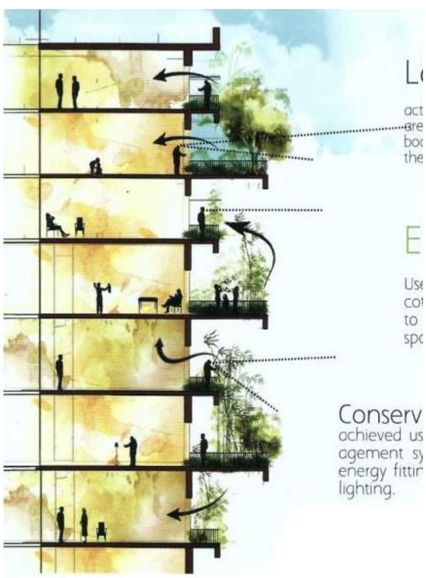
The natural benefits of a Vertical Garden

- Improved air quality
- Lower energy consumption
- Providing a natural shield between weather and inhabitants

figure 6: Green Walls

Landscaped sky gardens

act as buffers from the dust. heat and lashing rain. They staggered on alternate fioors to form a chequerboard like pattern giving double height spacing between the gardens and a private uninterrupted bit of



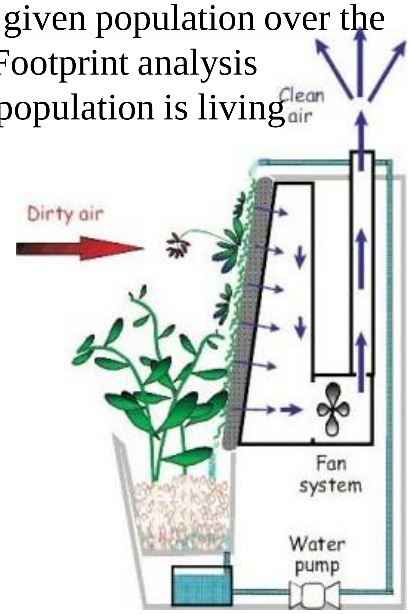
Energy Efficient

Use of a combination of laterite blocks. hollow cotta blocks and wire-cut bricks for the external to create thermally comfortable and energy spaces

Conservation Of resources

achieved using appropriate electrical and water mancgement systems: Timer controlled systems and low energy fittings for the common areas and for external lighting.

The Ecological Footprint is a measure of the amount of nature it takes to sustain a given population over the course of a year. Ecological Footprint analysis suggests whether or not that population is living within its ecological means.



Water Harvesting

Rainwater harvesting refers to the accumulation and storage of rain water before it reaches the aquifer. Rainwater collected from roof tops can be generally used as drinking water, for irrigation, landscaping, cleaning etc.

Installation of water efficient or low flow equipments in kitchens and bathrooms to reduce water consumption.

FACTORS TO BE CONSIDERED FOR GLAZING OF SKYSCRAPER

Many factors need to be considered when glazing super tall structures. Environmental factors such as high temperatures, ultra-violet radiation, inclement weather/high wind loads and even seismic activity all need to be considered when specifying products to ensure high quality glazing. Lower maintenance and safety of building façade with long term adhesion durability on specific substrates need to be studied.

Silicone Structural Glazing (SSG) is a method utilizing a silicone adhesive to attach glass, metal or other panel material to the structure of a building. Wind load and other impact loads on the façade are transferred from the glass or panel through the structural silicone sealant to the systems' framework. SSG is the most common glazing method in the world. The performance and economical production have made SSG famous. It also provides waterproofing, acoustic and thermal benefits to the system.

Durability: Designing a building skin by SSG gives many of benefits as mentioned above but there are key things need to be considered before and during fabrication in order to enjoy the performance benefits. Some parameters are there to specify a sealant.

- Mechanical performance criteria such as elasticity, modulus and movement capability.
- Adhesion to specified substrates.

The substrates must be properly prepared in all cases. They must be clean, dry, sound and free of loose particles, contaminates, foreign matter, water-soluble material and frost or ice. Many sealants require primer on all substrates, while some require them on only certain substrates. Primer is to change the chemical characteristics of the substrate surface to render it more suitable for the sealant, to stabilize the subrate surface by filling pores.

Weatherproofing: Sealing the joint with sealant material is economical and practical ways of doing for weather tightness, it it's properly installed there could be no comparable weatherproofing replacement. But most people do not think about its importance seriously. For high-rise building construction, its not easy to check every part of the sealing process for the façade so there might be serious weatherproofing issues.

The mechanically tested Sealants should have more Elastic recovery under ISO 11600 and should pass the minimum requirement. There are so many weatherproofing sealants available from the market and all they are claimed for high performance of weather tightness.

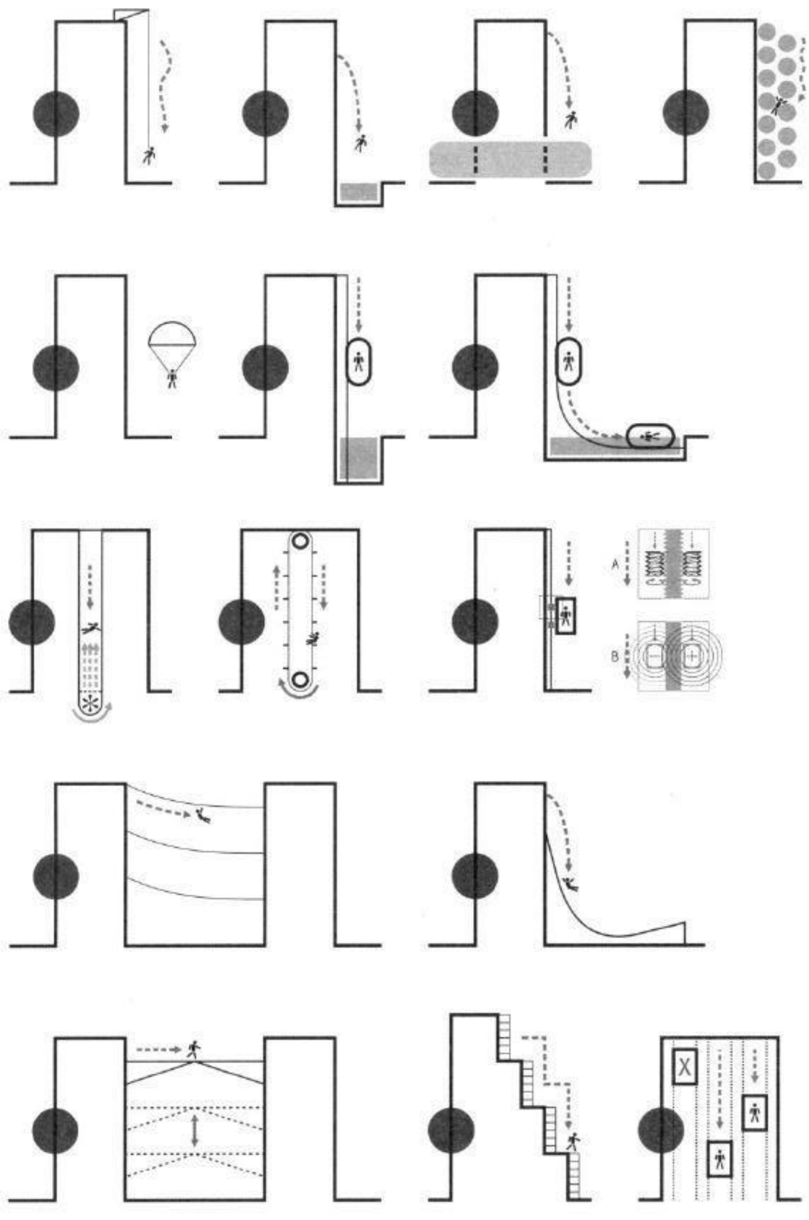
Aesthetic: The aesthetic satisfaction for building maintenance is getting more important than before to lower maintenance cost. Many efforts have been dedicated by industry during the last years to better understand the aesthetics effects of sealant in buildings, in particular those that affect the sealant itself and those that affects the adjacent building substrates. Issues such as typical dirt pick up, microbial growth, chalking, sealant inversion, fluid migration, surface crazing and change of color. There could be severe dirty appearance on the building façade because of migrants from weather sealant. All the material for building cladding could be influence by the pollutants from the environment and the potential contaminant from the sealant material. The simple dirt pick up or fluid migration on the joints of the panel system might be severe. Alternative sealants should be used to lower the building maintenance cost and waterproofing performance.

Quality Control: Along with selecting right glazing material under relevant industry, specification and guidelines, proper quality control procedures and application expertise should be ensure to have originally intended performance Chapter - 3 Designing Consideration of High-rise High-rise Structure – Mumbai (Vertical urbanization) Page | 48 of building façade and design of building skin. A large percentage of cladding seal defects and failures can be attributed to poor workmanship, lack of proper site supervision and poor fabrication. In order to minimize failed cladding works there must be proper fabrication check for every stage of the fabrications for clean, accurate and consistent application. More specifically all the required steps such as what need to be done, where it need to be done, when, who is to do should be well documented and passed to the respective personnel. Once silicone sealant and adhesive are cured properly, it will form durable and flexible anchor for curtain wall system. Long term durability of its structural function has been proved based on many of successfully fabricated land-mark projects over the world for last 40 years.

Conclusion: Super tall building has several important meanings for the society by cultural, environmental, tourism and economical. Sealant and adhesive take small portion for total budget and mass volume of building construction but it has own contribution factors. For example, structural silicone sealant is one of key contributors for the architects to fulfill unique building design based on its flexible structural features. Once wall cladding successfully done using structural silicone and weatherproofing sealant, it will give huge tangible benefits for all people in the society but if it fails, it could make human made disaster. Whatever aspect they are for sealants in building construction, either for structural function or for weatherproofing function, it is a matter of durability and proper quality control.

EXTERIOR EVACUATION METHOD THROUGH FACADE

One of the most important safety measures in every design is the provision of means of evacuation in ensuring people to escape quickly to a safe area in a short time from any point of the building. A redundant design will have more than one means of evacuating or exiting the building during such period of emergency. Emergency exits within the interior of the building as well as the exterior exits with facilities for leaving the building from windows or doors located at the facades.



Exterior Evacuation method through Facade

VERTICAL TRANSPORTATION (ELEVATOR SYSTEM)

The structure of the vertical transportation system is of critical importance as these complexes are designed for following reasons.

In addition to escalators and automatic walkways, which usually only serve to connect a few floors conveniently and without delays, passengers and goods are normally carried up and down by elevators in high-rise buildings. The comparison made above between a high-rise building and a small town also applies with regard to the number of people inside the building: in the course of a few hours every morning, tens of thousands of people stream into a mega building to start work and leave again within a very short space of time at the end of the day. They are supplemented by visitors, guests and customers, with the result that the elevators often have to transport well over 100,000 people every day.

The two operating systems commonly used today – namely group and changeover operation only became possible with the development of powerful drive systems and controllers, as well as highly effective braking systems with multiple braking for safety reasons.

In group operation, for which a separate shaft is (still) required for each elevator, the elevators or groups of elevators only serve certain floors: one group of elevators serves the first ten floors, for example, while a second group serves floors 10 to 20 from the entrance level, the next group then serves floors

20 to 30, etc. The groups must overlap on at least one floor so that people can transfer from the 17th to the 23rd floor, for example, although they must change elevators in the process. The advantage of this system is that the number of elevator shafts decreases towards the top of the building, thus counteracting the lower floor space frequently found on the top floors.

In changeover operation, large and very fast express elevators serve a small number of central floors which are often also highlighted architecturally. In New York’s Empire State Building, these elevators take no more than a minute to travel from the ground floor to the 80th floor. “Local elevators” serve the floors between the “changeover floors“. Here too, the elevators may serve groups of floors in exceptionally large high-rise buildings. If the equipment rooms are located alongside the elevator shaft, a number of local elevators can be operated one above the other in the same shaft; in this way, the number of shafts can be reduced while maintaining the transport capacity.

Providing Proper Vertical Transportation without Consuming the Building Core

Carful elevator analysis must be conducted to provide advice to the design team in order guide the architectural design of these complexes. This helps create a "Stacking" which allows for optimal elevator performance while minimizing the total number of elevator shafts in the building core. Additionally, by careful consideration of the stacking, the core designs of these mixed-use towers can use stacked elevator hoist ways where multiple elevator uses can have hoist ways stacked one atop the other.

Elevator Users' Segregation by Mixed-use Type

As each of these user types are considered, the expected level of elevator performance varies by each group type. Average wait times and elevator handling capacity expectations are markedly different. The most demanding elevator performance is required by the Class A office space and while less aggressive elevator performance is required of the residential components of these towers with other uses falling in between. Local elevators for the respective spaces should be given. Example, Hotel Pool is present in the 5th

Floor and hotel lobby in the 30th floor. Then people going to their residents to 40th floor should travel with the People with wet bathing suits till 30th floor.

Front of House vs. Back of House vs. People vs. Material segregation (Elevators)

Just as we strive to segregate rider types as we transport passengers vertically through these complexes it also is important to keep back of house staff and material transportation separated from passengers. Beyond that segregation it is important to also segregate BOH user types. Hospitality BOH need are significantly different than those of residential, office or retail users. These challengers also must be considered but are significant design points that cannot be overlooked. Current life Safety requirements for high rise buildings also place a design requirement on BOH vertical transportation with most local codes requiring at least 2 elevators that serve every level of a tower.

Security Concerns

These mixed use facilities ask a great deal of the elevator system in order to provide the segregation discussed above. Modern elevator technology and access control systems enable an even finer level of segregation when required. For example, the use of Destination based dispatching in an elevator system along with access control systems (Proximity cards, swipe cards, proximity fobs or even keypad PIN entry) allows an elevator group to provide security against unauthorized access to certain levels in case of VIP ride or Medical emergency.

Life Safety in Modern Mixed-Use towers

As mixed-use complexes/towers become ever taller and more divergent in user types, it has become increasingly important to develop life-safety solutions that take advantage of vertical transportation in ways that were previously unheard of. The traditional solution was to evacuate of a high-rise was to not use elevators in the case of fire and to rely on stairwell egress. This solution is becoming untenable as these structures grow in height. Occupant Evacuation Operation (OEO) has now been recognized by the International Building Code (IBC) as a means of providing egress from a high-rise building code professional if such a design approach is considered as there are significant architectural and code related geographical concerns. The use of OEO and other new strategies provide opportunities to reduce the number of stairs in a project, which can lead to significant core space savings.

ELEVATOR EVACUATION MEASURES

As time goes on, technology evolves; demands change; building gets taller; people evacuation becomes more and more challenging. All of these factors mean the actions required to protect human life become more and more intricate. The use of elevators for emergency evacuation becomes an integrated part of the overall building design and building egress system.

Building power outrage*:* In the event of normal building power loss, the system will identify the power available in the emergency generator network and allocate the use by priority as follows; firefighting elevators first, then dedicated shuttle elevators, then passenger elevators and then non-fire freight and service elevators.

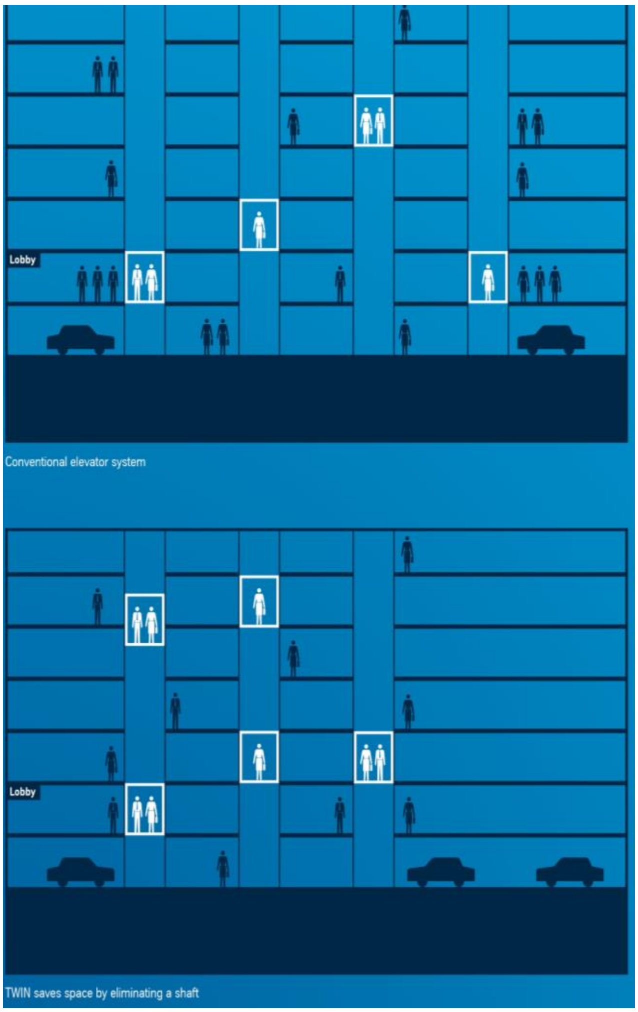
Fire Condition*:* Elevators will first return to the main floor via activation of lobby detectors and lobby recall switch. In the event of a power interruption before, during or after a fire emergency, the system will identify the power available from the emergency generator network; prioritize orderly evacuation of elevators serving that portion of the building prior to general elevators first, then fire/service elevators and then non-fire freight and service elevators.

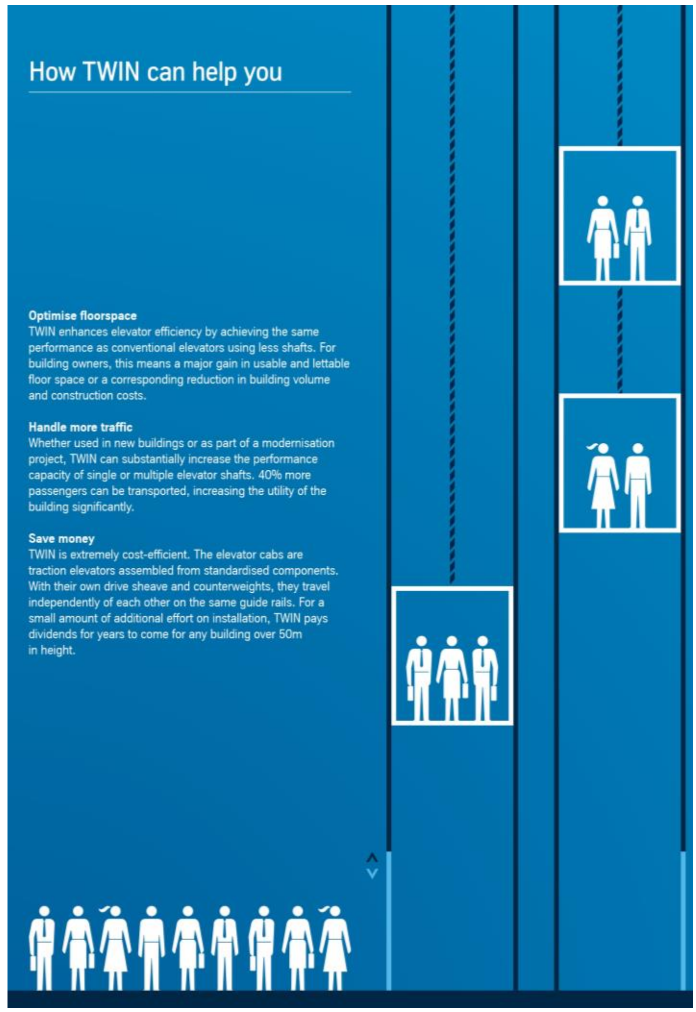
Normally the occupants are advised to evacuate to dedicated refuge areas in mechanical levels and proceed based on building emergency response team directions. Several dedicated shuttle elevators can be used by trained emergency response personnel to assist evacuation and can also be used for transportation of emergency personnel to ground level.

TWIN ELEVATOR SYSTEM

Reduce energy consumption

- When passenger volumes are low during off-peak periods, one of the cabs can be parked on the lowest or highest floor while the other remains in operation. Not something that can be done with a double-deck lift system.
- Even when only one person is traveling, a double-deck lift system has to move a double sized car and counterweight, but TWIN can operate with just one.
- Furthermore, all TWIN elevator systems can be equipped with an energy recovery function which can feed about 30% of the energy back into the building's power grid.





How TWIN works Two independent cars in one shaft save space, and time too

Two independent cars are arranged on top of each other in one shaft using the same guide rails and landing doors.

Each elevator has its own traction drive, controller, ropes, counterweight and governor. Both cars move independently in the shaft, including travelling in opposite directions and with different top speeds. However, they are always kept a minimum distance apart to ensure passenger safety.

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 plugin 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

2,5.1 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 to tally different temperatures. The planning effort required on the patt 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 centres in the basement or on the ground floor, on intermediate floors and on the roof.

2.5.3 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,

2.5,2 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 ejected from above and the such arged through coresponding exhaust air windows. A second, independent two-channel high-pressure system additionally blows air Into the rooms from the false floors. Fig 2.5 Ventilation and Air-conditioning system

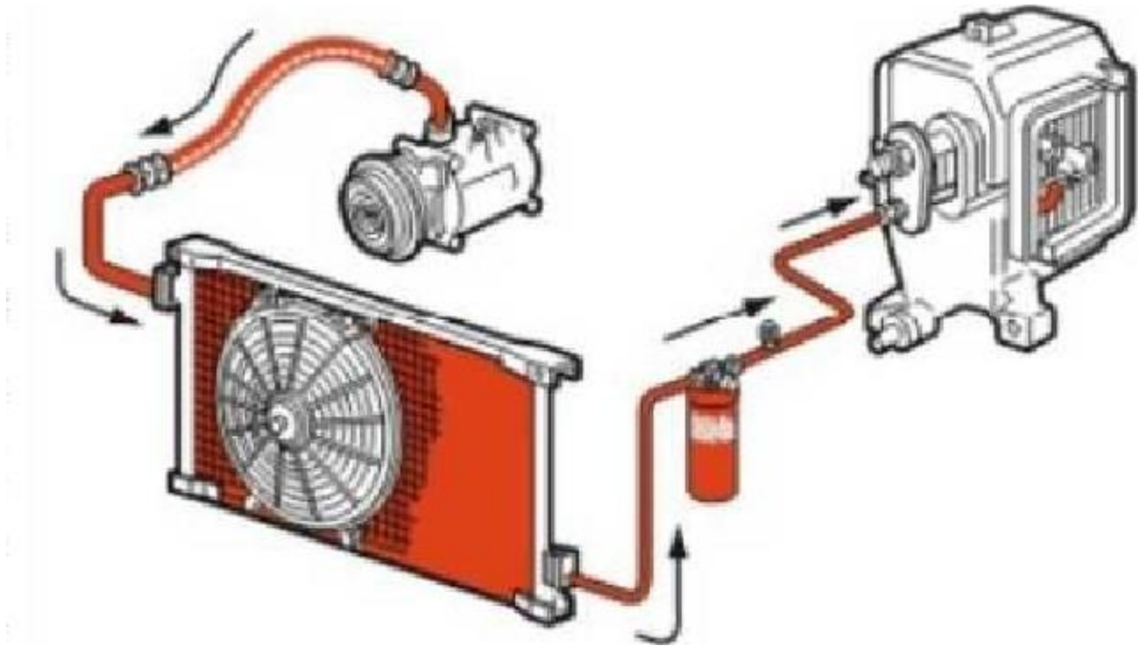
In principle, all air-conditioning and ventilation systems must meet the same basic requitements:

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 mg/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 coresponding parts of the building are not in use.



2.5.4 CONTROL SYSTEMS

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

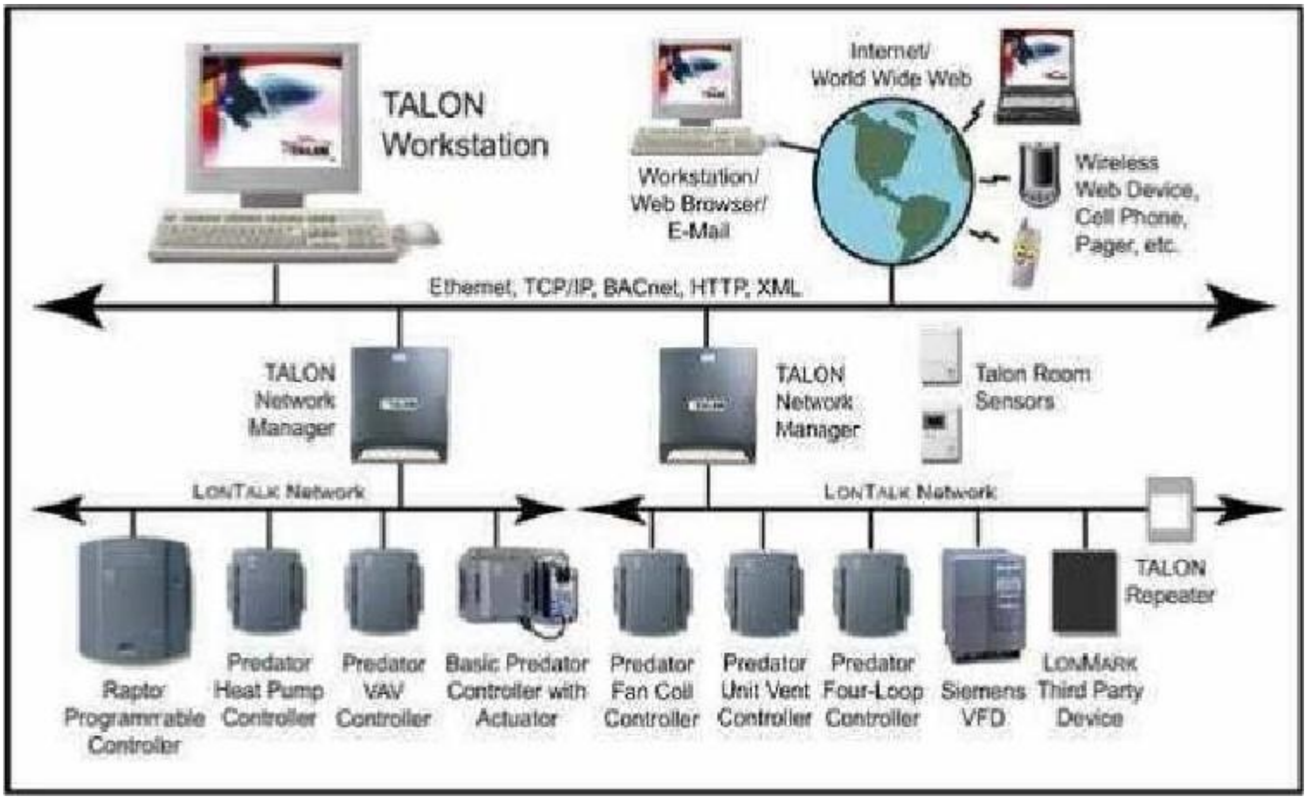
- Optimization of the overnight and weekend temperature reduction,
- Linking the heating of service water with re-cooling of the refrigeration system, operation of the external blinds.

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.

206.3. AREAS OF REFUGE

The tower design includes strategically placed areas of refuge which allow for better controlled evacuation. Represented in Fig: 2, 7, 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 tumped. As usual, the areas of refuge are encased in fire resistant concrete, are well ventilated, and can be lit by emergency lights.



2.6 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.

2.6.1. FIRE FIGHTER ACCESSIBILITY

It is important for emergency personnel (e.g. firefighters, 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 processes

2.62 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.

206.3. AREAS OF REFUGE

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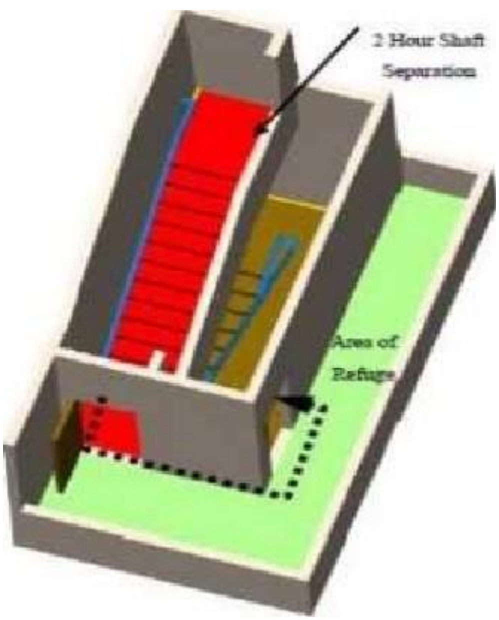


Fig: 2.7 Typical design for area of Refuge

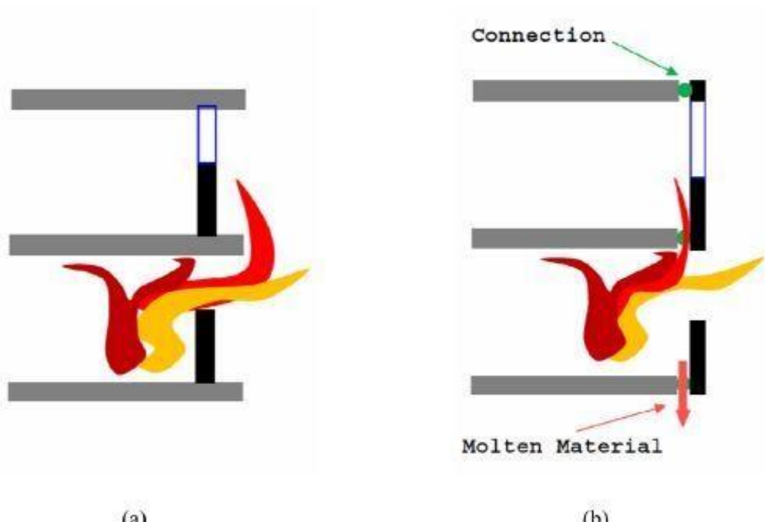


Fig.34 (a) Fire spreading from origin of the floor to all above floors

(b) 'Compartmentation' is done and thus reducing the spreading of fire

2.6.4 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 insttucted on what to do if a fire breaks out and also be familiarized with the use of these hand-operated fire extinguishers.

Know your Fire Extinguisher

Symbols found on fire extinguishers and what they mean	WATER	FOAM SPRAY	ABC POWDER	CARBON DIOXIDE	WET CHEMICAL
Wood, paper & textiles (A)	✓	✓	✓	✗	✓
Flammable Liquids (B)	✗	✓	✓	✓	✗
Flammable Gases (C)	✗	✗	✓	✗	✗
Electrical Contact	✗	✗	✓	✓	✗
Cooking oils & fats (F)	✗	✗	✗	✗	✓

2.6.S 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.An adequately dimensioned water line and adequate water pressure must be ensured when planning and designing the building. In very high buildings, booster systems must be installed in the wet risers to increase the water pressure. Whether the water for fire-fighting can be taken from the public mains or from separate water reservoirs or tanks must be decided in each individual instance in accordance with local conditions and regulations. For greater safety, it may be useful to install not only wet risers, but also dry risers into which the fire brigade can feed water at the required pressure from the ground floor.

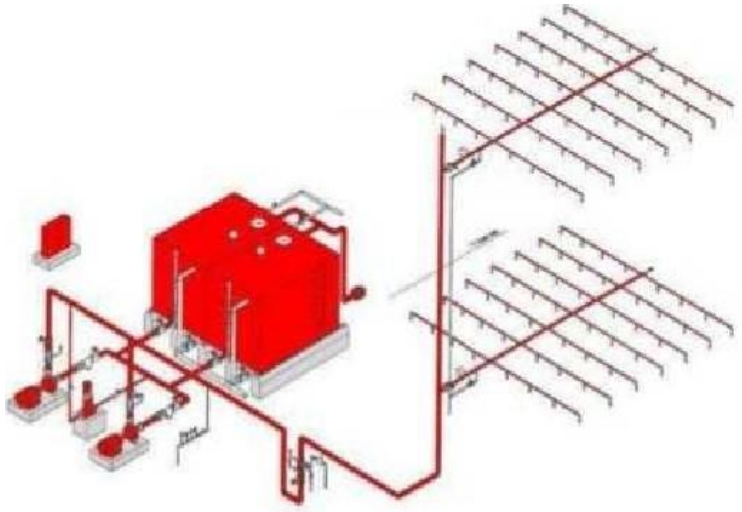
2,6.6 SPRINKLERS

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 eases outlined above, there were 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 file 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 signaled 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 . 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.



2.6.7 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.

The Design of facade in high rise should be carefully examined about the durability, weatherproofing and quality control. Another main factor for the façade is the fire safety consideration to be taken into account. Our understanding of the mechanisms of floor-to-floor fire spread at the curtain wall has been established by the work of fire researchers and fire engineers. From a fire dynamics perspective, we know that flames emitting from an exterior window can extend higher than 5m (16.5ft) above the top of the window. A test of Yokoi's was done in a test room with plywood walls/ceilings which is a characteristic of residential occupancies and at the lower end of the fire load scale. The hot gases from the room measured 400 – 500o c at 1750mm (5.75ft) above the top edge of the fire room window. The glass broke out under this exposure.

Thus portion of the hot gases are unable to burn inside the room due to limited air but upon the movement of air towards the outside sufficient air is entrained to the fire, allowing the hot fuel gases to burn outside the building. The result is the flame projecting out and upward from the window.

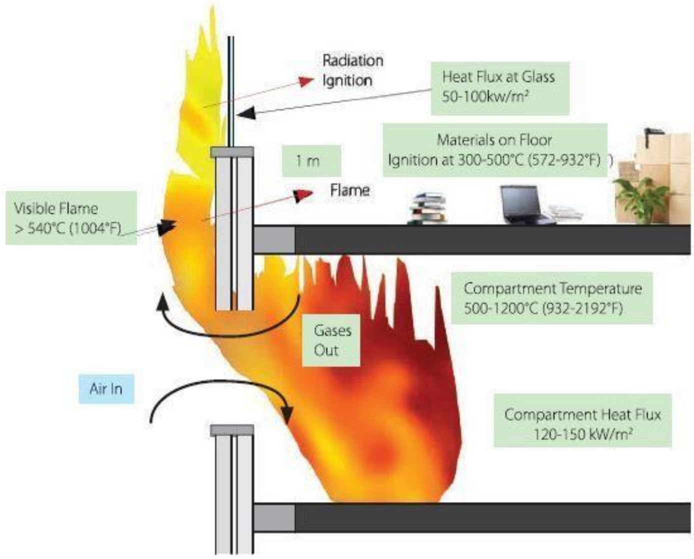
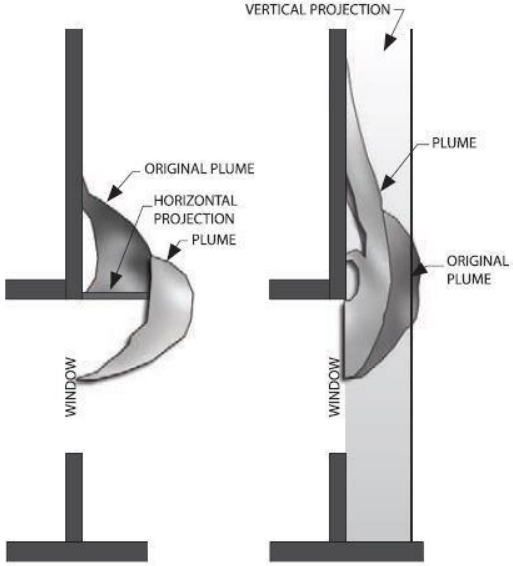


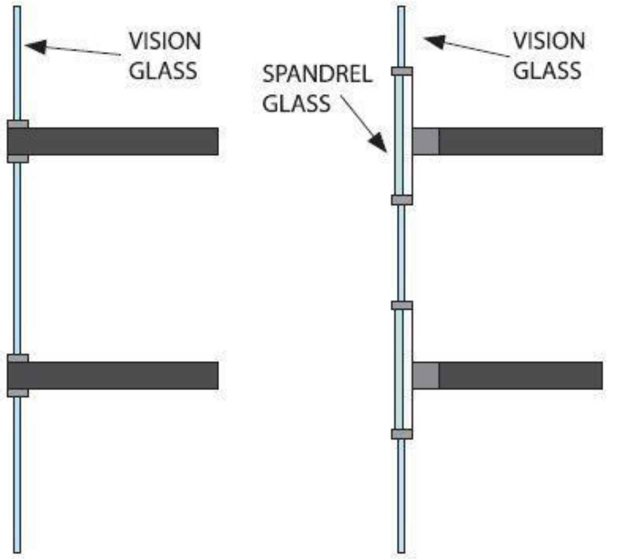
Fig.22 Mechanism of Fire breakout in building

From a fire containment perspective, there are currently two basic ways to provide a code complying curtain wall design in fully sprinklered buildings. The most basic approach is for the curtain wall to be supported directly on the structural floor slab edge, which precludes any gap or joint condition to or extends past the building envelope. This is most common approach for the installation and support of curtain wall.



Impact of Horizontal and Vertical projection in the building

The second approach is applicable when the curtain wall assembly is positioned just outside the edge of a fire rated floor system, such that a void space results between the floor system and the curtain wall. The void space at the slab edge is sealed with an approved material or system to prevent the interior spread of fire. This requires some form of a joint system or what today are called "Perimeter fire barrier systems".

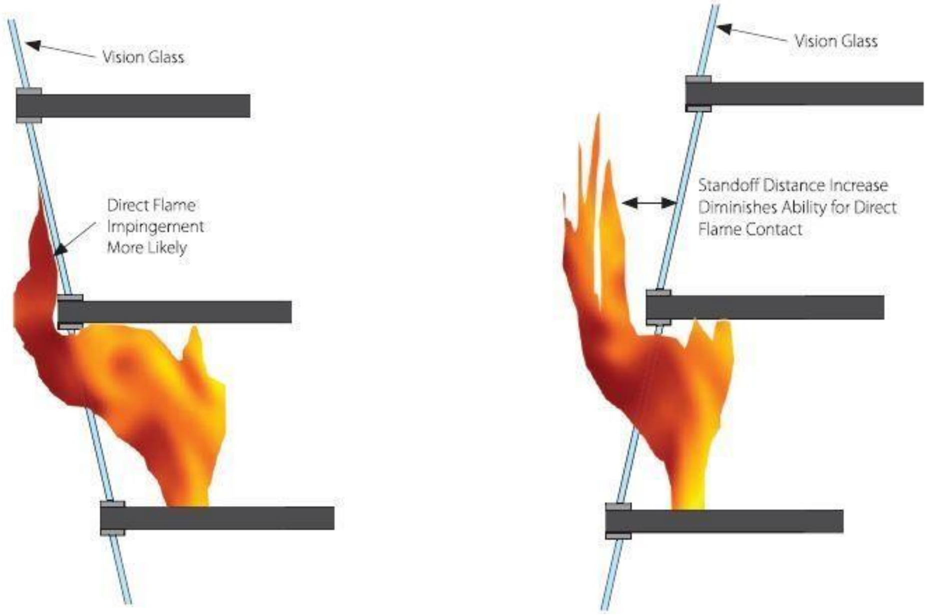


(left)Curtain wall supported on slab edge (right) Curtain wall hung off slab edge

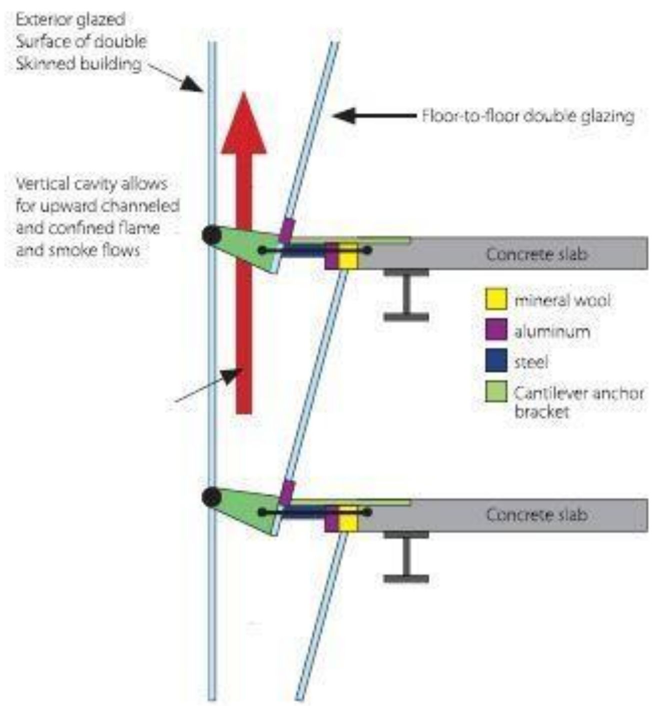
Key factors that impact the curtain wall's resistance to the vertical fire spread are as follows:

- Full height or partial height vision glass systems
- Nature of the glass used to construct glazing system
- Nature of the curtain wall components
- Height of spandrel panels
- Vertical or Horizontal projections on exterior that may deflect or enhance flame behavior
- Building geometry at curtain wall – twister, staggered, sloped etc.
- Operable windows/openings-size, vertical or horizontal orientation
- Ability of perimeter fire barrier system to remain in void during fire exposure

Composite – Complex Curtain wall system: The curtain wall inclined and double skinned curtain wall can come in handy when the fire factors are considered. Building geometry and exterior projection of the curtain wall or building structural elements can have beneficial or negative effect on flame length extension and heat flux exposure to curtain wall elements above the fire compartment.



(left) inclined forward (right) incline backward



double skin curtain wall

Double curtain wall systems, where two glazed walls are separated by distances of less than a meter are being implemented. This introduces new concerns arising from the fact that any flame that breaks through the inner façade is confined to within a long tall shaft-like space.

Conclusion: Our understanding of fire and its mechanisms of spread in buildings no longer eludes us, however the risks of fire spread related to highrise buildings and the facades that define their character has not been well examined. The successful record of fully sprinkler protected high-rise building and only requires that the void space between the curtain wall and floor slab be resistive to fire spread using a perimeter fire barrier system.

Ventilation and Noise control using double skin facade

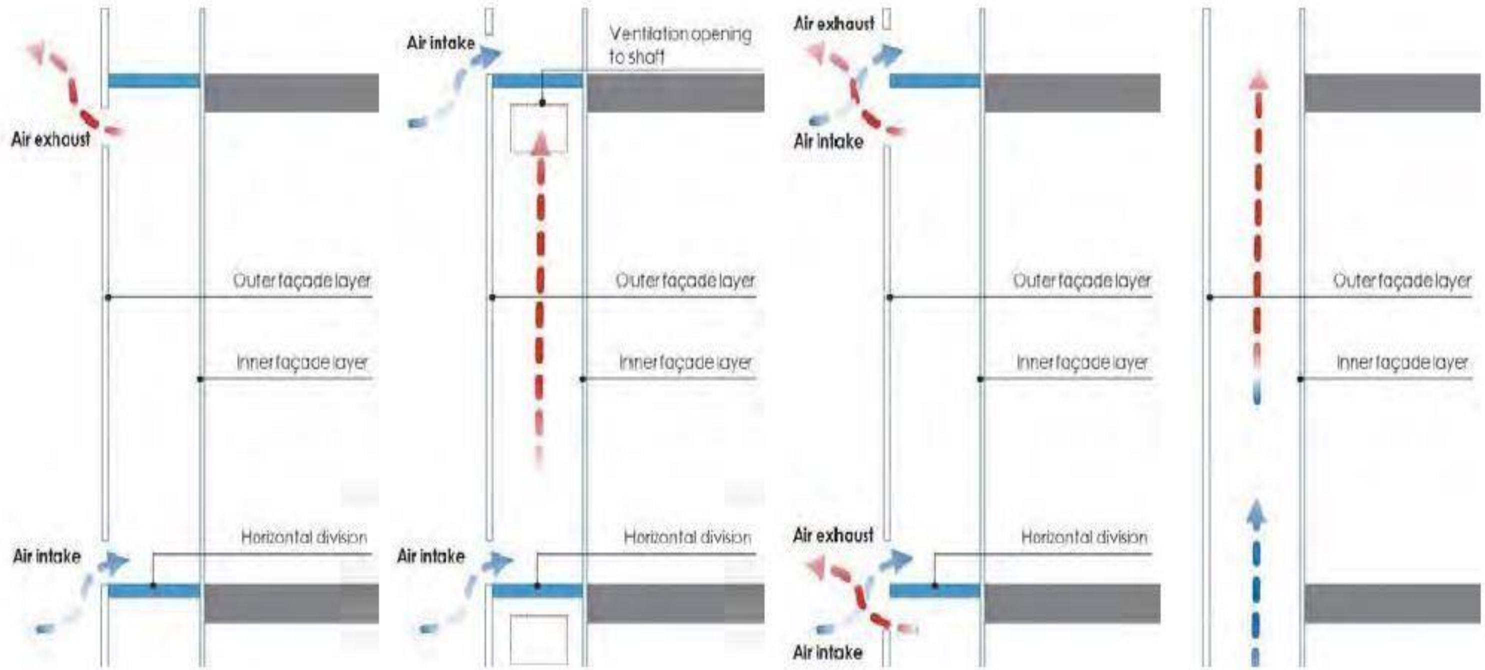
"The World Health Organization (WHO) has suggested that environmental noise should not exceed 55 dB and 40dB for daytime and nighttime respectively, to prevent potential psychosocial effects"

Urban noise is drastically increasing in the rapid increase in the urban population. Thus the noise factor is one to take into account of the present urban scenario. The increase in major outdoor noise source, causing adverse health effects in urban environments and to the urban people living.

Conclusion: Differing spatial configurations of DSF air cavities, achieved by varying the vertical glass fin and air cavity depth, affected air temperature, air velocity and sound transmission loss inside the air cavity.

Kinds of effect	Symptoms
Physical effects	Noise-induced hearing loss, hearing impairment, threshold shift
Physiological effects	Startle and defense reaction, leading to potential increase of blood pressure
Interference with speech communications	Reduction in intelligibility of conversation, radio, music, television and others
Sleep disturbance	Difficulty in falling asleep, alterations in sleep rhythm, awakening
Psychological effects	Headaches, fatigue, irritability
Performance effects	Task performance, distraction, productivity
Annoyance	Feeling of displeasure; tolerances vary enormously; noise pulses more annoying than a steady noise

The adverse health effects of noise



TYPE 1

- Commonly used in situations where there are high external nose levels
- Insulation is required between adjoining rooms.
- Continuous divisions help to avoid noise transmission
- Each box window requires its own air intake and extract openings

TYPE 2

- Vertical shafts are linked with the adjoining box windows
- Requires fewer openings in the external façade layer
- Effective in limiting external noise
- Height of the stack is limited
- Most suitable for lower-rise buildings

TYPE 3

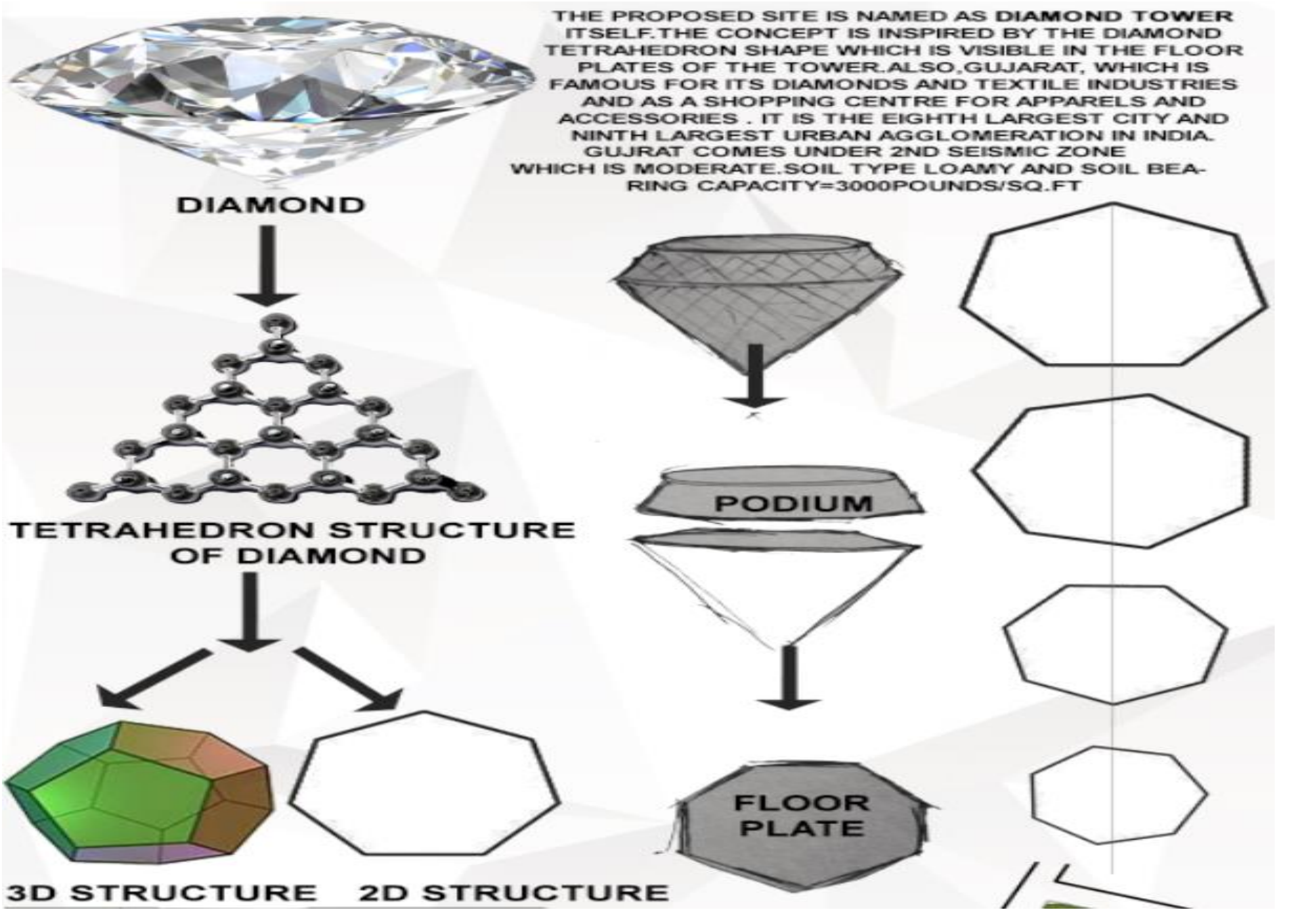
- Air cavity between the two façade layers is closed at the level of each floor
- Horizontal divisions limit noise and fire transmission, and aid ventilation
- Special care is needed to limit noise transmission from room to room

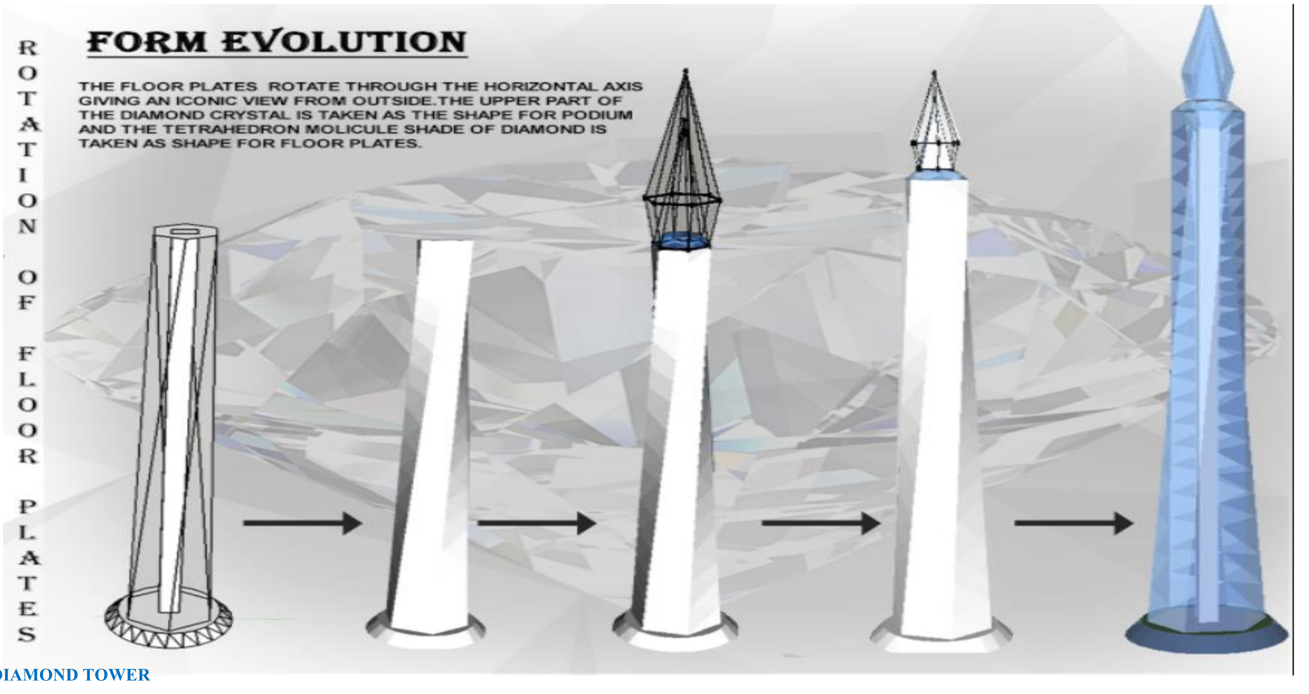
TYPE 4

- Air cavity between two façade layers is adjoined vertically and horizontally by a number of rooms.
- Ventilation openings are positioned at the top and bottom of the overall façade
- Suitable where external noise levels are very high
- Attention should be paid to noise transmission within the intermediate space.

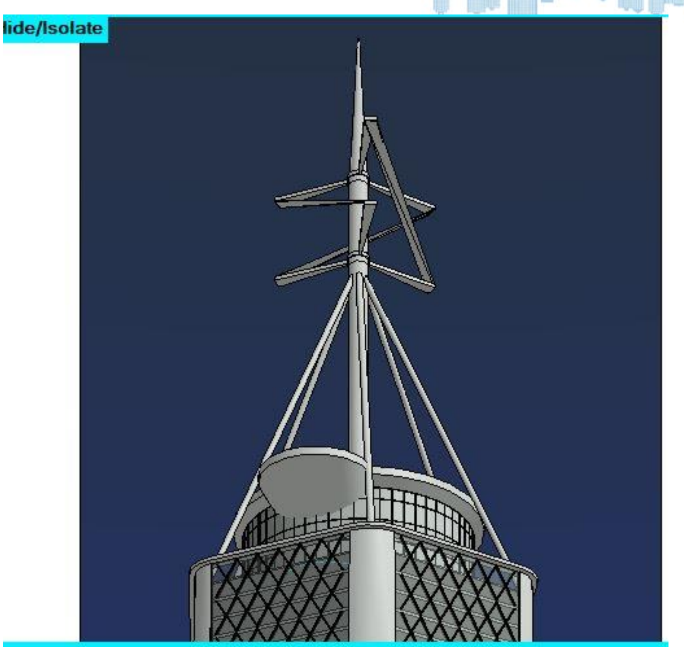
Figure 3. Airflow diagrams based on types of DSF air cavity design. Source: Oesterle et al., 2001.

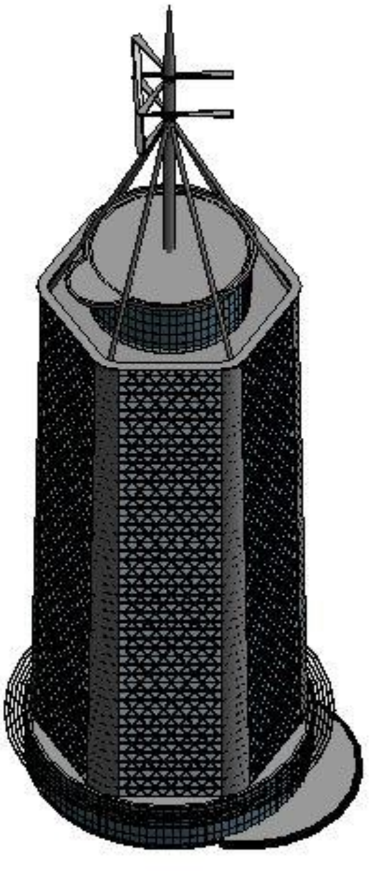
CONCEPT


THE PROPOSED SITE IS NAMED AS DIAMOND TOWER ITSELF.THE CONCEPT IS INSPIRED BY THE DIAMOND TETRAHEDRON SHAPE WHICH IS VISIBLE IN THE FLOOR PLATES OF THE TOWER.ALSO,GUJARAT, WHICH IS FAMOUS FOR ITS DIAMONDS AND TEXTILE INDUSTRIES AND AS A SHOPPING CENTRE FOR APPARELS AND ACCESSORIES . IT IS THE EIGHTH LARGEST CITY AND NINTH LARGEST URBAN AGGLOMERATION IN INDIA.
GUJRAT COMES UNDER 2ND SEISMIC ZONE WHICH IS MODERATE.SOIL TYPE LOAMY AND SOIL BEA-RING CAPACITY=3000POUNDS/SQ.FT
DIAMOND
TETRAHEDRON STRUCTURE OF DIAMOND
3D STRUCTURE
2D STRUCTURE
PODIUM
FLOOR PLATE

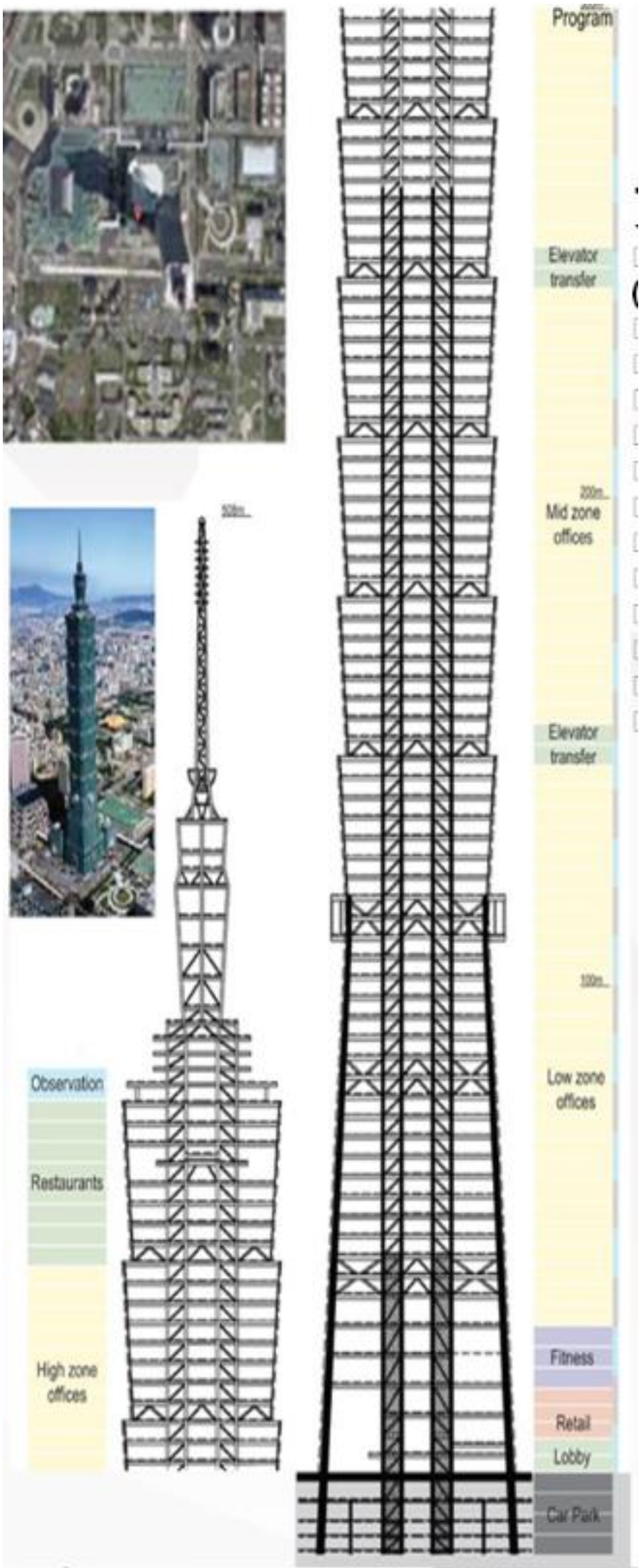

FORM EVOLUTION
THE FLOOR PLATES ROTATE THROUGH THE HORIZONTAL AXIS GIVING AN ICONIC VIEW FROM OUTSIDE.THE UPPER PART OF THE DIAMOND CRYSTAL IS TAKEN AS THE SHAPE FOR PODIUM AND THE TETRAHEDRON MOLICULE SHADE OF DIAMOND IS TAKEN AS SHAPE FOR FLOOR PLATES.
ROTATION OF FLOOR PLATES

FINAL FORM EVOLUTION





LITERATURE STUDY – TAIPAI 101



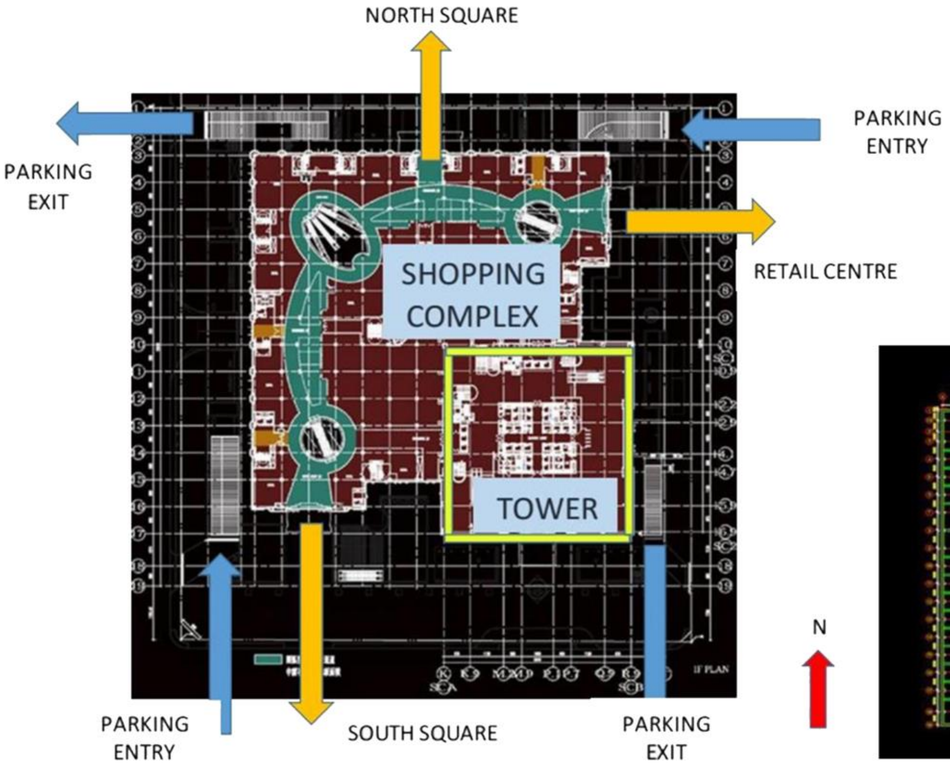
INTRODUCTION

Location: Xinyi District,Taipei City, Taiwan, 2004
Architect: C.Y. Lee & Partners
Owner: Taipei Financial Centre Corporation
Structural Designer: Thornton Tomasetti
Main Contractors: KTRT Joint Venture And Samsung C&T
Floors: 101 floors
Gross Floor Area: 412.500 m2
Architectural style: Postmodern
Height: 508 m
Cost US$: 1.6 billion
Elevators: 61
Status: Constructed(1999-2004)

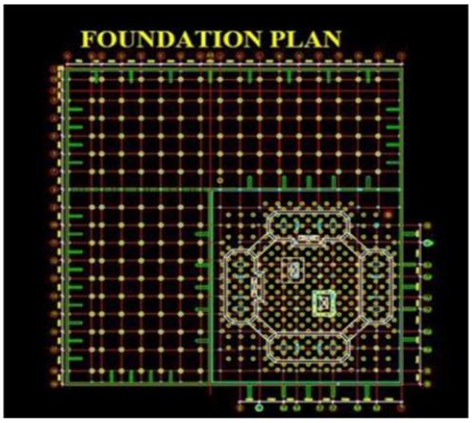
VERTICAL ZONING

□ 101st floor summit 101 (private VIP club)
□92nd-100th floor Communication
□91st floor outdoor observatory deck
□88th-89th floor indoor ob. Deck
□85th-86th floor high zone office
□59th-84th floor sky lobbies
□35th-58th floor mid zone office
□36th floor Taipei 101 conference center
□35th-36th floor sky lobbies
□35th floor Amenities
□9th-34th floor low zone office
□b1st-5th floor Taipei 101 mall
□b5th-b2nd floor parking levels

LITERATURE STUDY – TAIPAI 101

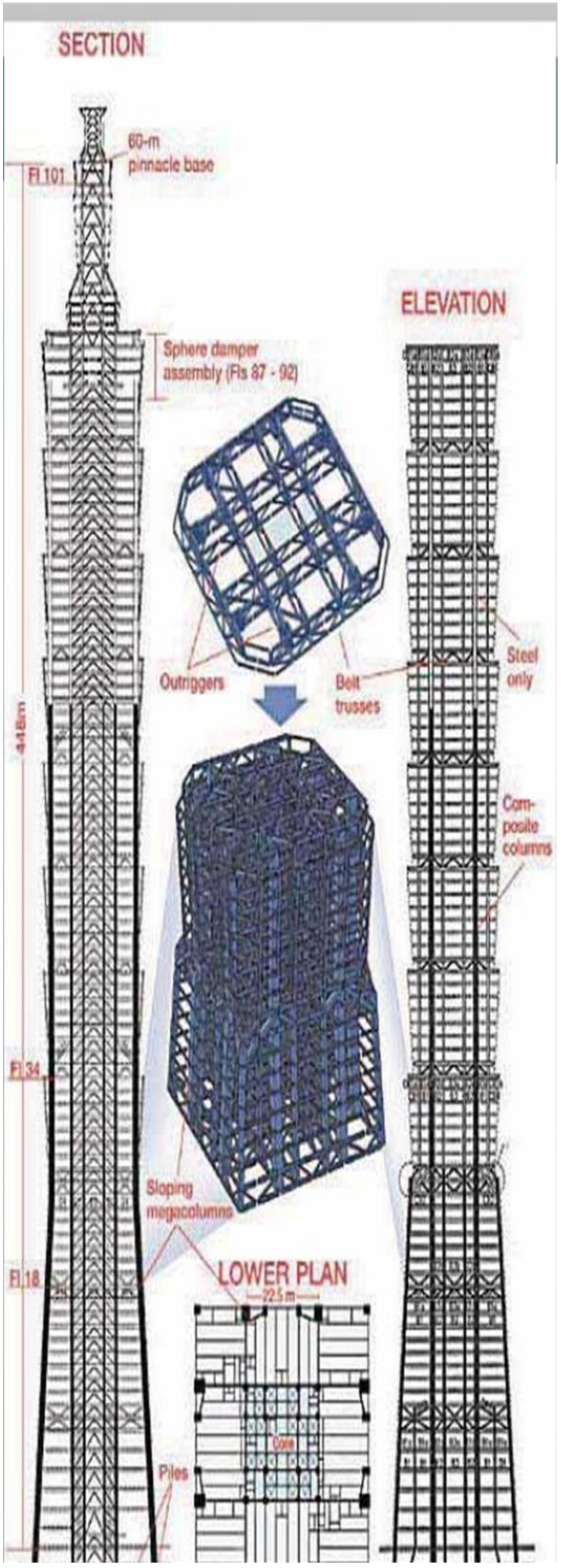


SITE PLAN



The Taipei 101, formerly known as the Taipei World Financial Center, is a landmark skyscraper
located in the Hsinyi District of the city, the rapid-growing "Manhattan" of Taipei. This is the
future centre of financial power in Taiwan. Taipei 101 is owned by the Taipei Financial Centre
Corporation (TFCC).
Taipei 101 has one of the world's fastest moving elevator which could travel at a speed of
55ft/sec.These Toshiba elevators are able to take visitors from the main floor to the observatory
on the 89th floor in under 39 seconds.
Taipei 101's own roof and facade recycled water system meets 20-30 percent of the building's
water needs. Upgrades are currently under way to make Taipei 101 "the world's tallest green
building" by LEED

STRUCTURAL DESIGN CONSIDERATIONS



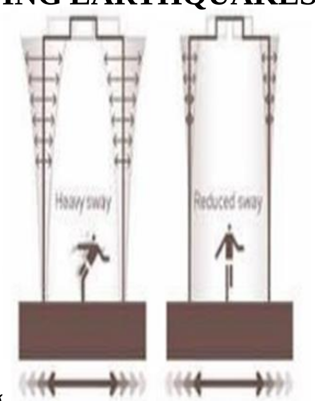
FOUNDATION

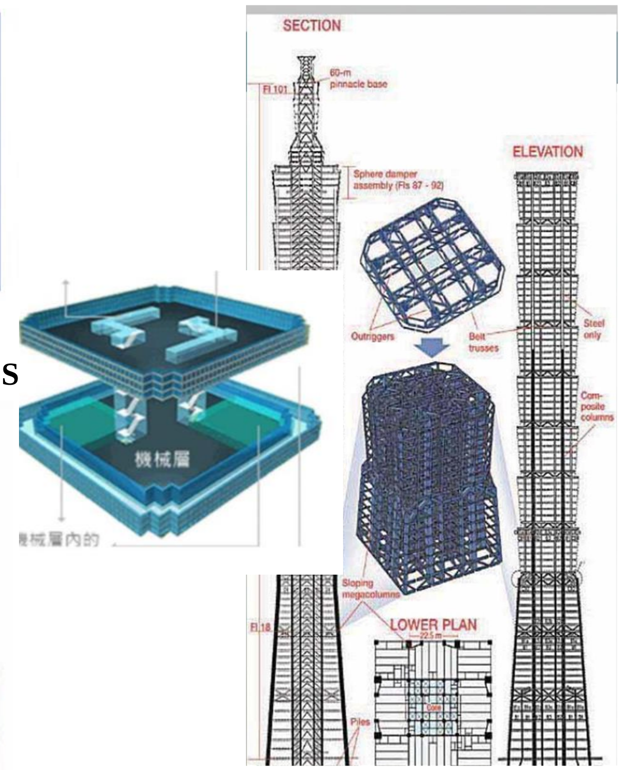
Soft rock occurs beneath 40 to 60 m of clay and stiff colluvial soil. Five major components were used to create two different foundation systems: Each podium column bears on a single 2 m (6.5 ft.) diameter drilled pier. Sockets 5 to 28 m (16 to 92 ft.) into bedrock resist net uplift from a podium pressure slab resisting buoyancy. The single-pierdesign permitted top down basement construction: a floor was cast to brace perimeter walls, then a storey of excavation proceeded below it. Superstructure framing was erected at the same time. As a result, the retail podium opened about a year before the tower topped out. A second slurry wall, enclosing just the tower footprint, was supported by steel cross-lot bracing as excavation proceeded to full depth.

The walls were braced to accommodate construction sequencing. A continuous reinforced concrete mat 3 to 4.7 m (10 to 15f1) thick transfers load from discrete column and shear wall load points to a distributed pattern of 380 drilled piers, 1.5 m (5 ft.) in diameter, spaced 4 m (13.12 ft.) on centre in staggered rows to resist gravity loads between10.7 and 14.2 nn (1500 and 2000 kips).Using steel framing minimized building weight, helping to reduce foundation costs compared to a straight shaft, if the structural system engages the perimeter columns.

STRUCTURAL DESIGN CONSIDERATIONS

“A” SHAPED FRAMES RESISTING EARTHQUAKES

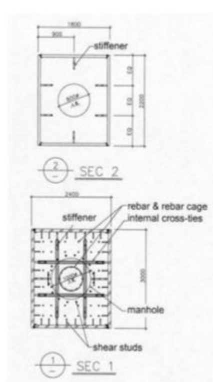




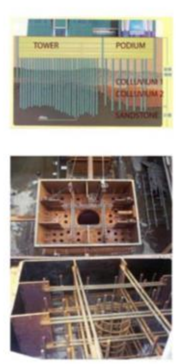
The above diagram shows building during an earthquake with and without seismic damper. With SD, the building have less sway that it is less shaking is seen.
Without SD, heavy sway is observed. Seismic Dampers are the devices introduced in buildings,
which absorb the EQ loads and resist the building.

FIRE FIGHTING

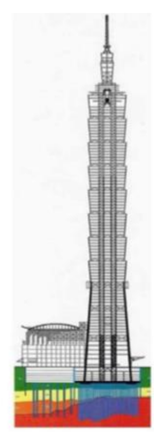
Automatic sprinkler system throughout building Basement and mechanical floor are equipped with water tanks. The mechanical floor water tank is driven by gravity so that power failure does not interrupt water supply. Each floor is equipped with fire hydrants and fire extinguishers, and par-king lot uses foam fire extinguishers.



Cross section of columns



Construction Images



Section with foundation

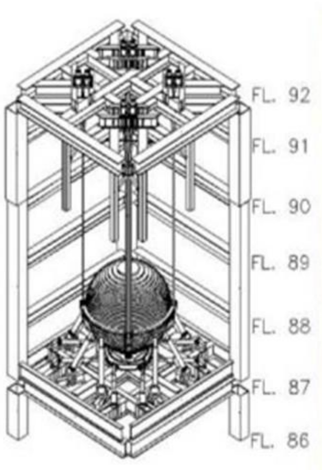
CONCEPT

The unusual tower shape is an idea of the architect C.Y. Lee from Taipei. He was inspired by local culture, the building reflects the culture in which it functions. Lee was looking for balance between local culture and internationalism. The tall building symbolizes a broader understanding and anticipation of things to come: we “climb” in order to “see further”. The building rises from the ground like a bamboo, a symbol of everlasting strength in Chinese culture. In the section, the shape of a pagoda is recognizable.
Taipei 101 Tower rises in 8 modules, a design based on the Chinese lucky number “8”. In cultures that observe a seven day week the number eight symbolizes a renewal of time (7+1). In cultures where seven is the lucky number, 8 represent 1 better than ‘lucky seven’. Each module has 8 floors and flares wider to the top. There are 101 floors above the ground and 5 floors underground.

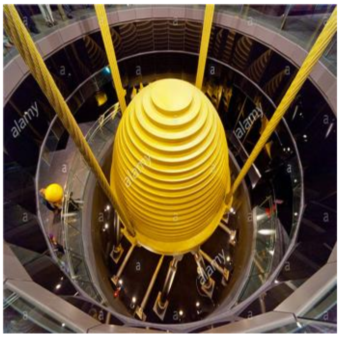
It’s more challenging to design and build a super-tal building in Taipei than any other location in the world because typhoon winds, large potential earthquakes and weak soil conditions all need to be overcome. A damping system was implemented to reduce the excessive lateral accelerations from wind.

SEISMIC DESIGN MEASURE TUNE MASS DAMPER (TMD)

A mega mass damper reduces the effect of wind. The pendulum has a weight of 660.000 kilogram and is situated on the 88th floor. It sways to offset movements in the building caused by strong gusts. Its sphere, the largest damper sphere in the world, consists of 41 circular steel plates. The structure has to be flexible enough to resist an earthquake, and stiff enough to resist a typhoon. Eight mega columns giving the stiffness to the building.



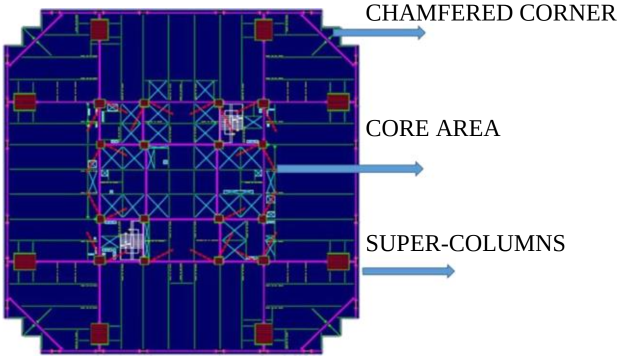
- Reinforced mat of 3-4.7m thick casted to transfer load from discreet columns and shear wall load point to a distributed pattern of 380 piers.
- Piers-staggered form
- 1.5m dia- spaced 4m on centre in staggered row.



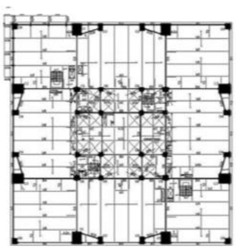
Besides the top 101, the building has five floors that serve as underground parking. Opened in July 2003, the building is divided into two parts, one tower and a larger multi-building complex. The upper part consists of six levels for commercial plazas, and from the seventh to the top floor are reserved for commercial offices.

LITERATURE STUDY – TAIPAI 101

PLAN WITH STAIR STEP CORNERS FOR WINDS



Sharp corners creates large crosswind excitation Rounded and chamfered (45o) corners reduced lateral response, but a 'saw tooth' or 'double notch' corner with 2.5 m (8.2 ff.) notches achieved a dramatic reduction. Stair step corner in plan to reduce effects of wind. Rough corners can reduce vortex shredding
effect.



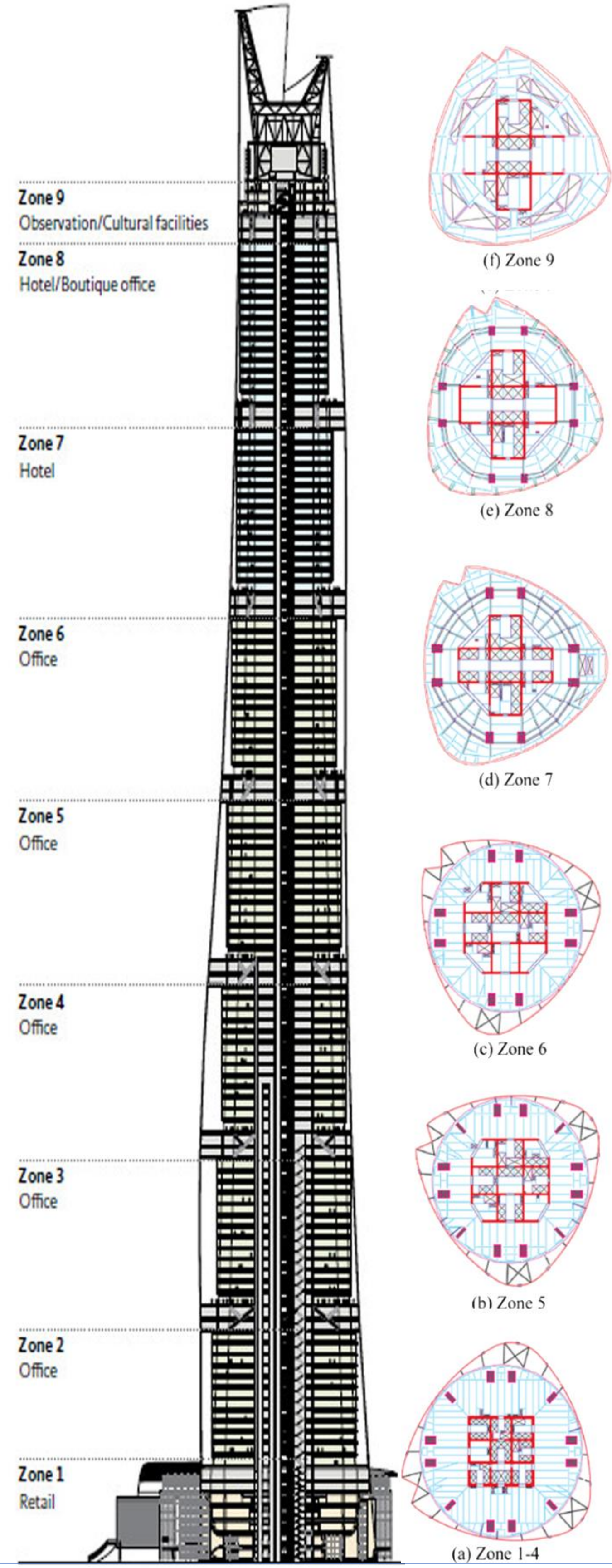
TYPICAL FLOOR PLAN LOWER FLOORS

TYPICAL FLOOR PLAN UPPER FLOORS

The body of the columns are filled with reinforced concrete, to achieve greater endurance. Part of the circular building is made up of "mega mega columns and beams," and to link the
two is made, every eight floors, the central columns interlocked with the side through the rafters. For the unions are performed some cuts in the beams, which allows better stabilize the peso and dissipate energy in cases of landslides, so that the walls are cracking. In the main part of the building will also add about 30 meters of columns, which can penetrate to the rocky terrain. In this part of the support, adding a total of 601 underground columns of 1.5 meters in diameter, plus another 16 support columns in the commercial part of Taipei. To distribute the load of the building, engineers built a concrete platform in the middle of 3.5 meters thick and at the periphery of 4.7 meters and on the sides of 3.5 meters. “The columns are based on the platform and it in turn distributes the load on the columns of support to ground level,” said Shi Ying Kan, during his recent visit to the Dominican Republic.

This typical setback floor plan shows sawtooth corners, a braced core with 16 steel box columns, outriggers to eight perimeter concrete-filled steel box supercolumns,upper (inner) and lower (outer) perimeter wide flange moment frame columns and in-floor bracing to transfer story shear between modules.

LITERATURE STUDY – SHANGHAI TOWER



INTRODUCTION

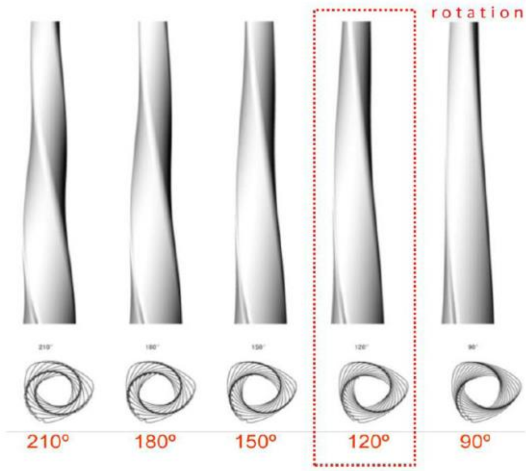
TYPE - Museum,Hotel,Office,Observation.
LOCATION - Shanghai, China
COORDINATES - 31°14′12″N -121°30′10″E.
CONSTRUCTION STARTED - 29 November 2008.
CONSTRUCTION COMPLETED - 16 May 2015.
COST - 1560 Billion Rupees
OWNER - Shanghai Tower Construction and Development.
FLOOR COUNT - 128 (5 below ground).
FLOOR AREA - 3,80,000 m2 (40,90,300 sq ft) above grade. 170 m2 (1,800 sq ft) below grade.
ARCHITECTURAL HEIGHT - 632 m (2,073 ft).
TIP HEIGHT - 632 m (2,073 ft).
TOP FLOOR HEIGHT - 561.3 m (1,842 ft).

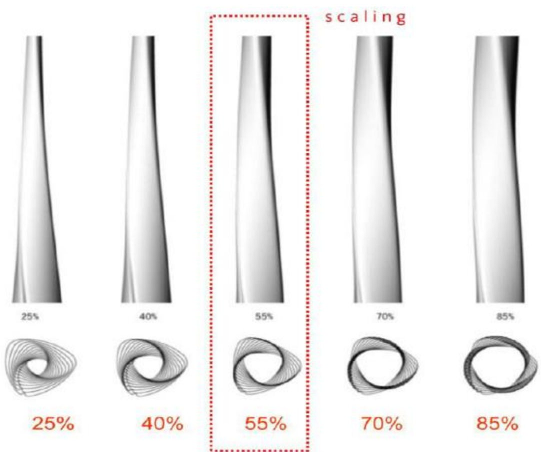
BASIC

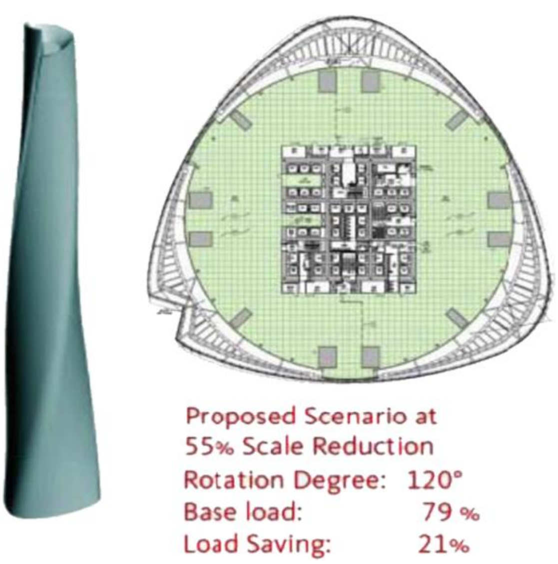
The development will be separated into eight distinct bioclimatic zones, with each having its own atrium, lush gardens, indoor air controls and panoramic 360° views of city.

The building will be situated within a 10,000 sqm open green space that will become both a public park and the front entry to the tower.

LITERATURE STUDY – SHANGHAI TOWER

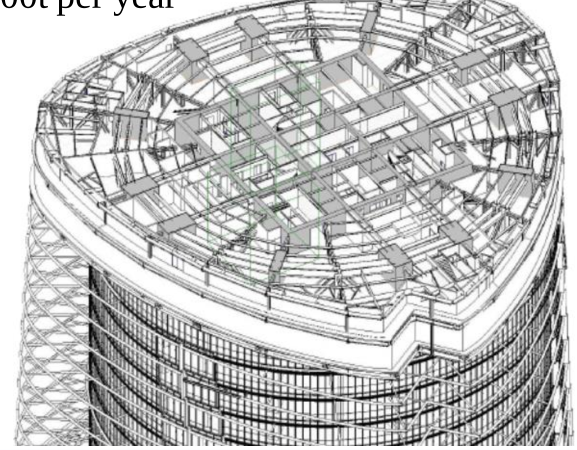






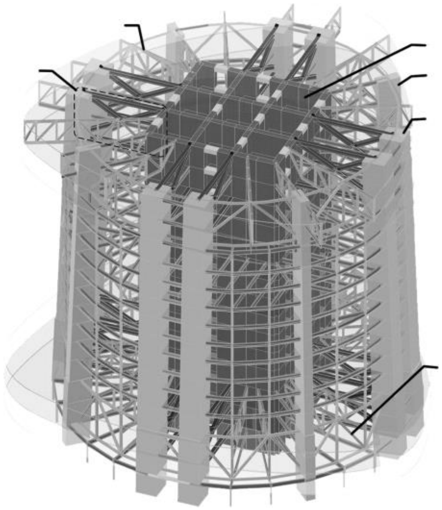
DESIGN

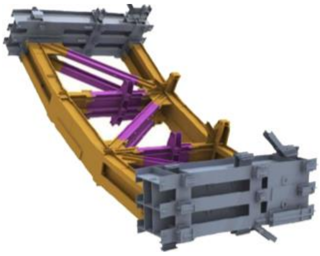
- The tower takes the form of nine cylindrical buildings stacked at the top each other, having total 121 floors, all enclosed by the inner layer of the glass facade.
- Between that and the outer layer, which twists as it rises, nine indoor zones provide public space for visitors.
- Each of these nine areas has its own atrium providing 360-degree views of the city.
- The tower is able to accommodate as many as 16,000 people on a daily basis.
- The Shanghai Tower joins the Jin Mao Tower and SWFC to form the world's first adjacent grouping of three super tall buildings.
- The world's first adjacent grouping of three super tall buildings concept.
- The tower employs 43 green and energy-saving technologies to reduce energy usage by 21% and water consumption by 40%.
- The building will recycle 2,35,000 m³ (62.1 million gal) of water per year, and deploy an additional 20,000m³ (5.28 million gal) of grey and storm water.
- The sustainable features of the tower will reduce the carbon footprint of the building by 34,000t per year

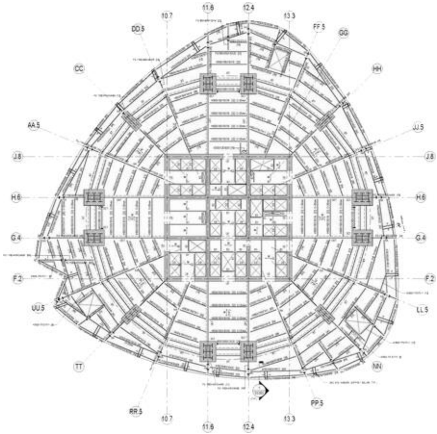


LITERATURE STUDY – SHANGHAI TOWER

STRUCTURE



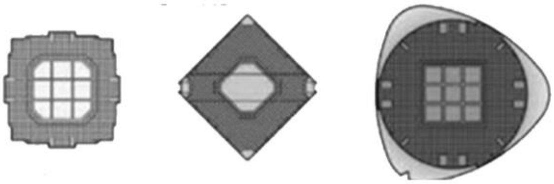




- The core of the tower acts with an outrigger & super column system. There are four paired super columns - two at each end of each orthonormal axis.
- These four super columns along each 45^{O} axis are required at by approximately 50 meters between the main orthonormal columns.
- The tower is divided into nine zones each with 12 – 15 floors.
- At the interface of the adjacent zones, a two story, full floored area is created to house mechanical, electrical & plumbing equipment.
- The full floor platform creates a base for atrium spaces directly.

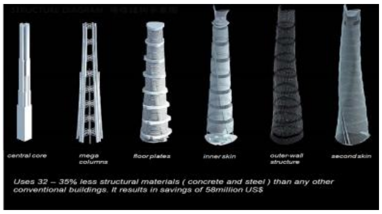
BASIC

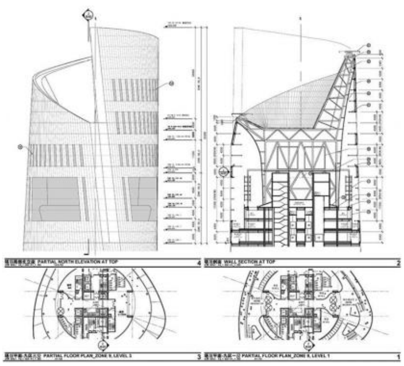
The development will be separated into eight distinct bioclimatic zones, with each having its own atrium, lush gardens, indoor air controls and panoramic 360° views of city. The building will be situated within a 10,000 sqm open green space that will become both a public park and the front entry to the tower.



LITERATURE STUDY – SHANGHAI TOWER

PRACTICAL PROBLEMS



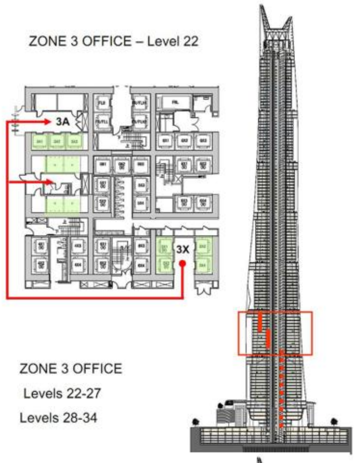


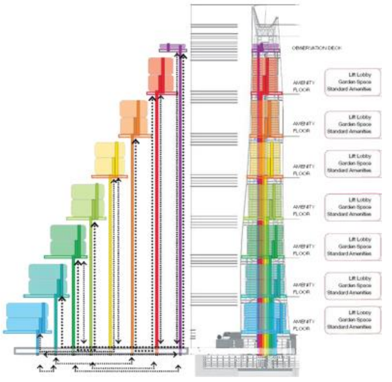
- There was a problem to lift people from street level to the top of the structure quickly and efficiently without making them feel that they are on a fairground ride.
- Keeping air cool and fresh within the building and pumping Water around each floor were also challenges for the designers and architects.
- There were problems of spreading the weight of the 80,000 tons of steel and concrete that will stretch up into the sky.
- Each upper floor bears down the shear weight of the building. to compress the load, contractors needed to find out new techniques and materials to ease their task.
- Not only was compression a problem, but at 800 yards high, the Tower is a giant monolithic post only fastened at the bottom. When the wind blows, it experiences a whole new lot of structural pressures other than compression.

SUSTAINBILITY FEATURES

- Shanghai Tower is built based on the Green Building and its energy level is LEED GOLD.
- The tower employs 43 green and energy-saving technologies to reduce energy usage by 21% and water consumption by 40%.
- The building will recycle 2,35,000 m³ (62.1 million gal) of water per year, and deploy an additional 20,000m³ (5.28 million gal) of grey and storm water.
- The sustainable features of the tower will reduce the carbon footprint of the building by 34,000t per year.
- Innovative skin technology is one of many sustainable design and renewable energy systems in the tower.
- The spiral shape facilitates vortex shedding and creates an asymmetrical surface to reduce wind loads on the building by 24%. reducing the structural load on the building.
- The building's spiraling parapet collects rainwater, used for the tower's HVAC systems.
- Wind turbines located directly beneath the parapet generate on-site power. Thus energy consumption of building is 35-40 % less than any other conventional
- building.
- 40% less water consumption i.e. they save 675 million L/ annum =245 Olympic size swimming pools

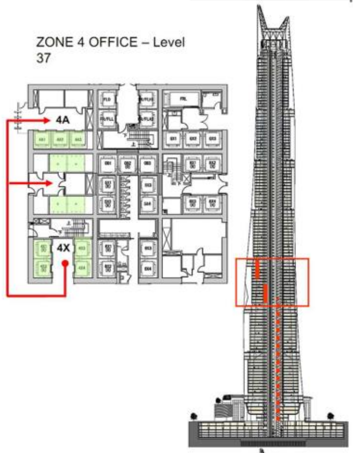
LITERATURE STUDY – SHANGHAI TOWER





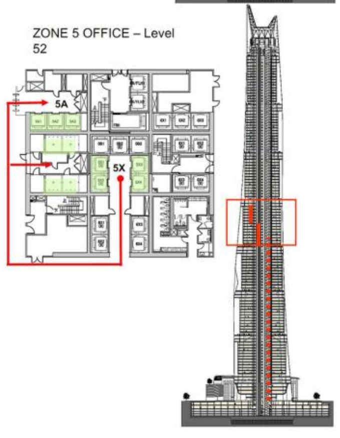
CORE

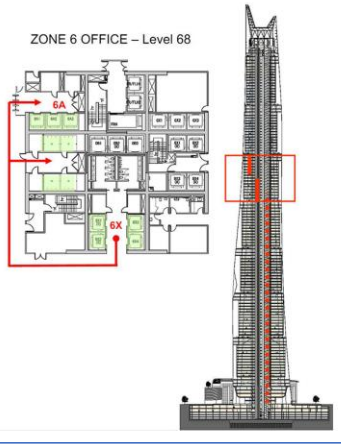
Tower features a soft triangular shape, the tower rotates as it goes skyward and concludes with an open-top design.
As the shape rises, a "strike“ or open notch curves up and around the building which is an engineering feature to control the wind up and away from the building.



DOUBLE SKIN BUILDING

Tower features a soft triangular shape, the tower rotates as it goes skyward and concludes with an open-top design. As the shape rises, a "strike“ or open notch curves up and around the building which is an engineering feature to control the wind up and away from the building.





CASE STUDY-SUPERTECH SUPERNOVA

OVERVIEW OF PROJECTS

VERTICAL ZONING

1-3rd floor-lobby, clubs

4th floor-service floor

5-17th-3/4 BHK

18th-Service floor

19th-43rd-studio apartment

44th-service floor

45th-club

46th-56th-2/3BHK

57th-71th-suits

72nd-80th-observatory deck

80th-Helipad

Supertech Supernova is one of India's tallest mixed used developments spread across 5 million Sq. Ft. People will live, work, and play in a unique environment. The project will have 2 luxury hotels, premium and luxury retail brands, offices, serviced apartments, and luxury residences. The project is located at Sector 94 in Noida which is exactly at the Delhi-Noida border and is well connected via Noida Expressway, Metro and proposed kalindi-kunj 8 lane expressway. Supertech Supernova project features five breathtaking towers all blending cutting edge architecture with traditional vaastu principles. Rising from the banks of Yamuna River, they overlook the greenery and waterways of India's largest nature reserve. In addition, leading banks such as HDFC, IDBI are sanctioning the home loan for the project. The construction is ongoing and project is expected to be handed over by December 2015.

The project is located at the edge of NOIDA Expressway and is close to Sector-18, the entertainment hub of Noida. The location boasts of several other advantages like the proximity to various leading schools, 5 minutes from Noida Film City, and 5 minutes from botanical garden metro station at Sector 37.

CASE STUDY-SUPERTECH SUPERNOVA

AMENITIES:

- Observatory deck
- Exclusive club-house
- Automated elevator
- Fine dining, leisure and entertainment options
- Luxury shopping mall
- 5-star hotels

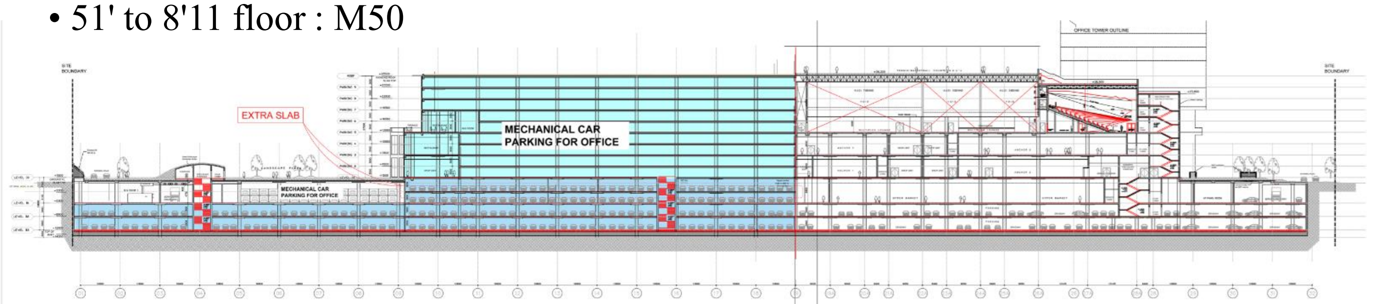
- Five breathtaking towers work in perfect harmony thanks to the flowing curves and shining facades of the design - which also incorporates Vaastu principles.
- Spectacular podium level that features lush gardens and attractive event platforms.
- Mixed-use development spread across 5 million Sq. Ft. area.
- Two luxury hotels, premium and luxury retail brands, offices, serviced apartments, and luxury residences.
- Leed certified Green Building (Platinum rating) by IGBC, Hyderabad Concierge facilities

LOCATION

Strategically located at the beginning of Noida-Greater Noida Expressway, Supernova is well connected to south Delhi via DND flyway and to Jasola through the Okhla Bridge. Access is easy to East and Central Delhi via NH-24 and to Noida and greater Noida through the greater Noida expressway.
Supernova is strategically located just in front of Okhla Bird Sanctuary metro station and connected via a flyway that directly enters into the supernova campus.

BUILDING MATERIAL

- Concrete shear wall + Frame structure
- Grade of concrete in column: M80 to M60
- Grade of concrete in beams: M50 • Pile foundation: M60
- 0-30'h floor : M80
- 31st to 50th floor: M70
- 51' to 8'11 floor : M50



SECTION THOUGH PARKING MNCP

CASE STUDY-SUPERTECH SUPERNOVA

SITE PICTURES


PLANT ROOM AND FIRE STAIRCASE


CHILLAR PLANT AND COOLIMG SYSTEM


CABLE TRAY WITH ELECTRICAL WIRES


PRESSURIZED SHAFT FOR FIRE LOBBY


DUCTS FOR EXHAUST AND COOLING


PLUMBING DUCT AND ELECTRICAL SYS.


MACHANICAL ROOM


FLY WAY CONNECTING METRO


PLUMBING DUCT


MACHINE ROOM


CAPITAL COLUMN AT BASEMENT


AAC BRICKS

ASTRALIS LOBBY


ASTRALIS


PODIUM CONSTRUCTION

CASE STUDY-SUPERTECH SUPERNOVA

DESIGN CONSIDERATIONS FOUNDATION

The superstructure is supported by a large 4m reinforced concrete mat, which In turn supported by 1.2m dia-52m deep bored reinforced concrete piles 229 in numbers constructed in 21,000 cubic metres of concrete including mat and piles. Piles are largest longest conventionally available in region

VERTICAL TRANSPORTATION

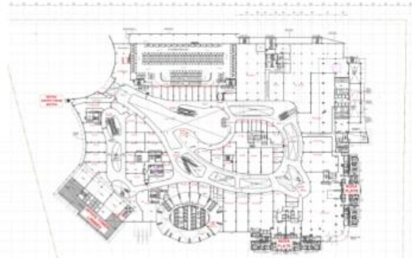
Supernova will be home to 112 elevators and 18 escalators. Supernova will be the first mega-high rise in which certain elevators will be preorganised to permit controlled travel to certain level. Observatory elevators are traveling at 8 meters per second, they will have the region's longest travel distance from lowest to highest stop

DESIGN ANALYSIS

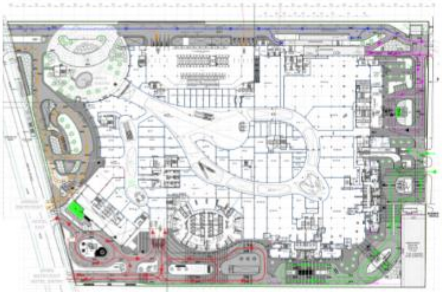
• There are three types of columns used in the structure: A- 4500 x 500 mm B- 2500 x 1100 mm C- 2500 x 900 mm
• The combination of Pile Raft foundation provides greater stability for high rise construction
• The structure comprises a concrete core and Post tensioned concrete slab and spandrel beams.
• The central core system helps the structure to resist the lateral loads.
• The podium act as an immediate ground floor for the users of Spire tower.
• Different entry and exit point to segregate different kinds of users.
• Services floor which is two storey high is located at 4th, 18th and 44th floor of the tower.
• Provisions for Grey water system and storm water, rainwater harvesting system reduces the water wastage and helped the Spire tower to bag the 1 GBC green building rating .

PLANS AND SECTION

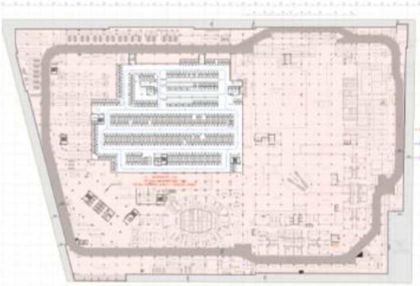
SITE PLAN



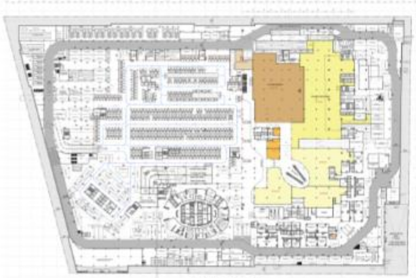
FIRST FLOOR PLAN



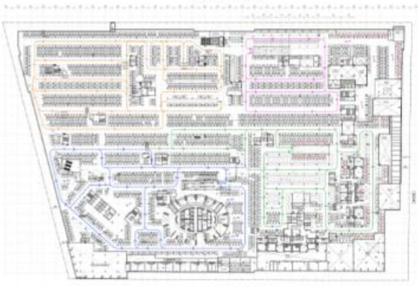
GROUND FLOOR



BASEMENT LEVEL-B1(A)



BASEMENT LEVEL 'B1'



DESIGN CONCEPT AND PHILOSOPHY

The captivating Spira tower sits elegantly on the new Noida skyline. One of the world's greatest Superstructures, its sculpted form is designed to represent nature and growth, spiraling 300 meters towards the sky. It is symbolic of the renaissance of Noida, Its prosperity and energy. At the peak is the development "halo" housing a thrilling observation deck, a cantilevered helipad, luxury sky restaurant and bar. All levels enjoy glorious 360 degree views over the Yamuna waterways that were the original inspiration for Spira's flowing shape.

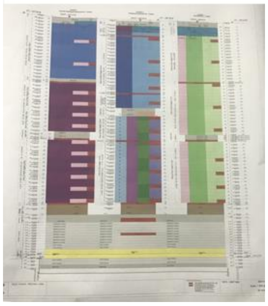
PHILOSOPHY:

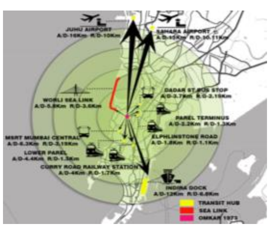
Supernova takes advantage of the surrounding by including ample amount of landscaped exteriors to create a naturally beautiful setting which is only enhanced by the prominent tower and mixed use offer. All the five towers of the supernova campus have their own use and own style of architecture. Lush green landscaped site plan where the podium serves as shopping complex and the basement as the parking area. Dream home, Futuristic offices that makes work a pleasure, an indispensable retail heaven and a recreational wonderland.

CONCLUSIONS

- The Concrete Raft Pile foundation provides a better stability to high rise structures over other foundation systems
- In case of mixed use building separate and multiple entry exits should be provided for better crowd segregation
- Strategic location of service floor is important as it act as the backbone for the high rise constructions.
- Providing provisions for low waste generation should be considered though planning and designing

CASE STUDY - OMKAR TOWERS





INTRODUCTION

OMKAR 1973

LOCATION:	Worli, mumbai
ARCHITECT:	Foster+partner
CLIENT:	Omkar retailors
PROGRAM:	Residential, Commercial
PLOT AREA:	3.5acre
HEIGHT:	300m
FLOOR COUNT:	78
STATUS:	70%constructed
COORDINATES:	19.0167°N 72.8167°E

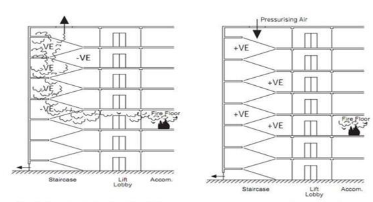
SITE APPROACH

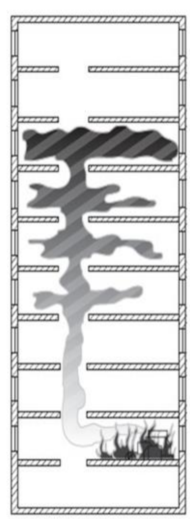
Omkar 1973 will be one of the tallest structures in India. The 400-plus sky bungalows, ranging from 2,500 sq. ft. to 18,200 sq. ft. area. It will have a height of over 300 meters and an area of about 5,000,000 sq. ft. It consists of three towers scaling 81-storey, 81-storey and 76-storey. The project is scheduled for completion by Dec-2020

Amenities

- Club House
- Garden
- Indoor games facility
- Jogging Track
- Squash Court
- Multi - purpose Hall
- Private Elevator
- Wooden flooring
- Swimming Pool
- Spa
- Library
- Sea View
- Tennis Court
- Crèche
- Modular Kitchen
- Motion Censor Electric System
- Gym
- Sauna
- Business Lounge
- City View
- Badminton Court
- Marble Flooring
- Balcony
- Premium bathroom fittings
- Children's Play Area
- Jacuzzi
- Cafe
- Garden View
- Cricket Pitch
- High Ceiling
- Deck

Tower A Floor Plan	size: 3175 - 4436 ft²	rooms: 3/4	baths: 4/5
Tower B Floor Plan	size: 5971 - 9387 ft²	rooms: 3/4/5	baths: 4/5/6
Tower C Floor Plan	size: 9682 - 21375 ft²	rooms: 4/6	baths: 5/7





CASE STUDY - OMKAR TOWERS

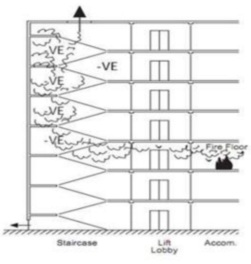


Fig 1 - Smoke Control by Ventilation

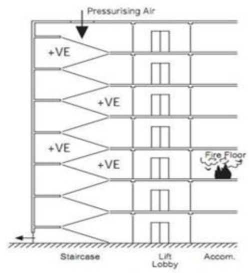


Fig 2 - Smoke Control by Pressurisation

Amenities

✔ Club House	✔ Swimming Pool	✔ Gym	✔ Children's Play Area
✔ Garden	✔ Spa	✔ Sauna	✔ Jacuzzi
✔ Indoor games facility	✔ Library	✔ Business Lounge	✔ Cafe
✔ Jogging Track	✔ Sea View	✔ City View	✔ Garden View
✔ Squash Court	✔ Tennis Court	✔ Badminton Court	✔ Cricket Pitch
✔ Multi - purpose Hall	✔ Crèche	✔ Marble Flooring	✔ High Ceiling
✔ Private Elevator	✔ Modular Kitchen	✔ Balcony	✔ Deck
✔ Wooden flooring	✔ Motion Censor Electric System	✔ Premium bathroom fittings	

Tower A Floor Plan	size: 3175 - 4436 ft²	rooms: 3/4	baths: 4/5
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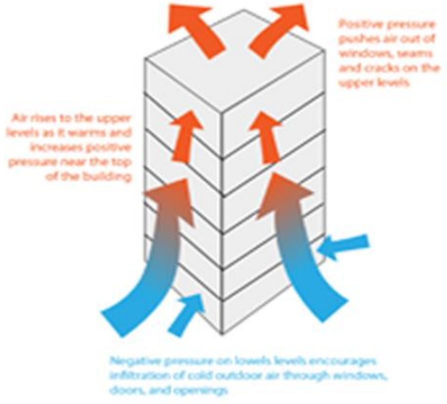


VENTILATION

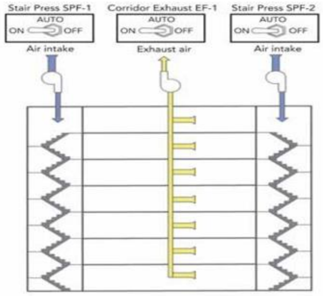
- Planned and systematic removal of smoke, heat, and gases from a structure
- Traditional ventilation not always available in high-rises
- If no horizontal ventilation:
  – Enclosed stairwell can be used
  – Hold open door on fire floor into stairwell
  – Use positive air pressure fans (with caution)

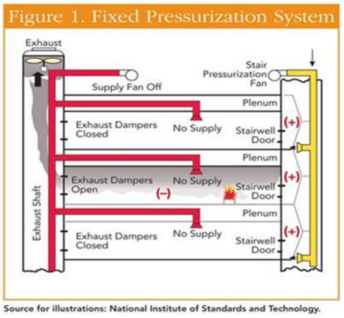
STACK EFFECT

- Natural movement of air within a tall building caused by temperature difference between outside and inside of building
  Becomes stronger as the building gets taller and the temperature difference becomes greater
- Stratification location: when light heated air flows upward and reaches a point where it is same temperature/weight as surrounding air

BUILDING FIRE PROTECTION SYSTEMS

– Standpipes
– Sprinkler and water supply systems
– Fire pumps
– Fire communications and command systems
– Pressurized stairwells





Source for illustrations: National Institute of Standards and Technology.

A. A Supply Air System designed to blow into the protected spaces a sufficient quantity of air to maintain the required pressure level or air velocity. This will always be fan powered.

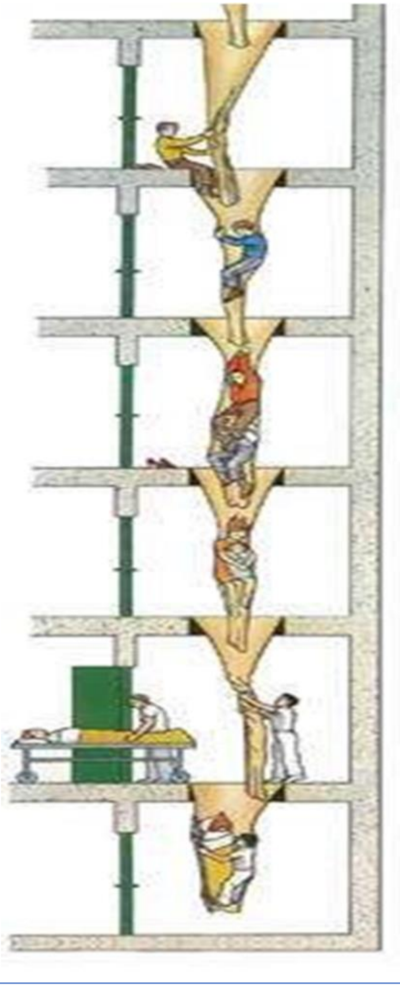
B. An Exhaust Air System to enable the pressurising air to escape from the unpressurised areas of the building via the fire floor. This can be either a natural or fan powered method.

– Fire dampers installed to prevent fire and heated gases from circulating in other parts of buildings

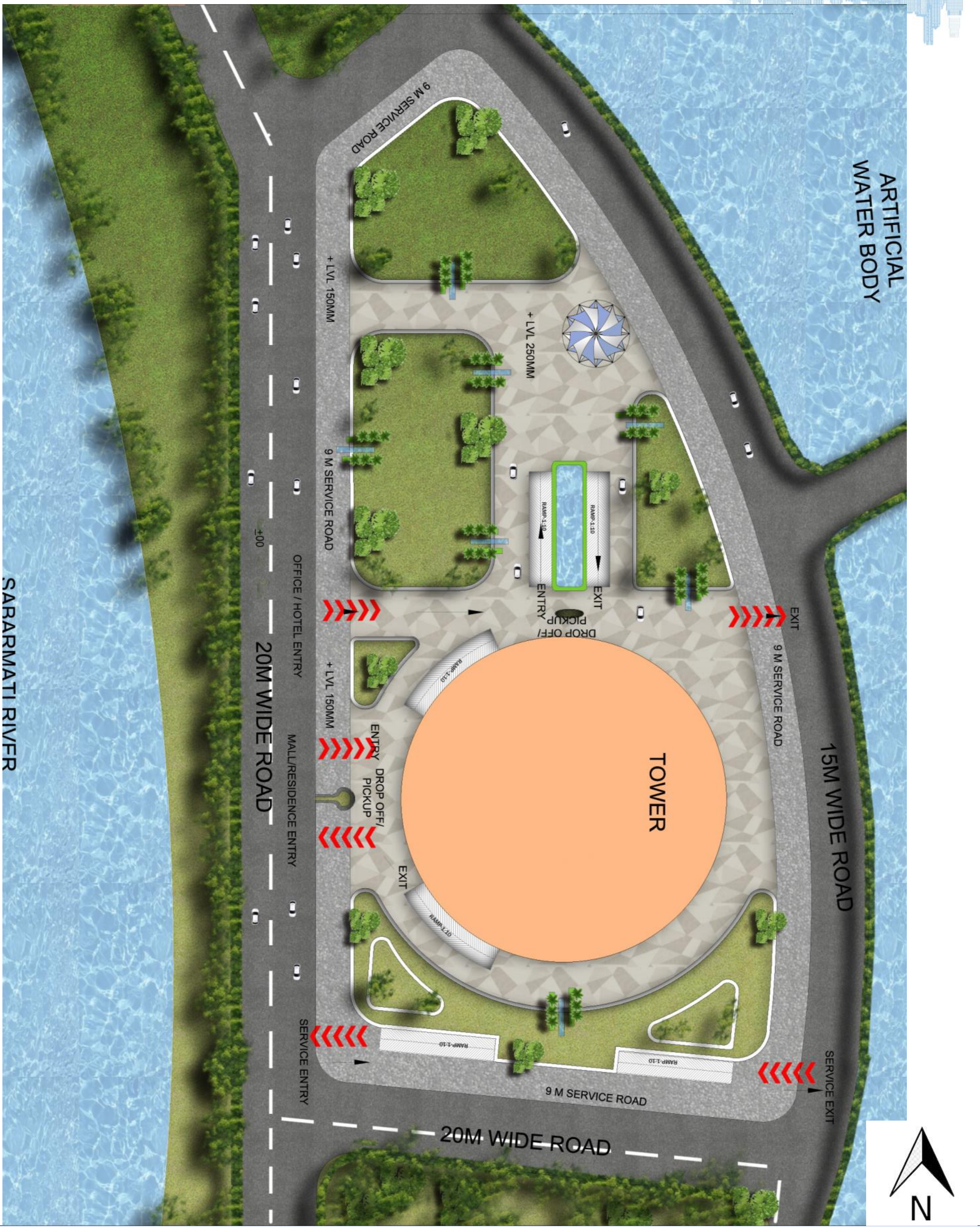
ESCAPE CHUTE

An escape chute is a special kind of emergency exit, used where conventional fire escape stair ways are impractical. The chute is a fabric (or occasionally metal) tube installed near a special exit on an upper floor or roof of a building, or a tall structure. During use, the chute is deployed, and may be secured at the bottom by a fire fighting crew some distance out from the building. Once the tube is ready, escapees enter the tube and slide down to a lower level or the ground level

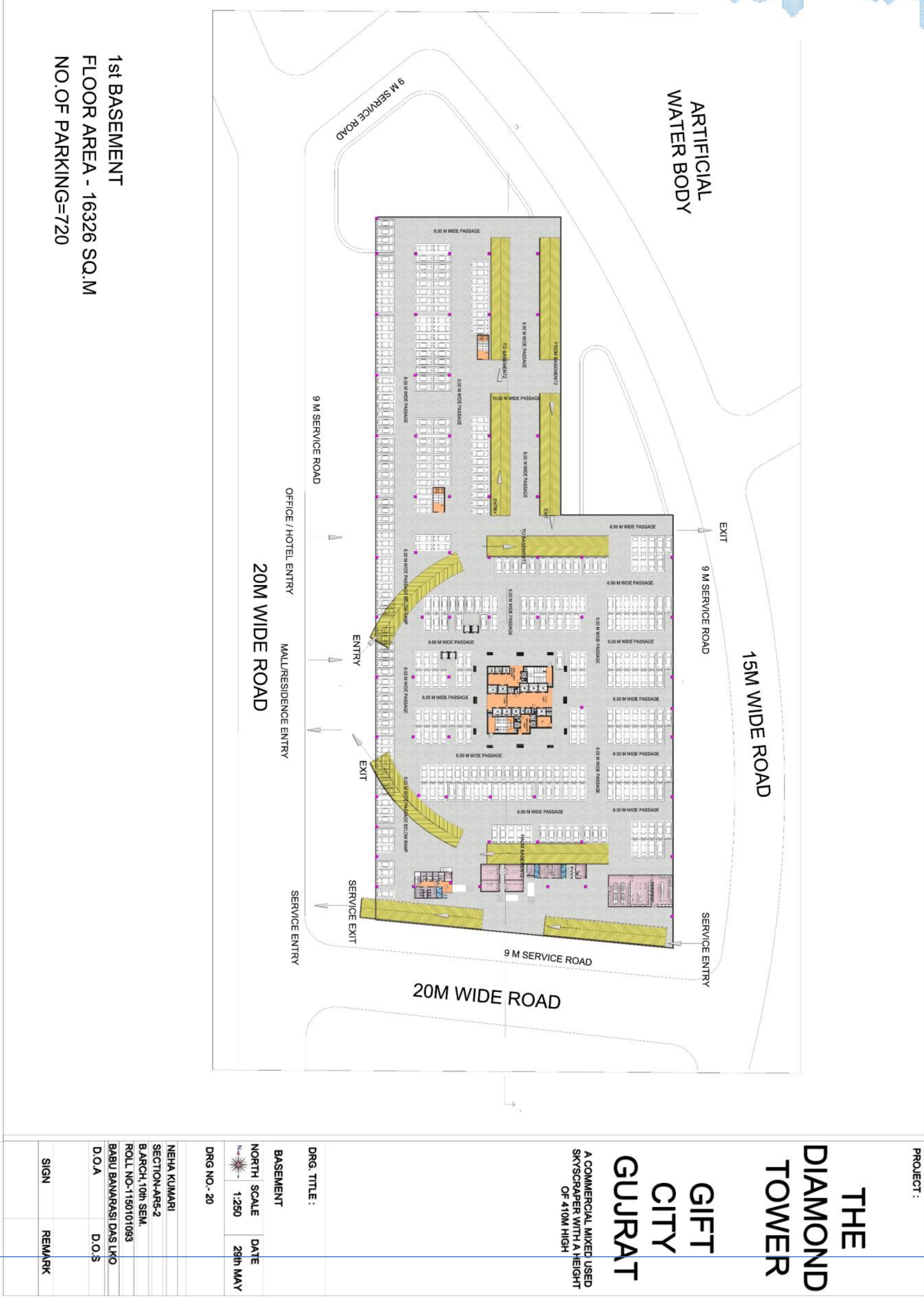
This type of emergency evacuation method is effective and very simple to use in relatively low buildings and when the line or path of descend is not compromised by fire or smoke. However, users require a reasonable level of courage and physical abilities to manage and control the speed of descend.



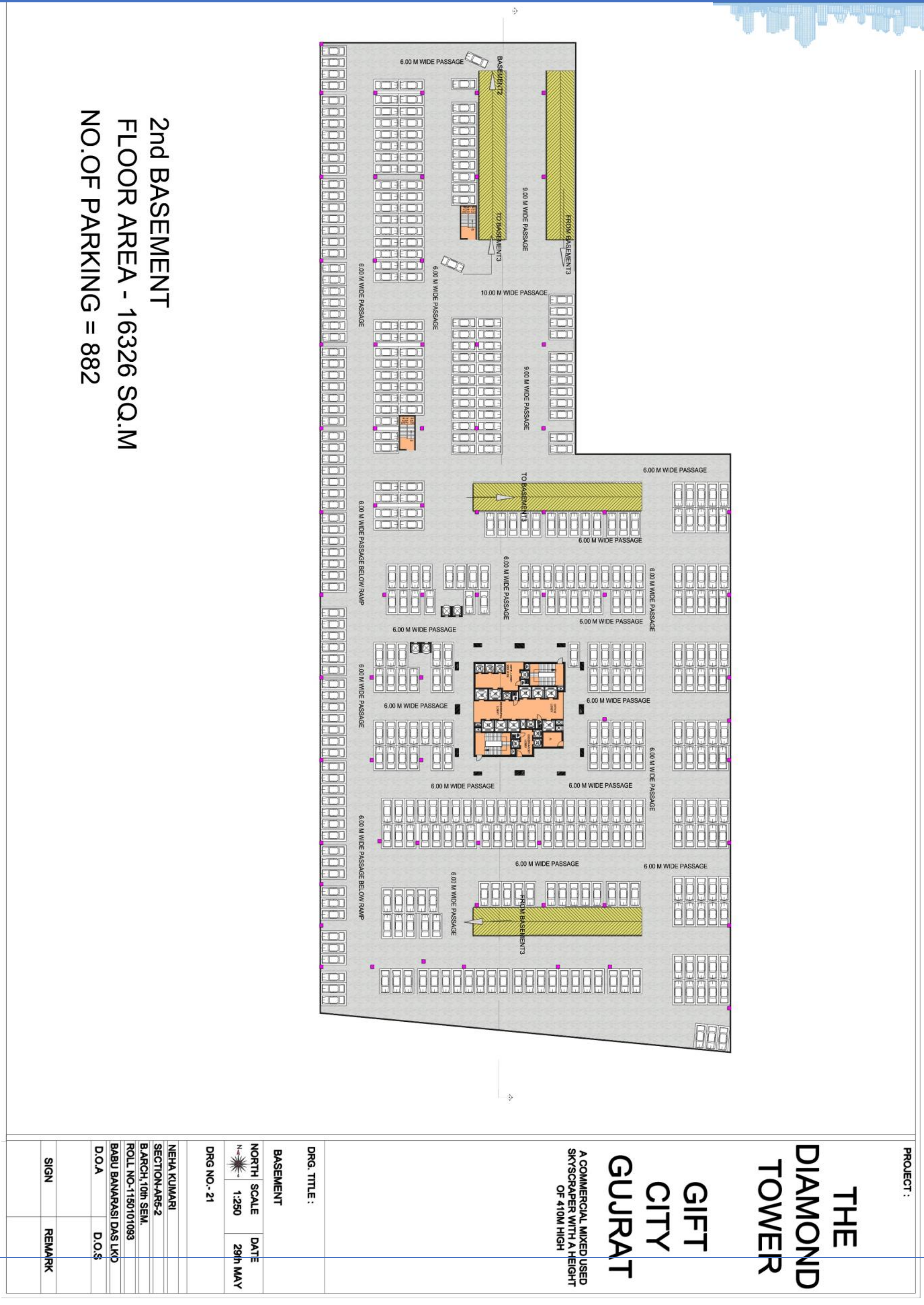
SITE PLAN


9 M SERVICE ROAD
ARTIFICIAL WATER BODY
+ LVL 150MM
+ LVL 250MM
9 M SERVICE ROAD
RAMP-1:10
RAMP-1:10
ENTRY
EXIT
DROP OFF/ PICKUP
±00
OFFICE / HOTEL ENTRY
EXIT
9 M SERVICE ROAD
SARARMATI RIVER
20M WIDE ROAD
TOWER
15M WIDE ROAD
+ LVL 150MM
ENTRY
DROP OFF/ PICKUP
MALL/RESIDENCE ENTRY
EXIT
SERVICE ENTRY
SERVICE EXIT
9 M SERVICE ROAD
20M WIDE ROAD
N

BASEMENT

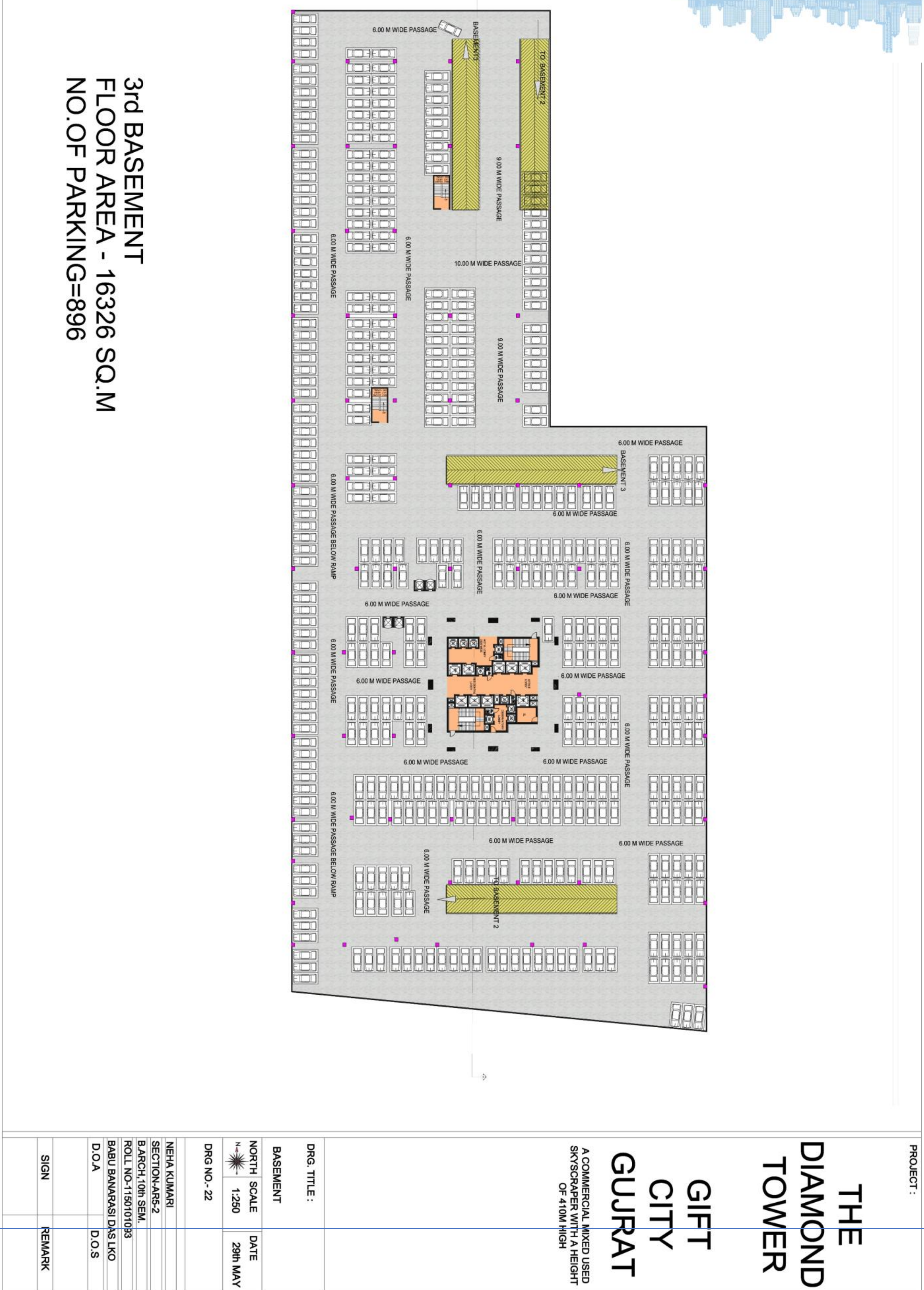

1st BASEMENT
FLOOR AREA - 16326 SQ.M
NO.OF PARKING=720
ARTIFICIAL WATER BODY
9 M SERVICE ROAD
15M WIDE ROAD
20M WIDE ROAD
OFFICE / HOTEL ENTRY
MALL/RESIDENCE ENTRY
ENTRY
EXIT
SERVICE EXIT
SERVICE ENTRY
6.00 M WIDE PASSAGE
PROJECT :
THE DIAMOND TOWER
GIFT CITY GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
BASEMENT
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 20
NEHA KUMARI
SECTION-AR5-2
B.ARCH.10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK

BASEMENT



2nd BASEMENT
FLOOR AREA - 16326 SQ.M
NO.OF PARKING = 882
6.00 M WIDE PASSAGE
9.00 M WIDE PASSAGE
10.00 M WIDE PASSAGE
6.00 M WIDE PASSAGE BELOW RAMP
BASEMENT2
TO BASEMENT3
FROM BASEMENT3
PROJECT :
THE DIAMOND TOWER
GIFT CITY GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
BASEMENT
DRG NO.- 21
NORTH
SCALE 1:250
DATE 29th MAY
NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-115010093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK

BASEMENT


3rd BASEMENT
FLOOR AREA - 16326 SQ.M
NO.OF PARKING=896
6.00 M WIDE PASSAGE
BASEMENT 3
TO BASEMENT 2
9.00 M WIDE PASSAGE
10.00 M WIDE PASSAGE
6.00 M WIDE PASSAGE BELOW RAMP
TO BASEMENT 2
PROJECT :
THE DIAMOND TOWER
GIFT CITY GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
BASEMENT
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 22
NEHA KUMARI
SECTION-AR5-2
B.ARCH.10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK

GROUND FLOOR (PODIUM)/ZONE 1

FLOOR AREA - 5655 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 1
PODIUM/MALL BLOCK

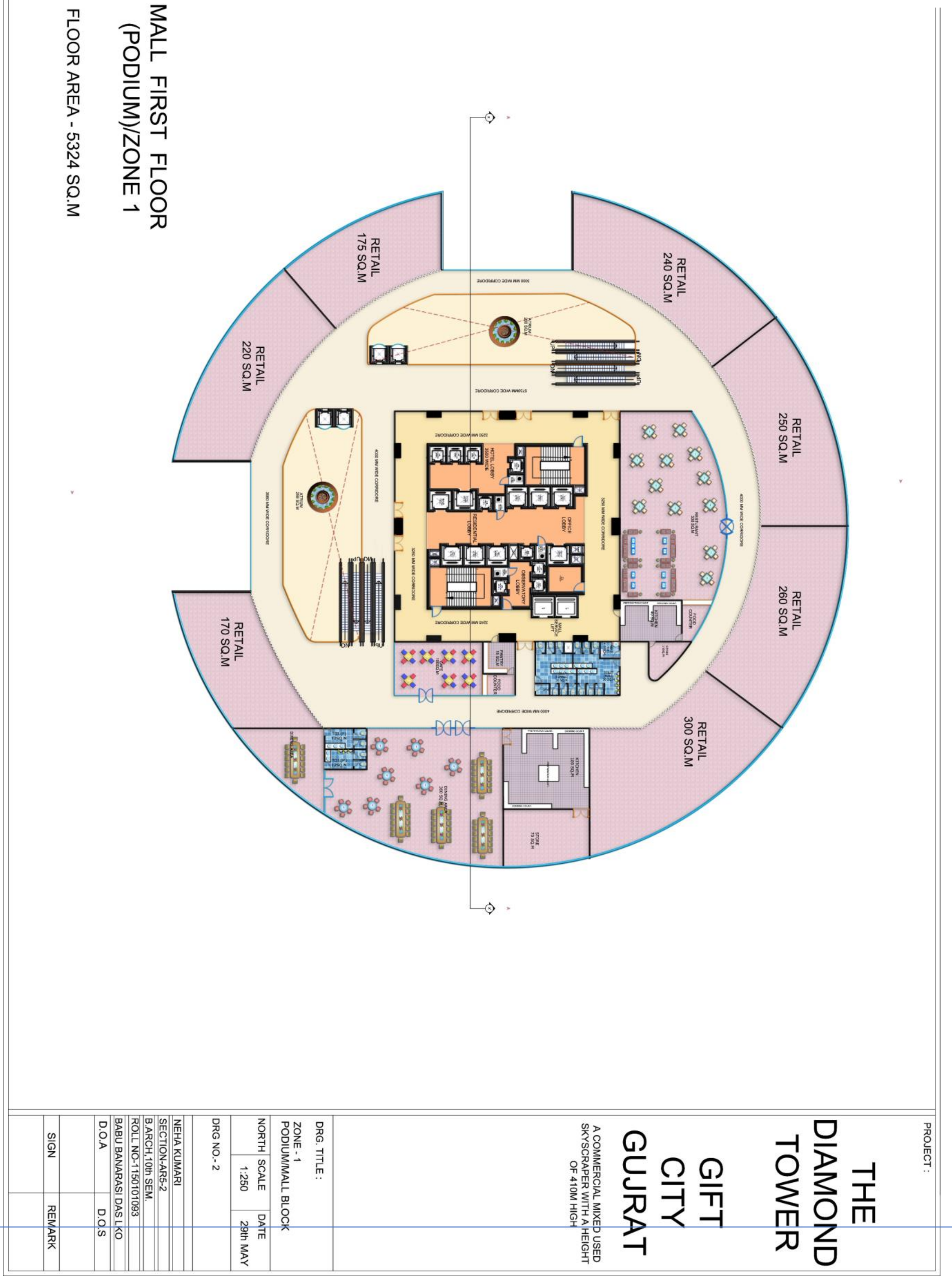
NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 1

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

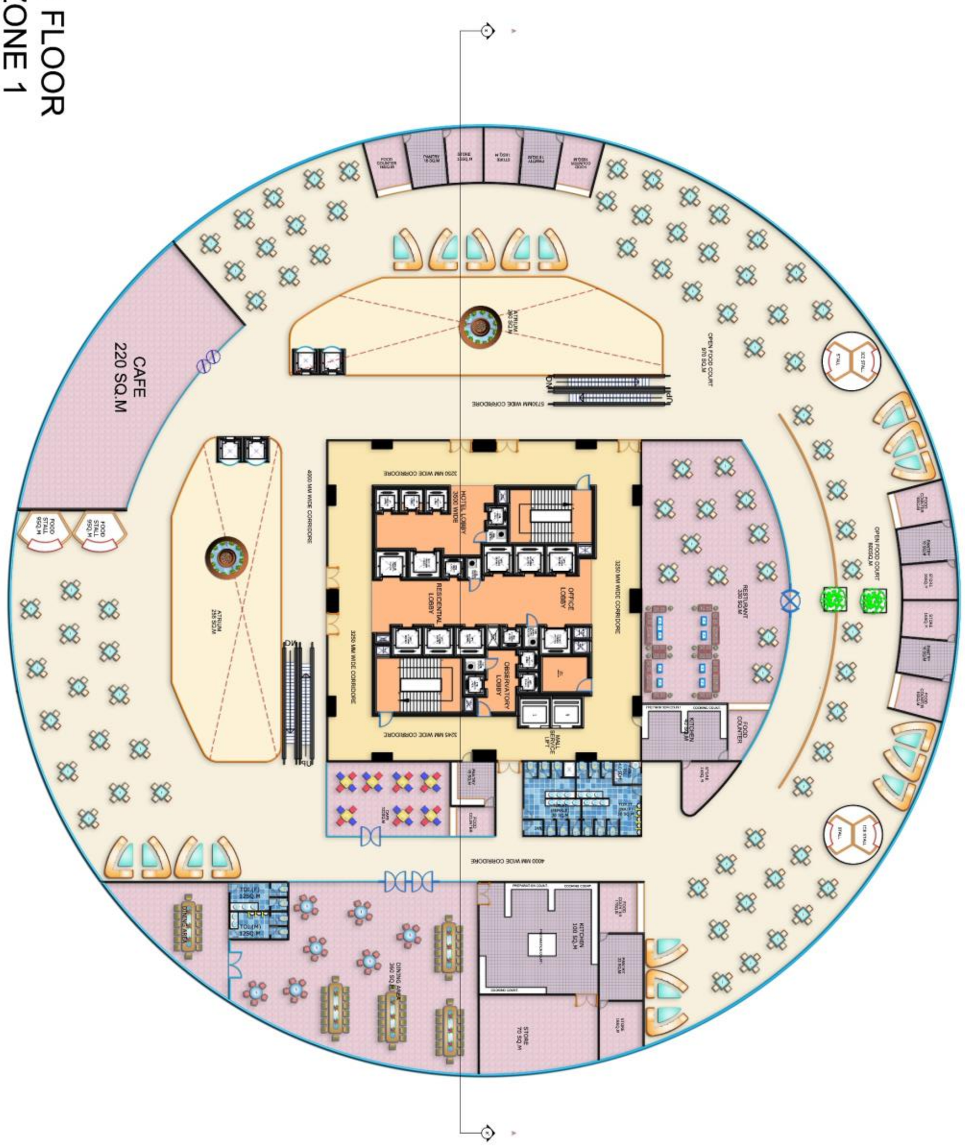
FLOOR PLANS



MALL FIRST FLOOR
(PODIUM)/ZONE 1
FLOOR AREA - 5324 SQ.M
RETAIL 175 SQ.M
RETAIL 240 SQ.M
RETAIL 220 SQ.M
RETAIL 250 SQ.M
RETAIL 260 SQ.M
RETAIL 170 SQ.M
RETAIL 300 SQ.M
PROJECT :
THE DIAMOND TOWER
GIFT CITY GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
ZONE - 1
PODIUM/MALL BLOCK
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 2
NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-115010093
BABU BANARASI DAS,LKO
D.O.A
D.O.S
SIGN
REMARK

MALL 2nd ,3rd FLOOR (PODIUM)//ZONE 1

FLOOR AREA - 5655 SQ.M



PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 1
PODIUM/MALL BLOCK

NORTH	SCALE	DATE
	1:250	29th MAY

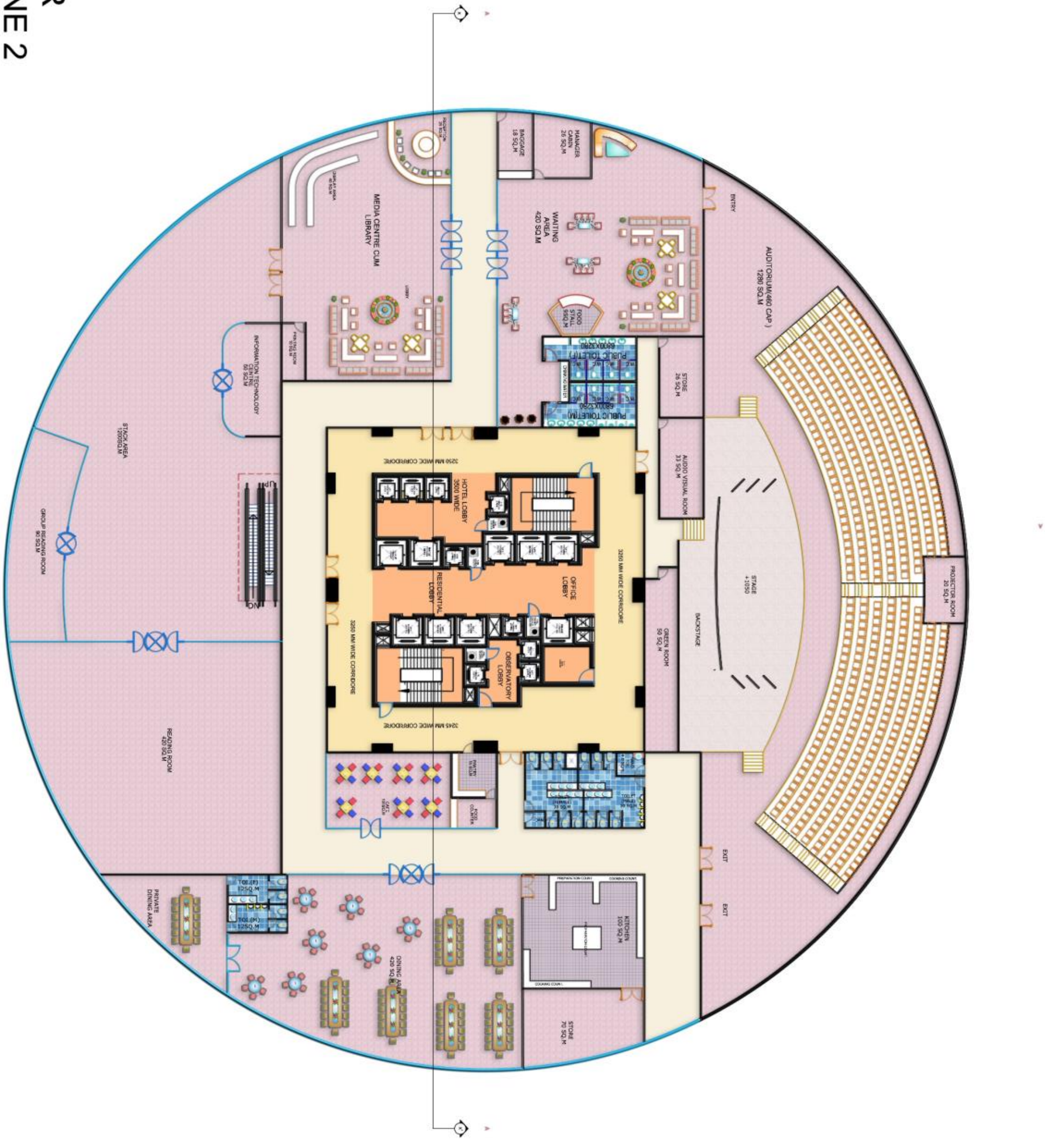
DRG NO.- 3

NEHA KUMARI
SECTION-AR5-2
B.ARCH.10th SEM.
ROLL NO-115010093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

FLOOR PLANS

4th FLOOR
(OFFICE) /ZONE 2
FLOOR AREA - 5655 SQ.M



PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

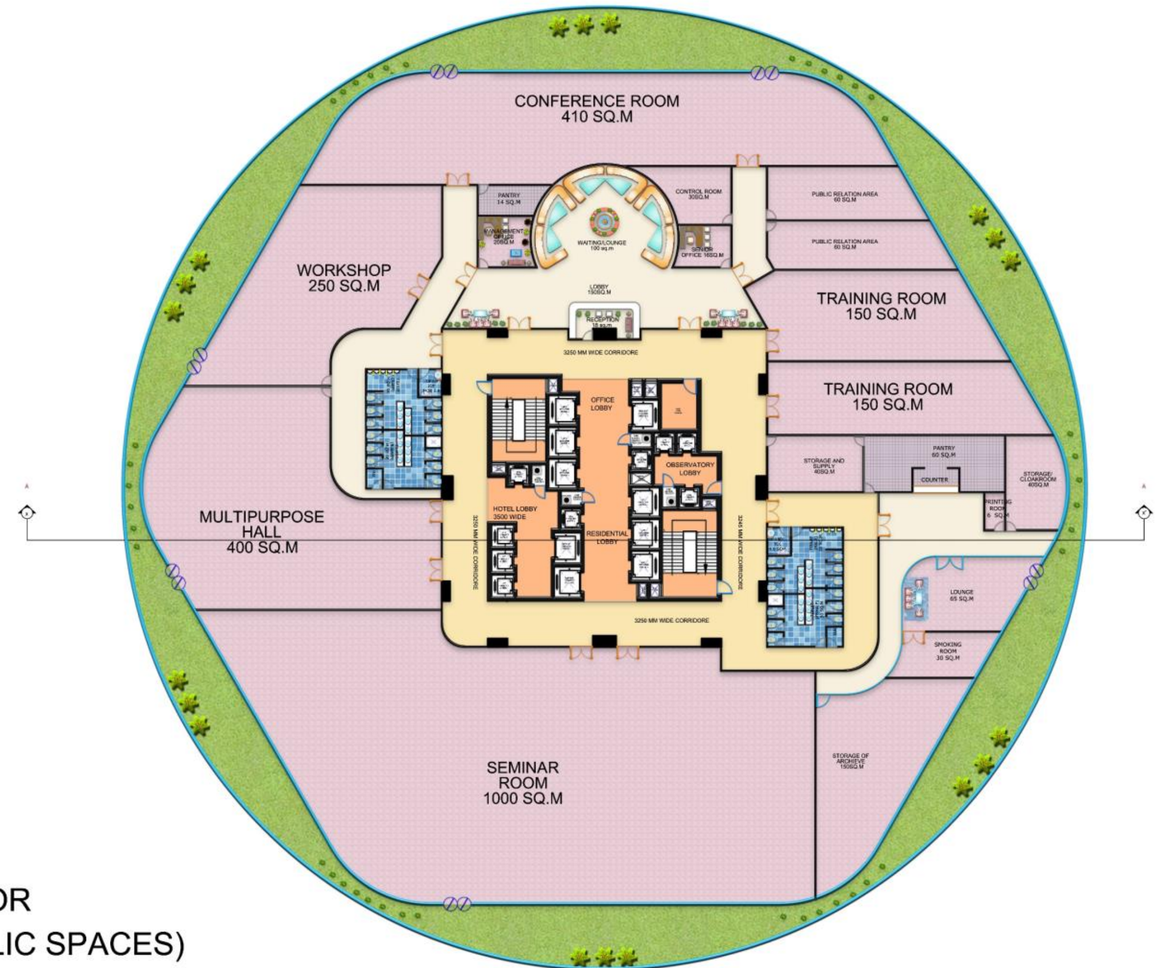
DRG. TITLE :
ZONE - 2
OFFICE ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 4

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK



5th FLOOR
(OFFICE PUBLIC SPACES)
/ZONE 2

FLOOR AREA - 5655 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 2
OFFICE ZONE

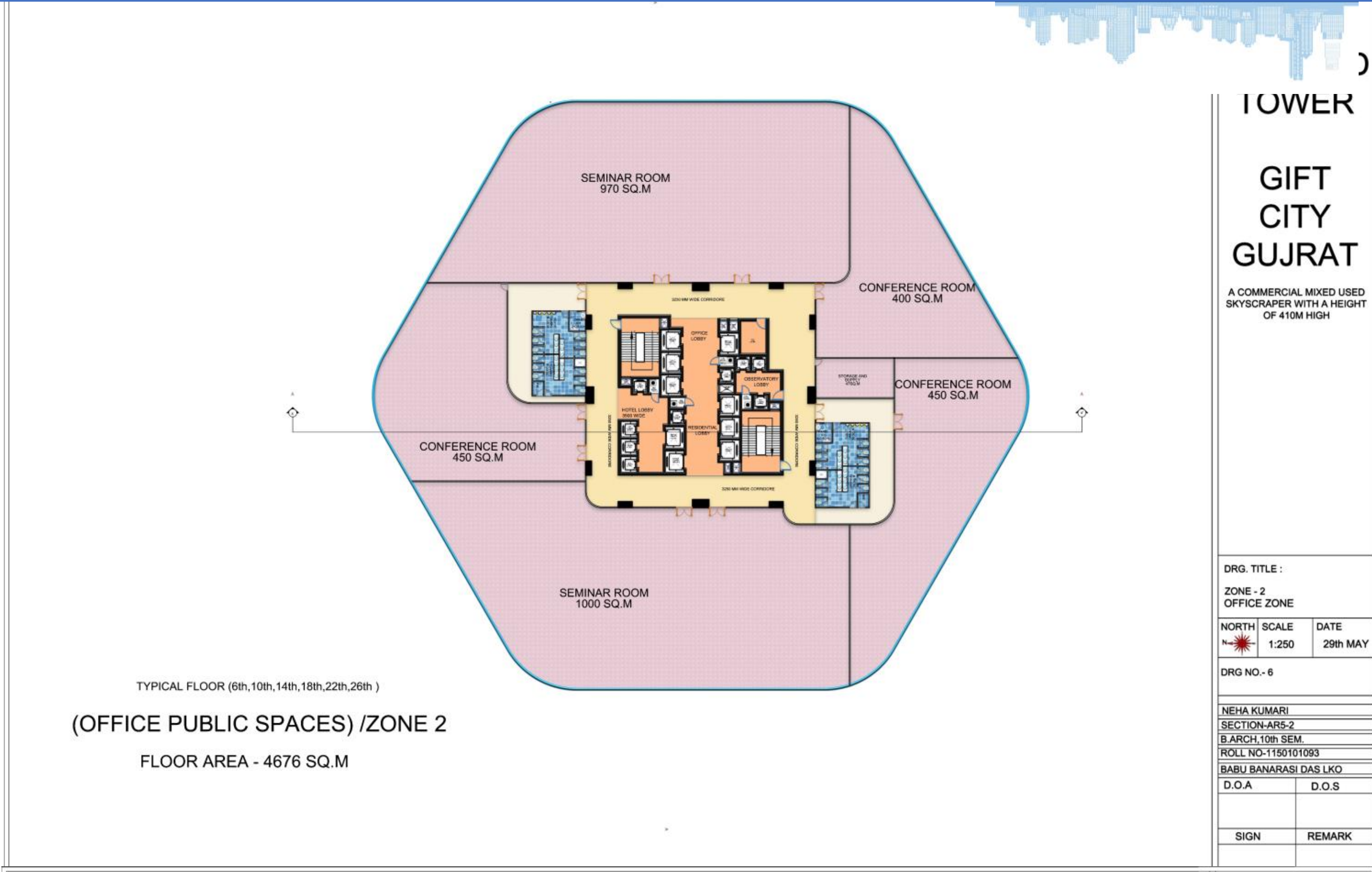
NORTH	SCALE	DATE
N	1:250	29th MAY

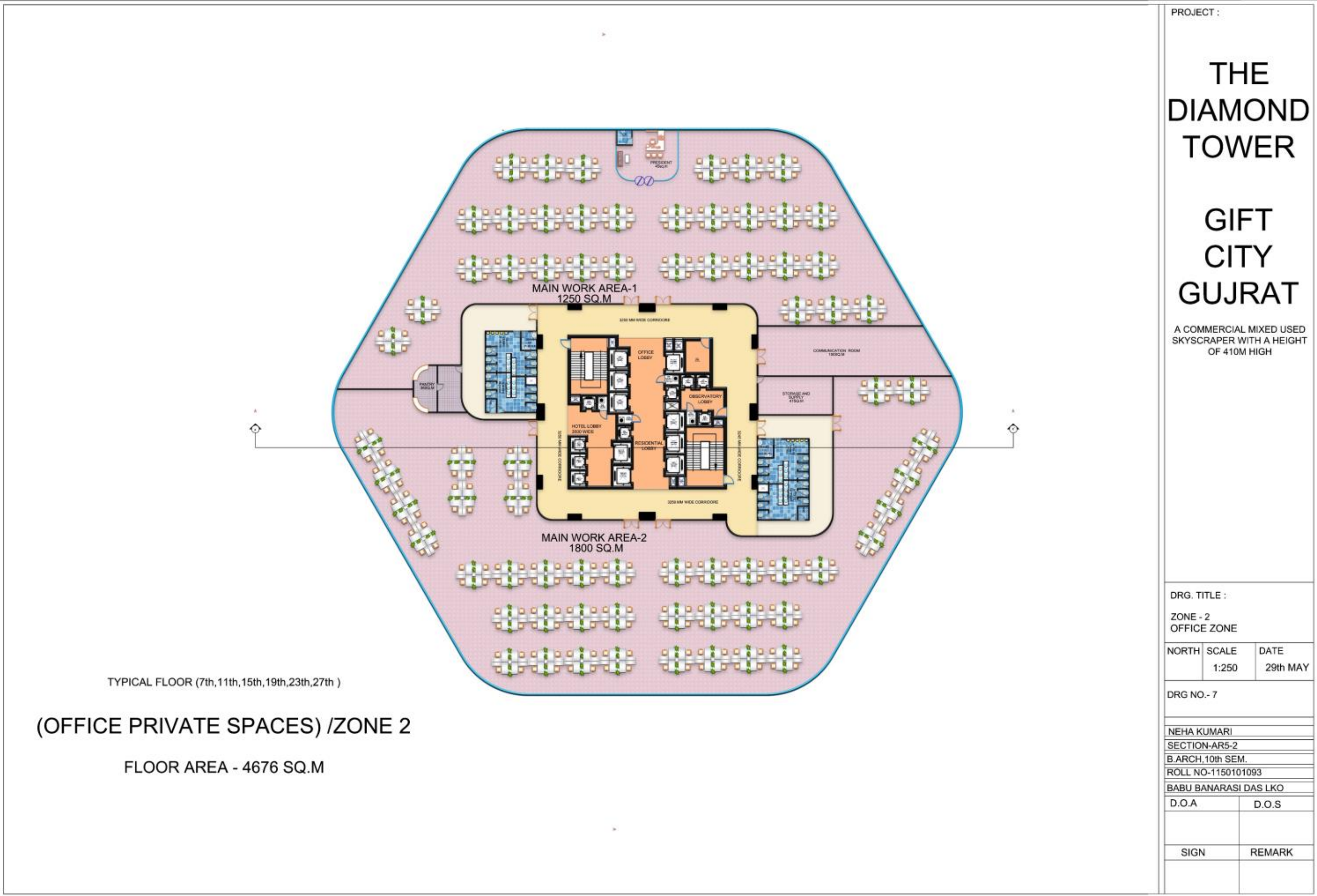
DRG NO.- 5

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

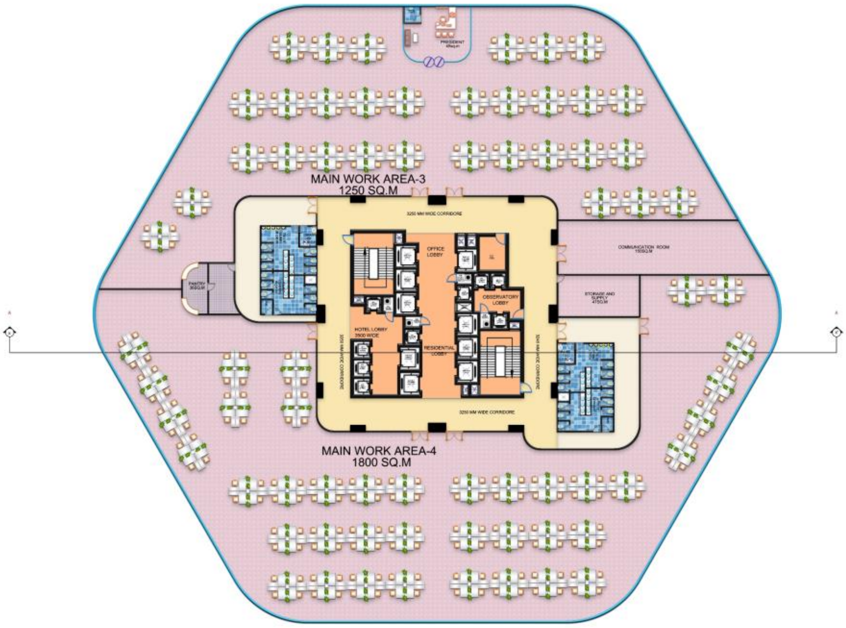
D.O.A	D.O.S
SIGN	REMARK

FLOOR PLANS


SEMINAR ROOM
970 SQ.M
CONFERENCE ROOM
400 SQ.M
CONFERENCE ROOM
450 SQ.M
CONFERENCE ROOM
450 SQ.M
SEMINAR ROOM
1000 SQ.M
TYPICAL FLOOR (6th,10th,14th,18th,22th,26th)
(OFFICE PUBLIC SPACES) /ZONE 2
FLOOR AREA - 4676 SQ.M
TOWER
GIFT
CITY
GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
ZONE - 2
OFFICE ZONE
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 6
NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK


MAIN WORK AREA-1
1250 SQ.M
MAIN WORK AREA-2
1800 SQ.M
TYPICAL FLOOR (7th,11th,15th,19th,23th,27th)
(OFFICE PRIVATE SPACES) /ZONE 2
FLOOR AREA - 4676 SQ.M
PROJECT :
THE
DIAMOND
TOWER
GIFT
CITY
GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
ZONE - 2
OFFICE ZONE
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 7
NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK

FLOOR PLANS



TYPICAL FLOOR (8th,12th,16th,20th,24th,28th)

(OFFICE PRIVATE SPACES) /ZONE 2

FLOOR AREA - 4676 SQ.M

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 2
OFFICE ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 8

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

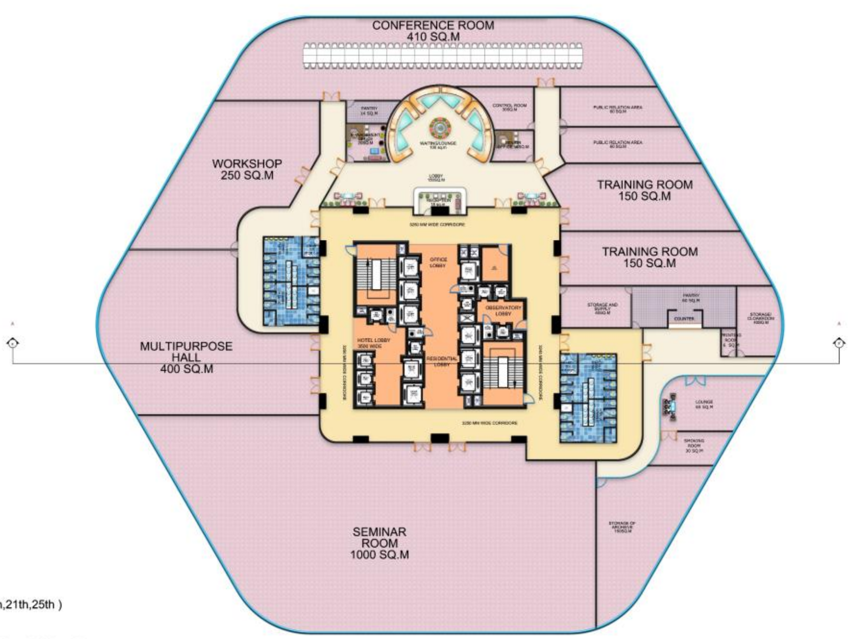
D.O.A	D.O.S
SIGN	REMARK

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH



TYPICAL FLOOR (9th,13th,17th,21th,25th)

(OFFICE PUBLIC SPACES)/ZONE 2

FLOOR AREA - 4676 SQ.M

DRG. TITLE :

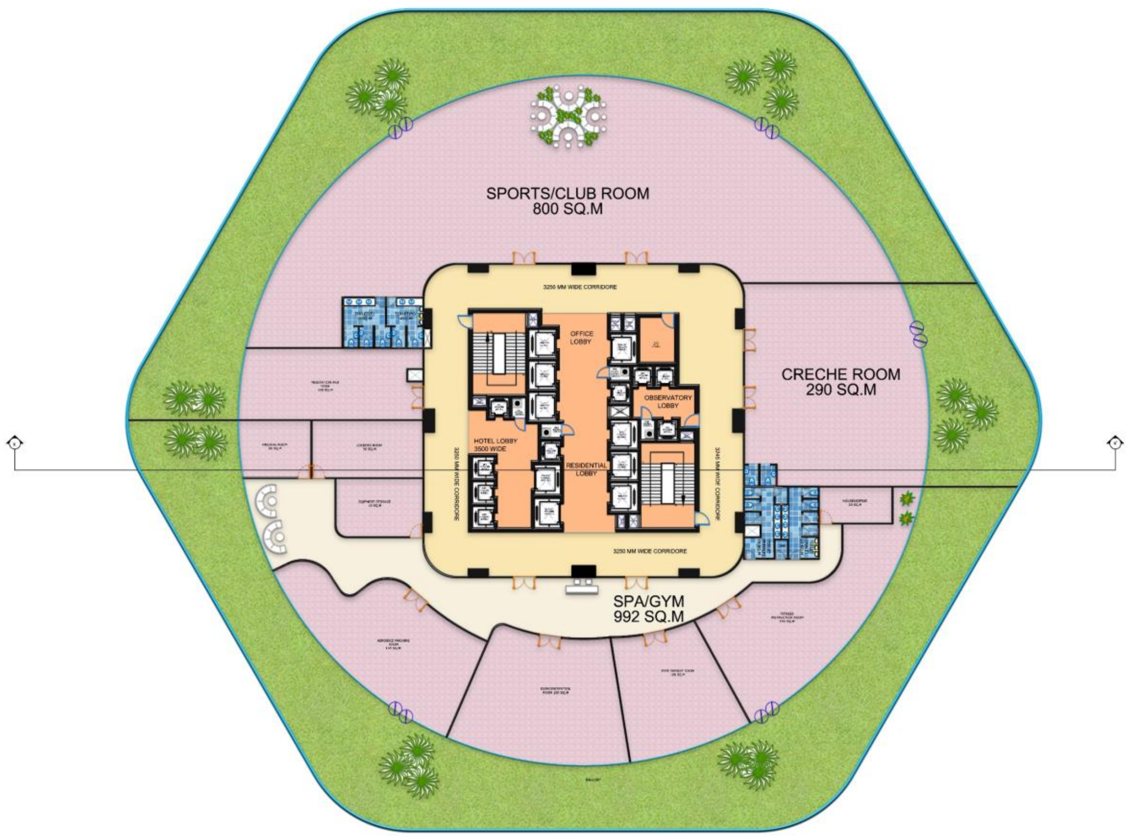
ZONE - 2
OFFICE ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 9

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK



29th FLOOR

RECREATIONAL AREA /ZONE 2

FLOOR AREA - 4676 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 2
RECREATIONAL ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 10

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

30th FLOOR

SINGLE OCCUPANCY SUITS /ZONE 3

FLOOR AREA - 3923 SQ.M
TOTAL NO.OF SINGLE
OCCUPANCY SUITS = 92

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

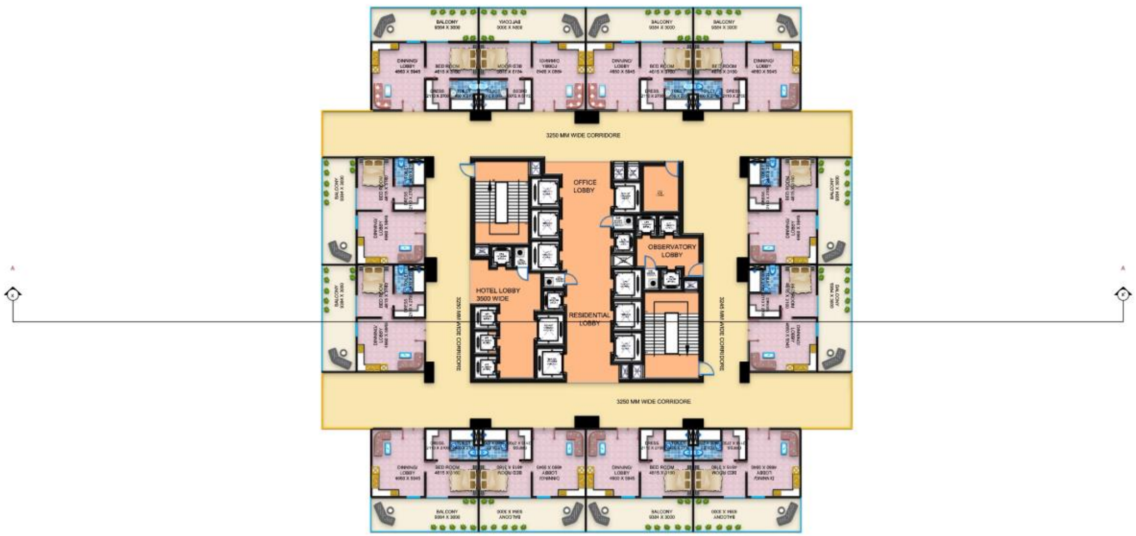
ZONE - 3
SERVICE APARTMENT ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 11

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK



TYPICAL FLOOR (31th and 36th)

SINGLE OCCUPANCY SUITS /ZONE 3

FLOOR AREA - 2018 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 3
SERVICE APARTMENT ZONE

NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 12

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

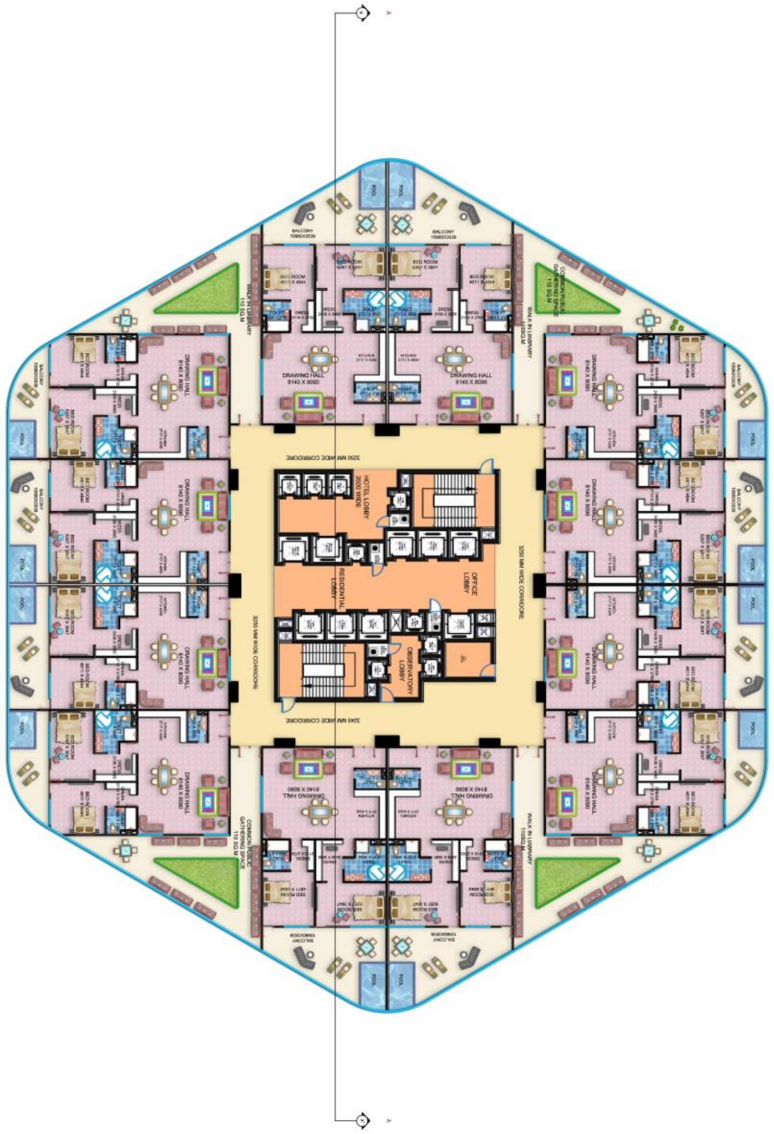
D.O.A	D.O.S
SIGN	REMARK

FLOOR PLANS

TYPICAL FLOOR (37th-40th)

DOUBLE OCCUPANCY SUITS /ZONE 3

FLOOR AREA - 3923 SQ.M



PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKY SCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 3
SERVICE APARTMENT ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO. - 13

NEHA KUMARI
SECTION-AR5-2
B.ARCH-10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S

SIGN	REMARK

41th FLOOR

HOTELS /ZONE 4

FLOOR AREA - 3923 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 4
HOTEL ZONE

NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 14

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

FLOOR PLANS

42th FLOOR
HOTELS /ZONE 4
FLOOR AREA - 3923 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 4
HOTEL ZONE

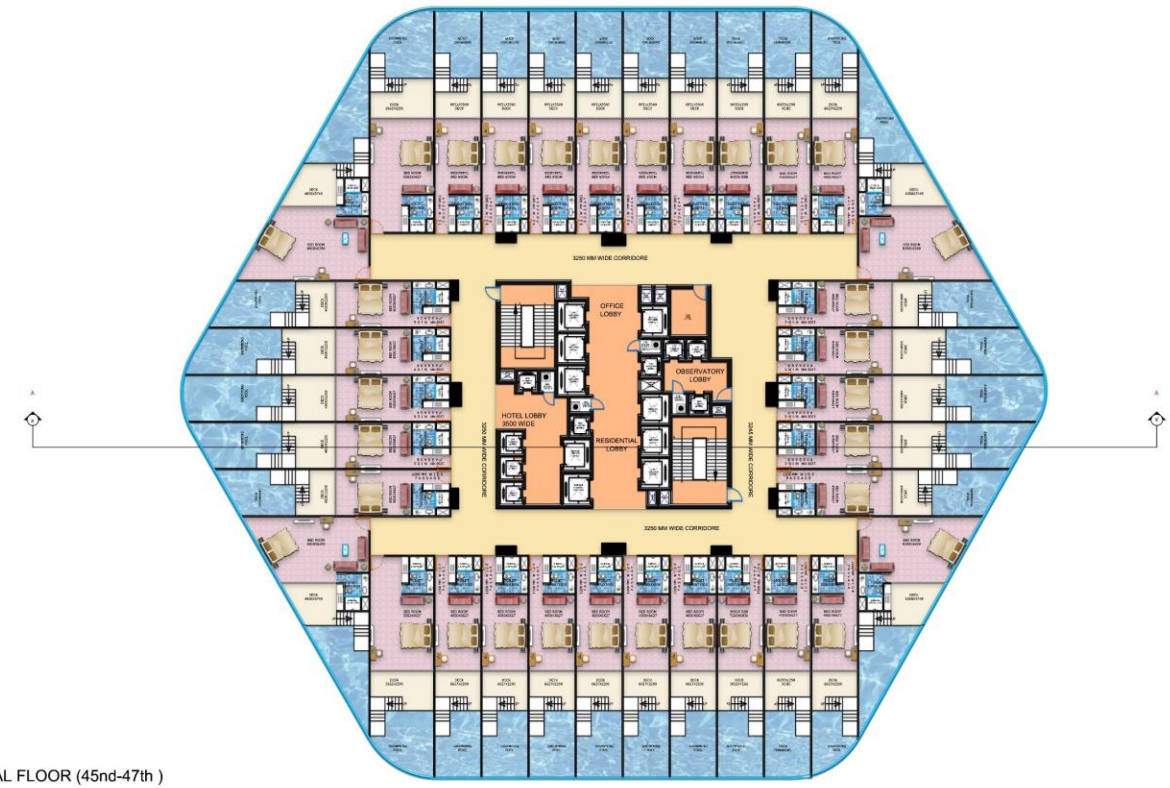
NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 15

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

FLOOR PLANS



TYPICAL FLOOR (45nd-47th)

HOTELS (DELUXE SUITS) /ZONE 4

FLOOR AREA - 3923 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

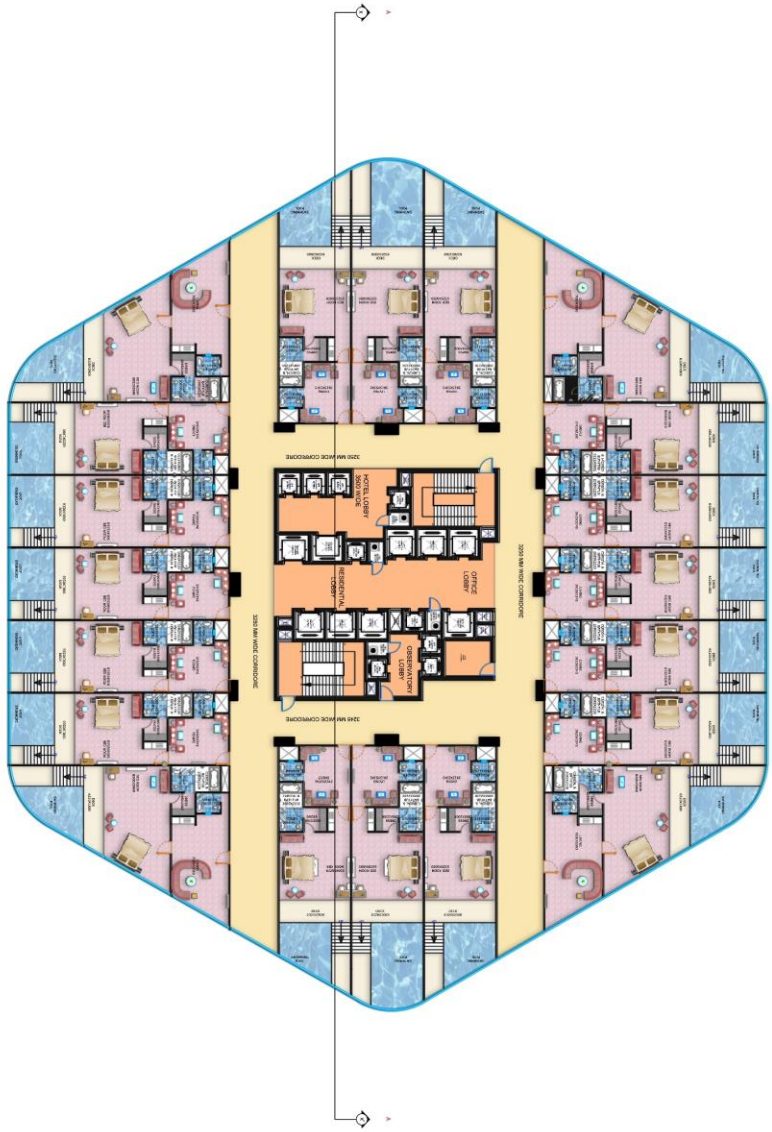
DRG. TITLE : ZONE - 4 HOTEL ZONE		
NORTH	SCALE 1:250	DATE 29th MAY
DRG NO.- 16		
NEHA KUMARI		
SECTION-AR5-2		
B.ARCH,10th SEM.		
ROLL NO-1150101093		
BABU BANARASI DAS LKO		
D.O.A	D.O.S	
SIGN	REMARK	

FLOOR PLANS

TYPICAL FLOOR (48th-52TH)

HOTELS (LUXURY SUITS) /ZONE 4

FLOOR AREA - 3923 SQ.M



PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

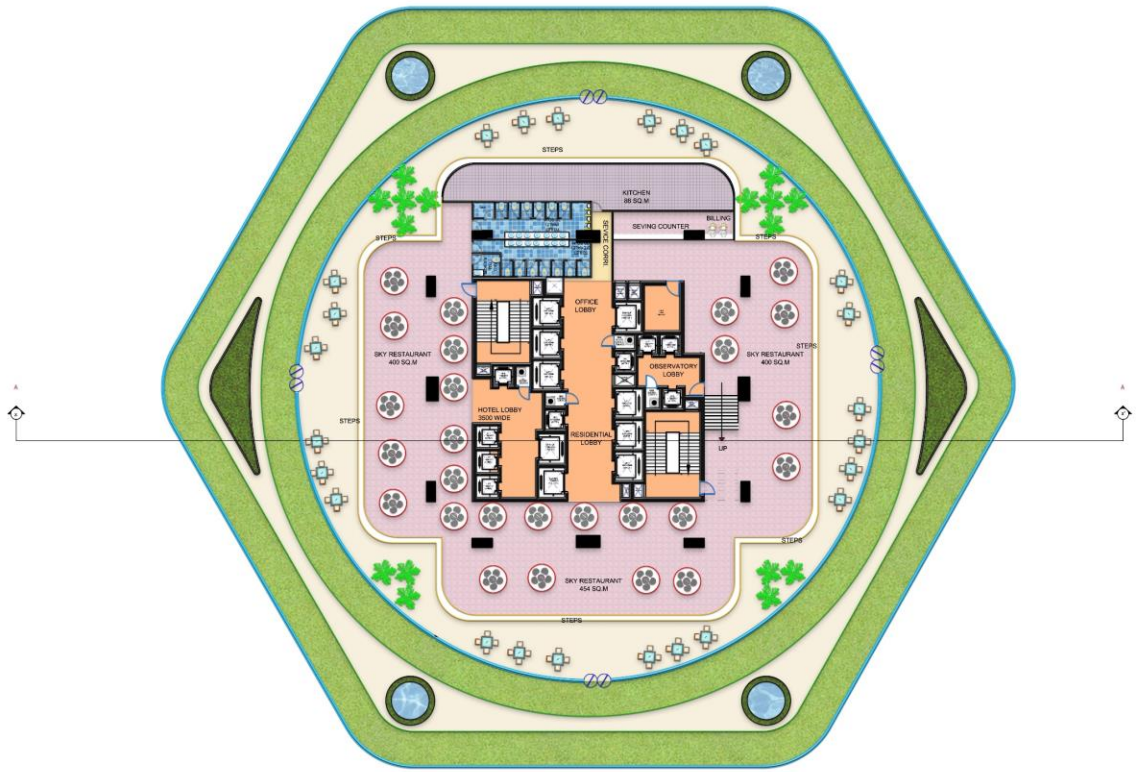
ZONE - 4
HOTEL ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 17

NEHA KUMARI
SECTION-AR5-2
B.ARCH.10th SEM.
ROLL NO-15010093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK



53rd FLOOR

OBSERVATORY(SKY RESTAURANT)
/ZONE 5

FLOOR AREA - 3923 SQ.M

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

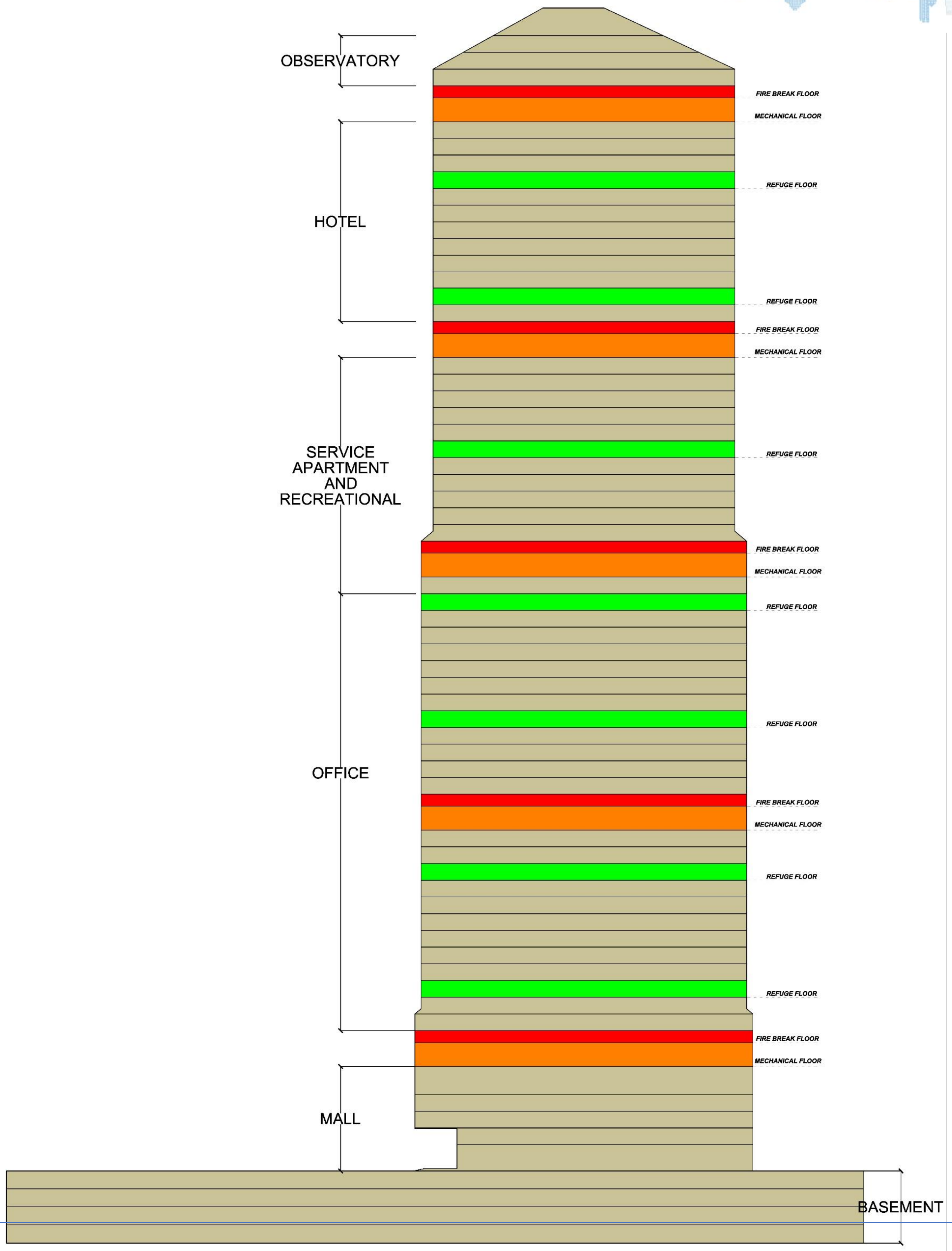
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE : ZONE - 5 OBSERVATORY		
NORTH	SCALE 1:250	DATE 29th MAY
DRG NO.- 18		
NEHA KUMARI		
SECTION-AR5-2		
B.ARCH,10th SEM.		
ROLL NO-1150101093		
BABU BANARASI DAS LKO		
D.O.A	D.O.S	
SIGN	REMARK	

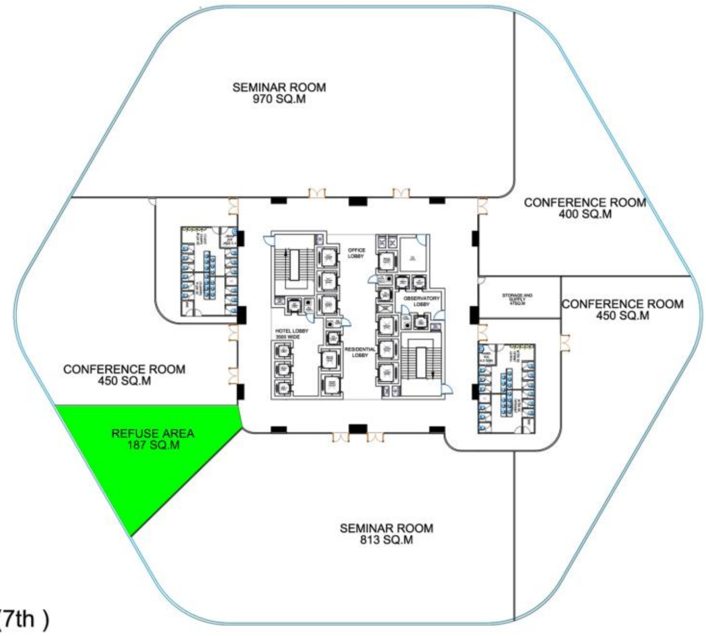
FLOOR PLANS


54th FLOOR
OBSERVATORY(PUB/CLUB) /ZONE 5
FLOOR AREA - 2127 SQ.M
NIGHT CLUB AND PUB
1966 SQ.M
DANCE FLOOR
SNACK COUNTER
STAGE
5000x11000
BAR COUNTER
HOTEL LOBBY
OFFICE LOBBY
RESIDENTIAL LOBBY
OBSERVATORY LOBBY
DN
55th FLOOR
OBSERVATORY(INFINITY POOL)
/ZONE 5
FLOOR AREA - 2127 SQ.M
INFINITY POOL
SEATING
KITCHEN
45 SQ.M
SEVICE CORRI.
STOR
OFFICE LOBBY
RESIDENTIAL LOBBY
HOTEL LOBBY
OBSERVATORY LOBBY
SNACK COUNTER
SUN ROOM
DN
PROJECT :
THE DIAMOND TOWER
GIFT CITY
GUJRAT
A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH
DRG. TITLE :
ZONE - 5
OBSERVATORY
NORTH
SCALE
1:250
DATE
29th MAY
DRG NO.- 19
NEHA KUMARI
SECTION-AR5-2
B.ARCH.10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO
D.O.A
D.O.S
SIGN
REMARK

VERTICLE ZONNING /REFUGE FLOORS



REFUGE FLOOR



REFUSE AREA FLOOR (7th)

(OFFICE PUBLIC SPACES) /ZONE 2

FLOOR AREA - 4676 SQ.M

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 2
OFFICE ZONE

NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 21

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

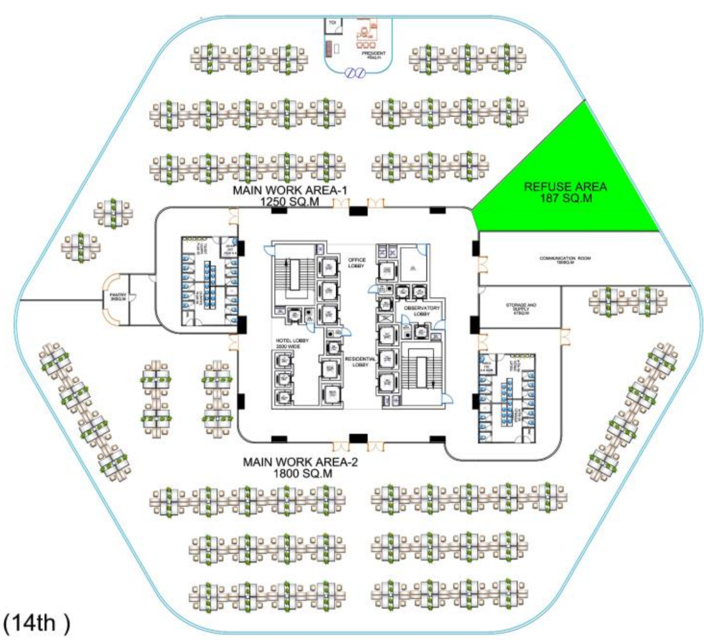
D.O.A	D.O.S
SIGN	REMARK

PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH



REFUSE AREA FLOOR (14th)

(OFFICE PRIVATE SPACES) /ZONE 2

FLOOR AREA - 4676 SQ.M

DRG. TITLE :

ZONE - 2
OFFICE ZONE

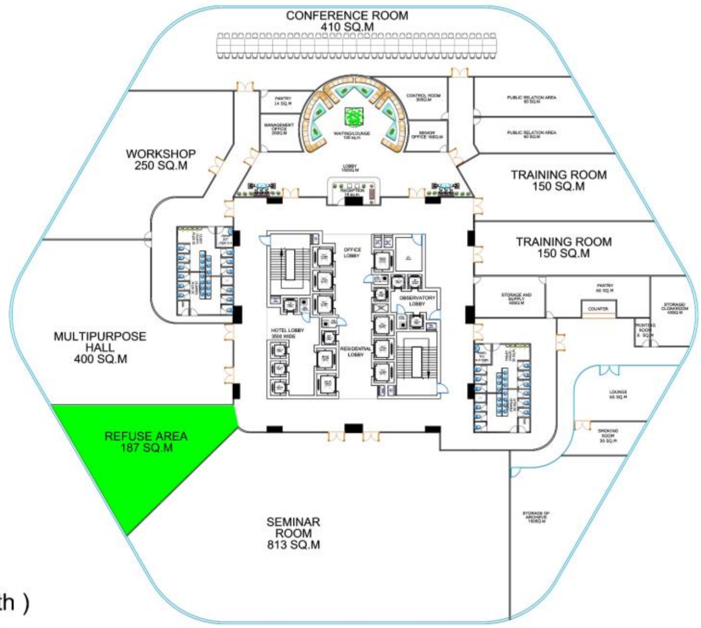
NORTH	SCALE	DATE
	1:250	29th MAY

DRG NO.- 22

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

REFUGE FLOOR



REFUSE AREA FLOOR (28th)

(OFFICE PUBLIC SPACES)/ZONE 2

FLOOR AREA - 4676 SQ.M

TOWER

GIFT
CITY
GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 2
OFFICE ZONE

NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 24

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

REFUSE AREA FLOOR (35th)

SINGLE OCCUPANCY SUITS /ZONE 3

FLOOR AREA - 2018 SQ.M

PROJECT :

THE
DIAMOND
TOWER

GIFT
CITY
GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

ZONE - 3
SERVICE APARTMENT ZONE

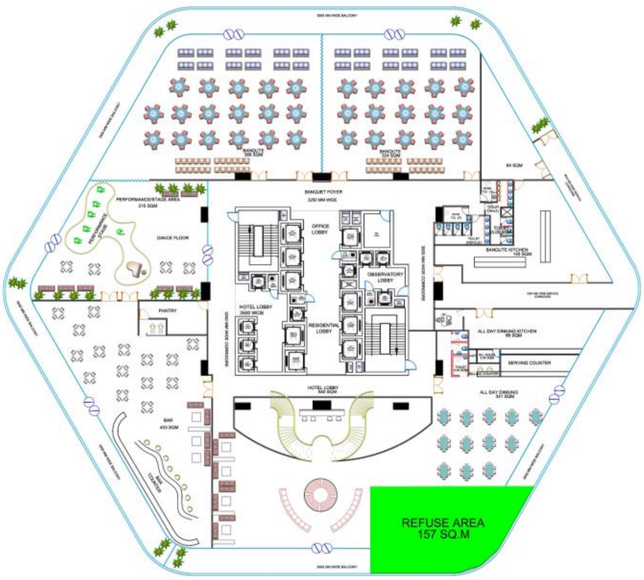
NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 25

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

REFUGE FLOOR



REFUSE AREA FLOOR (42nd)
HOTELS /ZONE 4
FLOOR AREA - 3923 SQ.M

GIFT
CITY
GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :
ZONE - 4
HOTEL ZONE

NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 26

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

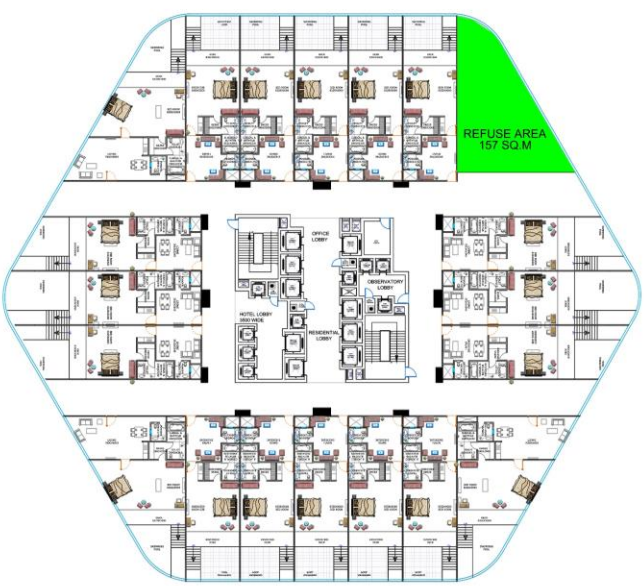
D.O.A	D.O.S
SIGN	REMARK

PROJECT :

THE
DIAMOND
TOWER

GIFT
CITY
GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH



REFUSE AREA FLOOR (49th)
HOTELS (LUXURY SUITS) /ZONE 4
FLOOR AREA - 3923 SQ.M

DRG. TITLE :
ZONE - 4
HOTEL ZONE

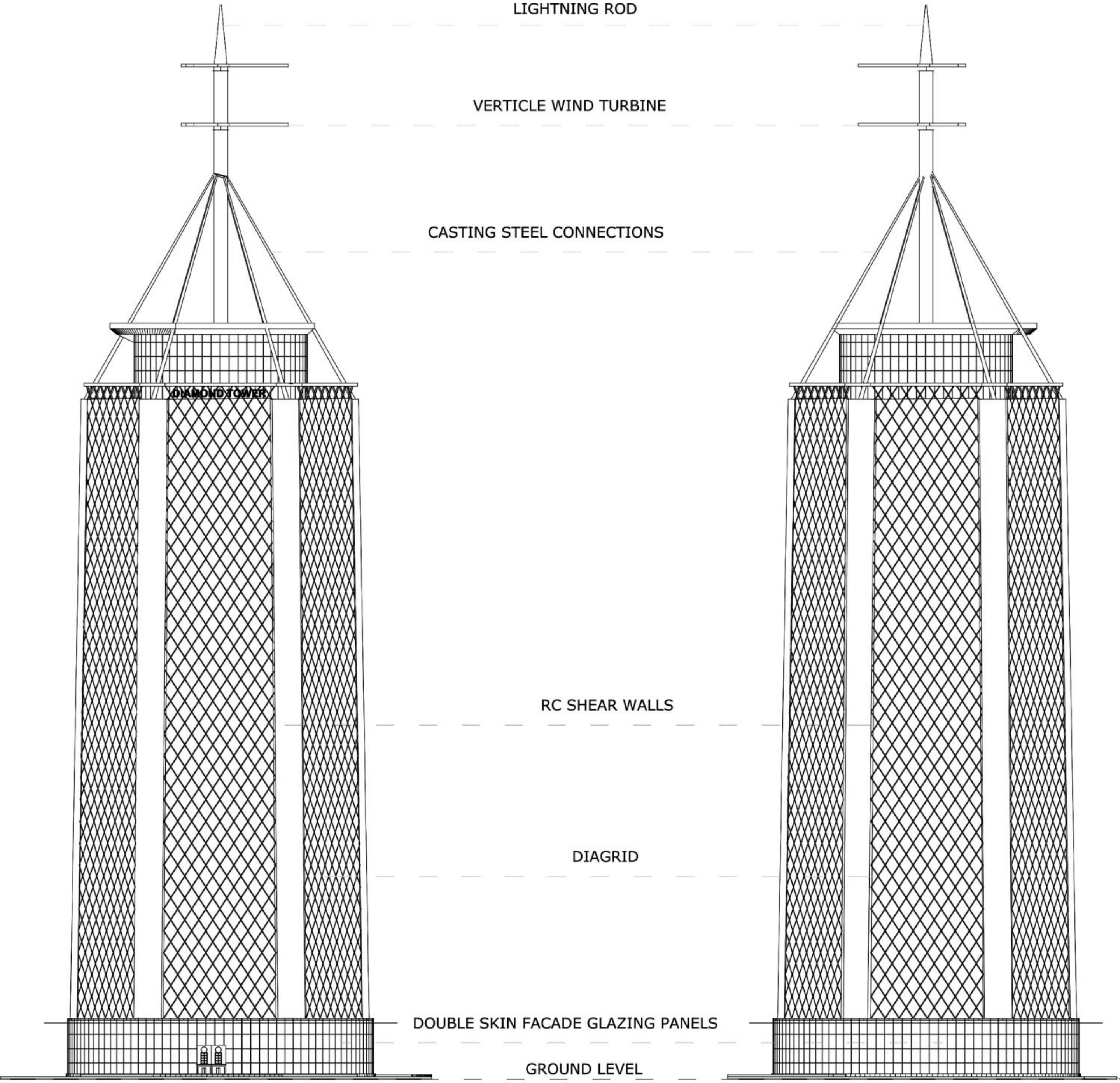
NORTH	SCALE	DATE
N	1:250	29th MAY

DRG NO.- 27

NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

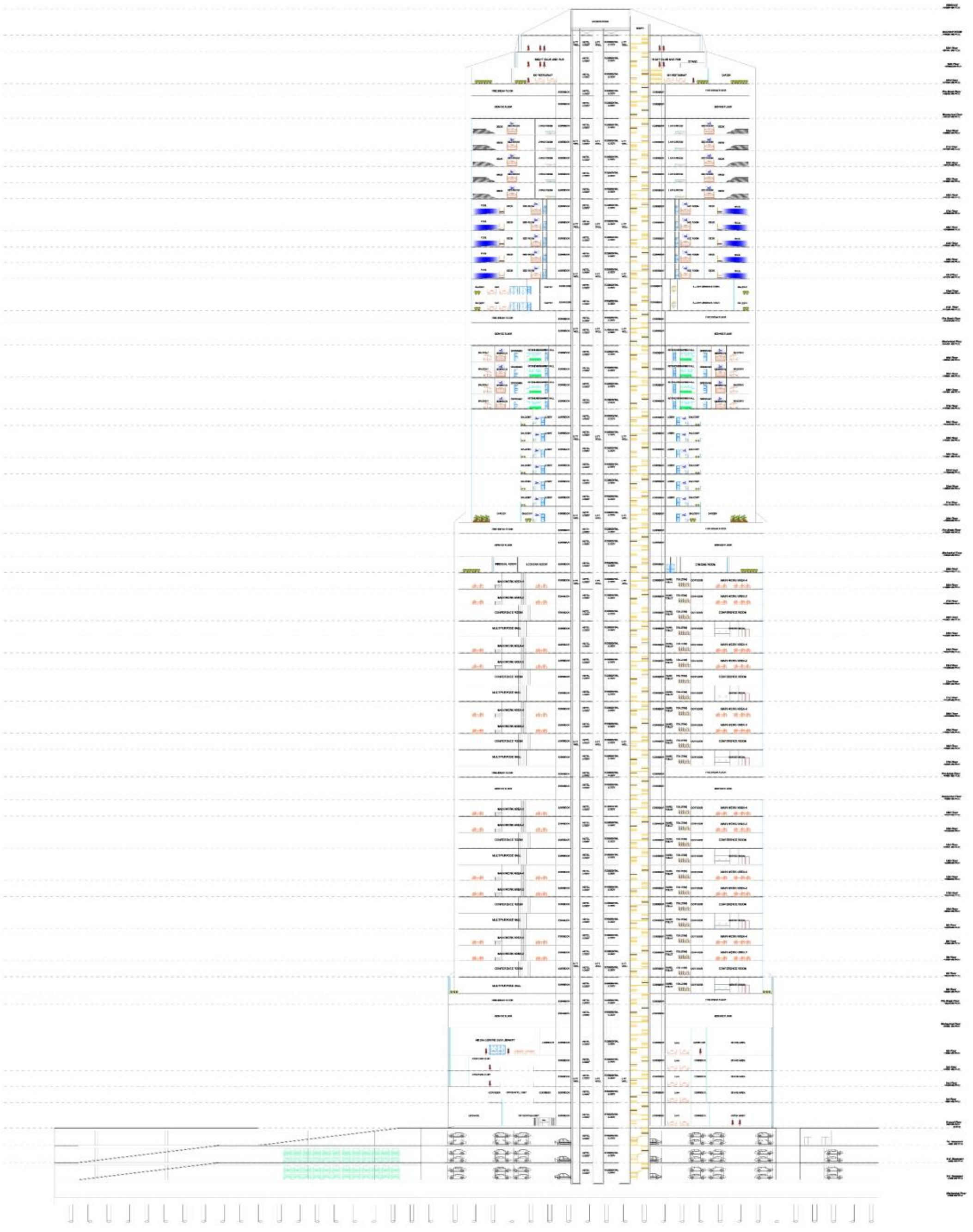
D.O.A	D.O.S
SIGN	REMARK

ELEVATION



FRONT ELEVATION SIDE ELEVATION

SECTION



PROJECT :

THE DIAMOND TOWER

GIFT CITY GUJRAT

A COMMERCIAL MIXED USED SKYSCRAPER WITH A HEIGHT OF 410M HIGH

DRG. TITLE :

SECTION X-X'

NORTH	SCALE	DATE
N	1:250	29th MAY

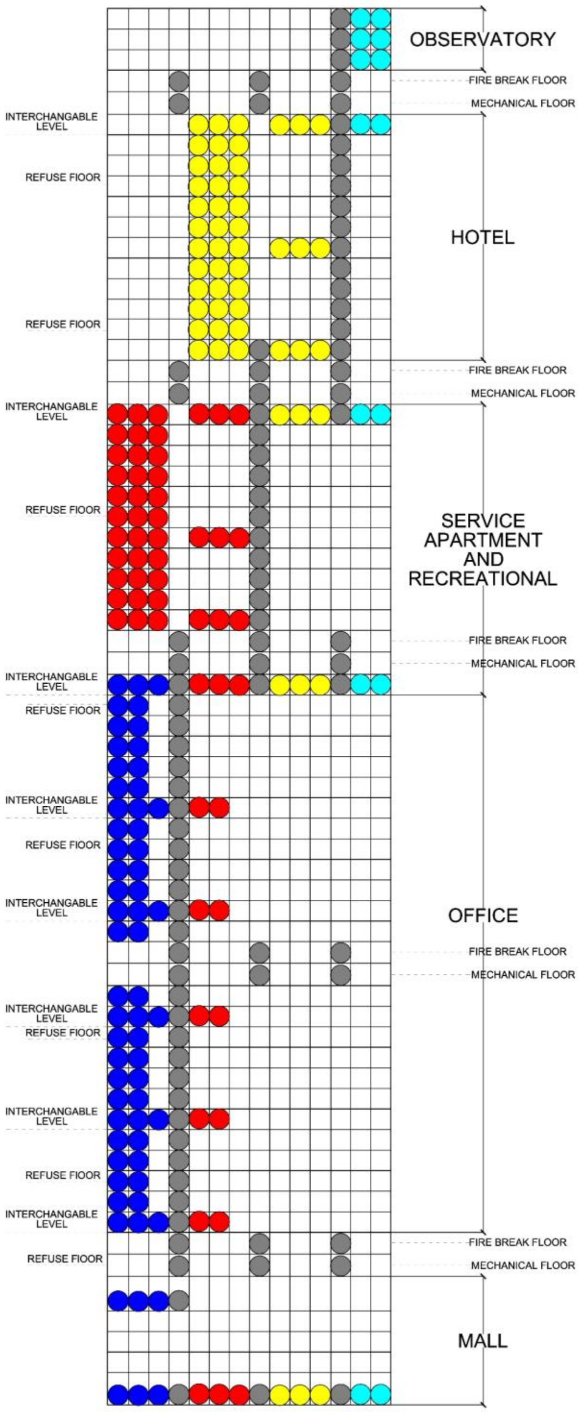
DRG NO.- 23

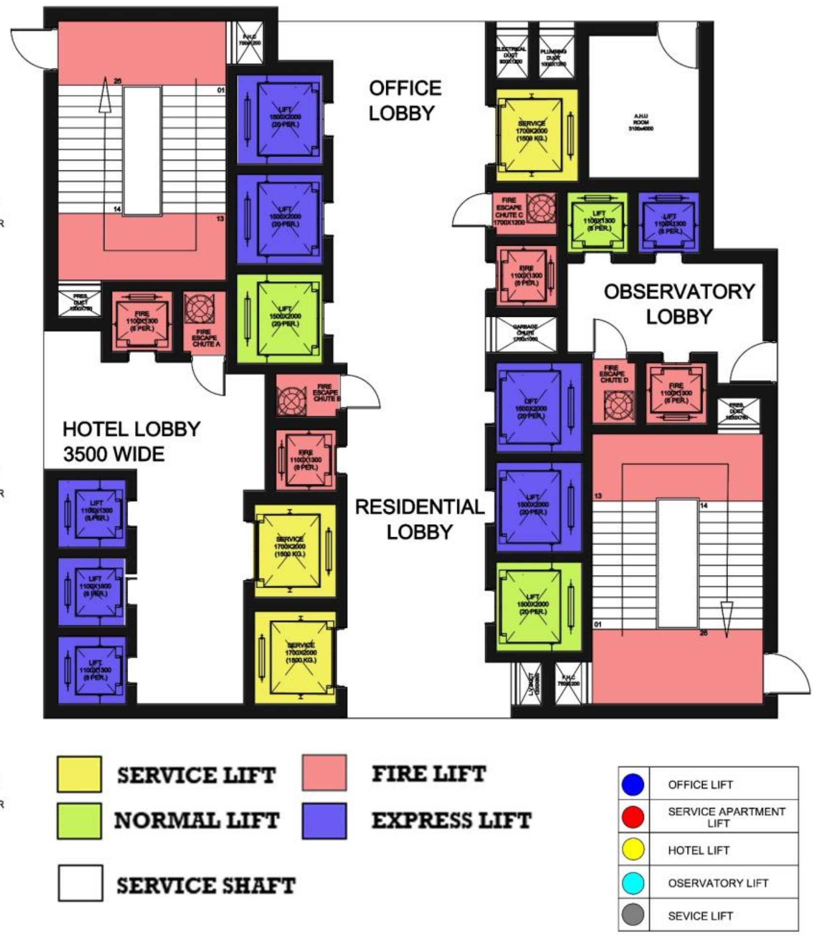
NEHA KUMARI
SECTION-AR5-2
B.ARCH,10th SEM.
ROLL NO-1150101093
BABU BANARASI DAS LKO

D.O.A	D.O.S
SIGN	REMARK

LIFT

LIFT MOVEMENT

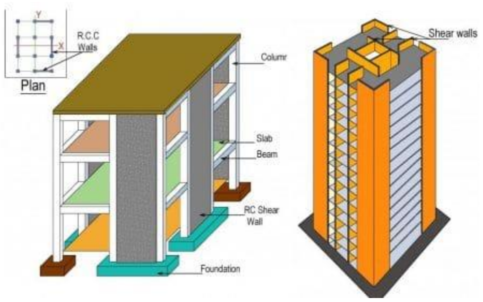




TYPE	CAPACITY	WAGON	SHAFT	SPEED	ENTRANCE
NORMAL LIFT- 1	16 TO 20 PERSONS	1500 X 2000	2400 X 2500	4M/S	1000 MM
EXPRESS LIFT - 1	16 TO 20 PERSONS	1500 X 2000	2400 X 2500	10M/S	1000 MM
NORMAL LIFT- 2	8 PERSONS	1100 X 1300	1900 X 1900	4M/S	800 MM
EXPRESS LIFT - 2	8 PERSONS	1100 X 1300	1900 X 1900	10M/S	800 MM
FIRE LIFT	8 PERSONS	1100 X 1300	1700 X 1700	8M/S	800 MM
SEVICE LIFT	1500 KG	1700 X 2000	2300 X 2600	3M/S	1700 MM

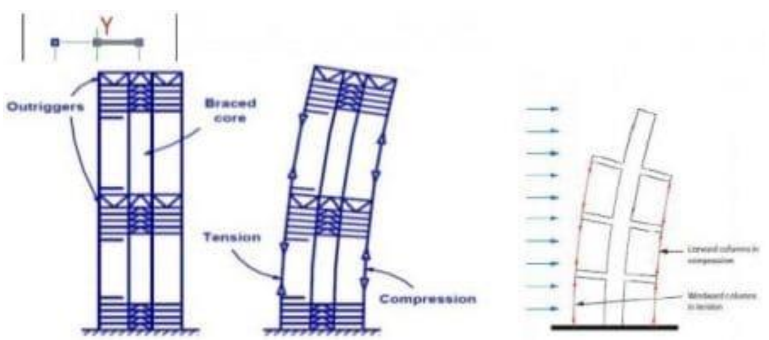
Shear wall system

- It is a continuous vertical wall constructed from reinforced concrete or masonry wall.
- Shear walls withstand both gravity and lateral loads, and it acts as narrow deep cantilever beam.
- Commonly, constructed as a core of buildings
- It is highly suitable for bracing tall buildings either reinforced concrete or steel structure. This because shear walls have substantial in plane stiffness and strength.
- Shear wall system is appropriate for hotel and residential buildings where the floor-by floor repetitive planning allows the walls to be vertically continuous.
- It may serve as excellent acoustic and fire insulators between rooms and apartments.
- shear wall structural system can be economical up to 35 stories building structure.
- Shear walls need not to be symmetrical in plan, but symmetry is preferred in order to avoid torsional effects.



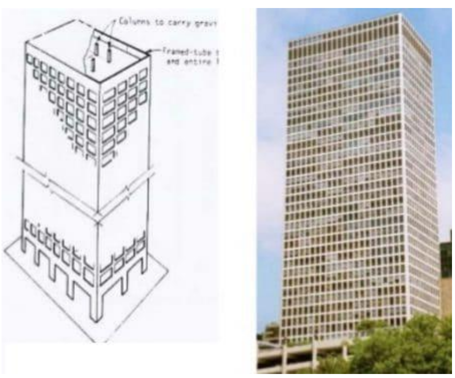
Core,diagrid and outrigger structural system

- Outrigger are rigid horizontal structures designed to improve building overturning stiffness and strength by connecting the core or spine to closely spaced outer columns
- The central core contains shear walls or braced frames.
- Outrigger systems functions by tying together two structural systems (core system and a perimeter system), and render the building to behave nearly as composite cantilever.
- The outriggers are in form of walls in reinforced concrete building and trusses in steel structures.
- Multilevel outrigger systems can provide up to five times the moment resistance of a single outrigger system.
- Practically, Outrigger systems used for buildings up to 70 stories. Nonetheless, it can be used for higher buildings.
- Not only does the outrigger system decline building deformations resulting from the overturning moments but also greater efficiency is achieved in resisting forces.

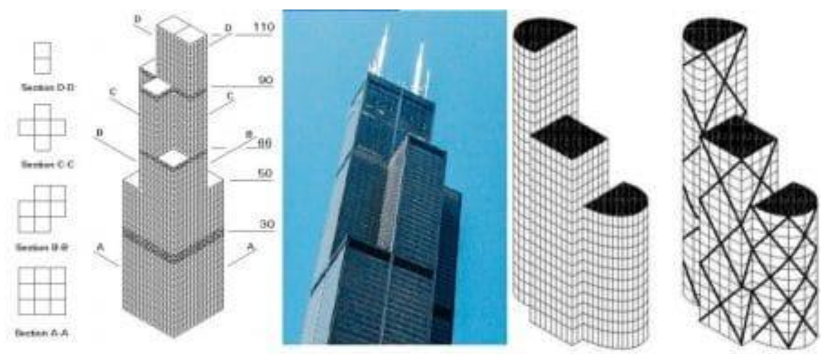


Tube structural system

•This system consists of exterior columns and beams that create rigid frame, and interior part of the system which is simple frame designed to support gravity loads.
•The building behaves like equivalent hollow tube.
•It is substantially economic and need half of material required for the construction of ordinary framed buildings.
•Lateral loads are resisted by various connections, rigid or semi-rigid, supplemented where necessary by bracing and truss elements.
•It is used for the construction of buildings up to 60 storeys.
•Types of tube structure system include framed tube system (fig.9), trussed tube system (fig.10), bundled tube system (fig.11), and tube in tube system (fig.12).
•Trussed tube system is formed when external bracing added to make a structure stiffer. This structure type suitable for building up to 100 storeys.
•Bundled tube system consists of connected tubes and it withstand massive loads.
•A tube-in-tube system (hull core) is obtained, if the core is placed inside the tube frame structure.

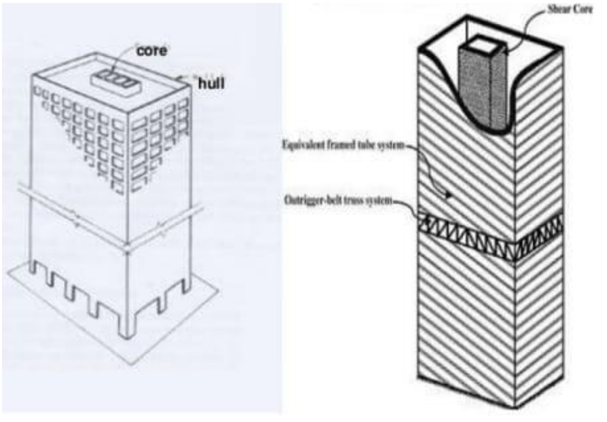


Framed tube structure system

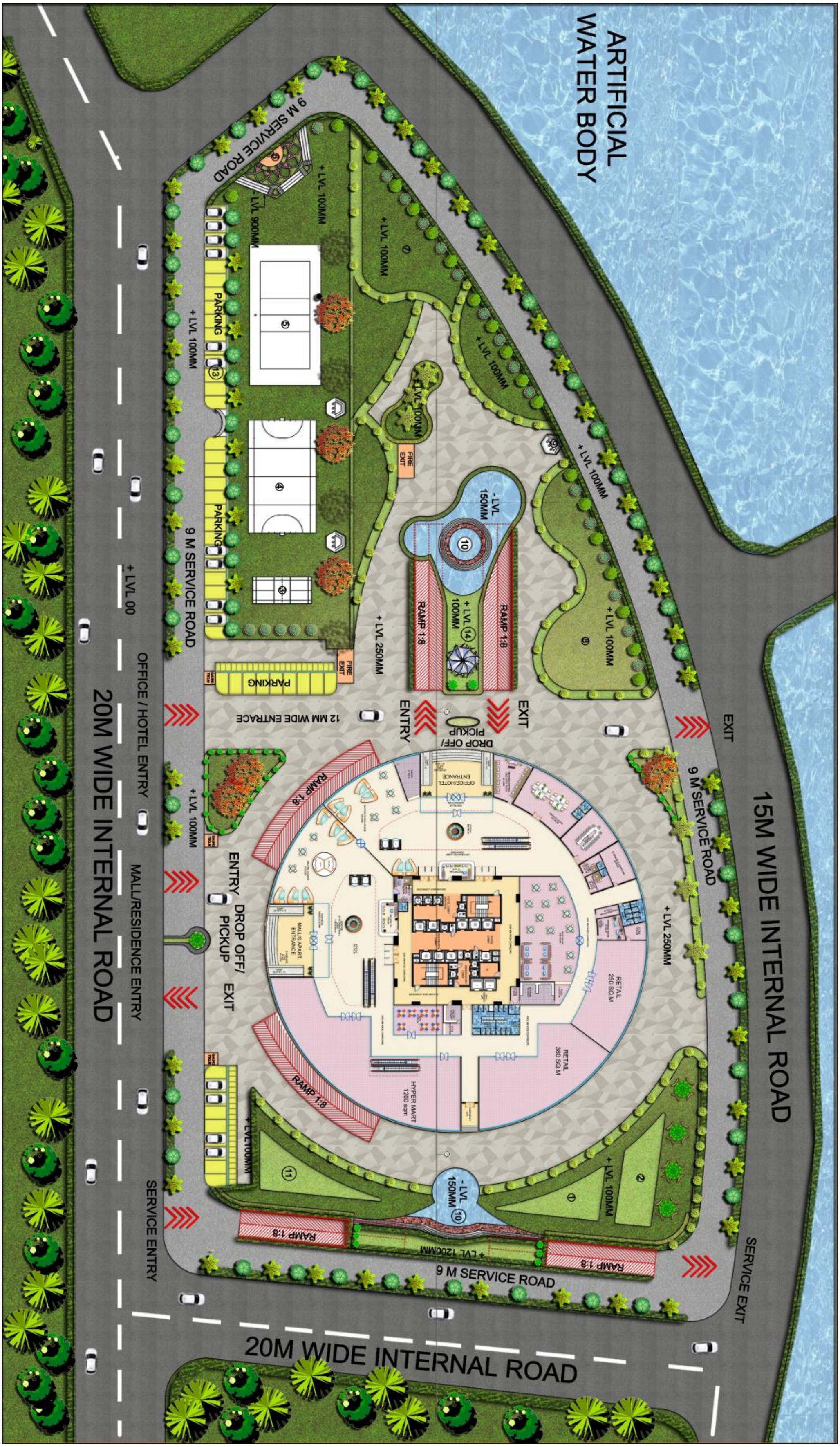


Bundled tube structure system

Trussed tube system



Tube in a tube system



ARTIFICIAL WATER BODY
20M WIDE INTERNAL ROAD
15M WIDE INTERNAL ROAD
20M WIDE INTERNAL ROAD
9 M SERVICE ROAD
9 M SERVICE ROAD
9 M SERVICE ROAD
9 M SERVICE ROAD
OFFICE / HOTEL ENTRY
MALL/RESIDENCE ENTRY
SERVICE ENTRY
SERVICE EXIT
EXIT
ENTRY
EXIT
DROP OFF/ PICKUP
ENTRY
DROP OFF/ PICKUP
EXIT
12 MM WIDE ENTRANCE
PARKING
PARKING
PARKING
FIRE EXIT
FIRE EXIT
RAMP 1:8
RAMP 1:8
RAMP 1:8
RAMP 1:8
RAMP 1:8
RAMP 1:8
RAMP 1:8
+ LVL 100MM
+ LVL 250MM
+ LVL 250MM
+ LVL 00
+ LVL 1200MM
- LVL 150MM
- LVL 150MM
LVL 900MM
RETAIL 250 SQ.M
RETAIL 380 SQ.M
HYPER MART 1200 sqm

L A N D S C A P E

LANDSCAPING LEGENDS

NAME	TYPE	HEIGHT	FOLIAGE	DESCRIPTION
FOXTAIL PALM	EVERGREEN	8 - 10 M	6' - 9'	BIG GREEN LEAVES
JACARANDA	EVERGREEN	20 - 30 M	5 CM	TROPICAL BEAUTY
MANGOLIA	FLOWERING	8 - 12 M	8"	LILY FLOWERS
JUNIPER	EVERGREEN TREE	20 - 40 M	5 - 25 MM	2 TYPE OF LEAVES
TABEBUIA	EVERGREEN	30 M	4"	TREE AS WELL AS SHRUBS
FICUS PRESTIGE	EVERGREEN SHRUB	8 - 10"	3 - 5 CM	HEDGING AND SCREENING
MUSANDA	ORNAMENTAL PLANTS	3 - 5 M	6"	FEATURING FLOWERS
CYCUS	PALM OR CYCAD	2 - 3'	7"	LONG LIFE (50 TO 60 YEARS)
GOLDEN DURANTA	TROPICAL SHRUBS	18'	3 - 5 M	ATRACTIVE VARIEATED LEAF
BATISTA BEGONIA	ANNUAL	6" TO 12"	2.5 CM	TALL HOUSEPLANT
WATER BODY				
INTERLOCKING BRICKS				
CARPET GRASS				

	OUTDOOR AMENITIES
1	ZEN GARDEN (150 SQ.M)
2	REFLEXOLOGY PARK (160 SQ.M)
3	BADMINTON COURT (6MX13M)
4	BASKETBALL COURT (25MX15M)
5	TENNIS COURT (30MX15.5M)
6	AMPHITHEATER (135 SQ.M)
7	HEARB GARDEN (450 SQ.M)
8	CHILDREN PLAY AREA (600 SQ.M)
9	SIT OUT SHADE (16 SQ.M)
10	FOUNTAIN
11	PARK (500 SQ.M)
12	JOGGING TRACK
13	SURFACE PARKING (48 FOUR WHEELER & 44 TWO WHEELERS

LANDSCAPING

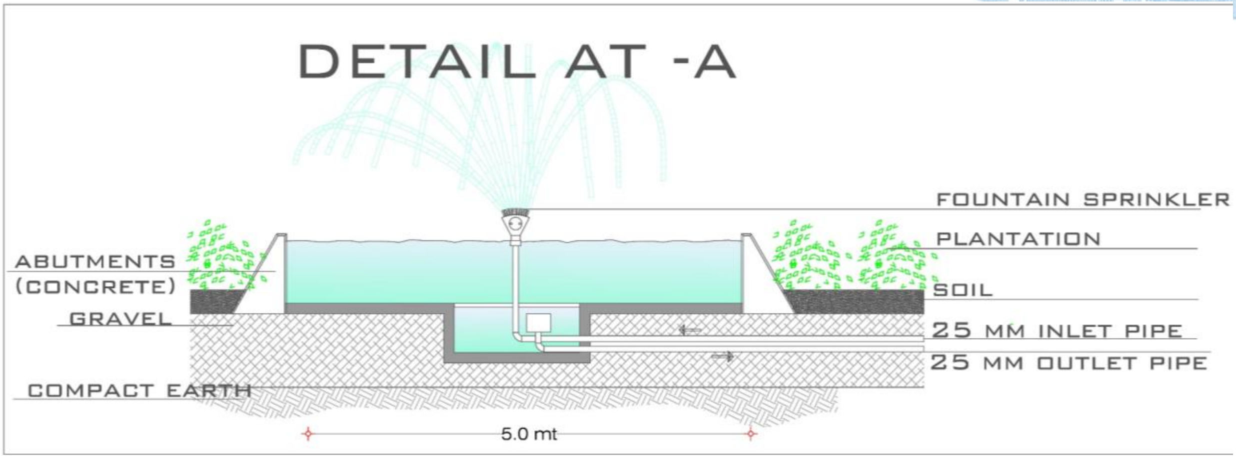
SITOUT

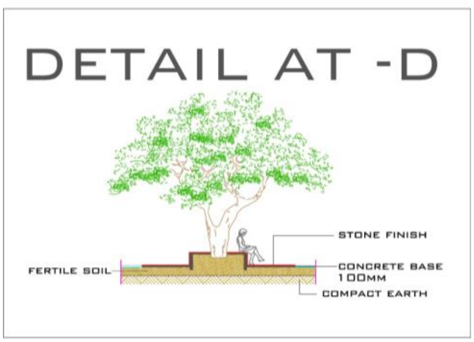
SEATING SHADE

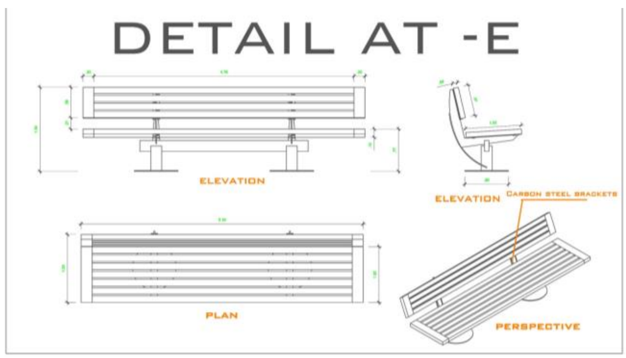
AMPHITHEATRE

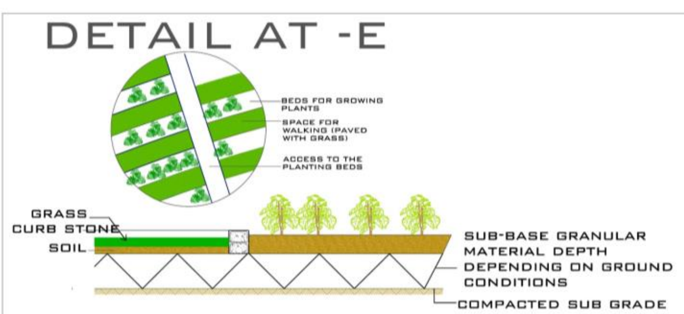
PAVALLION

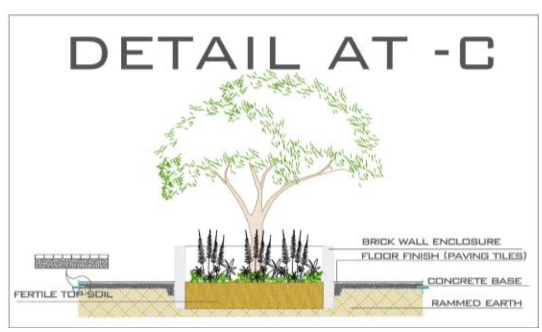
LANDSCAPING



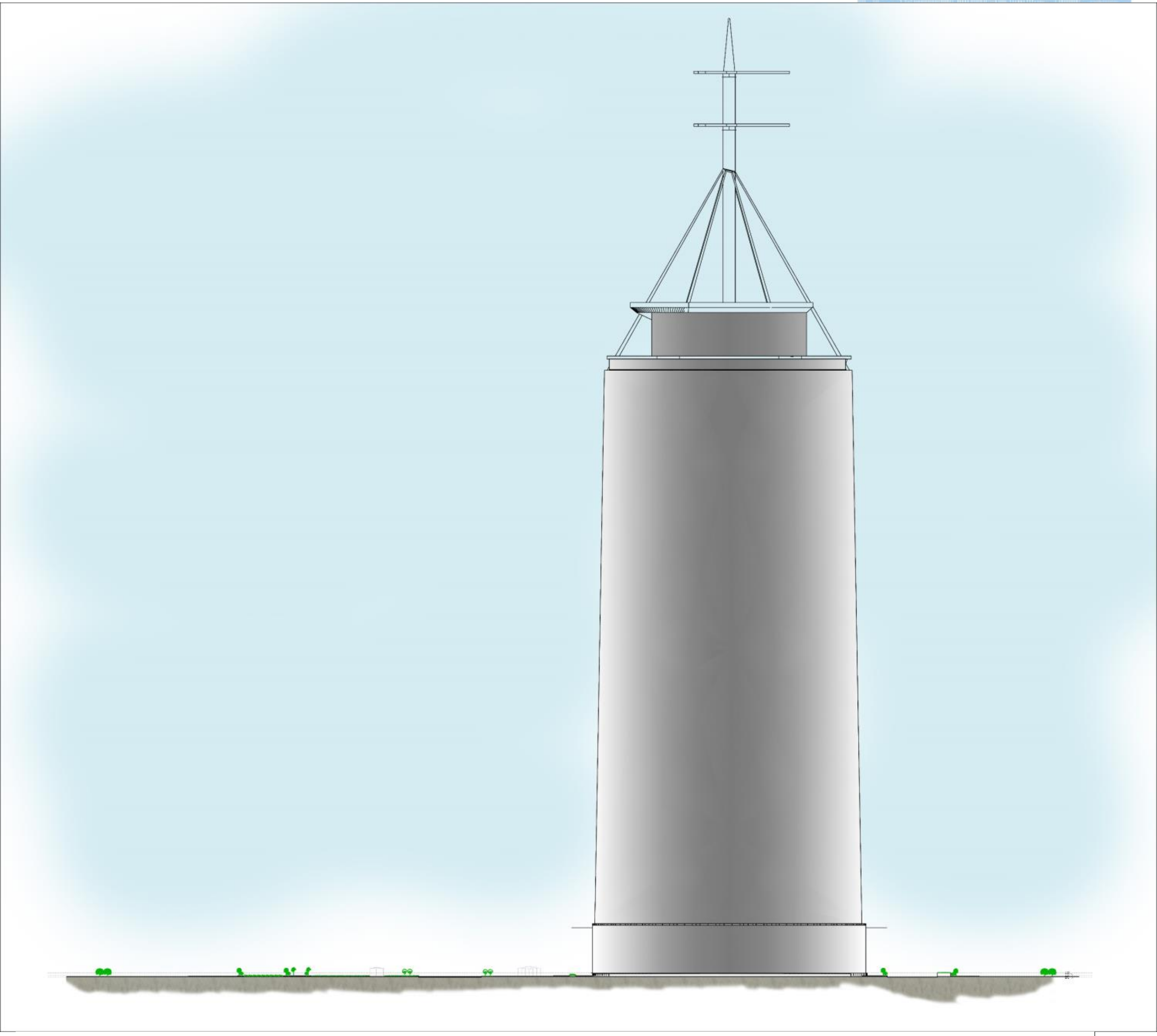


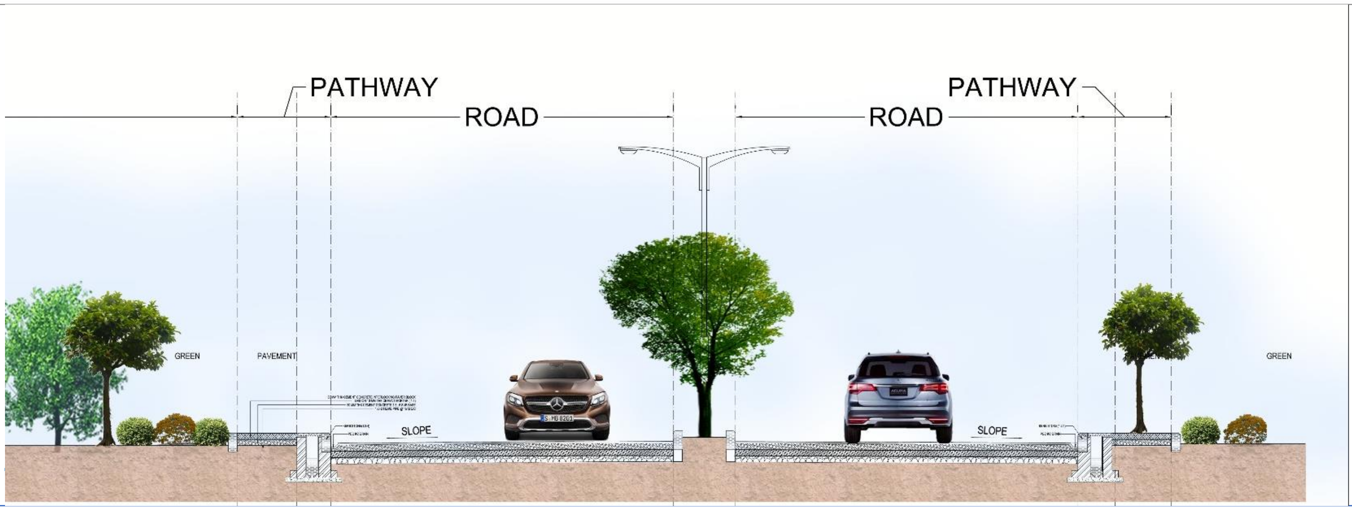






SITE AND ROAD SECTION





VIEWS

VIEWS

BASEMENT VIEWS

THE DIAMOND TOWER

WALKTHROUGH

THANKYOU