URBAN DEVELOPMENT DEPARTMENT - GOVERNMENT OF KARNATAKA

MANGALURU
SMART CITY

DETAILED PROJECT REPORT

(CIVIL, PUBLIC HEALTH & ELECTRICAL WORKS)

FOR THE PROPOSED CONSTRUCTION OF

INDOOR STADIUM FOR KABADDI & SHUTTLE BADMINTON

NEAR URWA MARKET , MANGALURU, D. K. DISTRICT,

ARCHITECTS & CONSULTANTS (A.E.F.)

THE CONSORTIUM Of
M/s. KUMARCHANDRA & ASSOCIATES &
M/s ASHTADIK INFRASTRUCTURE PLANNING CONSULTANTS, Pvt. LTD.

ARCHITECTURE , URBAN DESIGN & ENVIRONMENTAL PLANNING CONSULTANTS
2425, First Floor, Opp: Syndicate Bank, Kadri Road , MANGALORE-575003
PHONE & FAX NO. : 0824(2217188) , Email: architectskca 87@gmail.com, info@ashtadik.com

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Mangaluru is a chief port city in the state of Karnataka and is known as the gateway to Karnataka. It is situated on the west coast of the country. The western Ghats span the city of Mangalore on its eastern side. It is the district headquarters of Dakshina Kannada District. It lies on the backwaters formed by the Gurupura river and Netravati river.

Figure 1- Location of Mangalore

Source: Google Images

Mangalore derives its name from the local Hindu Goddess Mangaladevi. It developed as a port on the Arabian Sea – remaining, to this day, a major port of India. Lying on the backwaters of the Netravati and Gurupura rivers, Mangalore is often used as a staging point for sea traffic along the Malabar Coast.

Mangalore is spread over an area of 184.85 sq.km and houses about a population of approximately 8 lakhs. A rich history of trade coupled with industrial growth has led to the formation of dynamic civic and economic zones historically within the city core. In Mangalore, the people, culture and its festivals form an integral part of the city.

Mangalore is connected to Bengaluru and other major urban centers in India by air routes. International link is also established to gulf region of the Middle East. The Mangalore International airport is located near Bajpe around 20 km north-east of the city. Mangalore is a major all-weather harbour linked to other major national and

international harbours. The harbour also links areas served by the inland transport facility in Netravathy and Gurpur Rivers. The old bunder (port) is a relatively small-scale freight and fishing harbour. New Mangalore Port is also an all-weather port situated at Panambur handling imports and exports.

Introduction to Kabaddi and Badminton Sports

Physical exercise is good for mind, body and spirit. Furthermore, **team sports** are good for learning accountability, dedication, and leadership, among many other traits. Putting it all together by playing a sport is a winning combination.

Kabaddi requires both brains and brawn. This is a true Indian game where the quality of players are tested at every level. Kabaddi has been a part of the Indian life since the ancient times as it has been mentioned in Mahabharata along with some other games .It is the state game of many.Indian states ; which also includes Karnataka.The sport of kabaddi has been gaining popularity far and wide owing mainly to the success of VIVO Pro Kabaddi over the past five seasons.

Badminton is a racquet sport played using racquets to hit a shuttle cock across a net. the most common forms of the game are "singles" and "doubles". Badminton is a great racquet sport that offers a tremendous amount of benefits for participants. Whether it's in singles or doubles, badminton is a fun and exciting sport to pick up if you're looking for an activity that boosts your physical, mental and social aspects of health.

Figure 3 - History of Kabaddi

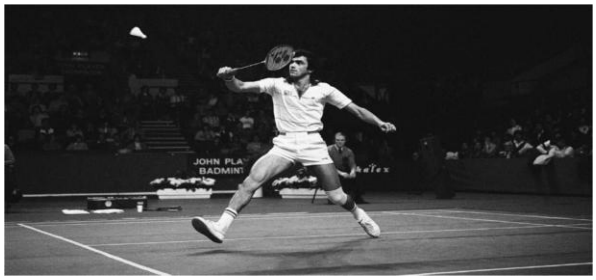


Figure 2 - History of Badminton

1.2 PROJECT PURPOSE

Sports have a huge impact on the socio-cultural and economic aspects of the state. A sound state policy on sports will have a profound impact on human development and promote healthy participation in the society. Sport achievements also bring a sense of achievement and foster growth among the youth. The region of Dakshina Kannada has contributed immensely to the growth of sports activities in the state. Mangalore, being the centre of such activities has various sports facilities in the city. In addition to the prevailing sports facilities, Mangalore being a strong banking, education and heath hub of Karnataka has tremendous potential for creating a rich sports ecosystem in the state.

Badminton and Kababbdi are well played sports in the city of Mangaluru. Few private badminton courts and the presence of private clubs within the city have led to the growth of the sport. Kabbadi is a sport that is well played and promoted from the primary schools to colleges. Also, the recent development of public interest in both the sports through the promotion of various premiere leagues has given tremendous further boost. The Badminton and Kabbadi players association in the region has joined hands with the Karnataka state youth and sports department and has actively worked to develop the sports in the region. Identifying the potential for the development of the above sport, the Smart City Mangaluru proposed to construct a Kababddi and Badminton stadium in a land allocated to Karnataka state youth and sports department by the Mangalore city corporation.

The state government through its Karnataka Sports Policy 2018 promotes growth of sports through four pillars namely- Governance and Institutions, Eco-System, Hard Infrastructure and Soft Infrastructure. In line with the current State Sports Policy 2018, this proposal aims to develop a world class indoor sports complex for Kabbadi and Badminton sports housing all other ancillary sports facilities required for the same. The scope of the consultant is to provide Architectural and Engineering Consultancy services for the development of Urva Kabbadi and Badminton Indoor Stadium after

assessing the needs put forward by the various stakeholders. After due consultation with the Smart city Mangaluru and the officials of the district youth and sports department, the Consultant has assessed the needs and a proposal for development of works has been briefly described and detailed as under.

1.3 PROJECT BRIEF

- To provide a state of the art, modern indoor stadium facility for Badminton and Kabaddi.
- To provide 6 interchangeable Badminton and Kabaddi courts.
- To provide accommodation for players and supporting facilities.
- To provide comfortable spectator / audience seating.
- To provide offices for the sports center and for badminton and kabaddi associations.
- To provide a sports club including café and member facilities.
- To provide commercial space for economic self sustenance.
- To provide all associated provisions of parking , building services and amenities.

1.4 PROJECT DELIVERABLES

The facility is required to have six badminton and two Kabbadi indoor courts which can be interchangeable by addition of synthetic mats depending on the requirements. This will be built over two levels of space. Other facilities such as sufficient parking facilities for sport events, toilets, changing rooms, meeting rooms, dorms, medical facilities, training centre, fitness zones along with a separate commercial zone in order to financially sustain the maintenance needs of the facility in the longer run is required. This will be built over 5 levels along the indoor courts. Based on the above needs, the project was further conceptually detailed and the overall budget required for the execution of the project was estimated to be twenty seven crores with the built up area of around 11,020 Sq.M. The funds for the same will be allocated in the phase wise

manner for development. For the first phase of this development, the Smart city Mangaluru has allocated a fund of Five crore rupees.

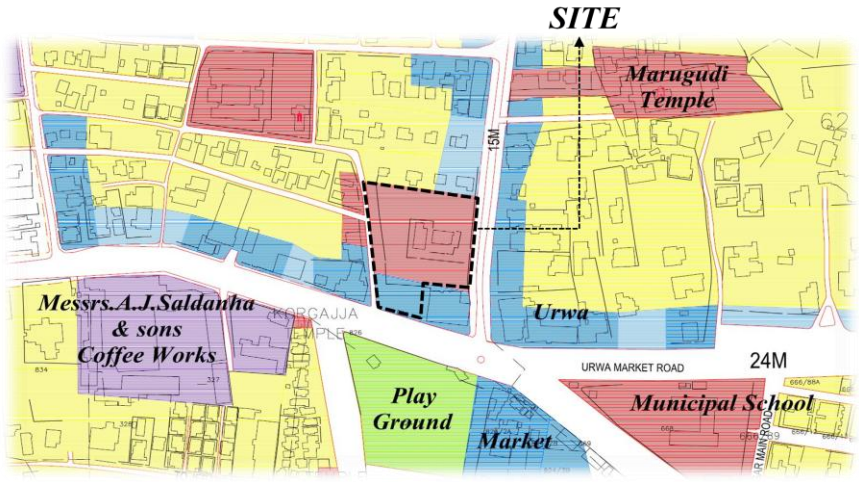
For the first phase of allocation, site development works and the partial construction of the basement floor housing the parking and other services can be taken up. The Basement floor has an area of 2921 Sq.M which includes areas for parking as well as other services. The remaining areas can be taken up in the subsequent phases. The AEC consultants, based on the assessment of the existing needs, propose that the development of subsequent phases should be taken up immediately following the first phase.

2 APPLICABLE STANDARDS

The literature for the applicable standards has been primarily split into the following:

1. Mangalore Zonal Regulations, 2011
2. Indoor Stadium Design Guidelines.

2.1 MANGALORE ZONAL REGULATIONS , 2011



PROPOSED LANDUSE - 2021				
EXISTING	PROPOSED	LANDUSE	AREA WITHIN CONURBATION (IN HECT.)	%
		RESIDENTIAL	366.96	57.40
		COMMERCIAL	73.71	11.53
		INDUSTRIAL	20.34	3.18
		PUBLIC & SEMI PUBLIC	35.68	5.58
		PARKS & OPEN SPACES, PLAY GROUNDS	28.41	4.44
		PUBLIC UTILITIES	0.79	0.12
		TRANSPORTATION & COMMUNICATION	107.89	16.88
		URBAN AGRICULTURE & WATER BODIES	5.57	0.87
		TOTAL	639.35	100.00

Figure 4 - Land-use Map Showing site and Context

Source: Mangalore Urban Development Authority (MUDA)

A Rough Estimate of the overall plot area under consideration for this project is around 4687 Sq.M., a figure on which the regulations have been applied.

2.1.1 Land Use

The Land Use Zones as part of Section 3.1 show the following classification of Land into various zones:

1. Residential (R)
2. Commercial (C)
3. Industrial (I)
4. Public and Semi Public (P & SP)
5. Public Utilities (PU)
6. Parks & Open spaces (P)
7. Transport and Communication (T & C) Agriculture land, water sheet (A, W)

As this Project envisions or explores Civic Amenities (Badminton and Kabaddi Stadium), Recreational/ Public Use Areas, Commercial Areas (Offices, cafe, and Hotels), the following could be the applicable categories under the Permissible Land Use

Table 1 - Applicable Land Use Categories

Section	Category	Particulars	Category Code
3.2.2	Commercial	a. Education Coaching Centers, Hostels b. Eateries c. Gyms, Yoga Center d. Retail Shops e. Grocery Shops	C2
3.2.2	Commercial	a. Recreational Clubs b. Restaurants and Hotels c. Commercial and Corporate Offices d. Banks, Consulting Offices e. Department Stores f. Hospitals, Nursing Homes	C3
3.2.2	Commercial	a. Kalyana Mantaps b. Commercial and Corporate offices c. Shopping Complexes d. Convention Centers,	C4

			Banquet Halls e. Financial Institutions f. Cinemas and Multiplexes g. Entertainment, Amusement centers h. Social Clubs and amenities i. Exhibition centers	
3.2.4	Public and Semi-Public		a. Parks, Playgrounds b. Cultural Complexes c. Public Library	P&SP 3

Source: Mangalore Zonal Regulations, 2011

Notes:

1. Category Code C4 includes allows all uses of C1, C2 and C3. Likewise, C3 includes all uses of C1 and C2 and so forth.
2. Uses permitted in all the above categories are subject to space standards
3. Before permitting any uses permissible under special circumstances, the authority shall publish the proposals calling for public objections in at least two leading local daily newspapers giving stipulated time of fifteen days. The objections received within the stipulated period shall be placed before the authority and the reasons for accepting/rejecting the objections shall be recorded in the proceedings based on which the authority may take appropriate decision.

2.1.2 Floor Area Ratio

The Floor Area Ratio (FAR), means the quotient of the ratio of the combined gross floor area of all floors, except the areas specifically exempted under these regulations, to the total area of the plot, viz.

Floor Area Ratio =	Total floor area of all the floors
	Plot Area

The road flanking the Project area on south side has a width of 24 meters, with a Project area over 4,000 sq. m. Consequently, the applicable FAR based on proposed Land uses is given in

Table 2 - Applicable FAR

Plot Area (sq. m)	Road width		Permissible FAR	Premium	TDR	TOTAL	Land use in MP- II	Allowable Land uses				
	Existi	Proposed						R	C	I	P&SP	T&C
Over 4000	12m	18m	2.3	1.0	0.5	3.8	R	R	C3	I-2	P&SP3	T2
							C	R	C5	I-3	P&SP3	T3
							I	R	C5	I-4	P&SP3	T3
							P&SP	-	-	-	P&SP4	-
							T&C	-	-	-	-	T4
	12m	**24m**	**2.5**	**1.0**	**0.5**	**4.0**	R	R	C3	I-2	P&SP3	T2
							C	R	C5	I-3	P&SP3	T3
							I	R	C5	I-5	P&SP3	T3
							P&SP		-	-	P&SP4	-
							T&C	-	-	-	-	T4

Note:

1. All the uses permitted under equivalence table are subject to space standards.

2. Additional FAR availed by amalgamation of properties or from TDR / DR originated from the same property shall be permitted over the total FAR prescribed in the Table subject to maximum FAR of 4, if the proposed road width is 12m and above.

3. Car parking has to be provided as per Table – 8 for different land uses permitted.

4. The minimum road width criteria should be a combination of existing and proposed road width in the Table. Proposed road width shall be as in the Master Plan or as proposed by the local authority.

5. If the width of any existing road which the plot faces falls between two different categorized width of existing roads, then the lower road width shall be considered for calculating the FAR:

6. The FAR of the individual plots in an approved layout shall be governed by the proposed width of the approach road (widest among the approach roads in case of multiple approach roads) to the layout or the road abutting the plot, whichever is lesser.

7. FAR shall be calculated for the entire plot area after deducting the portion surrendered for road widening.

2.1.3 Space Standards

The following table provides the space standards for various buildings and uses:

Table 3 - Space Standards for Various Proposed Uses

Common to all permissible zones	Minimum size of plot (Sq.m)
Kalyana Mantaps/Conference hall (Up to 500 seats) (Above 500 seats)	 1000 2000
Game centers, convention centers, truck terminals	4000
Social clubs and amenities	1000
Multi storied car parking,	4000
Petrol pumps / Fuel stations	750

Hotels and lodges	1000
Service Apartments	1000
Public libraries	300
Community hall	1000
Star hotels (up to 3 star)	2000
Star hotels (above 3 star)	8000
Office buildings in C3 and above	500
Uses in C5 (excluding C1, C2, C3 & C4)	4000

Source: Mangalore Zonal Regulations, 2011

2.1.4 Parking Requirement

1. Each off-street parking spaces (parking bay) provided for motor vehicles shall not be less than 12.5 m2 area (2.5 m X 5 m) and for scooter parking space provided shall not be less than 2.0 m2 (2.0 m x 1.0 m) and it shall be additional 25% of the no. of car parks required as per Table 8.

2. The minimum width of drive way shall be 3.5m. Aisles and such provisions required for adequate monitoring of vehicles shall be exclusive of parking space stipulated. The width of driveway with entry to parking bays shall be:

Table 4 - width of driveway with entry to parking bays

Width of driveway	Width of parking bay
4.5 m	2.5 m
4.0 m	2.75 m
3.5 m	3.0 m

3. Mechanical stacking of cars is permitted. The total car parking space required shall not be reduced by more than 25% by this arrangement.

4. For multi-level car parks, ramp should be provided compulsorily. If car lifts are provided, they should be at least two in number.

5. The following areas would be excluded for computing the parking requirements:

    - Electrical room, electrical substation, generator room
    - Pump room
    - Public toilets
    - All services provided within plinth of the building
    - Security room, maintenance room, fire control room provided within plinth of building
    - Common corridors, staircase, lifts, open ducts

6. Table 2-5 presents the requirement for off street parking spaces based on occupancy type:

Table 5 - Off Street Parking Spaces

Sl. No	Occupancy	Minimum one car parking space of 2.5 M x 5.0 M for every
1.a	Residential buildings up to 4 dwelling units.	No parking required for a floor area less than 100M^2 1 tenement exceeding 100 M^2 to 200 M^2 floor area. 1/2 tenement exceeding 200 M^2
1.b	Multi dwelling apartments building.	2 tenements each are having a floor area of less than 75 M^2 1 tenement exceeding 75 to 175 M^2 floor area. 1/2 tenement exceeding 175 M^2
2	Lodging establishments, tourist homes, hotels	4 rooms or 50 M^2 of floor area, whichever is more.
3	Educational	150 M^2 floor area or fraction thereof.
4	Hospital Nursing homes	100 M^2 floor area or fraction thereof. 75 M^2 floor area or fraction thereof.
5	Assembly/Auditorium	15 seats subject to minimum of 20 car parks or 50 sq.m of floor area, whichever is more.
7	Banks and other Retail business	50 sq.m floor area or fraction thereof

8	Industrial	100 M^2 floor area or fraction thereof plus one lorry parking (3.5 M x 7.5 M)
9	Storage/Wholesale Business	150 sq.m up to 600 M^2 floor area and every 200 M^2 thereafter or fraction thereof. Additional one loading/unloading bay (3.5 M x 7.5 M) for every 1000 sq.m
10	Community Hall / Kalyana Mantapa	50 sq.m of floor area or fraction thereof.
11	Office building (Government or Private) including IT & BT	75 sq.m of floor area or fraction thereof.
12	Restaurant serving food and beverage (exc. toilet)	50 M^2 of floor area
13	Hostels	10 rooms or 100 M^2 of floor area whichever is more

Note:

i. For multi storied buildings, an additional 10% of the required car parking space shall be provided for visitors/ guest parking within the plot

ii. Parking provision for buildings on stilts:

   a. Parking are shall be exempted from FAR calculation, if parking is provided on the ground floor of the building on stilts.

   b. All sides of the stilt parking should be open, barring which, the area would be taken into FAR calculation

   c. When stilts parking is provided, its height shall be taken into account while calculating the total building height

7. Car parking as per Table 2-5 or additional car parking prescribed in these regulations may be provided in the setback area allowing 3.5m from the building

as drive way (wherever required) in case of the buildings within a height of 18m and allowing 6m from the building as driveway in case of buildings having a height of 18m and above. The front setback may be used for parking in case of commercial buildings if no compound wall is constructed between the plot and the road. However, this shall be exclusive of the parking area required for the building as per Table 2-5 for buildings having a height of 18m and above.

8. For Commercial complexes with retail shops or multiplexes having an area of 2,500m2, additional 1 no. auto-rickshaw parking (2.25 x 1.75m) and 1 no. additional parking for every 2,500m2 or fraction thereafter has to be provided. This parking facility has to be treated as public parking and shall be abutting the road. The area of the building considered for the parking requirement shall be the area considered for computing other vehicle parking requirements in the building.

2.1.5 Setback and Height

As the Plot in question for the Project is surrounded by roads of width of 24 m and 15 m on the south and east side respectively, and a narrow road around 6 m on the west side, the following tables show the relationship between the widths of the road, the setback required and the building line distance from the center of the road:

Table 6 - Minimum Front setbacks for building with respect to road width

Proposed Road width	Minimum Front setbacks	Building line from center of road
12.0 m	3.5 m	9.5 m
18.0 m	3.5 m	12.5 m
24.0 m	3.5 m	15.5 m
30.0 m	4.0 m	19.0 m

Table 7 - Minimum setbacks with respect to the height of buildings

Source: Mangalore Zonal Regulations, 2011

Height of Buildings (m)	Minimum exterior open spaces/set backs		Maximum plot coverage %	
	Front (m)	Rear and Sides (m)	Residential	Non-residential (except industrial)
7 up to 9.99	2.0	1.5	75	80
10 up to 11.99	3.0	2.5	70	75
12 up to 14.99	4.0	3.0	70	75
15 up to 17.99	5.0	5.0	65	70
18 up to 20.99	5.0	6.0	65	70
21 up to 23.99	6.0	7.0	60	65
24 up to 26.99	6.0	8.0	60	65
27 up to 29.99	7.0	9.0	55	60
30 up to 34.99	7.0	10.0	55	60
35 up to 39.99	8.0	11.0	50	55
40 up to 44.99	8.0	12.0	50	55
45 up to 49.99	9.0	13.0	45	50
50 up to 54.99	9.0	14.0	40	50
55 and above	10.0	16.0	35	45

Source: Mangalore Zonal Regulations, 2011

Note:

1. Front setback is essentially with regard to the road width and height of the building and side and rear setbacks are with reference to the height of the buildings.

2. Front setback should be provided in the remaining plot after deducting area for road widening as mentioned in the Master Plan. If the road widening is not touching / crossing the frontage of the plot, the front setback shall be provided in the plot itself.

3. Front setbacks prescribed shall be considered from the frontage of the plot abutting the road only and side and rear setbacks prescribed shall be considered from all other boundaries of the plot.

4. Front setback line shall be considered as the building line beyond which no portion of the building should be projected, either below the ground or above the ground except for balcony projections mentioned in the rules herein. However, cantilever porches and steps to ground floor entry may be permitted depending upon the site condition. However, such projection should in any case not be beyond 0.5m from the road widening line.

5. In the case of corner sites, both the sides facing the road shall be treated as front side and regulations applied accordingly.

6. In case of site facing roads both in front and rear, both the sides facing roads should be treated as front and other two sides not facing the roads should be treated as sides and the setbacks be applied accordingly

7. In case of more than one building proposed on a single site, the set-backs shall be applied with respect to the height of the individual buildings or the road width whichever is higher subject to access and fire requirements of the taller building being satisfied.

2.1.6 High Rise Building

For high rise buildings, No Objection Certificates from the following departments have to be furnished by the applicant before obtaining Commencement Certificate/ license. The No Objection Certificates have to be obtained as per the conditions stipulated in this Zonal Regulations.

- Department of Fire Services.
- Karnataka State Pollution Control Board/MOEF, wherever applicable.
- Coastal Regulation Zone Authority, where ever applicable.

The Department of Fire Services will consider No Objection Certificate for buildings considering the height of the building, setbacks, road width, ramps, parking and all other provisions of the Zonal Regulations. It may follow National Building Code (NBC) for other fire safety measures.

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*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/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2)	10 m and above but not exceeding 15 m in height	R	R	R	NR	R	R (*see* Note 4)	R	R	100 000	5 000 (5 000) (*see* Note 6)	(*see* Note 10)	NR
3)	15 m and above but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	150 000	10 000	(*see* Note 11)	NR
4)	24 m and above but not exceeding 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
ASSEMBLY BUILDINGS (D) (*see* Note 16)													
a)	**Buildings (D-1 to D-5)**												
1)	Less than 10 m in height												
	i) Up to 300 persons	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	20 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	ii) More than 300 persons	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000 (5 000) (*see* Note 6)	NR	900 (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 (*see* Note 1)	R	100 000	5 000 (5 000) (*see* Note 6)	(*see* Note 10)	450 (450) (*see* Note 6)
3)	Above 15 m but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	150 000	10 000	(*see* Note 10)	NR
4)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
b)	**D-6**	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 12)	NR
c)	**D-7**	For details *see* **6.4.4**											

Table 8: Minimum Requirements for firefighting installations

2.1.7 Water Requirement for buildings other than residences as per NBC 2016

Sl.No	Type of Building	Domestic Litres per head /day	Flushing Liters per head /day	Total consumption Litres per head /day
01	Factories including canteen where bath rooms are required to be provided	30	15	45
02	Factories Including canteen where no bathrooms are required to be provided	20	10	30
03	Hospital (excluding laundry and kitchen a. Number of beds not exceeding 100 b. Number of beds exceeding 100 c. Out patient department(OPD)	230	110	340
		300	150	450
		10	5	15
04	Nurses homes and medical quarters	90	45	135
05	Hostels	90	45	135
06	Hotels (upto 3 stars) Excluding laundry . kitchen, staff and water bodies	120	60	180
07	Hotels (4 star and above) excluding laundry , Kitchen, Staff and water bodies	260	60	320
08.	Offices(including canteen)	25	20	45
09	Restaurants and food court including water requirement for kitchen			
	a. Restaurants	55 per seat	15 per seat	70 per seat
	b. Foodcourts	25 per seat	10 per seat	35 per seat
10	Club house	25	20	45
11	Stadiums	4	6	10
12	Cinemas. Concert Halls and theatres and multiplex	5 per seat	10 per seat	15 per seat
13	Schools / Educational Institutions a. Without boarding facilities	25	20	45
	b. With boarding facilities	90	45	135
14.	Shopping and retail Mall a. Staff	25	20	45
	b. visitors	5	10	15

Sl.No	Type of Building	Domestic Litres per head /day	Flushing Liters per head /day	Total consumption Litres per head /day
15	Traffic terminal Stations a. airports	40	30	70
	b. Railway stations(Junction) with bathing facility.	40	30	70
	c. Railway stations (Junction) without bathing facility	30	15	45
	d. Railway stations (intermediate) with bathing facility	25	20	45
	e. Railway stations (intermediate) without bathing facility	15	10	25
	f. Interstate Bus terminals	25	20	45
	g. Interstate bus terminals/metro stations	10	5	15

Table 9: water requirement as per NBC 2016

Source: National Building code 2016

Water Demand calculation (Peak Demand)

Type	Requirement as per NBC (lpcd)	Number of users /day	Total (Lts/ Day)
Stadium	10	800	8000
Shopping and retail	45	60	2700
Dormitories(hostels)	135	45	6075
Total			**16775**

Table 10 : Water Demand calculation for the Proposed Indoor stadium

Water requirement as per Fire Norms (NBC- 2016)

Overhead Tank **-** Required: 10000 Lts , Provided: **100000 Lts**

Underground Tank – Required: 150000 Lts **,** Provided: **150000 Lts.**

Therefore Total capacity of water tank provided : 250000 Lts

2.1.8 Means of Access

Table 11 - Width of Corridors, Pedestrian Ramps for Types of Buildings

Building use or type	Minimum width of the corridor (m)	Minimum staircase width (m)	Minimum Ramp width (m)
Assembly buildings such as auditorium, community hall etc.	2.0	2.0	2.0
Commercial buildings such as retail shops, private office, nursing homes, lodges, etc.	1.5	1.5	1.5
All other buildings	1.5	1.5	1.5

Source: Mangalore Zonal Regulations, 2011

2.1.9 Public Toilets

In any commercial complex, neighborhood shops and assembly buildings, public toilet blocks shall be provided compulsorily. Such public toilet shall be of minimum 1.5 percent of the total commercial floor area if the total commercial floor area is above 10000 Sq.m and of minimum 2 percent of the total commercial area if the total commercial area is less than 10000 Sq.m. Minimum size of common toilets should be 1.0 m x 1.25 m

2.1.10 Distance of Building from Electrical Lines

Table 12 - Distance of Building from Electrical Lines

Description	Vertical distance from maximum sag of electrical line (m)	Horizontal distance from the edge of the electrical line (m)	Electric line corridor width (m)
L.T. line	3.5	1.8	4.5
H.T. line of 11 KV	4.5	1.8	4.5
H.T. line of 33 KV	4.5	2.5	15.0
H.T. line of 66 KV	4.58	3.0	18.0
H.T. line of 110 KV	5.0	3.2	22.0
H.T. line of 132 KV	5.0	3.5	27.0
H.T. line of 220 KV	6.2	4.2	35.0
H.T. line of 400 KV	Subject to clearance form Electrical Dept.		50.0

2.1.11 Solar Water Heater Requirements

Table 13 - Solar Water Heater Requirements

Type of use	100 liters per day shall be provided for every unit
Restaurants service food and drinks with seating/ serving area of more than 100 m^2 and above.	40 m^2 of seating or serving area
Lodging establishments and tourist homes	3 rooms
Hostel and guest houses	6 beds / persons capacity
Kalyana Mantapa, community hall and convention hall (with dining hall and kitchen)	30 m^2 of floor area
Recreational clubs	100 m^2 of floor area

Source: Mangalore Zonal Regulations, 2011

SUMMARY OF APPLICABLE STANDARDS

- **Floor Area Ratio (FAR): Based on our Analysis of the applicable standards, the available FAR is (2.3 + 1.0 + 0.5) = 3.8**
- **Permissible FAR at 2.5 and 4.0 for Plot area 4,687 Sq.M is as follows:**

FAR (Unit)	Calculation	Applicable BUA
2.5	4,687*2.5	11,717 sq. m. or 1.3 lakh sq. ft.
3.8	4,687*4.0	17,810 sq. m. or 1.9 lakh sq. ft.

- **Ground Coverage (GC)**: Permissible range is 65%.
- **Setbacks and Height Permissible:** For a Total Height of +23M from Ground Level, setback considered is 6M on the south side, i.e. side consisting of 24M wide Road. A Setback of 7M is considered for the rest of the sides.
- **Total parking required – 152 Total parking provided - 160**

2.2 STANDARDS FOR BADMINTON AND KABADDI COURTS

2.2.1 Badminton Standards

The standard size is that of a doubles court, although, a singles court can be used where space is severely restricted. Outside the court area, the appropriate dimensions are:

safety strip (sides)	1.25m
safety strip (front and rear)	2.5m
side-to-side distance between courts	0.3m
end-to-end distance between courts	1.3m
between courts and walls	1.5m

- Spectators must always be accommodated behind the safety strip.
- For international competitions, the minimum hall height is 8 m, with at least 6 m over the back line of the court.
- The height of the net at the posts is 1.55 m and is 1.525 m in the middle. The depth of the net is 760 mm.
- The floor should be lightly sprung.
- The hall, if possible, should not have windows, the court being lit by roof lights, which should not be dazzling (i.e. 300 lux or less)

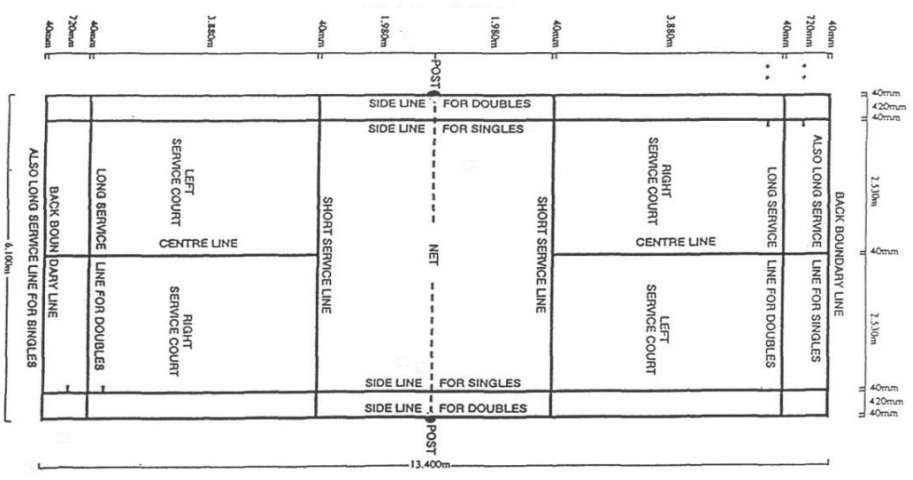


Figure 5 - Badminton court dimensions

Source : Badminton World federation

2.2.2 Indoor Kabaddi Standards

The game of Indoor Kabaddi will be governed and played under the following rules of IKF

PLAY FIELD

1. The game of Kabaddi will be played on a Synthetic Ground (Kabaddi Mat) or on soft soil surface.

   The specifications of the Kabaddi Mat are as follows:

- Japanese Synthetic Rubber + Ethylene Vinyal Acetate
- 25 to 30 Shore A
- Thickness 25 mm to 40 mm
- Proper carpeting should be done beneath the Mat before Laying the Mat.

2. The desirable ground size should be 18x18 Meter but not less than 15x17 Meter (Where 15 is vertical)
3. **PLAY FIELD MEASUREMENTS**

   Men and Junior Boys 11x9 Meters (as shown in the diagram)

   Women and Junior Girls 10x8 Meters (as shown in the diagram)

TERMINOLOGIES OF FIELD OF PLAY (FOP)

1. **Boundaries** The line on the four side of the playfield are known as the boundaries. All lines will be of 3 to 5 cm width and will be the part of the FOP.
2. **Lobbies** The area on both the vertical sides of the playfield measuring one meter in width x length of the FOP are known as the Lobbies. Lobbies will become part of Play field once struggle starts.
3. **Mid Line** Horizontal line that divides the play field into two halves is known as the mid-line.
4. **Half** Each half of the playfield divided by the mid line will be known as half.

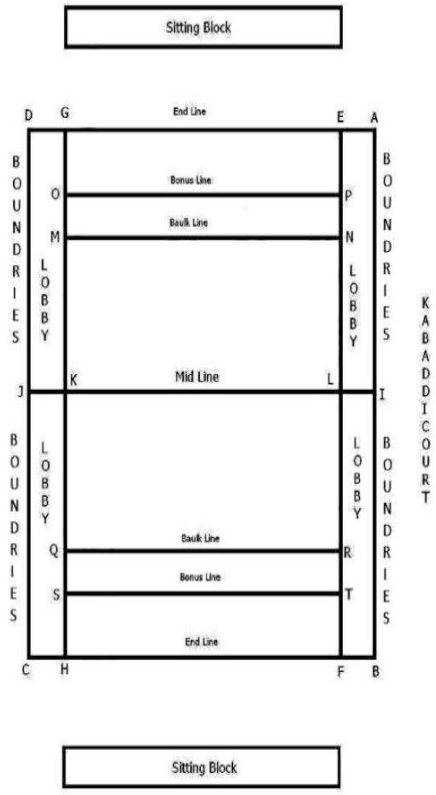


Figure 6 - Kabaddi court dimensions

Source: AKFI-Rules and Regulations of all forms of Kabaddi, 2017

	FIELD MEASUREMENTS	MEN & JUNIOR BOYS	WOMEN & JUNIOR GIRLS	SUB JUNIOR BOYS & GIRLS
		ALL MEASUREMENTS IN METERS		
1	Side lines (AB, CD, EF & GH)	13	12	11
2	End Line (AD, BC)	10	8	8
3	Lobby (AE, BF, DG, CH)	1	1	1
4	Baulk Line (from Mid line) (LN, KM, LR, KQ)	3.75	3	3
5	Baulk Line (RQ, MN)	8	6	6
6	Mid-line (IJ)	10	8	8
7	Bonus Line (TS, PO) from Baulk Line (RT, QS, MO, NP)	1	1	1
8	Bonus Line (MN, ST)	8	6	6
9	Sitting Block (2 meters away from End lines)	8x1	6x1	6x1
10	Half (Each half of the playfield divided by the mid line)	6.5	6	5.5
11	Space surrounding the play field from side lines	4 meter	4 meter	4 meter
12	Duration of a Match	20-5-20 Minutes	15-5-15 Minutes	15-5-15 Minutes

Source: AKFI-Rules and Regulations of all forms of Kabaddi, 2017

3. SITE STUDY

3.1 CITY CONTEXT AND CONNECTIVITY

- Mangalore is the gateway to Karnataka. It is a port city and the headquarters of Dakshina Kannada district in the coastal region of Karnataka State in India.
- The site is located at Urwa market, Mangalore.
- Urwa is a residential locality within the city limits of Mangalore, in the state of Karnataka in India.
- Urwa is famous for the Mariyamma Temple, which is popularly known as Urwa Marigudi, and also several renowned educational institutions
- The site is situated at a distance of 760 metres from the Gurupura river.

Figure 7 - Existing Site

3.2 IMPORTANT LANDMARKS

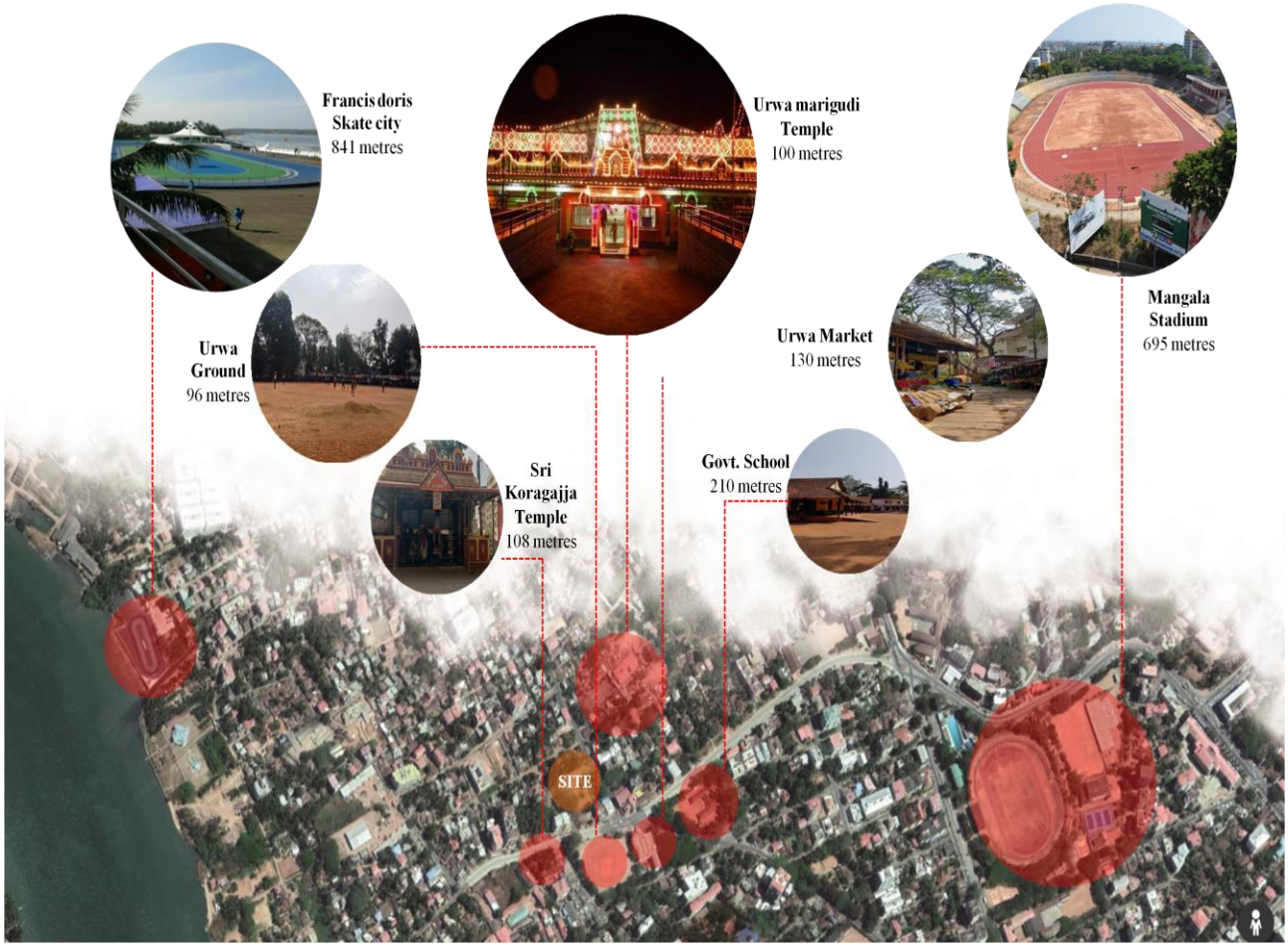


Figure 8 - Important Landmarks

3.3 SITE ACCESS

- The site could be primarily accessed through the Sultan battery road or Pentland pet road.
- The secondary two access to the site is through the Urwa Marigudi road and a vehicular driveway/pedestrian pathway.
- There is a medium traffic intensity around site.

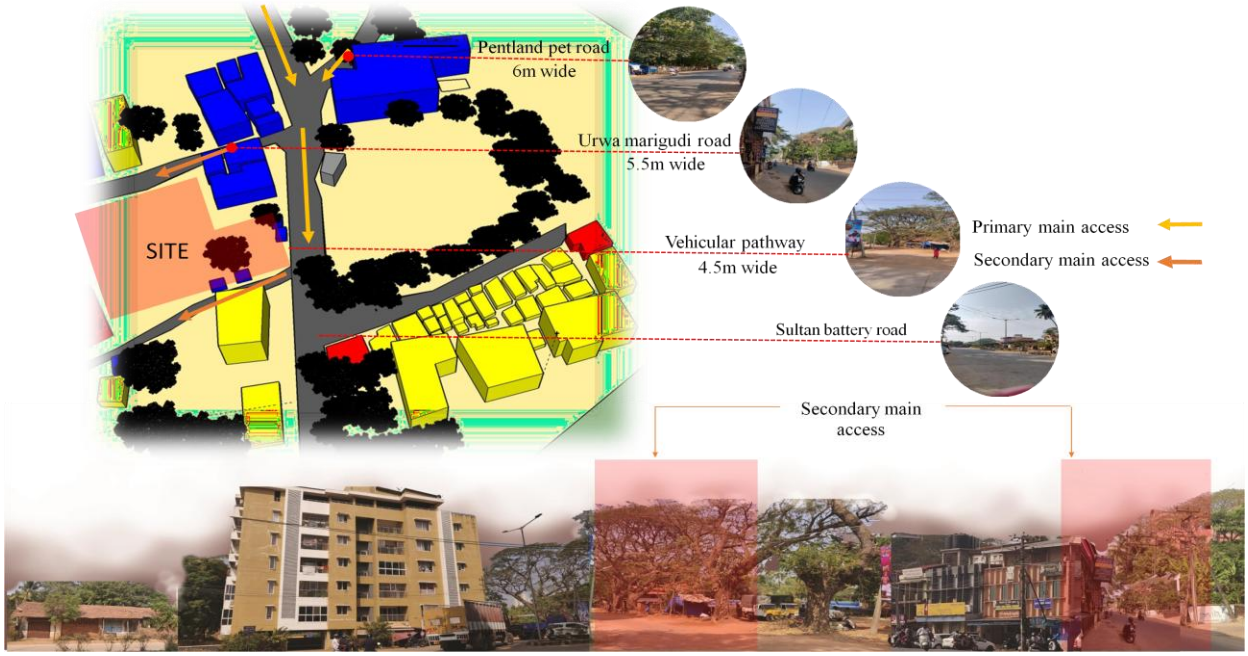


Figure 9 - Site Access

3.4 SUN PATH

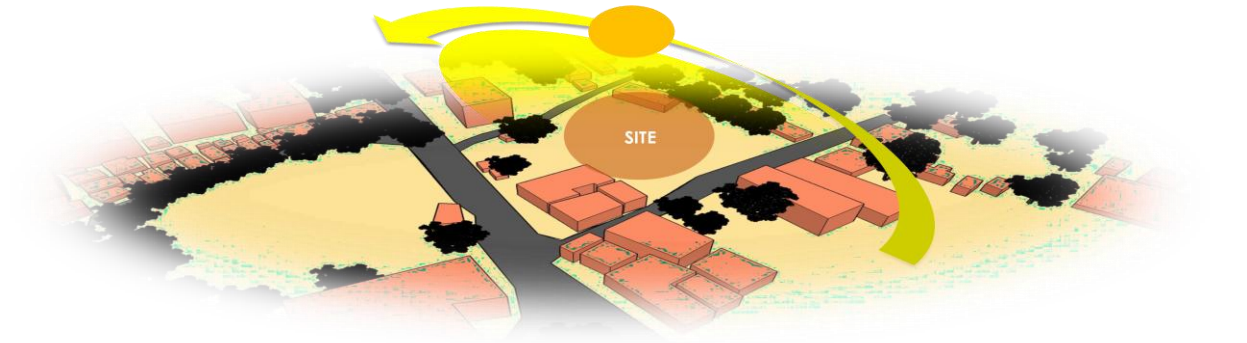


Figure 10 - Sun Path

Figure 12 - Summer Solstice – 21st June

Source: Google Maps

Figure 11 - Winter Solstice – 21st

Source: Google Maps

3.5 CLIMATE

3.5.1 TEMPERATURE

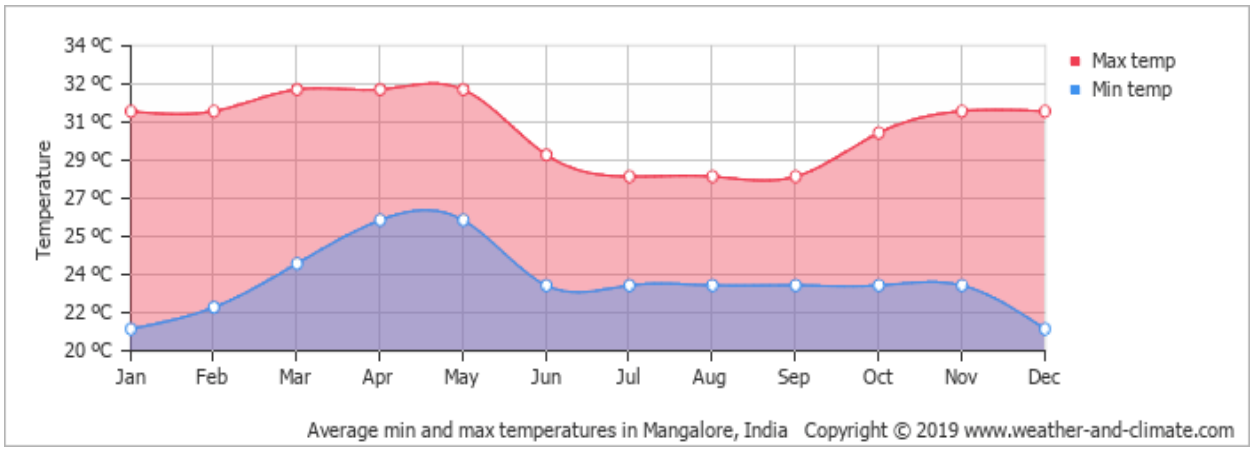
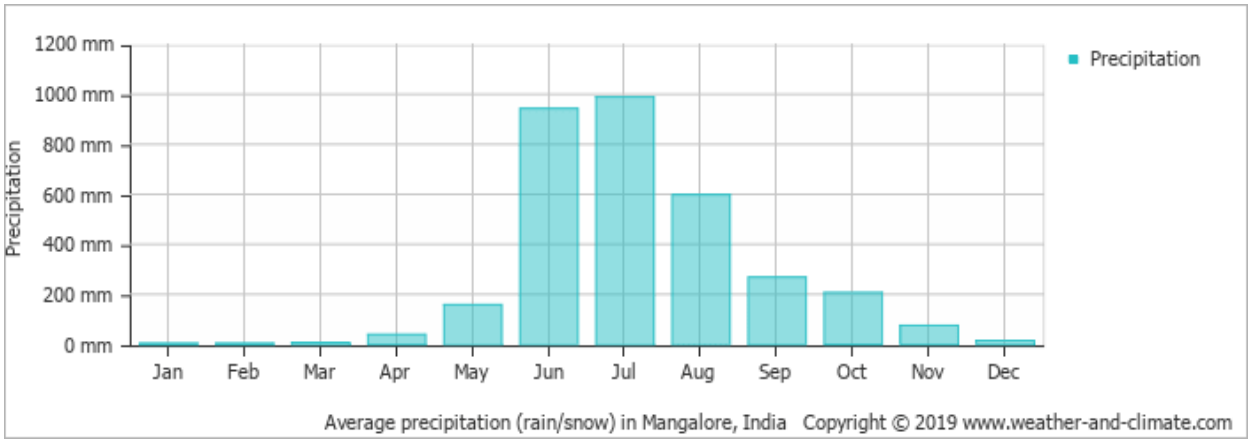


Figure 13 - Average Temperatures

Mangalore belongs to the tropical/ megha thermal zone and is under the direct influence of the Arabian Sea branch of the south-west monsoon. Temperature Mangalore has a tropical climate; summer and winter months experience similar temperature conditions, with average temperatures ranging from 27 °C (81 °F) to 34 °C (93 °F).

Wind Moderate to gusty winds occur during day time and gentle winds at night. Winds are strong and are mainly westerly and south-westerly in the southwest monsoon months. In the rest of the year, winds are mainly from north-east in the fore-noon and westerly and north-westerly in the afternoon.

3.5.2 PRECIPITATION



Source: www.weather-and-climate.com

Figure 14 - Average Precipitation

- Mangalore receives about 90 per cent of its total annual rainfall within a period of about six months from May to October, while remaining relatively dry from December to March.
- The annual precipitation in Mangalore is 4,242.5 millimetres (167 inches). Humidity is approximately 78 per cent on an average, and peaks during May, June and July. The maximum average humidity is 93 per cent in July and average minimum humidity is 56 per cent in January. The relative humidity is generally very high reaching saturation levels during the summer period.

3.5.3 WIND DIRECTION

- From the month of January 2019 to December 2019, 38% of wind travels from east to west, where as, 28% of wind travels from west to east.
- These have been considered as the prominent wind directions for the site.

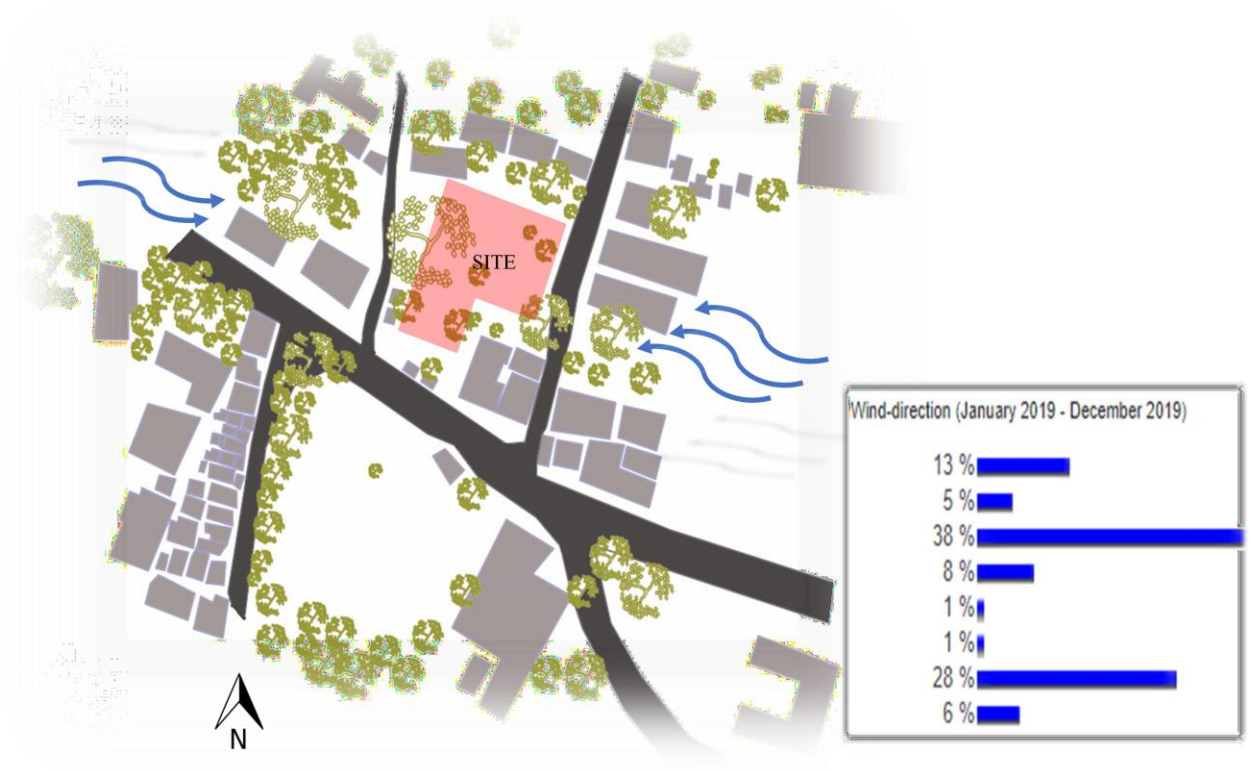


Figure 15 - Wind direction for Mangalore Source: www.weather-and-climate.com

3.6 VEGETATION STUD

Figure 16 - Vegetation Study

3.7 TOPOGRAPHY STUDY

Figure 17- Topography and Elevation

Source: Google Maps

- The site has slight level differences within the plot, which leads to opportunities for different entrances by each level.
- Site is elevated at 83ft from sea level

3.8 ACTIVITY MAPPING

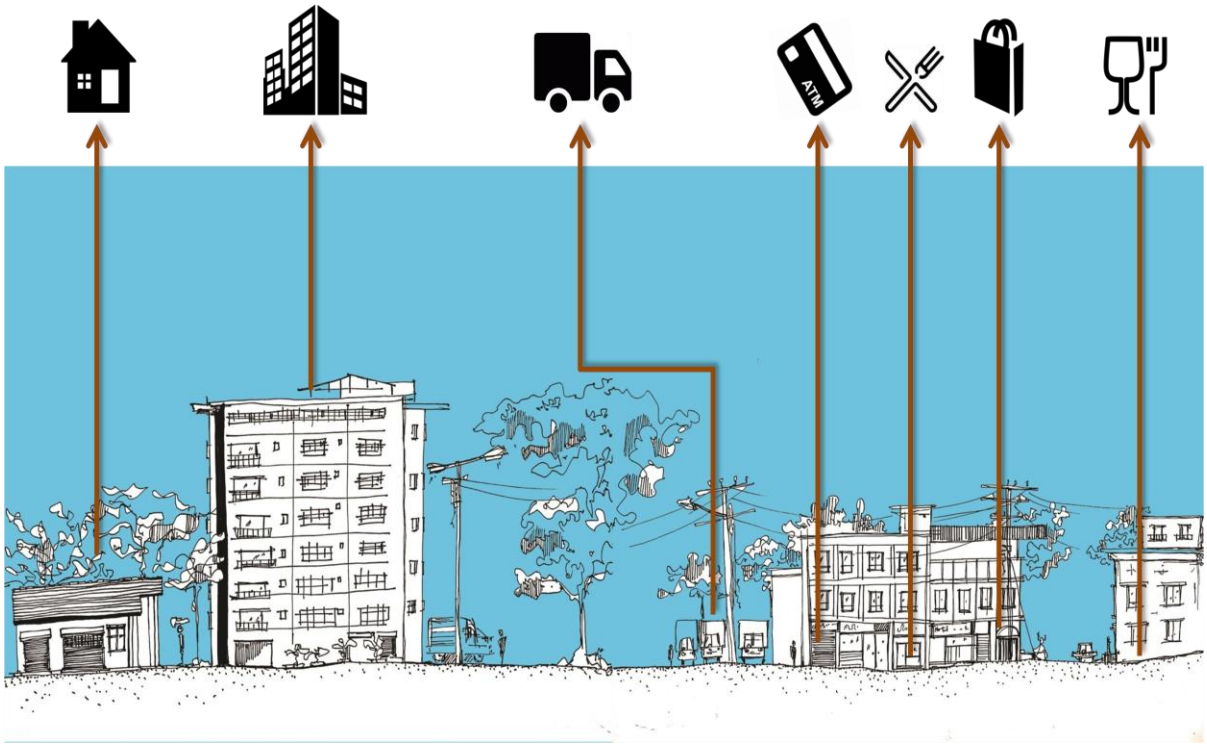
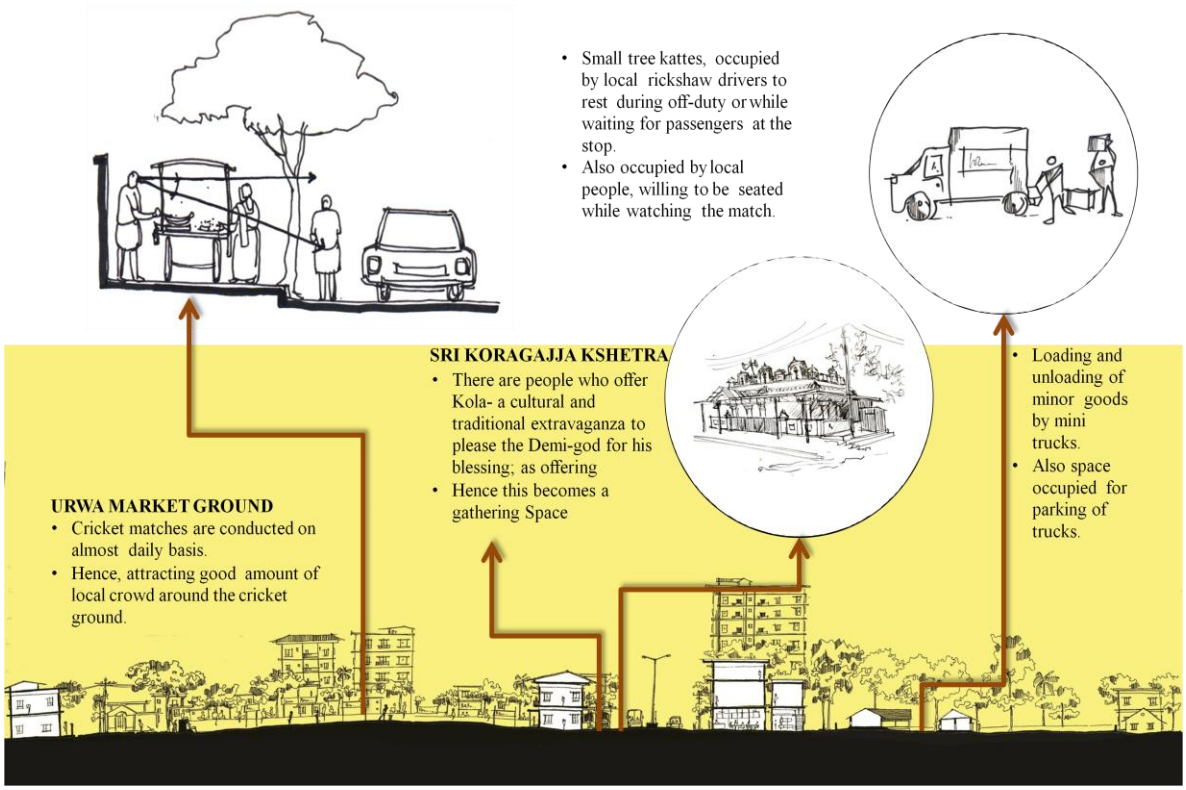
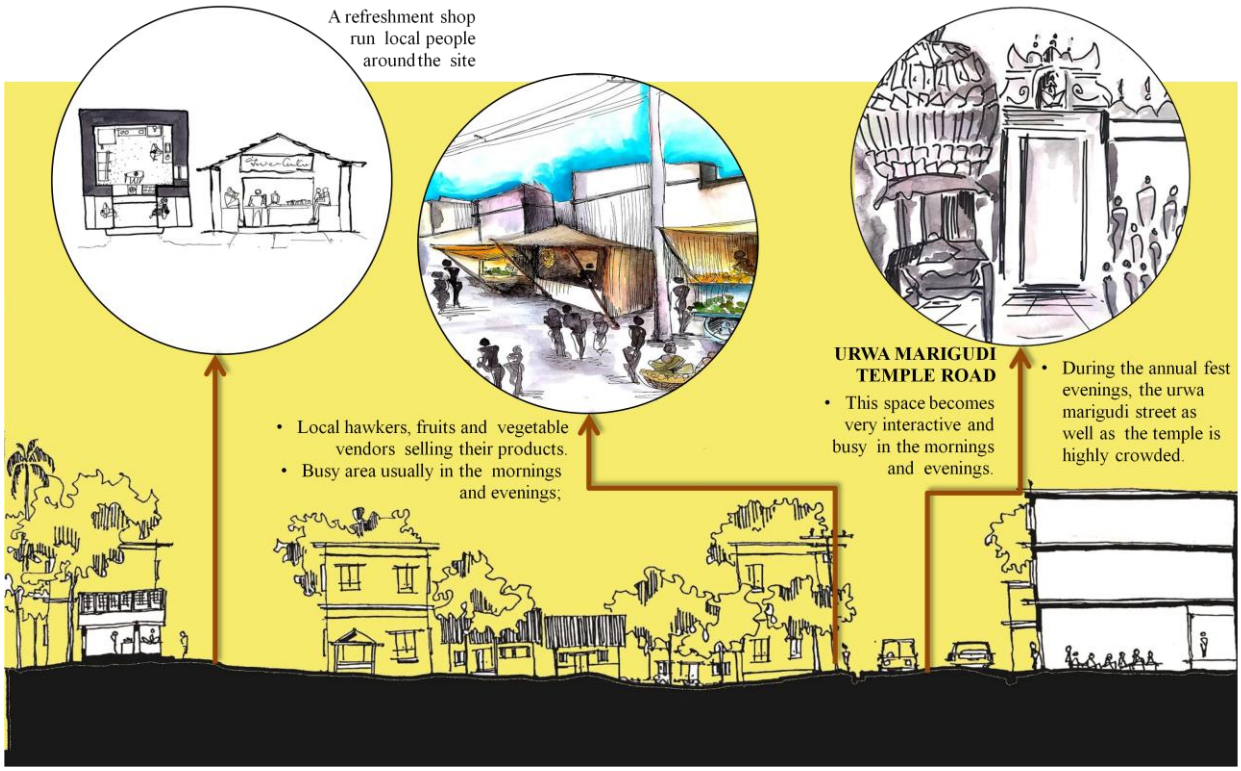


Figure 18 - Activity mapping





3.9 SITE IMAGES

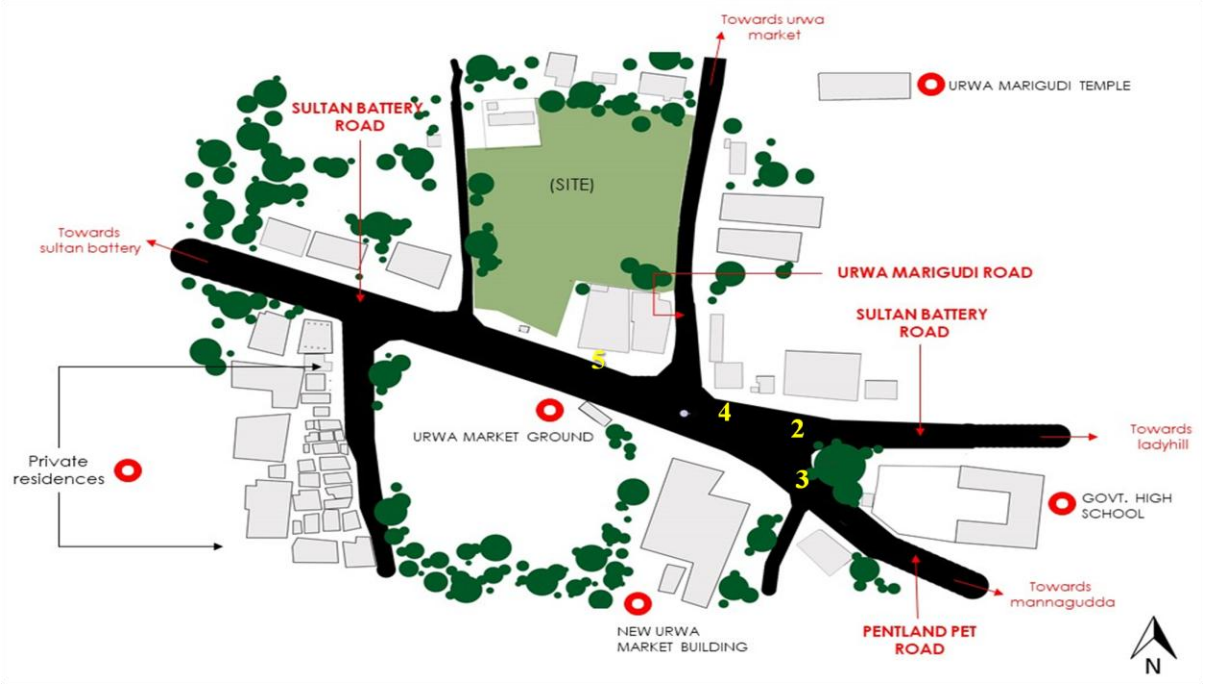


Figure 19 - Site Images

Figure 21 - .View of the Urwa market bus stand from Sultan Battery road.

Figure 20 - View of the local Deity's Katte from Sultan Battery road.

Figure 23 - View of old Urwa market area from Pentland pet road.

Figure 22 - View of new Urwa market building from urwa marigudi road.

Figure 24 - View of Urwa market ground pavilion from Sultan Battery road

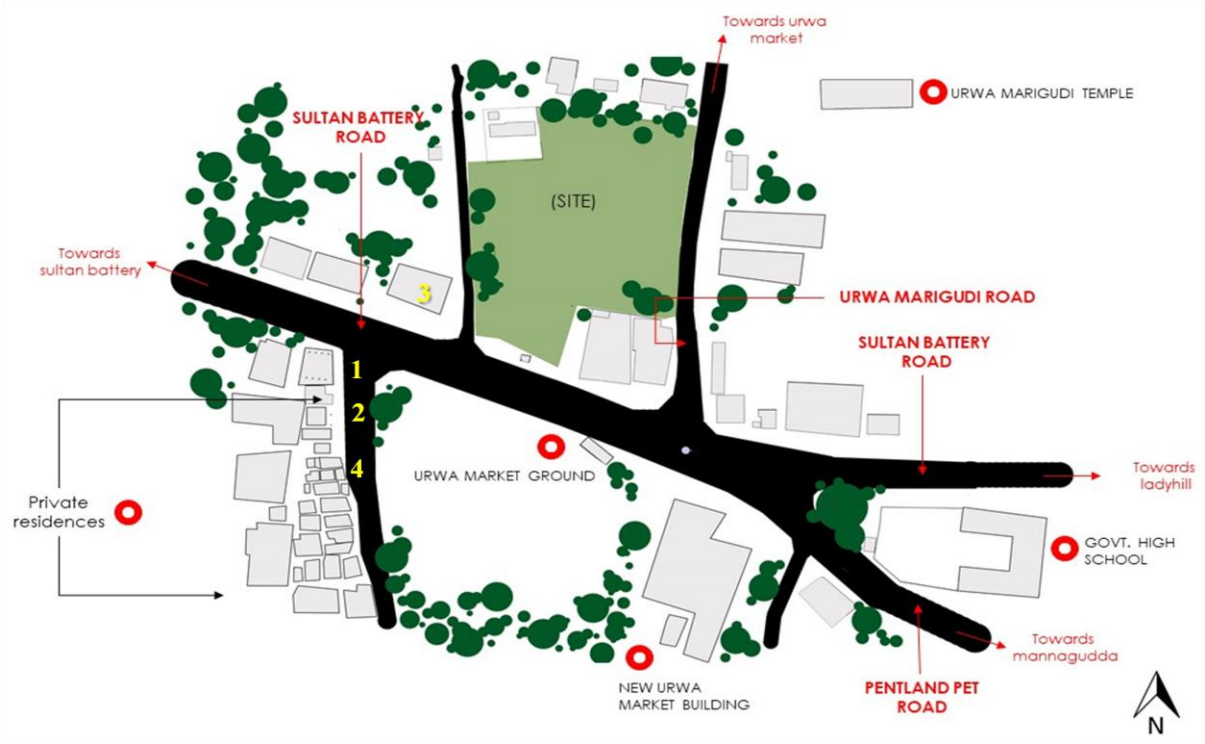


Figure 26 - View of the Koragajja temple from Sultan Battery road.

Figure 25 - View of Residential Buildings from Sultan Battery road.

Figure 28 - View of Residential Building from Sultan Battery road.

Figure 27 - View of new Urwa market ground from residential building

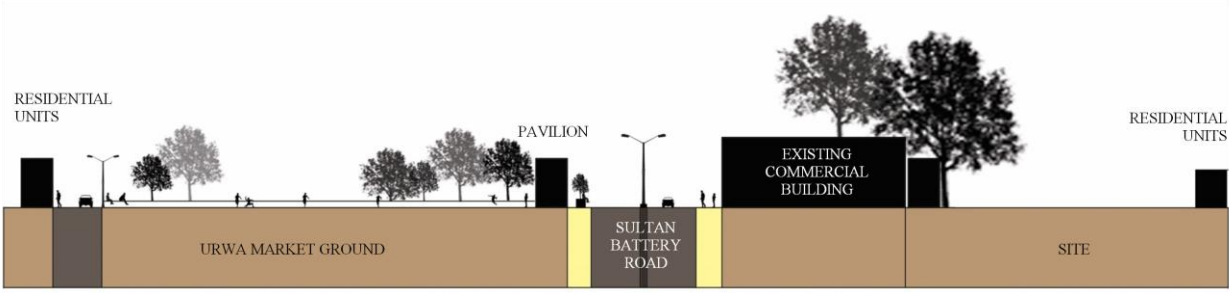


Figure 29 - Google earth image of the site

4 CASE STUDIES

4.1 INTRODUCTION

A large amount of relevant literature pertaining to indoor sports complex projects was collected, analyzed and subsequently incorporated into this Report. A selection of Case Studies is provided in the sections below alongside their key practices and learnings.

4.2 SAN WAYAO COMMUNITY SPORTS CENTRE, CHENGDU, CHINA

More than a sports facility, this project grew from the need for a communal center for all age groups, for its neighborhood. With the aim of producing a friendly and welcoming ambience, the concept was to integrate the building and site. Creating a sloping exterior by extruding and connecting the sports ground on the east with a walkable sloping roof , lead to a stronger space perception of the building as a public facility. The roof serves the dual purpose of a walking route, and bleachers for the east sports ground. Moreover, the lawn roof provides spaces for grass skating, yoga, picnic and more for the community without charging a fee.

Table 14 - San Wayao Community Sports Centre: Details

Architects	CSWADI
Built-up area	11,936.0 sqm
Sports Facilities	•Swimming pool •Fitness center •Tennis courts •Basketball courts •Squash court •Ping pong table
Additional Facilities	•Café •Spa •Sauna •10 Retail Shops

Source: "San Wayao Community Sports Center / CSWADI" 29 Jun 2015. ArchDaily

Figure 30 - Case study 1- Basement Plan

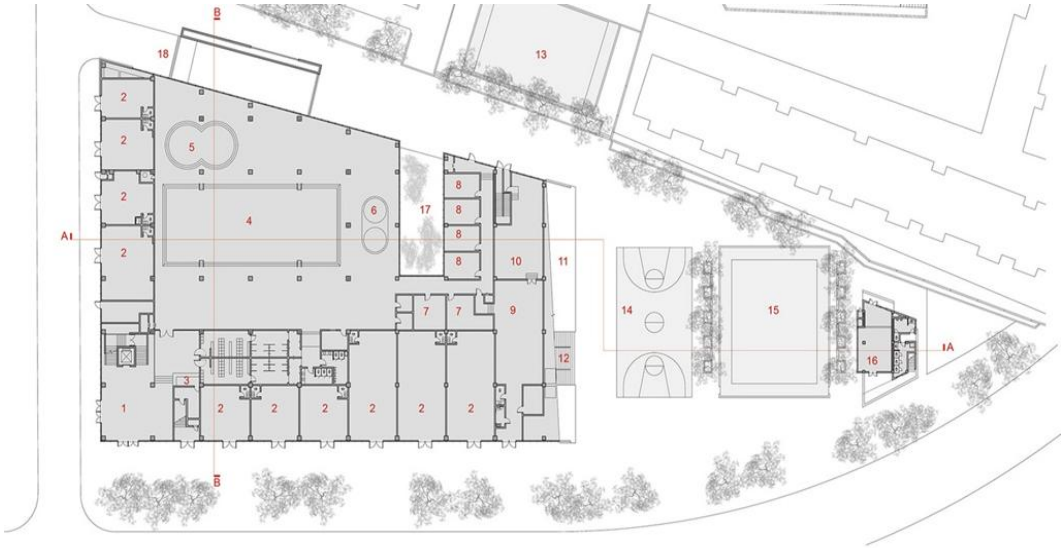


Figure 31 - Case study 1 Ground Floor Plan

Figure 32 - Case study 1- First Floor Plan

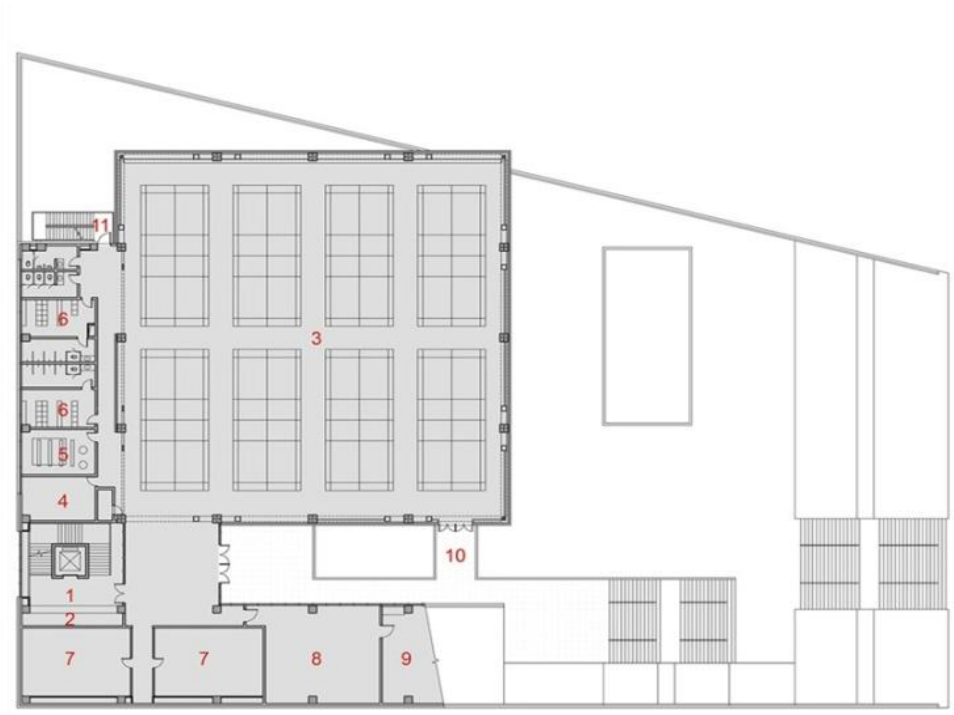


Figure 33 - Case Study 1- Second Floor Plan

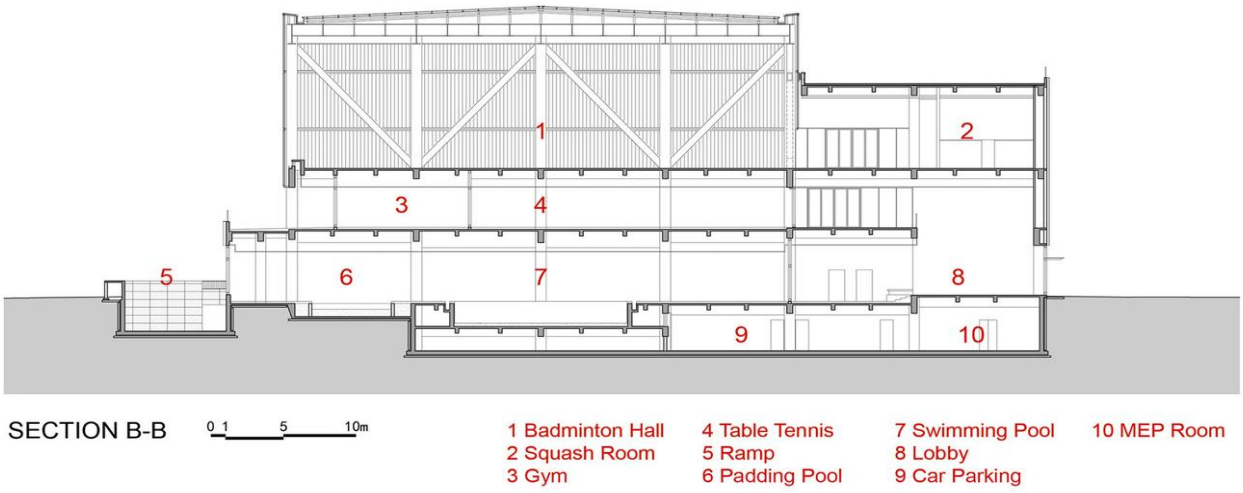


Figure 34 - Case Study 1 - Section

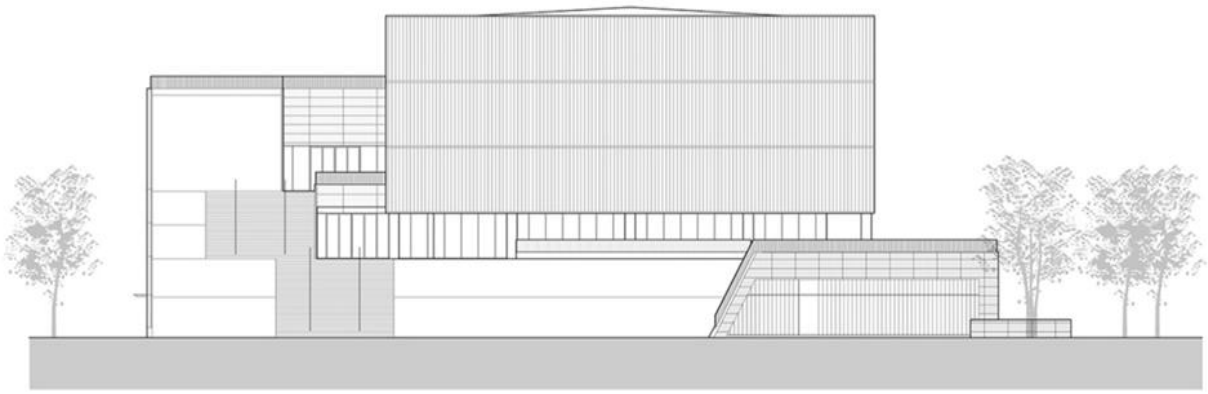


Figure 35 - Case Study 1- East Elevation

Figure 37 - View of Sports Centre

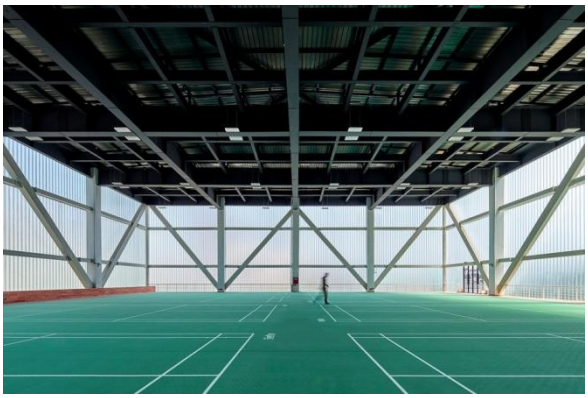


Figure 36 - View of Badminton

Source: ArchDaily.

4.3 CHEOMDAN BADMINTON COURT, GWANGJU, SOUTH KOREA

The concrete exterior of this badminton court by JHW IROJE architects and planners and The Sa-ram Architects, is colored to match the soft red-brown color of the local soil along the Yeongsan riverbank. It is contrasted with a row of clerestory windows clad in blackened-steel. A ribbed treatment introduces further texture to the external surfaces. The horizontal lines engraved into the facades are intended to evoke the movement of a shuttlecock. The robust rectilinear volume contains several badminton courts in a single-span hall measuring 50 meters long by 20 meters wide. Post-tensioned beams supplement the concrete framework and negate the need for visible vertical supports. Natural light filters into the hall through gaps between the concrete beams, which span the full width of the building.

Figure 39 - Case Study 2-Indoor Badminton Courts

Figure 38 - Case Study 2-Exterior View of Complex

Source: ArchDaily.

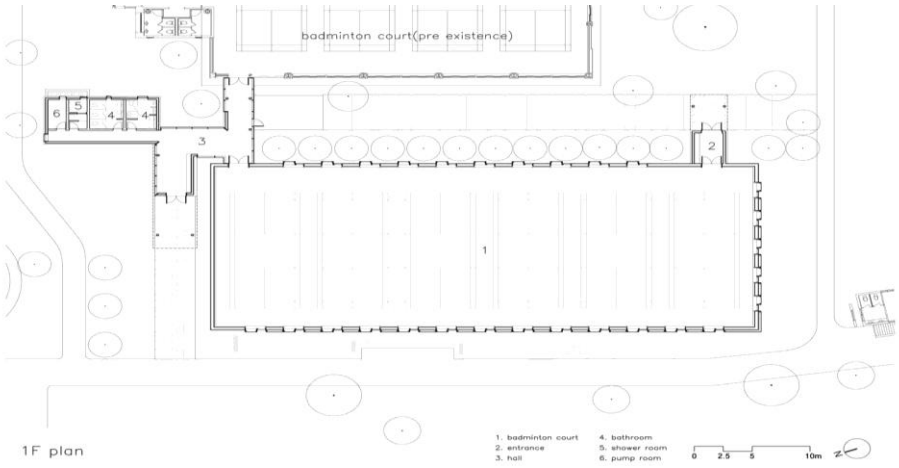


Figure 40 - Case Study 2-Ground floor plan

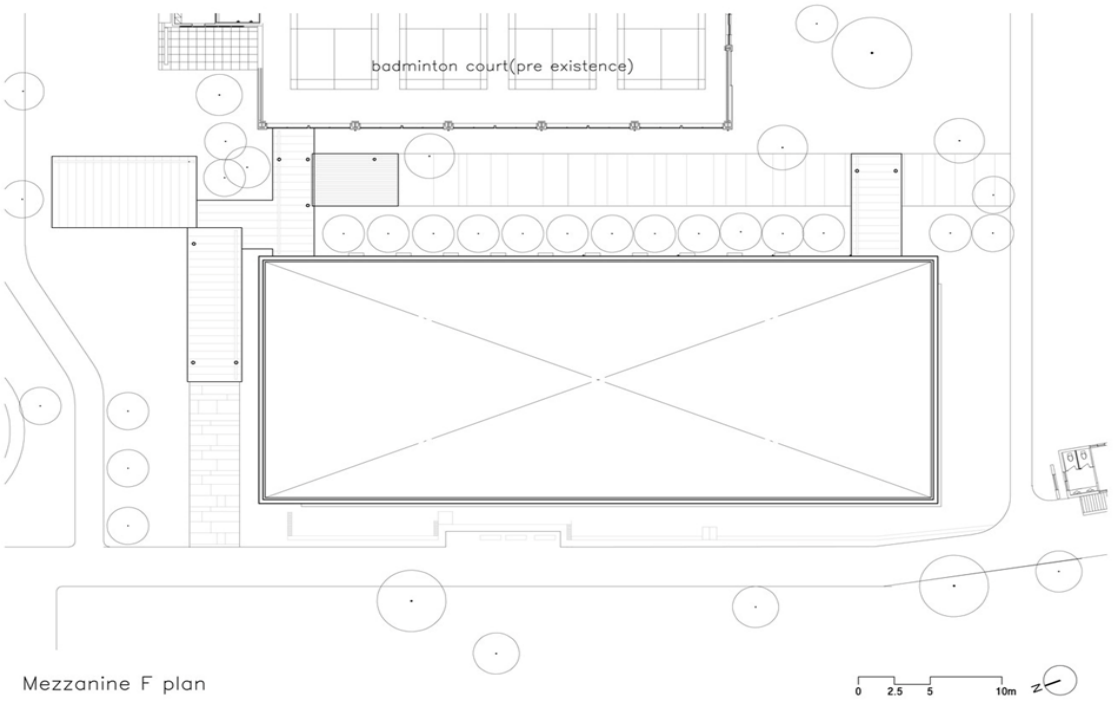


Figure 41 - Case Study 2-Mezanine floor plan

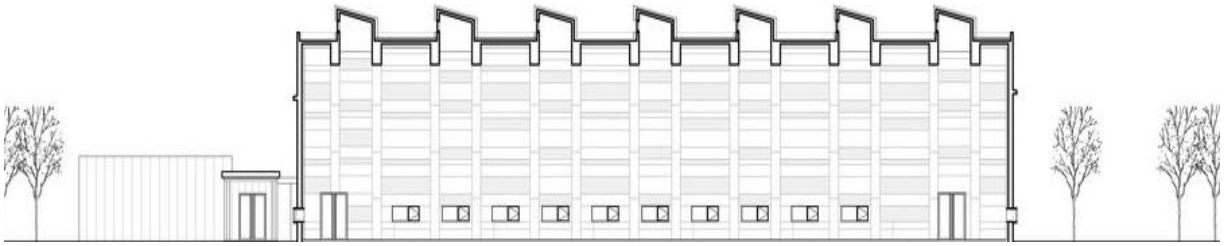


Figure 42 - Case Study 2-Section

Figure 43 - Case Study 2-East elevation

4.4 MARENA INDOOR SPORTS ARENA, KARNATAKA, INDIA

This state-of-the-art indoor sports arena, is made to cater to the recreational and fitness needs of students and staff of Manipal University, Manipal. The idea of a complex such as this stemmed from the fact that Manipal is totally drenched for about six months during monsoons, frustrating sports enthusiasts and the fitness freaks. The sloping glass façade, gives the complex a modern look, as well creates a welcoming ambience. A major challenge was the steep contours of the area, which led to five basement levels, below the entrance floor. A major attraction is the jogging track on the first floor, which offers breathtaking views of the lush green surroundings

Table 15 - Marena Indoor Sports Arena: Details

Built-up area	13,197 sqm
Sports Facilities	•Synthetic jogging track •Separate locker rooms for boys and girls •Four squash courts •Basketball court •Five badminton courts •Playing area for futsal •Cricket bowling machine
Additional Facilities	•Idea Centre •Sauna and steam rooms •Simulation game enclosures •Gymnasium

Source: https://manipal.edu/content/dam/manipal/mu/documents/marena-brochure-2-pdf.

Figure 45 - Case Study 3-Exterior View of Marena

Source: Marena Sports Brochure, Manipal.edu

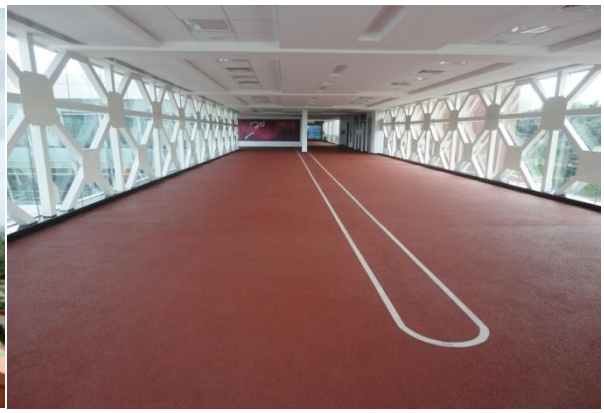


Figure 44 - Case study 3- Jogging Track

Source: Marena Sports Brochure, Manipal.edu

Figure 47 - Case Study 3-Transition Spaces and Seating

Source: Marena Sports Brochure, Manipal.edu

Figure 46 - Case Study 3- Indoor Badminton Courts

Source: Marena Sports Brochure, Manipal.edu

4.5 IIM BANGALORE SPORTS CENTRE, Karnataka, India

The intended concept of the facility, aims to establish a tranquil relationship between building, human, site and nature Main access and secondary access spines are created using trees as focal points, in order to retain the existing trees on site. The sports facilities are planned in two levels, in response to the contours. There is a gradual transition: starting from the pergola-covered double height, which acts as the main circulation spine, up to a semi open verandah and eventually to the enclosed sports hall. Wide steps and platforms located in the sporting facility hold cultural activities and connect the building to the landscape. The intended concept aims to establish a tranquil relationship between building, human, site and nature. Formal and informal interaction is encouraged through the use of common areas for staff and students. The main materials are stone and concrete, that help unify the new to the existing material in terms of language

Table 16 - IIM Bangalore Sports Centre: Details

Architects	Mindspace
Built-up area	3,438 sqm
Sports Facilities	•Cricket •Tennis •Basketball •Volleyball •Badminton •Table tennis •Pool •Swimming pool

Source: "IIM Sports Center / Mindspace"

Figure 49 – Case Study 4-View of Sports Center

Figure 48 – Case Study 4- Indoor Badminton Courts

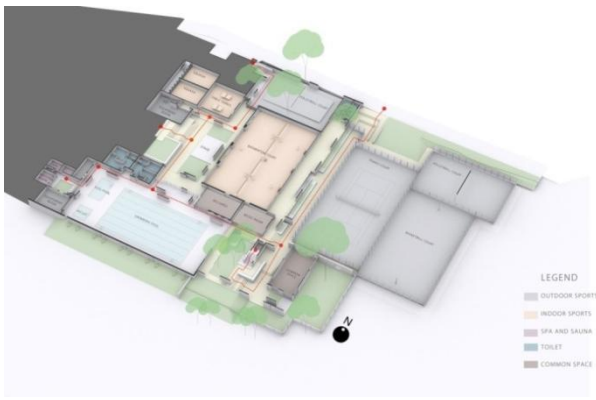


Figure 51 - Case study - Ground Floor Plan

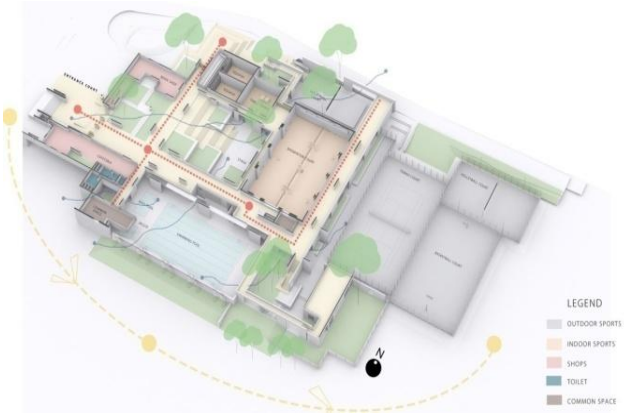


Figure 50 – Case Study- First Floor Plan

Figure 52 –Case Study 4- Section

4.5 KEY LEARNINGS AND OBSERVATIONS

Parameters	Inferences
Context	•The structure could follow the architecture of the surrounding buildings, yet stand out and be iconic landmark.
Accessibility	•Access to public transport plays an important role in the location of a sports facility. •It should be easily accessible to all age groups.
Parking	•On site parking should be implemented for the public. •Basement parking can be proposed if the site is constrained.
Zoning	•Changing and locker rooms should be in proximity to the courts. •Dorms/ guest rooms can be proposed within the facility. •Commercial spaces such as retail shops can be proposed to create a self-sustaining economic structure.
Circulation	•The courts should be column free. •The column layout should not hinder visibility from the seating areas.

Table 17- Case Study Inferences

5 SUSTAINABLE DESIGN CONCEPTS

5.1 INTRODUCTION

This section covers the certain elements that have been proposed in the project to make it sustainable. This would not only make the project environment friendly, but also reduce the present and future cost leading to a win-win situation. Construction of a building requires a lot of energy consumption, even more so, during its lifetime in terms of maintenance. The sustainable design concepts help to reduce that energy consumption footprint. Conventional materials and building practices would be replaced by energy efficient products making it a project for the future that the residents of Mangalore city can be proud of.

5.2 GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

Green Rating for Integrated Habitat Assessment or GRIHA is a tool to facilitate design, construction, operation of a green building, a process which in turn measures the "greenness" of a building in India. The standard is promoted by the Ministry of New and Renewable Energy, Government of India. As of date, more than 1000 projects have been registered with almost 430 million sq. ft. of built up area. GRIHA can rate all types of habitable spaces including offices, retail spaces, institutional buildings, hotels, hospital buildings, healthcare facilities, residences and multi-family high-rise buildings etc. The rating variants are given as an example in the figure below:

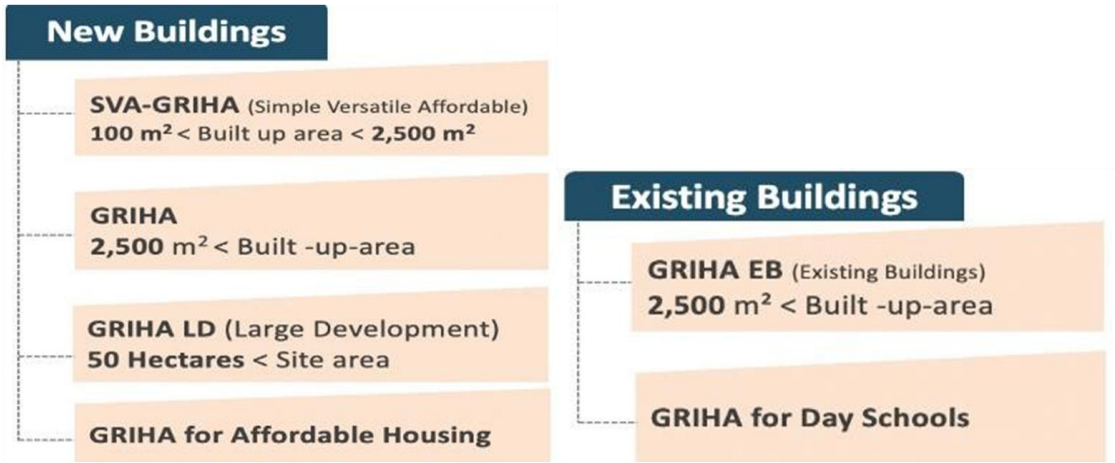


Table 18 - GRIHA Rating Variants

GRIHA is involved in all stages of the Project, right from Design, Construction, and Operation to Maintenance. The rating process is thus:

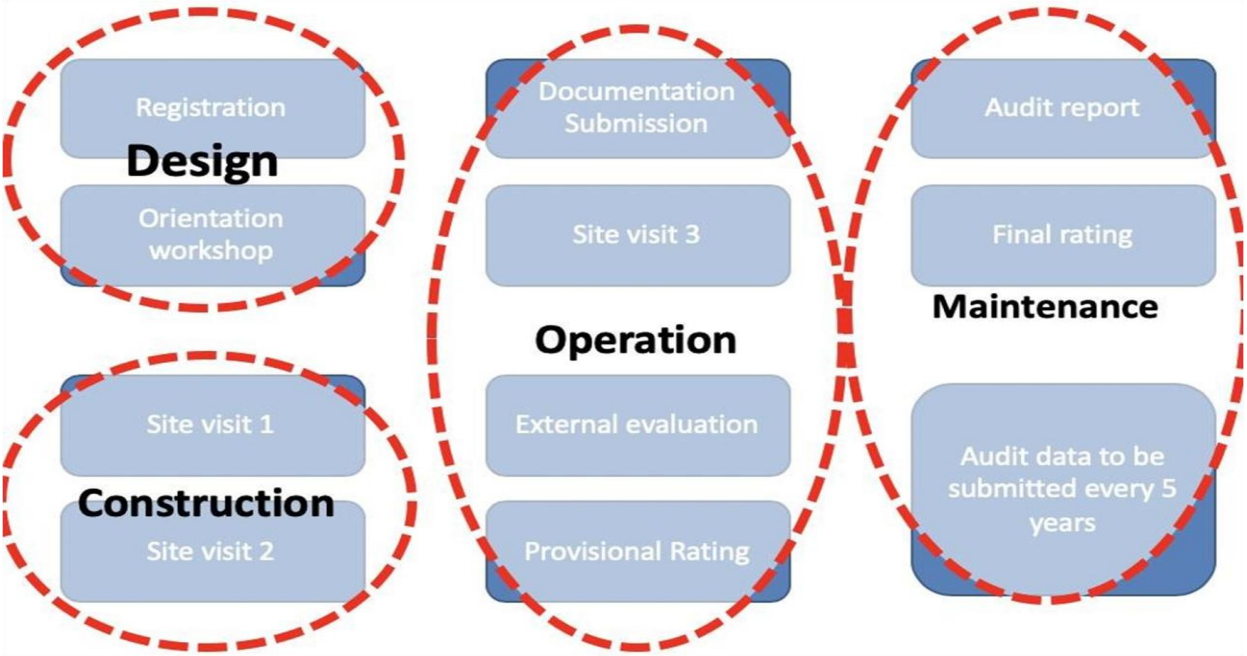


Figure 53 - GRIHA Rating Process

Source: GRIHA

The key features of GRIHA V 2015 are:

1. rates all building typologies
2. performance based rating system
3. rates air-conditioned as well as non-air-conditioned buildings
4. criteria are customized for different climate zones and regions of India
5. adopts an integrated design approach
6. emphasizes on human comfort
7. non-applicability clauses – common sense in rating system

While the point's weightage and associated scores are given in the figures below:

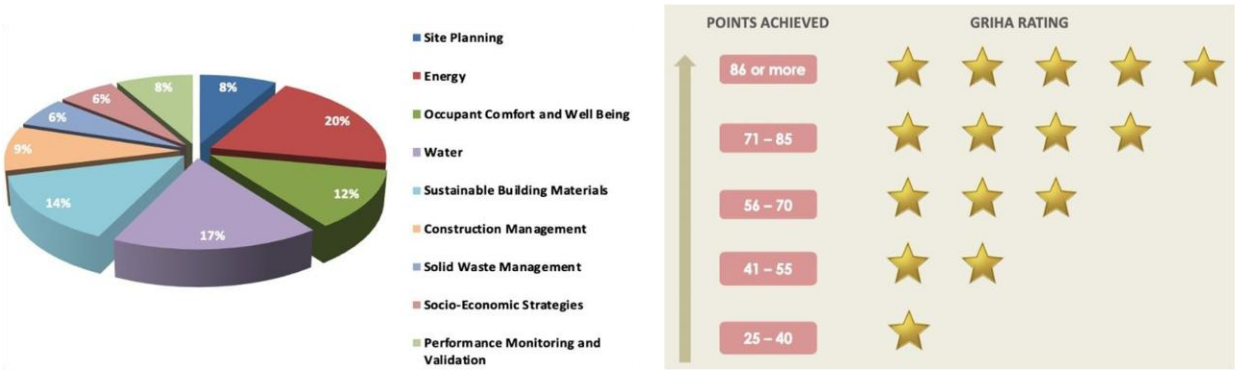


Figure 54- GRIHA Points Rating and Weightage Source: GRIHA

An example of a 5-star GRIHA rating is the HAREDA (Department of Renewable Energy, Government of Haryana) building. It is a Zero Energy Building with an Energy Performance Index (EPI) of 17 kWh/ sq. m. /annum and 42.5 kWp of Renewable Energy (RE) installed. Similarly, the Indira Paryavaran Bhawan in New Delhi is also certified as GHIRA 5-star with an EPI of 24.13 kWh/ sq. m. / annum with RE of 930 kWp and zero water discharge.

Figure 56- HAREDA, Haryana

Source: GRIHA

Figure 55 - Indira Paryavaran Bhawan, New Delhi

Source: GRIHA

5.3 BUREAU OF ENERGY EFFICIENCY

The Government of India, set up Bureau of Energy Efficiency (BEE) on 1st March 2002, following the pre-requisites of the Energy Conservation Act, 2001. The purpose of the Bureau of Energy Efficiency is to help promote policies and strategies with a push on self-regulation and market strategies, within the overall structure of the Energy Conservation Act, 2001 with the initial objective of diminishing the energy strength of

the Indian economy. This will be accomplished with the effective participation of all stakeholders, resulting in the accelerated and continued confirmation of energy efficiency in all sectors.

The Major Regulatory Functions of (Bureau of Energy Efficiency) BEE include:

- Develop least energy performance patterns and labeling design for tools and appliances (TV, refrigeration, A/C etc)
- Promote precise energy conservation building codes
- Promote projects focusing on selected users
- Promote special energy expenditure norms
- Verify energy managers and energy auditors
- Authorize energy auditors
- Describe the manner and periodicity of necessary energy audits
- Develop reporting formats on energy consumption and action used on the advice of the energy auditors
- **BEE Star Rating**
- The **star rating** is a measure of energy efficiency of an appliance, it is a five points scale where higher the rating lower is the energy consumption and hence better savings. BEE Star Label is usually present on heavy electrical appliances like Air conditioners, Refrigerators and Washing machines etc. with a number of stars it has got and an estimated power consumption of the appliance in a year that it is expected to consume (Power consumption = 1 electrical unit).

Figure 57 - BEE Star Rating

Source: BEE

5.4 ENERGY CONSERVATION BUILDING CODE

The Energy Conservation Building Code (ECBC), was launched by Ministry of Power, Government of India in May 2007, as a first step towards promoting energy efficiency in the building sector. The Code applies to new commercial buildings with a connected load of 100 kW & more or contract demand of 120 kVA or more.

Key features:

- Introduces passive design features such as daylight requirements and shading provisions;
- Introduces provisions of installing Renewable Energy Systems;
- Sets minimum energy efficiency standards for design and construction;
- Encourages energy efficient design or retrofit of buildings;
- Pathway toward Near Zero Energy Buildings

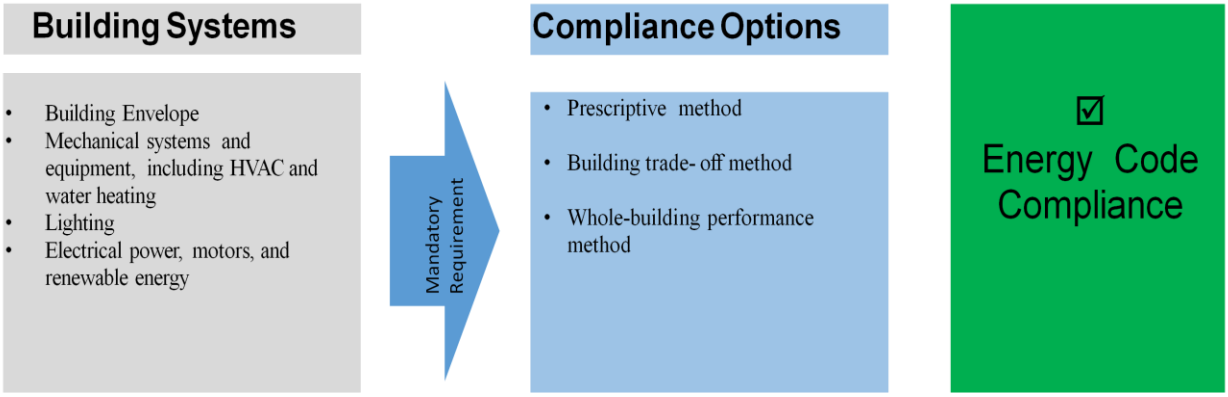


Figure 58 - Energy Code ComplianceSource: BEE

Building Classification

Any one or more building or part of a building with commercial use is classified as per the functional requirements of its design, construction, and use. The key classification of the stadium as per the code, is as below:

Assembly: Any building or part of a building, where number of persons congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes. Buildings like theatres or motion picture halls, gathering halls, and transport buildings like airports, railway stations, bus stations, and underground and elevated mass rapid transit system are included in this group.

Figure 8-8 Components covered by ECBC

Building Components covered by ECBC

Components not covered by ECBC

ECBC 2007	ECBC 2017	ECBC 2017
• Building envelope • HVAC • Lighting • Power • Water heating	• Building envelope • Mechanical systems, including HVAC, water heating • Lighting • Electric power and renewable energy	• Plug loads • Equipment that uses energy for manufacturing processes • Parts of the building that use energy for manufacturing processes.

Source: BEE

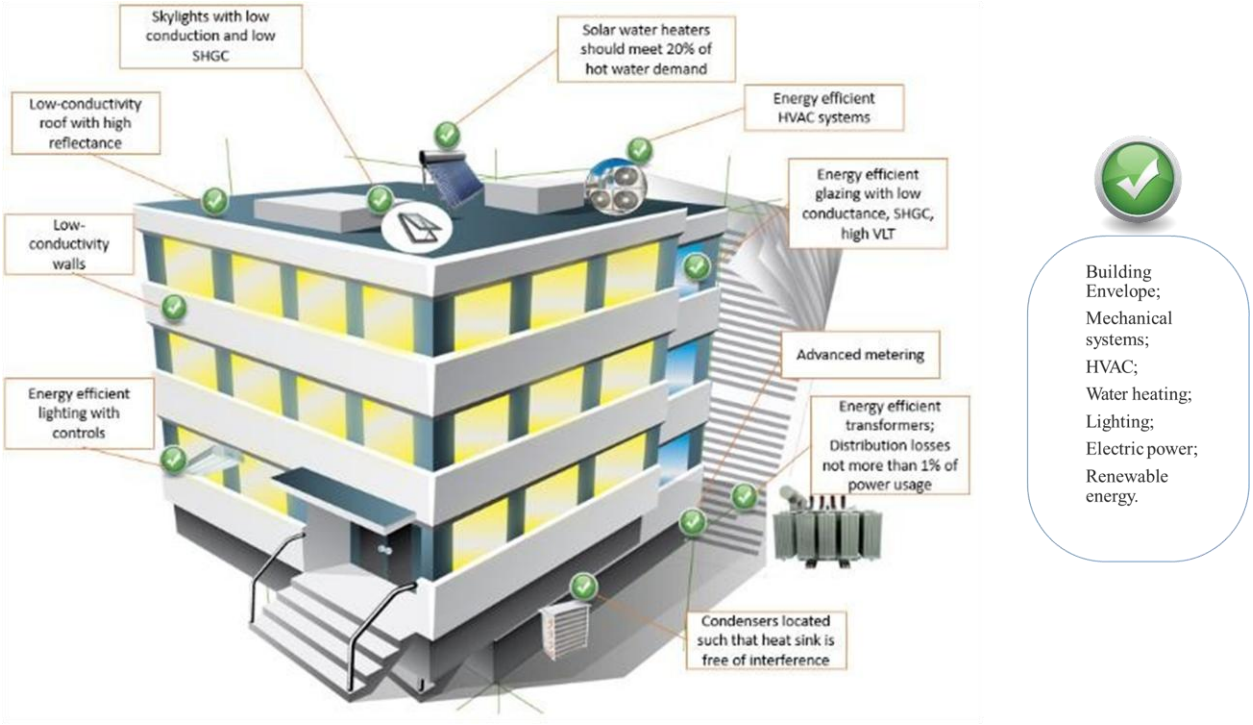


Figure 59 - Building Model for Energy Compliant Building

Source: BEE

5.5 ENERGY EFFICIENT GLASS

Double and triple layer glass windows with air gaps, are a type of energy efficient glass that are designed to provide higher levels of resistance to heat transfer acting as an extra thermal insulator against climatic effects. A generic working is provided in the figure below:

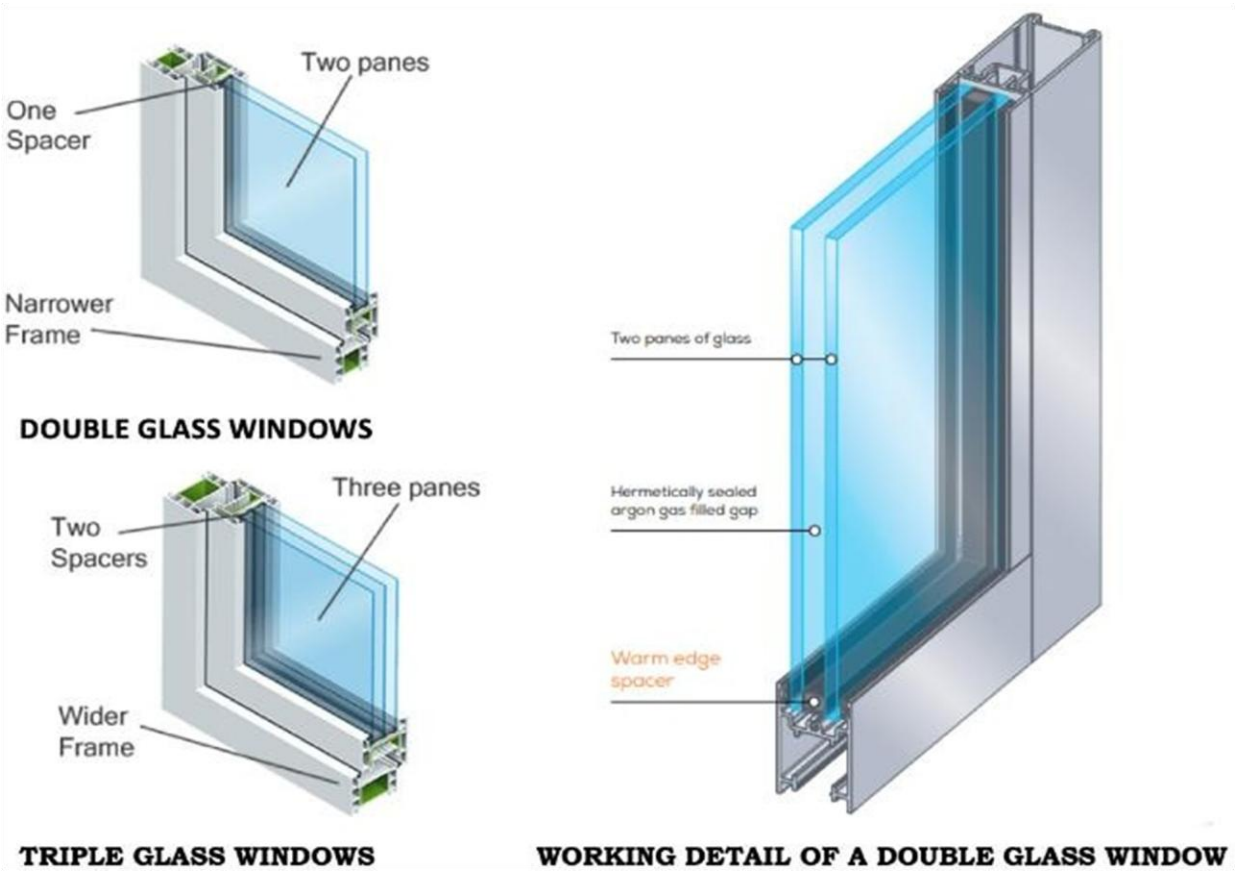


Figure 60 - Energy Efficient GlassSource: Reuters

The benefits are:

1. Warmer in winter & cooler in summer, keeps comfortable temperature all year and saves overall HVAC load.
2. Lowers energy consumption resulting in lesser greenhouse gas emissions.
3. Sound insulation: Double glazed windows improve sound insulation.

4. Enhances resale value: Double glazing is an excellent way to increase the resale value of property.
5. Preserves items inside the space from fading by reducing UV radiation.
6. Increases security: Discourages intruders and adds to safety and security. It is difficult for intruders to break in through double glazed windows, particularly if you include laminated or toughened glass.

5.6 GREEN LANDSCAPE IN PUBLIC PLAZA

Green landscaping, also known as sustainable or eco-landscaping is a method to design, create, and maintain your landscape to save time, money & energy.

Figure 61 - Green Landscape in Public PlazaSource: Reuters

The benefits are:

1. Green landscapes reduce air, soil, and water pollution and make healthy recreation spaces.
2. All plants can act as air cleaners and are more beneficial in removing toxins from the air.

3. Reduced heat buildup as plants in a plaza area, can reduce on-site heat buildup, decrease runoff and enhance night time cool downs.

4. Cost effective as this would not only make the project environment friendly, but also reduce the present and future cost.

5. Most people spend a majority of their time in the open area, so it is important to create a space where they feel productive and comfortable.

5.7 ALTERNATIVE POWER SOURCE IN ROOFTOP SOLAR PANELS

These systems generate power during the day, which is utilized by powering captive loads and feed excess power to the grid. In case power generated is not enough, the captive loads are served by drawing power from the grid. The concept is based on the scale of the PV plant rather than if it is situated on a roof/terrace or not. Hence, the definition of RTS also includes small solar plants on the ground.

Figure 62 - Rooftop Solar Panels

Source: Trina Solar

The benefits are:

1. Utilization of available vacant roof space that produces renewable energy and supports energy needs from other conventional sources.

2. Nonpolluting and have a long life of around 30 years.

3.Cost effective and needs less capital to maintain.

4.Lower transmission and distribution losses.

5.Improvement in the tail-end grid voltages and reduction of system congestion and long-term energy and ecological security by reduction in carbon emission.

5.8 UNCONVENTIONAL METHODS SUCH AS AUTOCLAVE AERATED CONCRETE BLOCKS

AAC blocks are a lightweight, load-bearing, high-insulating and durable building product, available in wide range of sizes and strengths.

Size (mm)	**Block**
Length	600
Thickness	75,100,120,150,200,240,250,300
Height	250

Table 19- Standard Sizes of AAC Blocks

1. The benefits are:
2. AAC Blocks is lightweight and compare to the red bricks. Reduces dead load of the building, Hence the overall construction cost also reduces
3. Acoustic insulation offers more privacy for occupants
4. These are fire resistant, pest resistant, and long lasting
5. They provide high thermal insulation & have high compressive strength;
6. Have high resistance to water penetration and are moisture resistant.
7. No pollutants or hazardous wastes are generated in the process make its more environment friendly and almost zero carbon footprint.

Figure 63- Autoclave Aerated Concrete Blocks

Source: Generic Image

5.9 WALL AND ROOF INSULATION

Polyurethane insulation is used in many residential and commercial buildings in the world. Polyurethane is formed by mixing an isocyanate, such as methylene diphenyl di-isocyanate (MDI) with a polyol blend. These components are mixed to form a rigid, cellular foam matrix. The resulting material is an extremely lightweight polymer with superior insulating properties. Polyurethane insulation comes in open or closed cell form, in varying densities. It is typically installed as insulation on the roofs, walls, floors and ceilings of new and retrofit buildings.

The benefits are:

1. Efficient thermal performance that can reduce energy usage.
2. Easily sprayed on roof with joint less finish, removing thermal bridges.
3. Faster application & easily available material.
4. Act as a composite System and act as a secondary waterproofing.
5. Higher temperature rating ,ensures product does not get detached from the surface.
6. Additional structural strength across the entire breadth of the panel.

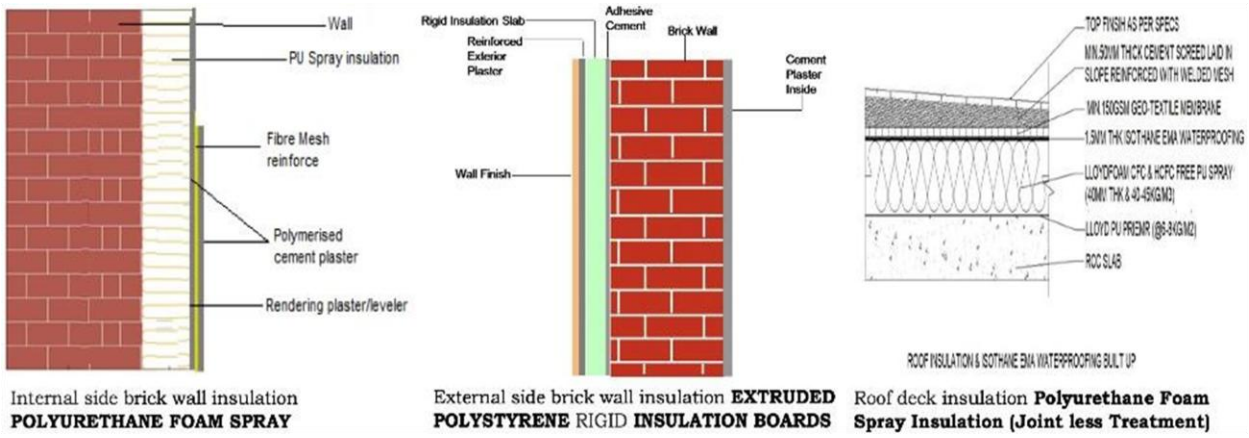


Figure 64- Wall and Roof Insulations

Source: Generic Representation

5.10 SPACE FRAMES

Space Frame or space structure is a truss-like, lightweight rigid structure constructed from interlocking struts in a geometric pattern. Space Frame can be used to cover large areas with few column supports. Space Frame is strong because of the inherent rigidity of the triangle; flexing loads are transmitted as tension and compression loads along the length of each member

Figure 65 - Space Frames

Source: Generic Representation

The key features are:

1. High strength, durability, enormous spanning capability, lightweight, and high aesthetics with higher safety factor.
2. Material: Stainless steel, Mild Steel, Galvalume sheet for roofing purpose.
3. Span Width: 40m~150m clear span.

Adding natural light, solar heating, fresh air and better ventilation to spaces

6 REAL ESTATE MARKET TRENDS

6.1 INTRODUCTION

Mangalore is located on the Konkan coast, between the Arabian Sea and the Western Ghats, in the state of Karnataka and is colloquially known as the chief port city. It is the second major city of Karnataka after Bangalore and is home to nearly 5 lakh inhabitants as per the 2011 Census.

Mangalore port handles about 75% of India's coffee and cashew exports and the chief economic activities of the city are the heavy industries, which include the automobile leaf spring industry, petrochemicals, iron-ore, fertilizers and agricultural processing.[1] Given its proximity to Bangalore, the Information Technology (IT) industry has also been making major inroads in recent times. The city is governed by an elected Mayor, through the Mangalore City Corporation, while the Mangalore Urban Development Authority (MUDA) performs the planning and development functions. With regards to connectivity, the city is connected by roads (national and state highways) (NH17, NH48, NH13, SH 88 and SH 66), by rail (as part of the Konkan rail network), by Air (via an International Airport), and by aforementioned Port.

6.2 KEY DRIVERS

1. Proximity to Bangalore – As Bangalore's urban infrastructure faces pressure, Mangalore, which is ~370 kms away, has started to attract the IT Industry and its related constituents. This is exemplified by the launch of new IT parks such as the ones in Thumbe, Ganjjimutt etc.

2. Heavy Industries and Port – The New Mangalore Port is the only major port of Karnataka and is the seventh largest port in India. The major commodities exported are iron – ore, coffee & cashew, manganese, granite stones etc. while the major imports are crude and petroleum products, LPG, timber, fertilizers, ammonia etc. The

[1] Statistics, New Mangalore Port Trust, Government of India

port drives the heavy industries in and around the city, which tends to have a positive cascading effect for the growth of the overall economy.

3. Education and Healthcare – Mangalore has always been seen as a traditional educational and healthcare hub, which has fueled the residential market.[2]

4. Smart City Status – The selection of Mangalore for the Smart City project of the Ministry of Urban Development would provide a positive impact to the real estate market of the city and adjoining areas.

6.3 REAL ESTATE TRENDS

As mentioned earlier in this Section, an increase in trade and commerce, development of service industries, IT industries and associated, and Special Economic Zones (SEZs) has been observed in Mangalore in the past few years.[3] The Mangalore Special Economic Zone (MSEZ) is designed as a multi-product SEZ catering to petrochemical, manufacturing, service, trading and warehousing industry. The district is one among the few PCPIRs (proposed) (petroleum, chemicals and petrochemicals investment regions) in the county. Oil and Natural Gas Corporation (ONGC)-Mangalore Refinery and Petrochemicals Limited.

With regards to the IT industry and its associated constituents, the district is fast catching up to other major cities. For example, IT major Infosys has a large presence in Mangalore district, while the Government of Karnataka is facilitating the development of an IT Corridor and Software Park in Mangalore.[4]

All in all, the Mangalore district is fast emerging as an attractive real estate destination in Karnataka. There is boom in construction industry in the district. The district also has a potential to emerge as one of the largest domestic hospitality markets in South India, driven by the growth of the tourism sector and its strategic location as a port city.

[2] YourStory, "How Coastal Karnataka is emerging as a hub for education and technology", Jan 2016

[3] ICICI Property Services, "Coffee Haven, Mangalore Residential Real Estate Report", March 2010

[4] Brief Industrial Profile of Dakshina Kannada District, MSME – Development Institute

6.4 LANDUSE DETAILS

Residential	Commercial	Industrial	Transport & comm	Public & utility	Public & semi-public	Open space	Agriculture Land	Other	Total
48.2	4.3	8.5	20.5	0.3	6.1	8.1	19.9	12.76	128.8

Source : Mangaluru City Corporation

6.5 RETAIL & COMMERCIAL SCENARIO

There exists an area of approximately 30 lakh sq. ft. for organized retail and commercial space in the city of Mangalore.

No.	Mall	Developer	Site Location	Zone	Approx. In Lakh Sq.ft
1	Bharat Mall	Bharat Builders	Bejai	Central Mangalore	1.5
2	Empire Mall	Mohtisham	M G Road	Central Mangalore	1.2
3	City Centre Mall	Mohtisham	K S Rao Road	Central Mangalore	5.5
4	Plama Mall	Plama Builders	Nanthur Junction	Central Mangalore	15
5	Excel Mall	Mohtisham	K S Rao Road	Central Mangalore	1.5
6	Forum	Prestige Developers	Pandeshwar	Central Mangalore	5.5
7	Mak Mall	Mak Group	Kankanady	Central Mangalore	
8	Transit One Mall	Team Ecologic Habitats	Thokottu	Outskirts	
9	Inland Ornate	Inland Builders	Kodailbail	Central Mangalore	

Source : ICICI Property Services Group Research

6.6. RENTED COMMERCIAL PREMISES DEMAND ASSESSMENT

The prevailing rate of rent in the premises is **50 Rs per sq.ft./month**

The total commercial area provided in the building is **5,000.00 sq.ft .**

The monthly rental income = 50 x 5000.00 = **2,50,000.00Rs**

Therefore annual rental income = 12 x 250000.00 = **30,00,000.00Rs**

Annual increase in the rent = **5%**

7 DESIGN FOR THE INDOOR KABADDI AND BADMINTON STADIUM

7.1 DESIGN BASIS APPROACH AND CONNECTIVITY

The site is located near Urwa market which is a residential locality within the city limits of Mangalore. It is a irregular shaped site with roads on three sides.The site can be primarily accessed from sultan battery road or the Pentland road on the south and has access from Urwa Maarigudi road on the east and a secondary road on the west. The site is gradually sloping down towards north. The site has a medium traffic density around .Main access to the stadium is taken from the secondary road which has comparatively less traffic density. Commercial areas are explored facing the other two major roads.

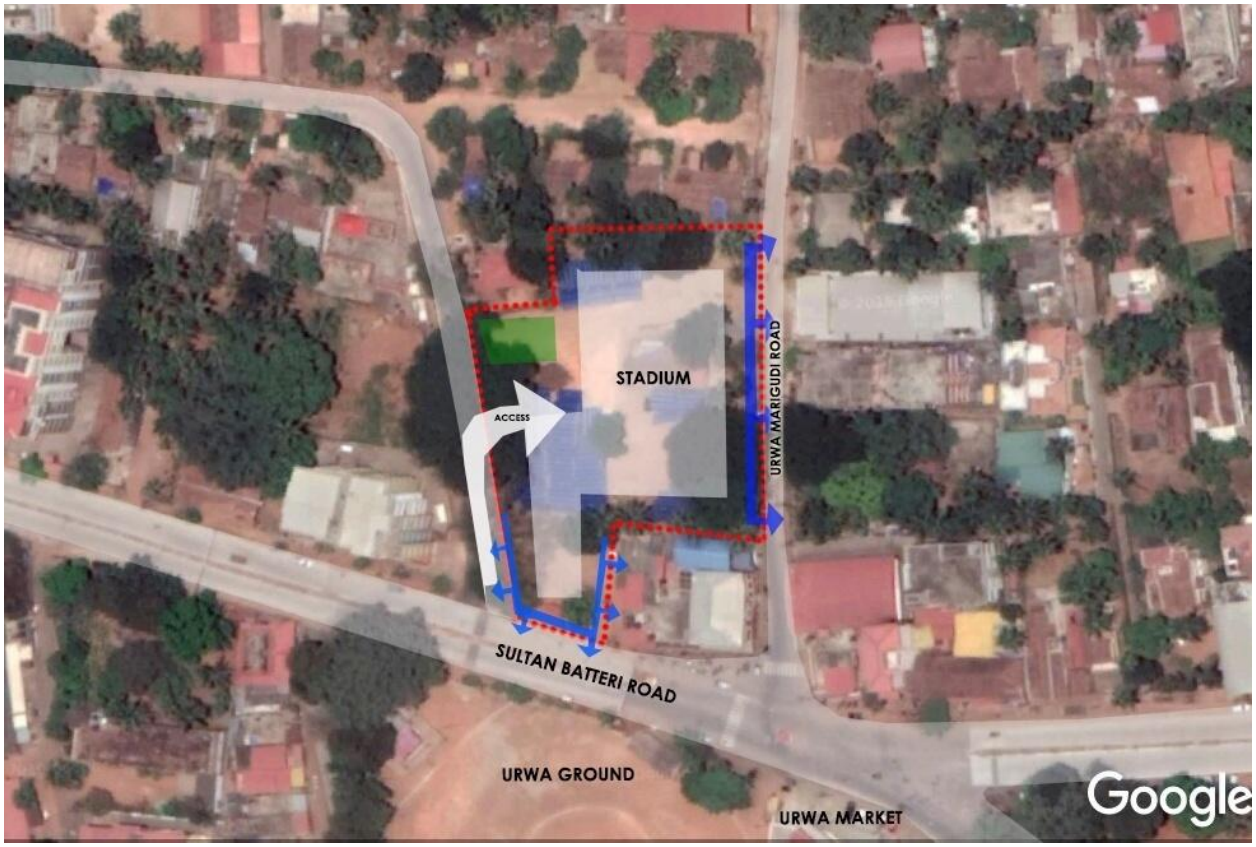


Figure 66 - Google earth image of the site

7.2 INDOOR STADIUM : DESIGN COMPONENTS FOR LAYOUT PLAN

Major components of the design incorporated in the layout plan may be summarized as follows.

1. Stadium with sports and spectator facilities (changing rooms , toilet blocks etc)
2. Waiting lounge / lobby
3. Shops , (commercial areas)
4. Office area - Administrative office & control room
5. V.I.P Lounge
6. Indoor sports facilities
7. Dormitories
8. Gymnasium
9. Cloak room , utilities and services
10. Parking facilities.

7.3 INDOOR STADIUM : DESIGN CONSIDERATIONS

Underlying concept of the building form comes from functionality. Local culture and context are considered as an important part of design and built form, thus creating a "**Contemporary yet traditional architecture**". Contemporary sports facilities are faced with the challenges of spatial organization, the design requirement consists of 4 badminton and kabaddi courts each. But due to lack of space to accommodate all the eight courts in one floor, the stadium is split into two stadia, stacked one above the other. Height of the structure is governed by the functional needs of a stadium and the exiting setbacks. Commercial potential of the site is also taken into consideration, thus commercial areas are explored along the frontages on west and south, facing Urwa Maarigudi and Sultan Batteri road, which could be a source of revenue for the stadium

7.4 INDOOR STADIUM: DESIGN CONCEPT PROPOSAL

The building is a **G+4** structure with a basement parking(capacity – 103 cars). Total height of the building is 20.85 meters. Four staircases on four corners are used for the vertical circulation.

Ground floor – Main entrance of the stadium is from west side from the secondary road. Ground floor consists of entrance lobby, reception, admin office and waiting lounge. Commercial areas are placed along the frontage facing east side and south side facing the two major roads Urwa Maarigudi road and Sultan Batteri road respectively. The kabaddi stadium is located in the ground floor along with players changing and restrooms. Stadium has seating on north and west sides. The kabaddi stadium has a clear height of 10.20mts

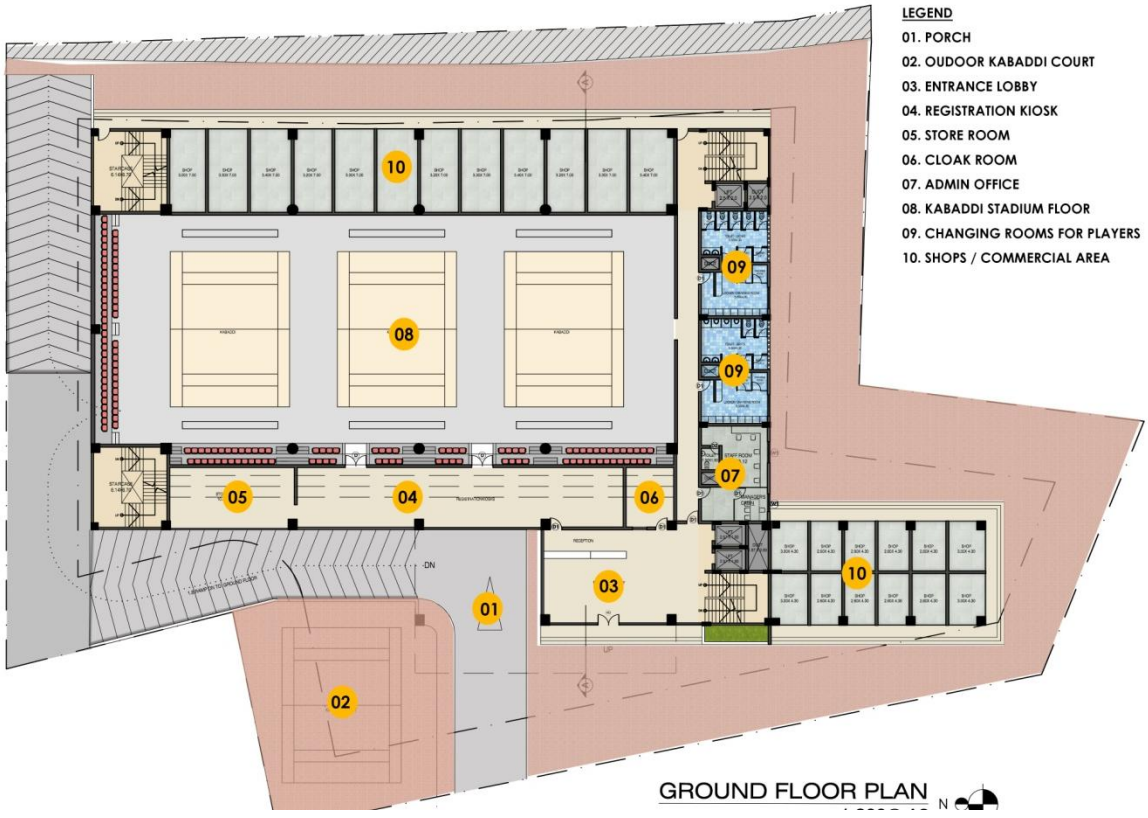


Figure 67- Ground floor

First floor- The main spectator entry happens in this floor. The staircase and the lift open to waiting lobby from which spectators are directed towards their seating area through a corridor that runs around the seating area. The public toilets and the dormitory are located on the south side. First floor also has a VIP lounge on the east side.

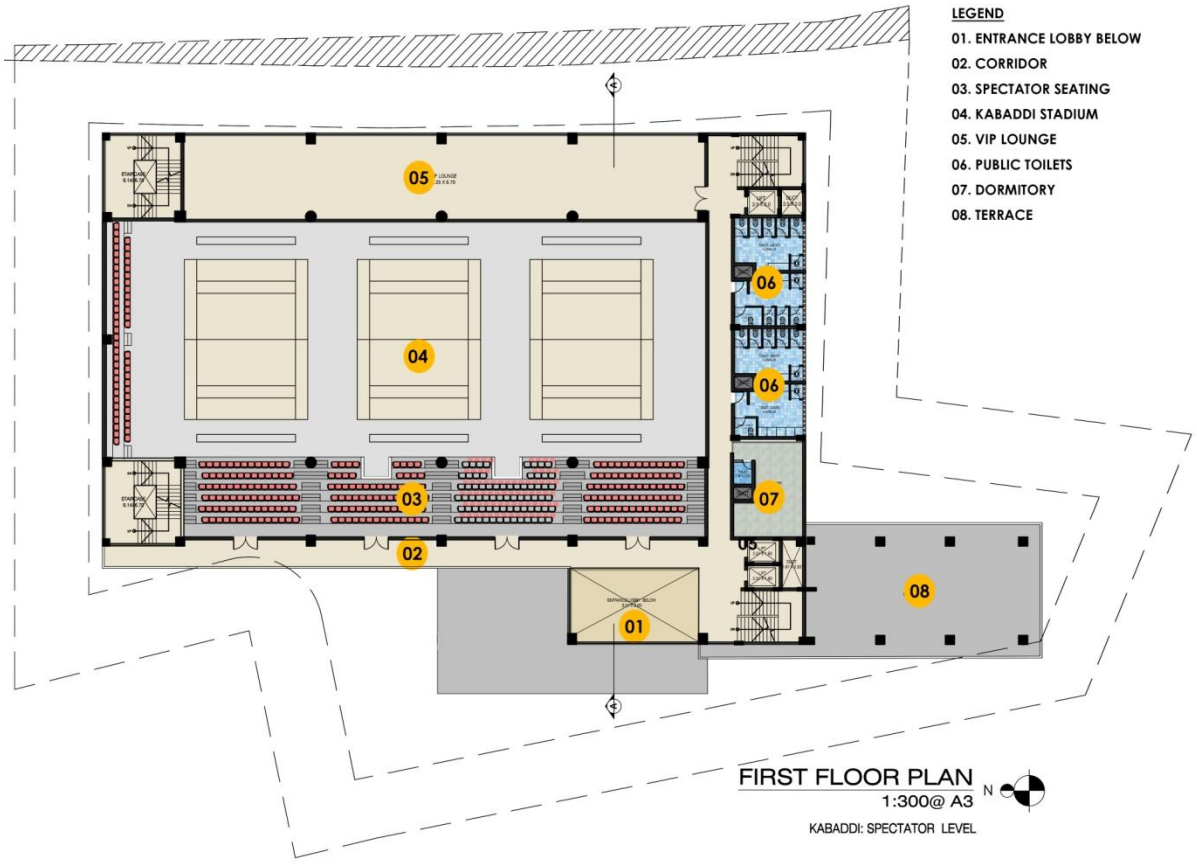


Figure 68 - first floor

Second floor - Second floor consists of Indoor sports facility and a gymnasium on east and south side respectively.

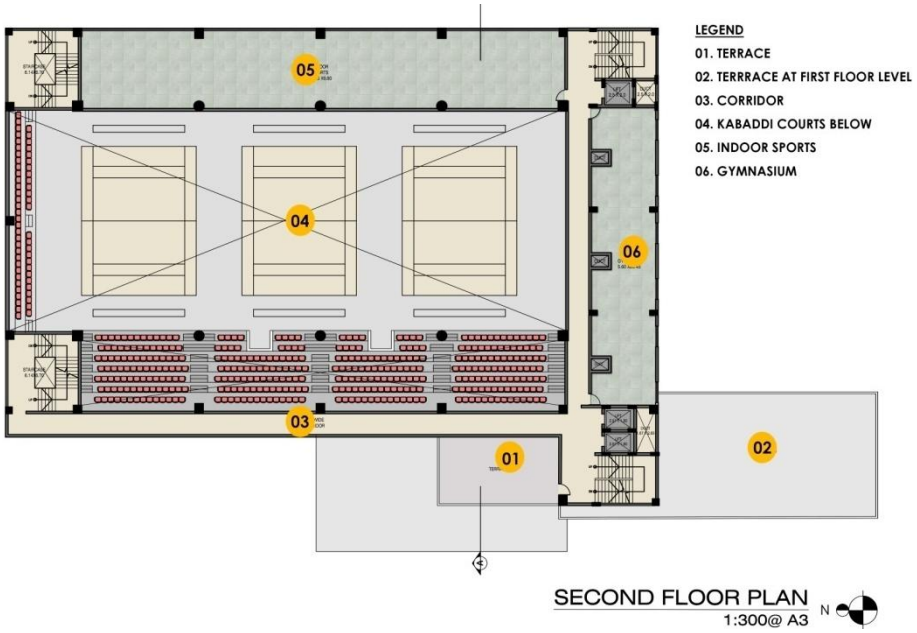


Figure 69 - Second floor

Third floor - Second stadium level is on this floor. Consists of 5 badminton courts. The spectator seating areas are on north, east and west sides. Changing rooms, toilet blocks for the players and a dormitory are on the south side.

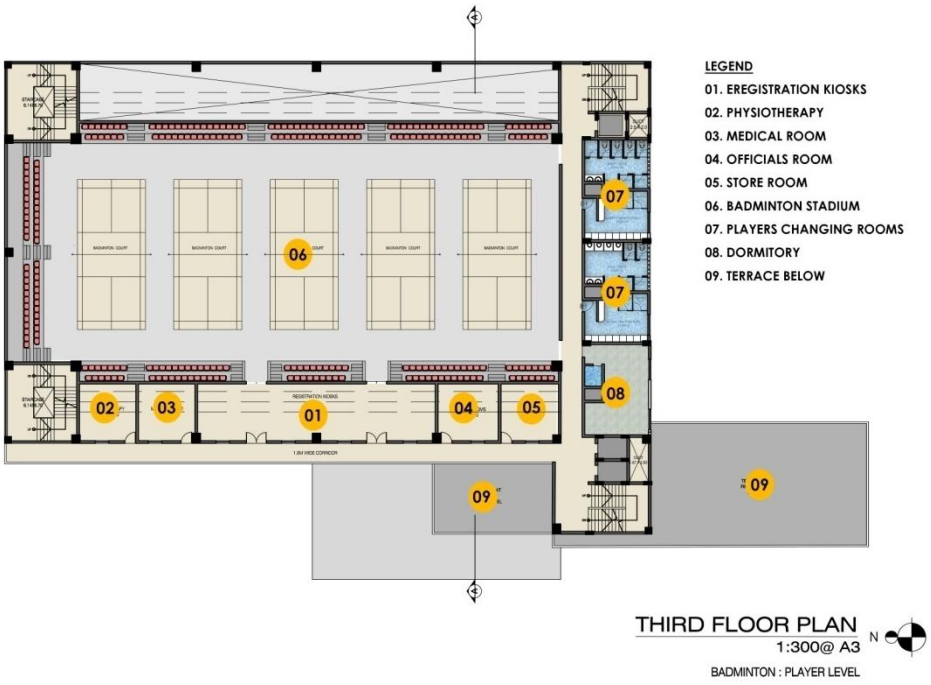


Figure 70 - Third Floor

Fourth floor - Spectator access to the second level stadium is on this floor. The staircase and the lift open to a lobby from which spectators are directed towards their seating area through a corridor that runs around the seating area. The public toilets and a dormitory are located on the south side.

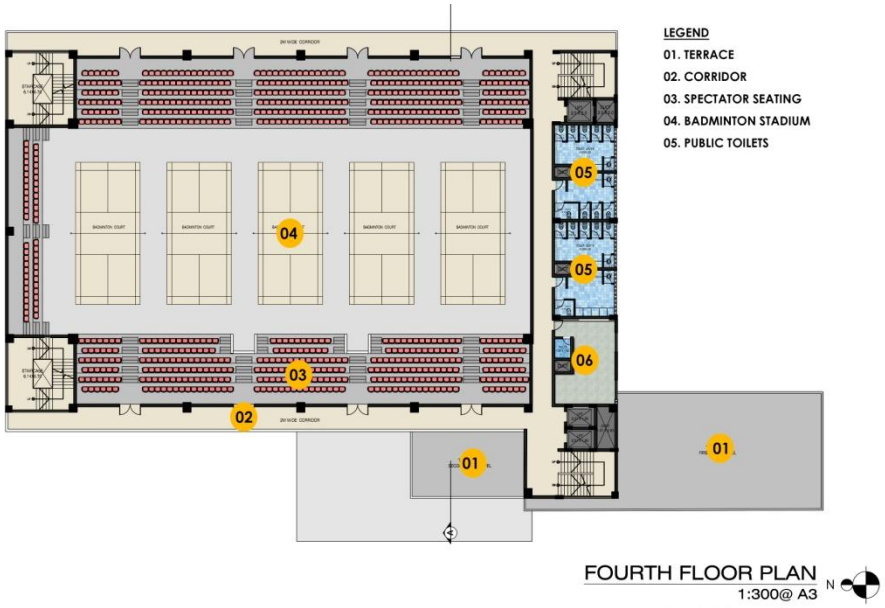


Figure 71- Fourth floor

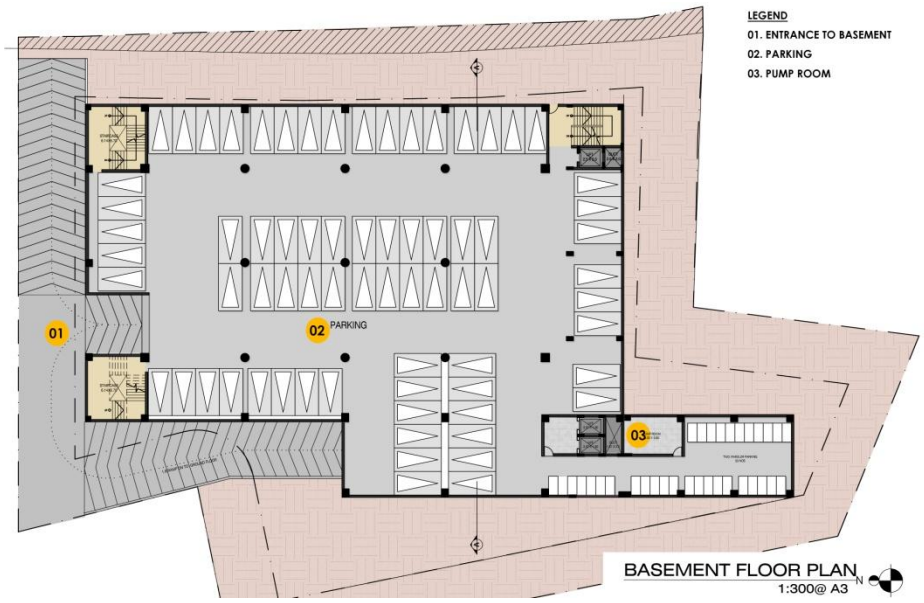


Figure 72- Basement

7.6 AREA STATEMENT :

COMPREHENSIVE AREA STATEMENT			
PERMISSIBLE			
	Area (Sq.m)		
Land area	1.13 acres (4573.11)		
Permissible ground coverage	70%		
Maximum permissible F.A.R	Permissible F.A.R+ Premium F.A.R+ T.D.R = 2.3 + 1 + 0.5 = 3.8		
Setbacks	Based on Building Height - Front – 5m, Rear & sides - 6		
ACHIEVED			
	Area (Sq.m)		
F.A.R Area Achieved	6529.60		
Built up area Achieved	9588.80		
Ground coverage achieved	48.68 %		
Effective building height	20.85 M		
Setbacks Provided	Front – 5m L.H.S – 7m R.H.S – 7m		
PARKING REQUIREMENTS			
Description	**Area**	**One parking for every**	**Parking requirement**
F.A.R AREA	6529.60 Sq.m		
Area for parking Calculation	5942.02 Sq.m		
Office spaces	557.33 Sq.m	75Sq.m	7.43
Dormitory	164.64 Sq.m	100Sq.m	1.64
Store Rooms	105.00 Sq.m	150Sq.m	0.7
Stadium	2699.67 Sq.m	50Sq.m / 15 seats	53.99
Remaining area	1965.56 Sq.m	50 sq.m	39.31
Total Required Parking			**103.00**

FLOORWISE AREA STATEMENT OF THE STADIUM	
GROUND FLOOR	
SPACE	**AREA (SQ.M)**
Entrance lobby and waiting lounge	108.12
Kabaddi stadium	940.00
Registration kiosk	137.00
Cloak room	20.00
Store room	52.50
Commercial area (Shops)	464.00
Administrative office	43.40
Players changing & toilets	111.81
Staircase and lift	150
Passage and access	183.27
Built up area on ground floor	**2385.97**
F.A.R Area on ground floor	**2235.78**
FIRST FLOOR	
Spectator seating area	273.61
Public toilets	111.81
Dormitory	43.40
VIP lounge	285.82
Passage and access	187.74
Staircase and lift	150.00
Built up area on the first floor	**1121.79**
F.A.R area on the first floor	**971.60**

SECOND FLOOR	
SPACE	**AREA (SQ.M)**
Indoor sports	285.82
gymnasium	143.67
Passage and common areas	187.74
Staircase and lift 4	150.00
Built up area on Second floor	**820.12**
F.A.R Area on Second floor	**669.93**

THIRD FLOOR	
SPACE	**AREA (SQ.M)**
Stadium area	940.00
Registration kiosks	104.64
Medical room	24.83
Physiotherapy	24.46
Officials room	26.52
Store room	25.37
Players changing rooms	111.81
Dormitory	43.40
Passage and common area	187.74
Staircase and lift	150.00
Built up area on the Third floor	**1739.68**
F.A.R area on Third floor	**1589.49**

FOURTH FLOOR	
SPACE	**AREA (SQ.M)**
Spectator seating area	550.00
Public toilets	111.81
Dormitory	43.40
Passage and common areas	303.05
Staircase and lift	150.00
Built up area on Fourth floor	**1212.99**
F.A.R Area on Fourth floor	**1062.80**
BASEMENT	
SPACE	**AREA (SQ.M)**
Parking	2004.38
services	24.01
Staircase and lift	150
Built up area on Basement 1	**2308.25**

7.7 PROPOSED CONSTRUCTION PERIOD

The proposed construction period for the project is 30 Months.

8. DESIGN DETAILS

8.1 ELECTRICAL DESIGN GUIDELINES FOR INDOOR STADIUM

8.1.1 SCOPE OF WORK

The objective of this report is to give an overview of services designed by consortium of KUMARCHANDRA & ASSOCIATES AND ASHTADIK INFRASTRUCTURE PLANNING CONSULTANTS PVT. LTD. for the INDOOR STADIUM FOR FOR KABADDI AND BADMINTON Near Urwa market - Mangalore Smart City. The designs of Engineering Services undertaken by The consultants includes following:

Internal Electrical Power and Lighting

External Electrical System

Earthing System

External and Internal electrical Details.

8.1.2 PROJECT OBJECTIVES

The project objective includes friendly design, centralized grouped location of services installation to ensure easy maintenance, fast track installation and compliance to all statutory regulations.

8.1.3 DESCRIPTION OF PROJECT

Proposed construction of Indoor stadium for kabaddi and badminton, near Urwa market. The stadium comprises of facilities like, restaurant, banquet halls, multipurpose halls, dormitories for athletes, guest rooms, commercial areas ,Gymnasium and a roof top swimming pool.

8.1.4 BROAD CONCEPT OF SERVICES

The Services Systems for the project have been conceptualized based on past experience and acceptable International design standards. Effort shall be made to conceal all services and still

provide access to these for accommodating changes in requirement in future. Conservation of energy, optimization of resources, eco-friendliness and State of the art technology shall be the key factors in the design concept to ensure least downtime and reduce maintenance hassles. Every effort shall be made to design, layout and install equipment in locations which will tend to encourage routine preventive maintenance by providing easy access for operation personnel. Manual isolation will be provided to enable servicing, expansion or renovation of any part of the system without interrupting the services in adjacent areas.

Electrical: The demand load for the building is estimated as 159 kW. To cater to this electrical load, the incoming power is available at 11 KV (these needs. MESCOM Service Provider.

ELECTRICAL SYSTEMS

a) Bus bars in all distribution panels are specified as tinned electrolytic hard drawn (HD) and high conductivity aluminium bus bars to reduce losses and improve reliability.

b) Copper conductor cables are specified for sizes of 25sq mm and below, this will reduce losses and improve reliability.

c) LED light fixtures shall be used for entire building areas.

d)All cables shall be derated to avoid heating during use. This also indirectly reduces losses and improves reliability

8.1.6 REFERENCE STANDARDS

The following standards and codes shall be followed/ referred during detailed design of the services:

- Local By - laws
- National Building Code of India - 2016
- Energy Conservation Building Codes 2018

· Relevant codes of Bureau of Indian Standards

. The Indian Electricity Rules, 1956

. Indian Electricity-Act 2003

· IEC 60947 / IS 13947: Specification for low voltage switch gear & control gear

8.1.7 DESIGN CALCULATIONS

Estimated Electrical Power requirements are calculated and indicated in Annexure A.

8.1.8 SOURCES OF POWER SUPPLY

It is understood that the Indoor stadium building will be supplied power from Local Supply Company. Based on the available note the LT power shall be available from Mangaluru smart city for the project at 433V. The Indoor stadium building will be supplied power from the Nearest Source of the Area.

8.1.9 STATE ELECTRICITY SUPPLY

The demand load for the Indoor Stadium is estimated as 159kW. based on the information available the power shall be available from the power supply company at 11KV. However, specific confirmation shall need to be taken from the relevant power supply company, prior to system design. Metering by the power supply co. shall be carried out at the metering room / Electrical room by client within the premises as per local norms.

8.1.10 LT POWER DISTRIBUTION SCHEME

LT Power from the supply company shall be brought to the Main LT Panel located in the LT Panel. Power from the main LT panel shall feed to Main Distribution Boards (MDB), At least 20% spare capacity on sub mains and rising mains shall be provided. Sub main protection shall be by circuit breakers, which will discriminate with

upstream protective devices. All switch boards shall be Form 3b construction and switching of incoming & outgoing circuits up to 800 amps shall be moulded case circuit breakers and above 800 amps shall be air circuit breakers. Aluminium bus bar shall be provided for all power distribution panels. Bus Stand Facility- 1 no 3 Phase LT meters. Independent lighting distribution panel shall be provided throughout the building. A dedicated room and associated riser shaft for cables. The effects of electromagnetic radiation on LV System shall be considered in locating of all LV system and cable. Shielding shall be provided where necessary. 15 - 20% spare capacity over maximum demand shall be provided in all services including cables.
Panel will be suitable for indoor installation with IP-54 degree of protection, fully compartmentalized design and will be provided with single bus bar system of copper/Al bus bars rated for short circuit withstand capacity of 50 kA for 1 second. Panel Colour shall be RAL-7032 Siemens Grey.

Main Distribution Boards and Sub-distribution Boards shall incorporate moulded case circuit breakers. Final distribution boards shall incorporate miniature circuit breakers of 10 KA minimum interrupting capacity (MCB) &residual current circuit breaker of 30 mA (RCCB).

Distribution boards shall be located in accessible positions to suit the area of floor within the Facility.

Sub Distribution Boards (SDB's) shall be located on area basis including metering system. Final Distribution Boards shall be fed from these MDB's &SDB's by means of either PVC insulated aluminium armoured cables or PVC insulated copper wires in appropriately sized MS/ PVC conduits.

8.1.11 SYSTEM EARTHING

Earthing system shall be designed in accordance with IS: 3043 for

earthing system. Dedicated earthing pits shall be provided for neutral earthing of major equipment Interconnected Earthing pits shall be provided for body earthing of equipment. Distribution earthing shall be carried all along the MV distribution system, and effectively bonding the equipment.

Earthing for light and power points shall be carried out with insulated copper earth wire running throughout the length of the circuit and shall be terminated at equipment, fixtures, etc with effective bonding to main earthing grid.

All the pits and main earthing bars are to be connected to each other to make a common earthing electrode grid. If the resistivity of the soil is very high, earthing calculations shall be done to ensure that the conductivity is maintained at less than 1 Ω.

8.1.12 RECOMMENDED ILLUMINATION LEVELS

The general lighting of various spaces shall be planned by the Interior Designer/ Lighting Consultant. The recommended illumination levels are given below for general guidance:

Table 20 - Indoor Stadium:Recommended Illumination Levels

	Area	Recommended Type of Lamps	Illumination Level Lux
1	Corridors & General Circulation (Service areas)	LED	100
2	Multi Purpose Hall/Lobby	LED	200
3	Public Toilets.	LED	
4	Offices/Conference Room	LED	300 - 500
5	Restaurant	LED	200
6	Kitchens	LED	300-500
7	Dormitory/Guest Room	LED	200
8	Parking/diveway	LED	75 - 150
9	Plant room/ Service areas	LED	200
10	Staircases	LED	150
11	Tennis/Kabadi Court	LED	500

8.1.13 SYSTEM OF WIRING

The system of wiring shall consist of PVC insulated copper conductor stranded flexible FRLS wires of 1100 volts grade of insulation, in metallic conduits for all exposed wiring and PVC/ metallic conduits for all concealed wiring. Minimum size of copper conductor shall be 1.5 sq. mm for lighting and 2.5sqmm for power. Colour code shall be maintained for the entire wiring installation that is Red, Yellow and Blue for the three phases, Black for neutral and Green with Yellow band for earthing

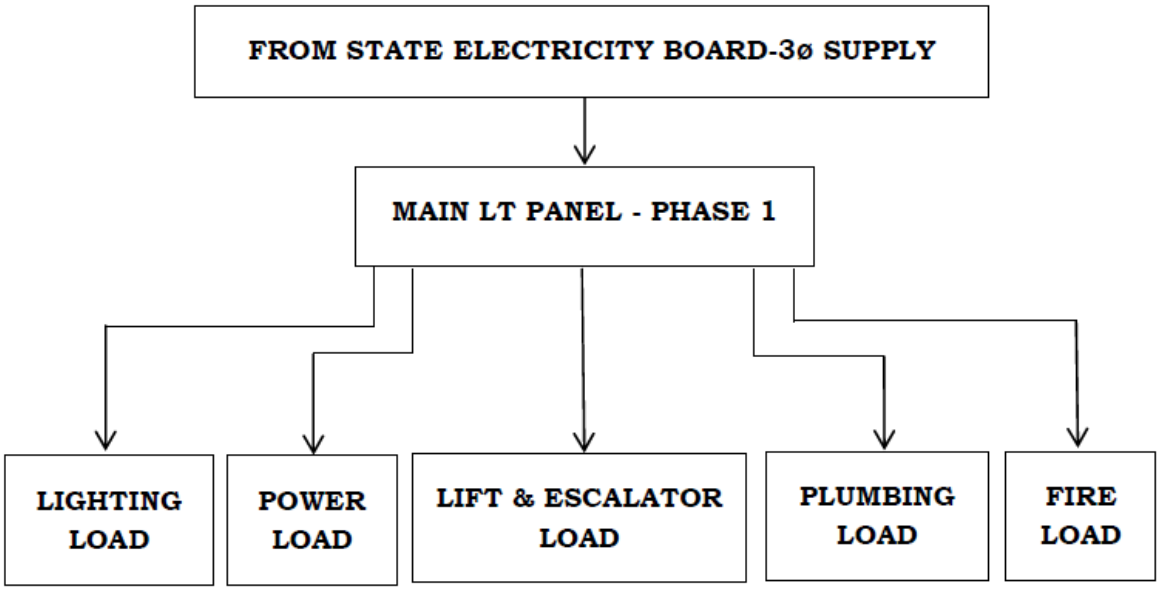
8.1.14 INTERNAL LIGHTING

Providing lighting which shall include Ceiling, wall mounted, etc. Cabling &earthling to all the light fixture. Switching for all above light fixture.

8.1.15 SWITCHING ARRANGEMENT

Switching arrangement at various locations shall be planned to keep in view the ease with which isolation can be achieved and also the level of fault protection desired at the particular current rating. Main distribution panels and sub-distribution panels shall incorporate moulded case circuit breakers. Final distribution panels shall incorporate miniature circuit breakers and earth leakage circuit breakers. All circuits breakers (MCCB) and miniature circuit breakers (MCB) in all breaker of main panel & incoming of all panels shall be of 4 pole for 3 phase power distribution with advance neutral feature for safety, which shall ensure connecting first and breaking last of the neutral contact and avoiding high voltage in the single phase circuits. Four pole breakers shall provide further safety against the unbalance floating current in the neutral, which could be dangerous, especially to the maintenance staff in case floating voltage is more than 50 volts.

Power Flow Schematic diagram



8.1.16 MOULDED CASE CIRCUIT BREAKER (MCCB)

MCCB shall be current limiting and comprise of quick make - break switching mechanism and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCB's shall be capable of defined variable overload adjustment. All MCCB's upto 250 amps shall have thermal magnetic releases and above 250 amps shall have microprocessor-based release with adjustable magnetic short circuit pickup. Wherever MCCB with earth fault protection is identified, the protection shall be an integral part of the release with adjustable magnetic short circuit and earth fault protection with time delay. The breaking capacity of MCCB's shall be as asked for on the single line diagram but minimum 25 KA. The breaking capacities specified shall be ICU=ICS.

8.1.17 MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with IEC 60898 / IS 8828. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCB's shall be rail mounted. The MCB shall be Current Limiting type (Class-3). MCB's shall be classified as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

8.1.18 CURRENT OPERATED EARTH LEAKAGE CIRCUIT BREAKER / RESIDUAL CURRENT CIRCUIT BREAKER (ELCB / RCCB)

ELCB / RCCB shall work on the principle of core balance transformer. The incoming shall pass through the torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding; this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. ELCB/RCCB shall be current operated independent of the line voltage; current sensitivity shall be of 30mA/100mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

Table 21 - Electrical Power requirement for Complete Facility: Load Details.

ELECTRICAL LOAD DETAILS				
SL NO	**ITEM**	**QTY**	**WATTS**	**TOTAL POWER IN WATTS**
A	**Lighting Load**			
1	Slant Batten Holders with LED Lamp	9	12	108
2	Bulk Head Light Fittings with LED Lamp	55	12	660
3	Batten LED tube Light Fittings 1x4'	381	20	7620
4	Batten LED tube Light Fittings 2x4'	39	40	1560
5	10W LED Square Down Light Fittings	290	10	2900
6	20W LED Square Down Light Fittings	697	20	13940
7	2'x2' LED Modular down Light Fittings	16	36	576
8	LED Post Top Lanterns	10	35	350
9	LED Flood Light Fittings	102	200	20400
10	Wall Bracket Light Fittings	9	5	45
11	8" Exhaust Fan light duty	42	30	1260
12	12"Exhaust Fan heavy duty	6	70	420
13	15"Exhaust Fan heavy duty, 1400 RPM	20	150	3000
14	Ceiling Fan	419	80	33520
	Total Load (A)			**86359**
B	**Power Load**			
1	6A Socket	250	100	25000
2	16A Socket	91	200	18200
3	20A Metal Clad Socket	2	300	600
4	1.5TR AC	9	1900	17100
5	2TR AC	3	2400	7200
6	Sump Pump	1	1500	1500
7	Borewell Pump	1	3800	3800
8	Lift	4	7000	28000
9	Fire Pump	1	9000	9000
10	STP Pump	1	7500	7500
	Total Load (B)			**117900**
C	**Commercial Space Load**			
1	Shops	25	1000	25000
2	Restuarent	1	3000	3000
	Total Load (C)			**28000**
	Total Load (A+B+C)			**232259**
	Total Connected Load in KW		KW	**232.259**
	Overall Diversity Factor @ 0.7		0.7	
	Maximum Demand Load in KW		KW	**162.5813**

TC

Maximum Demand Load in KVA - 162.5813 KW/0.8 = 203.226, Say 200KVA

Proposing 250 KVA TC

DG Set

Considering DG Load is 60% of 200 KVA = 120 KVA

Proposing 125 KVA DG Set

9 COST CHAPTER

SUMMARY

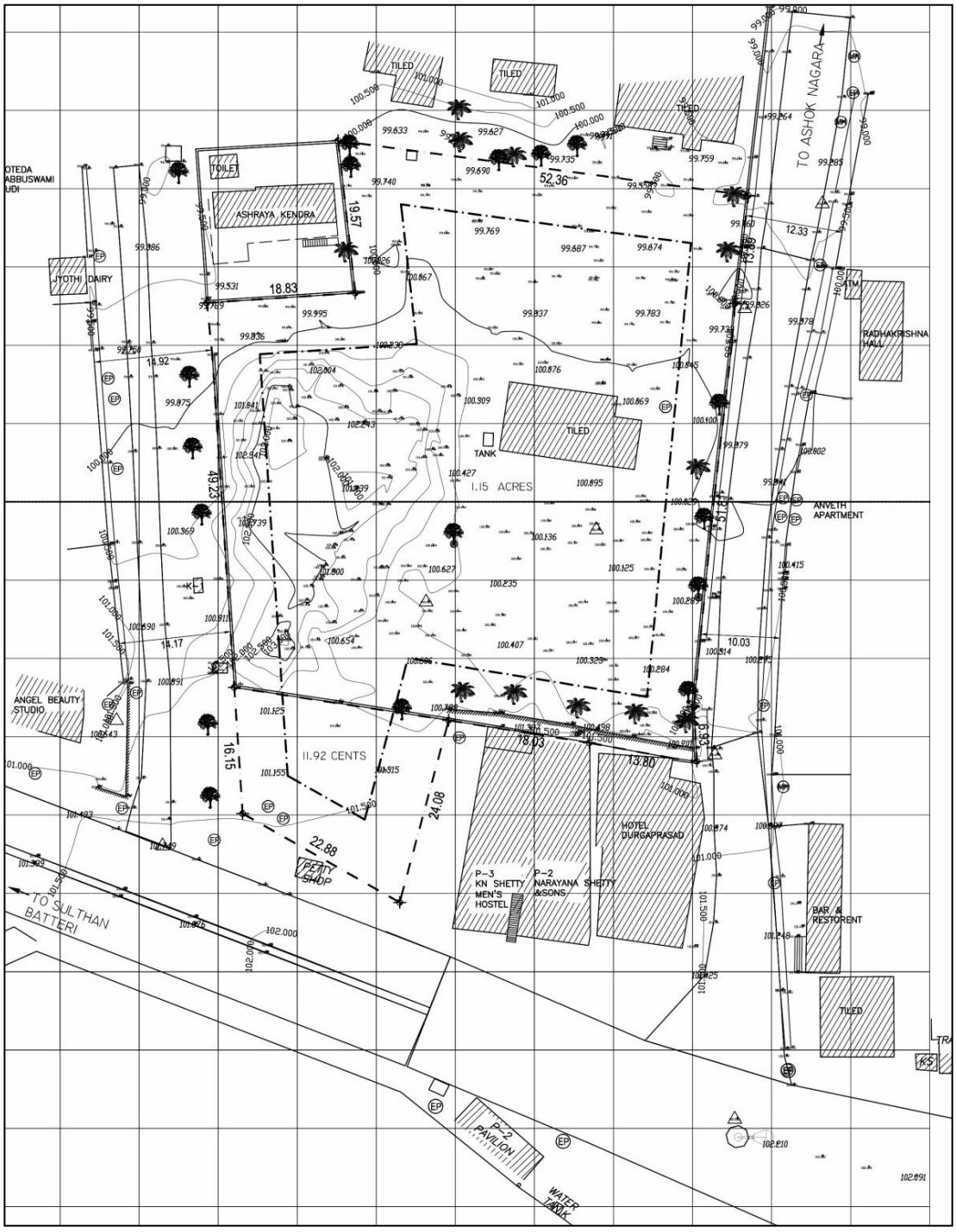
Item Nos	Part	Particulars		Amount
	SECTION 1 - CIVIL WORKS (A)			
1	PART	A Basement Floor	:	50,088,857.75
2		B Ground Floor	:	22,568,922.88
3		C First Floor	:	16,882,025.53
4		D Second Floor	:	21,011,982.93
5		E Third Floor	:	**16,300,917.63**
6		F Fourth Floor	:	13,928,030.96
7		G Terrace Floor	:	14,139,566.28
8		H Site development(Roads, Compound Wall, R.W Drain)	:	4,295,135.13
9		I U.G Sump tank	:	1,085,488.67
10		J Sinking of borewell	:	367,245.50
11		K Rainwater harvesting works	:	53,019.00
12		L Fire fighting equipments & installation	:	2,908,904.90
		TOTAL COST OF CIVIL WORKS (A) Rs		**163,630,097.16**
	SECTION 2 - PLUMBING AND SANITARY WORKS (B)			
13	PART	A Internal sanitary & water supply works	:	1,121,327.90
14		B External sanitary & water supply works	:	830,342.70
		TOTAL COST OF PLUMBING AND SANITARY WORKS (B) Rs		**1,951,670.60**
	SECTION - 3 - ELECTRICAL WORKS (C)			
15	PART	A Internal Electrical work	:	12,226,308.50
16		B External Electrical work	:	1,631,535.35
		TOTAL COST OF ELECTRICAL WORKS (C)Rs		**13,857,843.85**
	SECTION 4 - DISMANTALING AND SITE CLEARING WORKS (D)			
17		A Dismantaling and Site clearing works	:	66,457.25
		TOTAL COST OF DISMANTALING & SITE CLEARING WORKS (D)Rs		**66,457.25**
		TOTAL (A+B+C+D)		**179,506,068.85**
18		Add 12% GST	:	21,540,728.26
19		**TOTAL**	:	**201,046,797.12**
	SECTION 5 - NON - SR ITEM WORKS (E)		:	
20		A Fixtures	:	1,027,557.00
		TOTAL COST OF NON - SR ITEM WORKS (E)Rs.		**1,027,557.00**
25		Add 18% GST	:	184,960.26
		TOTAL	:	**1,212,517.26**
		TOTAL (SR + NON SR)	:	**202,259,314.38**
26		Add contingency	:	3,140,685.62
		GRAND TOTAL Rs.		**205,400,000.00**

(Rupees Twenty Crores Fifty Four Lakhs Only)

10

10 ANNEXURES

10.1 ANNEXURE 01: TOPOGRAPHIC SURVEY



10.2 ANNEXURE 02: GEOTECHNICAL REPORTS

सिविल अभियान्त्रिक विभाग
राष्ट्रीय प्रौध्यौगिकी संस्थान कर्नाटक, सुरत्कल
पोस्ट श्रीनिवासनगर, मंगलूरू - 575 025
DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL
POST SRINIVASNAGAR, MANGALURU - 575 025

Date: 09.12.2019

GEOTECHNICAL INVESTIGATION REPORT

General: This report is in response to the request made by Mr. Kumarachandra & Associates, vide letter No. 04/KCA/NITK-ST/MSCL-/KC/19 dated 02-12-2019 [Client : The Mangalore Smart City Ltd., (MSCL)]. In his letter, he requested us to carry out geotechnical investigation for the proposed construction of multi-storeyed (BF2 + BF1 + GF + 6 Floors) Indoor Stadium Building for Kabaddi and Shuttle Batminton at Urwa Market, Mangalore.

Boring and SPT were done by Mr. M. Manohar Rao as per clients requirements.

Soil Investigation:

The following observations were provided to us by the Engineer who carried out boring.

1. Boring was done at three locations (bore hole 1, bore hole 2 and bore hole 3).
2. Cutting of about 6m is proposed for the provision of two basement floors.
3. Water table is reported at 6.0m depth at the time of boring.
4. In bore hole 1 soft rock was encountered between 13.5 – 15m depth followed by rock till termination depth of 16m.
5. Bore holes 2 and 3 were terminated at 15m depth soon after touching the soft rock.

The SPT soil samples and N values were supplied to us. Bore logs are prepared and are enclosed herewith. Type of soil, thickness of soil strata, observed SPT N values are shown in the enclosed borelogs. To the supplied N values, corrections are applied as per IS codal procedures.

From laboratory testing, compressive strength of rock is established as 20,000kN/m^2 at bore hole 1 location (depth: 15m – 16m).

Recommendations:

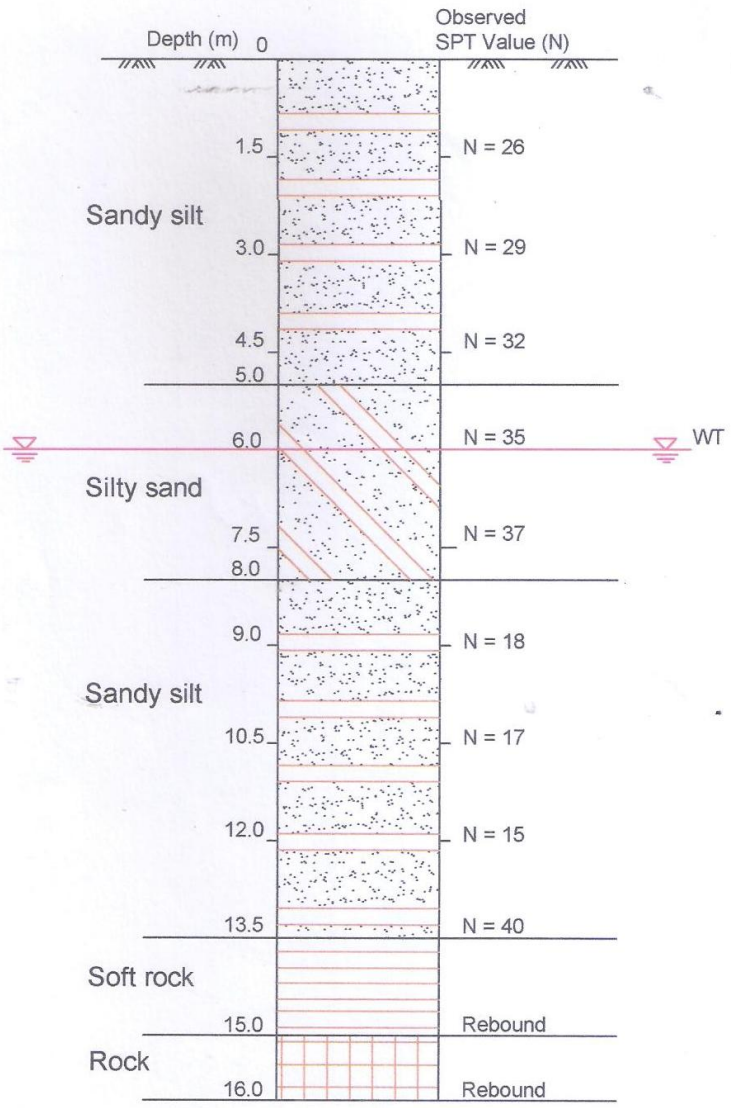
i. Recommended depth of foundation is 2m.
ii. Recommended to adopt raft foundation.
iii In bore hole 1 area, below raft foundation PCC bed, provide two layers of boulder + sand packing of compacted thickness 45cms. These layers shall extend 30cms on all sides of PCC bed. On this improved ground, for design of raft foundation, Safe Bearing Capacity (SBC) values of 190kN/m^2 is recommended.
iv. In bore holes 2 and 3 area, for design of raft foundation, Safe Bearing Capacity (SBC) values of 220kN/m^2 is recommended (without boulder + sand layers below PCC bed). Search for loose pockets shall be made before laying the foundation bed. If any pockets are found, it shall be compacted well using boulder + sand or lean concrete
v. Proper drainage shall be provided to avoid stagnation of water.

Encl: Borelogs 3 Nos.

Sayak 9/12/2019
(SITARAM NAYAK)
Professor
Dept. of Civil Engg.

Sayak 9/12/2019
for (K. SWAMINATHAN)
Professor& Head
Dept. of Civil Engg.

टेलिफैक्स (Fax) : +91-824-2474039
E-mail : hodcivil@nitk.ac.in
Web. : www.nitk.ac.in
दूरभाष (Ph) : +91-824-2474000, विस्तार (Extn.) : 3041
+91-824-2474051 सीधा (Direct)



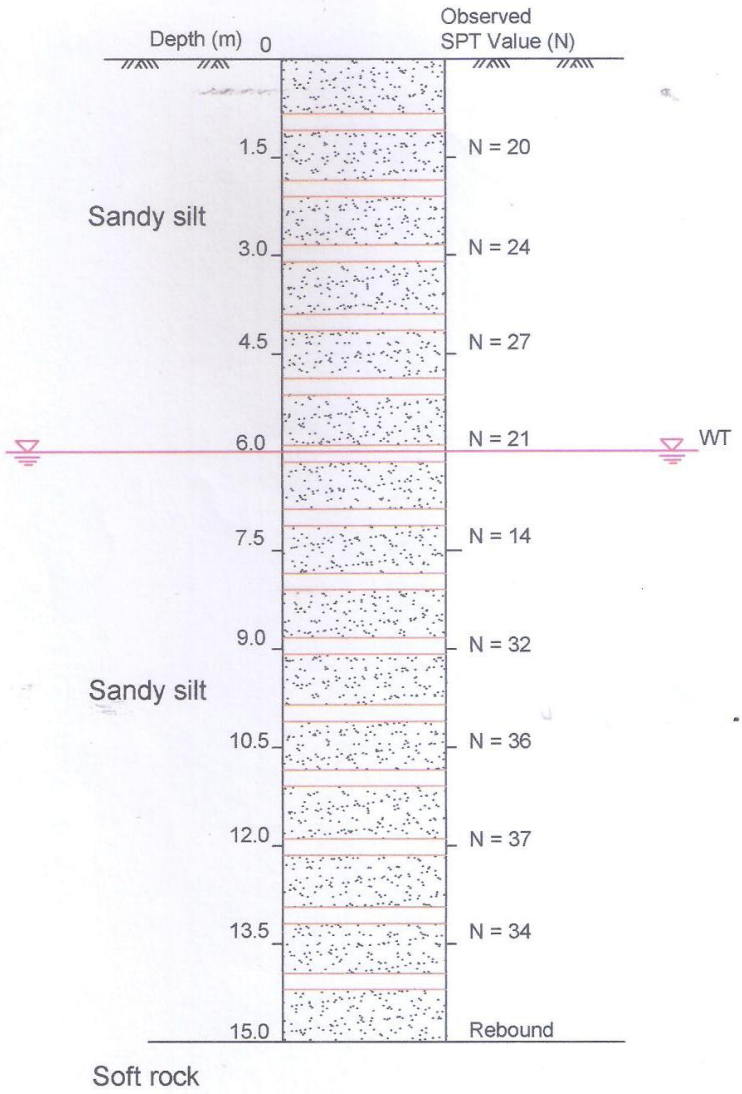
BORE HOLE NO. 1

DEPARTMENT OF CIVIL ENGINEERING, N.I.T.K., SURATHKAL

BORE LOG

PROJECT: Construction of Multi storeyed Indoor Stadium (BF1+BF2+GF+6 Floors) building for Kabaddi, Shuttle Badminton at Urwa Market, Mangalore.

CLIENT: M/s Mangalore Smart City Ltd. (MSCL), Mangalore.	Request letter by: M/s Kumarachandra Associates.
Sayak DR.SITARAM NAYAK PROFESSOR	Sayak for DR. SWAMINATHAN PROFESSOR & HEAD
	DRAWN : K.S.KUMAR
	DATE: 06 12/2019



BORE HOLE NO. 2

DEPARTMENT OF CIVIL ENGINEERING, N.I.T.K., SURATHKAL

BORE LOG

PROJECT: Construction of Multi storeyed Indoor Stadium (BF1+BF2+GF+6 Floors) building for Kabaddi, Shuttle Badminton at Urwa Market, Mangalore.

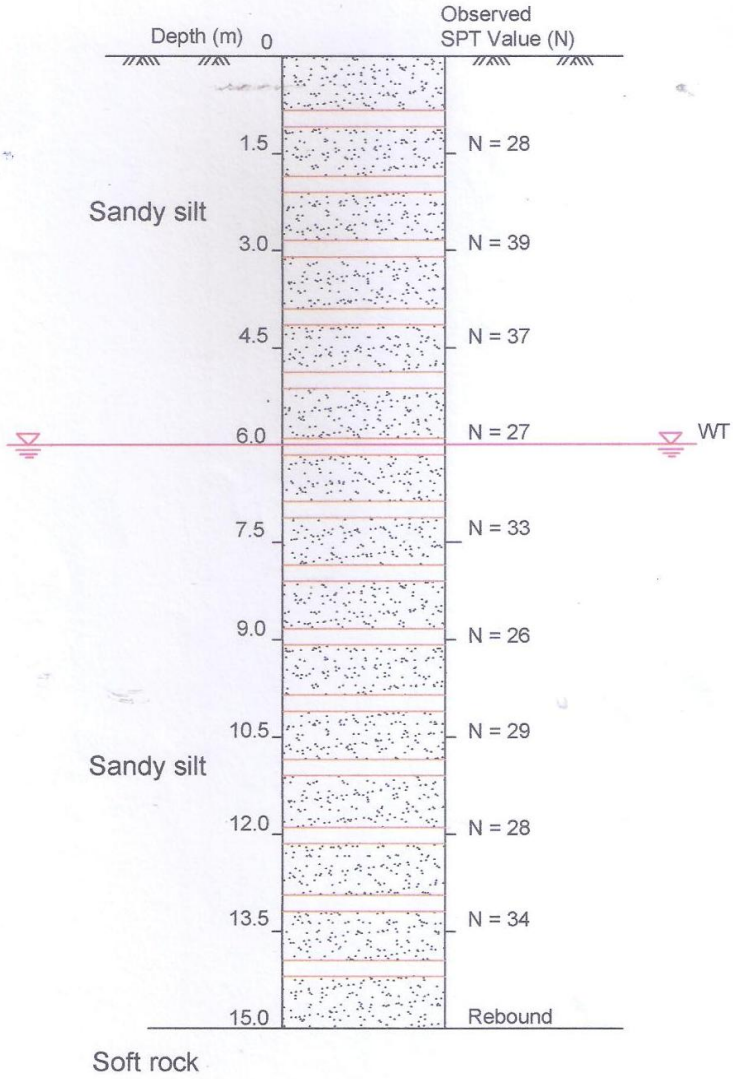
CLIENT: M/s Mangalore Smart City Ltd. (MSCL), Mangalore. | Request letter by: M/s Kumarachandra Associates.

Nayak
DR.SITARAM NAYAK
PROFESSOR

Nayak
for DR. SWAMINATHAN
PROFESSOR & HEAD

DRAWN : K.S.KUMAR

DATE: 06 12/2019



BORE HOLE NO. 3

DEPARTMENT OF CIVIL ENGINEERING, N.I.T.K., SURATHKAL

BORE LOG

PROJECT: Construction of Multi storeyed Indoor Stadium (BF1+BF2+GF+6 Floors) building for Kabaddi, Shuttle Badminton at Urwa Market, Mangalore.

CLIENT: M/s Mangalore Smart City Ltd. (MSCL), Mangalore.	Request letter by: M/s Kumarachandra Associates.
DR.SITARAM NAYAK PROFESSOR	for DR. SWAMINATHAN PROFESSOR & HEAD
	DRAWN : K.S.KUMAR
	DATE: 06 12/2019

Figure 73 - Bore log test at site

10.3 ANNEXURE 03: CADASTRAL MAPS