Construction of Office Building for Amaravati Local Head Office and Other Outfits at Amaravati, Andhra Pradesh in EPC Mode.

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Executive Summary

The "**Construction of the Buildings for Amaravati Local Head Office and other Outfits at Amaravati, Andhra Pradesh**" is envisioned as a modern, environmentally conscious and iconic office campus, spread across a **3-acre site**. The master plan integrates institutional functionality with a high-performance built environment, designed to support a dynamic work culture while upholding the bank's commitment to sustainability and long-term resilience.

The project encompasses a total built-up area of approximately **7,47,622 sq.ft**, housing a landmark high-rise office tower of 3B+G+14 floors, with sub-structure provision made for five additional floors as part of future expansion strategy. The development is intended to bring together a range of key administrative and operational divisions of SBI under one roof, including:

- The Local Head Office (LHO),
- SMECCC, LCPC, CAO, RACPC, CPPC, SAMB
- A dedicated Retail Branch with NRI Division, and Shared facilities such as auditorium, e-lobby, and commercial amenities.

This site is supported by a robust infrastructure framework that includes **three basement parking**, ensuring efficient and seamless movement for both vehicles and pedestrians. The planning emphasizes functionality, comfort, and a strong connection to the natural environment. The master plan is organized around a clear spatial hierarchy that enhances **functionality, privacy, and accessibility**, fostering a cohesive and vibrant living environment for the SBI community. The proposed building shall be designed to meet the standards of the **IGBC platinum rating and Net Zero Energy Building,** ensuring the highest standards of environmental performance and sustainability.

The design strategy is firmly anchored in *climate-responsive* architecture and *context-sensitive* urbanism. The orientation, massing, and facade articulation of buildings are meticulously calibrated to enhance the daylight access, while effectively minimizing thermal gain. The integration of solar-shading devices as a secondary skin not only minimizes solar heat gain but also establishes a distinctive architectural identity. Utility and service provisions are seamlessly integrated into the overall development. The design includes comprehensive systems for power distribution, water supply, rainwater harvesting, sewage treatment, fire safety, and waste management, ensuring a high degree of operational resilience and self-sufficiency. Critical infrastructure such as basement layouts, circulation networks, emergency access routes, and service cores are carefully coordinated to ensure efficiency, safety, and uninterrupted functionality. Green buffers, and distributed pocket parks are strategically placed to soften the built form and foster social interaction.

The overall architectural language of the Amaravati Local Head Office embodies modern institutional elegance, defined by clean vertical lines, articulated massing, and a refined, neutral material palette. To ensure structural efficiency, construction speed, and improved cost-effectiveness, a composite structural system is proposed for the office building. This approach enhances structural integrity while supporting the project's vision of a contemporary, future-ready corporate campus.

Upon completion, the development is poised to become a catalytic urban intervention, significantly enhancing the functionality, connectivity, and identity of the Amaravati. By setting a new benchmark for integrated institutional environments, the project will contribute meaningfully to Amaravati's emerging urban and architectural landscape—offering the State Bank of India a resilient, prestigious, and future-ready campus that embodies its institutional values and long-term vision.

1 CHAPTER 1: Project Overview

1.1 Introduction

The Architectural Design Basis Report (DBR) articulates the conceptual vision, planning strategies, and technical parameters that inform and shape the project's built environment. Serving as a comprehensive roadmap, the report encapsulates a deep understanding of the client's objectives, site context, and broader urban development imperatives, establishing a coherent framework to guide all subsequent phases of design and construction.

The State Bank of India's Local Head Office (LHO) at Amaravati is envisioned as a resilient, future-ready institutional campus that consolidates diverse administrative, operational, and customer-facing functions within a singular, state-of-the-art office facility. Core requirements articulated by the client include provision for specialized departments, central processing centers, and public interaction zones—integrated within a secure, efficient, and environmentally sustainable built environment.

The design methodology presented in the DBR is grounded in a thorough evaluation of key parameters, including **site topography**, **climatic conditions**, **urban connectivity**, **regulatory guidelines**, and **user-centric functionality**. The report covers:

- **Site analysis and contextual appreciation**,
- **Regulatory compliance**, including building height, zoning, and parking norms,
- **Master planning** and spatial organization,
- Detailed descriptions of individual **project components**,
- **Circulation and access strategies**, and
- Integrated **sustainability measures**.

Each section is structured to move from macro-level planning to micro-level detailing, ensuring that the architectural vision is rigorously aligned with structural, mechanical, electrical, plumbing, and life-safety systems. The overarching design philosophy is holistic, climate-responsive, and user-focused—aiming to deliver a cohesive, sustainable, and high-performance campus. The project aspires not only to meet the immediate functional needs of the SBI but also to set a new benchmark in financial institutional architecture within the context of Amaravati's rapidly evolving urban fabric.

1.2 Site appreciation and analysis

1.2.1 Location

Amaravati, the planned capital city of Andhra Pradesh, is envisioned as a modern administrative and institutional hub strategically located along the banks of the Krishna River. Designed to serve as the seat of governance and a catalyst for regional development, Amaravati is being developed with world-class infrastructure, sustainable urban planning principles, and integrated civic amenities. The project site lies within the **Andhra Pradesh Capital Region Development Authority (APCRDA)** limits, ensuring access to planned infrastructure and governance frameworks. Strategically located near Vijayawada and Guntur, the site offers excellent connectivity via national highways and express corridors. As per the 2011 Census, the Amaravati Capital Region had a population of approximately 5.8 million, with significant urban growth projected. This makes it an ideal location for constructing government and institutional buildings. The area aligns with the vision of a sustainable, future-ready capital city.

Figure 1 Location map

1.2.2 Topography of Amaravati

Amaravati is located in southern India within the Krishna River basin at approximately **16.57°N, 80.35°E**, with an average elevation of 30–40 m above mean sea level. The region features flat to gently undulating terrain, primarily composed of recent alluvial deposits laid down by the Krishna River and its tributaries. The subsurface geology consists predominantly of clayey and sandy soils with interbedded silt and occasional gravel layers, overlying older semi-consolidated formations. Hard rock outcrops are sparse, with the groundwater table typically shallow, especially near riverfront areas. The area falls under the jurisdiction of the **Andhra Pradesh Capital Region Development Authority (APCRDA)**. As per BIS IS 1893:2016, the region is classified under **Seismic Zone III**, indicating **moderate seismic risk**. The relatively flat topography supports large-scale development but requires planned stormwater drainage systems to mitigate seasonal inundation during monsoons.

1.2.3 Climate of Amaravati

a) **Temperature**: Amaravati experiences a tropical wet and dry climate, characterized by hot summers, high humidity during the monsoon, and mild winters. Analysis based on data from Gannavaram–Vijayawada SRC-TMYx weather station, Andhra Pradesh reveals the following:

- **Dry Bulb Temperature:** The region experiences temperatures ranging from 23 °C to 34 °C, peaking during April–May. Daytime heat often exceeds 30 °C, with limited night-time cooling. Design strategies should focus on minimizing heat gain during the hot months.
- **Relative Humidity**: Relative humidity ranges from 20–30% on dry afternoons to 85–95% during monsoon nights, with higher levels typically occurring at night and early morning. While natural ventilation is effective in dry months, humid periods require controlled airflow and moisture protection to maintain indoor comfort.
- **Dew Point Temperature**: Dew point ranges from ~8 °C in Jan–Feb to ~27 °C in Jul–Oct, with minimal daily variation. High humidity levels reduce comfort, necessitating dehumidification and moisture control in building design

This data underscores the need for adaptive building design in Amaravati that addresses high summer heat, variable humidity, and seasonal transitions to ensure occupant comfort and energy efficiency.

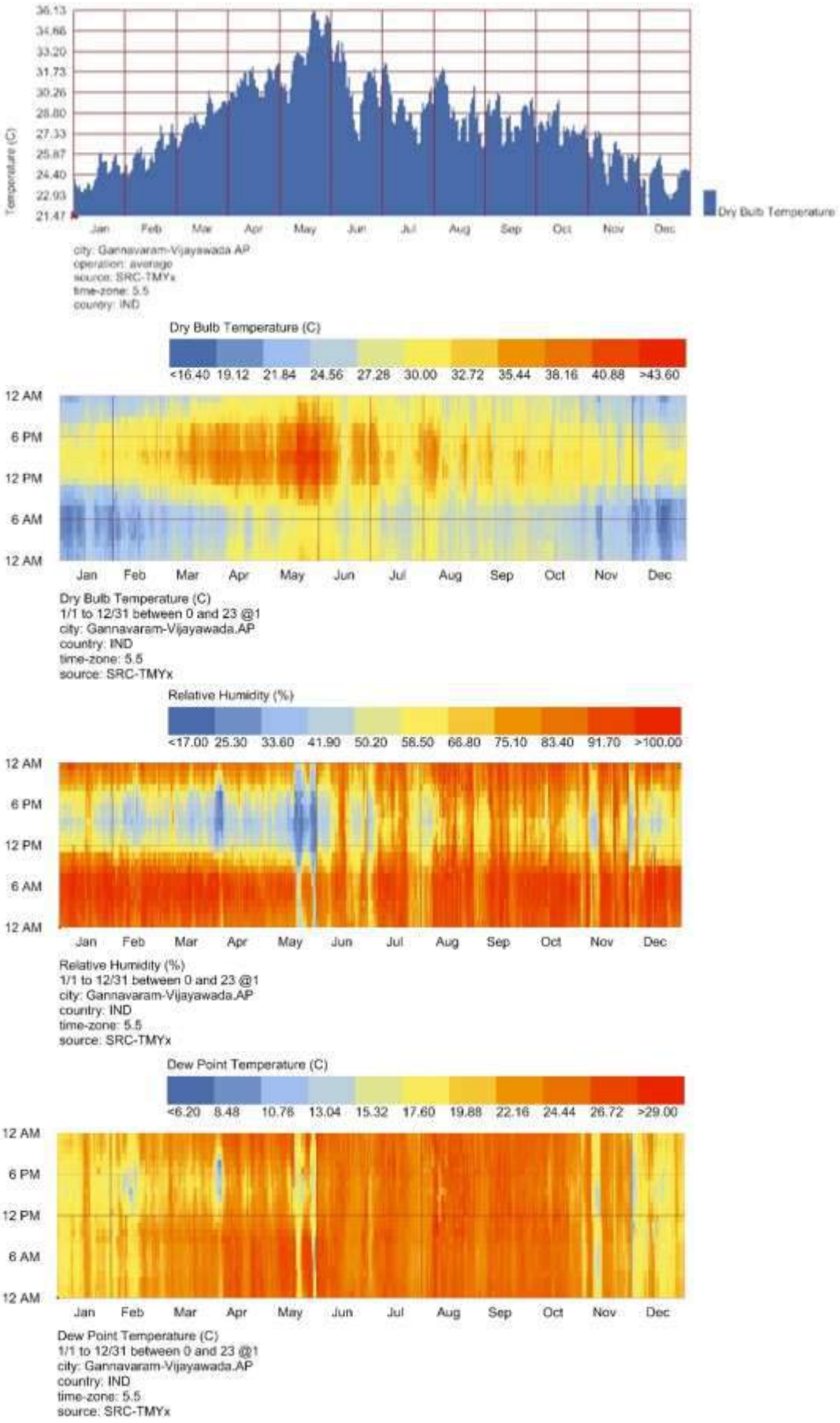


Figure 2 Temperature & Relative Humidity

Signature of the Bidder with Seal

b) Wind rose: The wind rose analysis for Amaravati shows that winds predominantly come from the west and northwest for most of the year, shifting to the southwest during the monsoon (June–September). Stronger winds (above 5 m/s) are observed during monsoon months, while calmer conditions prevail in winter (December–February). Wind speeds mostly range between 1 to 5 m/s. These patterns suggest that buildings should be oriented to capture southwest and westerly breezes for natural ventilation. Shading and wind protection are essential during monsoon and hot seasons to balance comfort and weather exposure.

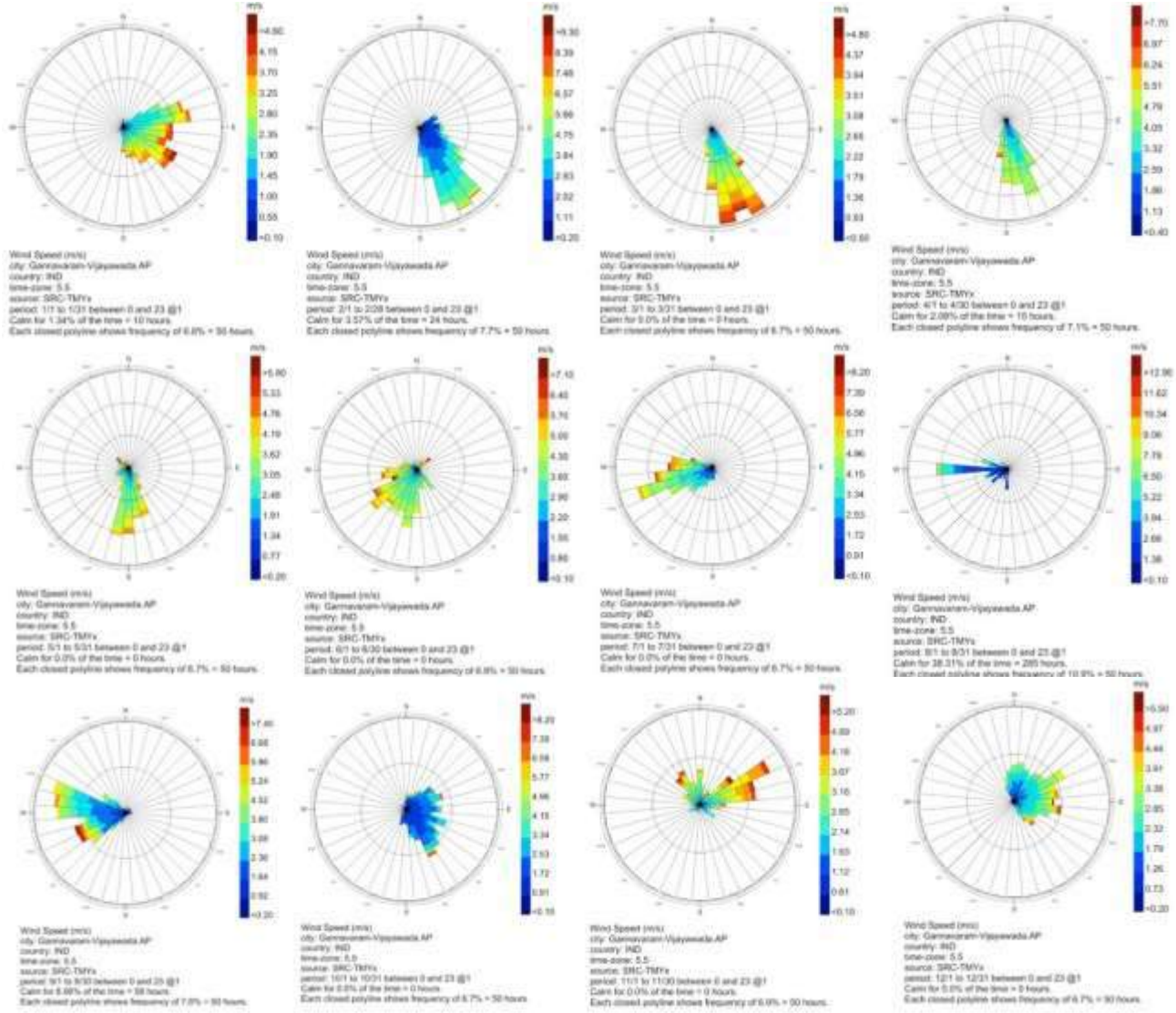


Figure 3 wind rose

c) Radiation analysis

The solar radiation analysis for Gannavaram–Vijayawada guides climate-responsive design by identifying solar exposure patterns throughout the year. The highest direct radiation is observed between May and August, mainly from the southeast to southwest directions. January to April and September to December receive moderate radiation, while diffuse radiation remains generally low, with a slight increase during June–July due to cloud cover insulated to minimize heat gain. North and northeast-facing sides receive minimal radiation, making them ideal for openings to enhance daylight and passive cooling. These insights support energy-efficient building orientation and envelope design. Southwest-facing façades (WSW to SSW) receive maximum radiation and should be shaded or insulated to minimize heat gain.

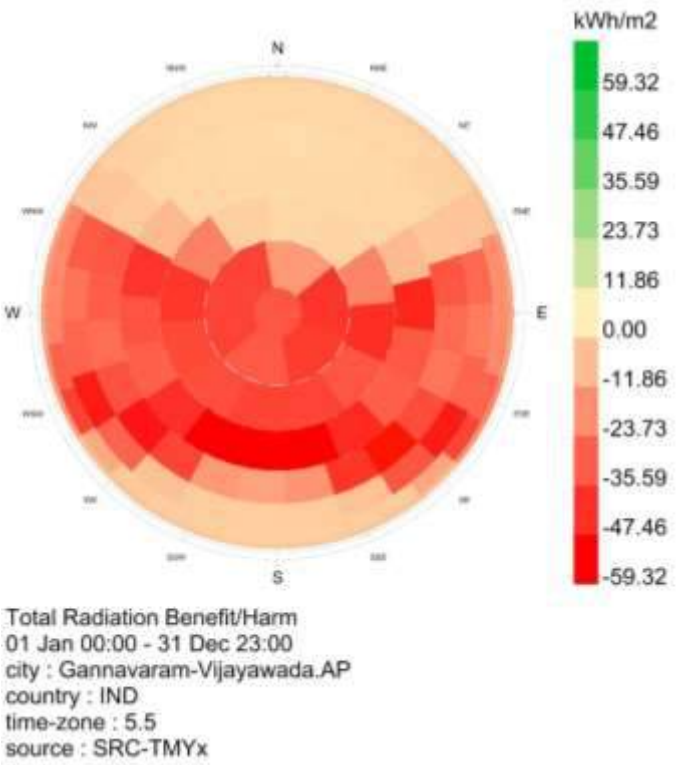


Figure 4 Solar Radiation

d) Psychrometric Chart Analysis – Gannavaram–Vijayawada

The psychrometric chart analysis for Gannavaram–Vijayawada provides insights into the annual climatic comfort conditions based on temperature and humidity. Most of the data points fall outside the natural comfort zone, indicating a hot and humid climate for the majority of the year. This highlights the need for passive and active design strategies to improve indoor thermal comfort and reduce energy loads.The building envelope should incorporate **thermal insulation, sun-shading devices**, and **north-oriented openings** to minimize heat gain and enhance thermal comfort throughout the year.

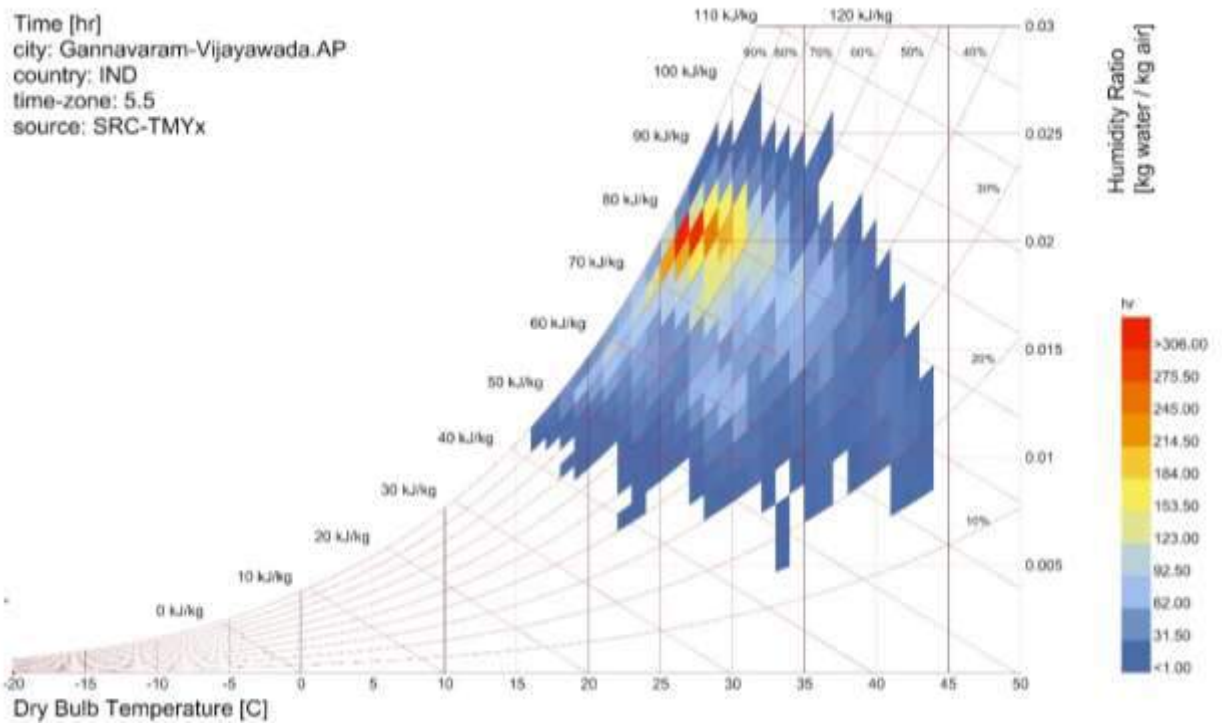


Figure 5 Psychrometric Chart

Signature of the Bidder with Seal

1.2.4 Proposed Site:

The proposed site for the office building is strategically located within the **S3 – Special Zone** of the **Amaravati Capital Region Development Plan.** This zone is designated for high-priority, special-purpose developments such as iconic structures, administrative establishments, and institutional projects, ensuring a prestigious and high-visibility setting. The site lies within the core urban grid, offering well-planned connectivity and proximity to essential civic infrastructure. It is bounded by a comprehensive road network, with access to arterial roads ensuring smooth vehicular movement. The site is flanked by Central business district zone (C6), Special zone (S3) and medium-to-high density residential areas (R3), providing a vibrant urban context and potential workforce catchment.

Surrounded by green buffers and adjacent to passive zones (P1), the site benefits from a balance between urban activity and ecological consideration. Its central location and inclusion in the special zone align with the project's envisioned institutional and administrative character, making it an ideal location for the development of a landmark office building with sustainable and future-ready design principles.

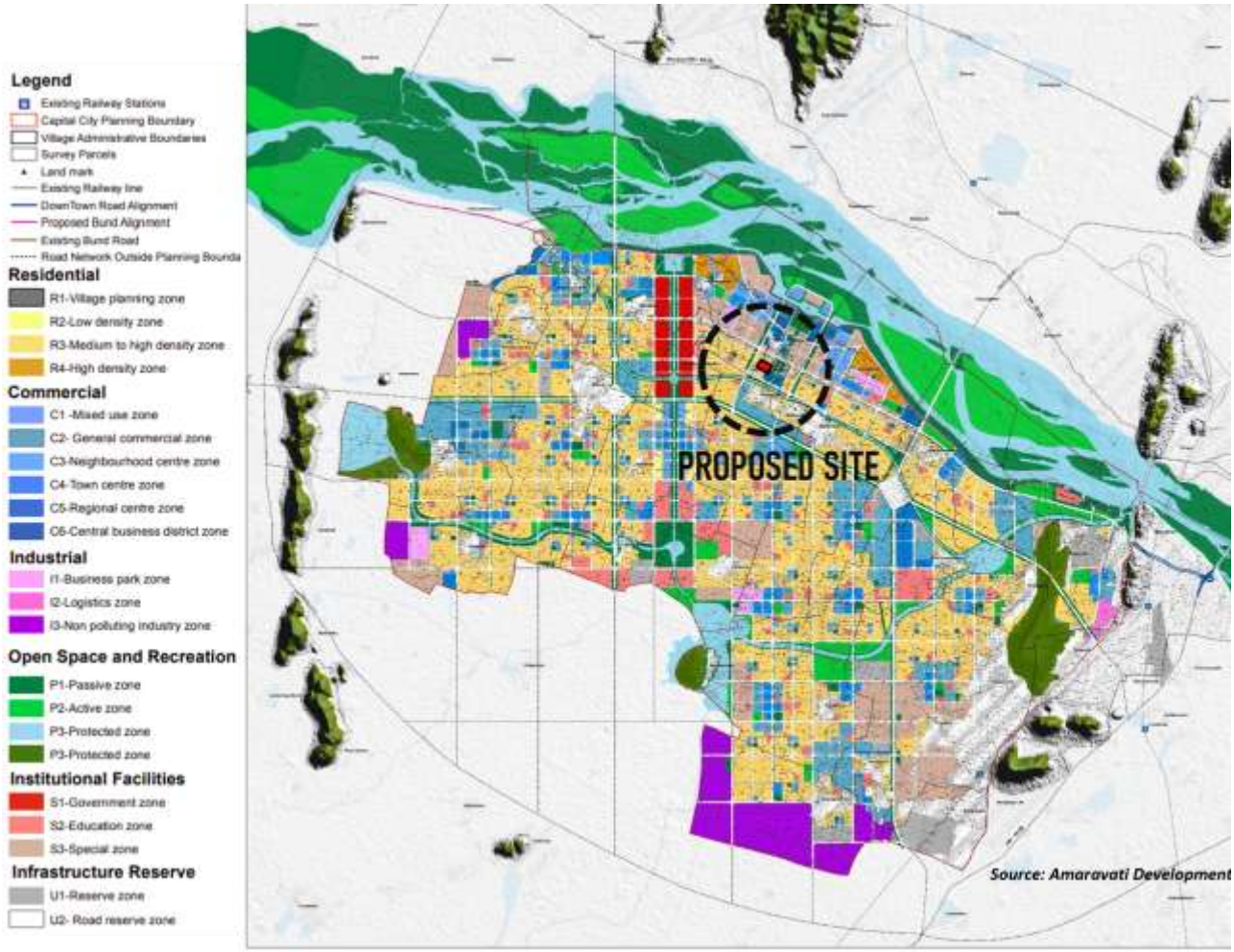


Figure 6 Land use Map

1.2.5 Connectivity & Circulation

The proposed site offering strategic connectivity to various urban nodes and major infrastructure. Its geographic positioning ensures smooth regional access and future-readiness for development. The site is linked to Amaravati–Vijayawada Expressway and major city roads through the Seed Access Road, ensuring direct connectivity to Vijayawada (22 km) and Guntur (35 km). Internal road networks are designed as per CRDA's grid planning, enabling structured vehicular movement and organized urban mobility. Public transport is supported through proximity to Vijayawada Railway Station, and PNBS bus terminal. Gannavaram Airport, located about 40 km away, ensures air connectivity, while a proposed Greenfield airport nearby will further enhance access. The site's flat terrain allows flexible internal circulation with potential for sustainable street design and multimodal movement.

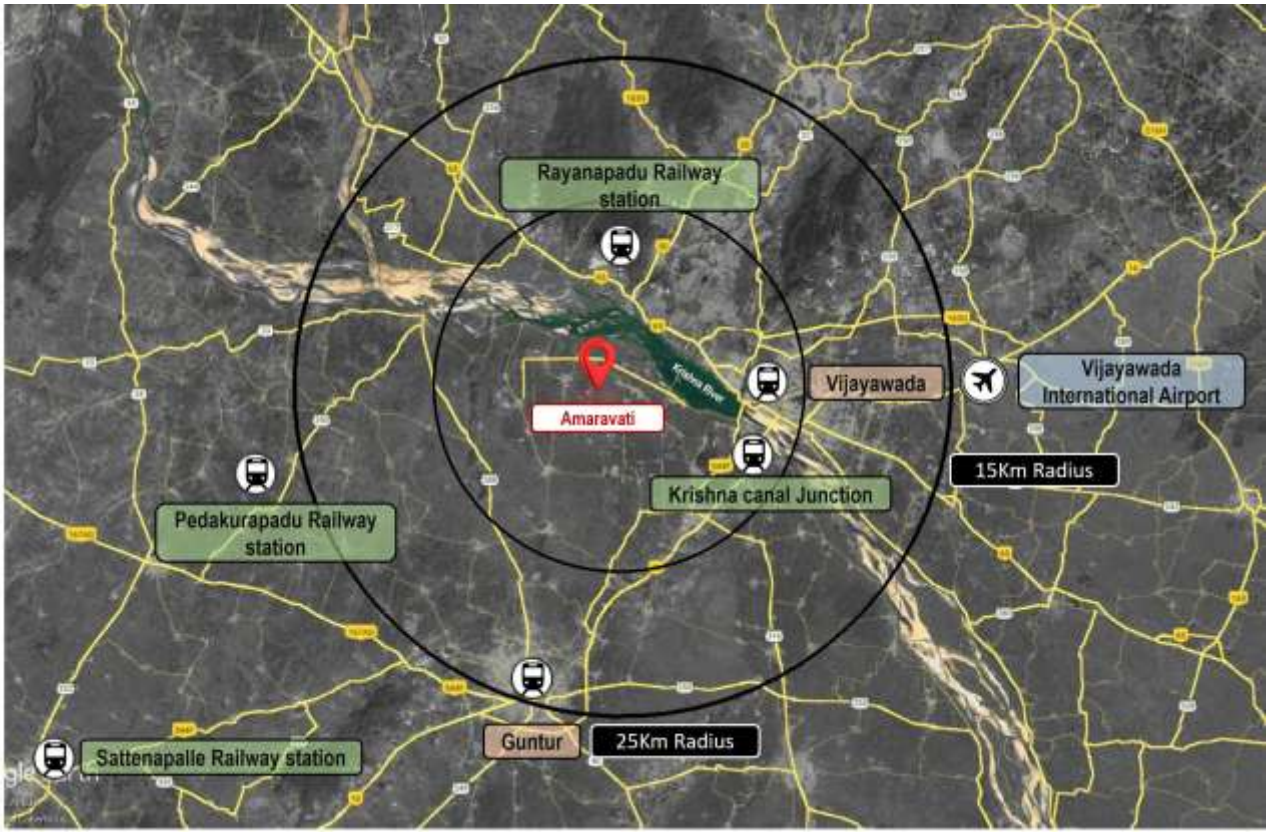


Figure 7 Map showing nearby transits

Railway Station	Distance to Amaravati	Notes
Vijayawada Junction	17 km	Best long-distance access; lots of trains to major cities
Krishna Canal	15-18 km	Suburban trains
Guntur Junction	33-38 km	Connects major cities
Rayanapadu	30 km	Suburban trains, emerging importance
Pedakurapadu	20-30 km	Small station; part of future Amaravati connectivity
Sattenapalle	35 km	Small station, on future expansion line
Amaravati Station	PROPOSED	Under construction; expected in ~2 years
Airport	**Distance to Amaravati**	**Notes**
Vijayawada International Airport	30 km Approx	Domestic and limited international flights

Figure 8 Major Terminals distance from the site

Figure 9 Nearby bus stop

1.2.6 Neighborhood Context:

The proposed site is centrally located in the Amaravati Capital Region, falling within a 2.5 km radius of key administrative and institutional landmarks. The site is in close proximity to the Andhra Pradesh Secretariat and the Legislative Assembly, making it an ideal location for public, cultural, or institutional development. To the southwest lies the High Court of Andhra Pradesh, further reinforcing the area's administrative significance. The neighborhood includes both urban villages and planned urban sectors such as Velagapudi, Uddandarayuni Palem, Mandadam, and Thullur, which are transitioning into mixed-use zones under CRDA's Amaravati Master Plan. Surrounding settlements like Rayapudi, Lingayapalem, Venkata Palem, and Tullaya Palem show increasing urban activity supported by planned road infrastructure like the Seed Access Road. The Krishna River to the northeast adds geographical and ecological value, with riverfront development envisioned under the city's sustainable growth model.

Figure 10 Neighborhood Places

1.2.7 Proposed Site in Amaravati

The proposed SBI Office Complex at Amaravati is planned on a strategically located **3-acre site** in Lingayapalem (Survey Nos. 49, 50 & 51) and Uddandarayunipalem (Survey No. 94). The plot, with approximate dimensions of **121.4m x 100m**, forms a near-square shape and is bordered by three major roads: a 60m wide Seed Access Road—serving as a key artery connecting Amaravati to NH-16—and two peripheral roads of 17m and 25m width.The office complex will accommodate several key SBI offices and departments including the Local Head Office (LHO), SME Credit Centre (SMECCC), Liability Central Processing Centre (LCPC), Central Audit Office (CAO), Retail Asset Central Processing Centre (RACPC), Centralized Pension Processing Centre (CPPC), Stressed Asset Management Branch (SAMB), and one operational branch focusing NRI Division. With a strong focus on environmental responsibility, the complex will follow green building norms, potentially aiming for IGBC Platinum & Net Zero energy certification. Modern amenities, intelligent space planning, and user-friendly facilities will make it a landmark in Amaravati's capital region. The site's excellent connectivity, prominent location, and institutional surroundings make it ideal for a major financial hub, aligning with SBI's vision for innovation, sustainability, and excellence in service delivery.

Figure 11 Site layout

2 STATUTORY REGULATIONS:

2.1 Height Restrictions - Airport Authority of India (AAI):

2.1.1 Airport Authority of India – AAI:

As per the **Airports Authority of India (AAI) NOCAS** which streamline and manage applications for height clearances of buildings and structures near airports and air navigation routes across India. As per the site coordinates input provided on the AAI, the elevation details are as follow:

- Approximate Permissible Top Elevation: 348 meters AMSL (Above Mean Sea Level)
- Site Elevation (AMSL): 48 meters

Based on these values, the maximum permissible building height at the site is:
348 m – 48 m = 300 meters. It will be the responsibility of the selected EPC contractor to cross-verify and ensure compliance with the applicable height restrictions by obtaining confirmation from NOCAS

Figure 12 Permissible top elevation as per AAI

2.2 Building bye laws:

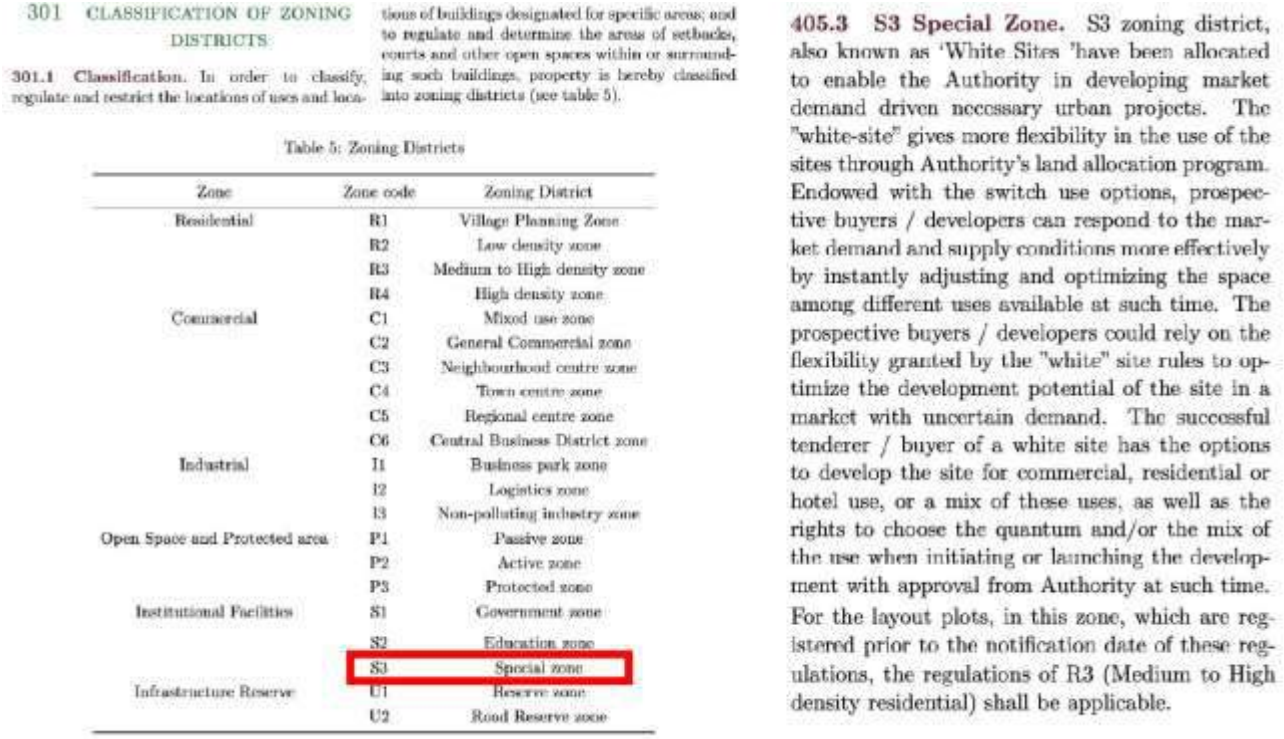
2.2.1 Amaravati Zoning Regulations, 2016:

The proposed site falls under the **S3 – Special Use Zone** as per the **Amaravati Capital City Zoning Regulations, 2016**. This zoning classification permits the development of institutional, administrative, and special-purpose buildings such as government offices, financial institutions, and public sector establishments. Developments within the S3 zone are governed by specific building controls related to permissible land use, maximum ground coverage, floor space index (FSI), building height restrictions, setbacks, parking provisions, and environmental sustainability measures. The proposed SBI Office Complex fully complies with these regulations, ensuring alignment with the

capital city's planned urban framework and development guidelines.

The proposed site falls under conditional use, with a permissible Floor Space Index (FSI) of 5 as per the applicable zoning regulations. The FSI for the proposed office building, including future five floors, is 3.8.

As per the Amaravati Zoning Regulations, 2016, a maximum **fence height of 2.5 meters** is permitted on all sides of the plot. A boundary wall may be constructed within this allowable height, and plantation along the plot boundary is also permitted. The APCRDA encourages the use of electronic security and surveillance systems in place of conventional physical boundary walls to promote an open and visually connected urban environment.



301 CLASSIFICATION OF ZONING DISTRICTS

301.1 Classification. In order to classify, regulate and restrict the locations of uses and locations of buildings designated for specific areas; and to regulate and determine the areas of setbacks, courts and other open spaces within or surrounding such buildings, property is hereby classified into zoning districts (see table 5).

Table 5: Zoning Districts

Zone	Zone code	Zoning District
Residential	R1	Village Planning Zone
	R2	Low density zone
	R3	Medium to High density zone
	R4	High density zone
Commercial	C1	Mixed use zone
	C2	General Commercial zone
	C3	Neighbourhood centre zone
	C4	Town centre zone
	C5	Regional centre zone
	C6	Central Business District zone
Industrial	I1	Business park zone
	I2	Logistics zone
	I3	Non-polluting industry zone
Open Space and Protected area	P1	Passive zone
	P2	Active zone
	P3	Protected zone
Institutional Facilities	S1	Government zone
	S2	Education zone
	S3	Special zone
Infrastructure Reserve	U1	Reserve zone
	U2	Road Reserve zone

405.3 S3 Special Zone. S3 zoning district, also known as 'White Sites 'have been allocated to enable the Authority in developing market demand driven necessary urban projects. The "white-site" gives more flexibility in the use of the sites through Authority's land allocation program. Endowed with the switch use options, prospective buyers / developers can respond to the market demand and supply conditions more effectively by instantly adjusting and optimizing the space among different uses available at such time. The prospective buyers / developers could rely on the flexibility granted by the "white" site rules to optimize the development potential of the site in a market with uncertain demand. The successful tenderer / buyer of a white site has the options to develop the site for commercial, residential or hotel use, or a mix of these uses, as well as the rights to choose the quantum and/or the mix of the use when initiating or launching the development with approval from Authority at such time. For the layout plots, in this zone, which are registered prior to the notification date of these regulations, the regulations of R3 (Medium to High density residential) shall be applicable.

Figure 13 Classification of Zoning

a) Parking:

5) Minimum Parking Requirements		
Residential		1 stall per dwelling unit.
Service apartments		1 stall per apartment.
Food outlets		1 stall per 5 seats in food outlets.
Commercial		
a.	Multiplex/Shopping Mall	1 stall for 33 sqm gross floor area.
b.	Retail/ Shopping Complex/Office Space/Hotels/Lodges	1 stall for 50 sqm gross floor area.
c.	Wholesale Market	1 heavy vehicle parking for 500 sqm. gross floor area
Logistics		1 heavy vehicle parking for 500 sqm. gross floor area
Industrial		1 stall for 100 sqm gross floor area and 1 heavy vehicle parking for 3000 sqm. gross floor area
Parks and open spaces		1 stall per 1000 sqm of park area
Cultural centres/Museum/Library/Community Centre		1 stall for 200 sqm gross floor area.
Cinema Hall/Theatre/Auditorium.		1 stall per 12 seats.

Table 1 Minimum Parking Requirements

The off-street parking regulations outline the minimum space requirements for various vehicle types, along with standards for driveway widths and ramp slopes. These provisions ensure safe access, smooth circulation, and efficient utilization of parking facilities in compliance with planning guidelines.

501.4 Minimum dimensions The following are the minimum dimension for parking:

	Width(m)	Depth(m)
Car Parking	2.5	5
Disabled car parking	4.85	5.5
Lorry Parking	3.5	10
Heavy Vehicle Parking	3.75	10
Ambulance parking	3	9

501.5.1 Driveway width.

Every parking facility shall be provided with one or more access driveways, the width of which shall be the following:

1. Private driveways at least 2.8 m.
2. Commercial driveways:

2.1. 3.6 m for one-way enter/exit.

501.5.2 Driveway and ramp slopes.

The maximum slope of any driveway or ramp shall not exceed 12.5 percent (1 in 8). Transition slopes in driveways and ramps shall be provided in accordance with the standards set by the Chief City Planner.

Table 2 Minimum Dimension for Parking

2.3 NBC, National Building Codes:

The NBC standards ensure structural safety, fire and life safety, building services, accessibility, and energy efficiency. All structural designs shall comply with NBC Part 6, including relevant IS codes. Fire and life safety measures, including refuge areas, fire exits, and firefighting systems, shall be designed as per NBC Part 4. Provisions for universal accessibility, ventilation, lighting, and sanitation shall follow the guidelines specified in Parts 3 and 9.

Electrical systems and lifts, designs shall be in accordance with NBC Parts 8 and 5. Additionally, parking, setback distances, open space requirements, and occupancy classifications must be in compliance with local bye-laws and NBC norms.

The EPC Contractor shall ensure full compliance with all applicable NBC parts throughout design and execution stages, incorporating all necessary approvals from statutory bodies.

Table 3 Occupant Load
(Clauses 4.3 and 4.4.2.1)

Sl No.	Group of Occupancy	Occupant Load Factor (m^2/person) (see Note 1)
(1)	(2)	(3)
i)	Group A: Residential	12.50
ii)	Group B: Educational	4.00
iii)	Group C: Institutional (see Note 2):	
	a) Indoor patients area	15.00
	b) Outdoor patients area	10.0
iv)	Group D: Assembly:	
	a) Concentrated use without fixed seating	0.65
	b) Less concentrated use without fixed seating (see Note 3)	1.40
	c) Fixed seating	see Note 4
	d) Dining areas and restaurants with seating and table	1.80
v)	Group F: Mercantile:	
	a) Street floor and sales basement	3.00
	b) Upper sales floor	6.00
	c) Storage/warehouse, receiving and the like	20.00
vi)	Group E: Business	10.00
vii)	Group G: Industrial	10.00
viii)	Group H: Storage (see Note 5)	30.00
ix)	Group J: Hazardous	10.00

NOTES

1 Gross area shall be the floor area as defined in **2.35**. All factors expressed are in gross area unless marked net.

2 Occupant load in dormitory portions of homes for the aged, orphanages, insane asylums, etc, where sleeping accommodation is provided, shall be calculated at not less than 7.5 m^2 gross floor area/person.

3 These shall include gymnasium, table tennis room, billiard room and other gaming rooms, library, swimming pool and like.

4 In case of assembly occupancy having fixed seats, the occupant load shall be determined by multiplying the number of seats by 1.2.

5 Car parking areas under occupancy other than storage shall also be 30 m^2 per person.

Table 3 Occupant Load

Travel Distance for Fire Safety:
The building layout ensures that maximum travel distances to exits comply with prescribed limits for business occupancy, restricted to 30 meters for all construction types. This design consideration enhances safe evacuation during emergencies in line with fire safety norms.

Table 5 Travel Distance (Based on Occupancy and Construction Type)
(Clauses 4.4.2.1 and 4.4.2.2)

Sl No.	Occupancy Group	Maximum Travel Distance in	
		Types 1 and 2	Types 3 and 4
(1)	(2)	(3)	(4)
i)	Residential (Group A)	30.00	22.50
ii)	Educational (Group B)	30.00	22.50
iii)	Institutional (Group C)	30.00	22.50
iv)	Assembly (Group D)	30.00	30.00
v)	Business (Group E)	30.00	30.00
vi)	Mercantile (Group F)	30.00	30.00
vii)	Industrial (Group G)		
	G-1, G-2	45.00	See Note 3
	G-3	22.50	
viii)	Storage (Group H)	30.00	
ix)	Hazardous (Group J)	22.50	

NOTES

1 For fully sprinklered building, the travel distance may be increased by 50 percent of the values specified.

2 Ramp shall not be counted as an exit in case of basements below the first basement in car parking.

3 Construction of Type 3 or Type 4 is not permitted.

Table 4 Travel Distance For Fire Safety

2.4 Other Regulations:

A ramp is a sloping pathway leading from one level to another. Ramps of an appropriate design shall be provided at all changes in level other than those served by an accessible lift or accessible lifting mechanism accommodating the specific requirements of persons with disabilities.

As per non-discrimination clause of the Disabilities Act-1995, we have to comply with requirements of providing ramps in buildings housing its branches / offices.

General requirements of ramps

Ramps shall meet the following requirements in general:-

Wherever the rise of a ramp exceeds 300mm, an additional flight of steps shall also be provided for ambulant persons. An isolated single step is not acceptable and hence a ramp is preferred to a single step.

Where there is a large change in elevation that requires multiple ramps and landing combination, other solution such as lifts should be considered.

Ramps should not ideally connect straight to doors as wheelchair users need a leveled platform at the end of the ramp to maneuver and negotiate opening the door.

A curved ramp is not a preferred design solution. Similarly, a cross fall may put a wheelchair

user at risk and may adversely affect steering, particularly on manually propelled chair. Shiny, polished surface materials that cause glare shall not be used for ramps.

Single row of tactile warning blocks (TGSI) shall be placed (as per figure) at the beginning and end of each ramp. Tactile ground surface indicators or tactile guiding and warning tiles/blocks aid blind and vision impaired pedestrians negotiate the built environment. Tactile ground surface indicators (warning type) shall be installed 300 mm before the beginning and 300 mm after the end of each flight of steps to aid people with visual impairments. This shall be placed 300 mm before the beginning and end of each ramp run to indicate the level change to visually impaired persons. Tactile warning strips shall also be provided at landings. For landings leading to a floor or those enclosed by wall, railing or balustrade, tactile warning strips of 300 mm in width shall be provided; for those leading to an open space or the entrance/exit of a building, the tactile warning strips shall be 600 mm in width.

Gradient

The gradient shall be constant between landings. The minimum specifications for ramp gradients addressing different level differences are given in table 1.

Width

The minimum clear width of a ramp (exclusive of handrails) shall be 1 200 mm and shall increase correspondingly as the level difference addressed by the ramp increases as below:-

Sl No	Level Difference	Max. gradient of ramp	Ramp width in mm	Handrail on both sides	Other requirements
1	150mm- 300mm	1:12	1200	Yes	-
2	301mm- 750mm	1:12	1500	Yes	Landings at every 5 m of ramp run
3	751mm- 3000mm	1:15	1800	Yes	Landings at every 9 m of ramp run
4	More than 3000mm	1:20	1800	Yes	Landings at every 9 m of ramp run

Table 5 Requirement for Ramp

Surface

Ramps and landing surfaces shall be non-glary, smooth, level, even and slip resistant even when wet. Outdoor ramps and their surface shall be designed to prevent water from accumulating on the walking surfaces. The surface finish shall be hard and suitable for the volume of traffic that the ramp

is likely to experience. An example of ramp with slope 1:20 and horizontal landings at beginning and end is illustrated in figure below.

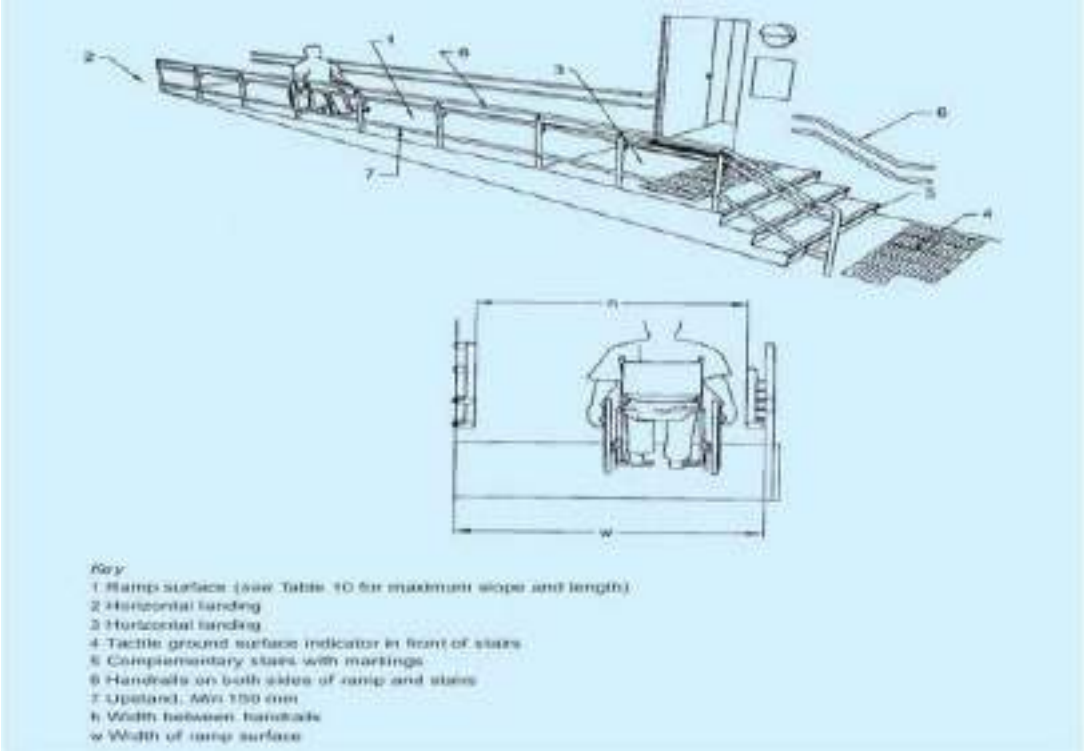


Figure 14 Examples of ramp with slope 1:20 and horizontal landings at beginning and end

Internal ramps

Internal ramps should, if possible, be avoided. Where required, internal ramps shall be designed in accordance with the following additional criteria:-

No series of ramps should rise more than 2000mm in total. If this is the case, an alternative should be provided, for example a lift.

An internal ramp should have the lowest practical gradient. In order to avoid trips and falls during a fire evacuation, a gradient of 1:15 should be the maximum permissible gradient within a building.

The minimum illumination at the top and bottom of the ramp should be 200 lux and 150 lux in between bottom and top.

Landings

An end landing shall be provided at the bottom and the top of a sloped path, a stepped path, or a ramp and also where the run changes direction. The area of the end landing may be a part of the continuing path (See fig 2 below). The length of an end landing and an intermediate landing shall be not less than 1 500 mm. Where the ramp run changes direction, the minimum landing dimensions shall be 1 500 mm × 1 500 mm. The area of a landing shall be clear of any obstruction including the path of swing of a door or a gate.

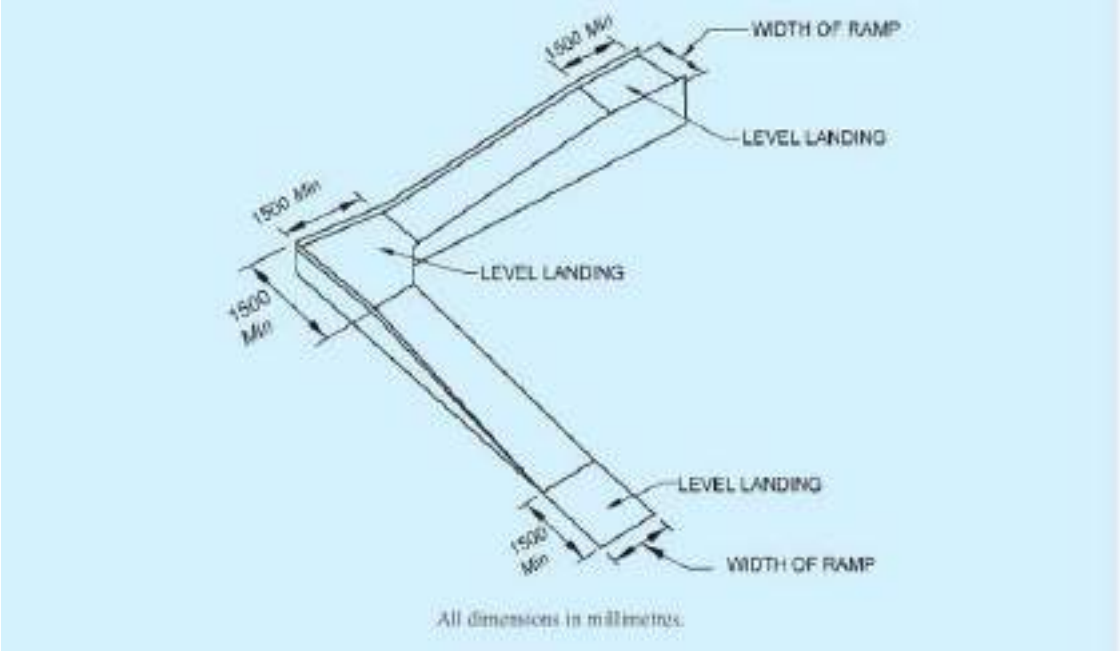


Figure 15 Development control rules and general building requirements

Landings shall also be provided at regular intervals of not more than 9 000 mm of every horizontal run. It shall conform to other provisions of this annex if served by a doorway. If the end landing follows or precedes a turn for a pathway or an entrance, the minimum dimension of the landing shall be minimum 1 500 mm × 1 500 mm.
The width of ramp and consequently the dimension of landing in the direction perpendicular to the direction of ramp shall also be governed by the provisions of Table 1.

Handrails for Ramps

A ramp run with a vertical rise greater than 150 mm shall have handrails that are on both the sides and comply with the following conditions:-

They shall be provided on both the sides;

They shall be continuous, even at the landings;

They shall extend at least 300 mm beyond the first and last nosing. A handrail shall not project into a transverse circulation path unless it is continuous and intended to form part of the guidance along that path. The end of the horizontal extension should be turned towards the wall on the closed side of the ramp or stairs, or be turned down and terminate at the floor or ground level.

They shall have a minimum clear space of 50 mm from the walls; and

The height to the top of a handrail shall be between 850 mm and 950 mm above the surface of a ramp, the pitch line of a stair, and the surface of a landing. A second handrail, with a lower profile than the first one, shall be provided. The height to the top of the second handrail should be between 650 mm and 750 mm above the surface of a ramp, the pitch line of a stair, and the surface of a landing. There shall be sufficient distance between the two handrails (say, 200 mm).

In case the handrail is enclosed in a recess, the recess shall extend at least 450 mm above the top of the rail.

Handrails/ grab bars are extremely important features and must be designed to be easy to grasp and to provide a firm and comfortable grip so that the hand can slide along the rail without obstruction.

Many Persons with Disabilities and elderly rely upon handrails/ grab bars to maintain balance or prevent serious falls.

Handrails may be provided with Braille/ tactile markings at the beginning and the end to give information to people with visual impairment.

Handrail should:-

be slip-resistant with round ends;

have a circular section of 38-45 mm in diameter;

have a minimum clear space of 50 mm from the walls;

be free of any sharp or abrasive elements; and

have continuous gripping surfaces, without interruptions or obstructions that can break a hand hold.

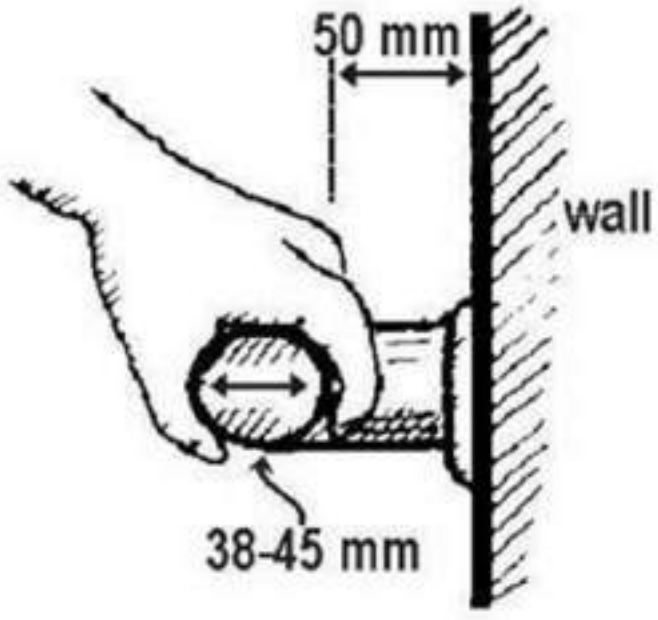


Figure 16 Grab bar details

Figure 17 Handrail with Braille information panel

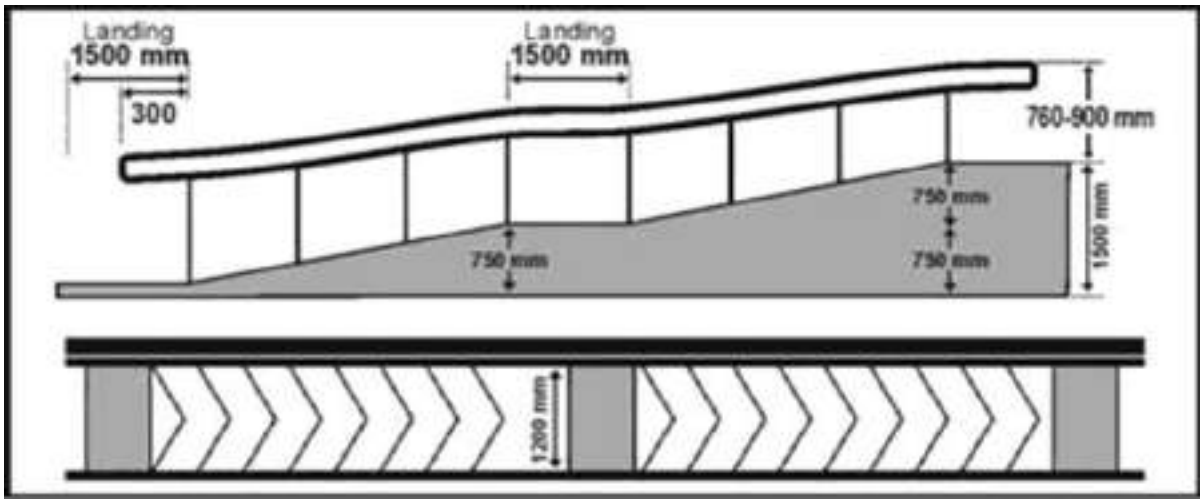


Figure 18 Handrail for ramps

Grab bars/ rails should be manufactured from a material which contrasts with the wall finish (or use dark tiles behind light coloured rails), be not too warm/cold to the touch and provide good grip. It is essential that all grab rails are adequately fixed, since considerable pressure will be placed on the rail

during maneuvering. In rural areas, indigenous materials such as bamboo/ wood/ other can be used for making grab bars in toilets.

Grab bars should:-

- be slip-resistant with round ends;
- preferably have knurled surfaces;
- have a circular section of 38-45 mm in diameter;
- be free of any sharp or abrasive elements;
- have a minimum clear space of 50 mm from the wall;
- be installed at a height of 760 mm to 900 mm;
- be able to bear a weight of 250 kg.

Edge Protection / Guarding Along Ramps

Ramps and landings not adjacent to a wall should have an edge protection in form of a 75 mm kerb. Providing protection at the side of the path protects people who use wheelchairs and ambulant people from injuring themselves as the result.

Clear floor space

A clear and level floor space of at least 900 mm x 1200 mm should be provided at controls and operating mechanisms designated for use by Persons with Disabilities.

Where a forward approach is used, a clear knee space of at least 900 mm wide, 480 mm deep and 650 mm high should be provided, which may overlap the clear floor space by a maximum of 480 mm.

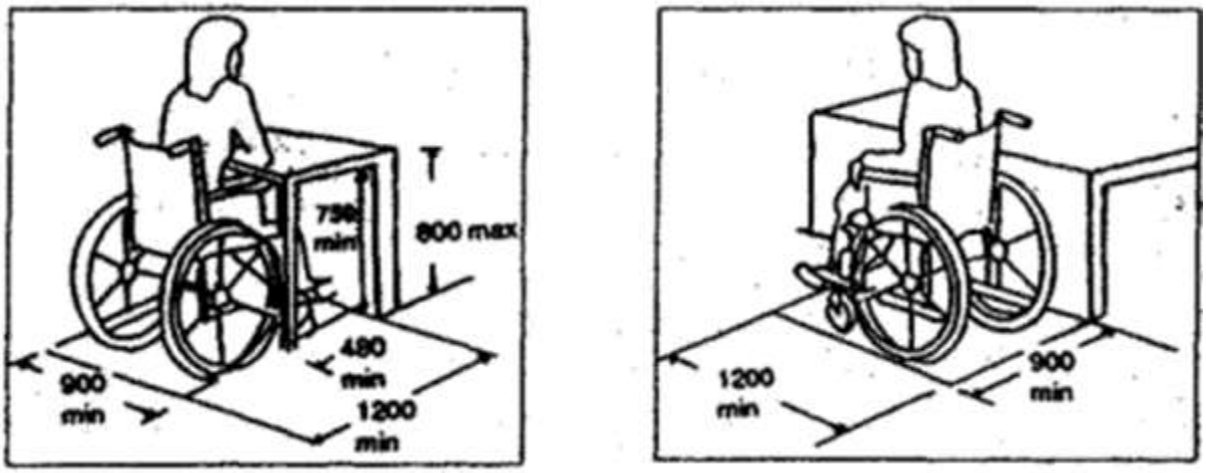


Figure 19 Space clearance for control operations

3 ARCHITECTURAL DESIGN

3.1 Master Planning Architecture Concept:

The master plan for the proposed Local Head office at Amaravathi has been thoughtfully designed to integrate functionality, environmental consciousness, and future-forward infrastructure. With IGBC Platinum and Net Zero as a core design driver, the plan ensures efficient resource use, sustainability, and long-term operational resilience, all while maintaining a strong architectural and urban identity.

- **Site Orientation & Connectivity:** The site is bounded by proposed 25m and 17m wide roads on the south and east sides respectively, providing strong external connectivity. The Northeastern side connects to the Seed Access Road with direct links to Venkata Palem and Velagapudi, ensuring regional accessibility. The placement of roads on three sides enhances permeability and allows for multiple controlled entry and exit points.
- **Zoning & Hierarchy:** The site is zoned efficiently with a single central office building as the core element, surrounded by infrastructure, landscape and service zones. The placement ensures a balanced approach to privacy, accessibility, and operational efficiency. Essential utilities like the substation, DG, and Security Cabins are located along the periphery to minimize noise and visual impact, while enabling easy maintenance access.
- **Circulation & Connectivity:** The master plan features 9-meter-wide internal roads for smooth vehicular circulation, with clearly defined entry and exit points along the proposed 17 metre road and proposed 25 metre roads to prevent congestion. Dedicated basement ramps manage parking efficiently, while surface roads remain clear for emergency and pedestrian use. Pedestrian pathways are safely segregated from vehicular zones.
- The main entry for the building is positioned on the northern side, seamlessly connecting to a landscaped drop-off zone with a canopy above, serving both the LHO and other outfits entry. A dedicated separate entry with a canopy is provided for the **branch office.** Furthermore, a **VIP entry** has been thoughtfully positioned on the **southern side** of the site. This approach provides a sense of exclusivity and privacy, with a dedicated drop-off and canopy structure above, ensuring dignified access for special visitors while minimizing conflict with general circulation.The canopy is constructed using mild steel (MS) sections, ensuring structural strength and durability, and is clad with glass panels, allowing natural light penetration while offering protection from weather elements.
- **Community Focus:** Though the site functions solely as an office zone, the plan emphasizes open space integration to enhance employee well-being. A landscaped space adjacent to the main building provides breakout zones, shaded seating areas, and fosters informal interaction among employees. These green zones create a pleasant microclimate and visual relief, contributing to user comfort and workplace productivity.

- **Environmentally Conscious Design:** Aligned with IGBC Platinum Net Zero Energy Building principles, the project integrates rooftop solar PV systems to power lighting, and essential services. The building is oriented for optimal daylight and reduced heat gain, supported by a high-performance envelope with energy-efficient glazing and insulation. Sustainable water practices include low-flow fixtures, rainwater harvesting, and greywater reuse. Native landscaping minimizes irrigation needs and enhances local ecology. Additionally, EV charging points and dedicated waste segregation zones promote sustainable mobility and responsible waste management.
- **Safety and Segregation:** Separate routes are provided for service vehicles, staff entries, and emergency access, ensuring safe and conflict-free operations. Basement access points are isolated from general traffic, and vehicular pathways are planned with safety signage and turning radii for larger service vehicles. Provision shall be made for installation of an Under Vehicle Surveillance System (UVSS) at all vehicular entry/exit points to ensure real-time monitoring of vehicle undersides.
- **Infrastructure and Utilities:** All critical utility components — substation, pump room — are incorporated within the layout with dedicated fencing and controlled access for safety and maintenance. Their placement ensures functional separation from staff and visitor areas while preserving visual harmony and safety.
- **Green balconies**, designed as interactive breakout spaces, have been thoughtfully integrated across multiple floor levels of the building. These landscaped extensions not only provide opportunities for relaxation and informal interaction but also enhance the building's environmental performance by improving natural shading, air quality, and overall visual appeal.

Name	Area (in sq ft)	Area (in %)
Plot coverage	51680	39.55 %
Landscape	40524	31.01 %
Roads	38476	29.44 %
Site	130680	100%

Table 6 Area for Site

- **Futureproofing:** The master plan is designed to accommodate future needs, allowing for technological upgrades and utility expansion without disrupting office operations.
- **Harmonious Development:** The combination of structured roadways, green landscaping, and thoughtfully placed service areas creates a clean, cohesive, and professional campus-like environment. The design supports a modern work culture, encourages employee wellness, and reflects sustainable, climate-resilient urban development principles.

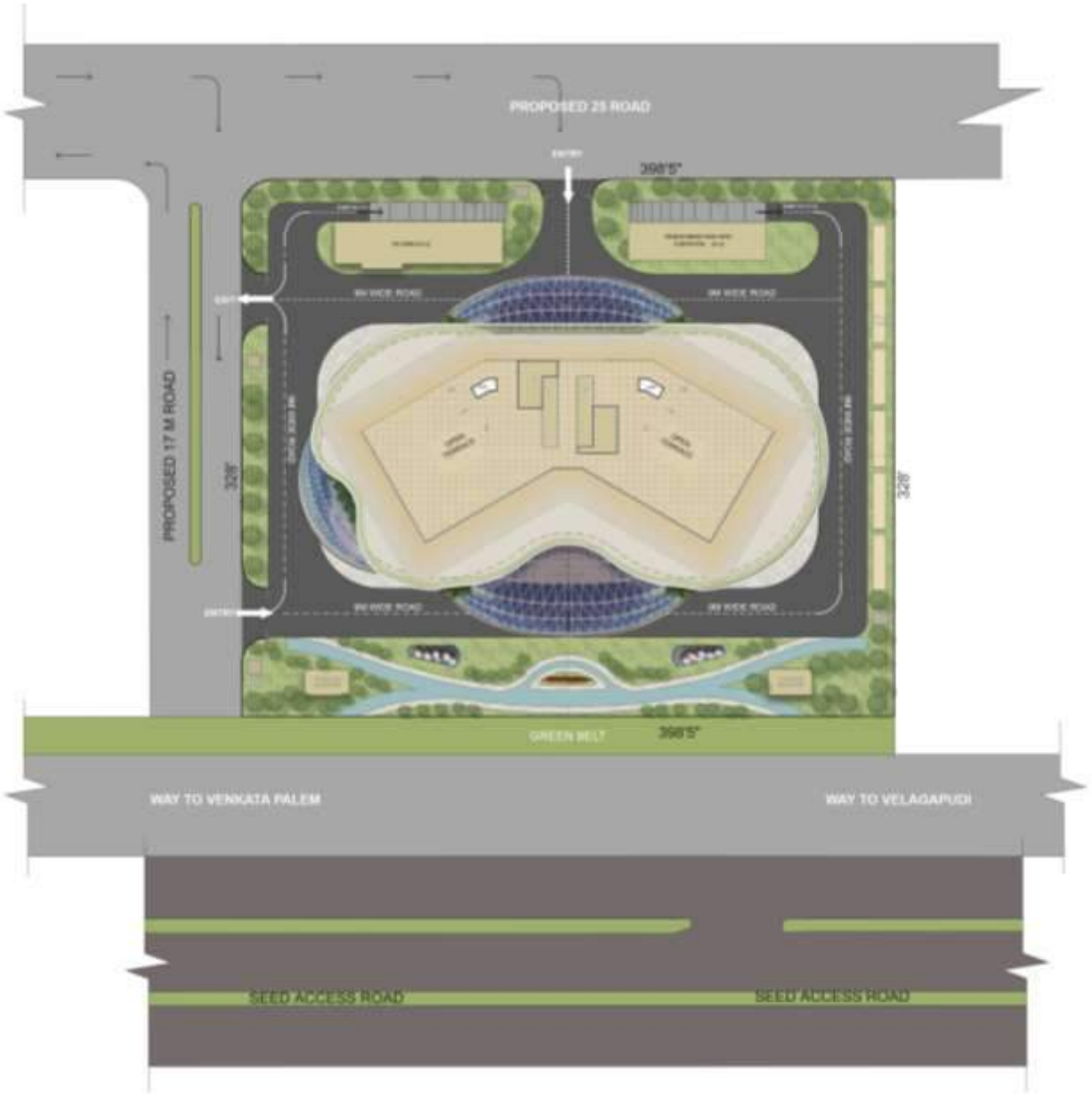


Figure 20 Site Plan for the proposed construction of office building.

3.2 Landscape:

The landscape design for the proposed Local Head Office at Amaravati prioritizes sustainability, functionality, and user well-being through a thoughtfully integrated open space plan.

- The landscape strategy focuses on **peripheral green buffers**, with tree-lined boundaries along the edges of the site. While this approach contributes to visual relief and edge-level microclimatic improvement
- The front landscape comprises the **Dharma Chakra of Buddhism** symbolizing cultural significance, with a pedestal height of 0.8 m and an external diameter of 9 m.
- A contemporary abstraction of the Dhanyamkatakam (Dharanikota) granary is incorporated into the design, constructed using terracotta blocks/tiles supported by a steel framework in three varying sizes. The structure is further enhanced with Darrieus rotor wind turbines to promote sustainability, detailed as follows:

- Type 1: Maximum diameter 1.7 m, minimum diameter 0.8 m, height 3.0 m, 4 nos.

- Type 2: Maximum diameter 2.0 m, minimum diameter 1.0 m, height 3.5 m, 4 nos.
- Type 3: Maximum diameter 2.4 m, minimum diameter 1.1 m, height 4.5 m, 4 nos.

- The water body, symbolically representing the Krishna River, extends 110 m in length and 2 m in width, featuring six fountains that enhance its ecological value and contextual identity. Collectively, these elements blend heritage, innovation, and environmental responsibility into a unified landscape concept

S.No.	Description	Sq.ft	Percentage
1	Green space	27281	67.32 %
2	Water body	3960	9.77 %
3	Pedestrian	9283	22.91 %
	Total Landscape area	**40524**	100 %

- **Layered Green Buffers:** Around the office building, smaller softscape pockets and buffer zones soften the built edges. These layered green spaces help scale down the mass of the structure at ground level, promoting comfort and a more human-centric environment.
- **Functional Open Spaces:** Green areas are designed not just for aesthetics, but to serve practical uses such as shaded seating areas, walking loops, and recreational green corners—creating opportunities for relaxation, casual interaction, and outdoor meetings.
- **Integrated Hard and Soft Landscaping:** A balanced mix of paved surfaces (walkways, driveways) and green patches ensures functionality without compromising aesthetics. Peripheral greens add visual relief and create shaded movement corridors. Over 30 % of the site is reserved for green and open spaces.
- **Ecologically Sensitive Design:** The landscape incorporates rainwater percolation zones, low-maintenance native species, and minimized hardscaping to support water conservation, biodiversity, and long-term ecological health of the site.

3.3 Project components

In brief, the project consists of a high-rise Institutional Office Building for SBI's Local Head Office along with all essential utility buildings and infrastructure, including the Electrical Substation, Security Cabins, Pump Room, Sewage Treatment Plant (STP), and comprehensive Site Development works.

Besides these, all required MEP, and other services, Utilities, External Development, Horticulture, Landscaping, Roads including Roundabouts and Pavements, Parking, Pathways, Planters, External Boundary Wall work at proposed site (3 Acres), Water Supply, Plumbing, Storm Water Drainage, Signages (external) and all related utilities as mentioned in the Design Basis Report and

otherwise taking into consideration with respect to all statutory regulations as required for development are also included in the scope of work.

In office building, the Electrical works except HT side (till Sub-station building), DG set, HVAC, Interior works (exclusions mentioned in finishes schedule as per DBR), CCTV, LAN/WiFi, lighting fixtures are excluded from the scope of the EPC contractor. However, the civil works required to carry forward the above exclusions at later stage is included in this tender scope to be executed by the EPC contractor. The designing and construction of boundary wall, Main Entrance Gate(s) etc. as per Master Plan are also in the scope of work of EPC Contractor, as per requirements.

1. Office:

Office building: 3B+G+14 floors.

The proposed state-of-the-art office building of height 66.4m is designed with three basement levels, a ground floor dedicated to shared amenities, and fourteen upper floors that accommodate the various functional requirements of the Amaravati Local Head Office. The vertical zoning efficiently integrates multiple SBI departments, including the **Local Head Office, SMECCC, Central Audit Office, Liability and Retail Asset Central Processing Centres, Centralized Pension and Stressed Assets Management Branches**, and a full-service branch with an NRI division. Additional facilities such as an auditorium and an e-lobby are also incorporated within the overall layout. Provision has also been made in the structural design to accommodate an additional five floors in the future, ensuring long-term adaptability and scalability of the facility. This integrated spatial organization ensures functional clarity, operational efficiency, and optimal space utilization.

AREA STATEMENT						
S.No.	Description	Core Area (Sq.ft.)	Lobby Area (Sq.ft.)	East wing Office Area (Sq.ft.)	West wing Office Area (Sq.ft.)	Floor Area (Sq.ft.)
1	Ground floor	8268	5318	13164	11604	38354
2	1st Floor	6781	1691	13918	13918	36308
3	2nd Floor	6093	970	6114	6114	19291
4	3rd Floor	5823	1259	8088	8088	23259
5	4th Floor	5823	1507	10088	10088	27506
6	5th Floor	6243	1744	12248	11797	32032
7	6th Floor	5823	1668	11500	11500	30492
8	7th Floor	5823	1582	10784	10784	28973
9	8th Floor	5823	1507	10088	10088	27506
10	9th Floor	5823	1442	9397	9397	26059
11	10th Floor	6243	1346	8743	8312	24644
12	11th Floor	5823	1259	8088	8088	23259
13	12th Floor	5823	1163	7459	7459	21905
14	13th Floor	5823	1066	6847	6847	20583
15	14th Floor	5823	968	6250	6250	19291
16	Terrace					1679
Sub total Builtup Area						401140

Figure 21 Area Statement Floorwise

The building is equipped with comprehensive modern amenities, advanced infrastructure, and sustainable systems to support a professional, efficient, and future-ready corporate environment.

2. Substation:

- The **substation facilities** are strategically positioned on the southeastern and southwestern sides of the site to ensure functional efficiency and convenient access to utilities. A G+1 structure is planned on the southeastern side to accommodate the diesel generator (DG) system and associated services, while an S+1 building is proposed on the southwestern side, with the stilt level designated for the transformer yard and the first floor allocated for the electrical panel room. The plinth height of the substation building is maintained at 0.9 metres above the finished ground level to safeguard against surface water ingress and to facilitate proper drainage. This layout ensures optimal accessibility for maintenance and operations while maintaining a clear separation between critical infrastructure services and the main office zones and landscaped areas, thereby preserving both functional efficiency and site aesthetics.

3. Parking & Circulation:

- **Dedicated ramp entries and exits** are provided on the southern side of the site, facilitating smooth access to the basement parking area. This arrangement

supports ample underground parking while maintaining a vehicle-free surface zone for enhanced pedestrian comfort and safety. Peripheral driveways allow for one-way vehicular circulation, minimizing traffic conflicts and improving overall site traffic flow.

- The **basement parking** is thoughtfully planned to meet the office building's functional needs. A total of **3,36,321 Sq.ft** has been allocated for parking, based on the Amaravati Zoning Regulation norms. This approach ensures efficient utilization of basement space while accommodating both parking and essential services
- Safety features include column guards around all structural columns within the basement and driveway zones to reduce the risk of impact. Additionally, high-visibility reflective signage is strategically placed throughout the basement and along driveways to aid navigation, especially in low-light conditions, enhancing overall vehicular safety.
- Access ramps for both vehicles and pedestrians are provided with code-compliant slopes. These ramps are equipped with MS structural shelters featuring tensile fabric roofing for weather protection. For universal accessibility, handrails and non-slip surfaces are integrated into the ramp design, in compliance with accessibility standards and safety norms.

4. Entrance Gate:

- A total of two entrance gates are proposed along the 17m wide road of the site. One gate is designated as the primary entry point to the office building, while the other one serve as exit points, supporting efficient one-way vehicular movement. These gates will feature motorised sliding mechanisms and may be accentuated with a formal entry arch, emphasizing the identity of the office campus.
- One additional gate is proposed along the secondary road frontage (25m wide road), enabling service, VIP entry and emergency access as needed. The placement and function of all entry/exit points have been carefully planned to support efficient traffic circulation and segregated movement of vehicles and service personnel, reducing congestion within the site. The entrance arch structure is accentuated with a glass roof, creating a visually striking and contemporary feature.
- The site includes three guard rooms—two at the main entry and exit point, and one at another entry gate. These are strategically positioned to monitor all vehicular and pedestrian movements, ensuring continuous site security and controlled access throughout the premises.
- The **boundary wall** is designed with integrated security features, including provisions for **guard posts, CCTV camera mounting points, anti-climb measures, and controlled access mechanisms** at all designated gate locations. This ensures a clearly **defined and secure perimeter** around the office campus, aligning with modern security standards and supporting the operational needs of the facility.

AREA STATEMENT		
S.NO.	DESCRIPTION	AREA(SQ.FT)
A	OFFICE BUILTUP AREA:	
	I) OFFICE AREA	399461
	II) TERRACE AREA	1679
	(A) - SUBTOTAL	401140
B	PARKING:	
	I) BASEMENT I	112107
	II) BASEMENT II	112107
	III) BASEMENT III	112107
	(B) - SUBTOTAL	336321
C	SUBSTATION	
	I) DG BUILDING AREA	5468
	II) PANEL ROOM BUILDING AREA	3918
	(C) - SUBTOTAL	9386
D	ENTRANCE ARCH	
	ENTRANCE ARCH BUILTUP AREA (D)	775
D	TOTAL CONSTRUCTION AREA (A+B+C+D)	747622

Figure 22 Area Statement

The Contractor shall prepare schematic drawings with concept (without deviating from the PMC's Concept), 3D models (designs) and Good for Construction (GFC) drawings for all relevant disciplines, including but not limited to Architecture, Structural, and MEP services, site development, etc for review and approval by the Bank/PMC prior to commencement of the corresponding works.

It shall be the Contractor's responsibility to ensure that all drawings and documents requiring prior approval are submitted sufficiently in advance to avoid any delay in project execution

The architectural layout, positioning, and schematic arrangement of services, as indicated in the current design, are minimum indicative, representing a baseline framework. During the detailed design stage, the EPC contractor shall carry out a comprehensive assessment to finalize spatial and capacity requirements. Any improvement or upgrades deemed necessary shall be implemented with the concurrence of the Engineer-In-Charge, ensuring alignment with overall functional and operational objectives.

3.4 Concept planning & aesthetics

3.4.1 Concept planning

The Amaravati Local Head Office campus comprises exclusively of office building, carefully organized around a central landscaped spine. The primary office structure rises up to fifteen floors with three basement level, offering a strong institutional presence within a compact and efficient footprint. The spatial layout emphasizes visual coherence, environmental

responsiveness, and functional efficiency, creating a professional and vibrant workplace environment anchored by green, interactive common zones.

3.4.2 Design philosophy and spatial planning

- The **Amaravati Local Head Office** campus comprises exclusively of commercial buildings, carefully organized around a central landscaped spine. The primary office structure rises up to **fifteen floors** with triple basement level, offering a strong institutional presence within a compact and efficient footprint. The spatial layout emphasizes visual coherence, environmental responsiveness, and functional efficiency, creating a professional and vibrant workplace environment anchored by green, interactive common zones.
- **Efficient Land Use:** The use of **vertical density** (up to 14 floors) allows for generous open spaces at ground level, including green walkways, social courts, and communal areas.
- Emphasize energy efficiency, water conservation and green building strategies through sustainable construction methodology and techniques, including rainwater harvesting and the use of eco-friendly materials and practices.
- The design shall ensure universal accessibility, in compliance with the latest National Building Code (NBC), and guidelines for barrier-free environments. All public areas, entrances, toilets, circulation spaces, and vertical transportation shall be designed to be accessible and user-friendly for persons with disabilities, the elderly, and individuals with limited mobility.

3.4.3 Aesthetics & Innovations

The facade of all the buildings should be designed by the contractor based on the concept design provided by the PMC and the same shall be approved by the Bank/PMC. The design embodies a modern urban style, seamlessly integrated with climate-conscious features and refined functionality:

- **Glass Facade with Triangular Lattice Pattern:** High-performance glass panels combined with a triangular lattice facade create a contemporary appearance. The reflective glazing further enhances the modern aesthetic while improving energy efficiency.
- **Facade material:** The **south and west facades** feature **square fin** solar-shading devices as secondary skin, effectively minimizing solar heat gain. The design incorporates a **triangular surface lattice** made of **anodised aluminium profiles** (white finish), while the **vertical edge lattice**—comprising eight members—is formed with a stainless-steel framework clad in folded **anodised aluminium panels** (white finish), achieving both functional efficiency and aesthetic refinement.
- The portico canopies are designed with **tubular steel truss frameworks** supporting **glass roofing**
- **Stone Cladding:** The lower levels feature stone cladding, lending a strong institutional character to the building. This contrasts elegantly with the sleek glass facade above, enhancing the overall visual richness and architectural depth.

- **Refuge Balconies for Safety:** Dedicated refuge balconies are integrated at specific levels for fire safety and emergency evacuation, meeting NBC norms. These also add depth and variation to the facade aesthetics.
- **Green Integration:** Multiple green balconies serve as breakout spaces, while integrated planter boxes soften the glass façade, harmoniously blending technology with nature. This approach enhances sustainability and reduces heat gain.
- **Biophilic & Smart Design:** Green terraces and planters integrate nature within the built form, improving indoor air quality and well-being. Integration of smart building technologies with automated lighting, adaptive shading, and intelligent energy management systems enhances operational efficiency and user comfort.
- **Sustainable & Energy-Efficient Features:** Likely uses solar panels on the rooftop for renewable energy. High-performance glazing reduces heat ingress, lowering cooling loads.
- The proposed buildings within the proposed site shall be designed and constructed in compliance with **IGBC Platinum and Net Zero-Energy Building** certification. In terms of **Net Zero-Energy**, the design emphasizes passive architectural strategies, energy-efficient lighting and Pumps, and on-site renewable energy generation through rooftop solar photovoltaic panels, ensuring that the total energy demand is met through clean sources.

3.5 Design Consideration

Excavation, foundation and plinth in all types of Soil, Hard Rock and Anti termite treatment as per CPWD Specification & design criteria. Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings etc. Earth work in surface excavation including getting out and disposal of excavated earth in all kinds of soil including bailing and pumping of water, strutting etc.

Anti-termite treatment as per necessity of ground shall be carried out as per relevant IS Codes / CPWD specifications

Structural / Non-Structural Grade slab as per the necessity at site/design requirement and as per the functional requirement of supported flooring shall be designed & provided accordingly.

Damp proof course shall be provided wherever as per CPWD specification.

Basement shall be designed as an integral part of superstructure and integrated with foundation system with suitable waterproofing system and measures for collection, pumping and disposal of water. Any extended basement beyond footprint of the Superstructure shall be designed and integrated with foundation system and its roof slab designed to carry all loads including fire tender load as required

Drainage and Plinth protection along the perimeter of the buildings shall be provided as per CPWD specifications or as per functional requirement.

Overall, the office complex will serve as a model for environmentally responsible development by integrating sustainable strategies that reduce resource consumption, lower operational costs, and enhance the health and well-being of its occupants.

3.5.1 Design Adherence:

The Contractor shall strictly adhere to the approved architectural concept and facade design; Minor modifications to internal floor plans may be considered prior to the commencement of construction, but only upon receipt of written instructions from the Bank/PMC.

Any proposed change in building orientation based on climatic or environmental analysis must be supported with detailed justification and shall be subject to prior written approval from the Bank/PMC.

3.5.2 Construction Methodology:

The EPC Contractor shall incorporate an integrated approach to structural system design, MEP coordination, and adopt fast-track construction techniques. These aspects must be reflected in the Contractor's pricing, scheduling, and execution methodology.

3.5.3 Sustainable Design Scope under EPC Contractor:

- The proposed buildings are to be constructed in compliance with IGBC Platinum and Net Zero-Energy Building standards as part of the EPC contractor's scope of work.
- The project aims to achieve green building certification under IGBC, adhering to criteria for energy efficiency, water conservation, material selection, and indoor environmental quality. Meeting these standards supports the building's sustainability objectives while also qualifying for potential incentives or rebates.

3.5.4 Design and Execution Compliance Requirements

All works associated with the proposed project shall be designed and executed in full compliance with the relevant ISO standards, NBC, APCRDA, applicable national and local codes, and statutory authority guidelines. The EPC Contractor shall be solely responsible for ensuring that all deliverables are completed in a fully functional, service-ready condition, without any compromise on performance, safety, or quality. The examples provided herein represent the minimum benchmark of the level of detail and quality expected.

Illustrative Example: Road Works and Associated Infrastructure

To outline the expected level of detail and execution, the following components serve as representative examples for road works. All items shall be implemented in accordance with relevant codes and guidelines such as APCRDA regulations, IRC codes, ITDP standards, and other applicable statutory or technical standards.

Internal Roads

- Road design and geometry as per IRC norms
- Cement Concrete (CC) Road finish for durability and low maintenance
- Proper camber, shoulders, and gradient
- Kerb stones and saucer drains
- Rainwater drainage system, stormwater inlets
- Underground utility ducts and service corridors
- Pedestrian crossings, tactile paving, road marking

- Speed tables, speed breakers, wheel stoppers
- Street lighting, bollards, boom barriers, signboards

Ramps and Shelter Structures

- Ramps designed for both pedestrian and vehicular access with compliant slopes per NBC standards.
- Ramp leading to basement shelters with MS structural framing and tensile fabric roofing, ensuring weather resistance and architectural harmony.
- Mild steel handrails and non-slip surface finishes to support universal accessibility and safety.

Podium Landscaping and Tree Plantation

- Installation of geotextile membranes and drainage layers above the basement slab to manage water flow.
- Topsoil thickness for softscape areas minimum 450 mm on the podium deck.
- Tree planter boxes with a minimum internal depth of 1.2 m and diameter of 1.0 m, integrated with waterproofing and drainage.
- All landscape features and softscape areas shall be supported by appropriate irrigation, drainage, and waterproofing systems.

Note:

The above-listed elements are not exhaustive and are intended to convey the expected standard of quality, completeness, and integration. When a specific item is mentioned in the scope, it shall not be interpreted as a bare minimum of only that item. Rather, it includes all associated components and ancillary works. The EPC Contractor shall ensure that all such comprehensive and integrated components are factored into their design, execution, and pricing. It is the EPC Contractor's obligation to ensure that all design and construction works comprehensively cover the scope, meet statutory requirements, and result in a fully code-compliant, functional, and integrated development.

All project deliverables must align with the client's expectations of performance, safety, operational readiness, and long-term sustainability.

3.6 Specifications of finishes

The EPC contractor must complete a mockup including all fixtures, fittings, finishes, etc for office approval of the Bank/PMC before starting the finishing works for office buildings.

3.6.1 Office

S.NO.	DESCRIPTIONS	WALL FINISHES	FLOORING	CEILING FINISHES
A	Ground Floor			
1	Lift Lobby	Italian marble with V-Groov upto the false ceiling	Italian Marble (16-18 mm thick) Basic Rate Rs.5400 per Sq.m	Plastered True Ceiling
2	Entrance Ramp	Granite (18 mm thick) upto 150 mm height	Leather finish Granite (18 mm thick)	True Ceiling with Acrylic Emulsion

				Paint Finish Including POP Punning
3	Electrical Room	NIL	NIL	True Ceiling with Acrylic Emulsion Paint Finish
4	Staircase	100 mm height skirting + Acrylic Emulsion Paint with POP Punning	Tread- Leather finished Granite with round nosing (Basic Rate: 1600 /Sqm), Riser-polished Granite, Basic Rate: 1850 /Sqm (18 mm thick)	True Ceiling with Acrylic Emulsion Paint Finish Including POP Punning
5	Entrance Lobby	NIL	NIL	NIL
B	First Floor/ Typical floors			
1.	Office Workspace	NIL	NIL	NIL
2.	Male/Female Toilet	Vitrified tile (600x1200 mm) up to 2400 mm height + Acrylic Emulsion Paint with POP Punning. Modular cubicles for toilet partition with necessary fixtures.	Double Charged Vitrified Anti-skid Tile 600X600 mm with waterproofing with water absorption less than 0.08% with joints finished with matching grout.	PVC False Ceiling Tile (600x600mm)
3.	Electrical Room & LV Room	NIL	NIL	True Ceiling with Acrylic Emulsion Paint Finish
4.	Staircase	100 mm height skirting + Acrylic Emulsion Paint with POP Punning	Tread- Leather finished Granite with round nosing (Basic Rate: 1600 /Sqm), Riser-polished Granite, Basic Rate: 1850 /Sqm(18 mm thick)	True Ceiling with Acrylic Emulsion Paint Finish Including POP Punning
5.	Lift Lobby (All Floors)	Italian marble with V-Groove upto false ceiling height	Italian Marble (16-18 mm thick) Basic Rate: Rs. 5400 per Sq.m	Plastered True Ceiling
6.	Refuge Balcony	NIL	NIL	WPC/HPL Soffit Panel (False Ceiling)
7.	Electrical/AHU/Staircase/ELV - Fire rated Door (2hr fire rated)	GI sheet with Rockwool/ mineral wool core	Powder-coated	Fire Rated Mortise Lock with lever handles, Fire Rated Hinges, Automatic Door Closer (Fire

				Rated), Panic Bar, Smoke seal / intumescent strip, Vision panel, Kick plate
8.	Toilet Door	Flush door with both side waterproof laminates (1mm thick) Basic Rate: Rs.1000 per Sq.m		SS Mortise Handle set, SS Hinges. Basic Latch Lock.

Table 7 Finishes schedule for Office

Note:

1. All Railing to be in Stainless Steel - 316 Grade.
2. All tiles will be laid with spacers on wall and floors and filled with Epoxy Grouting.
3. Aluminium reinforced PVC wall guard & SS Corner Guard to be provided as per design requirements.
4. Staircase and balcony railing to be provided in stainless steel (S.S.), as per design, with a height of 1.0 meter.
5. Refuge Balcony railings shall be finished with stainless steel (S.S.) and toughened glass, with a height of 1.2 meters from finished floor level (FFL), as per the architectural elevation.
6. The overhead tank shall be provided with an extendable staircase made of MS for durability and corrosion resistance.
7. All the brick wall and RCC wall surfaces shall be done with POP punning before applying paint over the surfaces.
8. The provisions for differently abled toilet should also be considered for design and execution in the office.

EXTERNAL FINISHES:

9. Textured with Elastomeric Weatherproof Paint.
10. All Elements to be in Compliance with Energy Conservation Building Code.
11. Building Façade Lighting as per Required LUX Level.
12. Exterior finish shall be completed with paint in combination with architectural elevation / façade design, as per drawings.

The items and specifications mentioned above are minimum requirements and subject to improvement. During the detailed design and engineering stage, the EPC Contractor shall undertake a comprehensive assessment to finalize the detailed requirements. Any improvement or enhancements shall be made in alignment with statutory norms and project objectives.

3.6.2 Basement

Table 8 Finishes schedule for Basement

S. NO.	DESCRIPTIONS	WALL FINISHES	FLOORING	CEILING FINISHES
1	Parking	Plastered with Acrylic Emulsion Paint	75 mm thick VDF using M- 30 Grade with Groove	True Ceiling (Plastered) with Acrylic Emulsion Paint Finish
2	Pump Room	Plastered Acrylic Emulsion Paint	75 mm thick VDF using M- 30 Grade with Groove	True Ceiling (Plastered) with Acrylic Emulsion Paint Finish

3.7 Sanitary finishes schedule for Office:

S. No	Fixture Description	Material	Finish	Colour	Mounting Type	Remarks	REF. Model	Location
1.	EWC	Vitreous China	Glazed Ceramic	White/Black	Wall hung wall mounted concealed flush tank with Wrought iron chairs	Dual flush concealed cistern	K-26998IN-0	As per Drawing
2.	Wash Basin	Vitreous China	Glazed Ceramic	White/Black	Countertop/ Wall	With overflow	K-26269IN-0	
3.	Basin Bottle Trap	Brass / PVC	Chrome-plated	Silver	Exposed	Decorative finish	K-75823IN-CP	
4.	Long Body Bib cock	Brass	Chrome-plated	Silver	Deck-mounted	Single lever	K-20070IN-4 CP	
5.	Mirror	Float Glass	Bevelled Edge	Clear	Wall-mounted	6mm thick, moisture-resistant backing	K-26052IN-CPL	
6.	Faucet (General)	Brass	Chrome-plated	Silver	Deck / Wall Mounted	Quarter-turn or sensor type	18656IN-ND	
7.	Floor Drain	Stainless Steel	Brushed SS	Silver	Floor-mounted	Removable grating, 100mm diameter	K-75422IN-CP	

8.	Urinal with Flush Valve with Separator	Vitreous China	Glazed Ceramic	White	Wall-mounted	Infrared sensor flush	K-26475IN-ER-0	
9.	Soap Dispenser	ABS / SS	Chrome / Matte	Silver	Wall-mounted	Manual or sensor-operated	K-10712D-CP	
10.	Toilet Paper Holder	Stainless Steel	Chrome-plated	Silver	Wall-mounted	With cover or open type	K-25071IN-CP	
11.	Angle Valve	Brass	Chrome-plated	Silver	Wall-mounted	Quarter-turn, used for WC and basins	K-76389IN-9-CP	
12.	Bidet Shower (Health Faucet)	ABS / Brass	Chrome-plated	Silver	Wall-mounted	With flexible hose & holder	12927IN-CP	

Table 9 Sanitary finishes schedule for Office

General Notes

- All reference models mentioned above are from Kohler brand.
- All items must be water-saving compliant where applicable.
- Sanitary fixtures must conform to IS/ASTM/EN standards.
- Submit samples for approval before procurement.
- Installation to be per manufacturer’s specifications and coordinated with MEP services.

The data provided above shall be considered as the minimum indicative requirement. The specific brands mentioned, are intended solely for benchmarking purposes and are not mandatory recommendations. Other makes specified in the technical specification may be proposed, provided they meet or exceed the specified benchmark in terms of quality, performance, and technical compliance. The above list of Sanitary fittings are indicative only. Additional items/equipment/fixtures/fittings may be identified during the detailed design phase and the EPC contractor has to execute the same. FAT shall include verification of safety features, protection coordination, control logic, and compliance with statutory and project specifications. The Employer/Consultant shall be notified in advance to witness the FAT as required.

4 STRUCTURAL DESIGN BASIS REPORT:

4.1 Introduction

The structure is designed for Office building, at Amaravati. This report covers minimum design specifications, which will form the overall design philosophy to be adopted in the structural design of the project. The Structural Design Basis Report (DBR) is prepared in reference with the relevant IS Codes and Architectural drawings. 3D wire frame models of the building are generated and analyzed for various loads and load combinations using ETABS design software. The loads and load combinations were considered as per relevant IS codes.

The Building consists of 3 Basement + Ground + 14 Floors and 5 Future Floor. Separate model for 3 Basement+ + Ground + 14 Floors and 3 Basement + Ground + 19 Floors. Rapid Methodology using Steel Concrete Composite deck to be adopted.

S.No	Total Height (m)	Floor Height (m)	No of Floors
1	66.4	4	3B + G + 14
2	86.4	4	3B + G + 14 + 5 Future floors

4.2 Site details

4.2.1 Project Location

The proposed project is located at Amaravati.

4.2.2 Soil Data

Geo technical investigation is done and report states that, the Load Bearing Capacity of Pile at --m depth below existing ground level based on soil test report is 400 Tonnes for mm Dia Pile.

Pile Capacity Chart is listed below

4.3 Structural system

4.3.1 Foundation

Bore Hole No	Pile Diameter, mm	Pile Length below Cut-Off-Level, m	Recommended Safe Pile Capacity, Tonnes			
			Vertical Capacity of Piles (T).	Uplift capacity of Pile. (T)	Lateral*** (Fixed head horizontal deflection)	Lateral*** (Free head horizontal deflection)
01	600	10.00	23.88	22.37	38.91 (M35)	18.81 (M35)
		15.00	59.40	37.10		
		20.00	83.58	54.57		
		25.00	100.51	72.04		
		30.00	117.44	89.51		
02	600	10.00	34.31	31.40		
		15.00	48.98	47.20		
		20.00	85.11	64.27		
		25.00	101.94	82.19		
		30.00	118.77	100.11		
03	600	10.00	34.94	32.39		
		15.00	61.42	48.23		
		20.00	97.40	65.44		
		25.00	150.72	88.12		
		30.00	172.40	110.80		
04	600	10.00	23.42	22.24	38.91 (M35)	18.81 (M35)
		15.00	35.27	35.27		
		20.00	69.50	49.85		
		25.00	85.27	66.73		
		30.00	101.05	83.62		
05	600	10.00	25.66	24.47		
		15.00	37.43	37.43		
		20.00	71.89	52.33		
		25.00	86.96	68.53		
		30.00	102.04	84.73		
06	600	10.00	26.81	25.89		
		15.00	37.63	37.91		
		20.00	76.65	53.38		
		25.00	93.08	70.91		
		30.00	109.52	88.44		
07	600	10.00	28.62	27.41		
		15.00	40.35	40.33		
		20.00	78.98	55.92		
		25.00	95.27	73.30		
		30.00	111.55	90.69		
08	600	10.00	29.99	28.48		
		15.00	42.26	41.92		
		20.00	79.10	57.46		
		25.00	94.94	74.40		
		30.00	110.78	91.35		
09	600	10.00	23.27	22.05		
		15.00	36.08	36.03		
		20.00	48.89	50.00		
		25.00	92.02	68.37		
		30.00	109.31	86.74		

Bore Hole No	Pile Diameter, mm	Pile Length below Cut-Off-Level, m	Recommended Safe Pile Capacity, Tonnes			
			Vertical Capacity of Piles (T).	Uplift capacity of Pile. (T)	Lateral*** (Fixed head horizontal deflection)	Lateral*** (Free head horizontal deflection)
01	1000	10.00	49.92	44.24	55.51 (M35)	21.77 (M35)
		15.00	137.53	76.65		
		20.00	240.72	124.36		
		25.00	285.37	172.08		
		30.00	330.03	219.79		
02	1000	10.00	95.10	83.30		
		15.00	123.33	114.91		
		20.00	307.50	164.71		
		25.00	366.66	226.66		
		30.00	425.82	288.60		
03	1000	10.00	69.81	61.33		
		15.00	97.07	91.98		
		20.00	232.56	129.09		
		25.00	495.99	192.03		
		30.00	556.17	254.96		
04	1000	10.00	49.32	44.21		
		15.00	71.28	69.67		
		20.00	171.61	103.80		
		25.00	249.81	149.88		
		30.00	293.10	196.25		
05	1000	10.00	52.70	47.83		
		15.00	74.27	72.91		
		20.00	212.88	109.77		
		25.00	254.47	154.48		
		30.00	295.06	199.18		
06	1000	10.00	58.38	35.94		
		15.00	83.37	50.47		
		20.00	244.46	68.45		
		25.00	290.62	88.50		
		30.00	336.78	108.54		
07	1000	10.00	58.07	52.89	55.51 (M35)	21.77 (M35)
		15.00	79.97	78.28		
		20.00	237.40	117.42		
		25.00	282.64	165.70		
		30.00	327.87	213.99		
08	1000	10.00	60.64	54.65		
		15.00	83.39	80.89		
		20.00	232.94	119.63		
		25.00	276.94	166.70		
		30.00	320.93	213.77		
09	1000	10.00	98.84	48.24		
		15.00	231.17	99.26		
		20.00	279.20	150.29		
		25.00	327.23	201.31		
		30.00	375.26	252.34		

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The depth of the pile varies from one bore to other, detailed interpretation shall be made based on the Bore log data to fix up an approximate pile depth (varies from bore to bore) till reaching the hard strata and socketing depth in addition to the pile length. The capacity shall be derived based on the parameters resulting the minimum capacity.

4.3.2 Super-Structure

The structural system is having combination of Steel Columns, RC Columns, RC Shear Wall, RC Beams, RC Slab and Steel Concrete Composite deck.

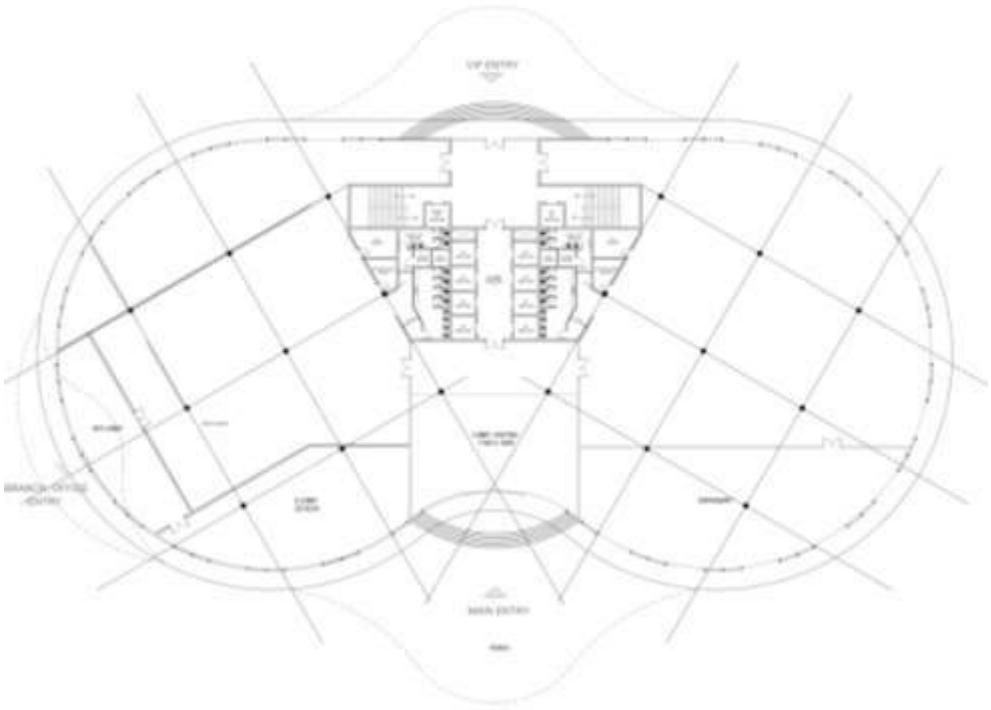
The functional requirements of the building are tabulated below:

S.No.	Description	Floor Height (m)	Floor Functional Requirement
1	Basement – 3 Levels	3.6	Car Parking
2	Ground Floor	4	Office, Toilet & Electric room
3	Typical floor (1 to 13)	4	Office, Toilet & Electric room
4	14^{TH} Floor	5.5	Auditorium
5	Terrace floor	4	Headroom & Outdoor Equipment

The gravity floor system consists of reinforced concrete structural system. The floor system will be supported on Columns.

4.3.3 Structure layout

Ground Floor Layout is as follows.



4.4 DESIGN CODES AND STANDARDS

Design Loads Other than Earthquake loads	
IS 875 (Part-1): 1987 Reaffirmed Year: 2018	Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures -Dead Loads
IS 875 (Part-2): 1987 Reaffirmed Year: 2018	Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures- Imposed Loads
IS 875 (Part-3): 2015 Reaffirmed Year: 2020	Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures- Wind Loads
IS 875 (Part-5): 1987 Reaffirmed Year: 2018	Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures- Special Loads and Combinations
Design for Earthquake Loads	
IS 1893 – 2016 (Part – 1) Reaffirmed Year: 2021	Earthquake Resistant Design Structures
IS 13920 – 2016 Reaffirmed Year: 2021	Ductile Detailing of Reinforced Concrete
IS 4326 – 2013 Reaffirmed Year: 2018	Earthquake Resistant Design and Construction of Buildings
Design of Concrete Structures	
IS 456: 2000 Reaffirmed Year: 2021	Code of Practice for Plain and Reinforced Concrete
SP 20: 1991	Handbook on Masonry Design and Construction
SP 23: 1982	Handbook on Concrete Mixes
SP 34: 1987	Handbook on Concrete Reinforcement and Detailing
IS 1904: 2021	Code of practice for General requirements for design and construction of foundations in soils
IS 2950: 1981 Reaffirmed Year: 2018	Code of practice for design and construction of raft foundations: Part 1 design
IS 2062: 2011 Reaffirmed Year: 2021	Steel for General Structural Purposes
IS 1786:2008 Reaffirmed Year: 2023	High strength deformed steel bars and wires for concrete reinforcement

IS 3370: 2021	Specifications for Liquid Containing Structures
IS 383: 2016 Reaffirmed Year: 2021	Specification for Coarse and Fine Aggregates from Natural Sources for Concrete
IS 269: 2015 Reaffirmed Year: 2020	Ordinary Portland Cement – Specification
IS 1489: 2015 Reaffirmed Year: 2020	Portland Pozzolana Cement – Specification
IS 9103: 1999 Reaffirmed Year: 2018	Concrete Admixtures - Specification
IS 2185(Part 1):2005 Reaffirmed Year: 2020	Concrete masonry units - Specification: Part 1 hollow and solid concrete blocks
IS 6041:1985 Reaffirmed Year: 2020	Code of Practice for construction of Autoclaved Cellular Concrete block masonry
Design of Structural Steel Construction	
IS 800: 2007 Reaffirmed Year: 2022	Code of Practice for Construction in Steel
IS 11384: 2022	Code of Practice for Composite Construction in Structural Steel and Concrete
IS 816: 1969 Reaffirmed Year: 2019	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel
AISC 360-05	**Specification for Structural Steel Buildings** ***Shall be referred special conditions and provisions not mentioned in Indian Standards**
Design of Tall Concrete Buildings	
IS 16700: 2023	Criteria for Structural Safety of Tall buildings
Design of Prestressed Concrete	
IS 1343: 2012	Code of Practice for Pre stressed Concrete
Design of Composite Deck Slab	
IS 11384 : 2022	**Composite Construction in** **Structural Steel and** Concrete — Code of Practice

4.5 Construction materials

4.5.1 Concrete

Concrete mix design grades of specified cube strength to satisfy codal norms, will be adopted as per design requirement of the structure. The following grade of concrete is used in the design of RCC Building

S. No.	Element	Concrete Grade	Structural Steel Grade
1	Foundation and Retaining Wall	**M35 to M50**	
2	Beam	**M35 to M50**	Fe250/Fe345
3	Column & Shear wall	**M35 to M50**	Fe250/Fe345
4	Slab	**M35 to M50**	
5	Deck	**M30 to M50**	Fe250/Fe345
6	PCC	M15	

Minimum cement content, water cement ratio etc. shall conform to IS 456:2000 provisions for durability and strength criteria.

4.5.2 Cement

Chemical and physical requirements for Ordinary Portland Cement of Grade 43, Grade 53 and Portland Pozzolana Cement shall be in accordance with IS 8112, IS 12269, IS 1489 (Part1) respectively.

4.5.3 Aggregate

Fine aggregate:

Fine aggregate shall be clean hard and durable and shall be natural sand, crushed gravel sand or crushed rock sand complying with IS 383. The material shall pass through a 4.75 mm IS sieve and the grading shall be in accordance with IS 383.

Coarse aggregate:

Coarse aggregate shall be clean hard and durable crushed rock, crushed gravel or natural gravel.

It shall be graded aggregate of nominal size 20 mm and 12 mm in accordance with IS 383.

4.5.4 Admixtures and additives

Admixtures of approved quality shall be mixed with concrete conforming to IS 9103. Self-compacting agents shall be used to enhance the performance of concrete in both fresh and hardened state.

4.5.5 Water

Water used for mixing and curing shall be clean and free from injurious quantities of alkalis, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel and shall comply with the requirements of IS 456:2000. The pH value of water shall be not less than 6.

4.5.6 Reinforcement

For design of concrete elements, High Yield Strength Deformed (HYSD) having yield strength of 500 MPa and minimum percentage elongation of 14.5% shall be used. It shall conform to IS 1786:2008.

4.6 Design loads

The building is analysed for following basic load cases: -

- Dead Load (DL)
- Superimposed dead load (SDL)
- Live load (LL)
- Seismic load (EQ/Spec)
- Wind load (WL)
- Temperature Load (TL)

4.6.1 Dead Loads (DL)

The dead loads considered as per IS: 875 (Part 1)-1987

Self-weight of plain cement concrete	24 kN/m^3
Self-weight of reinforced cement concrete	25 kN/m^3
Self-weight of mortar	20 kN/m^3
Self-weight of Steel	78.5 kN/m^3

4.6.2 Superimposed Dead Loads (SDL)

Load on Typical floor Slab		
Thickness of the floor finish mortar & plastering	75mm	1.5 kN/m^2
Thickness of the floor tiles	25mm	0.5 kN/m^2
Under deck Services, Fire Fighting and Cable trays		0.5 kN/m^2
Total		2.5 kN/m^2
Load on Typical floor Slab (Toilet Area)		
Thickness of the filling	250mm	5.0 kN/m^2
Thickness of the floor tiles and finishes	25mm	0.5 kN/m^2
Total		3.0 kN/m^2
Wall on Typical Floor Beam		
200mm Thick AAC wall (4m-0.3m)	3.7m ht	8.14 kN/m

4.6.3 Live Load.

The Live load considered as per IS:875 (Part 2)-1987

Room (Commercial)	4 kN/m^2
Toilet	2 kN/m^2
Corridor, Balcony	4 kN/m^2
Staircase	4 kN/m^2
Vault/Currency Chest	15 kN/m^2
Conference Hall	5 kN/m^2
Electric Room	7.5 kN/m^2
Terrace Floor	3 kN/m^2

Live Load Reduction (IS 875 (Part-2): 1987- Clause 3.2.1 & Clause 3.2.1.1)

For floor supporting structural members, following reductions is assumed in total imposed

loads on floors in designing columns, load bearing walls, piers, their supports and foundations:

No of Floors (including roof)	Reduction in Live load (%)
1	0
2	10
3	20
4	30

No reduction shall be made for any plant or machinery which is specifically allowed for, or in buildings for storage purposes, warehouses and garages. However, for other buildings where the floor is designed for an imposed floor load of 5.0 kN/m^2 or more, the reductions shown above shall be taken, provided that the loading assumed is not less than it would have been if all the floors had been designed for 5.0 kN/m^2 with no reductions.
In case if the reduced load in the lower floor is lesser than the reduced load in the upper floor, then reduced load of the upper floor will be adopted.

4.6.4 Seismic Loads

The following parameters are adopted for calculating seismic load as per IS 1893:2016.

Seismic Zone	III
Zone factor (Z)	0.16
Seismic importance factor (I)	1.5
Response reduction factor (R)	4.0
Approx. time period of the structure (T)	Time period as per 1893:2016
Soil type for estimating (Sa/g)	Type I as per IS 1893
Damping	5%
Mass participation	90%
Modal combination	CQC

Seismic weight	DL + SDL + 0.25 LL_1 (<3KPa) DL + SDL + 0.5 LL_1 (>3KPa)
Storey drift limitation	h_{story} / 250
Initial scale factor for Response spectrum to enhance the base shear	Ig/2R (In ETABS 'I/2R' is self-calculated, hence only 'g' to be applied)
Vertical earthquake shall be considered as per IS 1893 (Part 1):2016	

Percentage of Imposed Load to Calculate Seismic Weight		
S.No.	Imposed Uniformity Distributed Floor Loads	Percentage of Imposed Load
1.	Up to and including 3.0 kN/m^2	25
2.	Above 3.0 kN/m^2	50

Note:

1. It shall be ensured that the first three modes together contribute at least 65 % mass participation factor in each principal plan direction.
2. Response spectrum Analysis is performed, the Static design base shear (VB) shall be compared with Dynamic design base shear (VBT) is calculated using a fundamental time period Ta. If VB is less than VBT, all force quantities are multiplied by Scale factor.

Block			
S.No.	**Block No**	**Time Period**	
		X direction	Y direction
1.	G+14	0.63	0.95
1.	G+14+5 future floors	0.84	1.26

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4.6.5 Wind Loads

Wind pressure as per static method:

The following parameters are used for calculating wind load as per IS 875 Part 3-2015.

Basic wind speed, V_b	50 m/s
k1(probability factor)	1.08
Terrain category	Category 2
k2 = Factors to obtain Design Wind Speed Variation with Height in Different Terrains	Up to 10m – 1.00 10m to 15m – 1.05 15m to 20m – 1.07 20m to 30m – 1.12 30m to 50m – 1.17 50m to 100m – 1.24
k3 (Topography factor)	1.0
k4(Importance factor for cyclonic region)	1.0
Design wind velocity, V_z (m/s)	V_b x k1 x k2 x k3 x k4 Up to 10m – 54 10m to 15m – 56.7 15m to 20m – 57.78 20m to 30m – 60.48 30m to 50m – 63.18 50m to 100m – 66.96
Wind pressure at height z, P_z (kN/m^2)	0.6 x V_z^2 Up to 10m – 1.75 10m to 15m – 1.929 15m to 20m – 2.003 20m to 30m – 2.195 30m to 50m – 2.395 50m to 100m – 2.69
Wind lateral deflection limit	H/500
Design wind pressure, P_d	P_zx K_d x K_a x K_c > 0.7P_z
Where, K_d	Wind directionality factor
K_a	Area averaging factor
K_c	Combination factor

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Wind pressure shall also calculated using gust factor method since this is tall building and higher of both wind pressure is used for design.

4.7 Load combinations

The following load combinations are used to design the structural elements.

S. No.	Load Combination	Load Factors					
		DL	LL	WLX	WLY	Scaled	
						SpecX	SpecY
1.	1.5 (DL+LL)	1.5	1.5	-	-	-	-
2.	1.2 (DL+LL±SpecX)	1.2	1.2	-	-	±1.2	-
3.	1.2 (DL+LL±SpecY)	1.2	1.2	-	-	-	± 1.2
4.	1.5 (DL ± SpecX)	1.5	-	-	-	±1.5	-
5.	1.5 (DL ± SpecY)	1.5	-	-	-	-	± 1.5
6.	0.9 DL ± 1.5(SpecX)	0.9	-	-	-	±1.5	-
7.	0.9 DL ± 1.5(SpecY)	0.9	-	-	-	-	± 1.5
8.	1.2 (DL+LL ± WLX)	1.2	1.2	±1.2	-	-	-
9.	1.2 (DL + LL ± WLY)	1.2	1.2	-	±1.2	-	-
10.	1.5 (DL ± WLX)	1.5	-	±1.5	-	-	-
11.	1.5 (DL ± WLY)	1.5	-	-	±1.5	-	-
12.	0.9 DL ± 1.5WLX	0.9	-	±1.5	-	-	-
13.	0.9 DL ± 1.5 WLY	0.9	-	-	±1.5	-	-

4.7.1 Serviceability Load Combinations

S. No.	Load Combination	Load Factors					
		DL	LL	WLX	WLY	SpecX	SpecY
1.	1.0 (DL + LL)	1.0	1.0	-	-	-	-
2.	1.0DL+0.8LL±0.8SpecX	1.0	0.8	-	-	± 0.8	-
3.	1.0DL+0.8LL±0.8SpecY	1.0	1.0	-	-	-	± 0.8
4.	1.0 (DL ± SpecX)	1.0	-	-	-	± 1.0	-
5.	1.0 (DL ± SpecY)	1.0	-	-	-	-	± 1.0
6.	1.0 (DL ± WLX)	1.0	-	± 1.0	-	-	-
7.	1.0 (DL ± WLY)	1.0	-	-	± 1.0	-	-
8.	1.0 DL + 0.8 LL ± 0.8 WLX	1.0	0.8	± 0.8	-	-	-
9.	1.0 DL + 0.8 LL ± 0.8 WLY	1.0	0.8	-	± 0.8	-	-

D.L.: Dead Load (Includes SDL); L. L: Live Load

WL: Wind Load; Spec/EQ: Seismic Load,

Suffixes X, Y and Z in the above table indicate the direction in which the force is applied.
All members will be designed for the largest value of the design forces obtained due to positive as well as negative values of reversible combination of forces (Earthquake and wind).

4.8 Lateral drift and member stiffness modifiers

The maximum inter-storey lateral drift under lateral load shall not exceed the following values:

Drift by	Load Combination	Limitation
Seismic Load	DL + 0.8 LL ± 0.8 Spec Spec shall be unscaled	H=storey /250
Wind Load	DL + 0.8 LL ± 0.8 WL	H /500 at Terrace

(The wind load used in the combinations is with return period of 100 years).

Cracked sectional properties of the concrete elements for Wind and Seismic drift (From IS 16700:2017) and stiffness modifiers to be considered in **ETABS** analysis shall be as follows:

Structural Element	Model as	Factored Loads For Serviceability		Factored Loads For Strength		Stiffness Modifiers
		Area	Moment of Inertia	Area	Moment of Inertia	
Columns	Line	1.0 A_g	0.90 I_g	1.0 A_g	0.70 I_g	M22, M33
Walls	Shell	1.0 A_g	0.90 I_g	1.0 A_g	0.70 I_g	F11, F12, F22, M11, M12, M22
Beams	Line	1.0 A_g	0.70 I_g	1.0 A_g	0.35 I_g	M22, M33
Slab	Shell	1.0 A_g	0.35 I_g	1.0 A_g	0.25 I_g	F11, F12, F22, M11, M12, M22

Since the shear capacity of concrete is low, torsional effect can be redistributed to the adjoining members in flexure by assigning a torsion modifier of 0.01 to all the line elements (except a beam supporting a cantilever without back span which will be in pure torsion)

4.9 Serviceability criteria

4.9.1 Durability and fire resistance

Concrete cover requirement for a fire rating of 2 hours for Shear wall/Columns, beams and slabs shall be as follows:

S. No.	Element	Cover Adopted (mm)
a	Pile	**50**
b	Pile cap bottom Pile cap all other side	**75** **50**
c	Raft slab	**50**
d	Column	**40**
e	Beams & RC walls	**30**
f	Slabs	**25**

Minimum dimensions of reinforced concrete members for fire 2hr resistance shall be as follows:

S. No.	Element	Minimum thickness (mm) (Fire Criteria)	Minimum reinforcement
1	Columns	300	0.8 % of cross section area
2	Floor Slabs	125	0.12% of cross section area
3	Floor Beams	200	0.17 % of cross section area

Minimum water cement ratio and minimum cement content shall confirm to IS 456:2000 provisions of durability and strength.

4.10 Deflection control

• Short term deflection due to SDL+ Live load	**<**L /350 or 20 mm

	whichever is less
• Long term deflection	< L /250

Creep coefficients shall be taken as:

7 days	2.2

- Shrinkage coefficient 0.0003

4.11 Crack width control

Underground rooms, retaining walls, all water retaining structures, including UGT, STP, overhead water tanks shall be designed as per IS 456 & IS 3370, with allowable crack width for moderate exposure.

In addition, water proofing of such structures to be carried out using appropriate technology.

4.12 Analysis

The structure was analysed for the different load combinations as mentioned above, and the capacity of the structural elements such as columns, beams and slabs were checked for the maximum forces obtained from ETABS design software.

4.12.1 Gravity Loads

Gravity loads develop by virtue of self-weight of the structure and superimposed loads due to occupancy, architectural features, services, etc. Resistance to gravity loads shall be provided by concrete slabs supported by a network of beams. Beams will transfer the loads to vertical elements like columns and walls.

4.12.2 Lateral Loads

Lateral loads on the structure develop primarily due to wind and seismic activity. Resistance to lateral loads shall be provided by reinforced concrete ductile shear walls/Columns

Design of shear walls and columns will incorporate ductile reinforcement detailing in accordance with IS 13920:2016.

Design for seismic loads shall be based on response spectrum analysis of the three-dimensional model of the structures as per IS 1893: 2016. Design for wind loads shall be based on IS 875:2015-PART -III.

Retaining walls and all other sub-structure members shall be designed based on the soil parameters specified in geo-technical report, with the aid of in-house design spreadsheets.

4.13 Design

The steel reinforcements in the foundation, columns, shear walls; beams and slabs are calculated for maximum forces obtained from the static and dynamic analyses for the critical load combinations.

4.13.1 Design of Sub Structure

Pile foundation was recommended in the soil test report for this RCC building. The maximum axial load and moments acting on each column were obtained from ETABS output. Based on the soil test report, the foundation was designed for the maximum axial load and moments by using Excel sheet.

4.13.2 Design of Super Structure

All structural members shall be designed following the guidelines of the codes mentioned in section 3.1. Structural design will be in conformance to the stability criteria prescribed in clause 20 of IS 456:2000.

Design of Columns

Columns were designed for the maximum axial load and moments obtained from the analyses for the critical load combinations. The area of steel reinforcements obtained for columns/shear walls from ETABS output were checked manually.

Design of Beams

Beams were designed for the maximum moments and shear forces obtained from analyses for the critical load combinations. The area of steel reinforcements obtained for beams from ETABS output were checked manually.

Design of Slabs and Staircase

All slabs and staircase were designed as per IS 456:2000 with the aid of in-house design spreadsheets.

All other structural elements and Retaining walls shall be designed based on the soil parameters specified in geo-technical report, with the aid of in-house design spreadsheets.

4.14 Conclusion

The design basis outlined in this document is based on currently available data issued by the client and architect and it covers all the codal norms for the geometry and usage of the structure. It will need to be updated if design objectives or assumptions are revised.

All other guidelines or specific details will be given along with the working drawing and general drawing. Any perceived non-conformance with the project standards or expectations should be brought to our attention as early as possible.

5 ELECTRICAL DESIGN BASIS REPORT:

The scheme covers the complete Electrification of the proposed Construction of Buildings for Amaravati Local Head Office and other outfits at Amaravati, Andhra Pradesh. Design, Planning, Supply, Installation, Testing and Commissioning of following E&M Works/ Services with ultra-modern and state of the art best industry standards and practices, as per CPWD Specifications, Govt. Building Bylaws, Local Fire Service, NBC 2016, ECBC 2017, CPCB, relevant IS Codes, Indian Electricity Rules and Acts all amended up to date. The electrical systems, including power supply, metering, and energy infrastructure, shall conform to the norms and safety standards established by the **Central Electricity Authority (CEA)**. The EPC Contractor shall ensure that all installations and design parameters meet these regulatory requirements to obtain statutory approvals and ensure sustainable development, to get IGBC Platinum and Net Zero Rating for the campus

1. CPWD General Specifications for Electrical Works Part I Internal - 2023.
2. CPWD General Specifications for Electrical Works Part II (External) 2023.
3. CPWD General Specifications for Electrical Works (Part-III-Lifts & Escalators) - 2003.
4. CPWD General Specifications for Electrical Works Part IV Sub Station – 2013.
5. CPWD General Specifications for Electrical Works Part V Wet Riser & Sprinkler System– 2020.
6. CPWD General Specifications for Electrical Works Part VI Fire Detection and Alarm System – 2018.
7. CPWD General Specifications for Electrical Works Part VII D.G. Sets - 2013.
8. CPWD General Specifications for Electrical Works Part VIII Gas Based Fire Extinguishing System – 2013.
9. CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) - 2017 and amendments up to date.

a) The rating and capacity of equipment indicated herein below are minimum to be provided.
b) However during detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded.
c) Adequate measures shall be considered in design and detailed Engineering for safety of men & material for all services during construction, testing, commissioning, operation & maintenance.

5.1 Codes and standards

	IEC: 62271 - 1	High-voltage switch gear and control gear - Common specifications.
	IEC: 62271 - 100	High-voltage switch gear and control gear - Alternating current circuit-breakers
	IEC: 62271 - 200	High-voltage switchgear and control gear - AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV.
	IEC: 600441-1	Current Transformers

	IEC: 600441-2	Voltage Transformers
	IEC: 60529	Classification of degrees of protection provided by enclosures
	IEC: 60038	Standard Voltage
	IEC: 60255	Measuring relays and protection equipment - Part 24: Common format for transient data exchange (COMTRADE) for power systems.
	ANSI IEEE C 37/20	Switch gear assemblies including metal enclosed bus.

Low Voltage Switchgear -Standards & Codes

Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract.
Low Voltage Switchgear Assemblies IEC61 439-1 & 2
Low Voltage switchgear & control gear IEC 60 947 /IS 13947: 1993
Part I: General rules
Part II: Circuit Breakers
Part III: Switches, disconnectors, switch disconnectors and fuse combination units
Part IV: Contactors and Motor starters
Part V: Control circuit devices and switching elements
Degree of Protection of Enclosures for low voltage switchgear: IEC60529 /IS 2147: 1962
Internal arc – IEC 61641

CABLES - CODES OF PRACTICE GUIDE		
1.	IS 694: 1990 IEC 60227 - 1 to 5 : 1979	PVC insulated cables for working voltages up to and including 1100 V
2.	IS 694 : 2010	Polyvinyl chloride insulated sheathed and unsheathed cables with rigid and flexible conductor for rated voltages up to and including 450/750 V: Part general requirements (fourth revision)
3.	IS: 7098: 1988 (Part-I)	XLPE insulated (heavy duty) electric cables. For working Voltages up to and including 1100 V (third revision)
4.	IS 4288 : 1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and 1100 V (second revision)

IMPORTANT INDIAN STANDARDS CODES OF PRACTICE GUIDE		
Sl.No.	Standard	Title
1	IS 732:1989	Code of practice for electrical wiring installations (third revision)
2	IS 8061:1976	Code of practice for design, installation and maintenance of service lines upto and including 650 V
3	IS 8884:1978	Code of practice for the installation of electric bells and call systems
4	IS 5578:1984/	Guide for marking of insulated conductors (first revision)
5	IEC 60391 (1972) IS 11353:1985/ IEC 60445 (1973)	
6	IS 11353:1985/ IEC 60445 (1973)	Guide for uniform system of marking and identification of conductors and apparatus terminals
7	IS 13234:1991/ IEC 60909: 1988	Guide for short circuit current calculations in three-phase ac systems (superseding IS 5728)
8	IS 7752 (Part 1):1975	Guide for improvement of power factor
9	IS 3646 (Part 2):1966	Code of practice for interior illumination: Part 2 Schedule of illumination and glare index
10	IS 3646 (Part 3):1968	Code of practice for interior illumination: Part 3 Calculation of coefficients of utilization by the BZ method
11	IS 10118 (Part 1):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear : Part 1 General
12	IS 10118 (Part 2):1982	Code of practice for selection, installation and maintenance of Switchgear and control gear : Part 2 Selection
13	IS 10118 (Part 3):1982	Code of practice for selection, installation and maintenance of switchgear and control gear : Part 3 Installation
14	IS 10118 (Part 4):1982	Code of practice for selection, installation and maintenance of switchgear and control gear : Part 4 Main
15	IS 4146:1983	Application guide for voltage transformers (first revision)
16	IS 4201:1983	Application guide for current transformers (first revision)

17	IS 5547:1983	Application guide for capacitor voltage transformers (first revision)
18	IS 2309:1989	Code of practice for protection of buildings and allied structures against lightning (second revision)
19	IS 3043:1987	Code of practice for earthing
20	IS 5216 (Part 1):1982	Recommendations on safety procedures and practices in electrical work: Part 1 General (first revision)
21	IS 5216 (Part 1):1982	Recommendations on safety procedures and practices in electrical work: Part 2 Life saving techniques (first revision)

ELECTRIC FANS CODES OF PRACTICE GUIDE		
Sl.No	Standard	Title
1	IS 555:1979	Electric table type fans and regulators (third revision)
2	IS 1169:1967	Electric pedestal type fans and regulators (first revision)
3	IS 374:1979	Electric ceiling type fans and regulators (third revision)
4	IS 2997:1964	Air circulator type electric fans and regulators
5	IEC: 60665 (1981) IS 2312:1967	Propeller type AC ventilating fans (first revision), Draft Standard issued in wide circulation
6	IS 3588:1987	Electric axial flow fans (first revision)
7	IS 3963:1987	Roof extractor units (first revision)
8	IS 4283:1981	Hot air fans (first revision)
9	IS 6272:1987	Industrial cooling fans (man coolers) (first revision)
10	IS 4894:1987	Centrifugal fans (first revision)
11	IS 11037:1984	Electronic type fan regulators
12	IS 12155:1987	General and safety requirements for fans and regulators for household and similar purposes

LOW VOLTAGE SWITCH GEAR AND CONTROL GEAR CODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 4237:1982	General requirements for switchgear and control gear for voltages not exceeding 1000 volts ac or 1200 volts dc: (first revision) [superseded by IS 13947 (Part 1:1993)]
2	IS 6875 (Part 1):1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000 V a.c. & 1200 V d.c: Part 1 General requirements [superseded by IS 13947 (Part 5/Section 1)]
3	IS 6875 (Part 2):1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for

		voltages up to and including 1000 V a.c and 1200 V d.c: Part 2 Push-buttons and related control switches [superseded by IS 13947 (Part 5/Section 1)]
4	IS 6875 (Part 3):1989	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000 V a.c and 1200 V d.c: Part 3 Rotary control switches [superseded by IS 13947 (Part 5/Section 1)]
5	IS 10027:2000	Composite units of air-break switches and rewirable type fuses for voltages not exceeding 650 volt ac - Specification (first revision)
6	IS 4064 (Part 1):1978	Air-break switches, air break disconnectors, air-break switch disconnectors and fuses combination units for voltages not exceeding 1000 V ac or 1200 V dc: Part 1 General requirements
7	IS 2675:1983	Enclosed Distribution Fuse Boards and Cut Outs for voltages not exceeding 1000 V A.C. or 1200 V D.C.: Circuit-breakers for over current protection for household and similar installations (second revision)
8	IS 8828:1996	Miniature circuit breaker boards for voltage upto and including 1000 V A.c
9	IS 13032:1991	Residual current operated circuit-breakers for household and similar uses: Part 1: Circuit-breakers without integral over current protection
10	IS 12640 (Part 2):2007	Residual current operated circuit-breakers for household and similar uses: Part 2: Circuit breakers with integral over current protection
11	IS 2959:1985	Contactors for voltages not exceeding 1000 V a.c (second revision) [superseded by IS 13947 (Part 4 Section 1)]
12	IS 13314:1992	Specification for control transformers for switchgear and control gear for voltages not exceeding 1000 Volt AC
13	IS 5039:1983	Distribution pillars for voltages not exceeding 1000 volts (first revision)
14	IS 8623 (Part 1):1993 / IEC60439-1 (1985)/IS 8623 (Part 1):1985	Specification for low voltage switchgear and control gear assemblies: Part 1 Requirements for type-tested and partially type tested assemblies (first revision)
15	IS 8623 (Part 2):1993/IEC60439-2 (1987)	Specification for low voltage switchgear and control gear assemblies: Part 2 Particular requirements for busbar trunking systems
16	IS 8544 (Part 1):1977	Motor starters for voltages not exceeding 1000 V: Part 1 Direct-on-line starters [superseded by IS 13947 (Part 4 Section 1)]
18	IS 8544 (Part 2):1977	Motor starters for voltages not exceeding 1000 V: Part 2 Star-delta starters [superseded by IS 13947 (Part 4/Section 1):1993]
19	IS 8544 (Part 3/Sec 1):1979	Motor starters for voltages not exceeding 1000 V: Part 3 Rheostatic motor starters, Section 1 General requirements [superseded by IS 13947]
20	IS 8544 (Part 4):1979	Motor starters for voltages not exceeding 1000 V: Part 4 Reduced voltage ac starters: two step auto-

		transformer starters [superseded by IS 13947 (Part 4/Section 1):1993]

Sl. No.	Standard	Title
1	IS 694:1990 / IEC 60227-1 to 5 (1979)	PVC Insulated cables for working voltages up to and including 1100 V
2	IS 694:2010	Polyvinyl chloride insulated sheathed and unsheathed cables with rigid and flexible conductor for rated voltages up to and including 450/750 V : Part 1 General requirements (fourth revision)
3	IS 1554 (Part 1):1988 / IEC 60502 (1983)	PVC insulated (heavy duty) electric cables: Part 2 For working voltages up to and including 1100 V (Third revision)
4	IS 3961 (Part 1):1967	Recommended current ratings for cables: Part 1 Paper insulated lead sheathed cables
5	IS 4288:1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and including 1100 V (second revision)
6	IS 4289 (Part 1):1984 / IEC 60245-5	Flexible cables for lifts and other flexible connections: Part 1 Elastomer insulated cables (first revision)

ELECTRIC WIRING ACCESSORIES CODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 9537 (Part 1):1980 / IEC 60614-1 (1978)	Conduits for electrical installations: Part 1 General Requirements
2	IS 9537 (Part 2):1981	Conduits for electrical installations: Part 2 Rigid steel conduits (superseding IS:1653)
3	IS 3480:1966	Flexible steel conduits for electrical wiring
4	IS 2667:1988	Fittings for rigid steel conduits for electrical wiring (first revision) [Superseded by IS 14768 (Part 2): 2003]
5	IS 3837:1976	Accessories for rigid steel conduits for electrical wiring (first revision)
6	IS 9537 (Part 4):1983	Conduits for electrical installations: Part 4 Pliable self-recovering conduits of insulating material
7	IS 9537 (Part 5):2000 / IEC 60614-2-3	Conduits for electrical installations: Part 5 Pliable conduits of insulating material
8	IS 3419:1989	Fittings for rigid non-metallic conduits (second revision)
9	IS 14772:2000 / IEC 60670-1:1998	Enclosures for accessories for household and similar fixed electrical installations [Superseding IS 5133 (Part 1 and 2)]
10	IS 2412:1975	Link clips for electrical wiring (first revision)
11	IS 371:1999	Ceiling roses (third revision)
12	IS 3854:1997 / IEC 669-1:1998	Switches for domestic and similar purposes (second revision)
13	IS 4615:1968	Switch-socket outlets (non-interlocking type) (Withdrawn)
14	IS 4160:2005 / IEC	Interlocking switch socket outlets - Specification (first revision)

	60884-1:2002	
15	IS 1293:2005 / IEC 60884-1:2002	Plugs and socket outlets of rated

ELECTRICAL LAMPS AND THEIR AUXILIARIES CODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 418:2004 / IEC 60064 (1993)	Tungsten filament lamps for domestic and similar general lighting purposes (fourth revision)
2	IS 2418 (Part 1):1977 / IEC 81 (1974)	Tubular fluorescent lamps for general lighting service: Part 1 Requirements and tests (first revision)
3	IS 9900 (Part 1):1981 / IEC 188 (1974)	High pressure mercury vapour lamps: Part 1 Requirements and test [Superseding IS 2183 and IS 7023]
4	IS 9974 (Part 1):1981 / IEC 662 (1980)	High pressure sodium vapour lamps: Part 1 General requirements and tests
5	IS 12586:2005 / IEC 61184 (1997)	Bayonet lamp holders (fourth revision)
6	IS 3323:1980 / IEC 600402 (1972)	Bi-pin lamp holders for tubular fluorescent lamps (first revision)
7	IS 3324:1982 / IEC 400 (1972)	Holders for starters for tubular fluorescent lamps (first revision)
8	IS 2215:2006 / IEC 60155 (1993)	Starters for fluorescent lamps (third revision)
9	IS 1534 (Part 1):1977 / IEC 32 (1973)	Ballasts for fluorescent lamps: Part 1 For switch start circuits (second revision)
10	IS 1569:1976 / IEC 566	Capacitors for use in tubular fluorescent lamps
11	IS 6616:1982	

LIGHT FITTINGS AND LUMINAIRES CODES OF PRACTICE GUIDE		
Sl. No	Standard	Title
1	IS 1913 (Part 1):1978	General and safety requirements for luminaires: Part 1 Tubular fluorescent lamps (second revision)
2	IS 10322 (Part 1):1982 / IEC 598-1 (1979)	Luminaires: Part 1 General requirements
3	IS 10322 (Part 2):1982 / IEC 598-2 (1979)	Luminaires: Part 2 Constructional Requirements
4	IS 10322 (Part 5 / Sec. 2):2012	Luminaires: Part 5 Particular requirements, Section 2 Recessed luminaires (First Revision)
5	IS 10322 (Part 5 / Sec. 3):2012 / IEC 60598-2-3 (1979)	Luminaires: Part 5 Particular requirements, Section 3 Luminaires for road and street lighting (First revision)
6	IS 10322 (Part 5 / Sec. 4):1987 / IEC 60598-2-4:1979	Luminaires: Part 5 Particular requirements, Section 4 Portable general purpose
7	IS 10322 (Part 5 / Sec. 5):1987	Luminaires: Part 5 Particular requirements, Section 5
8	IEC 60598-2-5	Flood lights [Superseding IS 1947]
9	IS 3287:1965	Industrial lighting fittings with plastic reflectors

10	IS 1777:1978	Industrial luminaires with metal reflectors (first revision)
11	IS 2206 (Part 1):1984	Flameproof electric lighting fittings: Part 1 Well-glass and bulkhead types (first revision)
12	IS 3528:1966	Waterproof electric lighting fittings
13	IS 3553:1966	Watertight electric lighting fittings
14	IS 8030:1976 / IEC 162 (1972)	Luminaires for hospitals
15	IS 7537:1974	Road traffic signals
16	IS 9583:1981 / IEC 598-2-22:1980	Emergency lighting units

ELECTRICAL APPLIANCES -CODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 302 (Part 1):2008 / IEC 60335-1	Safety of household and similar electrical appliances: Part 1 General requirements (sixth revision)
2	IS 2268:1994	Electric call bells and buzzers for indoor use (second revision)
3	IS 3412:1994	Electric water boilers (second revision)

ELECTRICAL INSTRUMENTSCODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 6236:1971 / IEC 60258 (1968)	Direct recording electrical measuring instruments
2	IS 1248 (Part 1):2003 / IEC 600 51-1 (1997)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 1 General requirements (fourth revision)
3	IS 1248 (Part 2):2003 / IEC 600 51-2 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 2 Ammeters and voltmeters (third revision)
4	IS 1248 (Part 3):2003 / IEC 600 51-3 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 3 Watt meters and varmeters (third revision)
5	IS 1248 (Part 4):2003 / IEC 600 51-4 (1986)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 4 Frequency meters (third revision)
6	IS 1248 (Part 5):2003 / IEC 600 51-5 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 5 Phase meters, power factor meters and synchroscope (third revision)
7	IS 722 (Part 1):1998	AC electricity meters: General requirement and tests
8	IS 722 (Part 2):1977	AC electricity meters: Part 2 Single-phase whole current watt-hour meters, Class 2 (first revision)
9	IS 722 (Part 3):1988	AC electricity meters: Part 3 Three-phase whole current and transformer operated and single-phase transformer operated watt-hour meters
10	IS 722 (Part 5):1980	AC electricity meters: Part 5 Volt-ampere hour meters for restricted power factor range, Class

		3.5 (first revision)
11	IS 722 (Part 7/Sec1):1987	AC electricity meters: Part 7 Volt-ampere hour meters for full power factor range, Section 1 General requirements (first revision)
12	IS 722 (Part 8):1972	AC electricity meters: Part 8 Single-phase 2-wire whole current watt-hour meter (class 1.0)
13	IS 722 (Part 9):1972	AC electricity meters: Part 9 Three-phase whole current and transformer operated watt-hour meters and single-phase two-wire transformer
14	IS 8530:1977 / IEC 62011:2001	Maximum demand indicators (class 1)
15	IS 2992:1987	Insulation resistance testers, hand operated (magneto generator type) (second revision)

INSTRUMENT TRANSFORMERS CODES OF PRACTICE GUIDE		
Sl. No.	Standard	Title
1	IS 2705 (Part 1):1992 / IEC 60185 (1966)	Current transformers: Part 1 General requirements (second revision)
2	IS 2705 (Part 2):1992 / IEC 60185 (1966)	Current transformers: Part 2 Measuring current transformers (second revision)
3	IS 2705 (Part 3):1992 / IEC 60185 (1966)	Current transformers: Part 3 Protective current transformers (second revision)
4	IS 2705 (Part 4):1992 / IEC 60185 (1966)	Current transformers: Part 4 Protective current transformers for special purpose applications (second revision)
5	IS 6949:1973	Summation current transformers

FUSES CODES OF PRACTICE GUIDE		
Sl.No	Standard	Title
1	IS 9224 (Part 1):1979	Low voltage fuses: Part 1 General requirements [superseded by IS 13703 (Part 1):1993]
2	IS 9224 (Part 2):1979	Low voltage fuses: Part 2 Supplementary requirements for fuses for industrial applications (superseding IS 2208) [superseded by IS 13703 (Part 2/Section 1):1993]
3	IS 2086:1993	Carriers and bases used in rewritable type electric fuses for voltages up to 650 V (third revision) [Superseding IS 8724]
4	IS 9926:1981	Fuse wires used in rewritable type electric fuses up to 650 volts
5	IS 8187:1976 / IEC	D-type fuses

MISCELLANEOUS CODES OF PRACTICE GUIDE		
Sl.No	Standard	Title
1	IS 2551:1982	Danger notice plates (first revision)
2	IS 2448 (Part 1):1963	Adhesive insulating tapes for electrical purposes: Part 1 Tapes with cotton textile substrates

ELECTROTECHNICAL VOCABULARY - CODES OF PRACTICE GUIDE		
Sl.No	Standard	Title
1	IS 1885 (Part 1):1961	Electro-technical vocabulary: Part 1 Fundamental Definitions
2	IS 1885 (Part 9):1992 / IEC 60050 (446):1983	Electro-technical Vocabulary: Part 9 Electrical relays (second revision)
3	IS 1885 (Part 11):1966	Electro-technical vocabulary: Part 11 Electrical Measurements
4	IS 1885 (Part 16/Sec 1):1968	Electro-technical vocabulary: Part 16 Lighting, Section 1 General aspects
5	IS 1885 (Part 16/Sec 2):1968	Electro-technical vocabulary: Part 16 Lighting, Section 2 General illumination, lighting fittings and lighting for traffic and signalling
6	IS 1885 (Part 16/Sec 3):1967	Electro-technical vocabulary: Part 16 Lighting, Section 3 Lamps and auxiliary apparatus
7	IS 1885 (Part 17):1979	Electro-technical vocabulary: Part 17 Switchgear and control gear (first revision)
8	IS 1885 (Part 32):1993 / IEC 60050 (461):1984	Electro-technical Vocabulary: Part 32 Electric cables (first revision)

SAFETY CODES OF PRACTICE GUIDE		
Sl.No	Standard	Title
1	IS 4770:1991	Rubber Gloves for electrical purposes
2	IS 5424:1969	Rubber mats for electrical purpose (Superseded by IS 15652:2006)

5.2 Scope of work for commercial building;

Electrical & Allied Services' required for proposed Construction of Buildings for Amaravati Local Head Office and other outfits covers Electric Sub Stations, HT/ LT Panels upto Substation yard, External Electrical Installations, 33/0.433 KV HT and LT Cables, Road/Compound Lighting, Hybrid Solar Lighting Poles, Fire Alarm System, and lifts. It shall also include the construction of suitable trench for cable to LT panel room, all cables to be laid underground trench.

Suitable size shafts, cutouts, Niche etc. shall be provided to facilitate installation of Rising mains, Pipes, Cable trays, ducts, Pneumatic Tube System etc. in all floor slabs of building for various service areas, as required. If any discrepancy in the capacity of any E&M components between DBR vs EPC Contractors design vs Codal Norms, Maximum capacity shall be adopted.

5.3 Electrical power requirement

The Electrical Load requirement has been calculated on the basis of covered area of the building as per Guidelines of substation and power distribution system of building 2019 considering lighting, power load and HVAC load for commercial.

Load for the Central Air Conditioning Plant, Services, Lifts, Pumps, UPS, Fire Fighting, External Lightning, STP, WTP etc. has also been taken into account.

5.4 Source of Supply:

The electric supply on 33 kV for meeting electrical load requirements of office building from the CPDCL (from two different feeders, if one feeder fails another feeder shall be capable to feed Full Load). The EPC contractor shall arrange power supply from the nearest substation to the site. The demand notice issued by CPDCL will be reimbursed upon submission of supporting documents.

5.5 Electric sub-stations:

Electric substation shall be established to meet the electric load requirement of Commercial building including services as required. The projected peak load demand of substation for the commercial building is 4819 KVA. To meet this load requirement the capacity of the substation shall be 3 X 2500 KVA for commercial building. The transformers will be Oil Type Transformers with On Load Tap Changer (with AVR) Remote Tap Change Controller (RTCC).

Capacity of ESS shall be as per table below:-
HT RMU(VCB based) - 4 way RMU (2 in & 2 out)
- VCB (1 in & 4 out)

S. No.	Building	Transformer Capacity	DG Set Capacity
1	Commercial	3 X 2500 KVA	Will be procured by Bank later on

Table 10 Capacity of Transformer and DG

The substation shall be complete with 33KV panel board, Transformers, APFC panel, and other equipment as required and shall have necessary provisions and space to augment its capacity for future.

CONSTRUCTION OF OFFICE BUILDING FOR SBI LHO AMARAVATI									
POWER CALCULATION									
COMMERCIAL BUILDING									
S.No	Description	TOTAL AREA(Sq.m)	Lighting & Power Load, W/ Sq.m	HVAC W/ Sq.m	kW	DF	kW	TOTAL AREA(Sq.ft)	UNIT AREA (Sq.m)
1	Commercial	37266.84	40	0	1490.67	0.85	1267.07	401140.27	27950.13
2	Basement	31245.00	10		312.45	1.0	312.45	336321.18	
3	Lifts - 10 nos	10	10	-	100.00	0.6	60.00		
4	STP	-	-	-	35.00	0.6	21.00		
5	Water Supply pumps	-	-	-	50.00	0.6	30.00		
6	HVAC for Office Area	27950.13			1851.42	0.8	1481.13		
7	Ventilation Systems				330.00	0.8	264.00		
	Total Demand Load				**4169.54**		**3435.655849**	**737461.45**	

Table 11 Power calculation

CONSTRUCTION OF OFFICE BUILDING FOR SBI LHO AMARAVATHI
TRANSFORMER AND DG SIZING
COMMERCIAL

Sl. No.	Distribution transformer sizing (33kV/0.433kV)	Load	Unit	Remark
		Transformer		
1	Max Demad Load in kW	3436	kW	
2	Future Connection Consideration 25%	859	kW	
3	Distribution Loss 1.0%	43	kW	1.0% standard distribution loss factor
4	**Total Load Required With Loss**	**4338**	kW	
5	Power Factor	0.90		
6	Required KVA	4819	kVA	
	Max. Loading Factor 90%	5355		
7	**Actual Required Load in kVA**	**5400**	**kVA**	
8	**Selected Transformer in kVA**	**2500**	**kVA**	
9	**Number of transformers Considered**	**3**	**No**	
10	**Total KVA in Selected Transformer**	**7500**	**kVA**	
11	**Loading of factor**	**72%**		
Conclusion: **Transformer:** **3 nos of 2500kVA**				

Table 12 Transformer Sizing

It may be noted that the loads and demands are indicative only and may vary as per actual requirements. The EPC contractor shall determine the actual electrical capacity requirements as per the applicable NBC regulations, IS codes and statutory regulations, and the calculation may be upgraded or modified as per actual load calculation.

5.6 General requirement for substations

The proposed Substations shall be outdoor Type Sub-Stations complete with 33 KV panel board with fault passage indicator, Transformers, Sandwich bus-ducts, LT Switch Board, Capacitor Panels and all other accessories as required. The transformers shall be connected to respective LT Panels through suitable size indoor/outdoor sandwich bus ducts in the substation.

The substation will have 33 KV Panel board of suitable Nos. of feeders with minimum 1No spare feeder in each HT Panel. Adequate measures shall be considered in design and detailed Engineering for safety and interlocking shall be provided to prevent paralleling supply.

Main LT Panel in Substation and all other Electrical Panel shall be compliant to IEC-61439 and other Relevant IS Codes, ECBC /NBC norms. Panels should be compatible for monitoring and control with BMS/ SCADA System. Suitable size trenches shall be provided for installation of HT/LT/ Capacitor Panels etc. and also for Laying of HT/LT Power cables & Control Cables.

Substation shall comprise of all ancillary equipment like Battery Charger etc. Suitable size MS Chequered Plates, duly painted of minimum thickness 6 mm shall be provided for trenches inside the panel room as required. Hot Dip Galvanized Cable trays of suitable size shall be used as required.

All armoured HT/LT power cables, control cables, telephone cables, signal cables etc. shall be laid underground preferably along the roads & pathways at suitable depth as per CPWD Specifications. Adequate no. of NP-3&4 as per IRC code, RCC Pipes/Hume pipes/DWC HDPE Pipes having suitable diameter with spare shall be laid across the roads/pathways etc.

Maximum allowable transformer losses at 50% & 100% load shall comply with ECBC norms (Latest up to date). All Substations/HT/LT Panel Rooms/Floor panel Rooms shall be provided with safety equipment/items like suitable elastomeric mat (as per relevant IS codes), fire buckets, fire extinguishers, hand gloves, danger plates (HT/LT rating), First Aid Box, Gas Masks, safety charts, framed Schematic/SLD etc. Suitable civil foundation/trenches etc. for all equipment shall be provided as per design load of respective equipment. All HT Panel shall have one spare feeder, all LT Panels shall have 20% spare outgoing feeders (minimum one) for different rating of feeders. The energy metre of the solar system will be installed in the RMU panel with separate compartment at HT yard, and the meter will be provided by APSPDCL.

Power Factor Improvement & Harmonics Suppression:
Real time Automatic power factor control panels with ultra-heavy-duty capacitors, Thyrister switched, Hybrid harmonic filters (Active & Passive) are proposed to be provided in the substations to achieve overall power factor unity from existing Power Factor, as per ECBC with operation in both Auto and Manual mode. Power factor Correction Panel shall be BMS Compatible. The capacitor panels with Hybrid Harmonic filters shall be provided in substation to achieve THD less than 3%. Connection from Main LT Panel to Capacitor Panel is to be provided through sandwich bus duct. Automatic switching off of Capacitor Panel is to be considered during Power supply availability from DG Sets.

5.7 Electrical power distribution

The Electrical Power Distribution for electric supply shall be as detailed below.
Change over wherever being used shall be done through Automatic Transfer switching. Maximum allowable transformer losses at 50% & 100% load shall comply with ECBC 2017/ latest ECBC or relevant IS or amended up to date.

All Panels with incomer's ≥630 Amps shall be Certified Tested Assembly as per IEC 61439 and as per technical specifications. All Tested Assemblies shall be smart type having switchgears (ACB, MCCB) communicating their release data over Ethernet. Main LT panel shall be provided with all accessories required for panel and all metering shall be done through HMI being connected to each breaker release mounted on the panel door to achieve better fault tolerant system.

There shall be adequate measures considered for power factor correction and harmonic mitigation by using Hybrid Type APFC Panel.

Indoor/Outdoor type Compact Copper Sandwich Bus Duct of suitable capacity shall be provided from Transformers to Main LT Panel, and Main LT Panel to Capacitor panel. Adequate runs of XLPE insulated armoured Aluminium conductor cables (including standby cable) shall be laid from Main LT Panel to LT Panel of buildings.

Separate distribution system shall be provided for Lighting load, Power Load. Each distribution system shall be with Electrical panels, rising mains, Floor panels, Double door MCB Type DB's,

VTPN DBs etc. All TPN MCB DB's shall be PPI type.

Building shall have a LT room to receive power from the substation through armored cable and distribute power to the entire building through a Main LT Panel located in the LT room.

Each rising main shall have multiple Tap off provisions at every floor, feeding the floor panels with incoming & outgoing MCCBs of required capacities and numbers feeding the double door DBs/VTPN DBs.

Sub mains from floor panel to DBs shall be connected with cu armoured cable on cable tray.

The power cabling shall be sized so that the distribution losses do not exceeds 3% of the total power uses in building. Voltage drop for feeders shall not exceed 2% at design load and for branch circuit; it shall not exceed 3% at design load.

5.8 Earthing network

Earthing with Maintenance free Chemical earthing system/GI Earthing System/Copper Earthing system, as required, shall be provided for earthing sub stations equipments, Electrical Panel boards, UPS and other Equipment /installations in each building. Earthing shall be in conformity with provisions of rule 32,61, 67 & 68 of Indian Electricity Rules 1956 & as per IS-3043 as amended up to date. Copper/GI earth strips shall be used for connecting the Electrical equipment with Earth pits as required. Separate and distinct earth stations with insulated electrode shall be provided for the following:

- HT Panels- Copper Plate Earthing
- Main LT Panels – Copper Plate Earthing
- LT Distribution Panels-GI Plate Earthing
- Transformers - Neutral & Body –Copper Plate Earthing
- Lifts- GI Plate Earthing
- External Lighting Poles & Pillar– GI Pipe Earthing
- Any other equipment as required

All three phase electrical installations shall be provided with double Earth connection and single phase electrical installations with one Earth connection as per latest CPWD specifications & NBC 2016.

5.9 Lightning protection system

The Lightning Protection and Earthing System has been designed in compliance with IS/IEC 62305, IEC 62561 and DIN EN 50164-2 standards, using OBO type materials to ensure maximum safety and durability. The system consists of vertical aluminium alloy OBO type air terminals mounted with Fang Fix clamps, interconnected through aluminium round conductor routed along roof and façade with OBO type polyamide holders. Thermal expansion is managed by OBO expansion joints, while all cross/T connections are secured with hot-dip galvanized OBO universal connectors. Down conductors are equipped with OBO test joints enclosed in IP66 OBO junction boxes for reliable testing and maintenance. The earthing

arrangement comprises CPRI-tested, OBO type copper-coated earth rods with 250 micron coating, enhanced with OBO conductivity compound and protected by heavy-duty OBO earth chambers. All electrodes are interconnected using galvanized flat strips to maintain equipotential bonding and achieve earth resistance below 1 ohm. Additionally, an OBO lightning strike counter is installed on the down conductor to record the number, date, and time of strikes as per IEC 62561-6. This integrated OBO type system ensures reliable dissipation of lightning energy into the ground while safeguarding structural, electrical, and electronic assets of the office building.
. Aviation Obstruction Light (AOL) shall be provided in various buildings as per Civil Aviation regulations, NBC norms & CPWD Specifications as applicable.
All Aviation Obstruction Lights shall be fed with UPS supply. Surge protection devices shall be provided in the incomers of main LT Panels of all buildings.

5.10 Fire Detection / Alarm System

Standards:
IS 2189:2008,
IS 2175:1988,
IS 15908:2021,
IS/ISO 7240 series
NFPA 72
NBC 2016
CPWD Specifications

Automatic Addressable fire alarm system along with different type of Detectors, MCP, Hooter and Talk-back, PA system has been proposed in accordance with local fire norms and NBC 2016. All Detector Devices shall be provided with inbuilt isolators. (For Detectors/Device without inbuilt isolator, Fault Isolator or Isolator base to be provided with each detector/device). 2X1.5 sq mm cu armoured FS cable shall be used for Fire Alarm system and Public Address system.

All arrangements for firefighting shall be provided with as per NBC 2016/ State Fire Authorities Norms.

Audio-visual annunciation devices for indicating incidence of fire. Any other item required to the successful commissioning of the system.

Complete system should be LPCB/UL/VDS approved, Vendor has to submit project specific authorization letter issued by the OEM at time of bidding

The Cylinder must be filled in a UL/FM/PESO approved plant owned by the system OEM.

The electrical panel fire suppression system shall be complete with Direct Clean Gas storage cylinders for required capacities, extinguishing agent as specified, fire detection tubing, filling and end-of-line adaptors, pressure switches, control equipment, Clean Agent Cylinder/Valve Assembly, Cylinder Mounting Bracket and all necessary accessories to protect the Electrical panel in case of fire. The system will have an interface with Main Fire Alarm and Control Panel. In case of fire in the concerned panel, indication of Fire/discharge status should come in Main Fire Alarm and Control Panel

5.11 Boom barriers

Boom Barriers shall be provided at all Entry and Exit Gates. Push Button Type Control for open & Close the Boom Barrier through high Torque motors operated through 230 V AC Supply. In case of power failure, the barrier can be raised/lower manually. The Boom length shall be as

per the requirement of the road Width (4.5 - 6 mtr). The Opening time varies from 3 sec. to 6 sec. The Control Unit shall be minimum IP54 protected against rough weather.

5.12 EV Charging station:

As per IGBC, EV Charging stations for 10 Nos of 4 wheelers & 30 Nos of two wheelers shall be provided with cabling, charging unit etc. complete as required.

5.13 External/ compound lighting:

High efficiency LED Hybrid Solar light fixtures with minimum 48hours backup shall be provided in external road Street lighting. LED Light Fixtures (Bollard/Post top) for compound/landscape lighting. The lighting control /operation for external Lighting shall be automatically controlled with digital timer control switch through outdoor type Feeder Panels.

Medium/High mast LED lights with Suitable Poles shall be provided for external lighting of large open areas, amphitheater, and miscellaneous Sports areas etc.

Road / Compound Lighting / Landscape Lighting / Facade Lighting shall be designed as per NBC & ECBC Codes. Road / compound lighting shall be provided with outdoor type light fittings (IP-65).

All Street Light/ Compound lighting Poles shall be made out of hot dip Galvanized Iron (GI) Octagonal shape. Poles shall be suitable for single / double side arms or as required. Poles shall have a service window at the bottom comprising connector terminal & MCB. Poles can be mounted on foundation with Anchor bolts of suitable size & quantity. All the poles should be provided with double earthing. The height & spacing of the street light poles pole will be designed to achieve illumination Lux levels. The height & spacing of pole and illumination Lux level should be as per latest CPWD Specifications, NBC 2016 and other relevant norms.

Suitable outdoor type feeder panel with digital time controlling shall be provided for power distribution of various circuits of Street Lighting Poles/ High Mast /Bollard /Façade light etc.

5.14 Solar Power Generation System:

Direct Online Grid connected Solar Photo Voltaic Power system of following minimum capacity shall be provided in the various proposed building's roof top. The generated power will be directly connected to the Power grid/ Distribution Panel of respective Building for load sharing during day time. The average area requirement per kWp shall be 7-10 sq. Mtr on roof Top.

S.No.	Building	Solar Capacity minimum
1.	Office Building	Min. 200 kWp

Table 13 Solar capacity

It may be noted that the Calculation are minimum indicative only and may vary as per actual requirements. The EPC contractor shall determine the actual electrical capacity requirements as per the applicable NBC regulations, IS codes and statutory regulations.The supply and installation is not in the scope of EPC contractor, however the design scope rests with the successful bidder.

5.15 Construction of substation as per latest CEA norms

All panels (HT & LT) to be fabricated through OEM or OEM authorized Channel partner and CPRI approved vendor
All major electrical equipment and packaged systems shall be subject to Factory Acceptance Testing (FAT) to verify compliance with relevant IS codes, NBC Part 8 – Building Services and project-specific technical requirements.

Note: The above list of electrical equipment is minimum requirement only. Additional equipment may be identified during the detailed design phase and to be upgraded by the EPC Contractor. FAT shall include verification of electrical performance, safety features, protection coordination, control logic, and compliance with statutory and project specifications. The Employer/Consultant shall be notified in advance to witness the FAT as required.

The EPC Contractor shall ensure full coordination of electrical works with other services, including HVAC, firefighting, plumbing, BMS, civil/structural components, and interiors. Particular care shall be taken for routing of cable trays, earthing systems, and clearances from mechanical systems, ensuring seamless integration, safety, and code compliance throughout the facility.
All fixtures must be coordinated with other MEPF services to avoid clashes and ensure aesthetic alignment with ceiling elements. The finish of visible suspension components shall be as per the architect's approval and coordinated with ceiling design.

The Contractor shall submit shop drawings, mounting details, and mock-ups for approval before execution. Final installation must adhere to lighting design intent, prescribed lux levels, glare control parameters, and maintenance accessibility standards.

All electrical fixtures should be energy-efficient and selected in accordance with IGBC Green Building guidelines to support the achievement of Platinum certification.

The parameters, specifications, and information provided in the tender documents are intended to give a broad understanding of the project scope and design intent. It shall be the sole responsibility of the Contractor to carry out all necessary investigations, validations, detailing, and coordination required to deliver a fully functional, complete, and operational building. The building shall be designed and constructed fit for occupancy and use, and shall be handed over to the Client in full compliance with the latest provisions of the National Building Code (NBC) of India, all relevant Indian Standards (IS Codes), applicable statutory requirements, and the specific functional and operational requirements of the Statutory.

5.16 Day tank provision

The day tank, serving as the main diesel storage tank, is provided near the substation to ensure a reliable and uninterrupted fuel supply to the diesel generator (DG) system. The tank is designed to store sufficient fuel to sustain DG operation for the required duration during power outages or emergency conditions, in accordance with the design criteria. It is constructed from mild steel, with an internal epoxy coating for corrosion resistance and an external protective enamel paint finish for enhanced durability. The tank is equipped with all essential accessories, including inlet and outlet connections with isolation valves, a mechanical level gauge, high and low level sensors, a breather valve, drain valve, and emergency venting arrangement. The system is integrated with the DG control panel to enable continuous monitoring of fuel levels, alarm indications, and automatic operation of the transfer pump. Adequate safety measures such as overfill protection, spill containment tray, and fire protection provisions are incorporated in compliance with relevant IS standards and local fire safety regulations. The tank is installed in a well-ventilated and easily accessible location within the substation premises to ensure safe operation, routine maintenance, and convenient refueling.

6 DESIGN BASIS REPORT – LIFT:

6.1 General

Passenger lifts, Fire lifts etc. shall be provided in the buildings. The installation shall be Carried out as per rules & regulation of local bodies and IS Codes that governs the requirement of installation of the lift. The voltage and frequency of the supply shall subject to variation Permissible under Indian Electricity Act and Rules. For better use of lifts /service Personal Occupant Requirement Terminal technology should be applied where more than 2 lifts installed in the single lift lobby.

TOTAL NO.OF LIFTS			
OFFICE BUILDING	16 passengers Capacity	13 No's (PASSENGER LIFT) (2.5 m/s)	1 SERVICE LIFT (2 Ton, 0.5 m/s)

Table 14 Total Number of lifts

Passenger lifts shall be provided, as per details given below:

Lift Car shall be as per NBC - 2016 part 8 and OEM Standards.

Lifts shall be provided as per the Traffic Analysis of building as per NBC 2016 and relevant IS Standard.

	Lifts shall be provided as per Architectural Drawings & as per requirement of NBC-2016 & relevant IS Codes
	Note: 1. All Lifts will be Gearless type with Machine Room less. 2. All other accessories like ARD, Voice Announcement etc. will be standard type. 3. Speed shall be considered minimum 2.5 MPS or more for Passenger lift.

Note:

1. Lift well; Car Size, Lift Pit Depth, Overhead, and Clear Entrance Width & Height Dimensions shall conform to NBC 2016 or OEM Standards/ recommendations. All lifts shall be Gearless type Machine room less.

Anti-skid SS Chequered plate flooring of suitable thickness shall be provided in all the lifts.

Lifts shall be complete in all respect as per technical specifications and directions of Bank/Consultant.

7 PLUMBING DESIGN BASIS REPORT:

7.1 Water Supply, Storage & Sewerage Infrastructure

This section outlines the design criteria for the water supply, storage, and sewerage infrastructure facilities. The estimation of water supply and sewerage demand will be carried out in accordance with NBC 2016 guidelines, considering population-based projections and actual occupancy standards. All plumbing fixtures and fittings shall be selected to ensure water efficiency in accordance with the Indian Green Building Council (IGBC) rating system. All planning, design, and execution of water supply, sewerage, and solid waste management systems shall adhere to the latest guidelines issued by the Central Public Health and Environmental Engineering Organization (CPHEEO). The environmental aspects of air, noise, and water pollution control, waste disposal, and monitoring shall comply with the standards prescribed by the Central Pollution Control Board (CPCB).

7.2 Internal Plumbing Works

- Sanitary fixtures & C.P brass fittings
- Soil, waste & rain water piping system
- Internal water supply system with water meter
- Hot water supply system using individual storage geyser system as per NBC 2016 regulations. Actual requirement shall be worked out based on user requirements at the detailed design stage.
- Disposal of soil & rainwater pipe to 1st manhole of respective sewage and stormwater network outside the site.
- A dual piping system shall be provided to segregate potable water supply and treated recycled water (grey water) to ensure efficient reuse for flushing and landscape irrigation, in line with sustainability and IGBC guidelines.
- Waste water from wash basins, shower area, floor traps of toilets, etc. shall be treated in grey water treatment plant (to be provided by the EPC contractor) and used for irrigation purpose.

7.3 External Water Supply System

- The Source of water supply shall be met from Site having Supply from APCRDA / Concern Authority.
- Distribution System by hydro pneumatic system from UGT with booster pump shall be provided by the EPC contractor
- Treated Grey water shall be used only for irrigation purpose.

7.4 Sewerage System

- The sewer generated from the buildings shall be connected into the STP.

7.5 Storm Water Drainage System

- Collection and conveyance of roof top rainwater, surface storm water around the proposed buildings and connection to the existing network outside the campus.

7.6 Garden Hydrant System

- External garden hydrant system to supply the water for horticulture purpose to all landscaping/green area around the buildings and entire site. The system shall be inclusive of irrigation pumps, piping (UPVC pipes), bib cock at the desired locations etc.

7.7 Pumps & Water Treatment Equipment

- The U.G. water tanks shall be located separately as marked in the drawings and the Plumbing & Fire Fighting plant room shall be adjacent to underground tank. The plant room has fire pumps, water supply pumps, water treatment plant and all other related equipment located there. These services shall act as a centralized system for buildings.
- For pumping and distribution of domestic water to building, the hydro pneumatic system is being proposed. The system shall be designed to take care of peak demand of water and a residual pressure at the ground floor users point shall be minimum of 1.5 kg/cm^2.
- Water supply system will be completely automatic through level controller & mechanically operated float valve. Pump of required capacity shall be installed with appropriate head to supply water to OHT.
- RCC Overhead Tank of calculated capacity shall be provided on building terrace.
- Pipe sizing shall be based on fixture unit calculation as per ASPE standard. However, the maximum velocity of water in water supply piping shall not exceed 2.4 m/s, whereas the limiting maximum velocity in hot water return piping shall be 1.2 m/s.
- Water meters shall be provided in identified areas for water consumption recording for efficient monitoring and assessment.
- Colour coding for flushing water supply piping shall be ensured for clear identification of the piping.

7.8 Basic Objectives

The basic objective is to provide all sanitary engineering services and specification in relation to:

- High standards of materials and workmanship.
- Leak proof plumbing.
- Reliable and dependable engineering systems.
- Plan the system in such a way as to minimize the energy requirements.
- Create minimum nuisance or disturbance to the environment.

7.9 List of Codes and Manuals

The following codes of practice and design manuals are being referred for designing the

- Sanitary Plumbing and Fire Fighting Systems:
- National Building Code 2016, Part IX for Plumbing system.
- Hand Book on Water Supply & Drainage (with Special Emphasis on Plumbing), Bureau of Indian Standards SP-35.
- Manual on Water Supply & Treatment (Ministry of Urban Development).
- Manual on Sewerage & Sewage Treatment (Ministry of Urban Development).
- CPWD Specifications revised upto the latest amendment.
- National Building Code 2016 (Part-IV — Fire Protection)

7.10 Proposed Water Management System:-

Reduce, Re-use, Re-cycle Model has been adopted for meeting the water requirement.
The following measures shall be ensured for reducing water consumption:

- Disciplined use of water
- Installing water saving toilet fixtures and faucets and flow regulators
- Adopting water saving landscape techniques (selection of grass and plants) including irrigation

7.10.1 Water Supply System

Water requirements have been estimated on the basis of present acceptable standards, references from various sources such the National Building Code of India, Public Health Manuals, Ministry of Environment, Forests Guidelines, and CPWD Specification as well as Inputs from other services consultants involved on the projects.

7.10.2 Design for Water Supply Distribution System Pipes

For continuous water supply at adequate pressure, complete water supply system is designed with following type of pipe-lines-

CPVC Pipes for Internal plumbing

Stainless steel pipe and fittings.
All RO Drinking water supply lines and fittings used in potable water distribution system shall be of stainless steel, with required insulation to maintain the temp. of 20-22 degree at out floor, of grade 304 conforming to IS-17875. The pipes shall be housed in Shafts and Terrace Down take, thereon it shall be concealed outside the shaft upto the last tapping point for all buildings.

UPVC Pipes for External plumbing

The EPC contractor shall be responsible for ascertaining the exact quantum of RO water requirements based on the inputs provided by EIC prior to detailed design.

Waterproofing treatment

Waterproofing treatment shall be done as applicable and as required on terraces, sunken slabs, toilet slabs, lift pots, basement rafts & walls, water tanks, UG sumps, OHTs and any other liquid retaining structures. Water stops shall be provided in construction joints of liquid retaining structures.

7.11 Sanitary works

7.11.1 Sanitary Fixtures & C.P Brass Fittings

Plumbing fixtures, Chrome Fittings and accessories will be as per IS: 781-1984.
Porcelain fixtures of fairly high quality as given below.

- **WCs** - Low volume dual flushing system comprising concealed cistern are proposed as per IS: 2556.
- **Lavatory Basins** available in all size and shapes including wall hung, over or under counter types etc with infra-red sensor as per IS: 2256 (Part 7) 1995.
- Urinals, low flow shall be provided with Infra-red sensor battery operated as per IS: 2556 part.
- Faucets, bib cocks etc. low flow fixtures add description
- Accessories - Soap dispensers, toilet paper holders, hand drier, etc. shall be of Stainless Steel.
- Chrome Fittings Common toilet fittings shall be provided as per IS: 781 - 1984.

7.11.2 Soil waste Pipe System provision of UPVC Pipes

Above ground piping shall be designed on the basis of two pipe system as recommended in code of practice for soil and waste water.

- Soil pipes shall carry the wastes from WC's & urinals etc. Soil pipes shall connect directly to the 1st manhole outside the building.
- Internal buildings sanitary disposal system will be under the slab (By core cutting in slab and suspended at bottom)
- Waste pipes shall carry waste water from waste appliances (Wash basins, Drinking area, Shower & Pantry/ kitchen sinks etc.). Waste pipes shall connect to Gully Traps outside the buildings and shall be further connected to the Waste (Grey) water treatment plant. The treated water shall be used for irrigation purpose

Design Parameters

- Piping system has been designed in accordance with Code of Practice for Installation of Soil & Waste Pipes
- All vertical stacks will terminate as vent pipes at terrace level.
- All Vertical Stacks in the buildings will terminate at the ground floor level and connected to the external sewer. Pipe dia. and slope will be as per connected load.

Pipe Work

- All vertical stacks/ pipes will be installed in pipe shafts provided in drawings along the external face of the buildings or in internal shafts within the building according to the architectural planning of the toilets. However no pipe /vent shall be externally visible.
- Provide clean out doors and plugs for rodding and maintenance where necessary and required.

Materials for Soil, Waste & Vent Pipe System

- Pipes used for Soil, Waste and Vent system shall be UPVC & the terminal horizontal collection pipe shall be GI pipe.

7.12 Sewerage System

- Pipes used for Sewerage disposal system shall be with UPVC pipes and conforming to manufacturer specifications from building 1st Manhole to trunk line.

Wastewater generation is estimated based on the following criteria:

- 90% of the domestic water demand
- 100% of the flushing water demand

Accordingly, the total estimated wastewater generation is **195822** litres per day, which forms the basis for sizing the Sewage Treatment Plant (STP)

Description	Water Requirement (LPCD)			Waste Water generation (LPCI		
	Domestic(L)	Flushing(L)	Total(L)	Domestic (L)	Flushing(L)	Total(L)
Commercial (office building)	115190	92152	**207341**	103671	92152	**195822**

Design Parameters

- Flow of Sewage = 80% of daily water requirement.
- Peak Flow = 3 x Average Flow.
- Sub Soil Infiltration = 25% of Average Flow.
- Max. Velocity of flow in pipes = 7.5 m/sec. flowing half full
- Min. Velocity of flow in pipes = 2.0 m/sec.

Flow conditions in pipe

- Pipes up to 250 mm dia = 0.50 full running.
- Pipes from 400-900 mm dia = 0.67 full running.

Min. depth for sewers

- For branches = 1 M.
- For lateral, main & trunk sewers = 1.5 M as per required gradient

Type of Distribution

- Sewer flow shall be by gravity up to the final disposal point. The external sewer shall be connected into the Existing sewage Network.
- An inspection chamber shall be provided at the junction where the building's internal sewer line connects to the external/main sewage line, in accordance with CPHEEO norms and IS 4111.

7.13 Storm Water Drainage

7.13.1 Planning of Storm Water Drainage System

- The rainwater from the terraces, open surface areas, as per design, shall be collected in the clay brick masonry chambers with RCC pipe collection chambers and shall be ultimately connected to the main storm-water drainage system. All Rain Water Pipes to be routed through shafts provided in drawing & no such pipe should be visible externally.
- The network of storm water system shall be mostly catch basins and RCC (NP3) pipe network, as per requirements.
- All paved/road/green areas, the run off shall directly connect to the main storm water drains,
- All construction specifications with respect to the manhole sizes etc. will be respected and followed and as per CPWD specification.
- The complete storm water drainage system shall be designed with RCC pipes, clay brick masonry chambers and manholes etc.

7.14 Irrigation system for lawns and gardens

- Gardens and lawns shall be irrigated in combination with Garden Hydrant System, drip irrigation and Sprinkler Irrigation System.

7.14.1 Garden Hydrant System, Network System

- It is proposed to provide a separate and independent captive garden hydrant system to supply water for horticultural operations to all landscaped areas.
- The distribution grid for garden mains will be by a separate grid of UPVC pipe pressure pipes and connected to a separate pumping set obtaining it’s water supply from GWTP.
- The Main Distribution grid shall be with UPVC with pipes conforming to specifications.
- Garden hydrant points will be of 25 mm outlets with suitable distance centre to centre distance as per site condition.
- The garden hydrant pumping system is proposed to be planned so that the grid is sized to cater for a maximum of 6 outlets operated at the same time.

7.15 RO Water Supply

- Internal potable water distribution shall consist of a piping system that shall supply domestic potable water to all necessary sanitary fixtures, and all mechanical make-up water needs, except water closets and urinals. Potable water supply shall also include central RO plant (of minimum capacity of 2000LPH) water supply to drinking water points within the Building Complex and water supply pipe from RO plant to water coolers in Office building shall be SS pipe 304 grades with press fit technology as per JIS 3448.

7.16 List of IS Codes for Reference of Plumbing Design

S. No	ISI No.	Description
	I.S : 1536 : 1989	Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage (3rd Rev.) (Amendment 2)
	I.S : 1538 : 1993	Specification for cast iron fittings for Pressure Pipes for water, gas and sewage (3rd Rev.)
	I.S : 3114 : 1994	Code of Practice for laying of C.I. pipes (2nd Rev.)
	I.S. : 782 : 1978	Specification for caulking lead (3rd Rev.)
	I.S. : l239 (Part 2):1992	Specification for mild steel tubes; tubular & other wrought steel fittings: Part 2 Mild steel tubular and other wrought steel pipe fittings (4th Rev.) (Amendment 1)
	I.S. : 1879 : 1987	Specification for malleable cast iron pipe fittings (2nd Rev.) (Amendment 5)
	I.S. : 4984 : 1995	High density polyethylene pipe for water supplies (4th Rev.) (Amendment 1)
	I.S. : 783 : 1985	Code of practice for laying of concrete pipes (1stRev.) (Amendment 1)
	I.S. : 4127 : 1983	Code of practice for laying of Glazed Stoneware pipes (1st rev.)
	I.S : 780 : 1984	Specification for sluice valve for water works purposes (6th rev)(50 to 300 mm size)(Amendment 3
	I.S : 651 : 1992	Specification for salt glazed stoneware pipes and Fittings (5th rev.) (Amendment 1)

	I.S. : 456 : 1978	Code of practice for plain and reinforced concrete (3rd Rev.) (Amendment 2)
	I.S. : 12820 : 1989	Code of practice for dimensional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas & sewage.
	I.S. : 1172 : 1993	Code of basic requirements for water supply, drainage & sanitation (4th Rev.)
	I.S. : 1200 (Part-16) 1979	Code of practice for methods or measurements of building and Civil Engineering works: Part 16 Laying of water and sewer lines including appurtenant items (3rd Rev.)
	I.S. : 1200 (Part-19) 1981	Code of practice for methods or measurements of building and Civil Engineering works: Part 19 Water supply, plumbing and drains (3rd Rev.)
	I.S : 1729 : 1979	Specification for sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (1st rev.) (Amendment 4)
	I.S : 1742 : 1983	Code of practice for building drainage (2nd Rev.)
	I.S : 3989 : 1984	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (2nd rev.) (Amendment 2)
	I.S : 778 : 1984	Copper alloy gate, globe and check valves for water works purposes (4th rev.) (Amendment 2)
	I.S : 13095 : 1991	Butterfly valves for general purposes
	I.S : 5312(part1) : 1984	Swing check type Reflux valve (non-return valve): Part 1 Single door pattern (1st Rev.) (Amendment 1)
	I.S : 5312(part2) : 1986	Swing check type Reflux valve (non-return valve): Part 2 Multi door pattern
	I.S : 1239(part1) : 1990	M. S. tubes, tubular and other wrought steel fittings: Part 1 Mild steel tube (5th Rev.)
	I.S : 1879 : 1987	Malleable Cast Iron pipe fittings (2nd rev.) (Amendment 5)

	I.S : 651 : 1992	Salt glazed Stoneware pipes & fittings (5th Rev.) (Amendment 1)
	I.S : 458 : 1988	Precast Concrete pipes (with or without reinforcement) (3rd rev.) (Amendment 2
	I.S : 1726 : 1991	C.I. Manhole covers & frames (3rd rev.)
	I.S : 1916 : 1989 I.S : 12592 (part1) : 1988	Steel cylinder pipe with concrete lining and coating (1st rev.) Pre-cast concrete manhole covers and frames: Part 1 Covers (Amendment 3)
	I.S : 12592 (part2) : 1991	Pre-cast concrete manhole covers and frames: Part 2 Frames
	I.S : 6392 : 1971	Steel pipe flanges (Amendment 1)
	I.S : 6418 : 1971	C.I & malleable flanges for general Engg. Purposes.
	I.S : 4985 : 1988	Unplasticized PVC pipes for potable water supplies (2nd Rev) (Amendment 2)
	I.S : 7181 : 1986	Horizontally cast double flanged pipes for water, gas and sewage.(1st Rev.) (Amendment 1)
	I.S : 210 : 1993	Grey iron casting. (4th Rev.)
	I.S : 4985 : 1988	Unplasticized PVC pipes for potable water supply
	I.S: 7558-1974	Code of practice for domestic hot water installation.
	I.S: 2064-1973	Code of practice for selection, installation and maintenance of Sanitary appliances
	I.S: 2065-1983	Code of practices for watersupply in building
	I.S: 2183 (Part I)-1987	Code of practice for Plumbing in multistoried building
	I.S: 8329-2000	Code of practice for Ductile iron class K9 pipes for water supply system
	I.S: 15905-2011	Code of practice for Hubless centrifugal cast (Span) iron pipes epoxy coated in sides and out side
	IS 15778:2007	Chlorinated polyvinyl chloride (cpvc) pipes for potable hot and cold water distribution supplies — specification
	IS 15225:2002	Chlorinated Polyvinyl Chloride Compounds Used for Pipes and Fittings

7.17 Source of Water Supply

- The Source of water supply shall be met from Site having Supply from APCRDA / Concern Authority.

7.18 Pumps

It is proposed to provide all type of pumps like domestic water supply pumps, & Plant Room Sump Pump etc. catering to office building.

Basic Objectives

It is proposed to provide all sanitary engineering services and specification which are:

- High standards of materials and workmanship.
- Provide leak proof plumbing.
- Reliable and dependable engineering systems.
- Provide adequate safety and means to egress easily in case of fire.
- To plan the system in such a way as to minimize the energy requirements.
- To create minimum nuisance and disturbance to the environment

7.19 Water Supply System

Water requirements has been estimated on the basis of present acceptable standards, References from various sources such the National Building 2016 Code of India, Public Health Manuals, Ministry of Environment, Forests Guidelines, and CPWD Specifications etc.

7.20 Water Demand Projection

As per the estimated population and water demand norms discussed above, Total water demand has been estimated as detailed below.

Table 1 Water Requirements for Buildings Other than Residences
(*Clause* 4.1.2)

Sl No.	Type of Building	Domestic Per Day litre	Flushing Per Day litre	Total Consumption Per Day litre
(1)	(2)	(3)	(4)	(5)
i)	Factories including canteen where bath rooms are required to be provided	30 per head	15 per head	45 per head
ii)	Factories including canteen where no bath rooms are required to be provided	20 per head	10 per head	30 per head
iii)	Hospital (excluding laundry and kitchen) (*see* Note 2):			
	a) Number of beds not exceeding 100	230 per head	110 per head	340 per head
	b) Number of beds exceeding 100	300 per head	150 per head	450 per head
	c) Out patient department (OPD)	10 per head	5 per head	15 per head
iv)	Nurses' homes and medical quarters	90 per head	45 per head	135 per head
v)	Hostels	90 per head	45 per head	135 per head
vi)	Hotel (up to 3 star) excluding laundry, kitchen, staff and water bodies	120 per head	60 per head	180 per head
vii)	Hotel (4 star and above) excluding laundry, kitchen, staff and water bodies	260 per head	60 per head	320 per head
viii)	Offices (including canteen)	25 per head	20 per head	45 per head
ix)	Restaurants and food court including water requirement for kitchen:			
	a) Restaurants	55 per seat	15 per seat	70 per seat
	b) Food court	25 per seat	10 per seat	35 per seat
x)	Clubhouse	25 per head	20 per head	45 per head
xi)	Stadiums	4 per head	6 per head	10 per head
xii)	Cinemas, concert halls and theatres and multiplex	5 per seat	10 per seat	15 per seat
xiii)	Schools/Educational institutions:			
	a) Without boarding facilities	25 per head	20 per head	45 per head
	b) With boarding facilities	90 per head	45 per head	135 per head
xiv)	Shopping and retail (mall)			
	a) Staff	25 per head	20 per head	45 per head
	b) Visitors	5 per head	10 per head	15 per head
xv)	Traffic terminal stations (*see* Notes 3 and 4)			
	a) Airports	40 per head	30 per head	70 per head
	b) Railway stations (Junctions) with bathing facility	40 per head	30 per head	70 per head
	c) Railway stations (Junctions) without bathing facility	30 per head	15 per head	45 per head
	d) Railway Stations (Intermediate) with bathing facility	25 per head	20 per head	45 per head
	e) Railway Stations (Intermediate) without bathing facility	15 per head	10 per head	25 per head
	f) Interstate bus terminals	25 per head	20 per head	45 per head
	g) Intrastate Bus Terminals/Metro Stations	10 per head	5 per head	15 per head

NOTES

1 For calculating water demand for visitors, consumption of 15 litre per head per day may be taken.

2 The water demand includes requirement of patients, attendants, visitors and staff. Additional water demand for kitchen, laundry and clinical water shall be computed as per actual requirements.

3 The number of persons shall be determined by average number of passengers handled by stations, with due considerations given to the staff and vendors who are using these facilities.

4 Consideration should be given for seasonal average peak requirements.

5 The hospitals may be categorized as Category A (25 to 50 beds), Category B (51 to 100 beds), Category C (101 to 300 beds), Category D (301 to 500) and Category E (501 to 750 beds).

Figure 23 Water requirements

Description	Office
Water requirement break-up	**Domestic use**: 25 LPCD **Flushing use**: 20 LPCD
Total water requirement	**45** LPCD

It may be noted that the loads and demands are minimum indicative only and may vary as per actual requirements. The EPC contractor shall determine the actual water requirements as per the applicable NBC regulations, IS codes and statutory regulations. It is proposed that all the Underground Tanks shall be construct with service block & the top surface shall be 150mm above adjoining FGL or FRL & usable for parking

7.21 Water Storage

7.21.1 Under Ground/Overhead Water Storage:-

- It is proposed to have underground storage of water equal to minimum one and a half day requirement in case of Raw/Domestic and minimum half day storage for Irrigation Water Tank.
- The underground water storage tank shall be provided at the location marked on the plan as per design specified in rules with baffle wall and fire brigade collecting breaching. The design shall be got approved from EIC prior to execution.
- Overhead water tank design shall be got approved from EIC prior to erection. The tank shall be connected to the wet riser through booster pump through non return valve and gate valve.
- Campus Water collected in underground storage reservoirs with firefighting storage capacity. It is proposed to provide adequate static Storage for firefighting as per the norms of National Building Code 2016 and Local Fire Services.
- To prevent the stagnation of the water in the static storage tank, water would be made to circulate through overflow into the storage chamber for the domestic requirement.
- Over flow from fire water tank will fill the Domestic water tank.
- The Tank Detail - The Tank Details & capacity given in the above table are indicative only. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded subject to concurrence of Engineer-In-Charge.

Description	Water Demand as per norms (LPCD)		Water Requirement (LPCD)			Volume of the UG sump
	Domestic (L)	Flushing (L)	Domestic(L)	Flushing(L)	Total(L)	Volume of the UG Sump (Cu.m)
COMMERCIAL (OFFICE BUILDING)	25	20	115190	92152	207341	311

Table 15 Volume of UG Sump

Details & capacity given in the above table are minimum requirement only. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded subject to concurrence of Engineer-In-Charge.

Sizing of Pumps:-

- The Flow Rate of Pumps shall be suitably selected to meet building's water demand & of Sufficient Head depending upon Building Height, Pipe Friction losses, Bends etc. and other relevant Site Conditions. One Standby Pump to be considered in each & every variant. Hydro pneumatic pumps should be designed based on relevant standards.

7.22 Population and Area Data

The calculation is based on the built-up areas and corresponding unit types of office spaces facilities. The total population considered is derived using unit-wise occupancy standards.

- **Office Building**: The office building has a built-up area of 46,076 sq.m including future 5 floors. Based on the standard occupant load of **1 person per 10 sq.m**, the estimated populations are **4608** respectively

Table 3 Occupant Load
(Clauses 4.3 and 4.4.2.1)

Sl No.	Group of Occupancy	Occupant Load Factor (m^2/person) (see Note 1)
(1)	(2)	(3)
i)	Group A: Residential	12.50
ii)	Group B: Educational	4.00
iii)	Group C: Institutional (see Note 2):	
	a) Indoor patients area	15.00
	b) Outdoor patients area	10.0
iv)	Group D: Assembly:	
	a) Concentrated use without fixed seating	0.65
	b) Less concentrated use without fixed seating (see Note 3)	1.40
	c) Fixed seating	see Note 4
	d) Dining areas and restaurants with seating and table	1.80
v)	Group F: Mercantile:	
	a) Street floor and sales basement	3.00
	b) Upper sales floor	6.00
	c) Storage/warehouse, receiving and the like	20.00
vi)	Group E: Business	10.00
vii)	Group G: Industrial	10.00
viii)	Group H: Storage (see Note 5)	30.00
ix)	Group J: Hazardous	10.00

NOTES

1 Gross area shall be the floor area as defined in **2.35**. All factors expressed are in gross area unless marked net.

2 Occupant load in dormitory portions of homes for the aged, orphanages, insane asylums, etc, where sleeping accommodation is provided, shall be calculated at not less than 7.5 m^2 gross floor area/person.

3 These shall include gymnasium, table tennis room, billiard room and other gaming rooms, library, swimming pool and like.

4 In case of assembly occupancy having fixed seats, the occupant load shall be determined by multiplying the number of seats by 1.2.

5 Car parking areas under occupancy other than storage shall also be 30 m^2 per person.

Figure 24 Occupant Load

7.22.1 Tentative Allocation of Water Transfer Pumps

The pumps mentioned below against each group of building shall be installed on commencement of respective building construction.

Category (in terms of Stories of Building)	Building catering to	Pumping Sets
3B+G+14 Floors	Office	1 Pumping Set of suitable capacity including 1 no. Standby

Table 16 Pump set details for the buildings in site

The Pump Details, Layout scheme, Position and Application of Pumps given in the above table is minimum indicative only. During detailed designing, if required and found necessary, the EPC contractor shall do the detailed design to determine the capacity / rating of the equipment which may/may not require to be upgraded/ revised subject to concurrence of Engineer-In-Charge.

General Notes

- All items must be water-saving compliant where applicable.
- Sanitary fixtures must conform to IS/ASTM/EN standards.
- Submit samples for approval before procurement.
- Installation to be per manufacturer's specifications and coordinated with MEP services.

The data provided above shall be considered as the minimum indicative requirement. The specific brands mentioned, are intended solely for benchmarking purposes and are not mandatory recommendations. Equivalent makes or alternative models may be proposed, provided they meet or exceed the specified benchmark in terms of quality, performance, and technical compliance.

The above list of sanitary fittings are indicative only. Additional equipment may be identified during the detailed design phase. FAT shall include verification of safety features, protection coordination, control logic, and compliance with statutory and project specifications. The Employer/Consultant shall be notified in advance to witness the FAT as required.

7.23 General Responsibilities of the EPC Contractor

All major plumbing equipment and packaged systems shall be subject to Factory Acceptance Testing (FAT) to verify conformance with relevant IS codes, CPHEEO Manual, NBC Part 9 – Plumbing Services, and project-specific technical requirements. All planning, design, and execution of water supply, sewerage, and solid waste management systems shall adhere to the latest guidelines issued by the Central Public Health and Environmental Engineering Organization (CPHEEO). The environmental aspects of air, noise, and water pollution control, waste disposal, and monitoring shall comply with the standards prescribed by the Central Pollution Control Board (CPCB).The indicative list of equipment (but not limited to) requiring FAT includes:

Pumping Systems

- Hydro-pneumatic/booster pump sets
- Transfer pumps (domestic, flushing, treated water, etc.)
- Sump and dewatering pumps

Water Treatment Units

- Reverse Osmosis (RO) plants
- Softening and Filtration units

Sewage Treatment Plant Equipment

- STP packaged units
- Blowers, dosing systems, and sludge pumps

Water Meters and Flowmeters (electromagnetic or ultrasonic)
Prefabricated Tanks (HDPE/GRP/FRP, if applicable)
UV Disinfection Units and Dosing Systems
Control Panels for Plumbing Systems

Note: The list above is indicative. Additional items may be identified during the design stage. FAT shall include checks for hydraulic performance, control logic, safety features, and compliance with design and statutory standards by the EPC Contractor. The Employer/Consultant shall be notified in advance to witness factory testing, wherever required.

1. Testing, Commissioning & Certification: All systems shall be tested as per manufacturer's instructions and relevant IS codes. Functional tests shall be conducted in the presence of the Employer/Engineer's Representative and Fire Officer. Compliance certificates shall be obtained from certified agencies or local fire authority.

2. Documentation & Training: Contractor shall submit shop drawings, wiring diagrams, O&M manuals, test reports, and warranty certificates. On-site training shall be provided for the facility management team.

The Contractor shall coordinate the Water Curtain provision with all other services including structural works, HVAC ducts, electrical cabling, access control, and interior design to ensure seamless integration and code compliance.

8 FIRE FIGHTING INSTALLATION

8.1 Introduction to Fire Fighting Installations

This report has been framed to cover the engineering and technical details for providing Fire-fighting System in Buildings for Amaravati Local Head Office and other Outfits at Amaravati, Andhra Pradesh. The broad details provisions are given below: -

1. Wet Riser and Down-comer System with Hydrants
2. Automatic Sprinkler System
3. Portable Fire Extinguishers
4. Hydrant and Jockey Pumps
5. Sprinkler Pump
6. Diesel Engine Driven Fire Pump
7. Underground Tank and Overhead Tanks
8. Clean Agent Extinguishing System
9. Fire Sealant
10. Fire Signages
11. Panel Protection System
12. Water curtain system
13. Fire pump room
14. Addressable Intelligence Fire alarm system
15. Emergency exit light
16. Fire doors

8.2 List of Codes and Manuals

- Relevant IS codes published by Bureau of Indian Standards.
- National Building code 2016 Part IV for fire Protection System
- Pumps, Valves and Accessories shall be as per IS Standards
- CPWD General Specifications for Electrical Works-Part V (Wet Riser & Sprinkler System- 2021).
- IS: 3844-1989-Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises.
- IS: 13039-2011-Code of practice for external hydrant system provision and maintenance.
- IS: 2190-2010-Code of practice for selection, and maintenance of first aid fire extinguishers.

- IS: 15105:2021-Design & Installation of Fixed Automatic Sprinkler.
- IS 15493:2004, Clean Agent Extinguishing Systems — Design and Installation — Code of Practice IS 6382:1984 - Specification for Total Flooding System using Carbon Dioxide
- IS 16018:2012-Gaseous Fire Extinguishing Systems — Physical Properties and System Design of FK-5-1-12 (Novec 1230)

8.3 System description

The Fire Fighting System shall consist of Diesel Engine Standby Pump, Electrical Driven Fire Hydrant pump, Sprinkler Electrical pump & Jockey pump, Fire hydrant (Internal & External), Air Vessel, associated instruments, cabling, piping, valves, control panel etc. has been provided as per NBC -2016 requirement. Jockey pump shall maintain pressure in all water lines for Hydrants & Sprinklers fully charged under pressure for fully Automatic operation in case of fire.

Commercial – Office building

Description	As per NBC 2016	Proposal
Wet Riser	Required	Proposed
Fire Extinguishers	Required	Proposed
Hose Reel	Required	Proposed
Yard Hydrant	Required	Proposed
Down Comer	Not Required	Not Proposed
Landing Valve	Required	Proposed
Automatic Sprinkler System	Required	Proposed
Manual Fire Alarm System	Required	Not Proposed
Automatic Fire Detection & Alarm	Required	Proposed
UG Fire Tank	200 KL	200 KL
Overhead Tank	20 KL	20 KL
Electrical motor driven Fire Pump	2 Nos. 2850 LPM	2 Nos. 2850 LPM
Diesel engine driven Fire Pump Jockey Pump Terrace Pump	As per NBC	As per NBC

Details & capacity given in the above tables are minimum requirement only. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded subject to concurrence of Engineer-In-Charge.

Table 7 — (Continued)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Extinguisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm System (see Note 1)	Automatic Detection and Alarm System (see Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm² at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm²
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
BUSINESS BUILDINGS (E)													
1)	Less than 10 m in height	R	R	NR	R	NR	R (see Note 4)	R	NR	NR	10 000 (5 000) (see Note 6)	NR	450 (450) (see Note 6)
2)	Above 10 m but not exceeding 15 m in height	R	R	R	NR	NR	R (see Note 4)	R	R	20 000	5 000 (5 000) (see Note 6)	(see Note 14)	450 (450) (see Note 6)
3)	Above 15 m and up to 24 m in height	R	R	R	NR	R	R	R	R	100 000	10 000	(see Note 10)	NR
4)	Above 24 m and up to 30 m in height	R	R	R	NR	R	R	R	R	150 000	20 000	(see Note 11)	NR
5)	Above 30 m in height	R	R	R	NR	R	R	R	R	300 000	30 000	(see Note 12)	NR
MERCANTILE BUILDINGS (F)													
a)	F-1 and F-2 (see Note 16)												
1)	Less than 15 m in height												
	i) Ground plus one storey, with total of all floor area not exceeding 500 m²	R	R	NR	NR	NR	R (see Note 4)	NR	NR	NR	5 000 (5 000) (see Note 6)	NR	450 (450) (see Note 6)

Figure 25 Office firefighting installation requirements

An office building, classified as a business building with a height exceeding 30 meters, must comply with fire safety regulations that mandate the installation of wet risers to ensure an adequate water supply across all floors. The provision of fire extinguishers, first aid hose reels, yard hydrants, and an automatic sprinkler system is also required.

To further enhance fire protection, the integration of fire alarm control panels and proper compartmentation is essential. Additionally, a 200 cu.m underground static water storage tank and a 20 cu.m overhead fire tank are required.

Based on NBC 2016, Volume 1, Part 4-Fire and Life safety, the refuge balcony to be provided in the office block. Refuge area shall be provided in buildings of height more than 24 m. Refuge area provided shall be planned to accommodate the occupants of two consecutive floors (this shall consider occupants of the floor where refuge is provided and occupants of floor above) by considering area of 0.3 m^2 per person for the calculated number of occupants and shall include additionally to accommodate one wheelchair space of an area of 0.9 m^2 for every 200 occupants, portion thereof, based on the occupant load served by the area of refuge or a minimum of 15 m^2, whichever is higher.

Details & capacity given in the above table are minimum indicative only. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded subject to concurrence of Engineer-In-Charge.

8.4 Yard hydrant & internal wet risers:

The Yard hydrant shall cover the entire building externally with Hydrant points at appropriate location with hose boxes, hoses with all required hydrant accessories etc. Valve chambers shall be provided for housing the valves for above external pipes. The internal hydrant system

involving wet risers shall have landing valves, hoses, hose reels and branch pipes etc. in suitable hose cabinets at appropriate points on every floor.

Wet riser cum down comer of internal diameter of 15cms of G.I. C class pipe shall be provided with single/double hydrant outlet (as per local fire authority approval) and hose reel on each floor as shown on the plan. Pressure reducing discs or orifices shall be provided at lower level so as not to exceed the pressure of 5.5 kg/sq m.

The parameters, specifications, and information provided in the tender documents are intended to give a broad understanding of the project scope and design intent. It shall be the sole responsibility of the Contractor to carry out all necessary investigations, validations, detailing, and coordination required to deliver a fully functional, complete, and operational building. The building shall be designed and constructed fit for occupancy and use, and shall be handed over to the Client in full compliance with the latest provisions of the National Building Code (NBC) of India, all relevant Indian Standards (IS Codes), applicable statutory requirements, and the specific functional and operational requirements of the SBI, Amaravati.

8.5 Fire water source:

Underground RCC water storage tanks of 200cum capacity has been created in the basement& 20 Cum overhead tank shall be provided for Commercial.

8.6 Fire service inlet:

The Contractor shall provide suitably located Fire Service Inlets (FSIs) on the external face of the building, adjacent to the fire water tank and with direct vehicular access for fire tenders. The FSIs shall be installed in accordance with the latest NBC norms, local fire authority requirements, and relevant IS codes.
Separate and independent FSIs shall be provided for:
(a) Each vertical wet riser system, and
(b) Each sprinkler system zone or loop, including those serving laboratories, parking structures, or specialized areas.
All FSIs shall be clearly marked, fitted with standard instantaneous couplings, non-return valves, and be located at an accessible height for manual operation. The Contractor shall coordinate the location and routing with the fire authority during detailed engineering and obtain necessary approvals prior to installation. Breeching connection inlet shall be provided to refill U.G. Tank

8.7 Pressurization system:

This system shall comprise of One (1) No. electric motor driven Jockey pump, Pressure vessel. The hydrant system shall be kept pressurized all the times. The jockey pump shall start automatically upon getting impulse from pressure switch/relay. The pump shall stop automatically. The jockey pump shall take care of the leakages in the system, pipe lines, valves etc.

8.8 Mode of operation:

a) The residual pressure in the hydrant pipe network shall be maintained between 15.0 kg/cm² (maximum) and **3.5 kg/cm² (minimum).** In the event of a fire, when one or more valves are

opened, the jockey pump will compensate for the water demand. If the demand exceeds the capacity of the jockey pump, the pressure fall in the header shall automatically trigger the AC motor-driven fire pump via pressure switches. If the pump fails to meet the required water demand or in the event of a power failure, the standby diesel engine driven pump shall start automatically to maintain the pressure and flow. However, the shutdown of the pumps shall be manual, except for the jockey pump, which will start and stop automatically via the pressure switches.

8.8.1 Accessories and Equipment:

Strainers: The system shall include strainers on the suction side of each pump to prevent debris and foreign objects from damaging the pump.

Flow Meters: A flow meter shall be provided to monitor the flow rate of the water, ensuring it meets the necessary firefighting requirements.

Firefighting panel

Firefighting panels shall be provided for each building integrated with the Building Management System (BMS). The panel shall be equipped with both visual and audible alarms for system malfunctions.

Annunciation Panel

Fire alarm Graphic annunciation Panel shall be located in the fire control room on the ground floor of each building which shall give feedback allowing for remote access to pump, engine and tank water level status. It shall be capable of providing user friendly graphics user interface to Analog Addressable Fire Detection and Alarm System. It shall be capable of performing various Monitoring & Controlling functions.

Pressure Switch Settings: The pressure switches shall be adjustable to allow site-specific configurations for the desired sequence of pump start-ups, ensuring the system operates as required based on pressure drops.

Flexible Connectors: Flexible connectors shall be provided at the inlet and outlet of the pump system to absorb vibrations and reduce mechanical stress on pipes and fittings. These connectors shall be designed to prevent strain on the system caused by thermal expansion, contraction, or system movement. The material and size of the connectors shall be compatible with the fire-fighting system and shall conform to relevant IS standards.

Manual Starting Facility: In addition to the automatic start feature, the main fire pump shall also have an overriding manual start facility via a push-button arrangement in case of an emergency.

Each underground fire water tank shall be provided with level switches and level indicators.

All instrumentation used in firefighting system shall be BMS compatible and to be integrated with the BMS system.

8.9 Fire brigade inlet connection:

Fire brigade inlet connection shall be of gun metal with four 63 mm dia instantaneous type inlets with proof built in type check valves and 150 mm dia flanged outlet connections feeding to the main fire grid and UG water tank & risers. The collecting head shall conform to IS-904.

8.10 Pressure vessel, air compressor, pressure relief valve:

To compensate for minor pressure losses in the system and to provide an air cushion for counteracting pressure surges or water hammer in the pipework, an air vessel conforming to IS:3844 shall be installed in the pump room near the fire pump assembly.

The air vessel shall normally be half-filled with water, with the remaining volume filled with compressed air. During normal operation, the air shall remain under compression to effectively absorb transient pressure spikes and minimize shock to the pipe network.
To maintain the required air pressure inside the vessel, the following components shall be provided:

Air Compressor:
A suitably rated air compressor shall be installed to periodically replenish and maintain the required volume of compressed air within the vessel. The compressor shall operate automatically and be equipped with a pressure switch to start/stop based on preset pressure limits.

Pressure Relief Valve:
A pressure relief valve shall be installed on the air vessel to release excess air pressure and prevent over-pressurization. The valve shall be set to open at a pressure slightly above the maximum working pressure of the vessel. It will discharge excess air either to the atmosphere or into a designated drain, as appropriate. This ensures that the system remains within safe pressure limits, protecting both the air vessel and the pipework. In addition to the air vessel, a pressure relief valve shall also be installed on the hydrant ring main, at strategic points, to protect the entire fire-fighting system from over-pressurization caused by pressure surges or water hammer. These valves will ensure that pressure within the ring main does not exceed safe operational limits.

8.11 Automatic sprinkler system:

The automatic sprinkler system with separate Sprinkler riser of suitable size of G.I. ‘C’ class pipe shall be provided in each habitable room on each floor, in lift lobby/common corridor at each floor level and the sprinkler heads shall be distributed as per the Tariff Advisory Committee (TAC) / NBC-2016, Part IV so as to cover every 9 Sq Mtr. area with each sprinkler head. The sprinkler pump shall be suitable for automatic operation when there is a drop of pressure in the system. Sprinklers shall be provided throughout the building with separate sprinkler risers as required. Installation control valves and a hydraulic alarm in the basement shall be provided. An electrical sensor flow switch shall be provided on each floor and connected to fire control panel so that it would be possible to identify the location and the affected floor immediately.

8.12 Water curtain system

The Contractor shall design, provide, install, test, and commission automatic Water Curtains along with all associated apparatus in the buildings wherever applicable, strictly in accordance with the latest provisions of the National Building Code of India, 2016 (NBC 2016) Part 4: Fire and Life Safety, and applicable IS Codes including but not limited to IS 2189 (Fire Detection and Alarm System), IS 15301 (Smoke Barriers and Water Curtains), IS 8758 (Fire Protection of Cable Tunnels), and other relevant standards.
The Water Curtain system shall be designed to prevent the spread of flame and smoke between compartments, particularly across openings such as lift lobbies, staircase enclosures, vehicle ramps, and vertical service shafts. The underground tank capacity shall be accordingly worked out and implemented in the fire water tank.

The following components shall be included as part of the complete Water Curtain system:

1. Automatic Fire-Resistant Curtains: Gravity fail-safe, motorized deployment type, with fire resistance rating as per NBC and IS 15301. Shall have certification for performance under fire and smoke conditions.
2. Control Panels: Independent local control panels for each Water Curtain, linked to a centralized Fire Alarm Control Panel (FACP) and/or Building Management System (BMS), capable of manual override and diagnostics.
3. Fire/Smoke Detectors and Heat Sensors: To trigger curtain deployment upon detection of fire/smoke, with appropriate zoning and sensitivity as per IS 2189.
4. Integration with Fire Alarm: Full interfacing with the building's fire detection, annunciation and smoke extraction systems.
5. Safety Signage and Warning Systems: Illuminated and photoluminescent signs indicating “WATER CURTAIN DROP ZONE”, along with audible/visual pre-deployment warning signals to alert occupants before curtain descent.
6. Protective Enclosures and Finishing: Provision of concealed or semi-concealed enclosures for curtain housing, integrated into the false ceiling or soffit in coordination with architectural finishes.

8.13 Fire pump, sprinkler pump, jockey pump & booster pump

Wet riser shall be connected to a fire pump at ground level of appropriate capacity as mentioned in table above for hazard classification of each building type and their respective provisions as per NBC 2016, Part IV giving a pressure of not less than 3.5 kgs/sq cm at the topmost hydrant with suitable jockey pump. Booster pump of capacity 900 litres/min. having pressure of not less than 3.5 kg/sq cm at the hydrant outlets of the wet riser along with starter panel and pressure switch shall be provided at the terrace floor level.

An independent sprinkler pump of suitable capacity along with jockey pump shall be provided Sprinkler riser of suitable size of G.I. ‘C’ class pipe shall be provided in each habitable room on each floor, in lift lobby/common corridor at each floor

Diesel engine's day oil tank shall be of capacity sufficient to hold fuel up to 6 hrs of engine operation and mounted over stand fabricated using 25mm x 25mm x 6mm size MS angle providing with level indicator, inlet port, outlet port, drain port and diesel return line port and fuel pre filter, after filter etc. First fill of all consumables including grease, lubricants, oil and diesel fuel. Contractor shall also refill all the consumables after successful testing at the time of handing over the system.

Exhaust system having flexible metallic mufler, 150mm dia MS heavy pipe extended upto 10m outside pump house duly insulated with 50mm thick glass wool with 1mm thick aluminium sheet cladding, residential silencer with necessary MS support arrangements from wall or ceiling as per site condition. Diesel engine control panel shall be provided which will be also monitoring and displaying the critical diesel engine related parameters
Battery charger for diesel engine driven pump shall be provided at appropriate location.

8.14 Portable fire extinguishers

Fire Extinguishers as per applicable regulations in a few key areas as defined under (but not limited to) shall be provided near all the Internal Fire Hose Cabinets,
inside HT Panel Room,

LT Panel Room,

Lift Machine Room,

Fire Pump House,

Server Room,

UPS Room,

Fire Control Room,

Security Control Room,

Car Parking etc.

In addition to the above essential requirements sufficient qty. of portable/trolley mounted type fire extinguishers (Gas Based stored pressure type CO_2 type /Ammonium Phosphate Type/ Mechanical Foam etc.) shall be provided at all levels of the building, plant room, substation etc. at strategic locations as per requirements, generally to follow NBC-2016 and IS-2190: 2010 to extinguish fire of class A, B, C. As per NBC 2016/applicable IS Codes/statutory approval guidelines area of the Fire Extinguishers shall be considered.

8.15 Sand buckets

Sand buckets shall be provided as a basic fire-fighting measure in compliance with NBC 2016 – Part 4, Clause 3.4.6, particularly in areas prone to flammable liquid use or storage. Each unit shall comprise of at least four metal buckets (minimum 9-liter capacity), painted red and marked “FIRE”. Buckets shall be filled with dry, clean sand and mounted on a metal stand at a height of ~1 meter from finished floor level, placed in easily accessible and visible locations.

8.16 Refuge balcony

To ensure life safety in high-rise office buildings, refuge areas shall be provided in accordance with NBC 2016 – Part 4. For buildings exceeding 24 m in height, refuge areas shall be provided as follows:

a) Refuge area provided shall be planned to accommodate the occupants of two consecutive floors (this shall consider occupants of the floor where refuge is provided and occupants of floor above) by considering area of 0.3 m^2 per person for the calculated number of occupants and shall include additionally to accommodate one wheelchair space of an area of 0.9 m^2 for every 200 occupants.

b) The minimum area of the refuge shall be 15 m^2 or 0.3 m^2 per person (whichever is higher), based on the occupant load of that floor.

c) The refuge area must be open to the external air, clearly marked, and not used for any other purpose (e.g., storage).

d) It should be accessible from the staircase and located on a non-combustible cantilevered platform or within a protected area.

e) The location and design shall be such that it allows safe evacuation and temporary waiting space for building occupants in case of fire.

The EPC Contractor shall ensure that the design and construction of refuge areas fully comply with the latest NBC provisions and are coordinated with the architectural and structural disciplines.

8.17 Fire sealants:

Fire-resistant sealants shall be provided at all openings, joints, and penetrations in the fire-rated partitions, walls, floors, and ceilings, as per NBC 2016 guidelines. The sealants must comply with the IS 12117 standard for fire-resistant materials and ensure that fire and smoke do not pass through critical openings, maintaining the integrity of fire-rated barriers. These sealants shall be applied around pipes, cables, ducts, and other penetrations to prevent the spread of fire and smoke. Sealant material shall be selected based on the fire resistance rating (FRR) of the structure and the specific requirements of the area.

8.18 Clean agent fire suppression system

Clean agent fire extinguishing system shall be provided critical areas as per the fire safety requirements of the project. Clean agent fire extinguishers shall use an extinguishing agent, such as FM-200, Novec 1230, or CO_2, which are effective in suppressing fires without leaving residue and without damaging sensitive equipment or materials. These extinguishers shall particularly be provided for areas containing electronic equipment, valuable research materials, and sensitive processes. Critical areas shall include (but not limited to) spaces such as server rooms, data centers, control rooms, and telecommunication rooms, where the presence of electrical or electronic equipment demands fire protection that minimizes damage from fire suppression agents

For Server Rooms Rack Rooms & BMS / Battery rooms etc:
The Total Room Flooding system of fire detection and quenching is proposed in all Low Voltage Equipment rooms namely (but not limited to) Server rooms, Data Rack Rooms, BMS/ Battery rooms etc. where water sprinklers cannot be used. The Gas cylinder assembly should be UL/FM approved with seamless CCOE approved cylinder and will be connected to discharge nozzles through metal Piping. The master cylinder Kit fitted on Gas cylinder will be operated through separate Fire detection Panel and will release zero Ozone depletion potential Gas (Novec 1230) through the nozzles in case of fire. The system shall be designed as per NFPA 2001-2018 addition. Clean agent shall be UL/FM/VDS approved.

For Electrical panels:
Tube based Fire protection system shall be used in the Electrical Panels installed in substations. The detection Tube shall be installed throughout the compartment of panels. The location and spacing of tube shall be above the hazard to be protected. Seamless aluminium PESO approved Cylinder equipped with brass valve, pressure Gauge isolation valve will be fitted on the wall of the panel with suitable brackets and will be connected to the detection tube. In case of fire the tube shall rupture at a point. The rupture Tube (UL Listed) shall result in formation of discharge point and release Gas Agent (Novec 1230) in Uniform pattern. The cylinder shall be helium leak tested to 10^{-7} mbar litre per second.

Fire Signage

Various types of signage shall be provided throughout all the buildings in compliance with NBC 2016 Part - IV. The material for the signage shall be made of acrylic or aluminium, with dimensions conforming to the prescribed standards.

At each floor, near the lift landing, a diagram indicating the stairways shall be displayed, along with the instruction: “IN CASE OF FIRE, USE STAIRS UNLESS INSTRUCTED OTHERWISE”. This signage shall be placed above the call push button in the Lift Lobby.

Floor-specific signage shall be installed within the staircase area, clearly visible and easily readable. Additionally, each floor’s corridor shall feature directional signage indicating the Fire Escape Route to guide occupants to safety.

These signs may be equipped with LED lighting and shall be backed by a UPS power supply to ensure visibility during power failures. The signage shall be finished with photoluminescent paint to remain visible in the dark, enhancing safety during emergencies.

Electrical Works related to Fire Fighting System

Firefighting panel of suitable size incomer & sufficient numbers of outgoing feeders for all pumps along with spares/spaces shall be provided.

Power cabling of suitable size to be laid from LT panel to firefighting panel. Power cabling of suitable size from firefighting panel to fire pumps to be laid. Control cabling from fire pumps to firefighting panel & firefighting panel to pressure switch to be done. Fire annunciation panel is to be provided inside the fire control room at the ground floor level and it shall be integrated with the BMS system of the building.

Suspenders and/or cable trays for laying cables to be used for sprinkler system, fire annunciation panel needs to be considered. Motor shall be TEFC squirrel cage AC induction type. The motor shall be suitable for continuous duty & rating necessary to drive the pumpat150% of its rated discharge with at least 65% rated head. Motor shall be with class F insulation &1E-2 class efficiency. DOL/star delta starter/VFD shall be provided as per H.P rating of motors.

Adequate no. of NO/NC contacts for interlocks, indicating lamps, remote operation etc. shall be provided on starter/contactor.

Metallic body of all motors, medium voltage equipment etc. shall be connected by 2 separate & distinct earth conductors to the earth stations of the installations. Looping of such body earth conductors is acceptable from one equipment to another equipment considered of various sizes as per site conditions to maintain symmetry & crossing of ducts & other utilities

Automatic Upright Sprinklers shall also be installed in false ceiling voids exceeding 800 mm in height. Pressure in the sprinkler installation piping shall not exceed 12 bar and pressure at the most remote sprinkler at any level shall not be less than 0.5 bar

8.19 Water Curtain calculations

Curtain Length: Total water curtain length: **30 metres**

Design Flow Rate:(As per CPWD/NBC/NFPA norms for drencher/water curtain systems)

Flow Rate = **30–40 L/min/m**

Total Flow Requirement:

At 30 L/min/m × 30 m = **900 LPM (15 L/s)**

At 40 L/min/m × 30 m = **1200 LPM (20 L/s)**

Operational Duration:

10 minutes (as per CPWD/NBC standard)

Total Water Requirement:

Minimum: 900 LPM × 10 min = **9,000 litres**

Maximum: 1200 LPM × 10 min = **12,000 litres**

Impact on Fire Water Tank Capacity:

Increase dedicated fire water storage by **9,000 to 12,000** litres (preferably 12,000 litres for conservative design)

Impact on Fire Pumping Capacity:

Additional flow demand: **15–20 L/s**

Ensure either: Existing fire pump accommodates additional flow, or Provide dedicated deluge pump (min. 20 L/s @ ≥3.5 kg/cm²)

8.20 List of IS Codes for Reference of Fire Fighting Design:

S. No	ISI No.	Description
1	NBC: Part IV - 2016	National Building Code - Fire Protection
2	IS 4736: 1986	Galvanizing G.I. Pipes
3	IS: 778-1984	Specifications for copper alloy gate, globe and check valves for water works purposes
4	IS: 14846-2000	Specifications for sluice valves for water work purposes (50 to 1200 mm size)
5	IS: 5312: 1984	Specifications for swing check type reflux (Non-return) valve
6	IS: 5290: 1983	Specifications for landing valves
7	IS: 884: 1985	Specifications for first-aid hose reel for fire fighting
8	IS: 903: 1994	Specifications for fire hose delivery couplings branch pipe, nozzles and nozzles spanner
9	IS: 2190: 1992	Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers
10	IS: 2878: 1986	Specifications for fire extinguisher - Carbon-dioxide type
11	IS: 3844: 1989	Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises
12	IS: 2189 – 1999	Code of practice for selection and maintenance of automatic fire detection and alarm system
13	IS: 9668 – 1990	Code of practice for provision and maintenance of water supplies for fire-fighting
14	IS: 1538 – 1993	Specifications for cast iron fittings for pressure pipes for water, gas and sewage
15	IS: 15683	Portable Fire Extinguishers – Performance and Construction Specification
16	IS: 15105 – 2021	Design and Installation and maintenance of fixed Automatic Sprinkler Fire Extinguishing
17	CPWD SPECIFICATIONS	General Specification for Electrical Works Part-V (wet riser & Sprinkler Systems) 2020

8.20.1 General Responsibilities of the EPC Contractor

All major firefighting equipment shall undergo Factory Acceptance Testing (FAT) to ensure compliance with the relevant provisions of Part 4 – Fire and Life Safety of the National Building Code of India (latest edition), as well as applicable IS codes and manufacturer's standards.

The indicative list of equipment (but not limited to) requiring FAT includes:

Fire Pumps (Main, Jockey, and Standby – Electric/Diesel)

Pump Controllers and Panels

Motors and Diesel Engine for Fire Pump Sets

Fire Water Storage Tanks (prefabricated tanks, if applicable)

Pre-fabricated Hydrant Valves and Accessories

Sprinkler Control Valves and Assemblies

Fire-rated Doors and Glazing (if factory-finished)

Note: The Employer/Consultant shall be notified in advance for witnessing FAT. Acceptance of equipment at the factory shall not absolve the Contractor from responsibility for site performance and compliance with the approved design.

Testing, Commissioning & Certification: All systems shall be tested as per manufacturer's instructions and relevant IS codes. Functional tests shall be conducted in the presence of the Employer/Engineer's Representative and Fire Officer. Compliance certificates shall be obtained from certified agencies or local fire authority.
Documentation & Training: Contractor shall submit shop drawings, wiring diagrams, O&M manuals, test reports, and warranty certificates. On-site training shall be provided for the facility management team. The Contractor shall coordinate the fire services with all other services including structural works, Electrical cabling, access control, and interior design to ensure seamless integration and code compliance.

The parameters, specifications, and information provided in the tender documents are intended to give a broad understanding of the project scope and design intent. It shall be the sole responsibility of the Contractor to carry out all necessary investigations, validations, detailing, and coordination required to deliver a fully functional, complete, and operational building. The building shall be designed and constructed fit for occupancy and use, and shall be handed over to the Client in full compliance with the latest provisions of the National Building Code (NBC) of India, all relevant Indian Standards (IS Codes), applicable statutory requirements, and the specific functional and operational requirements of the SBI.

9 DESIGN BASIS REPORT – MECHANICAL VENTILATION:

9.1 Design Principles

Objective of Mechanical ventilation System Design is to ensure proper Indoor Air Quality as per design standards mentioned above along with Energy Efficiency, Flexibility of Operation, Cost Optimization, BMS Compatibility and Green Building Rating Compliances. All fixtures shall be selected to ensure energy efficiency in accordance with the Indian Green Building Council (IGBC) rating system.

Mechanical ventilation to be considered for the basement.

All ducting shall be GSS / GI construction as per SMACNA standard or IS-655.

9.2 Ventilation:

Natural Ventilation: Maximize natural ventilation to reduce reliance on mechanical ventilation, especially in non-air-conditioned areas.

Proper Ventilation Design: Design and install a ventilation system that provides adequate fresh air supply and removes stale air efficiently.

9.3 Outside Conditions

Summer: 41.0°C DB ; 28.5°C WB
Monsoon: 33.0°C DB ; 27.0°C WB
Winter: 18.0°C DB ; 13.0°C WB

Note: Amaravati experiences a tropical wet and dry climate. Summers are typically hot and dry with high daytime temperatures.

9.4 Mechanical Ventilation

For Mechanical Ventilation designing, NBC 2016 (National Building Code of India) guidelines shall be followed

For smaller toilet / toilet on external I / toilet with single WC / private toilet, circular fan for Toilet /propeller fan shall be used for Kitchen.

Pressurization of Lift Lobby, Lift Well, Staircase & Staircase Lobby (Wherever required)

All the staircases shall be pressurized to maintain 50 Pa pressure.

All the staircases lobbies shall be pressurized to maintain 25 Pa pressure.

All the lift well shall be pressurized through multi-level air injection to maintain 50 Pa pressure.

All the lift lobby shall be pressurized through multi-level air injection to maintain 25 Pa pressure. Latest NBC norms prevailing at the time of approval & execution to be followed.

Smoke extraction system in the basement will be provided by using axial fans. The whole floor will be converted in number of zone of each area 750-3000 Sq. Mt. as per NBC

9.5 Car parking ventilation (Emergency/Normal)

The entire basement car parking shall be ventilated zone wise.

Each zone shall have its independent fresh air and exhaust system.

The car parking ventilation shall be carried out by using axial fans for each zone.

In all zones, fresh air shall be brought mechanically by using suitable size axial fans.

The exhaust system for each zone shall be fully ducted (12 ACPH for Normal/Smoke exhaust) and fresh air supply shall also be fully ducted (12 ACPH for Normal/Makeup air in case of fire) in all zones.

The exhaust fans for all zones are split in the following configuration:

1 No. exhaust fan at 6 ACPH capacity (Jet fan)

The fresh air fans for all zones are split in the following configuration:

1 No. fresh air fan at 6 ACPH capacity (Jet fan)

The axial fan shall be suitably selected for best efficiency, low noise, optimum operating speed and lowest possible power consumption.

The axial fan shall have back draft dampers and all protective covering (like inlet wire mesh etc) so that any possible mishappening may be avoided.

9.6 CO Sensor

CO Sensors shall be installed for car park ventilation area zone wise.

They shall sense the level of CO in a particular zone and shall trigger the exhaust/fresh air fan accordingly.

The basis of triggering can be obeyed as:

a) CO level < 30 ppm – All fan off

b) 30 ppm< CO level <100 ppm – Normal Exhaust and fresh air fan

c) CO level > 100 ppm – Both Normal and Emergency Exhaust/Fresh Air fans are on

9.7 Design Engineering & Calculation

All required detail calculations shall be done by the EPC Contractor's appointed team and it shall be submitted to SBI/PMC for approval before starting the execution of the project. Calculations shall be prepared by a qualified Engineer.

9.8 Tender Drawings

The drawings issued with the tender documents are only for guidance of the tenderer.The actual & final mechanical ventilation GFC & Shop Drawings shall be prepared by the successful EPC Contractor after due co-ordination with other services & shall be approved by the SBI/ PMC before commencement of site work. The tenderer has to ensure that their proposal will meet with all the current rules & regulations pertaining to the relevant local / national statutory & NBC 2016.

9.9 Objective

The purpose of this report is to establish the design basis for the mechanical ventilation system required for the office building in SBI Amaravati.

This DBR given below shall be read in conjunction with the detailed specification, List of Make & overall other contract documents forming part of the EPS contract. In case of any variance, mechanical requirement given in this DBR or stringent among those shall supersede any other requirements mentioned in any parts of EPC contract document & the instructions/directions of SBI/PMC will be binding on the contract.

The design philosophy is to ensure fulfilment of all fundamental requirements in accordance with Design Guidelines, Relevant Standards and Codes as well as local Bye Laws.

The Design approach shall be sensitive to environmental issues. The main thrust shall be laid on Energy Conservation, Safety and Ease of Maintenance and current technical development.

The mechanical ventilation system must ensure ventilation, and filtration that meets safety, operational efficiency, and environmental compliance.

9.10 Standard & Codes

The applicable standards/ codes are: -

i. ASHRAE Standard 170-2017, Ventilation of Health Care Facilities.

ii. ASHRAE 62.1 – Indoor Air Quality

iii. National building codes – Building Services.

iv. IS: Codes.

v. ECBC 2017

vi. CPWD HVAC Specification 2017.

9.11 GFC Drawings, Shop Drawings & Technical Submittal

On the award of the work, the Contractor shall prepare & submit the detailed technical submittal of equipment & materials along with Services Space Planning Drawings indicating services rooms & cutouts along with shafts in architectural & structural drawings clearing defined with numberings, GFC drawings for approval of SBI/ PMC. Based on GFC drawings contractor shall submit shop drawings for approval before commencement of execution work at site.

The Contractor shall prepare and submit Good for Construction (GFC) drawings for all relevant disciplines, including but not limited to Architecture, Structural, and MEP services, for review and approval by SBI/PMC prior to commencement of the corresponding works.

It shall be the Contractor's responsibility to ensure that all drawings and documents requiring prior approval are submitted sufficiently in advance to avoid any delay in project execution.

To achieve the desired parameters/requirements as specified in Design Basis Report/Technical Specifications/Tender Drawings etc., the Contractor shall prepare detailed Heat Load Sheets of occupants of basement areas, CFM sizing of Fans (ventilation/pressurization) & submit to SBI/PMC for approval.

The EPC Contractor shall prepare the following shop drawings:-

A. Completion Drawings (As Built Drawings)

The EPC Contractor shall submit three sets (or as required by the engineer in charge) of paper prints of the as-built drawings & one soft copy, showing accurate record of the work as installed to the Client for his reference.

B. Operation and Service Manuals

The contractor shall also submit three copies (or as required by the engineer in charge) of an Operating Manuals in ring binder describing the brief write up on the system installed, operating instruction for all equipment, catalogues, maintenance of equipment etc.

The Contractor shall submit requisite sets of operation and service manuals in respect of the mechanical ventilation including salient details of plant including internal circuit diagrams. Following minimum details shall be furnished:

i. Detailed equipment data as approved by the Engineer-in-charge.

ii. Manufacturer's maintenance and operating instruction.

iii. Approved test readings.

The Contractor's all also submit requisite sets of technical literature on all automatic controls and complete technical literature on all equipment and materials.

C. Technical Submittals

The Contractor shall submit Technical Submittals for all materials, equipment and machinery for approval in writing of the SBI/PMC before placing orders.

The material submittals shall comprise of at least the following:

a) Manufacturer's technical catalogues and brochures, pump curves, Certifications etc. giving technical data about performance and other parameters.

b) Manufacturers drawings / sketches showing construction, dimensional and installation details.

c) Rating charts and performance curves clarifying rating of equipment proposed.

D. **Samples and Prototypes**

The Contractor shall submit samples of items as required by the SBI/PMC for prior approval in writing before placing the order. The Contractor shall also construct prototype or samples of work as laid down in the Contract or as instructed by the Engineer-in-charge.

9.12 Inspection at Work / Contractor's Premises

The client, PMC or their representatives shall at all reasonable time have free access to the Contractor's premises/works. The Contractor shall give every facility to them and necessary help for inspection and examinations and test of the materials and workmanship.

These representatives shall have full powers to inspect drawings of any portion of the work or examine the materials and workmanship at the contractor's works or at any other place from where the material or equipment is to be obtained. Acceptance of any material or equipment shall in no way, relieve the Contractor of his responsibility for meeting the requirement of the specifications.

9.13 Testing, Commissioning & Handing Over

9.13.1 Testing

Tests on equipment as called for in the specifications shall be carried out by the Contractor in accordance with the specifications, the relevant Bureau of Indian Standard Codes (BIS) and International Standards.

The Contractor shall pay for and arrange without any cost, all necessary balancing and testing equipment, instruments, materials, accessories, power, water, fuel and the requisite labour for testing. Any defects in materials and/or in workmanship detected in the course of testing shall be rectified by the Contractor entirely at his own cost, to the satisfaction of the SBI/PMC. The installation shall be tested again after removal of defects if any and shall be commissioned only after approval by the SBI/PMC. All tests shall be carried out in the presence of the SBI/PMC or his representative.

All types of specified & routine tests of the equipment shall be carried out at the works of the EPC Contractor or the manufacturers of the components. The Department shall be free to witness any or all tests, if they so desired. The EPC Contractor has to inform to the department before dispatch of any material / equipment.

On the completion of the installation, the EPC Contractor shall arrange to carry out various initial tests as detailed below:-

i. To operate and check proper functioning of all electrically operated components viz. Compressor motor, pumps, fans etc. as well as other electrical motors.

ii. To test and check the proper functioning of electrical gears, safety and other controls to ensure their proper functioning.

iii. To check the air distribution system and to provide designed airflow in all areas by adjusting the grills, diffusers and dampers for air-conditioning.

iv. To check the systems against leaks in different circuits, alignment of motor, 'V' belt adjustments, control setting and all such other tests which are essential for smooth functioning of the plant.

v. EPC Contractor shall have to submit the capacity test of all equipment at site.

9.13.2 Balancing

The EPC contractor has to balance the mechanical ventilation provided in the buildings

9.13.3 Provisional Taking Over

After completion of the system, the same shall be put to a continuous running test for a period of 72 (Seventy Two) hours. All adjustments should be made prior to this test so that proper conditions / working are achieved during this testing.

The Contractor shall pay for and arrange at his own cost for materials, accessories, power, water, fuel and the requisite labour for this testing the test readings shall be noted in the Testing format approved by the SBI/PMC.

The plant will be provisionally taken over after successful completion of the above test and the defects liability period shall commence after taking over of the system.

9.14 Performance Guarantee from EPC contractor

The EPC Contractor shall submit a performance guarantee certificate from OEM who supplied the work, counter signed by the EPC Contractor that the system shall maintain the desired parameters within tolerance limit of the specified parameters who shall also guarantee that the capacity of various components as well as the whole system covered under the scope of work, technical schedules and requirements etc., shall not be less than the specified capacities. The guarantee of the specific equipment supplied alone with regard to the performance of the system shall not be acceptable and overall responsibility of the Contractor for performance of work & its compliance with the Contract terms and conditions remains unchanged.