BHUBANESWAR DEVELOPMENT AUTHORITY

AKASH SHOVA BUILDING,
PANDIT JAWAHARLAL NEHERU MARG, BHUBANESWAR – 751001
PABX No.0674-2392801 / 0998 / 6437, FAX No.0674-2390633 / 085
Visit us at: http://bdabbsr.in/

Ref. No. 807 *Date.* 10.09.2018

To

The Member Secretary,
State Environmental Impact Assessment Authority,
Bhubaneswar, Odisha.

Sub: Construction of Inter State Bus Terminal (ISBT) of Baramunda and Bus Depot at Khandagiri, Bhubaneswar Odisha on EPC mode and EIA clearance thereof.

Ref: This Office Letter No.414 dt.11.05.2018
This Office Letter No. 442 dt.19.05.2018
Your letter No. 677(2)/SEAC-(Misc)-28 dt.07.08.2018.

Sir,

In continuation to this office letter under reference, this is to submit here with the modified proposal along with filled in application and drawings of the proposed project as per the height restriction approved by Airport Authority of India.

In this connection it is requested to issue necessary Environment clearance for the said project. The required fees pertaining to the said clearance amounting to Rs.5,00,000.00 (Rupees five lakhs)only bearing Demand draft No. 529444 dt.19.05.2018 issued by Oriental Bank of Commerce drawn in favour of "The Chairman State Environmental Impact Assessment Authority, Odisha, Bhubaneswar" towards scrutiny fee has already been deposited vide this office letter No.442/EE-I dt.19.05.2018.

In this context it is therefore requested for issue of Environmental clearance for the said project at an early date to take forwarded the prestigious project of the state.

Yours faithfully.

10.09.2018

Executive Engineer,
Division No.I, BDA.

Memo No._____/BDA., Bhubaneswar the th 2018.

Copy submitted to C.E.-Cum-Engineer Member, BDA for favour of kind information and necessary action.

Executive Engineer,
Division No.I, BDA.

STATE LEVEL EXPERT APPRAISAL COMMITTEE, ODISHA

(Constituted vide order No. S.O. 3387(E) dated 15th December, 2015 of MoEF&CC, Govt. of India)

Paribesh Bhawan, A/118, Nilakanthanagar, Unit-VIII,
Bhubaneswar – 751 012, ODISHA

No. 677(2) / SEAC-(Misc)-28

Date 07.08.2018
By Speed Post/Email

To

1. Mr. Sukanta Kumar Rout,
   Secretary
   Bhubaneswar Development Authority
   Akash Shova Building, Sachivalaya Marg,
   Bhubaneswar-751001
   E-mail – secy@bdabbsr.in

2. Mr. Rahul Choudhary,
   Sr. Executive (Projects)
   M/s. Paramitra Smart Infra Pvt. Ltd
   Plot No. 133, District Centre,
   Chandrasekharpur, Khurda, Odisha-751021
   E-mail-rahul.choudhary@shyamindus.com

Sub: Clarification sought on category- B proposals for grant of environmental clearance – regarding.

Ref: SEAC meeting held on 06.07.2018.

Sir,

In inviting a reference to above, it is to inform that your proposal was placed before the State Level Expert Appraisal Committee (SEAC), Odisha in its meeting held on 06.07.2018 for consideration of Environmental Clearance. The SEAC has decided to take decision on the proposal after receipt of certain information / documents/ clarification as per **Annexure – A**.

Therefore, you are requested to submit the above information / document / clarification through online with a hard copy of the documents by post to this office, after which your proposal for Environmental Clearance will be further processed.

Encl: Annexure - A

Yours faithfully,

7/8/18

SECRETARY
State Level Expert Appraisal Committee, Odisha

Memo No. 678 /Date 07.08.2018

Copy forwarded to the Member Secretary, SEIAA, Odisha, Qr. No. 5RF-2/1, Unit-IX, Bhubaneswar-22 for information and necessary action.

7/8/18

SECRETARY
State Level Expert Appraisal Committee, Odisha

Memo No. 679 /Date 07.08.2018

Copy to concerned files for record.

7/8/18

SECRETARY
State Level Expert Appraisal Committee, Odisha

ANNEXURE- A

CLARIFICATION / DOCUMENTS SOUGHT BY THE SEAC ON CATEGORY-B PROPOSALS IN ITS MEETING HELD ON 06.07.2018

Agenda Item No.	File No.	Name and Address of the proponent	Proposal	Recommendation of the SEAC
01	74935/31-NCP/05-2018	Mr. Sukanta Kumar Rout, Secretary Bhubaneswar Development Authority Akash Shova Building, Sachivalaya Marg, Bhubaneswar-751001 E-mail – secy@bdabbsr.in	Proposal for Environmental Clearance for construction of Interstate Bus Terminal (ISBT) at Baramunda, Bhubaneswar, Odisha of Bhubaneswar Development Authority (EC).	The SEAC decided to take decision on the proposal after receipt of the following from the proponent: (i) Modified proposals along with filled in application and drawings of the proposed project as per the height restriction approved by Airport Authority of India
03	75165/32-NCP/05-2018	Mr. Rahul Choudhary, Sr. Executive (Projects) M/s. Paramitra Smart Infra Pvt. Ltd Plot No. 133, District Centre, Chandrasekharpur, Khurda, Odisha-751021 E-mail-rahul.choudhary@shyamindus.com	Proposal for Environmental Clearance for proposed (G+4) stories Affordable Housing project at Mouza-Chandrasekharpur, Bhubaneswar, Dist - Khurda, Odisha of M/s Paramitra Smart Infra Pvt. Ltd with total built-up area 88217.71 m^2 (EC)	The SEAC decided to take decision on the proposal after receipt of the following from the proponent. (i) Certificate from the concerned DFO about exact distance of the boundary of the Eco-Sensitive Zone of Chandaka – Damapada Wild Life Sanctuary and boundary of Nandanakanan National Park from the proposed project site. (ii) Copy of land allotment letter along with land schedule indicating kisam of land.

BHUBANESWAR DEVELOPMENT AUTHORITY

BHUBANESWAR DEVELOPMENT AUTHORITY (BDA)

Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar

Detailed Project Report (Updated)

Volume I: Main Report

August 2018

A Joint Venture of The Government of National Capital Territory of Delhi & The IDFC Foundation.
An ISO Certified Company

DIMTS
We help people move

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E-mail: info@dimts.in | Website : www.dimts.in

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CHAPTER 1

Introduction

1. Introduction

1.1 Project Background

Bhubaneswar is considered as the nerve centre for the entire state of Odisha. It's one of those rapidly growing cities of eastern India which has greater regional influence after Kolkata. Bhubaneswar is also a major tourist destination in eastern India due to presence of numerous temples within the city. Strategic location of Bhubaneswar, close proximity to the golden quadrilateral, makes it one of the promising destination for the future development. Now to continue and maintain this development trends for the future years to come, it is very crucial to have good public transit system along with good transit infrastructure.

In its smart city proposal, Bhubaneswar has envisaged to become a city with sustainable mobility choices and afterward the city has taken up various developmental projects to change the city's futurescape with prioritizing the public transportation over private transportation. Success and efficiency of a good public transportation system also depends upon the infrastructure provided along with it.

Main objective of this project is to achieve following:

- To develop State of the Art Bus Terminal with all the necessary facilities for the passengers
- To provide more convenient and easy transfer experience to the passengers by integrating various modes
- To explore and generate revenues from non-fare box sources

1.1.1 Bhubaneswar Development Authority (BDA)

BDA is responsible for the statutory planning and development of the Bhubaneswar Development Planning Area (BDPA). It takes care of planned development in peri-urban area and at present its jurisdiction extends to 1110 sq. km. and 556 revenue villages. BDA is responsible for creating development plans, regulating development and use of land, undertaking works pertaining to construction of housing colonies, commercial complexes and providing public amenities like water supply, drainage, sewerage, and transportation, social facilities, etc.

Bhubaneswar Development Authority (BDA), also responsible for developing big transit infrastructure for the city of Bhubaneswar, has envisaged to develop a state of the art Inter State Bus Terminal(ISBT) at Baramunda area to serve as a centre for both city level and state level bus connectivity.

1.2 Site Selection

Bhubaneswar Development Authority (BDA) vide their RFP no. 17938/BDA dated 26.07.2018 and Agreement with DIMTS dated 18.09.2017 propose to develop Inter-state Bus Terminal (ISBT) at Baramunda. The aforementioned documents propose the existing ISBT at Baramunda to be developed into the state of the art facility. Details of the existing site are elaborated in 'Chapter-2: Site Appreciation' ahead.

1.3 Regional Profile

The capital city of Odisha, Bhubaneswar is located in the '**Khordha**' district. Khordha is the most urbanized of all the districts of Odisha. Khordha Road, the railway station that serves the town is also the divisional headquarters of the East Coast Railway of the Indian Railways. Khordha is known for its brass utensils, cottage industries, railway coach manufacturing, and cable manufacture.

The District Khordha came in to existence on 1st April 1993, by dividing it off its earlier Puri district. Puri was divided into three districts Puri, Khordha and Nayagarh. The geographic location of Khordha district stands at 19degree 55minutes to 20 degree 25minutes North Latitude and 84 degree 55minutes to 86 degree to 5minutes East Longitude. Its bioclimatology is much influenced for the short radial distance from the Bay of Bengal and presences of a huge water body like the Chilika Lake. The district enjoys normal 1408mm with maximum and temperature 42.2 degree Celsius and 11.1 degree Celsius respectively. The mean relative humidity ranges from 46% to 89% .It is situated in the East & South-eastern coastal plain and the agro-climatic zone blessed with sandy-loam, loam, clay-loam and clayey soil in varied agro-eco system.

Khordha into two district sub-regions one is Deltaic Alluvium sub-region which comprises of 3 blocks Balianta, Balipatna and Chilika Whereas Banpur, Begunia. Bhubaneswar, Bolagarh, Jatni, Khordha & Tangi belong to Lateritic sub-region.

Table 1-1: Administrative Setup of Khordha District

No. of Sub-Divisions	**2**
No. of Municipalities/Corporation	**3**
No. of Blocks	**10**
No. of Gram Panchayats	**168**
No. of Uninhabited Villages	**193**
No. of Tehsils	**10**
No. of N.A.Cs	**2**
No. of Police Stations	**27**
No. of Inhabited Villages	**1358**

No. of villages	**1551**

Known as the “Temple City”, **Bhubaneswar** has a unique position by virtue of the ability to seamlessly integrate its rich cultural heritage with a strong regional economic base. Founded during the Kalinga empire over 3,000 years ago, Bhubaneswar today boasts of a cluster of magnificent temples, constituting a complete record of Odisha temple architecture from its early beginnings to its culmination.

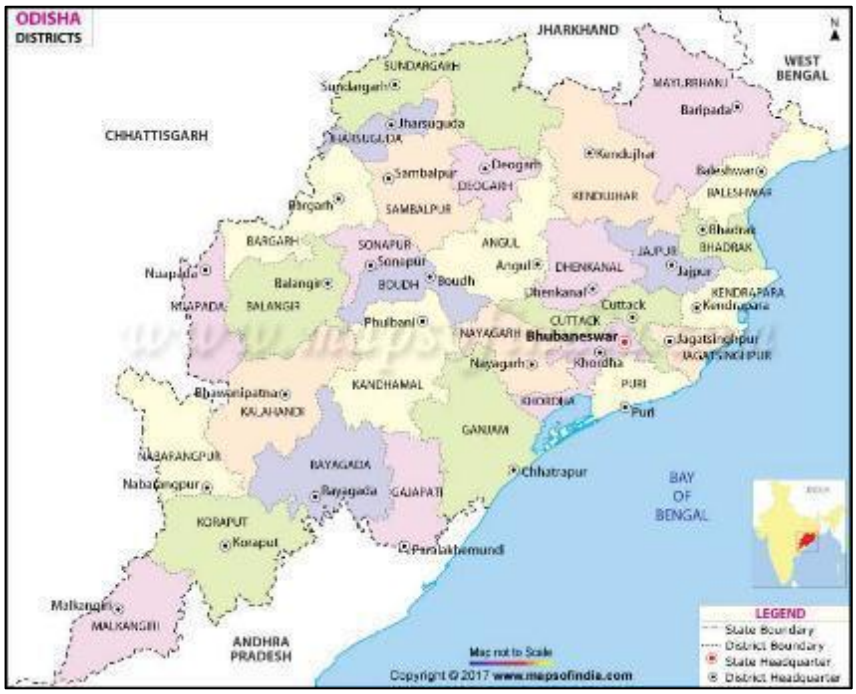


Figure 1-1: Location of Bhubaneswar in Odisha

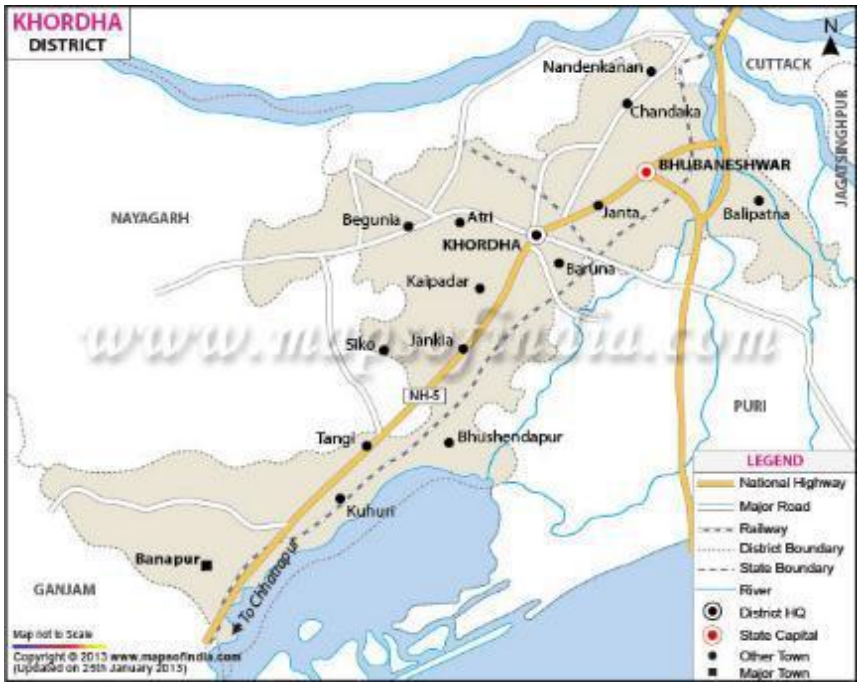


Figure 1-2: Location of Bhubaneswar in Khordha district

Post-Independence, the modern city of Bhubaneswar, designed by German architect Otto Konigsberger in 1946, was established to shape the city in serving as an administrative centre for the state. Today, the city is an emerging hub for education, health and information technology. The citizens of Bhubaneswar can take pride in the several distinctions bestowed to the city, including:

1. Only Tier-2 city in the country to host the top five Indian IT companies: Infosys, Wipro, Tata Consultancy Services , Tech Mahindra and Mindtree
2. Ranked 3rd Best Place to “Do Business in India” by World Bank
3. One of the planned four “Information Technology Investment Regions” in India

Bhubaneswar also plays an important role as a regional gateway to the Golden Tourist Triangle of Puri, Konark, and Chilika Lake. Its strategic geographic location along the east coast of India, has positioned Bhubaneswar to serve as the gateway to South-east Asia with easy access to existing and emerging ports, petrochemical and steel hubs at Paradeep, Kalinganagar, Dharma and Gopalpur. Additionally, a number of new ports are being proposed along the Odisha coast, which will further improve connectivity required for exports.

Bhubaneswar is located in Khordha district of Odisha. It is in the eastern coastal plains, along the axis of the Eastern Ghats. The city has an average altitude of 45 m (148 ft.) above sea level. It lies southwest of the Mahanadi River that forms the northern boundary of Bhubaneswar metropolitan area, within its delta. The city is bounded by the Daya River to the

south and the Kuakhai River to the east; the Chandaka Wildlife Sanctuary and Nandankanan Zoo lie in the western and northern parts of Bhubaneswar, respectively.

Bhubaneswar is topographically divided into western uplands and eastern lowlands, with hillocks in the western and northern parts. Kanjia Lake on the northern outskirts, affords rich biodiversity and is a wetland of national importance. Bhubaneswar's soils are 65 per cent laterite, 25 per cent alluvial and 10 per cent sandstone. The Bureau of Indian Standards places the city inside seismic zone III on a scale ranging from I to V in order of increasing susceptibility to earthquakes.

1.4 Major Connectivity & Linkage

1.4.1 Road Connectivity

Bhubaneswar has wide roads in grid form in the central city. Bhubaneswar has approximately 1,600 kilometres of roads, with average road density of 11.82 square kilometres (4.56 sq mi). Baramunda bus stand is the major bus terminus in the city from where buses ply to all the districts in Odisha as well as to neighbouring state's cities like Hyderabad, Kolkata, Visakhapatnam, Raipur and Ranchi. City bus service runs in public-private partnership between Bhubaneswar-Puri Transport Service Limited (BPTSL) and Dream Team Sahara (DTS) under JNNURM scheme. A fleet of 185 buses cover all major destinations including Cuttack, Puri and Khordha. Auto rickshaws are available for hire and on a share basis throughout the city. In parts of the city, cycle rickshaws offer short trips. To ease traffic jams, over-bridges at major road junctions and expansion of roads are under construction.

1.4.2 Air Connectivity

Biju Patnaik International Airport, 3 kilometres south of the city centre, is the major and sole international airport in Odisha. There are daily flights from Bhubaneswar to Delhi, Mumbai, Kolkata, Chennai, Hyderabad and Bangalore.

In March 2013, a new domestic terminal with a capacity of handling 30 million passengers per year was inaugurated to handle increased air traffic. In July 2015, the first international flight took off from Terminal-2 of Biju Patnaik International Airport. AirAsia has started its international operations to Kuala Lumpur, Malaysia from Bhubaneswar since April 2017.

1.4.3 Rail Connectivity

The East Coast Railway has its headquarters in Bhubaneswar. Bhubaneswar railway station is one of the main stations of the Indian railway network. It is connected to major cities by daily express and passenger trains.

1.5 Demographic Profile

As per the 2011 census of India, Bhubaneswar had a population of 837,737, while the metropolitan area had a population of 881,988. As per the estimate of IIT Kharagpur, which made a development plan, the Bhubaneswar-Cuttack Urban complex, consisting of 721.9 square kilometres (278.7 sq mi), has a population of 1.9 million (as of 2008). As of 2011, the number of males was 445,233, while the number of females were 392,504. The decadal growth rate was 45.90 per cent. Effective male literacy was 95.69 per cent, while female literacy was 90.26 per cent. About 75,237 were under six. Bhubaneswar's literacy rate is 93.15 per cent—significantly higher than the national average of 74.04 per cent.

The main language spoken in the city is Odia, however, Hindi and English are understood by most residents. Although *Odias* comprise the vast majority, migrants from other states also live there. Growth in the information technology industry and education sector in Bhubaneswar changed the city's demographic profile; likely infrastructure strains and haphazard growth from demographic changes have been a cause of concern.

1.6 Tourist Attractions

The archaeological remains at Dhauli, and hills of Udayagiri and Khandagiri give evidence of both Jain and Buddhist settlements around Bhubaneswar in the first two centuries BC. The waning of Buddhism and vanishing of Jainism with the growth of Saiva Pasupata Sect, in the second century BC saw Brahmanism as the dominant religion under the successive dynasties that ruled Odisha--the Shailodbhava and the Bhaumakaras in the 12th and 13th centuries.

The temple building reached the zenith of its glory between 7th and 12th centuries when thousands of sandstone temples were erected around the Bindu Sagar, earning it the title 'The city of Temples'. The period under the Gangas saw emergence of Vaishnavism to prominence.

The perfect symphony between its architecture and sculpture, the mastery carvings and the grand repertoire of its motifs make these temples unique. In the 15th century, the Mughals raided the city and razed all but a few of the temples. After independence, Bhubaneswar was

declared the new Capital replacing Cuttack.

The southern suburbs of the city have remnants of some of the striking temples, like the Lingaraja Temple, the Muktesvara Temple, etc., together with the famous archaeological and historical sites of Dhauli, Khandagairi and Udayagiri.

The area on the northeast has wide tree-lined avenues and many a modern administrative buildings. The commercial and the business activities are centered around places named as Kalpana Square or Kalpana Chhak on the busy Cuttack Road, Rajmahal Square, Station Square or Master Canteen and the road further on to Vani Vihar, Janpath, housing most lodges, restaurants, shopping arcades and banks.

Set on the Mahanadi Delta, the present city is a modern happening place with top class infrastructure. Many major national and international conglomerates having inked agreements to profitably invest in the State occupy offices here in Bhubaneswar. Star category hotels, restaurants, cafes, shopping malls provide quality lifestyle and refinement.

CHAPTER 2

Site Appreciation

2. Site Appreciation

2.1 Existing Site Infrastructure

The terminal spread over 15.5 acre lacks basic passenger amenities and the environment is unhygienic. The roads at the entry and exit have many potholes leading to traffic jams. The auto rickshaws and private vehicles add to the chaos.

The bus terminal is at a distance of 8 kilometres from the city centre, from where OSRTC and private operators (Rajdhani Association, etc.) run buses connecting Bhubaneswar to cities in Odisha and with the neighbouring states of Andhra Pradesh, Jharkhand, West Bengal and Chhattisgarh. The bus terminal is connected to the rest of Odisha and India by National Highways-NH 5, which is a part of the Kolkata-Chennai prong of the Golden Quadrilateral, NH 203, State Highway 13 (Odisha) and State Highway 27 (Odisha).

It is located at a distance of 6 km from Biju Pattnaik International Airport (Bhubaneswar) and 8 km from Bhubaneswar Railway Station.

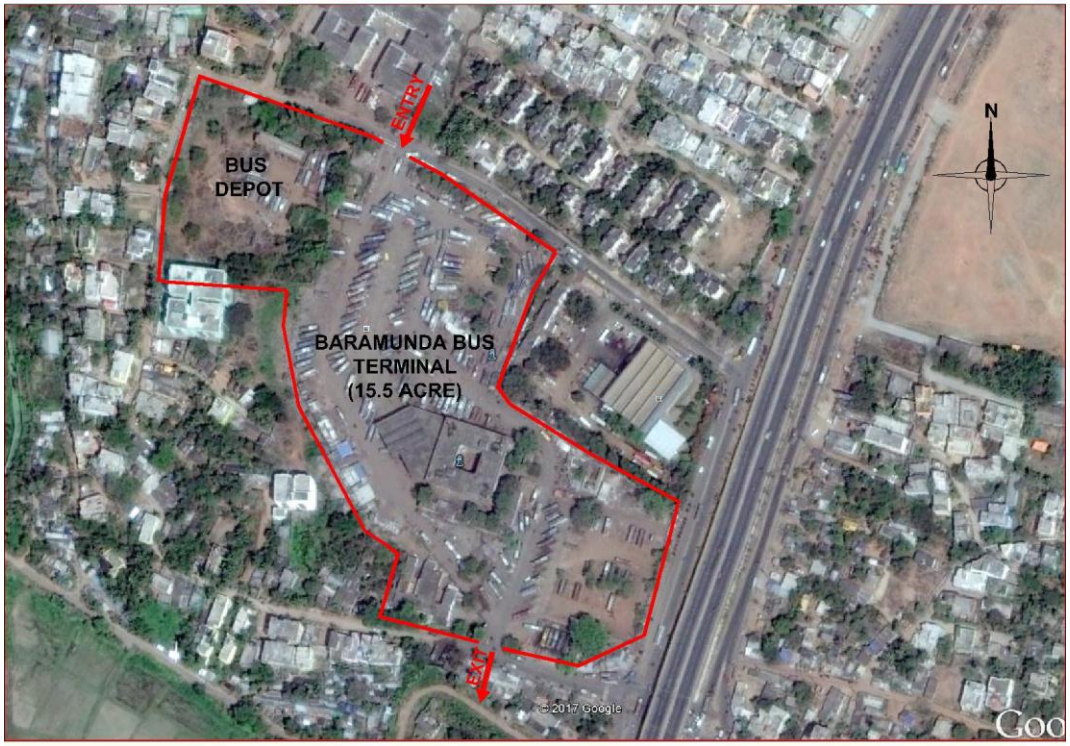


Figure 2-1: Site Location

2.2 Entry and Exit

Entry to the bus terminal and exit from it is via service lanes that run along NH-5.

The bus terminal has two main gates; Gate-1(located to the North of the bus terminal), which is used for the entry of buses, 2W and 4W vehicles, and passengers; and Gate-2(located to the South of the bus terminal), which is used for exit of buses and other vehicles from the terminal. Gate-2 is also used for entry of buses for a duration of two hours, i.e., 4 A.M. to A.M.

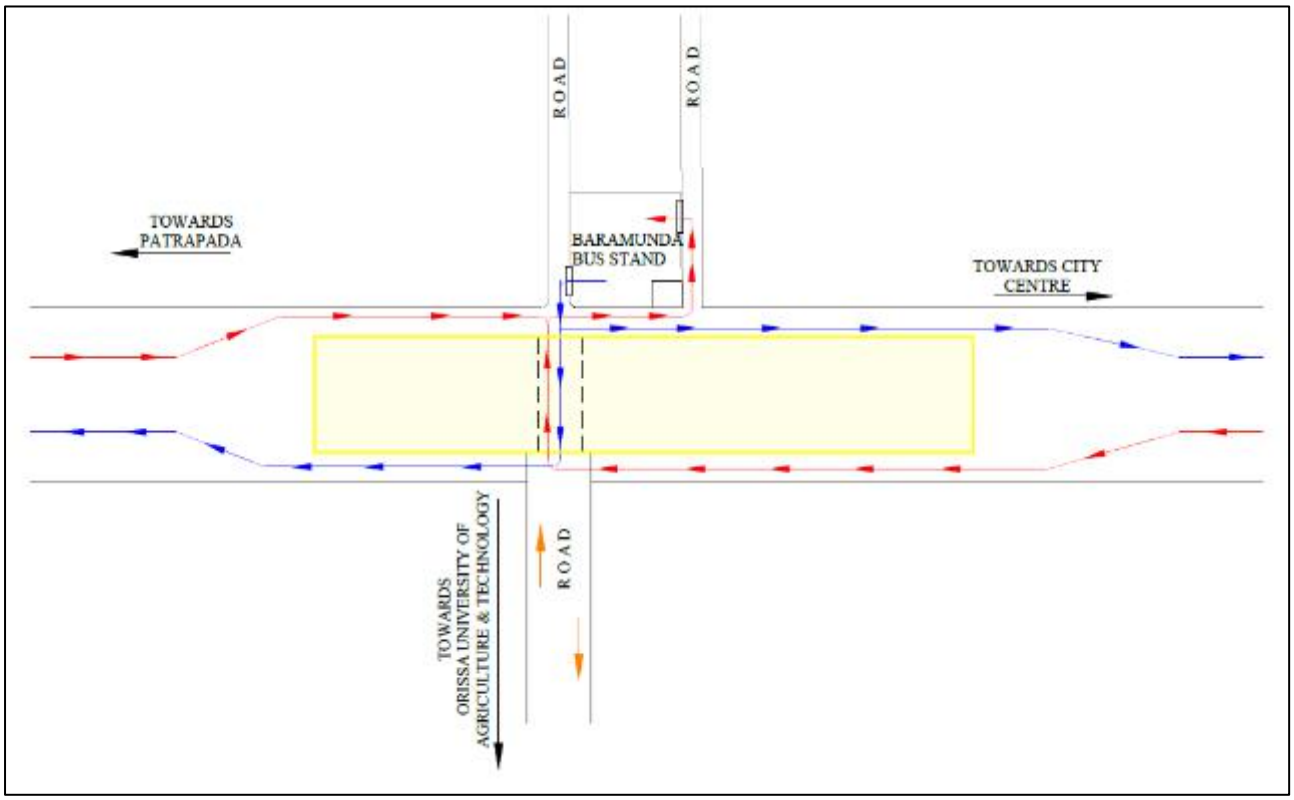


Figure 2-2: Current Bus Traffic Circulation of the Bus Terminal

Facilities available

The Terminal Building is a G+2 structure, situated at the centre of the bus terminal area. The ground floor of the building accommodates ticket counters, platforms, ATMs and an old-age home. OSRTC has taken up office space in the first and second floors. The second floor also houses certain number of guest houses.

The depot spreads across an area of 1 acre and is located to the right of the current entry gate of the terminal. Right next to Gate-1, there is a small 2-wheeler parking area which does not follow a systematic order for parking of the vehicles.

Some authorized (88) and unauthorized (approx. 20-30) shops are located towards the exit gate of the bus stand.

- Sub-station

- Authorized Shops (88); Unauthorized Shops (20-30)
- Storm Water Drain

Figure 2-3: Site Photographs







O.S.R.T.C.

CHAPTER 3

Data Collection and Methodology

3. Data Collection & Methodology

3.1 Approach & Methodology

3.1.1 Approach

After studying the Terms of Reference, the Consultants have proposed to follow task-based approach. The major task shall be data collection and database development, Data analysis, Demand forecasting and Recommendations. Each task will be taken up one after another through systematic and timely manner.

3.1.2 Methodology

The experience of the Consultants in previous similar projects has helped in evolving methodology to achieve requirements of the TOR. The various tasks of the proposed methodology are listed in the following section followed by detailed description of each task.

Task 1: Data Collection and Analysis

1.1 Secondary Data Collection

1.1.1 Passenger Demand (Time Series Data)

Consultants would collect the time series data pertaining to passenger demand for past ten years for all various ISBTs. This data would be used to work out the growth of passenger demand at these stations. The analysis will also encompass the study the pattern of growth of passenger demand supply in terms of fleet and other infrastructure facilities.

1.1.2 Other data and documents

In addition to get detailed information of the infrastructure facilities along the bus network and have appreciation of the existing norms and standards following data and documents will be collected by the Consultants

- Ticket sales data of various Transport Undertaking operating from Baramunda ISBT
- Data pertaining to Private Bus Operators from their association office

1.2 Primary Surveys

1.2.1 Bus Count and Origin-Destination Survey

Bus count and O-D surveys will be carried out at existing ISBT in order to estimate peak demand and travel pattern. Arrival/dispersal pattern counting will be carried out manually by trained enumerators at the entry and exit points. The registration number and time of entry and exit will be recorded for all the buses entering the terminal. The proforma designed for carrying out the bus count and OD survey is presented in **Annexure 3(A).**

1.2.2 Passenger Count and O-D Survey

Passengers entering and exiting will be counted manually by trained enumerators. The count data will be recorded at 15-minute interval. Passenger O-D survey will be conducted using an interview method on random sample basis. It will be carried out continuously for 24 hours on a normal working day and data regarding origin-destination, trip purpose, time spent at depot, access/egress modes, visitors etc., shall be recorded.

The proforma designed for carrying out the passenger count and O-D survey is presented in **Annexure 3(B).**

1.2.3 Parking Accumulation Survey

Parking accumulation survey will be carried out to understand the parking demand and will be conducted for 24 hrs using separate survey formats. The proforma designed for carrying out the parking accumulation survey is presented in **Annexure 3(C).**

1.2.4 Inventory of Terminal and Infrastructure Facilities

Inventory data for infrastructural facilities at ISBT would be collected by the Consultants in order to take a complete stock of the situation and judge the adequacy of these services at each of the terminal as per the existing norms and standards. The proforma is provided in **Annexure 3(D)**.

1.3 Data Analysis

After collection of primary & secondary data from the site. The next task is to analyse the collected data and present it in the form of inferences. Table below presents the outputs that can be obtained from each of the surveys discussed above:

Table 3-1: Summary of Primary Survey, Purpose and Outputs

Sl. No.	Type of Survey	Purpose	Outputs
1	Bus Count and OD	To estimate bus demand, characteristics and travel pattern	Daily/Average bus entering/exiting
			Peak hour characteristics
			Daily variations
			OD
			Dwell Time
2	Passenger Head Count	To estimate daily passenger volume and their characteristics	Daily Passenger volume
			Peak hour characteristics and passenger volume
3	Commuter Origin-Destination (OD) Surveys	To determine commuter travel characteristics at terminal	Commuter Travel pattern
			Trip Purpose
			Time spent at terminal
			Access-dispersal modes of commuter
4	Parking Survey	To estimate parking demand and characteristics	Peak hour parking
			Parking accumulation

Bus Count and OD survey data will be analysed to find out the average number of buses daily entering and exiting from the terminals. Along with this it will also be analysed to identify the peak hour and its characteristics, arrival pattern, average dwell time and dwell time distribution. Origin-Destination survey data will be coded for different trip origin and destination using traffic zone codes. The data will be analysed using in-house computer package to develop O-D matrices for different bus types. From O-D data the directions in which buses are moving will be identified, the state share of interstate buses will be computed which will help in delineating the project influence area.

Passenger count survey data will be analysed to find out daily passenger volume and peak hour characteristics of bus passengers. The data would be useful in estimating the various facilities required in the bus stations.

Task 2: Demand Forecasting

2.1 Data for Demand Forecasting

After analysing the current traffic behaviour, it becomes prudent to forecast the same for future years. Based on the forecasts, the facilities are to be planned in the future. It might also be the case that facilities to be developed in future are highly cost intensive. Thus, realistic forecasting is necessary for efficient utilization of resources.

For any traffic forecasting method in general there is a requirement of the data through which the analysis shall be done. The data requirement can be met by primary data collection obtained through conduct of traffic surveys and from secondary data collection obtained

through review of past relevant reports and also from the operational data of the various transport facilities of similar nature like historical data from the bus terminals in the present case.

Traffic growth is governed by a number of Economic factors (NSDP/GDP/ PCI.) and Demographic factors (Population, Age, Gender etc.).

2.2 Forecasting Method

If past traffic data indicator is available for a number of years and the corresponding data on some socio economic indicator such as NSDP, PCI, Population, Industrial Production etc. is also available, then the data can yield an econometric model of the following type:

$$\text{Log}_e P = A_o + A_1 \log_e \text{NSDP}$$

Where P = Traffic Indicator volume (may be classified like bus, car, truck etc.)
NSDP = Net State Domestic Product
A_o = Regression constant
A_1 = Regression coefficient

The value of A_1 is known as Elasticity coefficient. The elasticity coefficient is the factor by which the NSDP growth rate has to be multiplied to arrive at the growth rate of traffic.

Task 3: Bus Terminal Infrastructure Assessment

Terminal infrastructure includes both passenger related activities as well as bus operational facilities. Passenger facilities inside terminal shall be properly located and shall be accessible, such as seating, kiosks, vending machines and parking. The terminal operational facilities include bus bays, bus lanes, entry-exits and circulation pattern. The different components of this task are detailed as follows:

3.1 Estimation of Bus Bays (Active bays & Idle Bays)

Bus bays are the platforms where buses dock and where passengers board and alight at the bus terminal. Design of the bus bays must incorporate both vehicle and passenger needs. The bus bays are estimated for the peak demand. The bays will be estimated both for active bays (bays used for boarding/alighting of passengers) & idle bays (used for idle parking of buses).

Bus bays are calculated considering passenger & bus demand based on passenger footfall and travel needs. In addition, one of the major factors in the assessment of number of bus bays is the bus dwell time which is explained in detail below. The number of bays required at

the bus terminal has to be estimated based on the bus entry exit survey. This survey will also help us determine the dwell times which will further facilitate in planning bus bay requirement for intercity & intra-city buses.

3.2 Estimation of Dwell Time

Dwell time of a bus refers to the time spent by bus at the scheduled stop/bay. Typically, this time is spent for entering/exiting bus bay (clearance time), boarding and alighting of passengers and time allowed for passengers to buy tickets. Other factors which could also be considered is early arrival or delayed departure of buses from scheduled time.

3.3 Private Vehicle Parking

Parking requirement for private modes shall be assessed based on the travel patterns, modal share of vehicles accessing the terminal. In terms of the private modes such as two-wheelers and cars, long-term or all-day commuter parking will be considered as well as short-term or drop-and-ride activities. Parking analysis will require the assessment of existing & proposed parking requirement. The existing parking requirement will be developed on the basis of traffic surveys conducted and the same shall be forecasted based on suitable forecasting technique.

3.4 Pedestrian Infrastructure Facilities

One of the main components within the terminal planning guidelines is to provide adequate space and appropriate facilities to accommodate and disperse projected peak pedestrian demands while ensuring pedestrian safety and convenience. For this, facilities should be formulated based on the pedestrian flow rate at the terminal. The same will be determined on the basis of pedestrian volume count conducted at adjacent mid-block & junctions.

3.5 Number of Entry/Exit points and locations

The decision on number of entry and exit for the bus terminal and circulation pattern (one-way or two-way movement) shall be provided based on the assessment of road capacities in the influence area, size of the bus terminal plot, based on queue length observed during analysis and no. of buses entering/exiting the terminal in peak hour.

3.6 Circulation Plan

The circulation plan for both vehicular as well as pedestrian traffic will be worked out so as to avoid all points of conflict of movements. This would also include the traffic plan for the incoming and outgoing traffic at the main entry and exit points.

3.2 Database Development

3.2.1 General

As a part of the proposed ISBT study for Baramunda, Bhubaneswar; extensive data collection to develop baseline demand will be carried out. The data collection included the primary surveys in the field and the secondary data collection from various sources in PIA Region. This chapter presents the details of the various traffic surveys conducted with the locations and survey schedule.

3.2.2 Primary Surveys

The survey planning has been done after carefully analysing the study requirements and also undertaking a detailed review of the entire available database. A comprehensive site visit has been conducted by the senior members of study team to understand the existing bus operation in the city. Based on the findings of reconnaissance survey the locations for conducting the traffic surveys were identified. The project Site with the existing road network is as presented in the following figure.

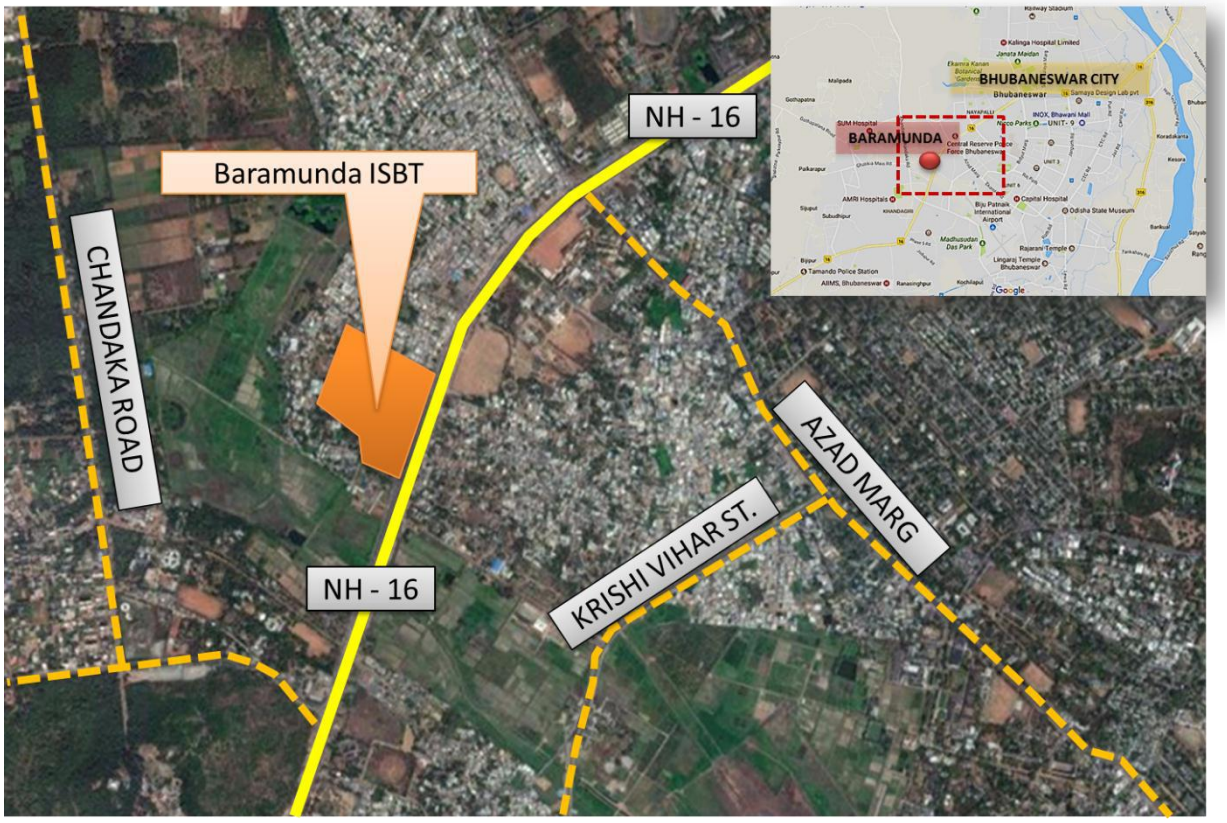


Figure 3-1: Road Network and the existing ISBT location at Baramunda, Bhubaneswar

The following primary surveys were carried out as part of the study to assess the demand of the proposed ISBT.

- Bus count and Origin destination surveys
- Passenger Head Count surveys
- Passenger Origin destination survey
- Parking Survey

3.2.2.1 Bus Count and Origin Destination Survey

Bus counts and origin destination surveys were carried out at all the entry and exit gates of the existing bus terminals. Bus count and OD surveys were conducted for 3 days at the terminal. The bus counts and origin destination surveys were conducted by manual counting method and registration plate survey method.

The photos depicting the bus counts and OD surveys in progress at different locations are as shown below.

Figure 3-2: Bus Count and OD Surveys at Entry and Exit Points

3.2.2.2 Passenger Head Count Survey

Passenger head counts survey was carried out at all the entry and exit gates of the existing bus terminals for 1 day. The passenger counts survey was conducted by manual counting method. The photos depicting the passenger count survey in progress at different locations are as shown below.


Figure 3-3: Passenger Head Count Survey at all Entry & Exit Points

3.2.2.3 Passenger Origin-Destination Survey

In order to appreciate the travel pattern of the passenger in the influence area of the ISBT, Origin-Destination surveys of commuters were conducted for 1 day. The photos depicting the passenger OD survey in progress at different locations are shown below.


Figure 3-4: Passenger Origin Destination Surveys at Strategic Locations

3.2.2.4 Parking Survey

The parking surveys were conducted to determine the parking accumulation at the existing terminals. The survey data will be used to obtain information regarding the variation of the parking demand over the day and to determine peak parking demand.

Traffic Survey locations and schedule are provided in Table 3-2 and Figure 3-5 given below.

Table 3-2: Survey Locations and Schedule

Date		Type of Surveys	Total Hours
From	To		
05.11.2017	08.11.2017	Bus Registration Plate Survey (entry/exit)	72
05.11.2017	08.11.2017	Bus Origin Destination Survey (entry/exit)	72
06.11.2017	07.11.2017	Passenger O-D Surveys	24
06.11.2017	07.11.2017	Passenger Head Count Survey (entry/exit)	24
07.11.2017	08.11.2017	Parking Survey	24
07.11.2017	07.11.2017	Pedestrian Survey at entry Junction & NH -16 (Across the Road)	16

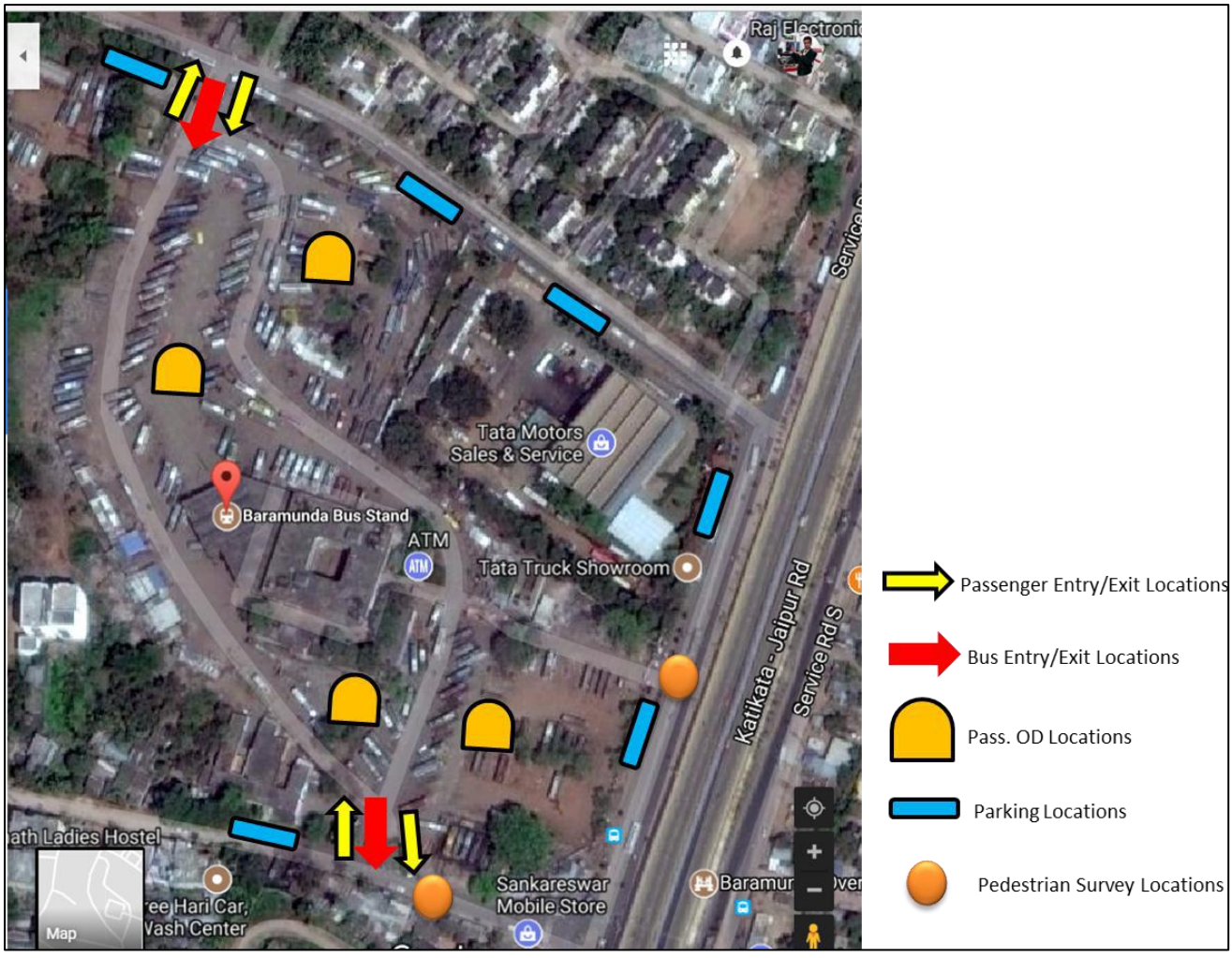


Figure 3-5: Survey Locations

3.2.3 Bus Count and Origin-Destination Survey

As discussed in the earlier section that the bus count and OD survey were conducted at 3 locations. The results of each of the locations are as presented in the subsequent sub sections.

3.2.3.1 Baramunda Bus Terminal

Private intercity and interstate buses were counted separately. On average, daily 919 buses are observed to enter and exit the Baramunda bus terminal in a day. Out of this 866 are intercity buses and 53 are interstate buses. The summary of the bus count is as presented in the Table 3-3 below.

Table 3-3: Daily Entry and Exit at Baramunda Bus Depot

Types of Bus	Number of Buses Entering and Exiting Daily
Inter City	866
Inter State	53
Total	**919**

Peak hour shares of buses are presented in below Table 3-4 and the average entry/exit pattern of daily buses are as presented in the Figure 3-6 respectively.

Table 3-4: Peak Period of Buses

Peak Period	% Share
14:00 to 15:00	6%

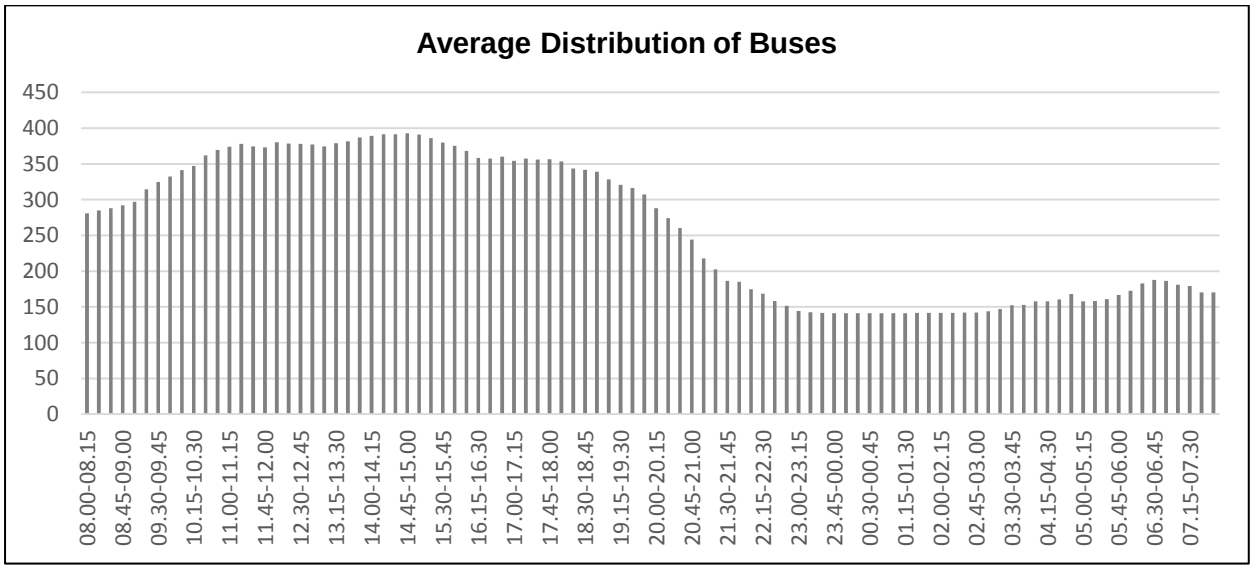


Figure 3-6: Entry/Exit Pattern of Buses

The average dwell time of the buses are as presented in the table below.

Table 3-5: Bus Duration in Stand

Average Bus Duration in Stand	
Time (in hours)	04:25:00

It can be observed that the average dwell time of the buses in terminal is on the higher side. The primary reason for such behaviour is that the buses generally move out of the terminal only after sufficient number of seats gets occupied. The pattern will change in future as the demand increases. The dwell time distribution all the buses are as presented below.

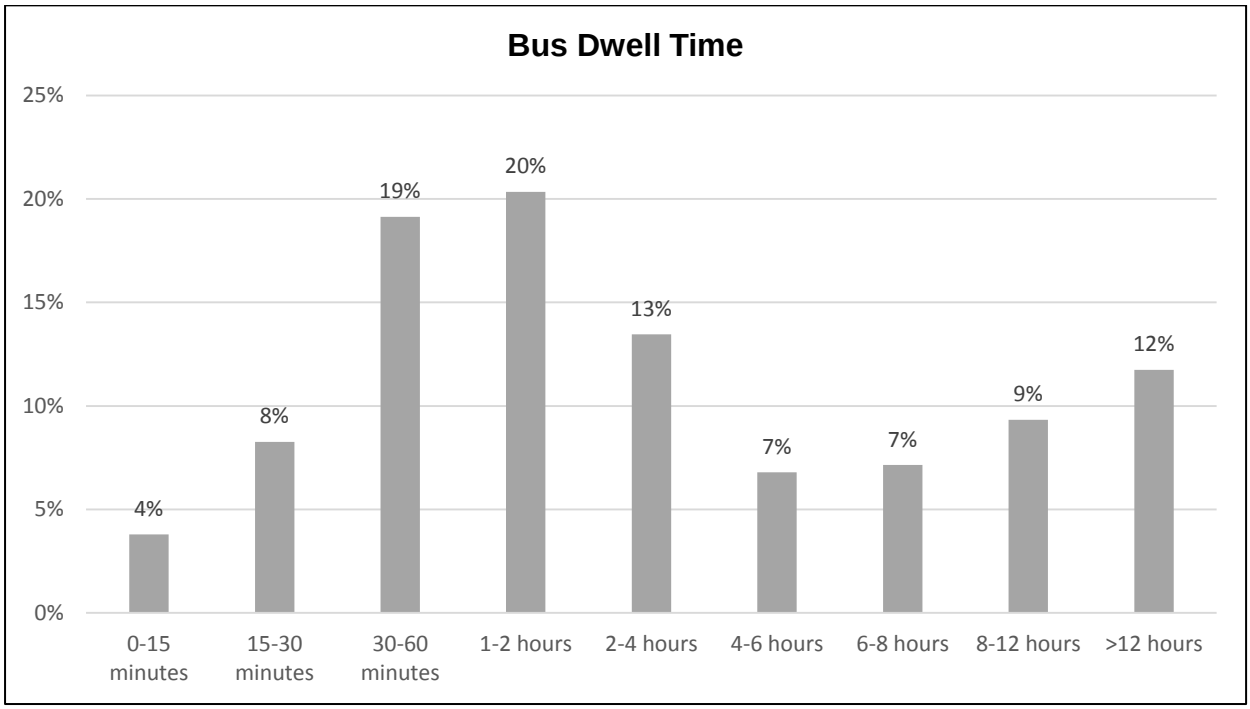


Figure 3-7: Frequency Distribution of Bus Dwell Time

3.2.3.2 Bus Origin-Destination Survey

To understand the spatial dimensions of the trip characteristics of the buses, a detailed zoning system was developed giving due consideration to the following factors:

- The road network catering to the present and proposed terminals.
- Important towns, villages, factories and industrial centers around the Bhubaneswar city.
- Administrative boundaries of districts and states.

The zoning system adopted for data collection was based on 72 zones. Out of these 72 zones, 57 are within the state of Odisha and remaining 15 zones are from the neighbouring states. The map showing the zones is as presented in the figure below.

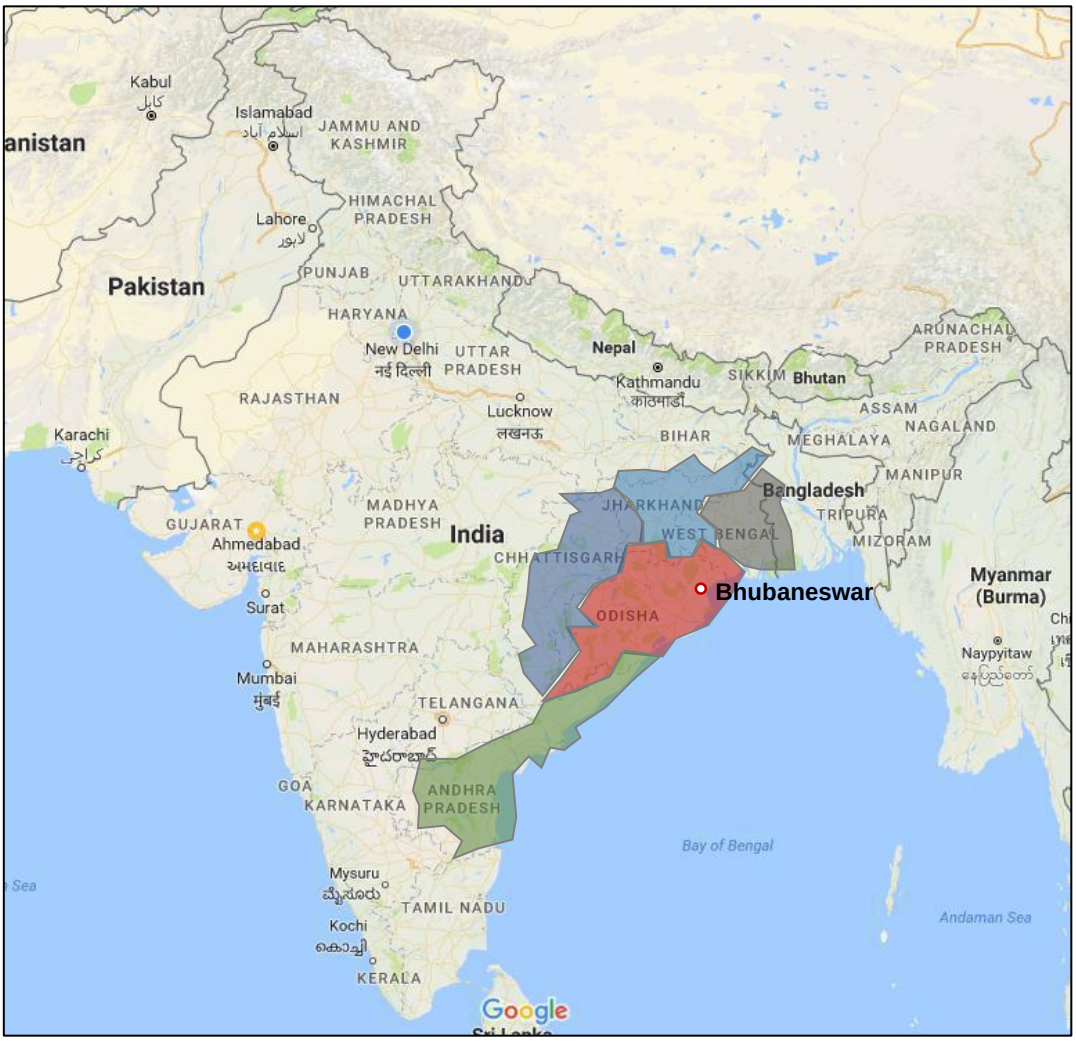


Figure 3-8: Zone Map

The OD data is analysed to understand the travel pattern of buses to establish the influence area which was later used in growth rate estimation. The state share for interstate buses as observed is as presented in the table below.

Table 3-6: State-wise Share of Buses

States	State-wise Share	Inter/Intra State Share
Odisha	94.26%	Intrastate: 94.26%
Jharkhand	01.00%	Interstate: 5.74%
West Bengal	03.75%	
Andhra Pradesh	00.06 %	
Chhattisgarh	00.33 %	
Rest of India	00.59 %	

3.2.4 Commuter Survey

A commuter survey was conducted for the period of 24 hours at all the terminals. Passengers were interviewed on a random sample basis and were asked about their travel characteristics such as their origin and destination, their access or egress mode to or from depot, time spent at the depot, bus type and their purpose of visit and number of visitors with passengers. Also, the survey was conducted to elicit passenger's opinion about the services/facilities they desired at the terminal.

It is observed from the analysis that most of the passengers inside the terminal area are boarding the bus. Out of total collected samples, 67% passengers are boarding and rest 33% are alighting. A number of passengers coming up to the terminal alight outside the terminal area where they can find egress modes (like IPT stand) to disperse.

It is observed that the trip purpose of most of the commuters is social followed by educational and returning home. The trip purpose distribution of commuters is as shown in the Figure 3-9 below.

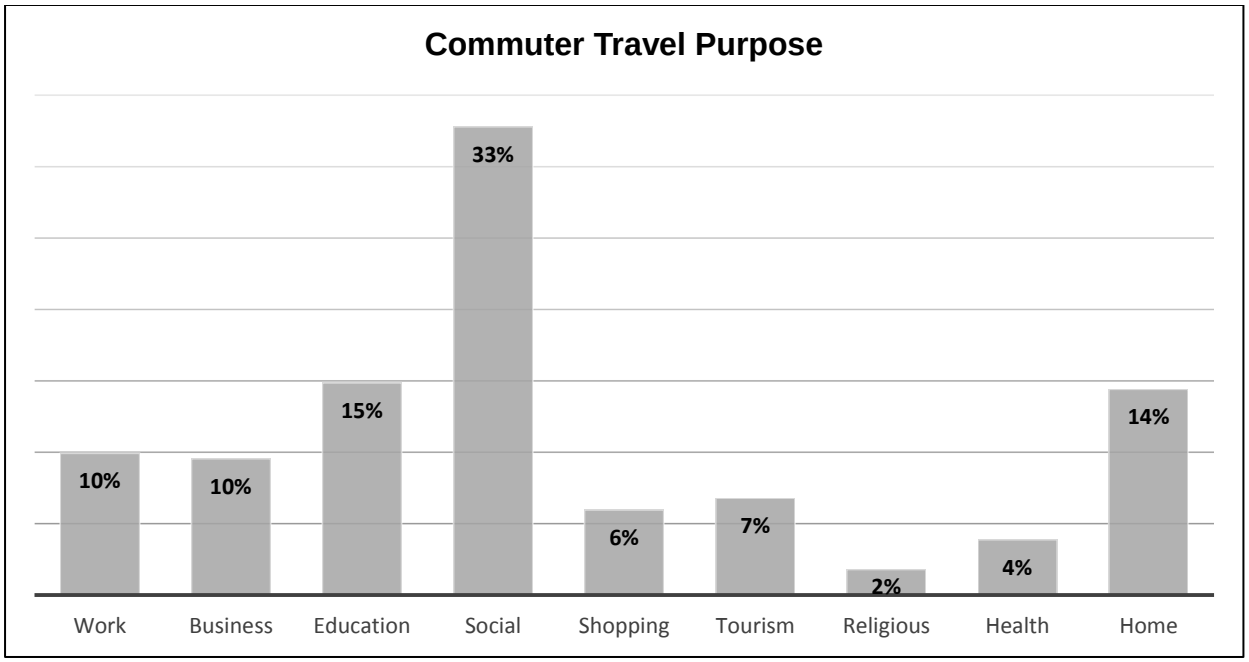


Figure 3-9: Travel Purpose of Commuters

Data analysis indicates that the main access-dispersal mode is Auto (24%) followed by Shared Auto (22%) and Private city bus (13%). Only 0.2% passengers preferred cycle rickshaw as access-dispersal mode. Figure 3-10 presents access-dispersal modal share of passengers.

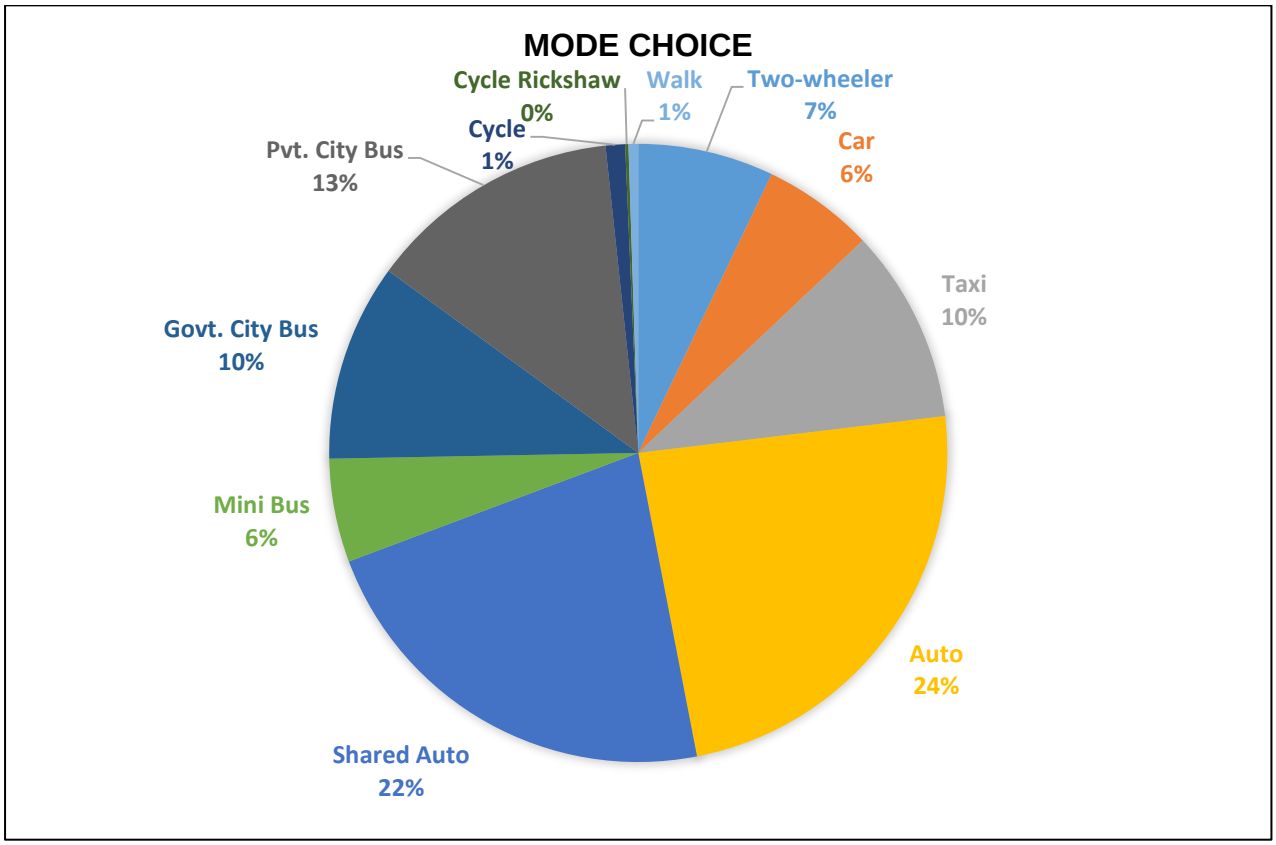


Figure 3-10: Passenger Mode Choice

In addition to this, 13 number of visitors were observed in the terminal area per 100 passengers. This ratio is used while estimating the demand of visitors in the terminal area.

The time spent by the passengers inside the terminal area is one of the important factors in designing the facilities of the terminal. The dwell time distribution of commuters inside the terminal area as observed is presented in the Figure 3-11 below.

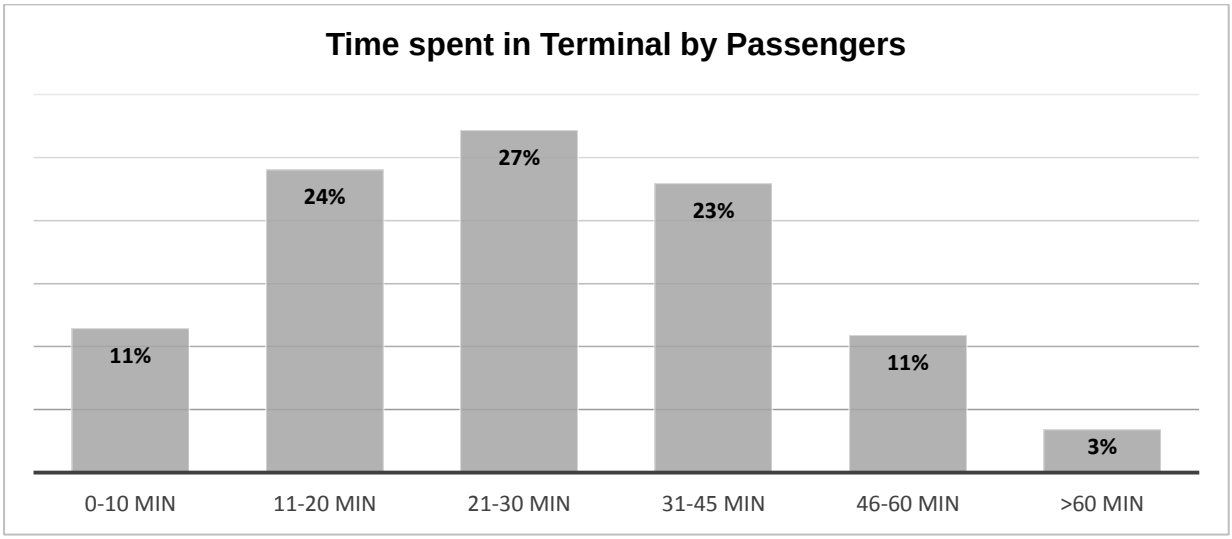


Figure 3-11: Time spent by passengers at Baramunda Bus Terminal

It can be observed from the above figure that the average time spent by the commuters inside the terminal is around 20-30 minutes. Approximately, 3% of commuters spent more than 1 hour inside the terminal area.

The commuters with different monthly income spread were observed inside the terminal area. The distribution of commuters based on their income levels is as presented in the Figure 3-12 below.

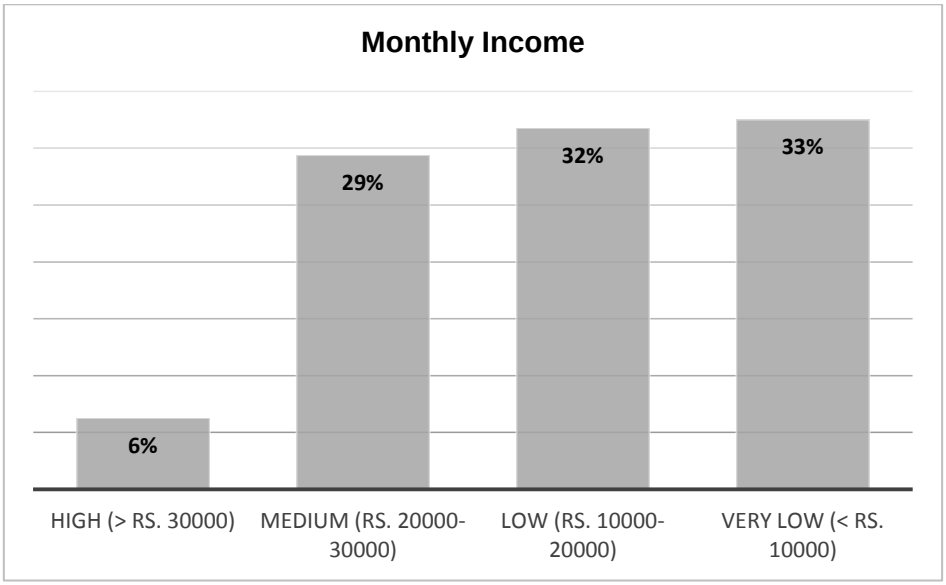


Figure 3-12: Monthly Income of Passengers

During the commuter survey, along with the trip characteristic details, users were also asked about additional facilities which should be provided at the terminal. The results of the survey

are as presented in the Figure 3-13 below. The stated needs of passengers on various facilities inside the terminal is presented in Figure 3-13.

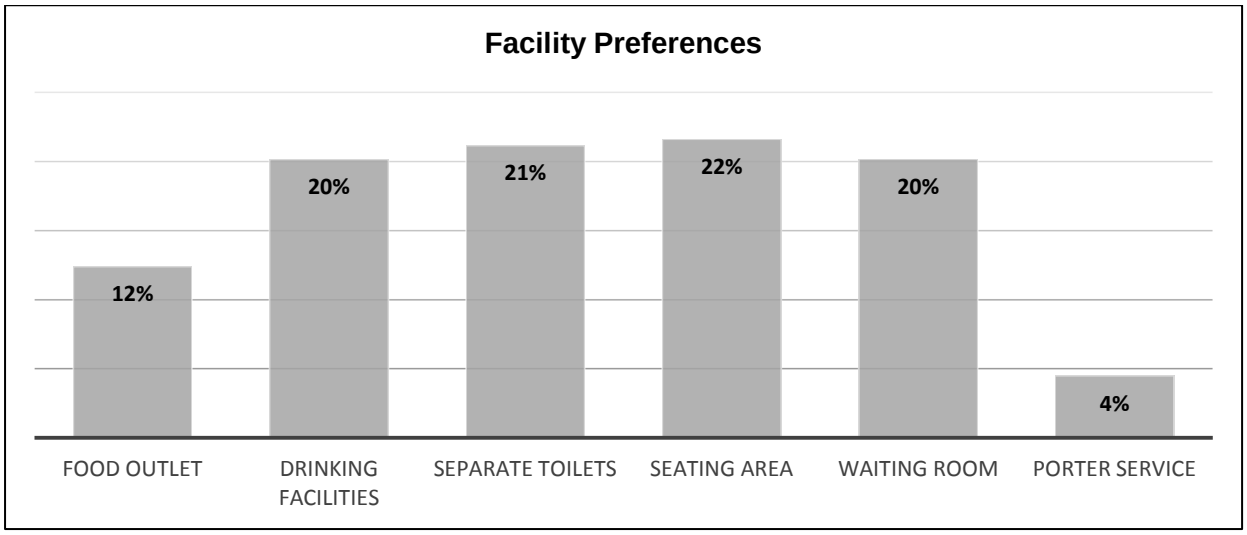


Figure 3-13: Passenger facilities preference

It is observed that there is an almost consistent demand for seating areas, separate toilets, waiting rooms and drinking water facilities. Some of the users also expressed the need for food outlets.

3.2.5 Passenger Head Count Survey

Passenger head count surveys were conducted at Baramunda Bus Terminal for a period of 24 hours. The survey was done by manually counting the passengers entering and exiting through all entry and exit points of the terminal in 15 minute intervals. The data is used to assess the total number of passengers that use the terminal in a day. The detailed analysis is described below.

At the location, 29175 passengers were observed in a day. The details about the number of passengers getting in and moving out of the terminal with the peak characteristics are as presented in the Table 3-77 below.

Table 3-7: Daily Passenger details at Baramunda Bus Terminal

Direction	Daily passenger (24 hours)	Peak Time	Peak Hour Passenger	Peak Hour Share
Entry	20417	18:00-19:00	1913	09.36 %
Exit	8758	18:00-19:00	1140	13.01 %
Both	**29175**	**18:00-19:00**	**3053**	**10.46 %**

It can be observed that during peak hour, 10.46% of the commuters were observed to either enter or exit the terminal. The hourly passenger load profile at this location is as presented in the figure below.

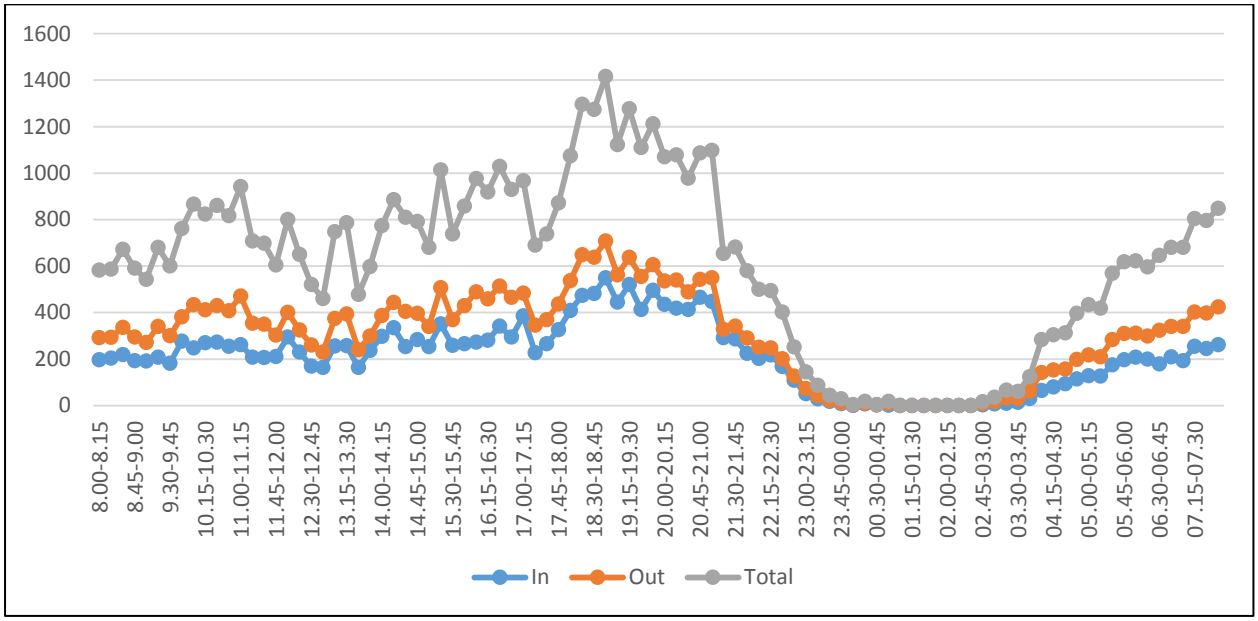


Figure 3-14: Hourly variation of Commuters at Baramunda

It can be observed from the above figure that most of the arrival/departure of passengers at terminal happens in the evening around 6 P.M. (1800 hours) and continues up to 7 P.M. (1900 hours). During late night hours, no passengers were observed to either enter or exit the terminal.

3.2.6 Parking Survey

Parking accumulation survey at this location was carried out for 24 hours on a normal working day. The hourly variation in the parking demand (in terms of ECS) of different vehicles observed is as presented in the Figure 3-15 below.

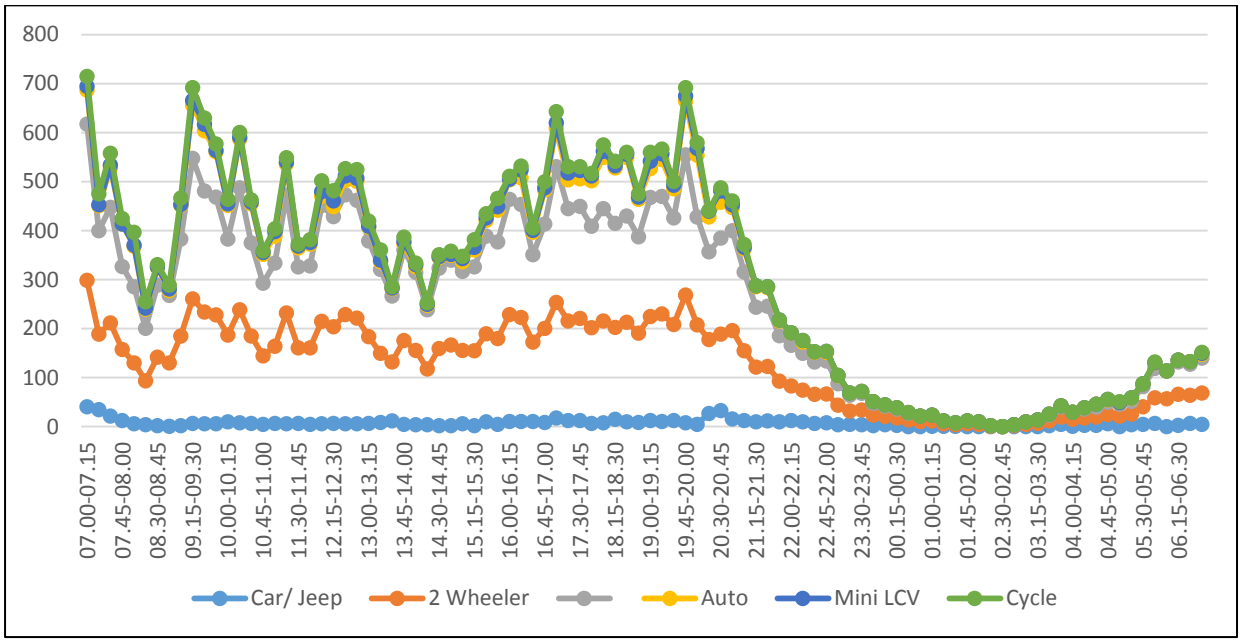


Figure 3-15: Hourly Variation of Parking Demand at Baramunda Bus Terminal

The peak parking demand observed is of **108 ECS** between 19:45 to 20:45.

CHAPTER 4

Bus Demand Forecast

4. Bus Demand Forecast

4.1 Background

The investment priorities are governed by the forecasted demand, assessed benefits and cost of the project. Demand assessment also plays an important role in planning a suitable capacity configuration of the facility for given requirements.

Since and ISBT project of this nature calls for significant investment and will become an identity of the city in the long run (one of the points from where people will enter and exit the city), prediction of bus/passenger demand therefore becomes an important task and has to be carried out considering all influencing parameters as the forecasted demand is used in designing all the facilities (like number of bays, idle parking space for buses, passenger movement area, passenger seating area, parking for private modes) of the proposed ISBT.

Accordingly, the consultants have carried out a detailed scientifically drawn analysis of various parameters to determine growth rates of bus demand. The growth rate is estimated as per the guidelines provided in IRC-108-1996 and the past experience of working on similar kind of projects.

4.2 Approach

Demand forecasting for ISBT was done considering past trend in growth and analysing future prospects of project influence area. Elasticity approach of growth rate estimation was used for long term demand forecasting for the prescribed Horizon Year of FY2048. The approach included:

i) Buses currently operating in the city were differentiated in various categories (intercity, interstate) as per their respective characteristics.
ii) Each category of bus was analyzed separately with respect to past trend of growth and development profile of its influence area.

4.3 PIA & Traffic Streams

A study of the socio-economic profiles of the Odisha region provides an overview of the factors likely to influence the pattern of economic development and hence the number of bus trips operating from the city. The details include population, per-capita Income, NSDP, GDP (India) and targeted growth rates of the economy. The profiles help to generate basic inputs for the estimation of future growth in transport demand on the basis of past scenarios, perspective changes in transport demand elasticity and economic growth rates.

As discussed in the previous chapter that the buses are broadly divided in two categories viz. intercity and interstate. The intercity buses are the one operating within the state of Odisha and the interstate buses are of different states. Thus, the PIA for intercity buses is only the state of Odisha. The PIA for interstate buses are identified based on the OD surveys conducted at different terminals. The details relating to the various states included in PIA of interstate buses with their shares is as presented in the table below.

Table 4-1: State shares for interstate buses operating in Bhubaneshwar

State	Share	Inter/Intra State
Odisha	94.26%	94.26%
Jharkhand	1.00%	5.74%
West Bengal	3.75%	
Chhattisgarh	0.33%	
Andhra Pradesh	0.06%	
Rest of India	0.59%	

4.4 Growth Trends

The past data of the number of bus trips from/to Bhubaneshwar would provide an exact growth trend. However, in the absence of this data past growth in the bus registrations in the region is generally a good indicator, as it is found to correlate reasonably well with growth in bus trips. To establish future bus trips from Bhubaneshwar, the trend in bus registrations of Odisha is studied. The bus registration data of Odisha is as presented below. These figures are based on the individual bus registration data of Odisha taken from the Road Transport year book published by MORTH from time to time and taking their weighted average as per their contribution on overall trips.

Table 4-2: Bus Registration Data of Odisha

Year	Number of Buses
2006-07	13,705
2007-08	14,349
2008-09	14,990
2009-10	15,766

Year	Number of Buses
2010-11	16,816
2011-12	17,273
2012-13	17,747
2014-15	18,358
2015-16	18,735
CAGR	**4.40%**

It can be observed from the above table that growth in the registration data of buses in Odisha is **4.40%.**

Past Growth in Regional Economies

Transport demand depends on existing development and future growth prospects of the connecting regions. The weighted (based on OD share) time series data of economic indicators at constant (2011-12) prices for Odisha are as presented below.

Table 4-3: Economic Indicators of Odisha

Year	Gross State Domestic Product (Rs. in lakhs)	Net State Domestic Product (Rs. in lakhs)	Population	PCI (Rs.)
2011-12	2,27,87,200	2,01,11,100	4,19,74,218	47,632
2012-13	2,38,37,000	2,11,30,700	4,25,29,492	49,543
2013-14	2,59,17,900	2,26,41,000	4,30,92,111	52,551
2014-15	2,74,72,100	2,39,05,100	4,36,62,174	54,926
2015-16	2,91,22,700	2,53,29,600	4,42,39,777	57,616
2016-17	3,14,36,400	2,73,91,400	4,48,25,022	61,678
CAGR	**6.65%**	**6.37%**	**1.32%**	**5.30%**

4.5 Transport Demand Elasticity

While the past traffic growth (past bus registration) trend are generally helpful to indicate growth pattern likely to extend in near future, it is not appropriate to use it for long term forecasts as demand changes are usually because of shifts in the pattern of economic activities in the influence area. Therefore, future traffic forecasting was done using elasticity

approach which takes into account the elasticity of transport demand and probable pattern of future growth of the economy.

The Elasticity Method relates traffic growth (past bus registration) to changes in the related economic parameters. This method studies, in an appropriate perspective, the changes observed in past trips in the context of changes in relevant economic indicators in Odisha, to which it was closely related in the past. Such parameters include Gross State Domestic Product (GSDP), income accruing to the major sectors of the economy, etc. This method takes into account not only the past growth of the major economic indicators, but also the future perspective. According to IRC-108, 1996, elasticity based econometric model could be derived in the following form:

Log e P = A0 + A1 Log e (EI)

Where: P = trip numbers;

EI = Economic Indicator;

A0 = Regression constant;

A1 = Regression co-efficient (Elasticity Index).

Elasticity values for each category of buses is estimated using the past bus registration data and the growth of GSDP. The elasticities obtained are as presented below.

Table 4-4: Elasticity value based on Bus Registration data and Growth of GSDP

Bus Type	Elasticity
Intercity	0.65

Projected elasticity values for intercity and interstate buses are given below. Elasticity values in the initial period are related to past elasticity values. However, it is observed that in absence of proper infrastructure for bus travel in the past as well as at present, the total demand observed is suppressed. Now, with the number of committed projects in the public transport sector it is expected that this latent demand will reappear and to capture this demand the elasticity value forecasted for the initial years is higher than the elasticity value observed in the past. Generally, the spread of economic development induces changes in the spatial distribution of activities and corresponding changes in transport demand elasticity. As regions become more and more self-sufficient, the need for long-distance transport diminishes. Accordingly, it was assumed that transport demand elasticity, for both intercity and interstate buses would tend to decline over time, despite growth in per capita income.

Table 4-5: Projected Elasticity Values

Year	Elasticity
FY19 to FY23	0.60
FY24 to FY28	0.55
FY29 to FY48	0.55

4.6 Future Growth of Odisha/PIA

Using the past trend of growth, a relationship is established between the GDP growth of India and the growth in GSDP of Odisha/PIA. Using this approach GSDP growth of Odisha is estimated. The values of estimated GDP of PIA is as presented below.

Table 4-6: Projected Growth of PIA

Year	Annual Growth Rate (%)
FY19 to FY23	6.50%
FY24 to FY28	5.50%
FY29 to FY48	5.50%

4.7 Projected Growth Rates

Based on the projected elasticity values and the growth of Odisha, the future average annual compound traffic growth rates have been estimated by using the following relationship:

Bus Trips Growth = $(GSDP_{gr})$ x E

Where, $GSDP_{gr}$ – growth rate of GSDP in Odisha

E – Elasticity value for mode

The growth rates computed are as presented in the table below.

Table 4-7: Projected Growth Rates of Bus Trips

Year	Annual Growth Rate (%)
FY19 to FY23	4.0
FY24 to FY28	3.0
FY29 to FY48	3.0

CHAPTER 5

Assessment of Transport Infrastructure Required for ISBT

5. Assessment of Transport Infrastructure Required for ISBT

5.1 General

Capacity is one of the most critical parameter in designing of facility like ISBT. The capacity in turn depends on the estimated demand levels. This chapter presents the assessment of demand levels of different elements (buses, passengers, private vehicles etc.) at proposed ISBT in the horizon year. The chapter also presents the infrastructure required for the corresponding demand levels.

5.2 Total Demand at the Proposed ISBT

Bhubaneswar has proposed many public transport oriented projects, the ISBT is one of the project. The map showing the different projects is as below.

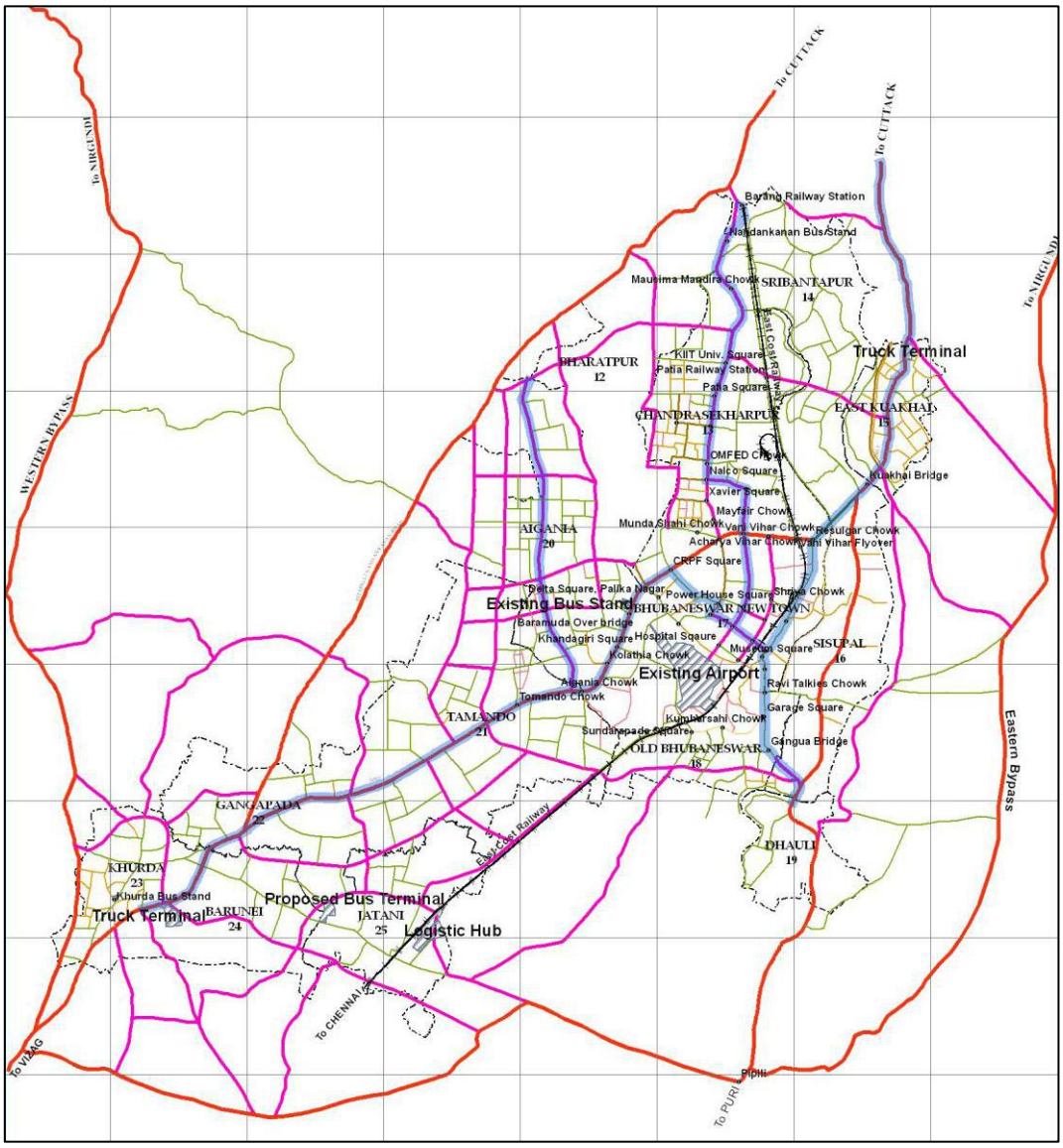


Figure 5-1: Transport Proposals

Based on the shift of demand the total trips (intercity and interstate) that will operate from the proposed terminal for different horizon years are as presented in the table below.

Table 5-1: Daily bus trips from proposed terminal in different horizon years

Year*	Number of bus trips#
FY18	919
FY23	1,118
FY28	1,296
FY48	2,341

* The future trips are estimated using the adopted growth rates
#Average bus entry and exit at the terminal

5.3 Bus Bays Requirement

As observed in the analysis chapter, the average dwell time of buses operating in the city is higher than 4 hours. To design bus bays based on such a high dwell time will lead to an inefficient design of the facility with high built up area and cost. The higher area of the terminal will in turn results in increase in walking distance of pedestrians thereby discouraging them from using the facility. In view of these constraints, it is proposed that the ISBT have segregated bays based on the activities (boarding, alighting and idle).

The idle bays are calculated excluding the buses which are through/via i.e. neither originated nor destined with in the city. It is observed that these buses have the dwell time of less than 30 minutes. Bay assessment for these buses are done separately.

The number of bays required for boarding and alighting are computed based on the trips in peak hour and the average boarding and alighting time for passengers. The average dwell time for alighting and boarding bays are adopted as 5 minutes and 10 minutes. Including circulation time, the average dwell time is adopted as 15 minutes. Also the idle space for parking of buses is computed using the arrival pattern and the dwell time distribution observed. Based on these assumptions, the number of bays required in the horizon year is as presented in the table below.

Table 5-2: Bus Bay Requirement for Different Activities

Horizon Year	Active bays (in no.)			Passive Bays (in no.)	
	Alighting	Boarding	Total	Idle Bays	Assumed Dwell Time
FY28	3	20	23	138	2.5 hours
FY48	4	35	39	147	1.5 hours

* Assumption: The future dwell time will reduce as the demand increases

5.4 Passenger and Parking Demand

For designing of facilities at the ISBT one of the most important inputs is the maximum number of people (passengers and visitors) expected to use the facility at a time. The peak demand is estimated using the peak details of bus trips and average occupancy. The average occupancy for arriving and departing buses is taken as 10 and 22 passengers respectively. The observed visitors to passenger ratio is 0.15. Based on this inputs the total passenger demand during peak hour in horizon year is **6173** (boarding passengers and visitors). Corresponding to this demand, the number of different vehicles for which parking needs to be provided is assessed. To estimate the parking demand, mode share of different vehicles are adopted based on the share observed and adjusting it to the future years (share of public transport modes is

increased and private modes is decreased). Suitable share of private modes availing parking facility is assumed. The parking requirement for the horizon year is as presented in the table below.

Table 5-3: Parking requirement in horizon year

Mode	Bays	ECS
Two Wheelers	234	58
Car	105	61
Cycle	36	4
TOTAL		**123**

The total required parking is **123 ECS**. In addition to this, the table below indicates the number of active bays for access and egress para transit modes.

Table 5-4: Para transit bay requirement in horizon year

Mode	Bays
Taxi	42
Auto	136
Shared Auto	104
Bus	3

The number of passengers and parking details do not include the staff and the commercial developments. Additional parking space shall be provided for this as per the codal provisions.

5.5 Surrounding Road Network and Connectivity

The site for the ISBT is flanked by roads on 3 sides, one of which is a highway to the city and abutting an intersection. The site is advantageous as buses remain on the highway and do not need to enter into the core city. The intersection in front of the ISBT has a flyover for highway moving traffic. To avoid friction of buses entering and exiting the site and for the ease of circulation of the buses and other access modes, it is recommended that the entry and exit of the ISBT be on the alternate access roads of the site. In addition, the highway face of the ISBT is proposed for the pickup and drop off of passengers thus ensuring their rapid turnaround through the site thereby saving unnecessary circulation space.

The schematic presenting the movement of traffic from different direction to the ISBT and vice versa is as presented below.

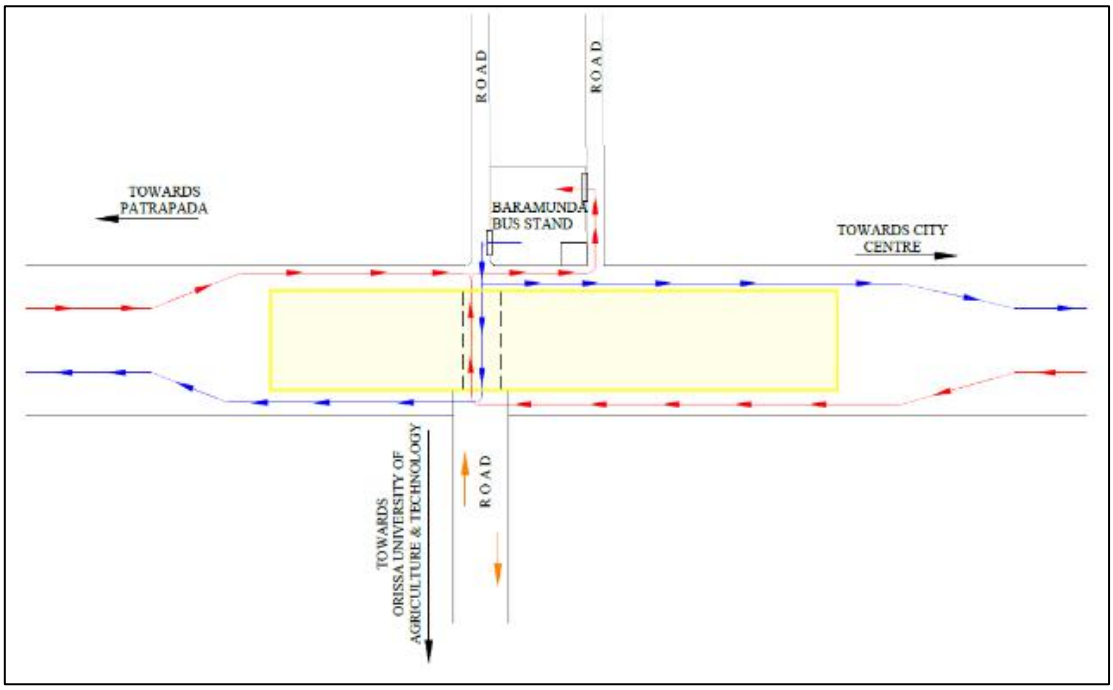


Figure 5-2: Schematic view of Accessibility of traffic from/to ISBT

This will not only help in decongesting the city roads but will also help in increasing the operational efficiency of the buses.

CHAPTER 6

Concept Plan

6. Concept Plan

6.1 Architectural Perspective

For public architecture, this project is indisputably a significant and exciting opportunity for the city. We will grasp this opportunity and create architecture of greatness which will enhance the terminal's contribution to the urban environment and vastly improve the experience passengers.

Minimize conflicting passenger flows

It is necessary to separate flows and avoid cross-flows and contra-flows as much as possible. Circulation must have adequate space and routes which are clear, direct and obvious, particular at 'decision points' and where bi-directional flows are inevitable. For passenger movements of this magnitude, alternative circulation planning concepts must be developed, and reference will be made to the most modern bus terminals.

Maximize accessibility and interchange

Proper integration of terminal and improved connectivity to the other transport networks in the surrounding area is critical to the success of the new master plan. The terminal must be made more accessible by foot, taxis, auto-rickshaws and two-wheelers. More spacious pickup/drop-off facilities should be provided so the experience of passengers arriving and departing is greatly improved. Efficiency of the road / transport network feeding the terminal must be improved.

Minimize Disruption to the operational elements

The works shall be planned and staged in such a way that effects on terminal operation are minimized. Some key issues are: safety of bus movements, passengers and staff, transport links to be maintained; trees and religious structures to be protected; impacts on existing facilities to be minimized.

6.2 Architectural Concept - Bus Terminal

The overall design of the terminal should trace the circulation of the passengers from arrival to departure ensuring that each juncture required in the movement of the passenger is as seamless as possible. The Bus stand/ terminal shall be visually appealing; open, spacious, well-lit and consistent with the environment. The space and facilities here shall satisfy functional requirements in the peak hour for the target year under all operating conditions.

Station interiors shall be designed with partition walls that are amenable for flexible space usage for retails, offices, and other passenger amenities.

The overall target is a 'state-of-the-art' terminal, for which we list key design objectives:

- Attractive, modern, iconic architecture with civic dignity.
- Comfort and convenience of the users of the facilities.
- User-friendly facilities & services for convenience of users.
- Special amenities for the physically challenged and special needs passengers.
- Circulation to have adequate space and routes which are direct and obvious.
- Planning to have good lines of sight, avoiding cross-flows and congestion.
- Provide a variety of amenities in a clean and pleasant environment.
- Entrances to be well coordinated with other forms of transport.
- All public areas to be visually open, welcoming and well lit.
- Retail and service areas to be modern, successful, and well-coordinated within the design.
- Utilize leading edge technologies and innovative services.
- Service access and emergency vehicle access to be coordinated within the design.
- Master plan to improve urban design and transport links in the entire area of terminal environs.
- Sustainable considerations in the development
- Commercial Property Development to be optimized and integrated within the overall design.

Material usage strategy will also be guided by fire and life safety requirements including smoke generation and toxicity. Materials should be robust, hard wearing and have low maintenance requirement over their life span. Surface finishes should be vandal resistant and easily cleaned during the normal maintenance routine.

The lighting system provides a major contribution to the effectiveness of safety, security, identity and way finding. All public areas, including foot-bridges, passages, stairways, steps, ramps and escalators, will be adequately illuminated.

As responsible planners and designers we will consider accessibility issues, exit for people in wheelchairs, visually impaired and partially sighted people, hearing impaired people and those with poor hearing, people with learning disabilities, expectant mothers, people with young children, and elderly people. Impediments to access will not be considered only physically, but

also psychologically. The planning of the terminal will have a barrier free strategy throughout the facilities.

Sustainable development requires the balancing of economic, social and environmental objectives. The objectives should embrace all the goals of the project, and should include cost and technical feasibility, as well as environmental, health and safety, and community/social indicators. It would be incorrect, for example, separately to assess a project for its “green” environmental or social credentials, before taking a final decision only on cost or technical grounds. Similarly, the economic, social and environmental objectives should be considered over the whole of the life of the project or project component, not just, say, the construction stage.

Strategy for commercial facilities will be considered and will depend on its location, predicted patronage, movement pattern, and the layout of the terminal. Commercial advertising shall be maximised in carefully integrated locations where commercial returns can be demonstrated. Commercial facilities should be coordinated with other facilities and be visible and easily accessible without causing obstruction to the normal traffic flow. The facilities must enable passengers, other customers and staff to use these facilities in convenience, comfort, and safety at all times.

6.3 Principles of Terminal Planning & Design

Principles governing how to approach the planning of bus terminals are focused towards ensuring enhanced passenger experience and level of service. These have been listed below, and may be applied during the de-sign development process.

Access and approach: Traditional bus terminal facilities fail to provide convenient access to public buses; their closed confines make access extremely difficult for passengers. Current attempts to improve bus-based public transport access are only concerned with improvement of street infrastructure, and focused mainly on pedestrian facilities and bus stops.

Access to the terminal should be convenient, barrier free and facilitate streamlined internal circulation. Additionally, the ingress and egress points should be so located that they are not in conflict with traffic circulation at the peripheral road network. One way of achieving this is by creating alternative access/egress points by integrating multi modal facilities with the bus terminal; this can further convenience commuters by providing access/egress choices.

Location: Locational characteristics make for the key factor attracting passengers using the bus terminal. Centrally located (core city areas) bus terminals are desirable for operational

efficiency and passenger convenience, as they provide ample interchange opportunities. Additionally, they are potential candidates for using terminals as a vibrant city space. Peripheral terminals, when integrated with depot functions, work best in minimizing dead mileage.

Operational parameters: Planning and designing of bus terminals is significantly influenced by the terminal's operational attributes. Several operational parameters bear upon a bus terminal's requirements. These include the number of routes served and their peak frequency, volume of waiting passengers, spaces for bus stacking (idle parking), the mix of terminating and passing services, and passenger circulation. Thus, it is essential to the terminal planning and development process that the operational parameters are fully understood and accounted for.

Existing capacity and future demand estimation: In addition to operational requirements, terminal planning and designing should also factor in the estimates for existing capacity and future (horizon year) demand. The considerations for redressal of potential short-term and long-term capacity constraints, and future expansion on the basis of estimated horizon year demand should be incorporated early in the planning stage.

Enhanced level of service: The basic premise of the Level of Service (LOS) framework is that passengers are sensitive to the amount of space surrounding them. When this space is compromised by crowding, they perceive it as a deterioration of service (Transportation Research Board 2011). LOS is an indicator of how good the present situation in a given facility is, and helps determine the environmental quality of a given space based on the function it is serving. To plan for critical LOS requirements for a terminal (as listed in different standards), one must first understand the entire journey of a passenger through the facility. Each activity planned for the passenger/commuter needs to offer a baseline level of service as per space standards and area allocation.

Integrating multi-modal accessibility and feeder infrastructure: Integrating provisions for feeder modes—like auto rickshaws, buses, private vehicles etc.—in the facility design, ensures improved accessibility and conflict free circulation. Planned allocation of space for such modes helps reduce delays, and improves level of service for passengers. The aim is to facilitate seamless transfers, in order to create the impression that the journey is continuous (and without breaks).

Integrating sustainable development practices: Infra-structure plans and development practices should consider green building technologies to reduce the overall carbon footprint

and adverse impact on the environment, both during the development and operational phase. Construction practices may employ material (and techniques) with low embodied energy, while energy requirements for the terminal's operations may be met through sustainable means and use of efficient technologies. This may include use of solar energy, efficient LED lighting, passive cooling/heating measures, higher reliance on natural lighting etc. Additionally, techniques for noise control, solid waste management, waste water re-cycling, use/re-use of waste water, and rain water harvesting should be integrated in the proposal during the planning stage.

Green Building Standards: The building should be planned as a Green Building to reduce the overall impact of the built environment on human health and natural environment by:

- Efficiently using energy, water and other resources.
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

6.4 Statistical Data related FSI, Ground Coverage

As per Comprehensive Development Plan, Bhubaneswar Development Plan Area this designated Bus stand falls under Transportation Land use as Bus depots/ Truck terminal.

As per Planning and Building Standards Regulations, 2008 (updated 2017) the following development control norms shall be followed for Transportation land use.

1. FAR (Floor Area Ratio)
    i. As per Clause 34 (3) " In case of transport related activities such as; railway yards, railway station, bus stands, bus shelters, transport depot, airport, special ware housing, cargo terminals, the maximum permissible FAR shall be **1.00**

    ii. Height as per the restriction laid by the airport authority of India is 15.1m above GL, i.e., 40 AMSL. Therefore the top most level of the proposed Built mass is **55 AMSL**.

    iii. Parking to be at 30% of total built up area (assumed **Assembly building** since the parking criteria table is silent on transportation buildings.) Also Assembly building may be defined as "Assembly Building" refers to a building or part of a building where group of people not less than 50 congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes for example, theaters, motion picture houses, assembly halls, auditoria, exhibition halls, museum, skating rinks, gymnasium, restaurants, places of worship, dance halls, club rooms,

passenger stations and terminals of air, surface and marine public transportation services, recreation piers and stadia, Baarat Ghar and Kalyan Mandap, etc.

6.5 Case Studies

6.5.1 Case Studies from India

6.5.1.1 Anand Vihar ISBT Redevelopment Plan

Anand Vihar ISBT is presently functioning on plot area of 10.2 hectares and has a triangular shape facing road no. NH56. DIMTS has been entrusted by Transport Department GNCTD, the work of designing and redevelopment of Anand Vihar ISBT as a state of the art, modern integrated Bus Terminal.

Figure 6-1: ISBT Anand Vihar Redevelopment Plan

Anand Vihar ISBT is designed as a state of the art, modern integrated Bus Terminal. The project shall serve as an example of an environment friendly 'Green Building'. The design is an emulation of a modern building which has to sensitively respond to its complex functional requirements and to the category of the end users. While being modern, in its design and appearance, the design carefully incorporates functional requirements which would be subjected to heavy dirty use by its components.

The site posed a district challenge of integrating an existing (under construction) elevated metro station and via duct which bisects the site into two areas along with an adjoining major Railway Station.

The design recognizes the independent characteristics and ownerships of all these components. The design of the ISBT creates a strong urban form which is in harmony with the other modes of transportation.

Figure 6-2: Planned ISBT - Segregated Paths for Bus, Taxi, and Auto-rickshaw

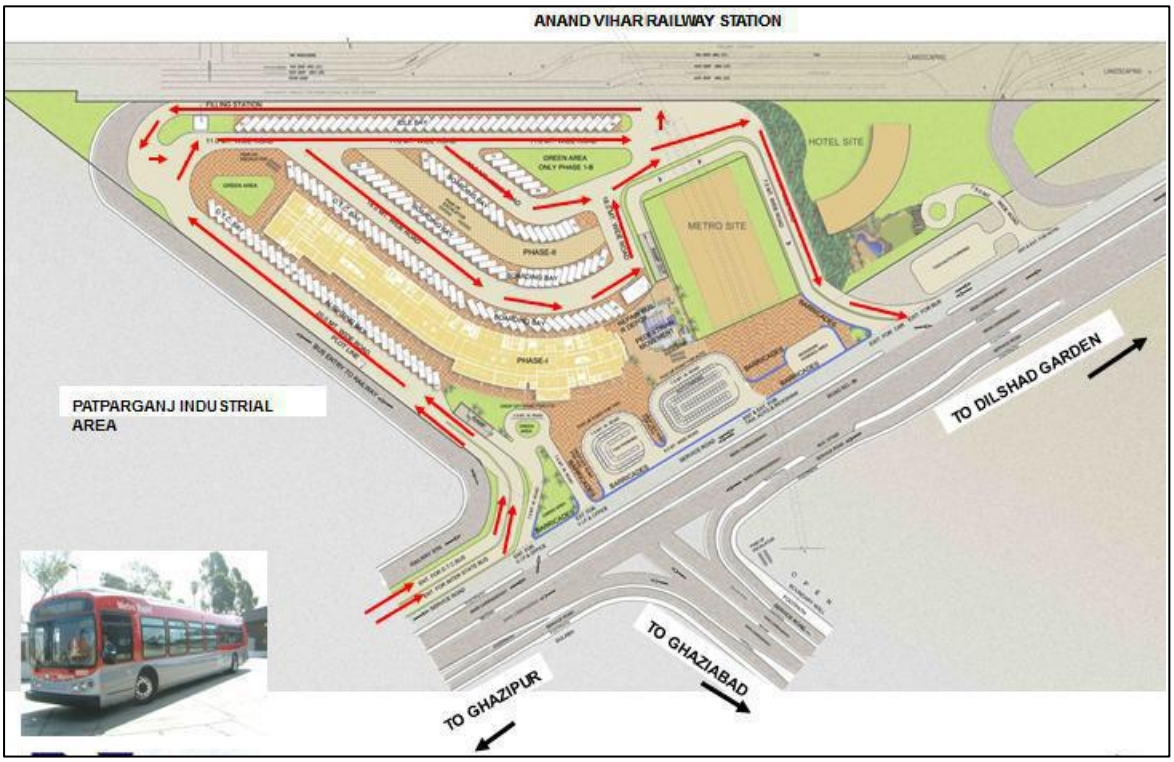


Figure 6-3: Segregated Paths for Bus

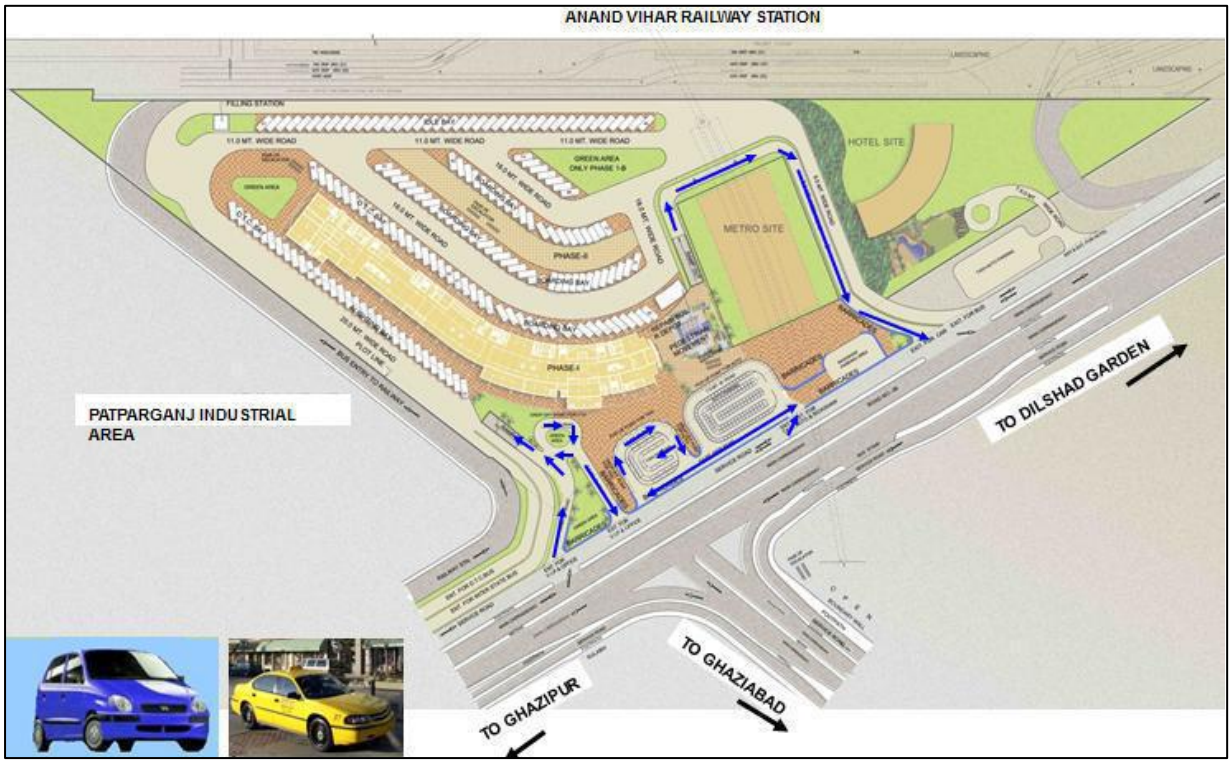


Figure 6-4: Segregated Paths for Car/Taxi

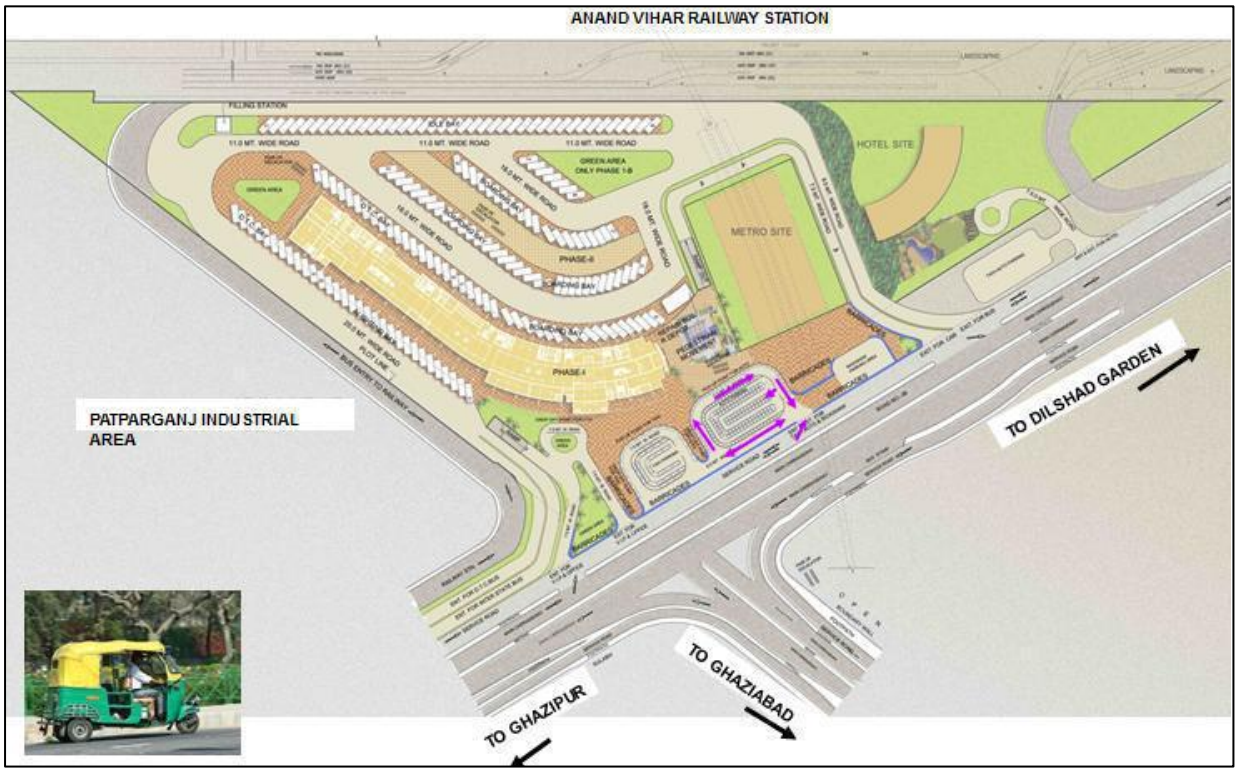


Figure 6-5: Segregated Path for Auto-rickshaw

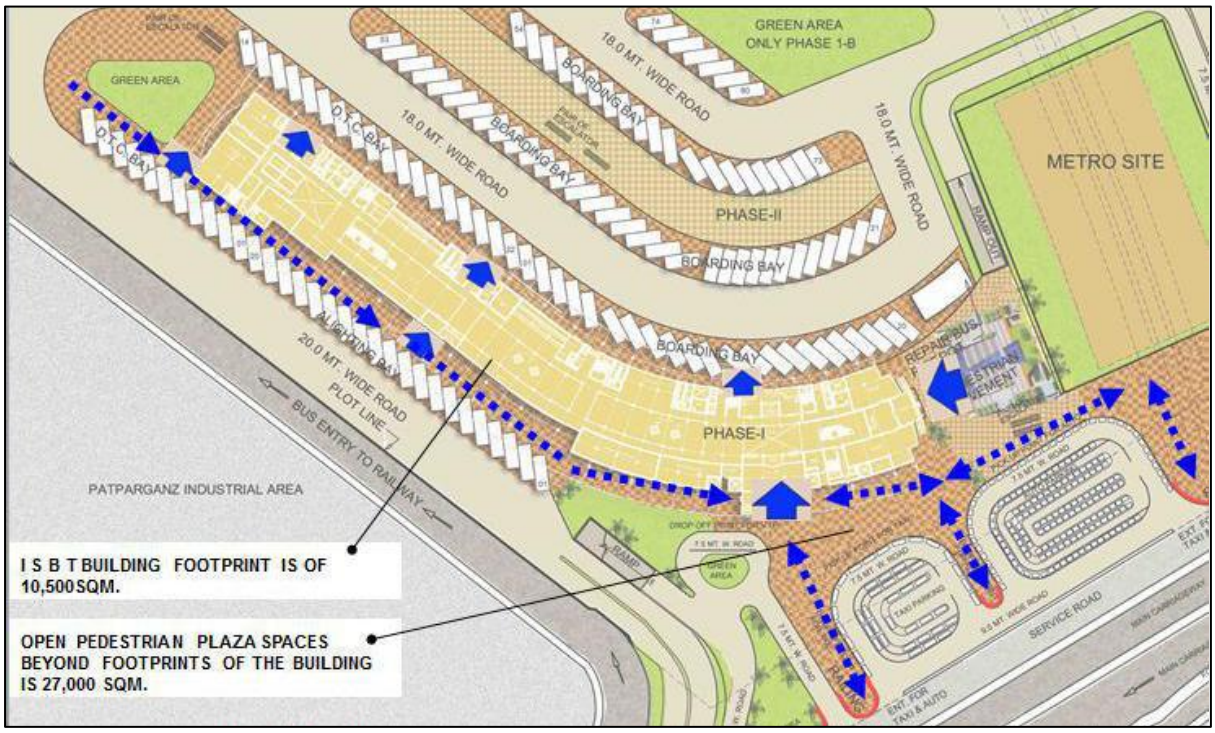


Figure 6-6: Pedestrian Movement at grade levels

Well Planned Network of foot-over bridges

A well planned network of foot over bridges is proposed for integration of pedestrian movement coming between ISBT Terminal, Metro Station and Anand Vihar Railway Station.

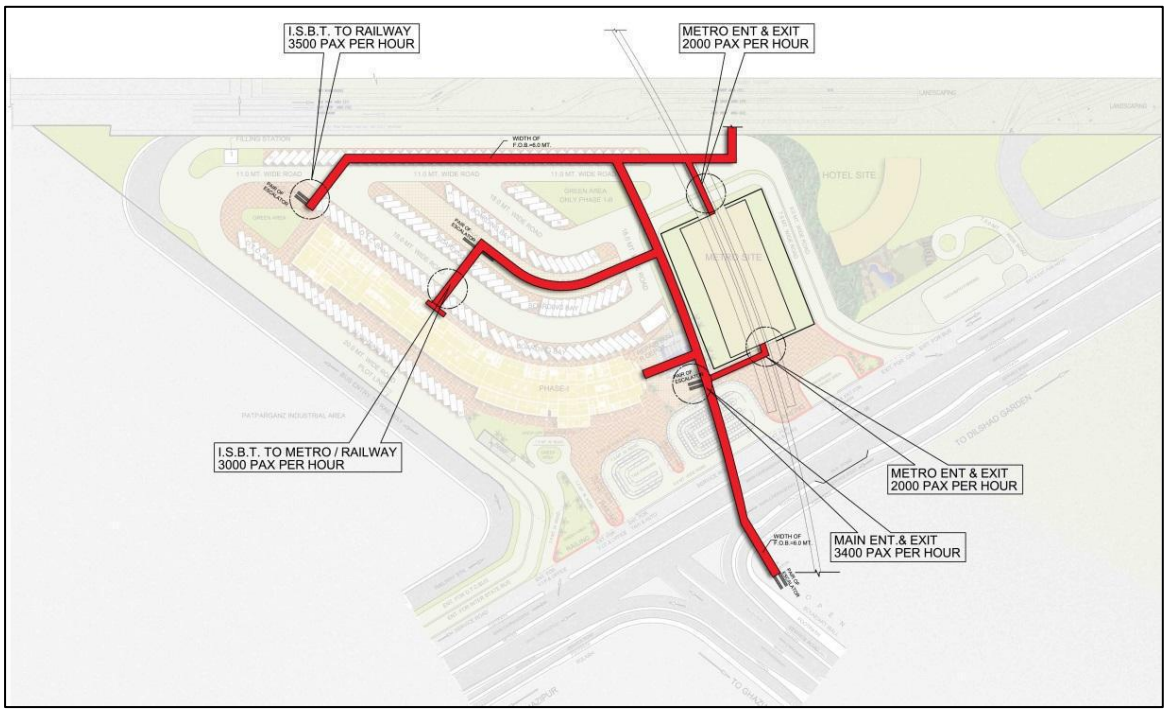


Figure 6-7: Proposed ISBT - Planned Foot Over Bridges

The site shall be developed in two phases.

Phase I construction includes main ISBT Building with boarding and alighting platforms along either side of buildings. This is to facilitate the commuter to board/alight the buses under shelter.

In Phase-I construction site shall be barricaded and separate safe pedestrian passage is planned so that the commuter can reach the present ISBT platforms.

Before the start of Phase-I construction present ISBT shelters shall be trimmed to create periphery road for bus movement. The existing underground services like electrical cables, storm water drains/sewerage shall be re-routed/rehabilitated before the start of Phase-I construction.

Ground floor and first floor areas shall be dedicated to ISBT use.

All the facilities like ticketing counter, security checking or waiting lounges, rest rooms, drivers' rest room, ISBT office, Police Check Post, Fire Control Room, Essential Shopping, etc. are being planned on ground floor. Separate dedicated entries for Public and Office has been planned.

Food courts, Restaurant facilities and Shopping Arcade has been at concourse level. Facilities like Dormitories for LIG, MIG, and HIG are being provided on upper level.

Concourse level has a double height atrium which is created for a Visual communication with commercial area on the upper level. The two floors are linked with stairs, escalators and lifts.

In order to create a strong design element and an environment friendly jali has been proposed at concourse level. This creates natural ventilation in design a building. To improve the comfort condition, fume draft ventilation is proposed in the concourse which will further give cooling effect and comfort to passengers inside the terminal in peak of summer.

Features

- There is dedicated, independent approach to the office floors through dedicated lift and stairs circulation cores.
- All parking facilities and utilities are planned in the basement.
- All office areas are centrally air conditioned.
- Basement Floor shall be built in two phases. It will accommodate car parking as per requirement besides the following utilities:
- STP/ETP
- DG Sets and Sub-Station
- Fire and Domestic Water Storage Tank
- Garbage Collection Chamber
- Essential Stores
- Lift and Staircases Lobby
- The Entire Basement shall be mechanically ventilated as per fire regulations.

Figure 6-8: Landscape plan

Landscape Strategy

- Landscape to reinforce Symbolic connection
- Green Envelope to be provided in pedestrian plaza
- Outdoor rooms defined by tree corridors
- Diversity of outdoor spaces for multiple uses
- Lighting to create safe and engaging night time use
- Public art to add meaning and interpretation of the site

6.5.1.2 ISBT Kashmere Gate

The Inter State Bus Terminal of Kashmere Gate is located in North Delhi, in Planning Zone (Division) 'C' of the Union territory of Delhi, as per the Delhi Development Authority. It is the oldest and biggest inter-state bus terminal of the city, catering to a vast city wide population traveling across towards the states of Punjab, Himachal Pradesh, Uttarakhand and Uttar Pradesh.

The Maharana Pratap ISBT at Kashmere gate was proposed in the 1962 Master Plan of Delhi. The site for the terminal chosen on different criteria, firstly, it is located at the intersection of the two National Highways, NH-1 and NH-24. It is a site on the ring road, which runs all around Delhi and is connected to all national highways and thus easily accessible. Also the site is in

close proximity to the Old Delhi railway station. ISBT Kashmere gate was initially designed to handle 500 buses per day.

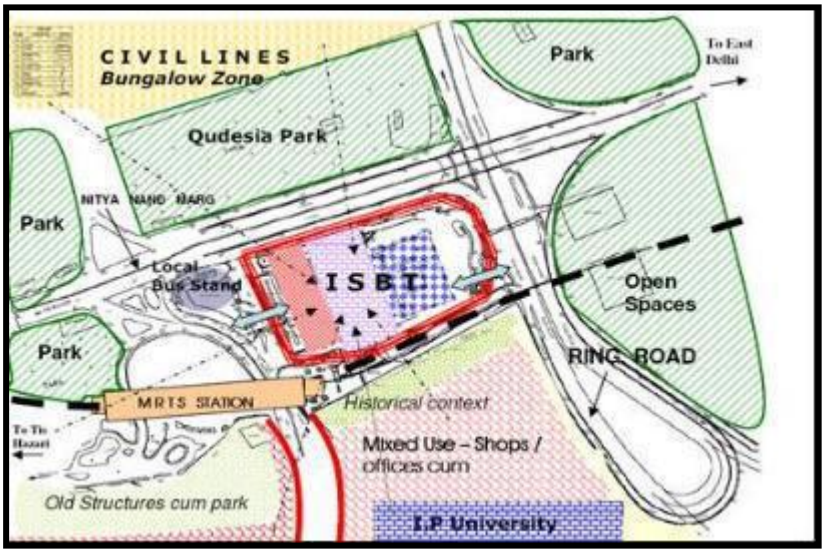


Figure 6-9: Location of ISBT Kashmere Gate

The project site is the major entry point of this zone. The connectivity of the zone has been enhanced by the fully developed Delhi Metro Link (Phase I), which connects the north-western portions of Delhi to Central Delhi, and onwards to East Delhi. The Kashmere Gate MRTS terminal is the key point of interchange for passengers in two different metro lines. Project site is a regional level landmark for North India, since most inter-state bus traffic either originates or terminates at this location.

Consequently, the project site is the focal point of a considerable volume of floating population.

Locationally, the project site is positioned at the intersection of two 60 m wide arterial roads, known as the Ring Road and the Nitya Nand Marg. It is adjacent to the Kashmere Gate terminal of the Delhi MRTS, and has proximity to the Guru Govind Singh Indraprastha University campus. The project site is developed in the form of an inter-state bus terminal, comprising bus parking areas, circulation zone, waiting areas and office developments.

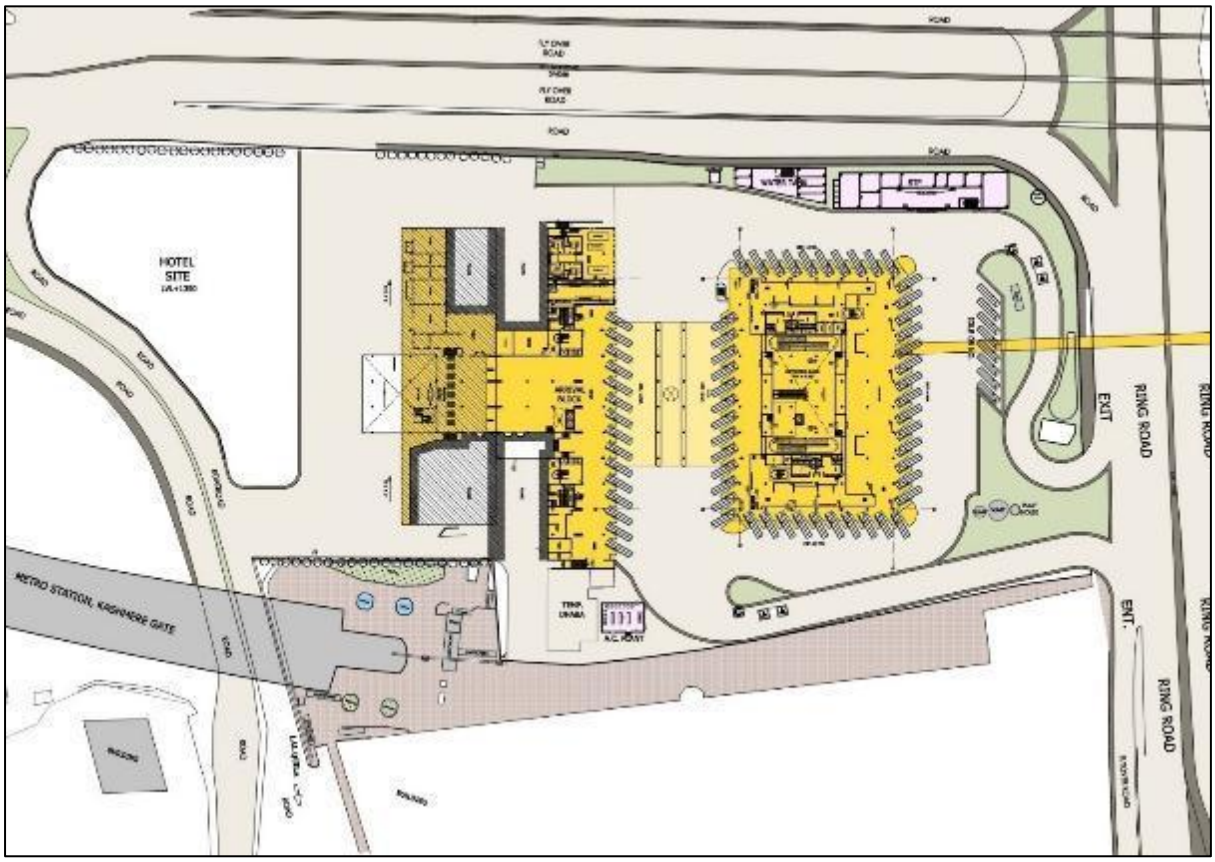


Figure 6-10: Site plan of ISBT Kashmere Gate

Salient Features

The ISBT is designed as a state of the art, modern integrated Bus Terminal. While being modern, in its design and appearance, the design carefully incorporates functional requirements which would be subjected to heavy dirty use by its components. The Upgradation and Renovation shall broadly comprise the following:

- Face lifting of the building while maintaining the original context of the exposed concrete character of the facade
- Provision of escalators and elevators
- Provision of heat, ventilation and air conditioning, CCTV, Security Equipment and BMS of the Terminal
- Providing continuous FOB for conflict-free connectivity to the terminal from the ring road
- Provision of bus, car/taxi and two wheeler parking
- Development of commercial areas in the Terminal
- Supplement the public transport in Delhi through a city-wide integrated multi-modal network of mass transit systems

- To facilitate an effective multi-modal changeover by integrating the existing ISBT with the Metro station and Old Delhi Railway Station
- To provide a state-of-the-art Multi Modal Transit Center that is user friendly, catering to varied passengers' comfort, pedestrian-friendly, handicapped-friendly, and aided with facilities as per best international practices
- To improve passenger amenities

Key Components in the ISBT

The project site is developed in the form of a large inter-state bus terminal and has the following key divisions:

1. The Arrival Block

   Catering to the arrival of passengers inside the terminal premises, the block is close to the existing auto, taxi and two wheeler parking. It comprises of vendor shops, ranging from foods & beverages to book stalls, waiting spaces, public conveniences, an electric sub-station and a pump house. Encroachments by vendors, blocking of the pedestrian pathways by food stalls, unkempt waiting spaces for passengers can be observed at the site.

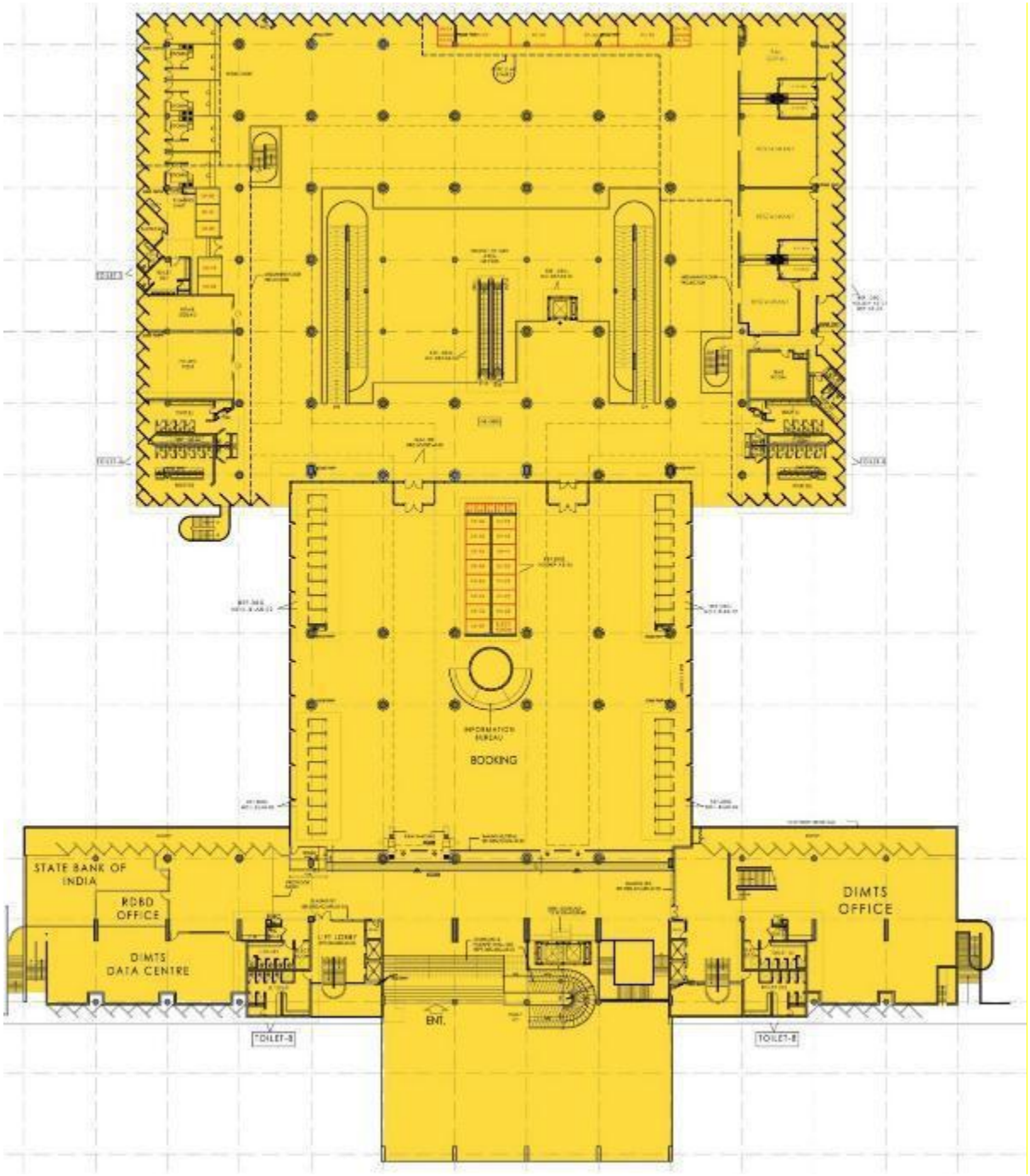


Figure 6-11: Terminal Building – Arrival floor plan

2. The Link Block

Close to the staff parking, the block provides an exclusive entry to the employees of the government and quasi-government offices located in the terminal premises. A six storey, rectangular shaped building structure has been developed at the onset of the Link Block, as an office space development. Comprising state and regional transport offices, like Rajasthan Tourism, Punjab Tourism, Himachal and J&K Tourism, Pollution Control Board,

Mahanagar Telephone Nigam Limited and the Rural Development Board, among others. The Link Block also comprises large waiting spaces for passengers, seating areas, inquiry counters, a few vendor stalls (selling books, medicines, etc) and more than 40 vacant ticketing counters. Besides public conveniences, the block has a dilapidated state of infrastructure and observes low passenger footfalls (owing to its location on the first floor). Passengers arriving from the Kashmere Gate terminal of the MRTS, enter the premises via the Link Block.

Figure 6-12: Link Block

3. The Departure Block

Comprising existing bus bays, the block has the maximum passenger footfalls (as it is located on the ground floor). The block has majority of the vendor stalls/shops (selling

foods & beverages, magazines, books, medicines, STD booths, clothing & accessories, durables, bags etc.), waiting spaces for passengers, public conveniences, cloak room, a few ticket counters and inquiry offices. The departure block has a poor state of infrastructure and is directly connected with the vehicular entry/exit of the terminal (from the Ring Road).

From an accessibility standpoint, the project site enjoys excellent advantages. It is easily accessible by road, with most of the inter-state bus traffic either originating or terminating at this landmark for the northern region. The site has excellent visibility from Ring Road, the major traffic artery at the city level. Moreover, the project site is a corner plot with entry possible from two adjacent sides of the property, with potential for excellent transport planning within the project site.

However, the surroundings of the project site provide a relatively poor visual image, an aspect that is likely to change over time. Project site enjoys the unique advantage of a considerable level of footfalls at the project site, an aspect that is likely to accord considerable advantage to the project site from the perspective of retail, and possibly hospitality, development. Overall, the project site possesses considerable real estate potential which may be unlocked through careful structuring of development typologies on the project site.

Figure 6-13: Departure Block

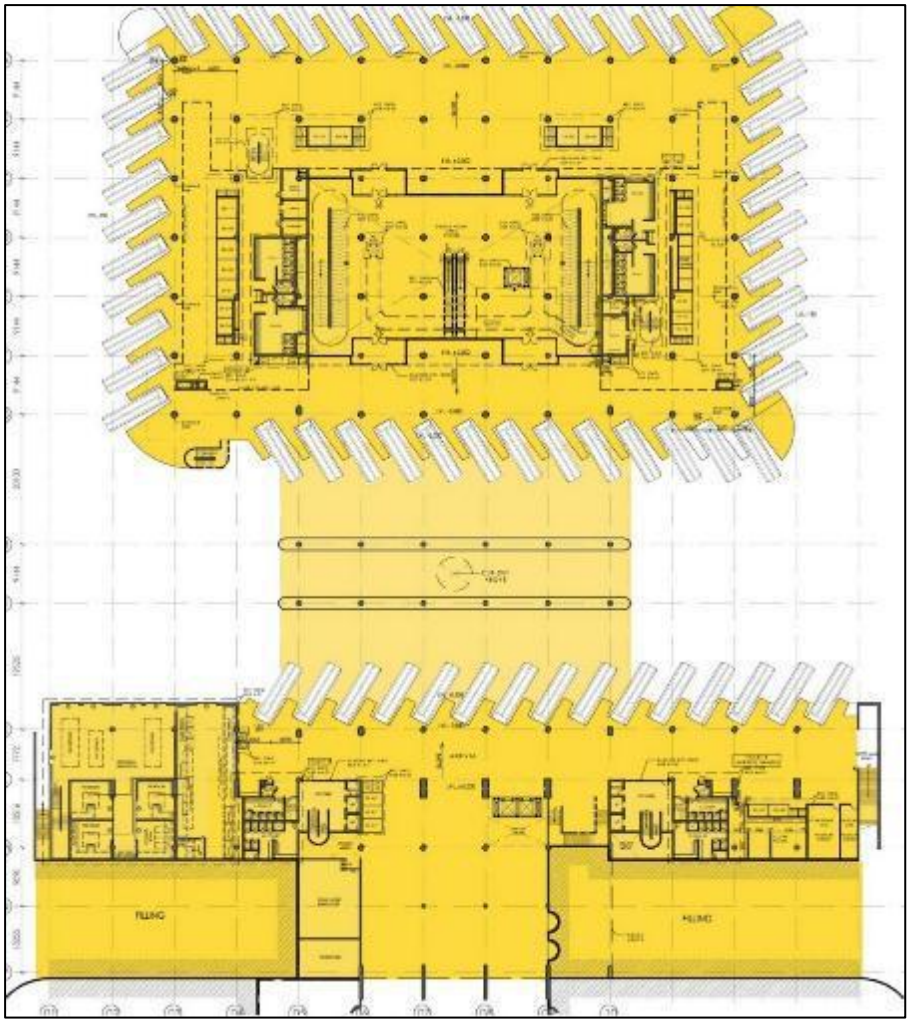


Figure 6-14: Ground level plan showing boarding and alighting bays

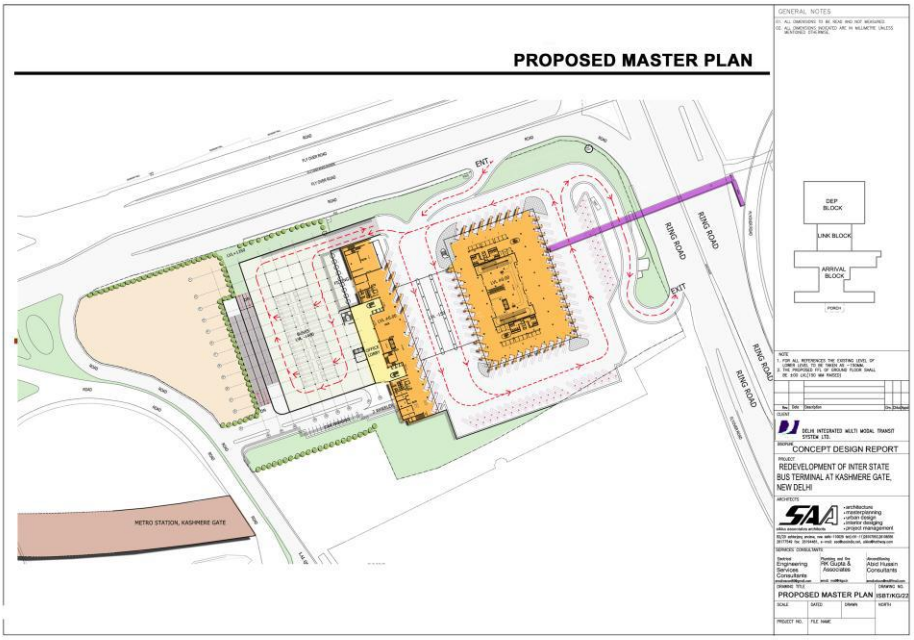


Figure 6-15: Proposed Master Plan - ISBT Kashmere Gate

6.5.1.3 ISBT Chandigarh

Sector 43 ISBT was recently developed on a 21-acre site in south-east Chandigarh, between junctions 58 and 59 on Vikas Marg. As presented in Figure the site is adjacent to District Court Complex and near Judicial Academy, opposite Kajheri Village.

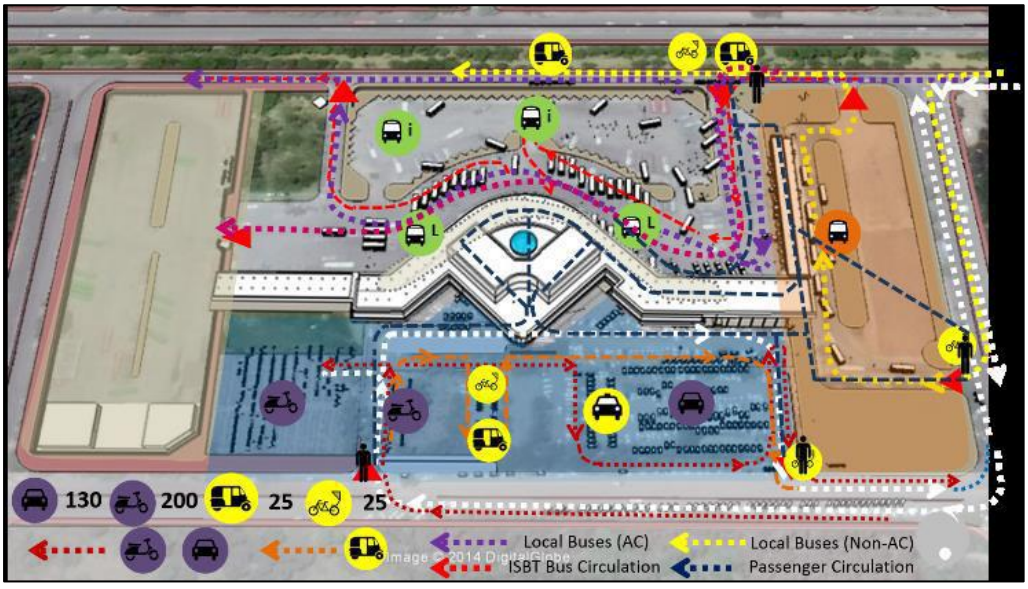
The terminal provides interstate bus connections for Punjab, Haryana, Uttarakhand, Himachal Pradesh, and Jammu and Kashmir; and intra-city as well as sub-urban connections. Bus services include A/C and non A/C services for inter-city and sub-urban routes. Currently, the

terminal serves over 80,000 passenger trips per day with an average occupancy of 45 per bus.

The existing terminal premises comprise five sections. Passenger volume during peak operation hours is estimated at 8,000, based on average passenger stay duration at 20 mins.

Daily, buses ply over approximately 91 routes (37 long, 47 local, 7 sub-urban). On average, 2 buses enter the terminal premises per minute, i.e. 120 per hour. The average bus frequency is 3-5 mins, average idle bus parking 20 mins, average offloading time 1 min, and average loading time 6 mins.

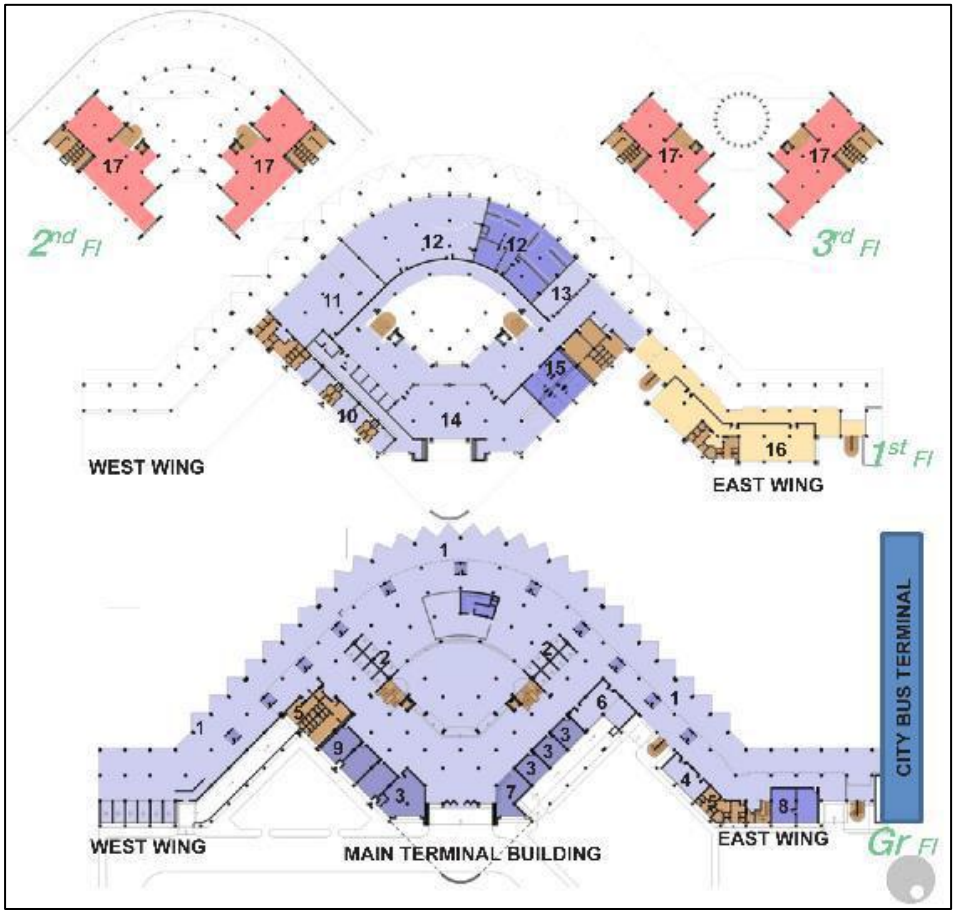
Vehicular circulation in the terminal. For ISBT buses, entry and exit to the terminal is from Vikas Marg.



Evaluation of present operations shows that due to lack of designated unloading bays, drivers park and unload randomly within the bus parking area and main carriageway. Additionally, city buses also access the interstate bus zone to offload passengers, and to access the local bus depot. This creates bus-pedestrian circulation conflicts, rendering the terminal inefficient and risky. This also creates an ambiguous bus movement resulting in chaotic circulation.

Vehicular parking can be accessed from the arterial road along the terminal site's periphery. It comprises 25 auto-rickshaw parking, 130 car parking (including taxi), 200 two-wheeler parking, and can accommodate up to 355 vehicles (ECS) at a time.
The terminal building comprises four floors with built-up area of over 8,500 sq. m. (excluding the currently vacant basement parking for two-wheelers).

The ground floor houses 11 reservation counters, 28 loading bays, shops, tourism offices, cloak room, and basic amenities like toilets and drinking water. It also includes facilities like a restaurant, Chandigarh Transport Undertaking (CTU) office, information, police assistance counter etc.



The first floor houses a commuter lodge, consisting of five rest rooms with attached toilets, and a dormitory with dining hall and kitchen. It also accommodates a post office, railway reservation office, and five tourist offices. In the first floor's east wing, drivers and conductors have been provided rest rooms, drinking water, and toilets. The second and third floors are designated for commercial activity, including pantry and toilets.

6.6 Design Standard and Specifications

6.6.1 Proposed Facilities

The guidelines for the design and planning aspects of various activities and facilities have been taken from the Time Saver Standards Space Requirements, Neufert's Architect's Data handbook and National Building Code (India).

The bye-laws referred to while planning the ISBT is "Planning and Building Standards Regulations (2017)", Bhubaneswar Development Authority.

6.6.1.1 Passenger Amenities

The activities for the passenger amenities in addition to toilets and cloakroom are given below:

- Tea/ Coffee Stall/Fruit/ Juice Shops
- Sweet Shops/Ice- Cream Parlours/Fast Food Outlets/ Snack Shops
- Restaurants
- Convenience/ General Merchant stores/ Department stores
- Stationary/ Book shop/ newspaper stand
- Chemist/ Pharmacist
- Travel accessories
- Shoe retail/ Repair Outlets
- PCO
- Barber/ Hair Saloon
- Toilet (Male/ Female)
- Waiting Room

- Cloak Room
- Enquiry Booths
- Dormitories

6.6.1.2 Services and Offices

As a part of generating revenue, following category of services or offices can be provisioned for within the complex.

- Banks/ Finance Companies/ ATMs
- Yatri-Niwas (Boarding & Lodging)
- Professionals: Doctors/ Dentist
- Business Centre/ Internet Cafe (Telephone, Fax, Internet, e-mail etc.)
- Insurance Company Offices

6.6.1.3 Furniture

In general furniture material output specification is listed below:

a) Street Furniture

- Street furniture will be kept to a minimum and located to avoid “clutter”
- Combined elements will be considered e.g. signs on light poles
- Street furniture will be designed as a family of elements, which also relates to the station materials
- Materials will be durable and low maintenance
- Where maintenance is required, street furniture should be designed to facilitate this

b) Seating

- Seating units will be provided where they will not impede circulation
- Benches will be designed with arm rests to discourage sleeping
- Materials will be rust-proof metals such as stainless steel or cast aluminium

c) Bollards

- Will be used to control vehicular access with minimal interruption to pedestrian flow
- Provide resistance against vehicular attack

- Concrete bollards in the form of bottle representing Odia bottle art. These concrete bottle bollards shall be painted in captivating Odisha art, depicting scenes from the life of Lord Krishna with a burst of colours.

Provision of the following furniture in specific areas is listed below

1) In Waiting Halls

- Chairs for seating purpose only

2) In Food Courts

- Combination of fixed tables and fixed chairs or Counter tables and stools or both

3) In Offices

- Executive chairs of approved make
- Tables of approved make
- Storage cabinets of approved make

4) In Ticket Booths

- Counters, chairs, cabinets and lockers of approved make

5) In Dormitories

- Beds with storage cabinets of approved make

6) Doors, Windows and shutters

- Sturdy and maintenance free
- Provision of grills in windows

6.6.1.4 Overall Aesthetics

Design guidelines to regulate the total development character and aesthetic have been formulated based on the following aspects:

1) Urban Design Guidelines (massing and volume, external furniture, signage)

2) Architectural Façade (Elements, Material, Colour)

3) Functional Essentials (Value Added Services during Implementation Phase)

4) Site Development Specifications (surface finishes & colours, plantation heights) and External Area Maintenance

- Horticulture and Landscape
- Footpaths, Railings, Curbs, Handicap access

5) Maintenance Procedures

(i) Maintenance and repairs of the facility and all its components, including roads, pavements, building, etc.

(ii) Setting performance standards to ensure management of complete operations & maintenance activity of minimum acceptable level.

(iii) Laying down timetable for Periodic inspections

(iv) Ensure minimal disruption of the operations of the bus stand during maintenance phase.

6) Guidelines for Cleanliness will cover the following

- Trash Collection / Maintenance of Receptacles (bins)
- Drinking Fountains – cleaning and purification
- Cleaning of Building & Furniture Surfaces
- Cleaning Carpeted & Non carpeted floors
- Cleaning of Toilets and Public Conveniences

6.6.1.5 Infrastructural Support

The offerings which will support all the stand functions and bring the necessary ambience effect are listed below:

1) Core Target Segment for customization

2) Cluster benefit

3) High quality of developed infrastructure amenities

- Assured water supply
- Assured quality and adequacy of power
- Provision of Sewerage Treatment Plant
- Drainage and Sewerage
- Excellent Telecommunication facilities

4) External/ Internal Connectivity

- People Transport
- Internal Connectivity
- Telecom Connectivity

5) Superior maintenance and Estate Management

6) Planning the systems in such a way so as to use minimum energy

7) Recycle and reuse the waste products to the maximum possible extent

8) Cost efficiency should be at the conceptual level itself

9) Provision for development and aesthetic value of surrounding environment i.e. plantations etc. in the proposed project

10) Use of National and International Standard Practices

6.6.1.6 Design of Bus Bay Arrangement

The boarding bays have to be easily accessible by the bus with minimum manoeuvring.

Three alternative ways of arranging the bus bays are shown in Figure.

- In Option 1, the buses are parked almost parallel at the bays and this provides maximum manoeuvrability. However it is inefficient use of space
- In Option 2, the bus bays are at 45° to the platform
- Option 3 envisages uni-directional movement bays

Considering the availability of space and following reasons, it is preferable that buses turn head first into the bay because boards are more visible and drivers find it more convenient. By considering vehicular and pedestrian manoeuvrability and area required per bay option 2 will provide a better solution than option 3, and the same has been considered in the concept development for the bus terminal.

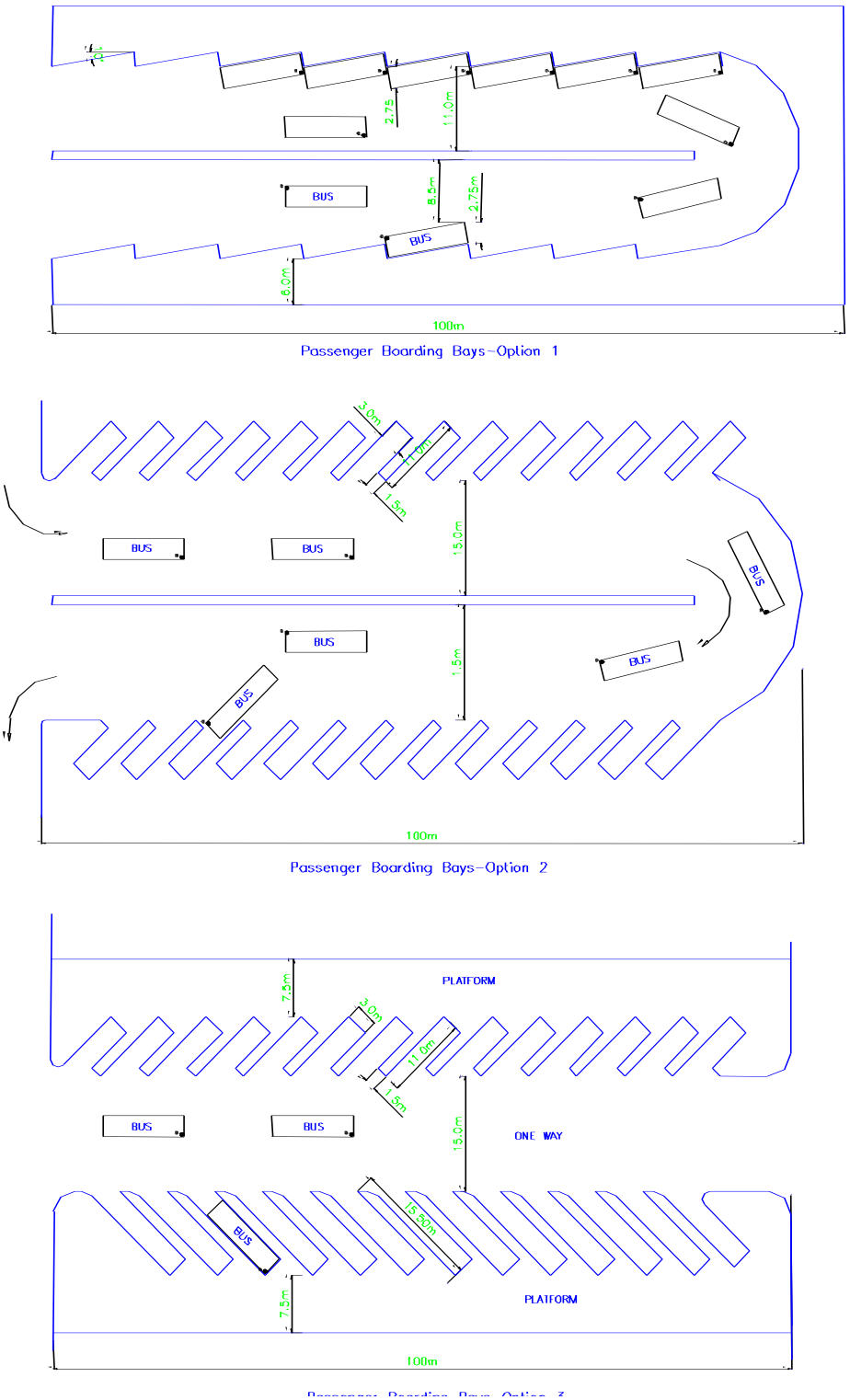


Figure 6-16: Bus Bay Arrangement

6.6.1.7 Structural Design

General

The latest revised versions of the Bureau of Indian Standards (BIS) codes are recommended for guidance of structural design.

Structure shall be analyzed using STAAD-Pro-V8i software. All the components shall be designed as per relevant IS codes.

The foundation shall be designed to withstand the worst combination of loads. The minimum depth of foundation in soil strata should be kept less than 1.5m below the ground level.

The material and loading standards for new structures shall be as follows:

Material

1. *Concrete*

In accordance with IS 456-2000 following grade of concrete has been used for moderate conditions of exposure for different components:

Member	Grade
Footing/Column	M 25/30
Slab	M 25/30
Beam	M 25/30

2. *Reinforcement Steel*

The grade of steel reinforcement shall be Fe 500 for HYSD bars.

IS Codes

Following code shall be referred in design of structure.

a) IS 456 – 2000 - for Concrete structure design
b) IS 800 – 2007 - for Steel structure design
c) IS 13920 - 1993 – for ductile detailing of reinforced concrete structures
d) IS 875 - 1987 – Part 2 - for Imposed loading (other than earthquake)
Part 3 - for Wind loading

e) IS 1893 – 2002 - for earthquake resistant design of structures

f) Sp -16 - 1980 – for column design

6.6.1.8 Services & Utilities

To satisfy the optimal infrastructural requirement for the project, it is envisaged with state-of-the-art infrastructural services and utilities.

Design Criteria & Description

The design criteria for basic infrastructural services have been addressed under this section; such as power supply, water supply, sewerage network and storm water drainage.

1. Electric Power Supply

Electrical system shall be planned to take care the following aspects:

a) Safety to personnel

b) Minimise fire hazards to the extent possible

c) Ease of maintenance

d) Automatic protection of all electrical equipment through selective relaying system

e) Considering the latest technical code/standards, Regulations and practices

f) Scope of future expansion

2. Road Illumination

Basic requirement of road & green area / periphery illumination shall be as follows:

a) Adequate level of illuminations for heavy vehicles/light vehicles/ cyclist

b) Uniform illumination level over the carriage way with minimum glare

c) Safety of movement

d) Minimum disturbance during fog condition/dust conditions

e) Use of high efficiency lighting fixtures with high lumen output and low power consumption

f) Aesthetic look

g) Security aspects

3. Water Supply

Water supply includes:

- Demand estimated
- Source of Water
- Treatment & Storage
- Supply Network

4. Sewerage Network

The following parameters can be used for the design and optimization of wastewater collection network and appurtenances.

- Type of Collection System
- Design Period
- Sewage Generation
- Peak factor
- Self - cleaning velocity
- Scouring Velocity
- Flow conditions
- Minimum size of pipe
- Minimum depth of sewer
- Ground water infiltration
- Hydraulic Formula for calculation for design of sewer lines.
- Manning's co-efficient 'n'

5. Storm Water Drainage System

The following factors should be taken into consideration for planning of the storm water drainage system:

(i) The pattern of natural slope of the site, its extent and direction.

(ii) Inlet time has been considered as 15 minutes.

(iii) Imperviousness factor considered as 72.9%.

(iv) The road network system envisaged and finished level of the roads.

(v) Multiple outlet points have been considered. As such storm water drains will be discharged in to proposed rain water harvesting pits.

(vi) Necessary pipe culverts have been considered to ensure better drainage and control of soil erosion.

(vii) Final outfall from site as specified by relevant authority.

Necessary Silt traps / basins of suitable size at outfall points have been considered to avoid un-aesthetic conditions and to eliminate chocking due to silting, and floating of solid waste like plastics, papers etc.

For working out an effective and adequate system of storm water collection, conveyance and disposal, adoption of an appropriate and comprehensive design base is of prime importance. The due considerations have been given in the Manual on Sewerage and Sewage Treatment by Central Public Health and Environmental Engineering Organization (CPHEEO), by the Government of India to decide design parameters for the design of storm water drainage system at proposed industrial parks.

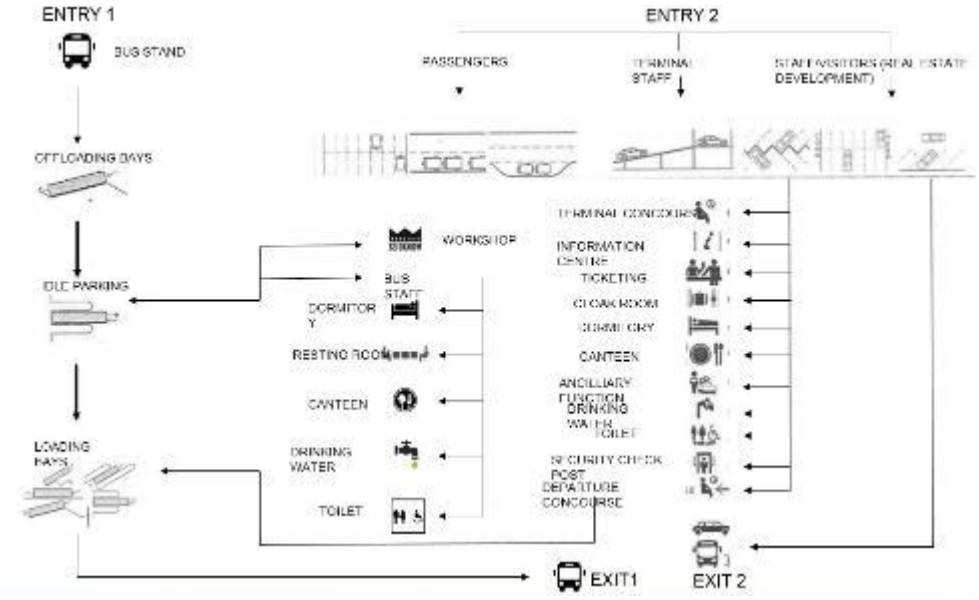
6.7 Proposed Redevelopment

6.7.1 Proposed Design Philosophy

The designed Bus terminology which is a transport hub would be user-friendly with amenities for commuters such as help line for buses, taxi and auto rickshaw passengers, a unified bus time-table, route guide maps / folders, directory of chartered bus services, fare charts from point to point, prepaid taxis / auto rickshaw booths.

The design of the bus system shall have the following features:

- Zoning for placement of Interstate bus movement related activities, City bus parking & movement activity and parking and movement activity of Taxis/Autos/ private vehicles
- Segregation of pedestrian and vehicular traffic
- Strategy for ensuring pedestrian connectivity between Inter-State Bus Stand, Local Bus Parking and local modes of transportation
- Strategy for planning the inter-state bus movement zone in terms of workshop area / Alighting/ Active bus parking area / idle bus parking area / Local Bus parking/ building area, any commercial building etc.
- Maximum Commercial exploitation, within the framework of Planning and Building Standards Regulations, for increasing the viability of the project for development
- Adequate provisioning for infra utilities (power supply, water supply, water treatment, sewerage, sewage treatment, storm water drainage, solid waste management, etc.)



6.7.2 Urban Design Context

- The proposal envisages built forms to largely utilize and reflect the plot geometries available on location. The built form has to be conceived to create a new identity for the urban pocket. Material choice for the exteriors is proposed to match with the external ambience of the surroundings and provide sensitive use of glass, natural stone and composite panel finishes reflecting to the new urbanism trends in the architectural treatments of building in the country and visual integration of the redevelopment with the characteristics of adjacent buildings.
- The human scale spaces and street treatment, preservation of existing movement patterns around the urban development, creating a unique identity of the built environment in terms of an existing urban landmark can be evident in the way the proposal has been structured and conceived.

6.7.3 Services in the Proposed ISBT

Following services/ facilities have been taken into consideration and are proposed to be provided at the ISBT.

- Provision of Independent Electrical sub-station
- Common Area Lighting with LED Lights
- Power Back-up - Provision of DG sets
- Provision for entertainment such as Televisions at designated places
- Passenger Information Displays System
- Provision for Elevators
- Provision of Escalators

- Fire Detection and Alarm System
- Fire-Fighting System
- Solar electric power system for harvesting Solar Energy
- CCTV System
- Public Address System
- Access Control System
- Parking Management System
- UPS & Emergency Lighting
- Signage
- Telephone Networking System
- Provision for drinking water
- Underground/ Overhead Water Storage Tanks
- Rain Water Harvesting System
- Sewage Treatment Plant [STP]
- Effluent Treatment Plant [ETP] for Bus Wash
- Water Distribution System
- Air-Conditioning of Passenger Lounge
- GPS based Digital Clock.
- Lightning Protection of Building

6.8 Concept Plan

There have been various approaches considering the present scenario and way forward on the movements and various activities that have to be integrated. Based on the above philosophy and keeping in mind the unity of thought process 3 options were conceived and visualized, of which option 3 with modifications have been conceptualized for finalization and the same are being represented below.

6.8.1 Concept

6.8.1.1 Zoning

The concept plan for the bus terminal is explained as follows:

1. Approximately 4 acre of land has been demarcated on the front towards National highway side for commercial purpose and this area is not included in ISBT land
2. The terminal and its related facilities are planned at the rear side (existing depot) of the site having the bus entry from the existing exit side, i.e., southern side access road.

3. The bus depot facilities, i.e., bus parking and workshop facilities are planned at the rear area, open to sky.
4. The private vehicle entry/ exit for the terminal is kept from the northern access road, thus integrating the terminal and non-terminal activities.
5. The terminal building has the minimum mandatory facilities on the ground floor and the remaining administrative facilities for terminal have been proposed on the first and the second floor, i.e., Driver's rest room, Administrative offices, Cloak rooms, etc.
6. Portion of the First floor are reserved for some amount of commercial activities like food court, restaurants and Retail spaces.
7. Portion of the second floor is reserved for Retail or office space (commercial space for revenue generation).
8. This commercial area within the terminal building has been provisioned with retail spaces, restaurants (fine dining), and offices.
9. Dedicated space for repair bays, bus wash and service pits have been at the rear area.
10. Ample space for private parking as per requirement is planned near the private vehicle drop off @ 42.5 m LVL
11. Dedicated auto lanes and taxi lanes near the drop off @ 45.65 m LVL have been planned for smooth movement of these modes of transport.
12. Dedicated access is kept for the commercial area from the northern access road.

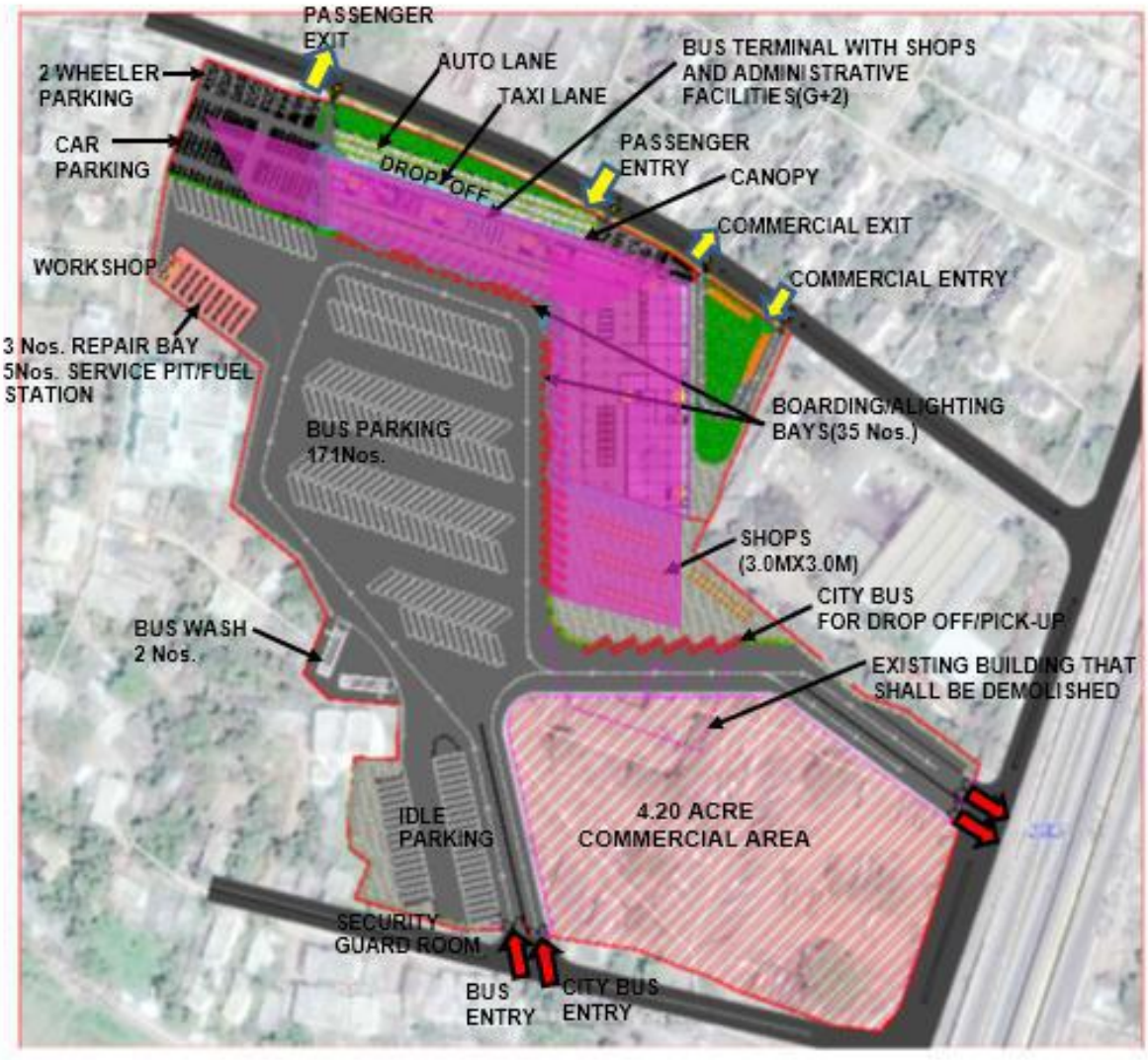


Figure 6-17: Concept Plan

The larger scale map of the above option is attached in Volume II: Detailed Drawings.

Figure 6-18: 3D View 1 - Passenger side

Figure 6-19: 3D View 2 - Terminal side

The 3D visuals of the entire scheme are attached in Volume II: Detailed Drawings.

6.8.1.2 Area Configuration

Area Statement

Table 6-1: Area Statement

Total Site Area	15.5 acre				
Less commercial area	4.02 acre				
ISBT area	11.48 acre				
	Revised plan (G+2)				
ISBT area	Covered area (building + stilt area)	Building area	Stilt area		Shops area
Ground floor (+40.15)	7939.56	4516.56	**3423**		In stilt = 702 sqm
			Parking = 936	Shops+ Plaza = 2487	In building area = 513 sqm
First floor (+45.65)	2108				Food court floor Includes VCEs, toilets, etc.
First floor (+45.65)	1322				Entrance lobby includes VCES and toilets and double height space
Second floor (+49.15)	4514				Rest rooms, administrative rooms, offices, etc.
	15883.56				
Commercial area (G+2)	Area in sqm				facilities
Basement	5130				Parking + services
Ground Floor	1510				Lobby area + retail(1000 sqm) + VCES services etc
First floor	5796				Retail + Restaurants+ VCES services etc
Second floor	4935				Retail / offices
	12241				
Total (Terminal + Commercial)	**28124.56**				

Car Parking Calculation

Table 6-2: Car Parking Calculation

Sl. No.	Description	Required area (sq. m.)/ NOS.	Provided area (sq. m.)
1	Required parking for terminal facilities (30 % of Built up area)	3738 sqm/ 162 ECS	4120 sqm (including drop off lanes)/ 161 ECS
2	Required parking for buses	300 Nos.	35 bus bays 191 idle bus parking (open)
3	Required parking for commercial facilities (30 % of Built up area)	3672 sqm / 159 ECS	5130 sqm / 160 ECS

6.8.1.3 Entry & Exit

- For the terminal, the bus entry is from the southern access road @ +40 m LVL and exit is on to the main highway service lane
- Dedicated entry/ exit gate and lane has been planned for local city buses
- The private cars and public transport like auto/ taxis enter from the rear (northern side) access @ surface level of that approach road, i.e., +45.65 m LVL
- The commercial area entry / exit is from the northern access road with a ramp down and the drop off is created @ + 42.15 m LVL

6.8.1.4 Vehicular Movement

- The intercity/ interstate buses enter from the southern access road, move along the boundary towards the respective bays along the terminal building
- The local buses enter from its dedicated lane and move right directly to their respective bays
- Private vehicles enter and exit from the northern access road and have a drop off along the other side of the terminal building
- Segregation of terminal and non-terminal activities/ traffic
- Private entry and exit for the commercial area is also from the northern access road

6.8.1.5 Parking

- The buses that enter drop off the passengers or park at the respective bay along the terminal building and then move to the respective idle parking in the island
- Parking for private vehicles, i.e., cars and two wheelers is proposed near the private drop off point at the 3m below surface drop off
- Minimum waiting space is provisioned for taxis and autos at surface level (northern access side)
- Dedicated parking for the commercial facilities is planned at the basement level

6.8.1.6 Pedestrian Amenities

- Basic pedestrian amenities are provisioned for in the terminal area
- It is expected that large scale barricading of road edges from pedestrian traffic will provide lot of relief to the motorized vehicular flow from the pedestrian movement
- Simultaneously, dedicated channels for pedestrian flow from one zone to another shall ensure that the requirements for the pedestrians are met in totality
- Pedestrian traffic shall not conflict with other modes of transport
- The proposal focuses on the pedestrian facilities and fills in all the gaps in the same/ it is mandated that pedestrian circulation has to be safe, secure and fully facilitated so that they do not have any incentive in sharing road space and mixing with vehicular traffic. The proposal ensures conflict free movement of pedestrians from one collection zone to other.
- Key measures adopted to arrive at the ideal solution for smooth traffic circulation include pedestrian barriers, foot over bridges, pedestrian underpasses and forcing vehicular merging and de-merging along the direction of vehicular flow
- Co-ordination of different activities in terms of functional and spatial inter-relationships
- Timely dissemination of vehicular and related necessary information to passengers
- The proposed redevelopment of the bus stand also included minimum spaces for the passengers to wind up and relax
- Provision of necessary facilities/utilities to meet the requirement of all user groups

6.8.1.7 Workshop for Buses

- To ensure to the maintenance of buses, 2 nos. bus wash facilities have been provisioned for
- Also workshop is proposed for buses, where there is a provision to carry out heavy repair and maintenance for at least 10 buses at a time

6.8.1.8 Signage

Proper directional signage's, road markings and road signage's is envisaged and is required to be detailed for making the proposal user friendly and efficient. Mandatory sign, information signs, warning signs as per IRC norms (IRC 67:2001 – code of Practice for road signs & IRC 35-1997- code for practice for Road Markings) is required wherever necessary.

6.8.1.9 Facility for Physically Challenged

Proper planning for the movement of the physically challenged/ differently abled is envisaged. Ramps are provided wherever change in level is planned. It is proposed to use mechanical systems like lifts for making it easier for pedestrians and physically challenged to encounter changes in grades. Barrier free movement throughout the bus stand is planned.

6.8.1.10 Lighting

Lighting is proposed to be upgraded using high mast lighting, pole lights and pedestrian bollard lights so that a minimum of 100 lux is available everywhere around the complex and paths are properly lit for the pedestrians.

6.8.2 Schedule of Finishes

Entrances

The points of ingress and egress to the building will provide:

- Shelter from the weather
- Environmental control
- Security both during operational and non-operational hours
- Emergency evacuation routes

External Walling

Design features will include:

- Wall panels to be dimensionally coordinated with flooring.
- Louvered infill panels to provide protection against rain and solar gain
- Structural columns in fair faced concrete

Common Areas – Floors

Safety is of paramount concern. Materials will be selected with safety as a priority. Flooring will be:

- Safe with durable non-slip characteristics
- Paved in single materials
- Zones relating to movement paths to be distinguished using varying colour and texture
- Access covers to be inlaid with general flooring material except where related to special equipment such as escalators where ribbed stainless steel is required
- Tactile strips to be integrated with floor material and defined in contrasting tone for partially sighted
- Natural Kota /granite stone in flamed, honed and polished finishes as appropriate
- Highly durable and easily maintained against the build-up of dust and dirt
- Concealed lighting with high luminance non-glare fittings
- Focus lighting in special areas
- Rapidly renewable materials will be preferred for interior construction
- Locally manufactured building materials will be preferred, especially with low embodied energy

Public Toilets

a) For flooring non-slip materials

b) Ceramic tile/ Granite cladding on walls

Landscape and Pedestrian Zones

a) Extra concrete/brick/stone generated during construction will be used up as filling materials/ paving in the landscape

b) Gypsum board will be broken down on site and gypsum will be used on site for soil amendment, while paper will be recycled

c) Most of the hard landscaping will be designed as pervious to reduce heat absorption. This shall include “green” roads for not often used sections.

d) Integrated sky courts and terraces with vegetated pergolas.

e) Low water landscape with drip irrigation

f) Roof gardens (almost everywhere) provide pleasure, insulation, thermal mass and transpiration, reduce roof run off, decrease the heat island effect of the development, and thrive on drip irrigation and humidifier techniques and recycle d waste water.

g) An accessible green vegetated roof and trellised façade will be developed on most of the available roof space. Besides the aesthetic benefits, this will improve roof insulation and lower ambient air temperature.

Other Miscellaneous

- Wherever possible, recycled, salvaged or refurbished materials will be specified, e.g. perforated MDF false ceilings and floors, or certified recycled aluminium for openings

Road Furniture

Pedestrian might experience prioritized only when their needs are fully taken care of. The proposal envisages benches, litterbins, shaded trees, rain shelters and drinking water points dispersed across the landscape.

Other Facilities

- Energy efficient and green building features have been incorporated to make the proposed building at par

6.9 Architectural Design

6.9.1 Development Control Norms

Bhubaneswar Development Authority have defined certain norms for a Bus stand project or for transportation projects. However on certain aspects the Bye laws are silent for this category of land use, i.e., Bus stand / Transportation. In such cases the parameters considered are for assumed land use of either Assembly building or Institutional or Government or Public or semi-public offices or Commercial buildings as and where relevant.

The development control norms as per Building Regulations for a bus stand are as follows:

6.9.1.1 Minimum Setbacks

Clause 31: The setbacks/ open spaces for other occupancies:

31 (3) (ii) Assembly buildings - The open space in front of the building shall not be less than 12 metres and the other open spaces around the building shall not be less than 6 metres.

6.9.1.2 Floor Area Ratio

Clause 34 In case of transport related activities such as Railway yards, Railway station, Bus stands, Bus shelters, transport depot, airport, special warehousing, cargo terminals the maximum permissible **FAR shall be 1.0**.

6.9.1.3 Height of a Building

Airport Authority of India has restricted the upper most point of the proposal to 55.17 m AMSL.

Refer **Annexure - 6(B)**.

6.9.1.4 Off-street Parking

Table 10 of Building regulations mentions the parking area requirement depending on its category.

Sl. No.	Category of building	Parking area to be provided as percentage of total built up area towards FAR
2	Restaurants, Lodges, Other commercial buildings, Assembly buildings, offices complexes, Hospitals, IT/ ITES complexes, Retail shopping	30

41.3 Off-street parking spaces shall be provided with adequate vehicular access to a street and the area of drives, aisles and such other provisions required for adequate manoeuvring of vehicles.

41.8 For parking spaces in basements and upper storey of parking floors, at least two ramps of minimum of 3.6 m width or one ramp of minimum 5.4m width and with maximum 1:10 slope shall be provided. Such ramps may be permitted in the front, side and rear setbacks after leaving 6m space for movement of fire-fighting vehicles. Access to these may also be accomplished through provisions of mechanical lifts.

6.9.1.5 Basement/ Cellar

Clause 40 (6) The basement shall fulfil the following requirements:

(i) Every basement shall be in every part at least 2.5 meters in height from the floor to the soffit of the roof slab or ceiling;

(ii) Adequate ventilation shall be provided for the basement. The standard of ventilation shall be the same as required by the particular occupancy according to regulations. Any deficiency

may be met by providing adequate mechanical ventilation in the form of blowers, exhaust fans (one exhaust fan for 50 square meters of basement area), air conditioning system;

(iii) The minimum height of the ceiling of upper basement shall be 1.20 meters and the maximum, 1.5 meters above the average surrounding ground level;

(iv) Adequate arrangement shall be made, so that surface drainage does not enter the basement;

(v) The walls and floors of the basement shall be water-tight and be so designed that the effect of the surrounding soil and moisture, if any, are taken in to account in design and adequate damp proofing treatment is given;

(vi) The access to the basement shall be separate from the main and alternative staircase providing access and exit from higher floors shall be provided. Where the staircase is continuous in the case of buildings served by more than one staircase, the same shall be of enclosed type serving as a fire separation from the basement floor and higher floor. Open ramps shall be permitted if they are constructed within the building line subject to provision of clause (iv) of sub-regulation (6).

(vii) The ramp providing access to basement to be used for parking shall have a gradient not steeper than 1:10 and this shall not obstruct the clear vehicular and pedestrian movement around the building including movement of fire tender (6 meters).

6.9.1.6 Norms for Barrier-free Access

Clause 50: Barrier free access for the differently abled person

50.1 Barrier free environment is one, which enables people with disabilities to move about safety and freely and to use all facilities within the built environment. The goal of barrier free design is to provide an environment that supports the independent functioning of individuals so that they can get into and participate in all activities without assistance.

50.2 The main purpose is to integrate and elderly persons fully into the society. In view of the above, the Government of India has enacted the Disabilities Act, 1955.

50.3 Section 44,45 & 46 of the said Act Stipulates that the appropriate Governments, local authorities to ensure provisions of barrier free facilities in all new Government buildings and public utilities roads and transport. Also, in 1996 Government of India enacted another person with Disabilities (Equal Opportunity), Protection of Rights and Full Participation) Act for the Barrier Free Environment for differently abled persons.

50.4 Site Development: Level of the roads, access paths and parking areas shall be described in the plan along with specification of the materials

50.5 Access path / Walk Way: Access path from plot entry and surface parking to building entrance shall be minimum of 1800 mm. wide having even surface without any steps. Slope, if any, shall not have gradient greater than 5% Selection of floor materials shall be made suitably to attract or to guide visually impaired persons (Limited to coloured floor material whose colour and brightness is conspicuously different from that of the surrounding floor material or the material that emit different sound to guide visually impaired persons hereinafter referred to as “guiding floor material”). Finishes shall have non slip surface with a texture traversable by a wheel chair, Curbs where ever provided should blend to a common level.
50.6 Parking - For parking of vehicles of handicapped people the following provisions shall be made:

50.6.1 Surface parking for two car spaces shall be provided near entrance for the physically handicapped persons with maximum travel distance of 30 meter from building entrance.

50.6.2 The width of parking bay shall be minimum 3.6 meter.

50.6.3 The information stating that the space is reserved for handicapped persons shall be conspicuously displayed.

50.6.4 Guiding floor materials shall be provided or a device which guides visually impaired persons with audible signals or other devices which serves the same purpose shall be provided.

50.7 Building requirements: The specified facilities for the buildings for handicapped persons shall be as follows:

50.7.1 Approach at plinth level: Every building must have at least one entrance accessible to the handicapped and shall be indicated by proper signage.

50.7.2 Ramp Approach: Ramp shall be finished with non – slip material. Minimum width of ramp shall be 1800 mm with maximum gradient 1:12, length of ramp shall not exceed 9 meter having 800 mm high hand rail on both sides extending 300 mm beyond top and bottom of the ramp. Minimum gap from the adjacent wall to the hand rail shall be 50 mm.

50.7.3 Stepped Approach: For stepped approach width of tread shall not be less than 300 mm and maximum riser shall be 150 mm. Provision of 800 mm high rail on both sides of the stepped approach similar to the ramp approach shall be made.

50.7.4 Exit /Entrance Door: Minimum clear opening of the entrance door shall be 900 mm and it shall not be provided with a step that obstructs the passage of a wheel chair user. Threshold shall not be raised more than 12 mm.

50.7.5 Entrance Landing: Entrance landing shall be provided adjacent to ramp with the minimum dimension 180 mm x 2000 mm. The entrance landing that adjoins the top end of a slope shall be provided with floor materials to attract the attention of visually impaired persons (limited to coloured floor material whose colour and brightness is conspicuously different from that of the surrounding floor material or the material or the material that emits different sound to guide visually impaired persons hereinafter referred to as “guiding floor material”) Finishes shall have a non – slip surface with a texture traversable by a wheel chair, Curbs wherever provided must blend to a common level.

50.7.6 Corridor connecting the entrance /exit for the handicapped: The corridor connecting the entrance /exit for handicapped concerning the overall use of the specified building can be provided to visually impaired persons by a person or by sign, shall be provided as follows:

50.7.6.1 Guiding floor materials, shall be provided or devices that emit sound to guide visually impaired persons.

50.7.6.2 The minimum width shall be 1250 mm.

50.7.6.3 In case there is a difference of level, slope ways shall be provided with a slope of 1:12.

50.7.6.4 Hand rails shall be provided for ramps / slope ways at a height of 800 mm.

50.8 Stairways: One of the stairways near the entrance/exit for the handicapped shall have the following provisions:

50.8.1 The minimum width shall be 1350 mm.

50.8.2 Height of the riser shall not be more than 150 mm and width of the tread 300 mm. The steps shall not have abrupt (square) nosing.

50.8.3 Maximum number of risers on a flight shall be limited to 12. \

50.8.4 Hand rails shall be provided on both sides and shall extend 300 mm on the top and bottom of each flight of steps.

50.9 Lifts: Wherever lift is required as per bye – laws, provisions of the at least one lift shall be made for the wheel chair user with the following cage dimensions of lift recommended for passenger lift of 13 persons capacity by Bureau of Indian Standards. The clear internal dimensions of the lift car shall be minimum of depth – 1100 mm, width – 2000 mm and entrance door width – 900 mm.

50.9.1 A handrail not less than 600 mm, long at 1000 mm above floor level shall be fixed adjacent to the control panel.

50.9.2 The lift lobby shall be of an inside measurement of 1800 mm x 1800 mm or more.

50.9.3 The time of an automatically closing door shall be minimum 5 seconds and the closing speed should not exceed 0.25 meter / sec.

50.9.4 The interior of the cage shall be provided with a device that audibly indicates the floor the cages has reached and indicates that the door of the cage for entrance /exit is either open or closed.

50.9.5 The control panel shall have making in Braille to help visually handicapped.

50.10 Toilets: One special Water Closet, in a set of toilets shall be provided for the use of handicapped with essential provision of washbasin near the entrance foe the handicapped.

50.10.1 The minimum size shall be 1500 x 1750 mm

50.10.2 Minimum clear opening of the door shall be 900 mm and the door shall swing out.

50.10.3 Suitable arrangement of vertical /horizontal handrails with 50 mm clearance from wall shall be made from the floor.

50.10.4 The water Closet seat shall be 50 mm from the floor.

50.11 Drinking Water: Suitable provision of drinking water shall be made for handicapped near the special toilet provided for them.

50.12 Designing of Children: In a building meant for the predominant use of the children, it is necessary to suitable alter the height of the handrail and other fittings and fixtures.

6.9.2 Proposed Facilities

The guidelines for the design and planning aspects of various activities and facilities have been taken from the Time Saver Standards Space Requirements, Neufert's Architect's Data handbook and National Building Code (India).

The bye-laws referred to while planning the Bus stand is Planning & Building Standards Regulations 2017, Bhubaneswar Development Authority (BDA).

6.9.2.1 Planning Configuration

Table 6-3: Bus Stand Planning Configuration (administrative building)

Sl. No.	Floor	Facilities Provided
1	Ground Floor (+40.15 M LVL)	• Pedestrian Circulation area • Bus platform • Ticket counters/ Enquiry counters • Police Control room • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs • Drinking Water Fountains (RO) • Shops/ kiosks
2	First Floor (+45.65 M LVL)	• Passenger entry lounge • Food court • Administrative offices/ Association offices • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs • Drinking Water Fountains (RO)
3	Second Floor (+49.15M LVL)	• Drivers/ Conductors rest room • Dormitory • Administrative offices/ Association offices • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs • Drinking Water Fountains (RO)
4	Terrace Floor (+52.65M LVL)	• Mumty • Machine room • Overhead Tanks • Solar panels

Table 6-4: Bus Stand Planning Configuration (Proposed Commercial building)

Sl. No.	Floor	Facilities Provided
1	Ground Floor (+42.15 M LVL)	• Space for Retail/ shops • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs

Sl. No.	Floor	Facilities Provided
		• Drinking Water Fountains (RO)
2	First Floor (+45.65 M LVL)	• Restaurant (fine dining) • Retail/ Offices • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs • Drinking Water Fountains (RO)
3	Second Floor (+49.15M LVL)	• Space for retail/ Offices • Toilets • Electrical room/ BMS room • Vertical Circulation elements- Elevators and Stairs • Drinking Water Fountains (RO)
4	Terrace Floor (+52.65M LVL)	• Mumty • Machine room • Overhead Tanks

6.9.2.2 Circulation

- Patterns of circulation play a determining role in the architectural organization of this bus stand. In this ISBT, strict segregation of vehicular (bus movement) and pedestrians is initiated in the entire station.

- One way movement

- Providing clear circulation will assist the flow of passengers create regular movement patterns inside the station. Where this is well executed security cameras using smart detection systems can easily detect abnormal behaviour. Effective signage can also be used to differentiate between the different objectives in the bus stand (travel, retail, etc.) and to prioritize circulation flow. For example the information provided about travel should be more conspicuous than that provided for retail and other ancillary activities.

- The key aim of successful circulation will be to reduce as much areas of high concentrations of people. Specifically to avoid bottlenecks in the bus stand, allowing sufficient space before and after the ticket gate-lines, elevators, stairs and other critical points where congestion could occur.

- Vertical circulation is provided from a variety of points throughout the station in the form of stairs and lifts. The combination of non-mechanical and mechanical means

of vertical circulation ensures that there is not a reliance being placed on the local electrical infrastructure which is generally considered unreliable. This being said, in the event of a power failure, an emergency backup Diesel Generator will be implemented, which will cause the lifts to restart automatically.

- Pedestrians have conflict free movement which eases the movement patterns and prevents unwanted accidents even within the complex.

6.9.2.3 Entrances and Exits

- At entrances and exits of the Bus way, Mild steel gates have been provided for security and safety purpose and also for avoiding trespassing during non-operational hours.
- Apart from the Gates which will remain open during the operational hours boom barriers have been provided for monitoring and managing the bus entry/ exit system.
- Aluminium composite panelling is done on Gantry structures that have been provided at the entrance of the Bus stand with name signage in Retro-reflective tape.
- Security cabins have been provided near the entrance and exit which houses space for 1 personnel who would manage the bus entry/ exit and assign necessary instructions for parking etc.
- The buses are expected to park at their allotted bays after entering the bus stand.
- Separate gates have been provided at the rear side for the private vehicles, autos and 2 wheelers.
- Separate entry and exit for private vehicles is planned in this Bus stand with unidirectional movement.

6.9.2.4 Parking

- Adequate space has been provided near the drop off area at the entrance for visitor/ passenger parking of Private vehicles, 2 wheelers, cycles and autos/ taxis.
- Private vehicle parking for staff and shopkeepers is provisioned at the northern edge.
- The road width considered in between two car parks is 5m
- The road width considered in between two 2 wheelers is 3m

- Islands with soft landscape has been planned at the edges of the parking lot.
- Parking area is defined with cement concrete kerbs and individual parking space is demarcated by paint.

6.9.2.5 Bus bays

- The buses are parking as nose in orientation at an angle of 45 degrees.

Figure 6-20: Bus Bay Arrangement

- The dimensions of the bus bay is shown as follows

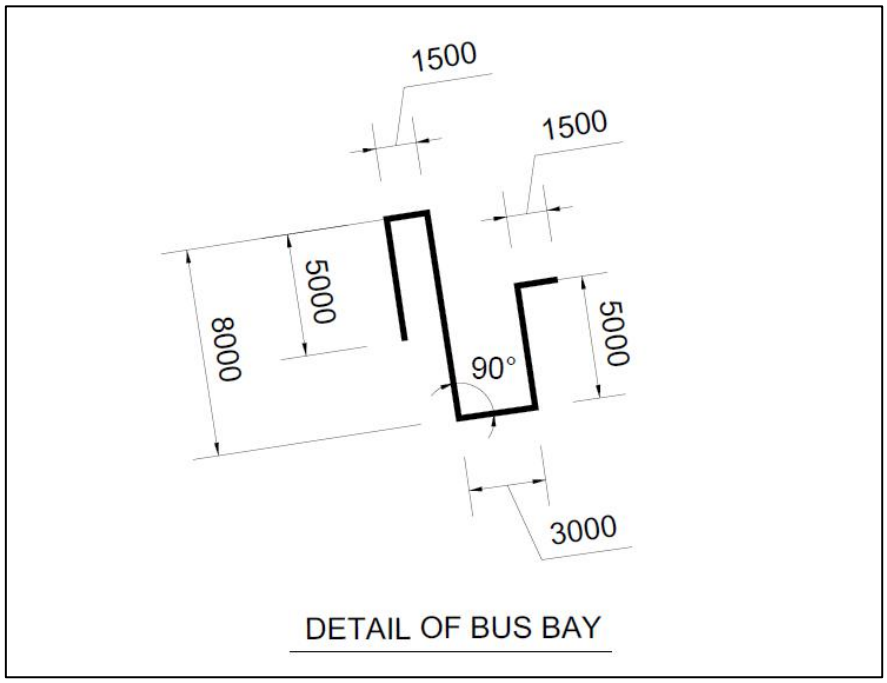


Figure 6-21: Detail of Bus Bay

- Tyre stopper provision has been made about 1m before the kerb so that the front overhang of the bus is within the bay and not projected onto the platform.
- The edge of the bay is defined by a 150mm high cement concrete kerb.

Figure 6-22: Concrete kerb at edge of bus bay

- The clear headroom for the buses is 5.5 m
- Steel space frame canopy with toughened glass above has been planned for above the bus bays partially to provide shade to the boarding and alighting passengers.

6.9.2.6 Platforms

- Platforms are the spaces for passengers to move and manoeuvre before and after boarding and alighting their buses respectively.
- These are not enclosed spaces, but roofed areas so that there is protection from sun and rains.
- For visual transparency within the platforms minimum mandatory enclosures are planned in this area like ticket counters, police control room etc.
- Flamed granite is used in flooring for ease of maintenance, durability and for its non-slip characteristic to aid the old age, physically challenged etc.
- Tactile flooring for the visually impaired people has been integrated with the granite flooring throughout the platform areas.
- Directional signage directing towards various spaces like toilets, drinking water etc. is planned at various locations for the ease of the commuters.
- All wall surfaces and column surfaces are cladded with polished granite up to ceiling for ease of maintenance and durability.

6.9.2.7 Administrative areas

- In the name of administrative areas ticket counters and a Police control booth is located on the Ground floor as maximum circulation space is desired.
- Ticket counters and Enquiry counters have workstations along with granite window counter for ticketing
- The windows in ticket counters are aluminium windows with fixed glass at lower portion of window with opening for cash and ticket transaction
- Aluminium grill for security has been provided at the window
- RCC slab at 3m level is provided with Gypsum false ceiling below

- Vitrified tile flooring is within the rooms
- Internal wall finish is in plastic paint
- Police control booth has provision of 2 workstations
- Second/ Third floor has other mandatory administrative spaces like Dormitories, Drivers Rest room, Cloak rooms, and Administrative offices
- All of these rooms are finished with Vitrified tiles on floor, Plastic paint on walls and Oil Bound Distemper finish on ceiling.
- Dormitories are provided with beds with lockable storage cabinets

6.9.2.8 Toilets

- Sanitary provisions have been made as per National Building Code (2005)

A - For Terminal - Ground Floor								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (terminals)**	
1	Built-up area					Sq. m.		
2	No. of persons (peak hour at horizon year)	6173				persons		
		Required		**Provided**			Male pop	Female pop
		Male	Female	Male	Female		3704	2469.2
3	No. of WCs	7	6	12	8	fixtures	as per terminal category in NBC 4 for every 1000, +1 every additional 1000	as per terminal category in NBC 5 for every 1000, +1 every additional 1000
4	No. of urinals	9		18		fixtures		3 for 46-70
5	No. of wash basins	9	6	12	8	fixtures		1 per 25
6	Toilet for disabled	1		1				

B - For Terminal - First Floor (Entrance lounge and offices)					
Sl. No.	**Parameter**	**Quantity**	**Unit**	**NBC norms (terminals)**	
1	Built-up area	1000	sqm		

B - For Terminal - First Floor (Entrance lounge and offices)								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (terminals)**	
2	No. of persons (peak hour at horizon year)	100				persons		
		Required		**Provided**			Male pop	Female pop
		Male	Female	Male	Female		60	40
3	No. of WCs	3	4	6	4	fixtures	as per terminal category in NBC 4 for every 1000, +1 every additional 1000	as per terminal category in NBC 5 for every 1000, +1 every additional 1000
4	No. of urinals	5		9		fixtures		3 for 46-70
5	No. of wash basins	5	4	6	4	fixtures		1 per 25
6	Toilet for disabled	1		1				

C - For Terminal - First Floor - Food Court								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (terminals)**	
1	Area in sqm.	1382				Sq. m.	Male pop	Female pop
2	Number of persons	276				persons	184	92
		Required		**Provided**				
		Male	Female	Male	Female			
3	No. of WCs	4	4	6	4	fixtures	1 per 50 seats upto 200	2 per 50 seats upto 200
4	No. of urinals	4		9		fixtures	1 per 50 persons	
5	No. of wash basins	4	4	6	4	fixtures	1 per WC	1 per WC
6	No. of baths							

D - For Terminal Office Area – Second Floor								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (office category)**	
1	Area in sqm.	1611				Sq m.	Male pop	Female pop
2	Number of persons	161.1				persons	107	54
		Required		**Provided**				
		Male	Female	Male	Female			
3	No. of WCs	4	4	6	4	fixtures	1 per 25	1 per 15
4	No. of urinals	3		9		fixtures	3 for 46-70	
5	No. of wash basins	4	2	6	4	fixtures	1 per 25	1 per 25
							1 per 8	

D - For Terminal - Rest rooms/ Dormitories – Second floor				
Sl. No.	**Parameter**	**Quantity**	**Unit**	**NBC norms (hostel)**
Attached washrooms as per norms to be provisioned in the rest rooms				

E - For Commercial - Ground Floor								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (office)**	
1	Area	1292				Sq m.		
2	No. of persons	172				persons		
		Required		**Provided**			Male pop	Female pop
		Male	Female	Male	Female		103	69
3	No. of WCs	4	5	8	6	fixtures	1 per 25	1 per 15
4	No. of urinals			7		fixtures	3 for 46-70	
5	No. of wash basins	4	5	8	6	fixtures	1 per 25	1 per 25
6	Toilet for disabled	1		1			1 per 8	

F - For Restaurants + Commercial - First Floor								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (restaurant)**	
1	Area	5796				sqm		
2	No. of persons	580				persons		
		Required		**Provided**			Male pop	Female pop
		Male	Female	Male	Female		348	232
3	No. of WCs	13	9	16	12	fixtures	1 per 50 seats upto 200, over 200 add @1 per 100 or part thereof	2 per 50 seats upto 200, over 200 add @1 per 100 or part thereof
4	No. of urinals	7		14		fixtures	1 per 50 persons	
5	No. of wash basins	13	9	18	14	fixtures	1 per wc	1 per WC
6	Toilet for disabled	1		1				

G - For Commercial - Second Floor								
Sl. No.	**Parameter**	**Quantity**				**Unit**	**NBC norms (restaurant)**	
1	Area	4851				Sq m.		
2	No. of persons	485				Persons		
		Required		**Provided**			Male pop	Female pop
		Male	Female	Male	Female		291	194
3	No. of WCs	5	8	16	12	fixtures	1 per 25	1 per 15
4	No. of urinals	6		14		fixtures	4 for 71-100, add 2.5 % over 200	
5	No. of wash basins	12	8	18	14	fixtures	1 per 25	1 per 25
6	Toilet for disabled	1		1				

3 nos. toilet is for the physically handicapped on each floor which is finished with non-slip materials on the floor with all support system on walls is planned.

- The toilet is finished in ceramic tile flooring
- In walls, cladding is in ceramic tile up to 7 feet height and Oil Bound distemper finish above 7 feet
- Wash basins counters are made of Polished Granite
- Looking Mirror is fixed in wooden frames at length along the entire wall above the wash basin up to 7 feet height

6.9.2.9 Vertical Circulation Elements

- Combination of manual and automatic vertical circulation elements is provided
- Staircases have been provided as per the codal provisions in the National Building Code 2005
- Flamed finish granite is for the floors
- Walls are cladded with polished granite up to ceiling for ease of maintenance.
- The Geometry of stone cuts is coordinated with the floor joints
- Stainless steel 304 grade railing is provided in the staircase
- 10 passenger capacity elevators 2 no. is provided especially for the physically challenged

6.9.2.10 Shops/ Commercial areas in Terminal area

- Apart from mandatory facilities in the bus stand certain other facilities like Snacks and Juice stall etc. are provided
- Due to space constraints some shops are provisioned for in the First floor
- Bare shell of these rooms is provisioned for and the finishing in terms of floor finish, wall cladding etc. shall be done as per the end user or the retailer to whom the shop would be allotted or leased out
- Each of the shop is provisioned with rolling shutter for security
- Windows for natural ventilation in aluminium finished frames with fixed glass and aluminium grills

6.9.2.11 Common areas

- All common areas are user friendly
- Combination of polished and flamed granite is used in flooring for ease of maintenance, durability and for its non-slip characteristic to aid the old-age, physically challenged, etc.

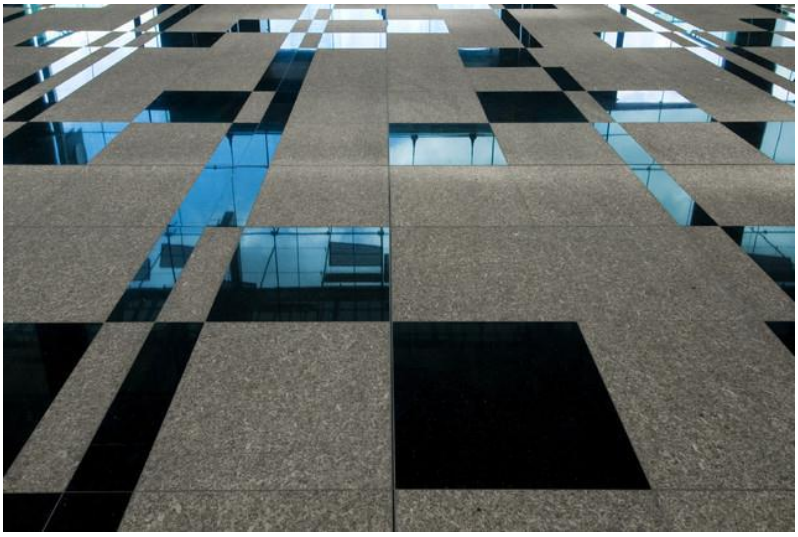


Figure 6-23: Combination of polished and flamed granite flooring

- Tactile flooring for the visually impaired people has been integrated with the granite flooring throughout the common areas on all floors

Figure 6-24: Tactiles integrated with Granite Flooring

- Directional signage directing towards various spaces like toilets, drinking water etc. is planned at various locations for the ease of the commuters

- All wall surfaces and column surfaces are cladded with polished granite up to ceiling for ease of maintenance and durability
- All seating in waiting areas is in brushed finish stainless steel finish fixed to the floor and not kept lose
- Seats are with arm rests to discourage sleeping

Figure 6-25: SS Benches

- Bollards are used at entrance areas to control vehicular access in the pedestrian zone
- To add the cultural touch local art form has been replicated in the bollards. Bottle painting , one of the famous art forms of Odisha

Figure 6-26: Bollards in the shape of Bottle painted in Odia art

6.9.2.12 Signage

Signage are user-friendly and provide information essential to users, engendering a sense of reassurance, security and orientation when entering, exiting or transferring. It shall guide users to various areas, provide information of the bus stand and its services and provide information on Bus services.

User information shall cover the following as the minimum:

- Static signages such as Bus stand name, destination of services, platform number, way finding signs, direction, entry, and exit
- Variable signages such as real time travel information to customers
- Maps and long term changeable information on scheduled services and ticket costs
- Information on the use or operation of a place or system
- Intermodal connections
- Emergency exits
- Rules of conduct to users
- All signages shall have alternate pictorial signages. User information displays are so located that users seeking information have ready access without obstructing free flow of users. Signs shall be placed at decision points, and perpendicular to the line of sight. Signages placed on the left side of passages including stairs, lifts and escalators.

Figure 6-27: Gantry signage at entry and exit of the bus stand – Type 1

Figure 6-28: Gantry signage at entry and exit of the bus stand - Type 2

Figure 6-29: Typical Directional Signage

Figure 6-30: Typical Directional Signage

6.9.2.13 Landscape

- Landscape features in the form of soft and hard scapes have been provided
- Ground cover and shrubs within the parking area and roundabouts have been provided
- Ground cover in the form of Iresene would be used

Figure 6-31: Iresene Ground Cover

- Shrubs like Wedeleia Trilobata and Clerodendrome Inerme will be used

Figure 6-32: Wedelia Trilobata

Figure 6-33: Clerodendrone Inerme

- These plantations will add colour to the soft scapes

- A lot of trees are also panted at the periphery for shade and greenery.
- The kerb edges are lined with bougainvillea trees.

Figure 6-34: Bougainvillaea plants

Design for People with Special Needs

6.9.2.14 Mobility Impaired and Visually Impaired People

Someone who does not use a walking aid can manage to walk along a passage way less than 700mm wide, but just using a walking stick requires greater width than this; a minimum of 750mm. A person who uses two sticks or crutches, or a walking frame needs a minimum of 900mm, a blind person using a long cane or with assistance dog needs 1100 mm. A visually impaired person who is being guided needs a width of 1200 mm.

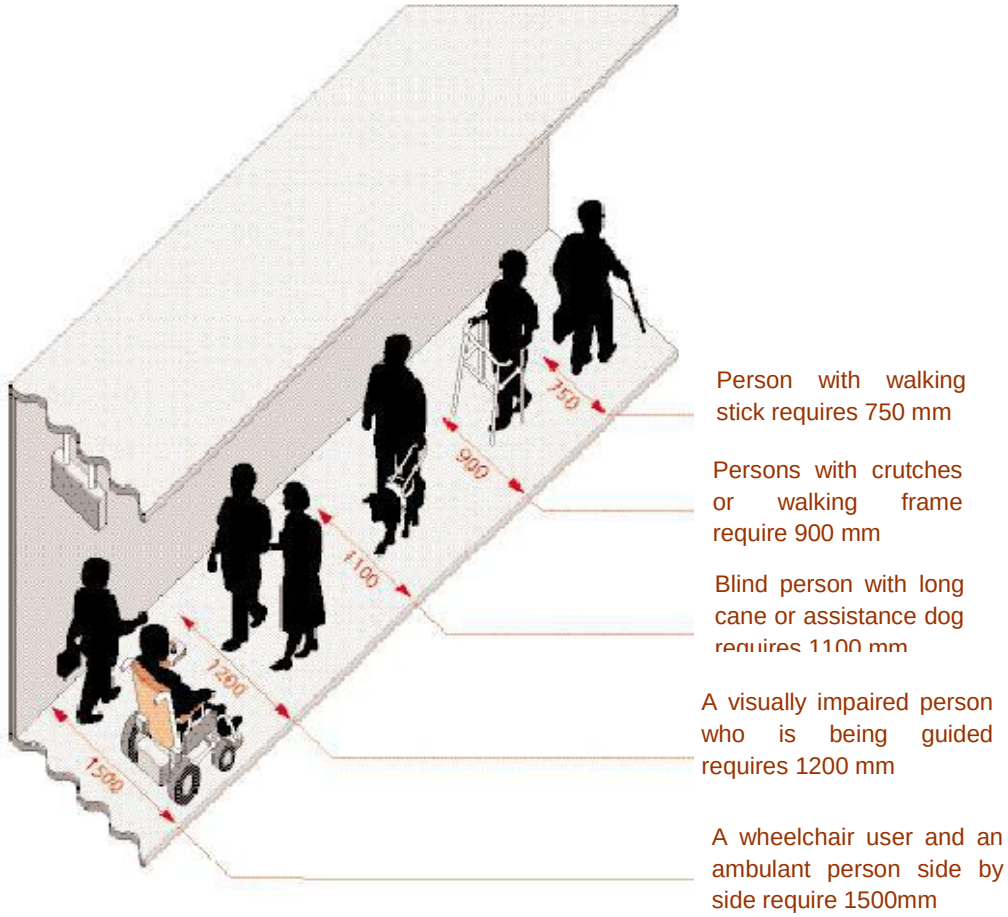


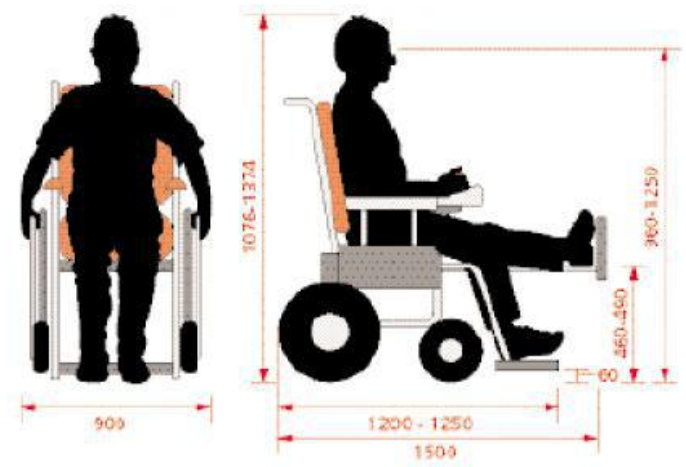
Figure 6-35: Footway Requirement for Mobility / Visually Impaired People

Unobstructed height above a pedestrian way is also important, especially for visually impaired people. Generally, this should be a minimum of 2300mm except on sub-surface station platforms where it should be 3000mm. Where a sign is suspended over a footway or pedestrian area, for example in a railway station a minimum clearance of 2100mm is acceptable (2300mm on cycle ways). Where trees overhang a footway it is advisable to cut them back to at least 3000mm clear height to allow room for regrowth.

Wheelchair users

Although a minority among disabled people, wheelchair users need quite a lot of space to move around comfortably and safely: usually more than mobility impaired people, although those who walk with two sticks can occupy a greater width than someone using a wheelchair.

A wheelchair user and an ambulant person side by side require 1500 mm



Note:

Requirements in transport regulations introduced under the Disability Discrimination Act 1996 are based on an occupied wheelchair 1200x700 mm.

Wheelchairs that are larger than this can and should be catered for in the built environment but it is not feasible to provide for larger wheelchairs on public transport.

Figure 6-36: Wheelchair Dimensions to be considered for Public Transport

A comprehensive set of measurements of wheelchair visitors to the Mobility Road show (1999) gave the figures for length and width summarized on the opposite page. The range of dimensions is considerable, particularly that for overall length. The greatest lengths are those of conventional wheelchair users with leg supports (maximum 1545mm, though this was the only measurement out of 745 of more than 1500mm) and electric scooters with a maximum of 1500mm. Conventionally seated wheelchair users do not occupy more than approximately 1250mm. However, if a wheelchair user has a personal assistant; their combined length will be typically 1750mm.

The ISO standard for wheelchairs (ISO 7193) notes that to propel a wheelchair manually needs a clearance of not less than 50mm, preferably 100mm, on both sides. The Mobility Roadshow survey also measured the heights of wheelchair / users. The overall mean height for all types of wheelchair users was 1243mm, with a 5th percentile of 1076mm, 95th percentile of 1374mm and a maximum of just over 1450mm. As with overall length, scooter users gave slightly greater figures, with a mean height of 1340mm, 5th and 95th percentiles of 1202mm and 1438mm respectively and a maximum of 1502mm. Other basic measurements which are of importance when considering design standards to accommodate wheelchair users are:

- Eye height, which is around 120-130mm below seated height giving a 5th-95th percentile range for
- Wheelchair users from 960mm to 1250mm (1080mm to 1315mm for scooter users)
- Knee height, 500mm to 690mm
- Seat height, 460mm to 490mm

- Ankle height, manual wheelchair users 175mm to 300mm; electric wheelchair users 380mm to 520mm
- Height to bottom of foot support, 60mm to 150mm.

Manoeuvring space is needed for a wheelchair to turn corners or turn around. Skilled users of manual wheelchairs can turn through 360Â°Â° in a space no more than 1500mm x 1500mm, but this is insufficient for larger chairs, particularly outdoor electric wheelchairs (turning circle 2420mm), electric pavement vehicles (turning circle 4350mm) and for wheelchair users with extended leg rests. Within transport related buildings, the following dimensions should be taken as the minima acceptable:

- Right angle turn (along corridor) 1200mm x 1200mm
- 180Â° turn (within corridor) 1600mm (width) x 2000mm (length)

Users of electric scooters and large electric chairs may need greater space than this for 180Â° turns, but the dimensions given (as minimum) will accommodate users of self-propelled wheelchairs and the majority of electrically powered wheelchairs.

Standing

Standing is difficult and painful for some disabled people, particularly those with arthritis, rheumatism and back problems. In the same study as that mentioned above, nine per cent of the survey respondents could only stand for less than a minute without discomfort, 24 per cent could manage between one and five minutes and a further 22 per cent could stand for up to ten minutes. The findings from this study emphasize the importance of providing plenty of appropriately placed and designed seating at places where people may have to wait and along pedestrian routes.

Walking distances

Walking distances were researched in some detail in the late 1980s and, based on the findings from these studies, the following are recommended:

Impaired Group	Recommended distance limit without a rest
Wheelchair users	150 m
Visually impaired	150 m
Mobility impaired using stick	50 m
Mobility impaired without walking aid	100 m

These figures are average measures; there is a lot of variation between individuals. Gradients, weather conditions, whether there are handrails etc. will also affect the distances people are able to walk. US regulations, for example, note that on distances over 100 feet (30m) disabled

people are apt to rest frequently. These regulations suggest that to estimate travel times over longer distances allowance should be made for two minutes rest time every 30 meters.

6.9.2.15 Footways, footpaths and pedestrian areas

The distinction between a footway and a footpath is that a footway (usually called the pavement) is the part of a highway adjacent to, or contiguous with, the carriageway on which there is a public right of way on foot. A footpath has no contiguous carriageway. Where reference is made to one, it can generally be regarded as applying to the other for design purposes.

A clear width of 2000mm allows two wheelchairs to pass one another comfortably. This should be regarded as the minimum under normal circumstances. Where this is not possible because of physical constraints 1500mm could be regarded as the minimum acceptable under most circumstances, giving sufficient space for a wheelchair user and a walker to pass one another. The absolute minimum, where there is an obstacle, should be 1000mm clear space. The maximum length of restricted width should be 6 meters.

It is also recommended that there should be minimum widths of 3000mm at bus stops and 3500mm to 4500mm by shops though it is recognized that available space will not always be sufficient to achieve these dimensions.

There is general agreement among guidelines from many countries that an 8 per cent (1 in 12) slope is the maximum that may be used; anything greater than this will cause difficulties for manual wheelchair users. Most guidelines also agree that 5 per cent (1 in 20) is preferred. (A ramp is generally defined as a pathway with a slope of more than 5 per cent).

If there is a steep slope or drop at the rear of the footway, precautions must be made to prevent wheelchair users running over the edge or blind or partially sighted people walking over it. Guardrails and barriers at the side of or across footways should be at least 1100mm high; preferably 1200mm measured from ground level.

6.9.2.16 Fences and Guardrails

Guardrails should also be designed to prevent guide dogs from walking under the rails, but there should be sufficient openings between vertical members to ensure that children and wheelchair users can see, and be seen, through the railings.

The top rail should have a smooth profile and, if intended to provide support, should be circular with a diameter of between 40 and 50mm. There should also be an upstand a minimum of

150mm in height at the rear of the paved area, which can then act as a tapping rail for long cane users as well as a safeguard for wheelchair users.

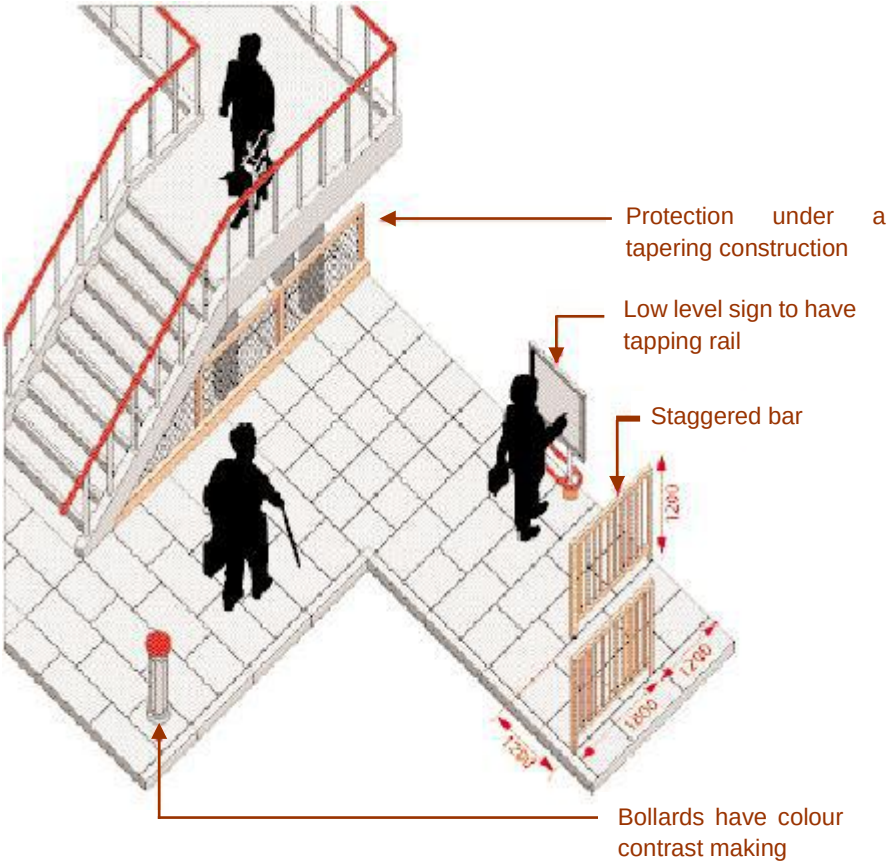


Figure 6-37: Fences and Guardrails in Transport Buildings

Source: Department for Transport – Inclusive Mobility, Govt. of UK

6.9.2.17 Seating

Mobility impaired people need seating at reasonably frequent intervals. In commonly used pedestrian areas, and transport interchanges and stations, seats should be provided at intervals of no more 50 meters. Wherever possible, seats should also be provided at bus stops and shelters. Seating should be placed adjacent to, but not obstructing, the pedestrian route and should be picked out in contrasting colours to help people with visual impairment.

6.9.2.18 Colour Contrast

Many guidelines advocate the use of colour / tonal contrasted marking to identify street furniture, railing or boarding around street works, scaffolding, tactile paving surfaces, and so on. The main purpose of using contrasted marking is to help partially sighted people avoid obstacles that they might walk into or trip over. The dimensions and placing of colour contrasted bands on poles and similar obstructions are a minimum depth of 150mm placed

with the lower edge of the band between 1400mm and 1600mm above ground level. Some guidelines advocate deeper bands (300mm) or more than one band (three dark, two light bands each 100mm deep), but the single band, minimum 150mm, is considered satisfactory by the Royal National Institute for the Blind (RNIB).

6.9.2.19 Surfaces

Uneven surfaces, gaps between paving slabs etc., whether within or outside buildings, can cause problems for people using sticks/ crutches, visually impaired cane users and wheelchair users.

- Joints between flags and pavers should not be less than 2mm and not more than 5mm wide.
- For pedestrian-only footways, flags can be laid with wider joints (6-10mm) filled with compacted mortar. Maximum deviation of the footway surface under a 1 metre straight edge should not exceed 3mm.
- Covers and gratings can also cause problems and may be mistaken by blind people as a tactile surface. It is recommended that the maximum size of openings should be 13mm and if openings are elongated they should be placed at right angles to the predominant direction of travel. It is also recommended that the spaces should not be more than 150mm long.
- Wherever possible gully covers and drainage slots should be positioned as far as possible from main pedestrian flows. Inspection chamber covers and service inspection chambers should be flush with the surface.

Tactile surface for Hazard warning

Type of surface: corduroy, consisting of rounded bars. The bars are 6mm (Â± 0.5mm) high, 20mm wide and spaced, centre to centre at 50mm.

Colour: the surface should contrast with the surrounding area but should not be red.

Application: at the top and bottom of steps, at the foot of a ramp to an on-street Light Rapid Transit (LRT) platform (but not other ramps), a level crossing, where people could walk inadvertently onto a platform at a railway station and where a footway joins a shared route (cycle/pedestrian). It should be noted that the surface is not recommended for raised bus stops.

Layout: the surface should be laid so that the bars run transversely across the direction of pedestrian travel and should extend across the full width plus 400mm each side of stairs at top and bottom, across the full width of the ramp (at the foot of the ramp only), across the full width of the footway at level crossings and the full width of pedestrian entry to unprotected railway station platforms.

Guidance path surface:

Type of surface: a series of raised, flat-topped bars running in the direction of pedestrian travel. The bars are 5.5mm (Â± 0.5mm) high, 35mm wide and are spaced 45mm apart.

Colour: contrasting to the surrounding area, but should not be red.
Application: the surface is recommended for use in pedestrian precincts where the traditional guidance given by a standard footway between the property line and carriageway does not exist, where pedestrians need guidance around obstacles, where visually impaired people need to find a specific location and possibly in transport terminals.

The layout of the guidance path will be determined by the specific location in which it is placed, but the path should be 800mm wide (with unobstructed space on each side also at least 800mm wide) as straight as possible and, in busy shopping centres, with a minimum 2000mm of unobstructed space between the path and the property line.
Where there is a right angle turn, the surface should be installed so that the bars run transversely across the path for 1200mm before the bend in both directions; the same applies to T junctions in the path. For bends other than right angles, the bars should be turned to follow the direction of travel.
When considering putting in guidance paths care should be taken to make sure that the layout of the pathways is not too complicated, otherwise they may cause confusion rather than assisting blind people. Local consultation on the proposed layout should be held to avoid any risk of confusion.

6.9.2.20 Dropped Kerbs and Raised Crossings

Level or flush access is essential for the majority of wheelchair users. Such access, either by dropped kerb or raised road crossing must be provided at all Zebra and controlled crossings and at other places side roads, access points to parking areas etc. used by pedestrians. On longer side roads and residential roads dropped kerbs should, where possible, be provided every 100 meters to avoid the need for wheelchair users to make lengthy detours to cross the road having given due consideration to desire lines for pedestrians and intervisability. Wherever possible the dropped kerb should be flush with the carriageway (maximum 6mm

rounded bullnose if really essential) and have a maximum gradient of 8 per cent (1 in 12) on the direct approach; 9 per cent (1 in 11) on the flared sides.

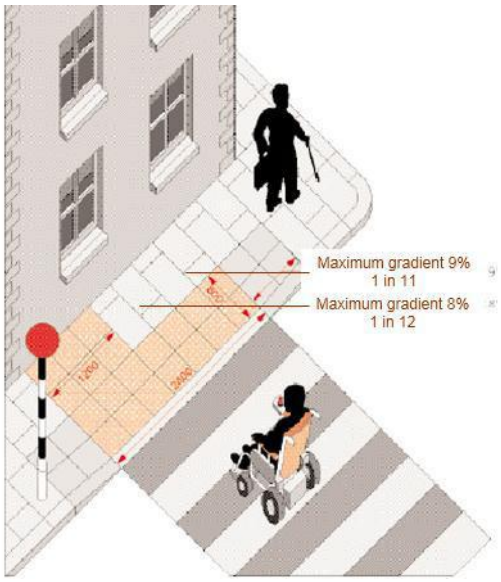


Figure 6-38: Dropped Kerbs and Raised Crossings

Source: Department for Transport – Inclusive Mobility, Govt. of UK

6.9.2.21 Car Parking

Provision should be made for car parking spaces for disabled motorists (Blue (formerly Orange) Badge holders) wherever conventional parking spaces are provided. In off-street car parks operated by a Local Authority and in car parks offered for public use by private companies, spaces for Blue Badge holders should be provided as close as possible, preferably within 50 meters of the facilities served by the car park with level or ramped (preferred gradient 5 per cent) access, and under cover if possible.

In open parking areas, designated parking spaces should be located on firm and level ground. The surface of designated parking spaces should be even and stable, with any variation of surface profile not exceeding Â± 5mm (eg. between paving, surface features or different surfaces).

Where the provision of designated parking spaces close to the building is not possible, a setting-down point for disabled passengers should be provided on firm and level ground, close to the principal entrance to the building. The surface of the pavement or footpath alongside a setting-down point should be level with the carriageway at this point. Tactile indication of this type of setting-down point is necessary to enable people with impaired vision to determine whether they are on the pavement or the carriageway.

In multi-storey car parks the spaces should be on the level or levels at which there is pedestrian access or, if this is not possible, near to a lift usable by wheelchair users.

Recommended spaces for disabled motorists parking

The recommended proportions of spaces for Blue Badge holders are:

- For car parks associated with existing employment premises: 2% of the total car park capacity, with a minimum of one space. Spaces for disabled employees must be additional to those recommended above; reservations could be ensured, for example, by marking a space with a registration number.
- For car parks associated with new employment premises: 5% of the total parking capacity should be designated (to include both employees and visitors).
- For car parks associated with shopping areas, leisure or recreational facilities, and places open to the general public: A minimum of one space for each employee who is a disabled motorist, plus 6% of the total capacity for visiting disabled motorists.

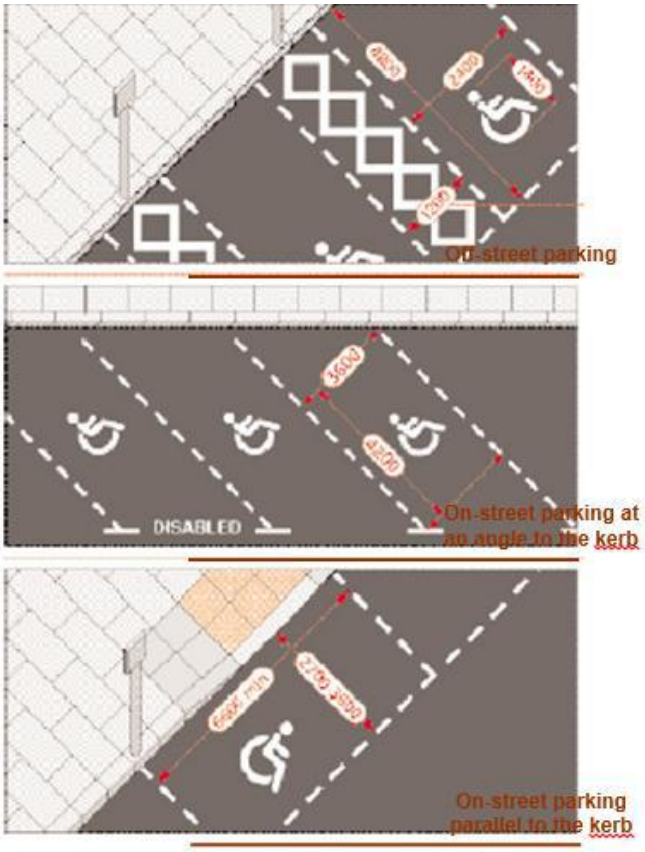


Figure 6-39: Parking Design for the Handicapped People

Source: Department for Transport – Inclusive Mobility, Govt. of UK

6.9.2.22 Bus Stop Design

The advent of low floor buses will improve access for disabled people, but full benefit will only be attained if bus stops are also designed to meet their needs.

The spacing of bus stops should, where possible, take account of gradients on the footpaths within the vicinity of the stop. A suggested standard is to reduce the maximum walk distance (400 meters) to a bus stop by 10 meters for every 1 metre rise or fall. Regular bus services designed particularly with elderly and disabled people in mind, such as the Swedish Service Routes have bus stops at more frequent intervals, typically every 200 meters.

On single carriageway roads it is normal practice to stagger bus stops in opposing directions so that buses stop tail-to-tail and move away from each other. The stagger should be a minimum of 40 meters and may have a pedestrian crossing in-between.

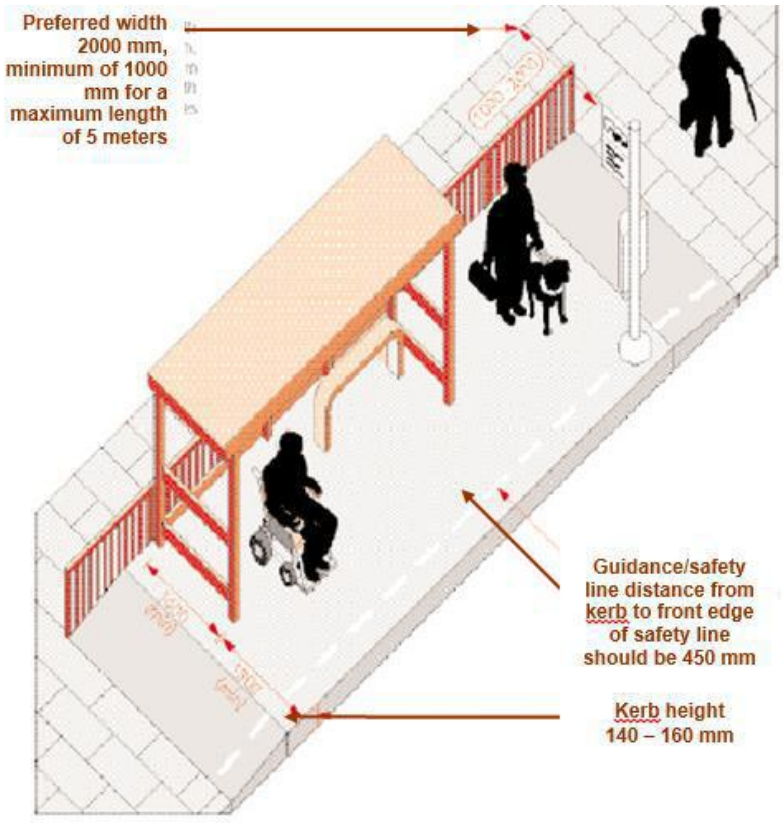


Figure 6-40: Bus stop Design for the Mobility Impaired

Source: Department for Transport – Inclusive Mobility, Govt. of UK

Raised bus boarding

A raised bus boarding area assists passengers boarding / leaving the vehicle and may enable some wheelchair users to board directly without using a ramp. The length of the boarder will

depend on the type of bus using the stop and whether or not a shelter is provided. For a conventional single entry / exit bus where there is no shelter a length of 3000mm is recommended. For buses with two doors, the recommended minimum length of the boarder is 9000mm.

Standard kerb heights range from 125mm to 140mm; above this it is recommended that specialized bus stop kerbs should be used (e.g. Marshalls, Charcon, Lafarge Redland) which can give heights up to 220mm.

Recent research by Greater Manchester Passenger Transport Executive suggests that a height of 160mm will give the best compromise between ease of access and reduced damage to the bus. A higher kerb may be appropriate where there is a segregated bus system or at places where the vehicle is guided into the stop.

Where a raised bus boarding area is provided, care should be taken to keep the transition gradients to acceptable levels (1 in 20 preferably, 1 in 12 maximum). Tactile warning surfaces (Section 4) should not be used on raised bus boarders.

Bus shelters

Shelters should be provided where there is space to do so. From the point of view of disabled passengers, particularly wheelchair users, the best location for a shelter is opposite the boarding point. Because of space constraints this may not be possible; an alternative is to place the shelter downstream, leaving 2000mm length of clear boarding / alighting area. In locations not exposed to severe weather, a cantilever bus shelter with one end panel offers good accessibility and some weather protection. Where the end panel is used for advertising, it should be at the downstream end of the shelter so that people can see the bus approaching. In more exposed locations enclosed shelters should be provided, if there is space to do so.

For reasons of personal security the bus shelter should be made mainly of transparent material and well-lit at night, though use of other materials may be more appropriate in rural areas. Where glass or transparent walls are used they should have a tonally contrasting band at least 150mm wide at a height of 1400mm to 1600mm from the ground. A second, lower band may be put at 900mm to 1000mm above ground level.

There should be sufficient space either to the rear of the shelter, or in front of it if the shelter has to be placed at the back of the pavement, to allow easy pedestrian movement. Where shelters are provided in newly built areas there should be a clear obstacle free footway width

of at least 2000mm, preferable 3000mm. These dimensions should also be used where practical, when improvement work on highways is being carried out.

Bus stop flags

Bus stop flags should be fixed as low as possible while remaining visible above road traffic, pedestrians and any other nearby obstacles. The bottom of the flag should not be less than 2500mm above ground.

The minimum size for the flag given in TSRGD is 300mm wide by 250mm high, but it is recommended that a larger size, 450mm wide by 400mm high should be used if possible. Bus route numbers on the flag should be at least 50mm high. A US demonstration project found that a limited amount of information was more effective than a substantial amount, which tended to lead to confusion. That research suggested just

- Route number / name
- Pictograph of a bus
- Special messages
- Telephone number for information

6.9.2.23 Access to and within transport-related buildings

Public transport can seldom provide through door-to-door services, so many journeys will involve passengers transferring from one mode to another or, at the very least having to walk from a station to their final destination.

Ideally interchanges and bus/coach stations should be located at, or immediately adjacent to the other transport services and to local shops and passenger destinations.

The size and layout of interchanges and bus stations will be dictated by the frequency and pattern of services, but it is important to use as compact a layout as possible, so minimizing walk distances. A two-level station, provided there is good access between the levels, may be better than an extensive single-level site. A compact layout with passenger facilities concentrated in one area will also be easier to supervise and reduce any fear felt by passengers who might otherwise have to wait in quiet, isolated areas.

Entrances and doors

The physical location of transport infrastructure bus, railway stations etc. varies greatly; at ground level, below ground, above, single or multi-level. The basic principles in designing access, however, remain the same whatever the specific physical characteristics of the

building. A single step at the entrance to a building or a kerb without a ramp in the road outside can make the most carefully designed terminal inaccessible to some disabled people.

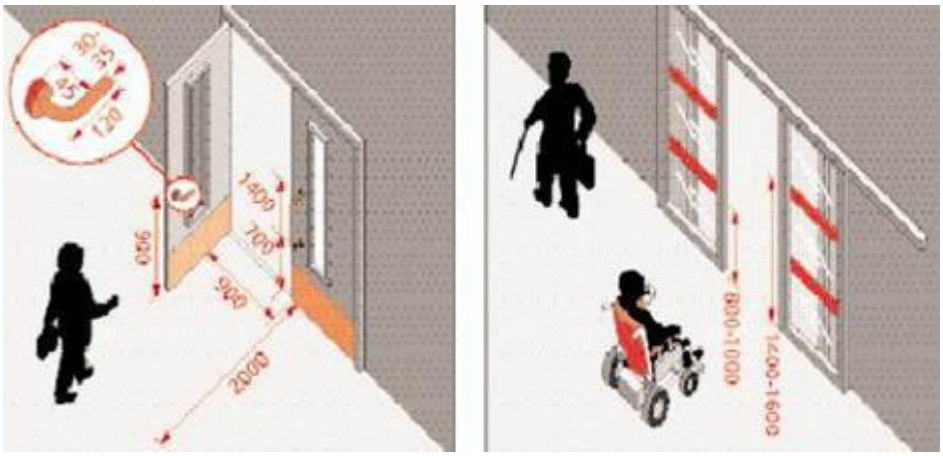


Figure 6-41: Doorways and Entrances for the Disabled

Source: Department for Transport – Inclusive Mobility, Govt. of UK

If possible entrances to stations should not have doors, but this is not always feasible, for example for reasons of security or to retain heat within the building. Where there are doors they should be automatic, linked either to a weight sensor or to sensors mounted above the door; manual doors are very difficult for people in wheelchairs to manage. Revolving doors are not well suited to many people, including disabled people, but if they are installed, an alternative hinged or sliding door must be provided.

The clear width of the door(s) once open should preferably be 1200mm; 900mm is the minimum acceptable. Where double leaf doors are installed each leaf should be 900mm wide, with 800mm as a minimum. Space immediately before and after a door is also important to allow for people to stand clear if the door opens towards them and for wheelchair users to manoeuvre. At the very least there should be a clear, level space of 1500mm on both sides of the doorway; preferably more than this. Where there are two doors in series there should be a minimum space between of 1340mm plus the width of any door swinging into this space. If a space of 2000mm can be achieved, it makes manoeuvring in a wheelchair much easier.

The door handle should be of the lever type, which is easier for people with any weakness in their hands to manipulate, and if horizontal should be at a height of 900mm and with a minimum length of 120mm. If the door has a vertical bar rather than a lever handle, this should stretch from 700 to 1400mm above floor level.

The diameter of the door handle or bar is recommended as 30mm to 35mm. As with any rails, there should be sufficient space between the inner side of the handle or rail and the surface of the door to avoid people catching their knuckles on the door. The recommended gap is 45mm.

Doors should be fitted with a kick plate, 400mm in depth at the bottom of the door and, where they are made of glass or other translucent material should have contrast colour banding in accordance with the standards given in Section 3.9 or a logo or other decorative symbol with minimum dimensions 150mm by 150mm set at eye level. The contrasting feature should be repeated at a lower level of between 800mm and 1000mm above floor level. However, clear glass doors can be a hazard for visually impaired people and use of this material should be avoided if possible, except to provide a viewing panel, which should extend from adult eye level down to 500mm from the floor. Glass used in a door must be safety glass.

Automatic sliding doors are recommended in preference to manually operated doors and should remain open for a minimum of six seconds, preferably nine seconds, and should not open faster than three seconds to back check. Many automatic doors incorporate a time delay device whereby the doors close automatically after a prescribed time lapse. Such doors can be hazardous to wheelchair users and some people with walking difficulties.

Thresholds should be level, but if this is not possible, the maximum acceptable threshold rise is 10mm. Any rise of more than 5mm should have a bevelled edge. Doors should have tonal contrast with the wall around them and door handles should contrast with the doors, to help visually impaired people. Doormats should be flush with the floor finish. Rubber backed mats, placed on top of the existing floor finish can ruck and present a trip hazard, and should not be used.

Coir dirt mats and mats with directional weave are not recommended, as they can impede access for people with walking difficulties and people using wheelchairs. There should be a lighting transition zone immediately within the entrance door to enable adjustment from a bright outdoors to a more dimly lit interior or vice versa. If there is a canopy at an entrance, care should be taken to ensure that the supporting structure is either incorporated into the building fabric, positioned on a verge or clearly marked at eye level (1400-1600mm) with contrasting banding 150mm in depth.

Access within transport sites and buildings: Passageways

The minimum width for a two-way corridor for wheelchair users, people with assistance dogs, etc. should be 2000mm. Where an access route is predominantly less than 1800mm wide, passing places should be provided to allow two wheelchair users to pass each other. A passing place should be a minimum of 2000mm long by a minimum of 1800mm wide and located within direct sight of another, or at a maximum distance of 50 meters from another, whichever is the closer.

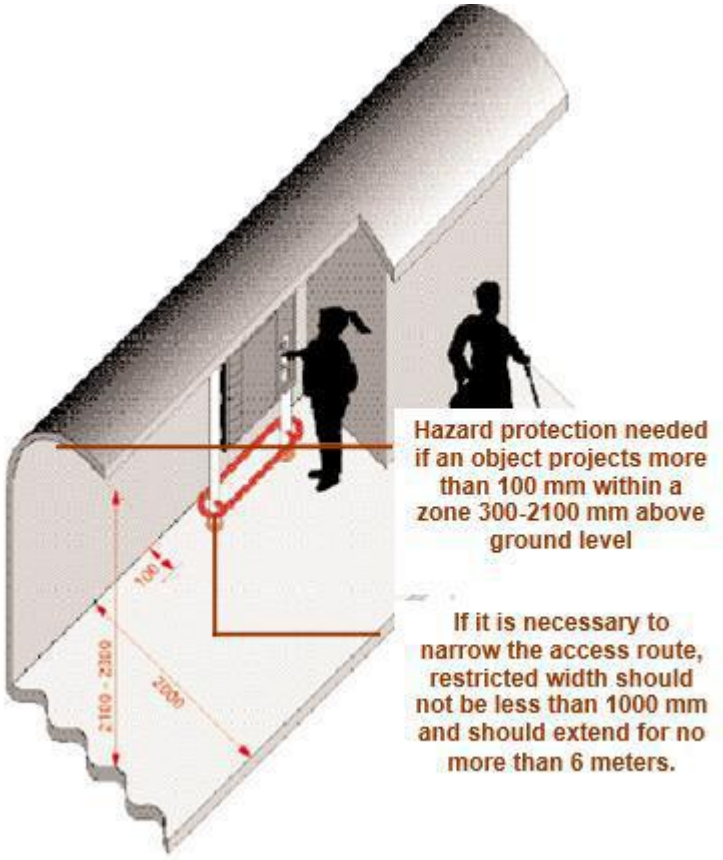


Figure 6-42: Access within Transport Sites and Building Passageways

Source: Department for Transport – Inclusive Mobility, Govt. of UK

Where it is necessary to introduce occasional narrowing of the access route, the restricted width should not be less than 1000mm and should extend for no more than 6 meters.

At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking, and accessible passenger loading zones and public streets or sidewalks to the accessible building they serve. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public. At least one accessible

route shall connect accessible buildings, facilities elements, and spaces that are on the same site.

An access route should have a clear height of not less than 2300mm (2100mm absolute minimum). Isolated objects that cause an occasional narrowing of the access route, but which project not more than 100mm from their base into the access route, do not need hazard protection. However, if an object projects more than 100mm within a zone between 300 and 2100mm above ground level then hazard protection should be provided. If the base of the projection is less than 300mm above ground level, no hazard protection is needed.

Well-designed corridors help every user to find their way through a building. People with visual impairments generally navigate by focusing mainly on the floor up to 1500mm ahead of travel. Floor finishes are therefore instrumental in helping visual impaired people to find their way. They should incorporate landmarks which may be one or a combination of features, such as visible clues, tactile indicators, sounds etc. For example, different materials, texture changes and raised symbols could indicate that stairs are being approached; there is a junction opposite etc. Such changes and symbols should be consistent throughout the building.

The end wall of a corridor should be highlighted by, for example, good colour and tone contrast between the wall and floor and a change in lighting. Glare problems caused by windows positioned at the end of corridors or passageways can be reduced by using tinted glass, anti-glare treatment or blinds. As a general rule, walls should have light, non-reflective surfaces and should be in a colour which contrasts with the floor, so that the boundary of the floor is clearly visible.

Changes in level

Even a single step will prevent access for the great majority of wheelchair users (and be a trip hazard for others), so alternatives must be provided; either ramps or lifts. However, the design of steps and stairs themselves is important. Good design can greatly assist ambulant disabled people and those with visual impairment.

Steps and stairs

A considerable amount of research on dimensions and design of steps and stairs was carried out in the 1970s and 1980s and there is reasonable consistency between the dimensions given in various national guidelines. A riser height of 150mm can be managed by most people; a little more than this is possible if there are well designed handrails but 170mm should be

regarded as the maximum in normal circumstances. Steps with very shallow risers can cause problems and should be avoided; 100mm is the absolute minimum.

Tread depth or going should be 300mm deep (approximately the length of a size 9 shoe), never less than 250mm and the nose of the step should be rounded (6mm radius) without any overhang. People with walking difficulties often pull their feet up the face of the riser; any overhang will catch their foot.

Common criteria from several guidelines are that all steps in a flight must have the same dimensions, that open tread staircases are to be avoided, as are curved or spiral staircases and that there should be tactile warning surfaces at the foot and head of the stairs. Stairs should be well lit (minimum 200 lux) and surfaced with a slip resistant material. Colour contrast on the step noses is essential for visually impaired people and should extend across the full width of each tread, 55mm deep on both tread and riser.

People with walking difficulties cannot manage long flights of steps. The maximum number of risers in a flight should be 12, with resting places between successive flights. Resting places should be at least 1200mm long, preferably 1800mm, and across the full width of the stairway. The minimum number of steps in a flight should be three; fewer than this is less safe.

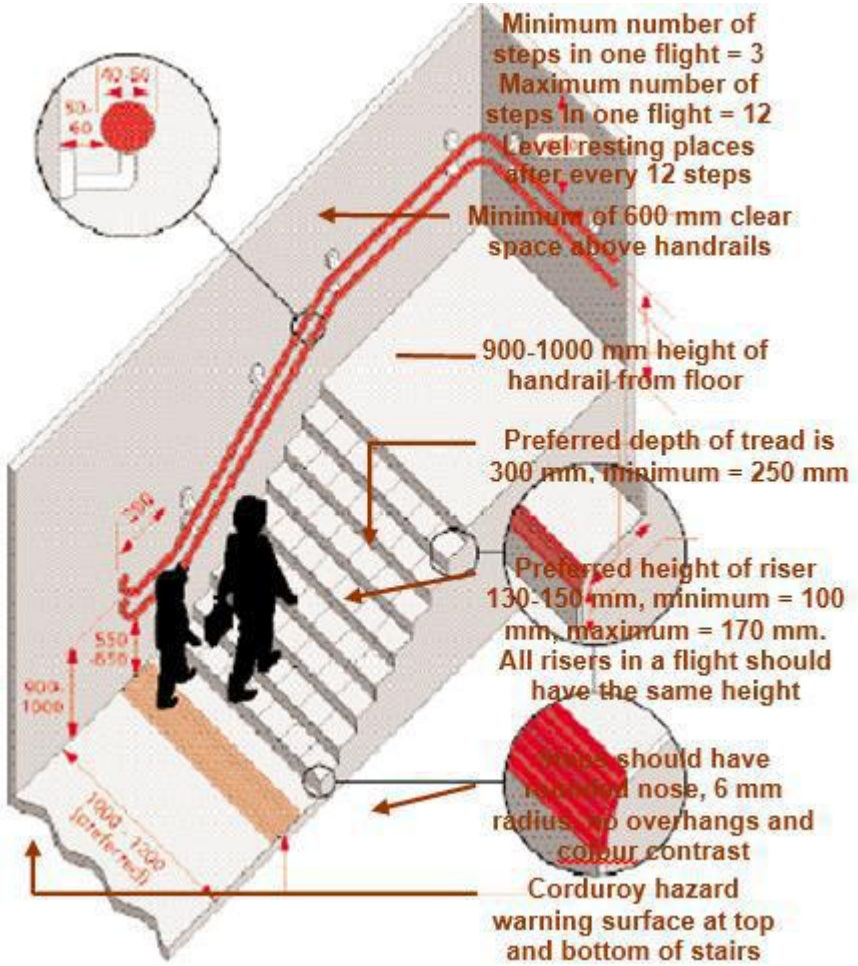


Figure 6-43: Steps and Stairs consideration for the Handicapped

Stairs should have a minimum clear width between handrails of 1000mm, preferably 1200mm which is sufficient for a disabled person and companion. Handrails should be provided on both sides and, where stairways have a clear width of more than 1800mm, a centre handrail should also be provided. Stairs of this width are needed where there is concurrent two-way movement. Stairs that lead to a platform, on which people will be carrying luggage, should be 3000mm wide (with centre handrails).

Means should be provided to limit the risk of people colliding with the underside of freestanding stairs or ramps at any point where the clear height is less than 2100mm. The appropriate hazard warning surface should also be provided at the top and bottom of steps.

There should be unobstructed landing space at the top and bottom of each flight of stairs of a length at least equal to the unobstructed width of the stairway.

Ramps

In many places ramps (defined as a gradient of more than 1 in 20) will provide the alternative access to stairs for wheelchair users. Where the change in level is no more than 200mm a ramp may be used without alternative steps.

Most guidelines specify 5 per cent (1 in 20) as the preferred gradient and 8 per cent (1 in 12) as the absolute maximum acceptable. There is a relationship between the length of a ramp and the gradient that people can manage; the longer the ramp the less severe the gradient that is feasible. One possible approach to this is, where a lengthy ramp is necessary, to design more frequent landings and lesser slopes for each successive segment.

Table 6-5: Recommended Ramp Dimensions for the Disabled

Going of a flight	Maximum Gradient	Maximum Rise
No exceeding 2 m	1:12	167 mm
Not exceeding 5 m	1:15	333 mm
Not exceeding 10 m	1:20	500 mm

Source: Department for Transport – Inclusive Mobility, Govt. of UK

A slightly steeper gradient of 1 in 10 is acceptable over very short distances, for example a ramp covering a distance of 600mm. Gradients steeper than 1 in 10 are not only physically difficult to manage but cause the wheelchair to overbalance.

If more than one flight is needed, there must be rest places between the flights. These should be level under cover (1 in 50 gradient if outside to drain surface water) should be at least 1500mm long and full width of the ramp. The landings at the foot and head of a ramp should be at least 1200mm long, of any obstruction such as door swing and, again, should be the full width of the ramp. The minimum surface width of a ramp should be 1200mm, but as with stairways, two-way movement requires more space preferably 2000mm (minimum 1800mm).

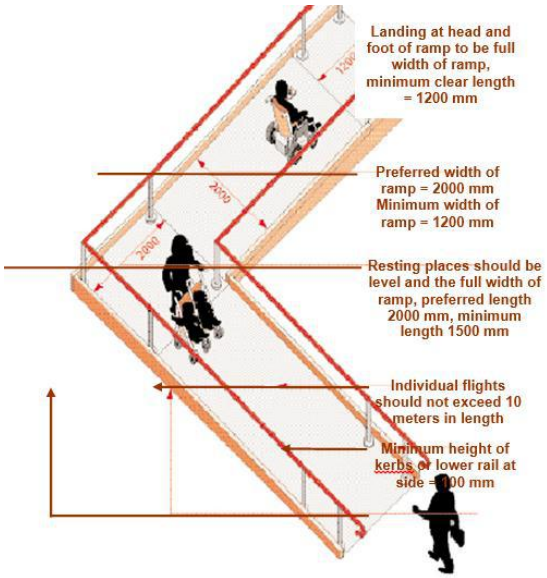


Figure 6-44: Ramp Design for the Disabled

Source: Department for Transport – Inclusive Mobility, Govt. of UK

Handrails should be provided on each side, with a minimum clear width rail to rail of 1000mm. Where this unobstructed width exceeds 2000mm, a central, continuous handrail may be used as an alternative a handrail on each side.

The sides of a ramp should be protected by a raised solid kerb at least 100mm in height. Australian standards also state that if the kerb height exceeds 75mm there must be no slot or gap greater than in the range of 75mm to 150mm. This is done to avoid the possibility of the footplate of a wheelchair riding over the kerb or becoming trapped. These standards also require the ramp-side face of the kerb be flush with, or no more than 100mm away from the ramp-side face of the handrail.

Transition between level and inclined parts of the ramp should be sufficiently rounded to ensure that wheelchair user does not get caught by the foot supports. There is rarely a need for cross fall on a ramp. Drainage is likely to be a problem, the use of a pervious surface should be considered.

Handrails

Handrails should be provided on both sides of stairways and ramps and down the centre of stairs when their unobstructed width (i.e. between handrails) exceeds 1800mm. The recommended height to the top of the principal handrail is between 900mm and 1000mm above the pitch line of the steps or above the surface of the ramp. On landings the top of the handrail should be between 900mm and 1100mm from the surface.

Handrails should continue beyond the end of the ramp slope or end of the stairs by a (minimum) distance of 300mm and should either return to the wall or down to the floor or have a minimum rounded downturn of 100mm.

Second, lower handrails for children and people of restricted growth are helpful and should be at heights of between 550mm and 650mm.

The handrail itself should be smooth and comfortable to use by people with arthritic hands that is they should not be too small in diameter. Circular handrails should have a diameter between 40mm and 50mm; if not circular the handrail should be a maximum of 50mm wide by 38mm deep with rounded edges (radius of at least 15mm).

There should be a clear space between the handrail and any adjacent wall of at least 50mm, preferably 60mm. Handrails should be supported centrally on the underside so there is no obstruction to the passage of the hand along the rail. There should also be a minimum of 600mm clear space above the handrail.

Colour / tonal contrasted handrails are essential to assist partially sighted users.

Lifts

Lifts are essential for wheelchair users and for some people who have walking difficulties when there is a substantial change in levels. They should be provided in preference to very long ramps. Finding the lift location can be a problem for blind, deaf-blind and partially sighted people. Lift locations should be clearly sign posted from the main pedestrian route and recognizable through design and location.

Ideally the internal dimensions of a lift should be big enough to enable a wheelchair user to turn round and come out facing forwards, but space constraints, particularly where a lift is put into an existing building may dictate less than an ideal size. The depth of lift required by a wheelchair user with an elevated leg rest may be more than the dimensions given; a minimum of 1500mm is suggested. This depth also makes turning a wheelchair round easier. Lifts provided in the pedestrian and transport environment should be large enough for a person to accompany the wheelchair user. The increasing numbers of scooters used in the outside environment also argue for using larger dimensions wherever possible than those given in the table. Where it is possible to fit them, walk through lifts (i.e. with doors on opposite sides) are preferable to single door lifts.

If a tip-up seat is provided it should not impede the normal use of the lift when in its folded position and it should be colour contrasted. The seat should have the following dimensions:

seat height from floor 500mm Â± 20mm depth 300 400mm width 400 500mm ability to support a mass of 100kg.

Handrails should be provided on the (non-opening) sides of the lift cabin at a height between 900mm and 1000mm and should contrast in colour with the interior of the lift.

However, the handrail should not be less than 30mm in diameter and should have at least 35mm clear space between rail and wall. The handrail should not continue across the control panel in order to avoid obstructing it. The ends of handrails should be closed and turned in to minimize the risk of injury.

The clear width of the doorway into the lift should be 900mm, which allows for wheelchair users elbow space. The minimum clear height of the doorway should be 2100mm, with 2300mm inside the lift cabin. Control buttons used to call a lift should be positioned between 900mm and 1100mm above floor level. They should not be positioned closer than 400mm to an internal corner or other obstruction; if they are a wheelchair user many find it difficult to reach them. The call buttons should have symbols in relief to enable tactile reading. Call buttons should also contrast in colour and luminance with the surrounding face plate; the face plate should contrast with the wall on which it is mounted.

Similar measurements apply to control buttons inside the lift, but there are some additional features. Emergency buttons (with an embossed tactile legend) should be placed at the bottom of the control panel, not less than 890-900mm above the floor and two-way voice communication should be at a height of 1200-1220mm. If communication is via a handset, it should have a minimum length of cord of 735mm. However, a push and talk facility is superior to a handset and cord and is more resistant to vandalism. As an aid to people with impaired hearing, the communication system should have an acoustic coupler and a volume control. There should be a yellow illuminated pictogram to indicate that the alarm has been activated and a green illuminated pictogram to indicate that the emergency call/alarm has been registered. Simple written information explaining emergency procedures should be provided for deaf people. The audible signal (voice communication) should have a sound level adjustable between 30dBA and 55dBA.

The control panel should be at least 400mm away from the corner of the lift cabin and there should be no fittings or objects between the panel and the floor which extend out more than 100mm from the wall. Where the lift has centre opening doors, the control panel should be located on the right hand side when entering the cabin. With side opening doors, it should be

on the closing side. Whichever side they are on, control panels should be on the flank wall of the lift rather than the front wall.

Outside the lift door there should be sufficient space for a wheelchair user to manoeuvre into place and to wait without obstructing the passage of other people. A clear landing 1500x1500mm is the minimum. If this floor area is finished in a different colour from its surrounding area it will help visually impaired people to locate the lift.

Control buttons both within and outside the lift should be 20mm in diameter and should protrude from the wall or lift cabin side. They should be at least 10mm apart. Control panels should include instructions in Braille and in relief: the latter should use characters raised 1mm from the surface and at least 15mm in size. The force needed to press the buttons should be between 2.5N and 5N. The buttons should contrast with their surrounding area, either by internal illumination or colour contrast on or around the button.

Visual and audible announcements should be provided both in and outside the lift, the audible announcements having a sound level of between 30dBA and 55dBA adjustable to suit the site conditions.

An audible signal on the landing should indicate when the doors are opening. An illuminated indicator arrow giving advance information on the direction the lift is going should be placed above or near the doors in a visible position. The height of the arrows should be at least 40mm. The visual information display inside the lift should be positioned just above head height, to ensure a clear sight line when the lift car is full (1800-1900mm above floor finish) and should have minimum dimensions of 60mm x 50mm. The display could be digital or segmented LED or an appropriate alternative. A yellow or light green on black display is preferred to red on black as it is easier to read.

Lift doors should be open long enough to allow people who can only move slowly to get in and out without being caught by the doors. A minimum of 3 seconds is acceptable, but a usual dwell time of 5 seconds before the doors begin to close after they are fully open is preferable. The control system should allow for the door dwell time to be adjustable up to 20 seconds: the means of adjustment should not be accessible to users.

Footbridges, tunnels and underpasses

While it is preferable to have at grade crossings wherever it is safe and feasible, there are places where a bridge or underpass has to be provided.

The design of road- and rail-related footbridges, tunnels and underpasses is largely governed by the good practice standards on stairs, ramps and handrails. It is worth remembering that the headroom to be accommodated on an underpass is usually less than that required for a footbridge, so the length of ramp and stairway will also be less.

Where underpasses are provided the approach to them should be as wide as possible to give an open aspect and sense of security. It is recommended that the width of the underpass itself should be at least 4.8 meters and have clear headroom of 3 meters. Within the underpass, handrails set at 1000mm above the walking surface should be provided on both sides. There should be a clear view from one end to the other and a good level of lighting, at least 50 lux.

6.9.2.24 Transport Building facilities

Ticketing and information

Service counters at ticket and information offices are conventionally designed for standing passengers and have a height of about 1050mm 1100mm: too high for passengers in wheelchairs or people of restricted growth. A service counter should be provided to meet their requirements, with a height of 760mm. There should be sufficient clear knee space below the counter for wheelchair users to come right up to the counter. It is recommended that this space should be 750mm high by 500mm deep and at least 900mm wide. There should be a clear space at least 1200mm wide in front of the counter. A support handrail should be provided at the side of each ticket office window.

The design of the counter top is also important. Some counters have a large radius curve on the top leading edge and when a customer sweeps the change or ticket into their hand it falls to the floor. A slight upstand at the front edge of the counter facilitates picking up small items. The design of the counter top should also reduce glare and reflection from lighting both natural and artificial.

Service counters should have induction loops for people who use hearing aids (with the appropriate sign displayed). The intercom unit should be mounted at a height of 1100mm from the floor this height being chosen so that there is no visual barrier between the employee in the ticket office and the passenger.

Where there is a glass screen partition, consideration should be given to installing a voice transfer system.

This is potentially of benefit to all hearing aid users (including those with a t-switch) as well as hearing impaired people who do not normally rely on a hearing aid for communication.

Glass screens should be non-reflective so that a person who relies on lip-reading or facial gestures can see the staff member. Where information centres have text-phones these should be well located with easy access to the staff member. Cash tills should display amounts due for payment on tickets so that they can be easily seen by the ticket purchaser.

Telephones

Some telephones, including text payphones, should be positioned 260mm lower than the standard height (i.e. at 1040mm to the top of the unit instead of 1300mm). A new kiosk has been designed with the receiver, keypad etc. at a height that is suitable for both standing and wheelchair users. On the keypad, the numeral 5 should always have a clear tactile marking.

Seating and Waiting Areas

Use of public transport usually involves waiting, so provision of seating is important. Merseyside PTE uses a seat design which provides two seat heights at 489mm and 584mm, thus meeting the requirements of most people. Seats placed in a row either should all have armrests or no armrests; a mixture within a single row can cause difficulties for visually impaired people.

Although conventional seating to the dimensions given above will meet the needs of most disabled people, there are some who find perch-type seating, against which people half lean and half sit, easier to use.

There may also be constraints on the amount of space available for seating, in which case fold down seats may be appropriate. Perch-type seating is recommended to be at a height of 700mm and fold down seating at 550mm to 600mm. If space permits it is helpful for people of restricted growth (and children) if there are some seats at a lower level than the standard height. For outdoor seating it is vital that rain water is not allowed to collect on any part of the seat; wire top or wire-mesh seats are an obvious way of preventing this. Seats should be made of vandal resistant easy clean material.

Waiting and Refreshment Rooms

Waiting and refreshment rooms should make provision for the needs of disabled travellers. Doorways must provide level access and have, preferably, automatic doors or ones which are capable of being opened easily.

Priority seating for older and disabled people should be clearly identified. Where tables are provided they should make provision for use by wheelchair users, with legroom below the table 700-730mm in height, 600mm (minimum) wide and 500mm (minimum) deep.

The tops of tables to be used by customers in wheelchairs should be no more than 750mm in height. Gangways between tables should be a minimum of 1300mm wide to allow for the passage of wheelchair users and people with assistance dogs, though a narrower width of 900mm may be acceptable in circumstances where space is very limited.

Colour contrasted seating and tables will assist visually impaired people, as will a contrast between wall and floor.

Luggage facilities

Where left luggage facilities are provided, they should be accessible to wheelchair users. Lockers of different sizes must be placed at heights appropriate to the range of passengers who wish to use them.

Toilets

Toilets should be no less available for disabled people than for non-disabled people. It is recommended that they should be designated as unisex, not integrated with male and female toilets. Providing unisex toilets allows use by the many disabled people accompanied by a carer or partner of the opposite sex. Accessible toilets should have a raised tactile sign 180mm x 100mm.

Toilet doors should have a clear minimum opening width of 925mm and be fitted with L or D shaped handles on the outside of the door at a height of 1040mm above floor level. A horizontal closing bar should be fixed to the inside face of an outward opening door and the lock should be large and easy to operate.

The overall size of the toilet cubicle depends on whether it has a corner WC or a central (or peninsular) WC. A central WC allows the user to transfer from right or left on to the toilet or from the front and needs overall dimensions of 2800mm width by 2200mm length. A corner layout, which allows transfer from either left or right, requires less space: 1500mm width by 2200mm length.

Where more than one WC is provided the opportunity should be taken to provide both left-handed and right-handed transfer layouts, with the handing indicated by a touch legible

pictogram. The overall dimensions quoted in this paragraph are sufficient to allow a wheelchair user to turn around.

In a corner WC layout, the WC centre line should be 500mm from the side wall on which the wash basin is fixed. The basin should be within reach; placed 140mm to 160mm forward of the WC. The height of the WC should be 480mm and the rim of the wash basin 720mm to 740mm above the floor. If a separate wash basin is provided for ambulant disabled people, the wash basin by the lavatory can be at a lower level. The toilet paper, soap dispenser and towel/hand drier should be within reach of a person seated on the lavatory. The wash basin should have a lever operated mixer tap on the side closest to the WC. A flushing lever attached to the WC cistern is preferable to a chain pull, and should be positioned on the transfer side of the pan where a corner layout is used.

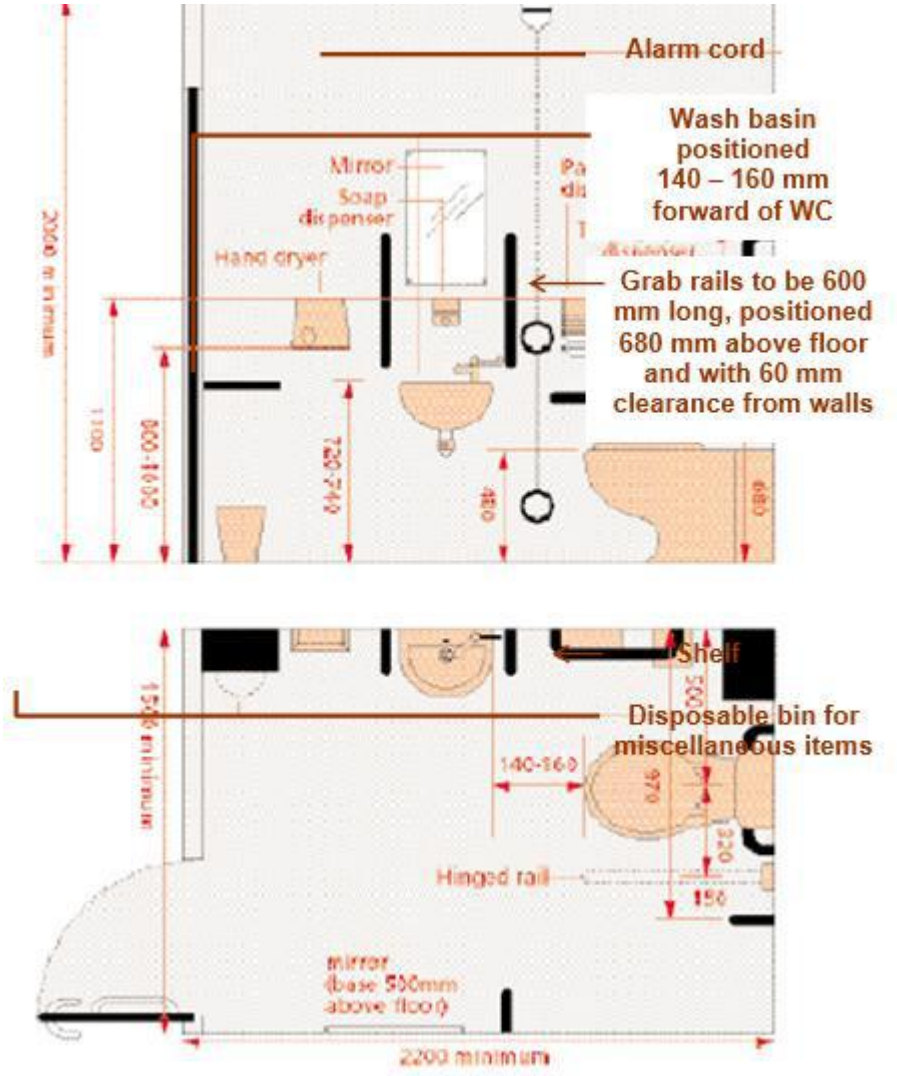


Figure 6-45: Toilet Design for the Handicapped

6.9.2.25 Signage and Information

Signs and information must be in forms that can be used by disabled people. It is particularly important to take account of the needs of visually impaired and hard of hearing people and to make information as simple and easily understood as possible. Simplicity helps everyone but particularly people with learning disabilities. The placing of signs is also important: reasonably close to, but not impeding passenger circulation areas.

Signage is also very important in relation to emergencies. Exit routes to be used in an emergency must be clearly signed; essential for deaf and hard of hearing people who may not be able to hear emergency announcements. Visual information systems used for emergencies should have flashing warning lights to alert deaf and hard of hearing people.

6.9.2.26 Lighting

Good lighting in the transport and pedestrian environment is important from several points of view personal security, safety, the ability to see signs and instructions.

People with visual impairments require clarity from a lighting system. Reflection, glare, shadows and large variations in lighting levels generate visual confusion and, in some cases, discomfort.

- Reflection can be minimized with the careful use of non-reflective finishes on internal surfaces.
- Glare can be reduced by the thoughtful positioning of lights out of the line of vision. Glare from daylight can be reduced with adjustable blinds on windows.
- Shadows can mask hazards. They can be avoided by increasing the level of ambient light and ensuring spotlights are not used on their own.
- Feature lighting, such as down-lighters should be located where they will not cause shadows to fall across people's faces making lip reading difficult.
- Large variations in lighting levels requiring swift reactions from the eye should be avoided. Any change in lighting levels should be gradual.

Lighting often fulfils secondary functions, for example, giving directional guidance along a corridor illuminated by a series of lamps mounted longitudinally on the ceiling or highlighting potential hazards such as stairs. Recommendations for carriageway and footway lighting levels are given by BS 5489, the Code of Practice for Road Lighting. Different parts of the Code relate to different types of area to be lit.

6.9.2.27 Disability Awareness Training

The Social Model of Disability views disability as something which is imposed on people with impairments whatever the nature of those impairments by the way society places barriers to equality. This guide is mainly concerned with designs that will remove these barriers, but disability awareness training is also essential if disabled people are to have equality of access and mobility.

Obviously it is most important that staff who come into contact with the public should have this training, but equally those who deal with designing, planning and managing facilities and services should also have a good knowledge of the needs of their disabled customers and users.

Senior managers need to understand the implications of the DDA on policy and procedures, planning, investment and strategy to ensure:

- Investment opportunities are not wasted.
- Investment helps meet the requirements of the DDA.
- The guidance and standards set out in this document are built into routine maintenance and construction projects to avoid making mistakes that may be expensive to rectify and to help ensure compliance with the DDA.
- All policies, practices and procedures at every location used by the public comply with the DDA.

Staff who are in regular contact with the public need to have awareness of how to serve a disabled person without discrimination and how to mitigate the effects of inaccessible premises, vehicles and services etc. in compliance with the DDA. All staff need to be able to think on their feet in unexpected situations or in an emergency.

Some transport operators and other organizations have produced training programs on disability awareness which can be used by other organizations. Training in disability awareness should form part of both induction training and refresher or promotion courses for staff. Disabled people should be involved in the design of training programs as well as their delivery where possible. Training should be tailored to the particular job function, but in general programs should include (as appropriate):

- Barriers faced by disabled people, including attitude, environment and organization
- Principles of access audits
- Suggestions for removing barriers faced by disabled people
- Information on the range of disabilities, including hidden disabilities

- The skills needed for assisting disabled travellers
- Communication and interpersonal skills for dealing with disabled people, particularly those with a hearing impairment
- General awareness of the DDA.

Any organization that is involved with transport and its associated environment should make sure that it has staff, who are well-trained and knowledgeable about access for disabled people.

6.10 Structural Design

6.10.1 General Description

The latest revised versions of the Bureau of Indian Standards (BIS) codes are recommended for guidance of structural design of building.

Structure shall be analysed using STAAD-Pro-V8i software. All the components shall be designed as per relevant IS codes as mentioned below under section “codes and standards”.

6.10.2 Type of Building

This building is a RCC framed structure (G+2) and (G+2) including basement resting on Shallow foundation.

6.10.2.1 General Structural Arrangement

The Building framing plan area is approx. 3650 sq. m for G+2 building and 5800 for G+2 building including basement. The RCC frame consists of RCC Columns Tied with RCC Beams and RCC Slabs. The Foundation is designed for the allowable net safe Bearing Capacity of 25 t/m^2

6.10.3 Structural Design Considerations

The main considerations followed for the design of structure are:

a) Structural safety and stability
b) Demand of aesthetics conceived by the Architects
c) Availability of material, equipment and expertise
d) Constructability and ease of construction
e) Durability
f) Economy

6.10.4 Foundation System

The assumed allowable net safe bearing capacity at founding level has been considered to be 25 T/m2 for (G+2) building , for (G+2) building including (basement structure) and Retaining wall.

6.10.5 Materials

6.10.5.1 Concrete

In accordance with IS 456-2000 following grade of concrete has been used for moderate conditions of exposure for different components:

Structural Elements	Concrete Grade
Foundation	M 40
Columns	M 40
Beam and Slab	M 40
Retaining wall	M 35

6.10.5.2 Reinforcement Steel

The grade of steel reinforcement shall be Fe 500 for HYSD bars.

6.10.6 Design Basis

The structural design of the building has been carried out in accordance with relevant Bureau of Indian Standards codes and specifications. The main I.S. Codes followed for the design are:

a) **IS: 875 - 1987** - Code of Practice for design loads (other than earthquake) for buildings (All Parts) and structure, following are its specific description:

- IS: 875 - 1987 Part 1, Dead Loads - Unit weights of building materials and stored materials.
- IS: 875 - 1987 Part 2, Imposed Loads
- IS: 875 - 1987 Part 3, Wind Loads

b) **IS: 1893 - 2016** - Criteria for earthquake resistant design of structure (Part-1)

c) **IS: 456 – 2000** - Code of Practice for Plain and Reinforced Concrete.

d) **IS: 4326 - 1993** - Code of Practice for earthquake resistant design and construction of buildings

e) **IS: 13920 - 1993** - Code of Practice for ductile detailing of reinforced concrete structures subjected to seismic forces.

6.10.7 Loading

6.10.7.1 Dead Load

Dead load consists of weight of structure complete with finishes, fixtures, partition walls.

6.10.7.2 Live Load

Live load has been considered as per IS: 875 (Part II).

6.10.7.3 Seismic Load

Seismic load has been considered as per IS: 1893(Part I):2002. Following parameter has been adopted for seismic analysis and design. Site is in Zone III, parameters have been used in design.

- Seismic zone factor (Z) = 0.16 for zone III
- Importance factor (I) = 1.5
- Response reduction factor (R) = 5.0 for RC, Moment resisting frames
- Damping Coefficient = 5 % for R.C.C. structures
- Type of Structure (ST) =1 (i.e. R.C.C. structure)

The structures have been analysed and designed using STAAD Pro V8i SS5 Software.

6.10.8 Clear Cover

Clear Cover to reinforcement considered in the design are:

a) Slabs: 20mm

b) Beams: 30mm or dia. of bar whichever is more

c) Columns: 40mm

d) Footings: 75mm (Bottom)

50mm (Top and All around)

6.10.9 Gravity Loads (Dead Load and Live Load)

6.10.9.1 Wall Load

<u>External Walls</u>

Partition Wall = 5 KN/m

<u>Parapet Wall</u>

230 mm thick = 2 x 0.23 x 21 = 9.66 KN/m

Plaster = 2 x 0.03 x 24 = 1.44 KN/m

Total ≈ 11.1 KN/m

6.10.9.2 Floor Load

Typical Slab (150mm Thick Slab)

Slab (150 mm thick) = 0.15 x 25 = 3.75 KN/m2

Finish (75 mm thick) = 1.875 KN/m2

Dead load Total = 5.62 ≈ 5.7 KN/m2

Live load = 4.00 KN/m2 (Ground, First and Second Floor)

6.10.10 Load Combinations

Support Reaction

DL+LL

Serviceability Condition

DL+LL+EQX

DL+LL-EQX

DL+LL+EQZ

DL+LL-EQZ

DL+LL+WINDX

DL+LL-WIND-X

DL+LL+WINDZ

DL+LL-WINDZ

DL+EQX

DL-EQX

DL+EQZ

DL-EQZ

DL+WINDX

DL-WIND-X

DL+WINDZ

DL-WINDZ

6.10.10.1 Concrete Design

Earthquake Load Combinations

1.5 (DL+EQX)

1.5 (DL-EQX)

1.5 (DL+EQZ)

1.5(DL-EQZ)

Wind Load Combinations

1.5 (DL+WINDX)

1.5 (DL-WIND-X)

1.5 (DL+WINDZ)

1.5(DL-WIND-Z)

1.2(DL+LL+EQX)

1.2(DL+LL-EQX)

1.2(DLL+LL+EQZ)

1.2(DL+LL-EQZ)

1.2(DL+LL+WINDX)

1.2(DL+LL-WIND-X)

1.2(DL+LL+WINDZ)

1.2(DL+LL-WIND-Z)

For Stability Condition

0.9(DL) +1.5EQX

0.9(DL) -1.5EQX

0.9(DL) +1.5EQZ

0.9(D) -1.5EQZ

0.9(DL) +1.5WINDX

0.9(DL)-1.5WIND-X

0.9(DL) +1.5WINDZ

0.9(DL) -1.5WIND-Z

6.10.11 STAAD Model Input

STAAD Input for G+2 Storey building - Left Side

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 11-Dec-17

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

1 -23 2 0; 2 -23 2 9; 3 -23 2 17; 4 -23 2 25; 5 -17 2 0; 6 -17 2 9; 7 -17 2 17;

11 -17 2 25; 12 -10 2 0; 13 -10 2 9; 14 -10 2 17; 18 -10 2 25; 19 -5.2 2 0;

20 -5.2 2 9; 21 -5.2 2 17; 25 -5.2 2 25; 100 -23 4 0; 101 -23 4 9;

102 -23 4 17; 103 -23 4 25; 104 -23 10 0; 105 -23 10 9; 106 -23 10 17;

107 -23 10 25; 108 -23 14 0; 109 -23 14 9; 110 -23 14 17; 111 -23 14 25;

112 -23 18 0; 113 -23 18 9; 114 -23 18 17; 115 -23 18 25; 116 -17 4 0;

117 -17 4 9; 118 -17 4 17; 119 -17 4 25; 120 -17 10 0; 121 -17 10 9;

122 -17 10 17; 123 -17 10 25; 124 -17 14 0; 125 -17 14 9; 126 -17 14 17;

127 -17 14 25; 128 -17 18 0; 129 -17 18 9; 130 -17 18 17; 131 -17 18 25;

132 -10 4 0; 133 -10 4 9; 134 -10 4 17; 135 -10 4 25; 136 -10 10 0;

137 -10 10 9; 138 -10 10 17; 139 -10 10 25; 140 -10 14 0; 141 -10 14 9;

142 -10 14 17; 143 -10 14 25; 144 -10 18 0; 145 -10 18 9; 146 -10 18 17;

147 -10 18 25; 148 -5.2 4 0; 149 -5.2 4 9; 150 -5.2 4 17; 151 -5.2 4 25;

152 -5.2 10 0; 153 -5.2 10 9; 154 -5.2 10 17; 155 -5.2 10 25; 156 -5.2 14 0;

157 -5.2 14 9; 158 -5.2 14 17; 159 -5.2 14 25; 160 -5.2 18 0; 161 -5.2 18 9;

162 -5.2 18 17; 163 -5.2 18 25; 164 -5.2 2.4 0; 165 -5.2 2.4 9;

166 -5.2 2.4 17; 167 -5.2 2.4 25; 168 -10 2.4 0; 169 -10 2.4 9; 170 -10 2.4 17;

171 -10 2.4 25; 172 -17 2.4 0; 173 -17 2.4 9; 174 -17 2.4 17; 175 -17 2.4 25;

176 -23 2.4 0; 177 -23 2.4 9; 178 -23 2.4 17; 179 -23 2.4 25; 180 -5.2 3.8 0;

181 -5.2 3.8 9; 182 -5.2 3.8 17; 183 -5.2 3.8 25; 184 -10 3.8 0; 185 -10 3.8 9;

186 -10 3.8 17; 187 -10 3.8 25; 188 -17 3.8 0; 189 -17 3.8 9; 190 -17 3.8 17;

191 -17 3.8 25; 192 -23 3.8 0; 193 -23 3.8 9; 194 -23 3.8 17; 195 -23 3.8 25;

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210 -13.5 10 17; 211 -13.5 14 0; 212 -13.5 14 9; 213 -13.5 14 17;

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223 -20 14 0; 224 -20 14 9; 225 -20 14 17; 226 -20 18 0; 227 -20 18 9;

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329 -42.44 2.4 0; 330 -42.44 2 9; 331 -42.44 2.4 9; 332 -42.44 2 17;

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337 -42.44 14 0; 338 -42.44 14 9; 339 -42.44 14 17; 340 -42.44 18 0;

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349 -42.44 3.8 9; 350 -42.44 3.8 17; 351 -42.44 3.8 25; 352 -47.24 4 0;

353 -47.24 4 9; 354 -47.24 4 17; 355 -44.84 10 0; 356 -44.84 10 9;

357 -44.84 10 17; 358 -44.84 14 0; 359 -44.84 14 9; 360 -44.84 14 17;

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365 -44.84 10 25; 366 -44.84 14 25; 367 -44.84 18 25; 368 -47.24 2 0;

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373 -47.24 2.4 17; 374 -47.24 10 0; 375 -47.24 10 9; 376 -47.24 10 17;

377 -47.24 14 0; 378 -47.24 14 9; 379 -47.24 14 17; 380 -47.24 18 0;

381 -47.24 18 9; 382 -47.24 18 17; 383 -47.24 2 25; 384 -47.24 2.4 25;

385 -47.24 10 25; 386 -47.24 14 25; 387 -47.24 18 25; 388 -47.24 3.8 0;

389 -47.24 3.8 9; 390 -47.24 3.8 17; 391 -47.24 3.8 25;

MEMBER INCIDENCES

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DEFINE MATERIAL START

ISOTROPIC CONCRETE

E 2.17185e+007

POISSON 0.17

DENSITY 23.5616

ALPHA 1e-005

DAMP 0.05

TYPE CONCRETE

STRENGTH FCU 27579

END DEFINE MATERIAL

MEMBER PROPERTY AMERICAN

47 69 83 91 TO 93 105 127 132 142 150 TO 152 164 186 191 201 209 TO 211 223 -

245 250 260 294 TO 296 303 306 TO 308 315 318 TO 320 327 360 TO 362 370 387 -

391 399 409 TO 411 418 433 TO 435 443 460 464 472 482 TO 484 491 506 TO 508 -

516 533 537 545 555 TO 557 564 579 TO 581 589 606 610 618 628 TO 630 -

637 PRIS YD 0.6 ZD 0.6

MEMBER PROPERTY AMERICAN

48 74 84 88 TO 90 104 128 133 143 147 TO 149 163 187 192 202 206 TO 208 222 -

246 251 261 357 TO 359 369 388 392 400 430 TO 432 442 461 465 473 -

503 TO 505 515 534 538 546 576 TO 578 588 607 611 619 PRIS YD 0.45 ZD 0.35

MEMBER PROPERTY AMERICAN

1 TO 3 8 TO 10 15 TO 17 22 TO 24 75 TO 78 109 TO 120 134 TO 137 168 TO 179 -

193 TO 196 227 TO 238 252 TO 255 262 TO 293 373 TO 384 393 TO 396 -

401 TO 408 446 TO 457 466 TO 469 474 TO 481 519 TO 530 539 TO 542 -

547 TO 554 592 TO 603 612 TO 615 620 TO 627 PRIS YD 0.6 ZD 0.6

MEMBER PROPERTY AMERICAN

45 46 59 64 81 82 94 TO 99 106 107 125 126 130 131 140 141 153 TO 158 165 -

166 184 185 189 190 199 200 212 TO 217 224 225 243 244 248 249 258 259 297 -

298 TO 302 304 305 309 TO 314 316 317 321 TO 326 328 329 363 TO 368 371 372 -

385 386 389 390 397 398 412 TO 417 419 420 436 TO 441 444 445 458 459 462 -

463 470 471 485 TO 490 492 493 509 TO 514 517 518 531 532 535 536 543 544 -

558 TO 563 565 566 582 TO 587 590 591 604 605 608 609 616 617 631 TO 636 -

638 639 PRIS YD 0.55 ZD 0.6

MEMBER PROPERTY AMERICAN

339 TO 356 424 TO 429 497 TO 502 570 TO 575 643 TO 648 PRIS YD 0.5 ZD 0.35

MEMBER PROPERTY AMERICAN

330 TO 338 421 TO 423 494 TO 496 567 TO 569 640 TO 642 PRIS YD 0.5 ZD 0.45

CONSTANTS

MATERIAL CONCRETE ALL

SUPPORTS

1 TO 7 11 TO 14 18 TO 21 25 248 250 252 263 288 290 292 303 328 330 332 343 -

368 370 372 383 FIXED

DEFINE 1893 LOAD

ZONE 0.16 RF 5 I 1.5 SS 2 ST 1 DM 0.05

SELFWEIGHT 1

MEMBER WEIGHT

46 47 64 69 82 83 91 TO 96 105 106 126 127 131 132 141 142 150 TO 155 164 -

165 185 186 190 191 200 201 209 TO 214 223 224 244 245 249 250 259 260 294 -

295 TO 299 303 304 306 TO 311 315 316 318 TO 323 327 328 360 TO 365 370 371 -

386 387 390 391 398 399 409 TO 414 418 419 433 TO 438 443 444 459 460 463 -

464 471 472 482 TO 487 491 492 506 TO 511 516 517 532 533 536 537 544 545 -

555 TO 560 564 565 579 TO 584 589 590 605 606 609 610 617 618 628 TO 633 -

637 638 UNI 5

45 59 81 97 107 156 166 215 225 300 305 312 317 324 329 366 372 415 420 439 -

445 488 493 512 518 561 566 585 591 604 608 616 634 639 UNI 11.1

ONEWAY LOAD

YRANGE 5 20 ONE 5.7

YRANGE 5 20 ONE 2

LOAD 1 LOADTYPE Seismic TITLE EX

1893 LOAD X 1

LOAD 2 LOADTYPE Seismic TITLE EZ

1893 LOAD Z 1

MEMBER LOAD

91 150 209 294 306 318 360 409 433 482 506 555 579 628 UNI GZ 6.33

88 147 206 357 430 503 576 UNI GZ 44.84

91 150 209 294 306 318 360 409 433 482 506 555 579 628 UNI GZ 7.8

88 147 206 357 430 503 576 UNI GZ 24

LOAD 3 LOADTYPE Dead TITLE DL

SELFWEIGHT Y -1

ONEWAY LOAD

YRANGE 5 20 ONE -5.7 GY

MEMBER LOAD

46 47 64 69 82 83 91 TO 96 105 106 126 127 131 132 141 142 150 TO 155 164 -

165 185 186 190 191 200 201 209 TO 214 223 224 244 245 249 250 259 260 294 -

295 TO 299 303 304 306 TO 311 315 316 318 TO 323 327 328 360 TO 365 370 371 -

386 387 390 391 398 399 409 TO 414 418 419 433 TO 438 443 444 459 460 463 -

464 471 472 482 TO 487 491 492 506 TO 511 516 517 532 533 536 537 544 545 -

555 TO 560 564 565 579 TO 584 589 590 605 606 609 610 617 618 628 TO 633 -

637 638 UNI GY -5

91 150 209 294 306 318 360 409 433 482 506 555 579 628 UNI GZ 23.5

88 147 206 357 430 503 576 UNI GZ 166.7

45 59 81 97 107 156 166 215 225 300 305 312 317 324 329 366 372 415 420 439 -

445 488 493 512 518 561 566 585 591 604 608 616 634 639 UNI GY -11.1

LOAD 4 LOADTYPE Live TITLE LL

ONEWAY LOAD

YRANGE 5 20 ONE -4 GY

MEMBER LOAD

91 150 209 294 306 318 360 409 433 482 506 555 579 628 UNI GZ 15.6

88 147 206 357 430 503 576 UNI GZ 47.792

LOAD COMB 5 1.5(DL+LL)

3 1.5 4 1.5

LOAD COMB 6 1.2(DL+LL+EX)

3 1.2 4 1.2 1 1.2

LOAD COMB 7 1.2(DL+LL+EZ)

3 1.2 4 1.2 2 1.2

LOAD COMB 8 1.2(DL+LL-EX)

3 1.2 4 1.2 1 -1.2

LOAD COMB 9 1.2(DL+LL-EZ)

3 1.2 4 1.2 2 -1.2

LOAD COMB 10 1.5(DL+EX)

3 1.5 1 1.5

LOAD COMB 11 1.5(DL+EZ)

3 1.5 2 1.5

LOAD COMB 12 1.5(DL-EX)

3 1.5 1 -1.5

LOAD COMB 13 1.5(DL-EZ)

3 1.5 2 -1.5

LOAD COMB 14 (0.9DL + 1.5EX)

3 0.9 1 1.5

LOAD COMB 15 (0.9DL + 1.5EZ)

3 0.9 2 1.5

LOAD COMB 16 (0.9DL - 1.5EX)

3 0.9 1 -1.5

LOAD COMB 17 (0.9DL - 1.5EZ)

3 0.9 2 -1.5

LOAD COMB 18 SLS-(DL+LL)

3 1.0 4 1.0

LOAD COMB 19 SLS-(DL+EX)

3 1.0 1 1.0

LOAD COMB 20 SLS-(DL+EZ)

3 1.0 2 1.0

LOAD COMB 21 SLS-(DL-EX)

3 1.0 1 -1.0

LOAD COMB 22 SLS-(DL-EZ)

3 1.0 2 -1.0

LOAD COMB 23 SLS-(DL+LL+EX)

3 1.0 4 1.0 1 1.0

LOAD COMB 24 SLS-(DL+LL+EZ)

3 1.0 4 1.0 2 1.0

LOAD COMB 25 SLS-(DL+LL-EX)

3 1.0 4 1.0 1 -1.0

LOAD COMB 26 SLS-(DL+LL-EZ)

3 1.0 4 1.0 2 -1.0

PERFORM ANALYSIS PRINT ALL

LOAD LIST 5 TO 13

START CONCRETE DESIGN

CODE INDIAN

CLEAR 0.04 MEMB 1 TO 3 8 TO 10 15 TO 17 22 TO 24 75 TO 78 109 TO 120 -

134 TO 137 168 TO 179 193 TO 196 227 TO 238 252 TO 255 262 TO 293 -

373 TO 384 393 TO 396 401 TO 408 446 TO 457 466 TO 469 474 TO 481 -

519 TO 530 539 TO 542 547 TO 554 592 TO 603 612 TO 615 620 TO 627

CLEAR 0.03 MEMB 45 TO 48 59 64 69 74 81 TO 84 88 TO 99 104 TO 107 125 TO 128 -

130 TO 133 140 TO 143 147 TO 158 163 TO 166 184 TO 187 189 TO 192 -

199 TO 202 206 TO 217 222 TO 225 243 TO 246 248 TO 251 258 TO 261 -

294 TO 329 357 TO 372 385 TO 392 397 TO 400 409 TO 420 430 TO 445 -

458 TO 465 470 TO 473 482 TO 493 503 TO 518 531 TO 538 543 TO 546 -

555 TO 566 576 TO 591 604 TO 611 616 TO 619 628 TO 639

FC 40000 ALL

FYMAIN 500000 ALL

MAXMAIN 25 ALL

RATIO 4 MEMB 1 TO 3 8 TO 10 15 TO 17 22 TO 24 75 TO 78 109 TO 120 134 TO 137 -

168 TO 179 193 TO 196 227 TO 238 252 TO 255 262 TO 293 373 TO 384 -

393 TO 396 401 TO 408 446 TO 457 466 TO 469 474 TO 481 519 TO 530 -

539 TO 542 547 TO 554 592 TO 603 612 TO 615 620 TO 627

RFACE 4 MEMB 1 TO 3 8 TO 10 15 TO 17 22 TO 24 75 TO 78 109 TO 120 134 TO 137 -

168 TO 179 193 TO 196 227 TO 238 252 TO 255 262 TO 293 373 TO 384 -

393 TO 396 401 TO 408 446 TO 457 466 TO 469 474 TO 481 519 TO 530 -

539 TO 542 547 TO 554 592 TO 603 612 TO 615 620 TO 627

TORSION 0 ALL

MINMAIN 20 ALL

DESIGN BEAM 45 TO 48 59 64 69 74 81 TO 84 88 TO 99 104 TO 107 125 TO 128 130 -

131 TO 133 140 TO 143 147 TO 158 163 TO 166 184 TO 187 189 TO 192 199 TO 202 -

206 TO 217 222 TO 225 243 TO 246 248 TO 251 258 TO 261 294 TO 372 -

385 TO 392 397 TO 400 409 TO 445 458 TO 465 470 TO 473 482 TO 518 -

531 TO 538 543 TO 546 555 TO 591 604 TO 611 616 TO 619 628 TO 648

DESIGN COLUMN 8 TO 10 15 TO 17 22 TO 24 76 TO 78 112 TO 120 135 TO 137 171 -

172 TO 179 194 TO 196 230 TO 238 253 TO 255 262 TO 277 376 TO 384 394 TO 396 -

401 TO 404 449 TO 457 467 TO 469 474 TO 477 522 TO 530 540 TO 542 -

547 TO 550 595 TO 603 613 TO 615 620 TO 623

END CONCRETE DESIGN

FINISH

STAAD Input for G+2 building including Basement – Right Side

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 11-Dec-17

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

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1287 838 742; 1288 839 756; 1289 840 767; 1290 841 777; 1291 842 787;

1292 727 732; 1293 729 734; 1294 731 736; 1295 753 754; 1296 764 765;

1297 774 775; 1298 784 785; 1299 831 837; 1300 832 838; 1301 833 839;

1302 834 840; 1303 835 841; 1304 836 842; 1305 831 843; 1306 832 844;

1307 833 845; 1308 834 846; 1309 835 847; 1310 831 709; 1311 832 710;

1312 833 711; 1313 834 712; 1314 835 713; 1315 836 714; 1316 747 734;

1317 751 736; 1318 761 754; 1319 771 765; 1320 781 775; 1321 791 785;

1322 747 625; 1323 751 629; 1324 761 639; 1325 771 649; 1326 781 659;

1327 791 669; 1328 746 740; 1329 750 742; 1330 760 756; 1331 770 767;

1332 780 777; 1333 790 787; 1334 746 624; 1335 750 628; 1336 760 638;

1337 770 648; 1338 780 658; 1339 790 668; 1340 797 795; 1341 800 798;

1342 803 801; 1343 806 804; 1344 809 807; 1345 812 810; 1346 797 675;

1347 800 678; 1348 803 681; 1349 806 684; 1350 809 687; 1351 812 690;

1352 745 748; 1353 749 758; 1354 759 762; 1355 769 772; 1356 779 782;

1357 789 792; 1358 745 623; 1359 749 627; 1360 759 637; 1361 769 647;

1362 779 657; 1363 789 667; 1364 843 832; 1365 844 833; 1366 845 834;

1367 846 835; 1368 847 836; 1369 843 721; 1370 844 722; 1371 845 723;

1372 846 724; 1373 847 725; 1374 848 849; 1375 850 851; 1376 852 853;

1377 854 855; 1378 856 857; 1379 858 859; 1380 860 861; 1381 862 863;

1382 864 865; 1383 866 867; 1384 860 868; 1385 854 869; 1386 870 871;

1387 862 872; 1388 856 873; 1389 874 875; 1390 876 877; 1391 878 879;

1392 880 881; 1393 864 882; 1394 858 883; 1395 854 732; 1396 856 734;

1397 858 736; 1398 860 738; 1399 862 740; 1400 864 742; 1401 866 744;

1402 870 748; 1403 880 758; 1404 876 754; 1405 878 756; 1406 884 762;

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1412 876 893; 1413 887 765; 1414 889 767; 1415 894 772; 1416 895 896;

1417 897 898; 1418 899 900; 1419 894 901; 1420 889 902; 1421 887 903;

1422 897 775; 1423 899 777; 1424 904 782; 1425 905 906; 1426 907 908;

1427 909 910; 1428 904 911; 1429 899 912; 1430 897 913; 1431 907 785;

1432 909 787; 1433 914 792; 1434 915 916; 1435 917 918; 1436 915 919;

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1442 917 795; 1443 920 798; 1444 923 801; 1445 926 927; 1446 923 928;

1447 926 804; 1448 929 930; 1449 926 931; 1450 929 807; 1451 932 933;

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1457 937 815; 1458 936 814; 1459 935 813; 1460 916 938; 1461 918 939;

1462 921 940; 1463 924 941; 1464 927 942; 1465 930 943; 1466 933 944;

1467 938 866; 1468 939 870; 1469 940 880; 1470 941 884; 1471 942 894;

1472 943 904; 1473 944 914; 1474 861 945; 1475 863 946; 1476 865 947;

1477 879 948; 1478 890 949; 1479 900 950; 1480 910 951; 1481 945 915;

1482 946 917; 1483 947 920; 1484 948 923; 1485 949 926; 1486 950 929;

1487 951 932; 1488 855 952; 1489 857 953; 1490 859 954; 1491 877 955;

1492 888 956; 1493 898 957; 1494 908 958; 1495 952 860; 1496 959 862;

1497 960 864; 1498 961 878; 1499 962 889; 1500 963 899; 1501 964 909;

1502 849 854; 1503 851 856; 1504 853 858; 1505 875 876; 1506 886 887;

1507 896 897; 1508 906 907; 1509 953 959; 1510 954 960; 1511 955 961;

1512 956 962; 1513 957 963; 1514 958 964; 1515 953 965; 1516 954 966;

1517 955 967; 1518 956 968; 1519 957 969; 1520 953 831; 1521 954 832;

1522 955 833; 1523 956 834; 1524 957 835; 1525 958 836; 1526 869 856;

1527 873 858; 1528 883 876; 1529 893 887; 1530 903 897; 1531 913 907;

1532 869 747; 1533 873 751; 1534 883 761; 1535 893 771; 1536 903 781;

1537 913 791; 1538 868 862; 1539 872 864; 1540 882 878; 1541 892 889;

1542 902 899; 1543 912 909; 1544 868 746; 1545 872 750; 1546 882 760;

1547 892 770; 1548 902 780; 1549 912 790; 1550 919 917; 1551 922 920;

1552 925 923; 1553 928 926; 1554 931 929; 1555 934 932; 1556 919 797;

1557 922 800; 1558 925 803; 1559 928 806; 1560 931 809; 1561 934 812;

1562 867 870; 1563 871 880; 1564 881 884; 1565 891 894; 1566 901 904;

1567 911 914; 1568 867 745; 1569 871 749; 1570 881 759; 1571 891 769;

1572 901 779; 1573 911 789; 1574 965 954; 1575 966 955; 1576 967 956;

1577 968 957; 1578 969 958; 1579 965 843; 1580 966 844; 1581 967 845;

1582 968 846; 1583 969 847;

DEFINE MATERIAL START

ISOTROPIC CONCRETE

E 2.17185e+007

POISSON 0.17

DENSITY 23.5616

ALPHA 1e-005

DAMP 0.05

TYPE CONCRETE

STRENGTH FCU 27579

END DEFINE MATERIAL

MEMBER PROPERTY AMERICAN

1 TO 3 15 TO 17 22 TO 24 75 77 78 109 TO 111 115 TO 120 134 136 137 -

168 TO 170 174 TO 179 193 195 196 227 TO 229 233 TO 238 252 254 255 262 264 -

265 274 276 277 286 288 289 298 300 301 306 308 309 318 320 321 330 332 333 -

342 344 345 350 352 353 362 364 365 374 376 377 386 388 389 394 395 397 399 -

401 403 405 407 412 414 416 418 423 425 427 429 434 436 439 442 445 447 450 -

453 456 458 461 464 488 TO 683 685 TO 687 689 TO 691 693 TO 695 697 TO 711 -

954 TO 962 969 TO 971 987 TO 989 996 TO 998 1005 TO 1007 1014 1015 1017 1019 -

1025 1028 1031 1040 TO 1094 1164 TO 1172 1179 TO 1181 1197 TO 1199 -

1206 TO 1208 1215 TO 1217 1224 1225 1227 1229 1235 1238 1241 1250 TO 1304 -

1374 TO 1382 1389 TO 1391 1407 TO 1409 1416 TO 1418 1425 TO 1427 1434 1435 -

1437 1439 1445 1448 1451 1460 TO 1514 PRIS YD 0.6 ZD 0.6

MEMBER PROPERTY AMERICAN

45 TO 47 59 64 69 81 TO 83 91 TO 99 105 TO 107 125 TO 127 130 TO 132 -

140 TO 142 150 TO 158 164 TO 166 184 TO 186 189 TO 191 199 TO 201 -

209 TO 217 223 TO 225 243 TO 245 248 TO 250 258 TO 260 266 TO 268 -

271 TO 273 278 TO 280 283 TO 285 290 TO 292 295 TO 297 302 TO 304 -

310 TO 312 315 TO 317 322 TO 324 327 TO 329 334 TO 336 339 TO 341 -

346 TO 348 354 TO 356 359 TO 361 366 TO 368 371 TO 373 378 TO 380 -

383 TO 385 390 TO 392 396 398 400 402 404 406 408 TO 411 413 415 417 419 -

420 TO 422 424 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 449 -

451 452 454 455 457 459 460 462 463 465 TO 478 713 TO 774 793 TO 816 835 -

836 TO 858 877 TO 900 919 TO 938 963 TO 968 972 TO 986 990 TO 995 999 TO 1004 -

1008 TO 1013 1016 1018 1020 TO 1024 1026 1027 1029 1030 1032 TO 1036 1095 -

1096 TO 1111 1118 TO 1123 1130 TO 1135 1142 TO 1147 1154 TO 1158 1173 TO 1178 -

1182 TO 1196 1200 TO 1205 1209 TO 1214 1218 TO 1223 1226 1228 1230 TO 1234 -

1236 1237 1239 1240 1242 TO 1246 1305 TO 1321 1328 TO 1333 1340 TO 1345 1352 -

1353 TO 1357 1364 TO 1368 1383 TO 1388 1392 TO 1406 1410 TO 1415 1419 TO 1424 -

1428 TO 1433 1436 1438 1440 TO 1444 1446 PRIS YD 0.6 ZD 0.6

1447 1449 1450 1452 TO 1456 1515 TO 1531 1538 TO 1543 1550 TO 1555 -

1562 TO 1567 1574 TO 1578 PRIS YD 0.6 ZD 0.6

MEMBER PROPERTY AMERICAN

479 TO 487 775 TO 792 817 TO 834 859 TO 876 901 TO 918 939 TO 953 -

1037 TO 1039 1112 TO 1117 1124 TO 1129 1136 TO 1141 1148 TO 1153 -

1159 TO 1163 1247 TO 1249 1322 TO 1327 1334 TO 1339 1346 TO 1351 -

1358 TO 1363 1369 TO 1373 1457 TO 1459 1532 TO 1537 1544 TO 1549 -

1556 TO 1561 1568 TO 1573 1579 TO 1583 PRIS YD 0.5 ZD 0.45

CONSTANTS

MATERIAL CONCRETE ALL

SUPPORTS

1 TO 7 11 TO 14 18 TO 21 25 164 173 178 183 184 193 198 203 204 213 218 223 -

604 606 608 630 641 651 661 726 728 730 752 763 773 783 848 850 852 874 885 -

895 905 FIXED

DEFINE 1893 LOAD

ZONE 0.16 RF 5 I 1.5 SS 2 ST 1 DM 0.05

SELFWEIGHT 1

MEMBER WEIGHT

46 47 64 69 82 83 91 TO 93 95 96 105 106 126 127 131 132 141 142 150 TO 152 -

154 155 164 165 185 186 190 191 200 201 209 TO 211 213 214 223 224 244 245 -

249 250 259 260 267 268 271 272 279 280 283 284 291 292 295 296 303 304 311 -

312 315 316 323 324 327 328 335 336 339 340 347 348 355 356 359 360 367 368 -

371 372 379 380 383 384 391 392 396 398 400 404 406 408 TO 411 415 417 419 -

420 TO 422 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 449 451 -

452 454 455 457 459 460 462 463 465 TO 468 470 471 473 474 476 477 -

482 TO 487 751 TO 774 793 TO 816 835 TO 858 964 965 967 968 973 TO 977 979 -

980 984 985 991 TO 994 1000 TO 1003 1009 TO 1012 1016 1018 1020 1022 TO 1024 -

1026 1027 1029 1030 1032 TO 1035 1038 1039 1106 TO 1111 1118 TO 1123 1130 -

1131 TO 1135 1174 1175 1177 1178 1183 TO 1187 1189 1190 1194 1195 -

1201 TO 1204 1210 TO 1213 1219 TO 1222 1226 1228 1230 1232 TO 1234 1236 1237 -

1239 1240 1242 TO 1245 1248 1249 1316 TO 1321 1328 TO 1333 1340 TO 1345 1384 -

1385 1387 1388 1393 TO 1397 1399 1400 1404 1405 1411 TO 1414 1420 TO 1423 -

1429 TO 1432 1436 1438 1440 1442 TO 1444 1446 1458 1459 UNI 5

243 248 258 302 346 361 373 385 390 478 TO 481 886 TO 888 892 896 900 1013 -

1037 1223 1247 1383 1386 1392 1410 1419 1428 1433 1457 UNI 11.1

ONEWAY LOAD

YRANGE 0 25 ONE 5.7

YRANGE 0 25 ONE 2

LOAD 1 LOADTYPE Seismic TITLE EX

1893 LOAD X 1

MEMBER LOAD

91 150 209 975 1185 1395 UNI GX 6.7

748 TO 750 1105 1315 UNI GX -1.7

359 371 383 1011 1221 1431 UNI GX -20

91 150 209 975 1185 1395 UNI GX 5.1

748 TO 750 1105 1315 UNI GX -2.5

359 371 383 1011 1221 1431 UNI GX -12

LOAD 2 LOADTYPE Seismic TITLE EZ

1893 LOAD Z 1

MEMBER LOAD

245 250 260 304 348 392 760 TO 762 766 770 774 UNI GZ -6.7

245 250 260 304 348 392 760 TO 762 766 770 774 UNI GZ -5.1

LOAD 3 LOADTYPE Dead TITLE DL

SELFWEIGHT Y -1

ONEWAY LOAD

YRANGE 0 25 ONE -5.7 GY

MEMBER LOAD

46 47 64 69 82 83 91 TO 93 95 96 105 106 126 127 131 132 141 142 150 TO 152 -

154 155 164 165 185 186 190 191 200 201 209 TO 211 213 214 223 224 244 245 -

249 250 259 260 267 268 271 272 279 280 283 284 291 292 295 296 303 304 311 -

312 315 316 323 324 327 328 335 336 339 340 347 348 355 356 359 360 367 368 -

371 372 379 380 383 384 391 392 396 398 400 404 406 408 TO 411 415 417 419 -

420 TO 422 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 449 451 -

452 454 455 457 459 460 462 463 465 TO 468 470 471 473 474 476 477 -

482 TO 487 751 TO 774 793 TO 816 835 TO 858 964 965 967 968 973 TO 977 979 -

980 984 985 991 TO 994 1000 TO 1003 1009 TO 1012 1016 1018 1020 1022 TO 1024 -

1026 1027 1029 1030 1032 TO 1035 1038 1039 1106 TO 1111 1118 TO 1123 1130 -

1131 TO 1135 1174 1175 1177 1178 1183 TO 1187 1189 1190 1194 1195 -

1201 TO 1204 1210 TO 1213 1219 TO 1222 1226 1228 1230 1232 TO 1234 1236 1237 -

1239 1240 1242 TO 1245 1248 1249 1316 TO 1321 1328 TO 1333 1340 TO 1345 1384 -

1385 1387 1388 1393 TO 1397 1399 1400 1404 1405 1411 TO 1414 1420 TO 1423 -

1429 TO 1432 1436 1438 1440 1442 TO 1444 1446 1458 1459 UNI GY -5

91 150 209 975 1185 1395 UNI GX 24.9

245 250 260 304 348 392 760 TO 762 766 770 774 UNI GZ -24.9

359 371 383 748 TO 750 1011 1105 1221 1315 1431 UNI GX -6.3

359 371 383 1011 1221 1431 UNI GX -74.5

243 248 258 302 346 361 373 385 390 478 TO 481 886 TO 888 892 896 900 1013 -

1037 1223 1247 1383 1386 1392 1410 1419 1428 1433 1457 UNI GY -11.1

LOAD 4 LOADTYPE Live TITLE LL

ONEWAY LOAD

YRANGE 0 25 ONE -4 GY

MEMBER LOAD

91 150 209 975 1185 1395 UNI GX 10.2

245 250 260 304 348 392 760 TO 762 766 770 774 UNI GZ -10.2

748 TO 750 1105 1315 UNI GX -5

359 371 383 1011 1221 1431 UNI GX -24

LOAD COMB 5 1.5(DL+LL)

3 1.5 4 1.5

LOAD COMB 6 1.2(DL+LL+EX)

3 1.2 4 1.2 1 1.2

LOAD COMB 7 1.2(DL+LL+EZ)

3 1.2 4 1.2 2 1.2

LOAD COMB 8 1.2(DL+LL-EX)

3 1.2 4 1.2 1 -1.2

LOAD COMB 9 1.2(DL+LL-EZ)

3 1.2 4 1.2 2 -1.2

LOAD COMB 10 1.5(DL+EX)

3 1.5 1 1.5

LOAD COMB 11 1.5(DL+EZ)

3 1.5 2 1.5

LOAD COMB 12 1.5(DL-EX)

3 1.5 1 -1.5

LOAD COMB 13 1.5(DL-EZ)

3 1.5 2 -1.5

LOAD COMB 14 (0.9DL + 1.5EX)

3 0.9 1 1.5

LOAD COMB 15 (0.9DL + 1.5EZ)

3 0.9 2 1.5

LOAD COMB 16 (0.9DL - 1.5EX)

3 0.9 1 -1.5

LOAD COMB 17 (0.9DL - 1.5EZ)

3 0.9 2 -1.5

LOAD COMB 18 SLS-(DL+LL)

3 1.0 4 1.0

LOAD COMB 19 SLS-(DL+EX)

3 1.0 1 1.0

LOAD COMB 20 SLS-(DL+EZ)

3 1.0 2 1.0

LOAD COMB 21 SLS-(DL-EX)

3 1.0 1 -1.0

LOAD COMB 22 SLS-(DL-EZ)

3 1.0 2 -1.0

LOAD COMB 23 SLS-(DL+LL+EX)

3 1.0 4 1.0 1 1.0

LOAD COMB 24 SLS-(DL+LL+EZ)

3 1.0 4 1.0 2 1.0

LOAD COMB 25 SLS-(DL+LL-EX)

3 1.0 4 1.0 1 -1.0

LOAD COMB 26 SLS-(DL+LL-EZ)

3 1.0 4 1.0 2 -1.0

PERFORM ANALYSIS PRINT ALL

LOAD LIST 5 TO 13

START CONCRETE DESIGN

CODE INDIAN

CLEAR 0.04 MEMB 1 TO 3 15 TO 17 22 TO 24 75 77 78 109 TO 111 115 TO 120 134 -

136 137 168 TO 170 174 TO 179 193 195 196 227 TO 229 233 TO 238 252 254 255 -

262 264 265 274 276 277 286 288 289 298 300 301 306 308 309 318 320 321 330 -

332 333 342 344 345 350 352 353 362 364 365 374 376 377 386 388 389 394 395 -

397 399 401 403 405 407 412 414 416 418 423 425 427 429 434 436 439 442 445 -

447 450 453 456 458 461 464 488 TO 683 685 TO 687 689 TO 691 693 TO 695 697 -

698 TO 711 954 TO 962 969 TO 971 987 TO 989 996 TO 998 1005 TO 1007 1014 1015 -

1017 1019 1025 1028 1031 1040 TO 1094 1164 TO 1172 1179 TO 1181 1197 TO 1199 -

1206 TO 1208 1215 TO 1217 1224 1225 1227 1229 1235 1238 1241 1250 TO 1304 -

1374 TO 1382 1389 TO 1391 1407 TO 1409 1416 TO 1418 1425 TO 1427 1434 1435 -

1437 1439 1445 1448 1451 1460 TO 1514

CLEAR 0.03 MEMB 45 TO 47 59 64 69 81 TO 83 91 TO 99 105 TO 107 125 TO 127 -

130 TO 132 140 TO 142 150 TO 158 164 TO 166 184 TO 186 189 TO 191 -

199 TO 201 209 TO 217 223 TO 225 243 TO 245 248 TO 250 258 TO 260 -

266 TO 268 271 TO 273 278 TO 280 283 TO 285 290 TO 292 295 TO 297 -

302 TO 304 310 TO 312 315 TO 317 322 TO 324 327 TO 329 334 TO 336 -

339 TO 341 346 TO 348 354 TO 356 359 TO 361 366 TO 368 371 TO 373 -

378 TO 380 383 TO 385 390 TO 392 396 398 400 402 404 406 408 TO 411 413 415 -

417 419 TO 422 424 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 -

449 451 452 454 455 457 459 460 462 463 465 TO 487 713 TO 953 963 TO 968 -

972 TO 986 990 TO 995 999 TO 1004 1008 TO 1013 1016 1018 1020 TO 1024 1026 -

1027 1029 1030 1032 TO 1039 1095 TO 1163 1173 TO 1178 1182 TO 1196 -

1200 TO 1205 1209 TO 1214 1218 TO 1223 1226 1228 1230 TO 1234 1236 1237 1239 -

1240 1242 TO 1249 1305 TO 1373 1383 TO 1388 1392 TO 1406 1410 TO 1415 1419 -

1420 TO 1424 1428 TO 1433 1436 1438 1440 TO 1444 1446 1457 TO 1459 -

1532 TO 1537 1544 TO 1549 1556 TO 1561 1568 TO 1573 1579 TO 1583

FC 40000 MEMB 1 TO 3 15 TO 17 22 TO 24 45 TO 47 59 64 69 75 77 78 81 TO 83 -

91 TO 99 105 TO 107 109 TO 111 115 TO 120 125 TO 127 130 TO 132 134 136 137 -

140 TO 142 150 TO 158 164 TO 166 168 TO 170 174 TO 179 184 TO 186 -

189 TO 191 193 195 196 199 TO 201 209 TO 217 223 TO 225 227 TO 229 -

233 TO 238 243 TO 245 248 TO 250 252 254 255 258 TO 260 262 264 TO 268 271 -

272 TO 274 276 TO 280 283 TO 286 288 TO 292 295 TO 298 300 TO 304 306 308 -

309 TO 312 315 TO 318 320 TO 324 327 TO 330 332 TO 336 339 TO 342 344 TO 348 -

350 352 TO 356 359 TO 362 364 TO 368 371 TO 374 376 TO 380 383 TO 386 388 -

389 TO 392 394 TO 683 685 TO 687 689 TO 691 693 TO 695 697 TO 711 713 TO 1446 -

1448 1451 1457 TO 1514 1532 TO 1537 1544 TO 1549 1556 TO 1561 1568 TO 1573 -

1579 TO 1583

FYMAIN 500000 MEMB 1 TO 3 15 TO 17 22 TO 24 45 TO 47 59 64 69 75 77 78 81 -
82 TO 83 91 TO 99 105 TO 107 109 TO 111 115 TO 120 125 TO 127 130 TO 132 134 -
136 137 140 TO 142 150 TO 158 164 TO 166 168 TO 170 174 TO 179 184 TO 186 -
189 TO 191 193 195 196 199 TO 201 209 TO 217 223 TO 225 227 TO 229 -
233 TO 238 243 TO 245 248 TO 250 252 254 255 258 TO 260 262 264 TO 268 271 -
272 TO 274 276 TO 280 283 TO 286 288 TO 292 295 TO 298 300 TO 304 306 308 -
309 TO 312 315 TO 318 320 TO 324 327 TO 330 332 TO 336 339 TO 342 344 TO 348 -
350 352 TO 356 359 TO 362 364 TO 368 371 TO 374 376 TO 380 383 TO 386 388 -
389 TO 392 394 TO 683 685 TO 687 689 TO 691 693 TO 695 697 TO 711 713 TO 1446 -
1448 1451 1457 TO 1514 1532 TO 1537 1544 TO 1549 1556 TO 1561 1568 TO 1573 -
1579 TO 1583

MAXMAIN 25 MEMB 1 TO 3 15 TO 17 22 TO 24 45 TO 47 59 64 69 75 77 78 -
81 TO 83 91 TO 99 105 TO 107 109 TO 111 115 TO 120 125 TO 127 130 TO 132 -
134 136 137 140 TO 142 150 TO 158 164 TO 166 168 TO 170 174 TO 179 -
184 TO 186 189 TO 191 193 195 196 199 TO 201 209 TO 217 223 TO 225 -
227 TO 229 233 TO 238 243 TO 245 248 TO 250 252 254 255 258 TO 260 262 264 -
265 TO 268 271 TO 274 276 TO 280 283 TO 286 288 TO 292 295 TO 298 300 TO 304 -
306 308 TO 312 315 TO 318 320 TO 324 327 TO 330 332 TO 336 339 TO 342 344 -
345 TO 348 350 352 TO 356 359 TO 362 364 TO 368 371 TO 374 376 TO 380 383 -
384 TO 386 388 TO 392 394 TO 683 685 TO 687 689 TO 691 693 TO 695 697 TO 711 -
713 TO 1446 1448 1451 1457 TO 1514 1532 TO 1537 1544 TO 1549 1556 TO 1561 -
1568 TO 1573 1579 TO 1583

RATIO 4 MEMB 1 TO 3 15 TO 17 22 TO 24 75 77 78 109 TO 111 115 TO 120 134 136 -
137 168 TO 170 174 TO 179 193 195 196 227 TO 229 233 TO 238 252 254 255 262 -
264 265 274 276 277 286 288 289 298 300 301 306 308 309 318 320 321 330 332 -
333 342 344 345 350 352 353 362 364 365 374 376 377 386 388 389 394 395 397 -
399 401 403 405 407 412 414 416 418 423 425 427 429 434 436 439 442 445 447 -
450 453 456 458 461 464 488 TO 683 685 TO 687 689 TO 691 693 TO 695 -

697 TO 711 954 TO 962 969 TO 971 987 TO 989 996 TO 998 1005 TO 1007 1014 -

1015 1017 1019 1025 1028 1031 1040 TO 1094 1164 TO 1172 1179 TO 1181 1197 -

1198 TO 1199 1206 TO 1208 1215 TO 1217 1224 1225 1227 1229 1235 1238 1241 -

1250 TO 1304 1374 TO 1382 1389 TO 1391 1407 TO 1409 1416 TO 1418 -

1425 TO 1427 1434 1435 1437 1439 1445 1448 1451 1460 TO 1514

RFACE 4 MEMB 1 TO 3 15 TO 17 22 TO 24 75 77 78 109 TO 111 115 TO 120 134 136 -

137 168 TO 170 174 TO 179 193 195 196 227 TO 229 233 TO 238 252 254 255 262 -

264 265 274 276 277 286 288 289 298 300 301 306 308 309 318 320 321 330 332 -

333 342 344 345 350 352 353 362 364 365 374 376 377 386 388 389 394 395 397 -

399 401 403 405 407 412 414 416 418 423 425 427 429 434 436 439 442 445 447 -

450 453 456 458 461 464 488 TO 683 685 TO 687 689 TO 691 693 TO 695 -

697 TO 711 954 TO 962 969 TO 971 987 TO 989 996 TO 998 1005 TO 1007 1014 -

1015 1017 1019 1025 1028 1031 1040 TO 1094 1164 TO 1172 1179 TO 1181 1197 -

1198 TO 1199 1206 TO 1208 1215 TO 1217 1224 1225 1227 1229 1235 1238 1241 -

1250 TO 1304 1374 TO 1382 1389 TO 1391 1407 TO 1409 1416 TO 1418 -

1425 TO 1427 1434 1435 1437 1439 1445 1448 1451 1460 TO 1514

TORSION 0 MEMB 45 TO 47 59 64 69 81 TO 83 91 TO 99 105 TO 107 125 TO 127 130 -

131 TO 132 140 TO 142 150 TO 158 164 TO 166 184 TO 186 189 TO 191 199 TO 201 -

209 TO 217 223 TO 225 243 TO 245 248 TO 250 258 TO 260 266 TO 268 -

271 TO 273 278 TO 280 283 TO 285 290 TO 292 295 TO 297 302 TO 304 -

310 TO 312 315 TO 317 322 TO 324 327 TO 329 334 TO 336 339 TO 341 -

346 TO 348 354 TO 356 359 TO 361 366 TO 368 371 TO 373 378 TO 380 -

383 TO 385 390 TO 392 396 398 400 402 404 406 408 TO 411 413 415 417 419 -

420 TO 422 424 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 449 -

451 452 454 455 457 459 460 462 463 465 TO 487 713 TO 953 963 TO 968 972 -

973 TO 986 990 TO 995 999 TO 1004 1008 TO 1013 1016 1018 1020 TO 1024 1026 -

1027 1029 1030 1032 TO 1039 1095 TO 1163 1173 TO 1178 1182 TO 1196 -

1200 TO 1205 1209 TO 1214 1218 TO 1223 1226 1228 1230 TO 1234 1236 1237 1239 -

1240 1242 TO 1249 1305 TO 1373 1383 TO 1388 1392 TO 1406 1410 TO 1415 1419 -

1420 TO 1424 1428 TO 1433 1436 1438 1440 TO 1444 1446 1457 TO 1459 -

1532 TO 1537 1544 TO 1549 1556 TO 1561 1568 TO 1573 1579 TO 1583

MINMAIN 20 MEMB 1 TO 3 15 TO 17 22 TO 24 45 TO 47 59 64 69 75 77 78 -

81 TO 83 91 TO 99 105 TO 107 109 TO 111 115 TO 120 125 TO 127 130 TO 132 -

134 136 137 140 TO 142 150 TO 158 164 TO 166 168 TO 170 174 TO 179 -

184 TO 186 189 TO 191 193 195 196 199 TO 201 209 TO 217 223 TO 225 -

227 TO 229 233 TO 238 243 TO 245 248 TO 250 252 254 255 258 TO 260 262 264 -

265 TO 268 271 TO 274 276 TO 280 283 TO 286 288 TO 292 295 TO 298 300 TO 304 -

306 308 TO 312 315 TO 318 320 TO 324 327 TO 330 332 TO 336 339 TO 342 344 -

345 TO 348 350 352 TO 356 359 TO 362 364 TO 368 371 TO 374 376 TO 380 383 -

384 TO 386 388 TO 392 394 TO 683 685 TO 687 689 TO 691 693 TO 695 697 TO 711 -

713 TO 1446 1448 1451 1457 TO 1514 1532 TO 1537 1544 TO 1549 1556 TO 1561 -

1568 TO 1573 1579 TO 1583

DESIGN BEAM 45 TO 47 59 64 69 81 TO 83 91 TO 99 105 TO 107 125 TO 127 130 -

131 TO 132 140 TO 142 150 TO 158 164 TO 166 184 TO 186 189 TO 191 199 TO 201 -

209 TO 217 223 TO 225 243 TO 245 248 TO 250 258 TO 260 266 TO 268 -

271 TO 273 278 TO 280 283 TO 285 290 TO 292 295 TO 297 302 TO 304 -

310 TO 312 315 TO 317 322 TO 324 327 TO 329 334 TO 336 339 TO 341 -

346 TO 348 354 TO 356 359 TO 361 366 TO 368 371 TO 373 378 TO 380 -

383 TO 385 390 TO 392 396 398 400 402 404 406 408 TO 411 413 415 417 419 -

420 TO 422 424 426 428 430 TO 433 435 437 438 440 441 443 444 446 448 449 -

451 452 454 455 457 459 460 462 463 465 TO 487 713 TO 953 963 TO 968 972 -

973 TO 986 990 TO 995 999 TO 1004 1008 TO 1013 1016 1018 1020 TO 1024 1026 -

1027 1029 1030 1032 TO 1039 1095 TO 1163 1173 TO 1178 1182 TO 1196 -

1200 TO 1205 1209 TO 1214 1218 TO 1223 1226 1228 1230 TO 1234 1236 1237 1239 -

1240 1242 TO 1249 1305 TO 1373 1383 TO 1388 1392 TO 1406 1410 TO 1415 1419 -

1420 TO 1424 1428 TO 1433 1436 1438 1440 TO 1444 1446 1457 TO 1459 -

1532 TO 1537 1544 TO 1549 1556 TO 1561 1568 TO 1573 1579 TO 1583

DESIGN COLUMN 1 TO 3 75 109 TO 111 134 168 TO 170 193 227 TO 229 252 262 274 -

286 298 306 318 330 342 350 362 374 386 488 TO 515 544 TO 571 600 TO 627 -

685 TO 687 689 TO 691 693 TO 695 697 TO 711 954 TO 956 969 987 996 1005 1040 -

1041 TO 1046 1054 TO 1060 1068 TO 1074 1089 TO 1094 1164 TO 1166 1179 1197 -

1206 1215 1250 TO 1256 1264 TO 1270 1278 TO 1284 1299 TO 1304 1374 TO 1376 -

1389 1407 1416 1425 1460 TO 1466 1474 TO 1480 1488 TO 1494 1509 TO 1514

END CONCRETE DESIGN

FINISH

6.11 Drainage and Pavement Design

6.11.1 Drainage Design

The main objective of the drainage study is to determine the required size area drain structures to allow the estimated design flow to be taken off from the bus Terminal quickly and safely.

Design Parameters for Drains

1. Cross slope

If a steep cross slope is provided, it helps in quick dispersal of water from the pavement surface, but it may be objectionable from considerations of bus Terminal. Therefore cross slope is often a compromise between the requirements of drainage and surface road of bus-stand. But from drainage point of view a reasonably cross slope will be helpful in minimizing ponding of water on flat grades. Flat slopes are major contributors to the condition which produces the phenomena of hydroplaning.

In keeping with the different guidelines and standard practices, the Consultants have adopted a cross fall 0.5% to 1% for Bus Terminal. This is considered enough to drain out the water from top of the pavement surface.

Drainage for the bus-stand project has been designed considering IRC-SP: 42-2014 Guide lines on Road Drainage & IRC-SP: 50-2013 Guide lines on Urban Drainage.

2. Minimum Section of Drains

Section is chosen in such a way that the drain would be able to be cleared periodically using a spade. Accordingly, it is recommended that minimum width of a drain would be 300 mm. In

case where drains are required to pass the existing cross roads, provision of buried pipe of minimum dia. 600mm is made for drain to cross from one side to other. For drain in bus Terminal, 0.45m to 0.900m internal width of drain is proposed and shown in drainage plan drawing.

3. Channel Shapes

The usual channel shapes are:

- Parabolic
- Trapezoidal
- Rectangular
- Triangular or V shaped

The parabolic section is the best from hydraulic consideration but it is very difficult to construct and subsequently maintain. The V-shaped drains are also very difficult to maintain as its desilting is difficult. The trapezoidal and rectangular sections are easier to construct and maintain, thus is considered the most suitable. Rectangular section is recommended to adopt for the bus-stand project.

6.11.2 Pavement Design

Rigid Pavement

Rigid pavement is proposed for this bus Terminal location. Jointed Plain Concrete Pavement is recommended and the design is carried out in accordance with IRC: 58-2015 “Guidelines for the design of plain jointed rigid pavements for highways”. Design life of thirty(30) year considered for design of rigid pavement. The pavement is designed to withstand the cumulative effect of the axle load repetitions of buses applied over the design life of 30 years.

The basic pavement structure consists of Pavement Quality Concrete (PQC) slab over Dry Lean Concrete (DLC) base and GSB Sub-base. These layers are laid over an appropriate subgrade of 500 mm thickness. The following inputs have been adopted for the design:

Modulus of elasticity of concrete	$E = 3.0 \times 10^4$ MPa
Poisson’s Ratio	$\mu = 0.15$
Coefficient of thermal expansion of concrete	$\alpha = 10 \times 10^{-6}\ per°C$
Max. Axle Load (for Bus)	= 8.5 MT

Subgrade CBR = 8.0%

Different trial thicknesses of concrete slab were carried out, and the pavement structure was checked for the cumulative fatigue life consumed over the design life. The slab thickness was checked for critical stress condition, which is the addition of flexural stresses due to traffic load and stresses due to temperature differential between top and bottom of the slab.

Based on the inputs mentioned as above and the formulas given in IRC: 58-2015, the rigid pavement thickness worked out is given in **Table 6-16** below. The design will be applicable for pavement at bus Terminal locations. A joint Spacing of 4.0 m and slab width of 4.0m are recommended.

Table 6-6: Concrete Pavement Design

Layer Type	Thickness (mm)
Pavement Quality Concrete (PQC) M 40 Grade	230
Dry Lean Concrete (DLC) M 15 Grade	100
Granular Sub-Base (GSB)	150
Total Pavement Thickness (mm)	**480**

6.12 Services Work

6.12.1 Electrical System Design

Electrical services hold an important role in functioning of the building services such as Lighting and Power, Water Supply, Fire Fighting, Air Conditioning, Passenger Information System, CCTV System, Public Address System etc.

6.12.1.1 Standards

The following tables provide details of standards and codes to be followed during detailed design of the services:

Table 6-7: Reference Standards for Distribution Transformer

Code	Details
IS:11171	Dry Type Transformers.
IEC 60044-1	Current Transformers
IEC 60044-2	Voltage Transformers
IS: 13947 (Part I)	Low-voltage Switchgear and Control gear

Code	Details
IS: 3231	Electrical Relays for Power System Protection

Table 6-8: Reference Standards for HT/ LT System

Referred Standards for HT/LT System	
IS: 7752	Guide for Improvement of Power Factor at Consumer's Installations
IS: 10118	Code of Practice for Selection, Installation and Maintenance for Switchgear and Control Gear
IS: 1248	Direct Acting Electrical Indicating Instruments
IS: 12640	Earth Leakage Circuit Breakers
IS: 12729	High Voltage Switchgear
IS: 13779	Digital Measuring Instrument and Testing Accessories
IS: 13947 (Part-3)	Low –Voltage Switchgear and Control gear – Switches, Disconnectors, Switch Disconnectors and Fuse Combination Units
IS: 2551- 1982	Danger Notice Plates
IS: 3401	Specification for Silica Gel
IS: 8478	Application guide for Tap- Changers
IS: 8623 (Part-II)	Bus Bar Trunking
IS: 8828	Miniature Circuit Breakers
IS: 9537	Rigid Steel Conduits for Electrical Wiring (Second Revision)
IS:1255	Code of practice for installation & maintenance of Power Cables upto & including 33 kv rating
IS:2705	Current Transformers Specifications
IEC 947-4-1	Low Voltage switchgear and control gear
IS:4201	Application guide for CT.

Table 6-9: Reference Standards for HT/ LT Power Cables

Referred Standards for HT/LT Power Cables	
IS:3961	Recommended current ratings for cables.
IS: 7098 (Part I)	XLPE Cables - LT
IS: 7098 (Part II) or IEC:60502-2	Cross-linked Polyethylene Insulated PVC Sheathed Cables for Working Voltage from 3.3kV up to and Including 33kV
IS: 8130 or IEC:60228	Conductors for Insulated Electric Cables and Flexible Cords
BS: 6387	Fire Survival Cables
IEC 60598-1	General Requirements and Tests
IEC 6076 Part-1	General
IEC 6076 Part-2	Temperature Rise
IEC 6076 Part-3	Insulation level and die-electric tests
IEC 6076 Part-5	Ability to the withstand short circuit

Referred Standards for HT/LT Power Cables	
IS: 10810	Methods of Tests for Cables (All Tests)
IS: 1271	Classification of Insulating Materials

Table 6-10: Reference Standards for Wires/Electrical Fixtures

Referred Standards for wires/ electrical fixtures	
IS: 694-2010	PVC insulated cables/ Cords with rigid and flexible conductor for rated voltage up to and including 450/750 V
BS: 7671-2001	Requirements for Electrical Installations. IEE Wiring Regulations – 16th Edition
IS/IEC 60309 (Part 1): 2002	Plugs, socket outlets & couplers for industrial purpose: general requirements
IS 732: 1989	Code of Practice of Electrical Wiring Installations (System Voltage not exceeding 600V)
IS 9537 : Part 1 : 1980/IEC 60614-1 (1978)	Conduits for electrical installations: Part 1 General requirements
IS: 3480: 1966	Flexible steel conduits for electrical wiring
General Specifications for electrical works Part-1 internal-2013 issued by CPWD	
Indian Electricity Act 2003 and IE Rules 1956 as amended from time to time	

Table 6-11: Reference Standards for Lighting

Reference Standards for Lighting	
IS: 10322 (All Parts)	Specification for Luminaires
IS 3646 (Part 1): 1992	Indian Standard: code of practice for interior illumination
IS : 1944 (PARTS I AND II) - 1970 (REAFFIRMED 2003) EDITION 2.2 (1981-10)	Indian Standard: code of practice for lighting of public thoroughfares
IS 15885, 16101, 16102, 16103, 16104, 16105, 16106, 16107 (Part I & II), 16108	All Indian standards on LED based systems for general illumination relevant to the applications and it future amendments.
SP72 (2010)	National Lighting Code 2010

Table 6-12: Reference Standards for Diesel Generator

Referred Standards for Diesel Generator	
BS: 5514, BS: 649	Diesel Engines
IS: 4722 BS 2613	Alternator
IS: 8183	Sound Insulation
BS: 4552	Fuel Filters
BS: 7226	Air Filters
ISO 8528	Genset
General Specifications for electrical works Part-VII DG Sets-2013 issued by CPWD	

Table 6-13: Reference Standards for Fire Detection & Alarm System

Referred Standards for Fire Detection & Alarm System	
National Building Code 2005	Automatic Fire Alarm Systems in Buildings
IS 2175:1988	Heat Sensitive Detectors for Use in Automatic Fire Alarm Systems
IS 2189: 1999	Code of Practice for Installation of Automatic Fire Alarm System

Table 6-14: Reference Standards for Earthing & Lightning Protection

Referred Standards for Earthing & Lightning Protection	
BS7430	Code of Practice for Earthing
IEEE 1100	Recommended Practice for Powering and Grounding of Sensitive Electronic Equipment
IEEE 80	Guide for Safety in AC Substation Grounding
IEEE 837	Standards for qualifying permanent connections used in substation grounding
IS 3043-1987	Indian standard code of practice for earthing
OISD-GDN-180	Recommended practice -Earthing and Lighting Protection.
IS/IEC 62305-1:2010	Lightning Protection
General Specifications for electrical works Part-I Internal-2013 issued by CPWD	

Table 6-15: Reference Standards for Solar Power System

Referred Standards for Solar Power System	
IEC 61723 Ed 1.0	Safety Guidelines for grid Connected photovoltaic systems mounted on the building.
IEC 62446 (2009)	Grid connected photovoltaic systems - Minimum requirements for system documentation, commissioning tests and inspection.
IEC: 61701	Salt mist corrosion testing of photovoltaic (PV) modules
IEC: 61730 Pt 1 & 2	Photovoltaic (PV) module safety qualification -Part 1: Requirements for construction Part 2: Requirements for testing
IEC:60904-1(2006)	Photovoltaic Devices- Part-I: Measurement of Photovoltaic Current-Voltage Characteristic
IS 12762	Photovoltaic Devices- Part-I: Measurement Principles for terrestrial Photovoltaic (PV) Solar Devices

6.12.1.2 Design Criteria

Occupants comfort, sustainable development and ease in maintenance are the main considerations for the scheme.

- The Lux Level of entire building shall be adequate and shall be as per National Lighting Code (SP72) and IS 3646

6.12.1.3 Basis of Calculations

Lighting and Power Load of the Terminal Area, Office Area and Commercial area based on the following considerations:

Table 6-16: Loads for Different Areas

Sl. No.	Description	Load considered for different area
a)	Bus Terminal Area	150 Watt / Sq. Meter
b)	Station Infrastructure	150 Watt / Sq. Meter
c)	Workshop Area	150 Watt / Sq. Meter
d)	Commercial Development area	150 Watt / Sq. Meter

6.12.1.4 Source of Power

Electrical power supply to the ISBT will be provided by Central Electricity Supply Utility of Odisha (CESU).

6.12.1.5 Electricity Tariff System

Tariff will be governed by Central Electricity Supply Utility of Odisha (CESU), Odisha.

6.12.1.6 Selection of Size of Transformer

The 33 KV power received shall be stepped down to 415 Volts which is the operating voltage, by installing 11KV/ 415 Volt Transformer. The transformer capacity required for Bus Terminal Building is 3000 KVA.

Transformer

The Transformer will be Dry Type with Automatic OLTC as per IS 11171.

Table 6-17: Transformer Load Sheet

Equipment	Wattage	Nos.	Total load (W)	Load (kW)
Lights on Poles	150	25	3750	3.75
High Masts	240	42	10080	10.08
Common Area GF to Second Floor including Basement	30	160	4800	4.8
Building Illuminated	90	20	1800	1.8
Common Area GF strut light	40	123	4920	4.92
Toilet/corridor Stair	18	900	16200	16.2
Electrical Rooms/Admin room	22	150	3300	3.3
Lift	7500	6	45000	45
Escalator	7500	2	15000	15
Digital Clock	60	2	120	0.12
Shops GF	1500	180	270000	270

Equipment	Wattage	Nos.	Total load (W)	Load (kW)
Fan	60	30	1800	1.8
Power point/Light point	60	40	2400	2.4
Admin GF	1500	15	22500	22.5
Shops FF	1500	12	18000	18
Shops SF	1500	15	22500	22.5
Water cooler				4
Bore well				5
Bus wash				5
Ticket Counter				3
Advertisement				10
CCTV				5
PIDS				5
PA				2
FDA				3
PMS				3
WTP				15
ETP				5
Fire				20
Water Supply				15
Signages				2
FAN basement	15000	6	90000	90
AC for ALL				1782
Total				2416.17
Max Demand				1932.936
Load factor 80%				2416.17
Power factor .85		0		2842.55
Transformer capacity required		0		**3000**
			Proposed	3x1000

6.12.1.7 Stand by Power Generation

For power back-up, Diesel Generating Sets have been proposed. Total DG capacity required for the building is 2250 KVA.

It is proposed to provide DG Sets with Power Command Centre (PCC) for AMF & Auto Synchronizing function. Separately PLC based Auto Load Management system shall be provided in main LT panel which will function in coordination with Power Command Centre provided in each DG Set.

DG sets shall be provided with Acoustic Enclosure as per CPCB norms.

Table 6-18: DG Load Sheet

Equipment	Wattage	Nos.	Total Load (W)	Load (kW)	
Lights on Poles	150	25	3750	3.75	
High Masts	240	42	10080	10.08	
Common Area GF to 2nd Floor including Basement	30	160	4800	4.8	
Building Illuminated	90	20	1800	1.8	
Common Area GF strut light	40	123	4920	4.92	
Toilet/corridor Stair	18	900	16200	16.2	
Electrical Rooms/Admin room	22	150	3300	3.3	
Lift	7500	6	45000	45	
Escalator	7500	2	15000	15	
Digital Clock	60	2	120	0.12	
Shops GF	600	180	108000	108	
FAN	60	80	4800	4.8	
Power point/Light point	60	80	4800	4.8	
Admin GF	1000	15	15000	15	
Shops FF	1000	12	12000	12	
Shops SF	1000	15	15000	15	
Water cooler				4	
Bore well				5	
Bus wash				5	
Ticket Counter				3	
Advertisement				0	
CCTV				5	
PIDS				5	
PA				2	
FDA				3	
PMS				3	
WTP				15	
ETP				5	
Fire					
Water Supply				15	
Signages				2	
FAN basement	15000	3	45000	45	
AC for ALL				1401	
Total				1782.57	
Max Demand				1426.056	
Load factor 80%				1782.57	KW
Power factor .85		0		2097.14	KVA
DG capacity required		0		**2250**	KVA
			Proposed	3 x 750	KVA

6.12.1.8 LT Power Distribution

415 Volt power from Sub-Station shall be integrated with DG power in Main LT/ DG panel and fed to various loads with 1.1 KV XLPE insulated Aluminium conductor armoured cables. The

panels shall be provided with MCCBs for feeder ratings up to 630Amps. ACBs will be provided for feeders above 630Amps. Distribution Boards (DB) shall be provided with MCB and RCCB. For feeding power to various floors from Main LT panels to floor panels/ Meter Boards, XLPE insulated cables will be provided. It is proposed to provide required numbers of meter boards on each floor housing dual Electronic energy meter for measurement of energy consumption of lighting and power load of each tenant.

LT Panels

LT panel with incoming ACBs/ MCCBs as required with protective relays, aluminium bus bars and outgoing MCCBs.

Distribution Boards

The DB's shall be sheet steel enclosed, cubical type, dust and vermin proof with incoming and outgoing MCCB’s. The distribution boards for light and power shall be recessed in wall with ELCBs/ RCCBs as incoming and MCB's as outgoing.

Capacitor Banks

Non-flammable oil impregnated automatic power factor improvement capacitors, 400/ 430 Volts. Automatic Power factor correction relay is proposed.

Capacitor Bank shall be provided along with Harmonic Filters for Power Quality improvement.

Wiring

PVC insulated copper conductor FRLS wires of 650/1100 Volts grade shall be used for lighting, fans, equipment and outlets.

Conduit & Accessories

MS conduits shall be used.

Earthing

Earthing system shall be provided in accordance with IS: 3043 - 1987 (with latest amendments and other statutory regulations).

All electrical equipment shall be earthed with 2 nos. G.I. strips/wires. The neutrals of Transformers and DG sets shall be earthed separately by two separate Copper earth electrodes. The body earthing of HT panels, Transformers, LT Panel, DG Sets as per IE –

rules shall also be carried out with GI strips with separate and direct connection to Earthing electrodes.

Cable Trays

M.S. painted perforated type cable trays for power cables, control cables and low voltage cables are proposed to be provided for laying of cables thereon. The mounting and supporting arrangement of cable trays shall be as per drawings.

All the cable trays shall be earthed with suitable size of 2 nos. G.I. strips in the entire length.

Switches & Sockets

All the Switches & sockets shall be modular type.

6.12.1.9 Lighting

Light fixtures for all public areas, landscape and commercial areas will be selected based on lux level requirement. Lighting arrangement is proposed with a combination of energy efficient fixtures using LED Lights (minimum 100 Lumen/Watt).

Lights for the public areas and parking area shall be controlled through MCB whereas lights in the offices/ rooms will be controlled by modular switches.

6.12.1.10 Telephone Networking System

Telephone/ Data connectivity will be provided with Optical Fibre Cables to be provided by the local Service provider in the area. Conventional Telephone Cabling will be provided along with tag blocks at each floor for connectivity to proposed offices/ shops. Intercom System has been proposed to be provided at strategic locations for maintenance staff. These outlets shall be connected with 2 pair telephone wires.

6.12.1.11 UPS for Emergency Lighting

To avoid total darkness during changeover time between Grid Power and DG power Centralized UPS with 30 minutes' battery backup is proposed which shall be connected to control rooms, etc.

6.12.1.12 Lightning Protection

Lightning Protection shall be provided by following methods which are briefly explained below:

Conventional Lightning Protection Scheme as Per IS/ IEC62305

This system is based on Faradays Cage Principle along with Cone of Protection principle in which lightning protection is provided to the building by providing Vertical air terminals (Franklin rods) along with Horizontal air terminations bonded to earth pit on the ground with vertically descending down conductors. In this scheme number of down conductors is calculated based on the roof area of the building to be protected. Also no part of the roof should be greater than 8 meters from the nearest horizontal conductor. In this system horizontal air terminations are to be exposed to the atmosphere and hence are generally fixed on the parapet wall on terrace. Each down conductor shall be connected to one number earth pit. All the earth pits provided in ground shall be connected to one another with suitable size of GI/ Al earth strips.

6.12.2 Solar Power System

Provision of solar panel based electricity generation has been taken. Solar panels will be installed at the available area on the terrace of the building. This will generate electricity during day time and thus save considerable amount of conventional electrical energy.

The power distribution shall be done using adequately sized cables/ wires to minimize voltage drop and the distribution losses. XLPE insulated aluminium/ copper conductor cables and FRLS wires shall be used for power distribution.

It is proposed to provide photo voltaic solar power plant at the terrace of the building as per available space at the terrace.

6.12.3 Air-conditioning System

It is proposed to install VRF AC system in the building for Air Conditioning. The main advantage of a variable refrigerant flow (VRF) system is its ability to respond to fluctuations in space load conditions. By comparison, conventional direct expansion (DX) systems offer limited or no modulation in response to changes in the space load conditions. A simple VRF system, comprising of an outdoor condensing unit and several indoor evaporators, which are interconnected by refrigerant pipes and refrigerant management controls, allows each individual thermostat to modulate its corresponding electronic expansion valve to maintain its space temperature set point. TFA units shall be installed provided to provide fresh air.

Table 6-19: Air Conditioner Load Sheet

Sl. No.	Description	Area (Sq. ft.)	Type	TR	Qty.	Total TR	IDU Cooling (kW)	Total IDU Cooling (kW)	Total ODU Modules
GF									
1	AC Floor Public Circulation	42642	DUCTABLE	7.5	48	360	25	1200	(54 HP X 5)+(36 HP X 2), DIVERSITY=126%
							TOTAL GF	**1200**	
MZ FL									
1	Mezzanine FF	13407	DUCTABLE	7.5	13	98	25	325	(54 HP X 1)+(38 HP X 1), DIVERSITY=126%
							TOTAL MZ FL	**325**	
FF									
1	Kitchen	3282	DUCTABLE	6	4	24	22.4	89.6	(54 HP X 10)+(40 HP X 1)+ (38 HP X 1), DIVERSITY=126%
2	Food Court 1 & 2	14687	DUCTABLE	7.5	12	90	25	300	
				6	3	18	22.4	67.2	
3	Common Area	13956	DUCTABLE	7.5	13	98	25	325	
				6	1	6	22.4	22.4	
4	Retail-1	15602	DUCTABLE	7.5	13	98	25	325	
				6	3	18	22.4	67.2	
5	Restaurant	13084	DUCTABLE	7.5	13	98	25	325	
6	Corridor	8705	DUCTABLE	7.5	7	53	25	175	
				6	2	12	22.4	44.8	
7	Retail-2	8985	DUCTABLE	7.5	9	68	25	225	
8	Retail-3	6122	DUCTABLE	7.5	6	45	25	150	
9	Retail-4	2001	DUCTABLE	7.5	2	15	25	50	
							TOTAL FF	**2166.2**	
SF									
1	Ladies Waiting Hall	3260	DUCTABLE	6	4	24	22.4	89.6	(54 HP X 11)+(46 HP X 1), DIVERSITY=126%
2	General Waiting Hall	5584	DUCTABLE	6	7	42	22.4	156.8	

Sl. No.	Description	Area (Sq. ft.)	Type	TR	Qty.	Total TR	IDU Cooling (kW)	Total IDU Cooling (kW)	Total ODU Modules
3	Resting Room-1	7769	CASSETTE	4	10	40	14	140	
				3.5	5	18	12.5	62.5	
4	Resting Room-2	1367	CASSETTE	3.5	3	11	12.5	37.5	
5	Driver Rest Room	2712	CASSETTE	4	5	20	14	70	
6	Terminal Office	2744	CASSETTE	4	5	20	14	70	
7	Assoc./Retail Offices	35852	DUCTABLE	7.5	35	263	25	875	
8	Admin Office	2712	CASSETTE	4	5	20	14	70	
9	Retail-1	6994	CASSETTE	4	6	24	14	84	
				3.5	8	28	12.5	100	
10	Retail-2	4110	CASSETTE	4	4	16	14	56	
				3.5	4	14	12.5	50	
11	Retail-3	3680	CASSETTE	4	5	20	14	70	
				3.5	2	7	12.5	25	
12	Retail-4	1151	CASSETTE	3	3	9	11.2	33.6	
13	Corridor	10222	DUCTABLE	7.5	10	75	25	250	
		230630			270				
				TOTAL TR		**1747.5**	**TOTAL SF**	**2240**	

6.12.4 Basement Ventilation

Ventilation in the basement shall be provided using axial flow fans for normal supply air/ exhaust air and for smoke exhaust in case of fire as per NBC.

6.12.5 Fire Detection and Alarm System

Fire Detection and Alarm system is proposed so that in case of fire in any area it can be immediately detected and required measures can be taken to fight it.

- **Intelligent Addressable Fire Detection and Alarm system** is proposed in which all detectors are addressable which means that in case of fire the fire panel shall be able to pinpoint exact location of fire with the help of displaying exact address of each detector, whereas in case of Conventional system we come to know only about the zone. In this system response indicators are not required. This is an expensive system as compared to conventional system.

- Multi-criterion Detectors shall be provided in entire building area

6.12.6 Passenger Information System

The passenger Information system for the Inter State Bus Terminal at Baramunda shall be of integrated LAN based system consisting of LED Boards and LED monitors. The objective of the system is to display Departure details from the Data entry terminals provided in the Control room, bus boarding area etc. The displays of bus departure details are controlled by a Central Server in the equipment room having a link with the PA system/ PMS for automotive announcement if required.

6.12.7 Public Address System

Public address system comprising speakers, amplifier, and microphone and control panel shall be provided. The speakers shall be installed in all the common areas. This system is required in order to make all types of announcements for the convenience of passengers and also the announcements in case of fire or any other emergency. The Public Address can also be integrated with Fire Detection system.

Software based system is being installed to provide information of buses scheduled from the ISBT including platform/ bay number and departure time. The system shall have facility for announcements of pre-recorded messages. However, override facility shall be provided at one or two location as may be required by Owner.

6.12.8 Parking Management System

It is proposed to provide parking management system to provide information to the bus driver/ conductor, collection of revenue, management of bus parking in ISBT premises. Motorized Boom Barriers shall be provided at the entrance and exit points.

6.12.9 CCTV System

It is recommended to install the close circuit television cameras for monitoring main exits and entries and key areas. IP based cameras are being provided at strategic locations in the common areas to keep a watch on the public activities in the bus stand and also to keep a record of the same to view in future, if required.

6.12.10 Building Management System

The terminal building shall be provided with an integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control etc. The control strategies shall be developed to ensure that the specified environmental conditions are maintained, whilst giving due regard to minimizing of energy consumption.

6.12.11 Fire-fighting System

Type of the Building considered - Assembly Building

a. Wet Riser & Hydrants System

The firefighting system shall be designed as per National Building Code of India 2005, other relevant I.S codes and recommendation of Local Fire Brigade.

- Two Static Underground storage fire tank and terrace tank of capacity as per NBC-2005 depending on the height of the block
- Wet-riser system with landing hydrant valves and fire hose cabinet shall be provided as per NBC part IV depending upon final architectural layouts

Each Fire Hose Cabinet shall consist of:

- One Number Fire Hydrant/ Landing Valve
- 2 nos., 63 mm dia. and 15m long RRL hose pipes.
- SS male and female instantaneous type coupling

- SS branch pipe with nozzle
- First-aid fire hose reels with 20 mm dia. 35m long thermos-plastic hose and with 5mm bore SS nozzle.
- Fireman's axe

b. Sprinkler System

Fire Sprinkler System shall be provided in all the areas in the terminal as well as commercial building. Pendant/ Upright/ Sidewall type sprinklers shall be used as per NBC-2016 and other relevant IS codes.

Upright sprinklers shall be provided at basement and for any false ceiling areas in Lobbies/common areas etc. which are greater than 800 mm in height.

The sprinklers shall be automatically activated at 68 degree centigrade by breaking of the glass bulb in the event of fire.

The sprinkler line shall be always pressurized. Sprinkler pump shall have the backup diesel engine driven fire pump. Necessary accessories such as Alarm Valves, Flow Switches, Inspector's Test Valve Assembly, and Annunciation Panel, etc. shall be provided as per the requirements.

c. Fire Pumps

There will be one number of electrical motor driven fire pumps of 2280 LPM capacity, for wet riser system and for sprinkler system. Similar capacity diesel engine driven pump will be provided as common standby. One number electrical motor driven jockey pumps of 180 LPM will be used to maintain line pressure in pump rooms.

d. Fire Extinguishers

Hand held type extinguisher shall be provided according IS: 15683. These extinguishers shall be placed at easily accessible places and strategic locations. Following types of fire extinguishers have been proposed:

a) Gas expelled water type
b) Carbon Di-oxide gas type
c) ABC powder type
d) Mechanical foam type

6.12.12 Plumbing

6.12.12.1 Design Consideration

Occupants comfort and ease in maintenance are the main considerations for the scheme.

- There shall be enough potable water on continuous basis to every usage points
- Proper use of treated effluent from the Sewage Treatment Plant wherever possible to achieve minimal use of fresh water
- Quick disposal of rainwater without stagnation and flooding and maximum use of storm water to recharge the aquifer
- Minimize the energy requirements by using variable frequency driven pumping system.
- Evolve a cost effective, Maintenance friendly and functionally efficient system
- Minimize adverse impact on environment

6.12.12.2 Water Requirement and Underground Water Tank Storage

Design Calculations

The scheme has been designed considering total no. of passengers & visitors per day (2048 Year) and considering maximum no. of passengers expected in the terminal at any given time, and considering the occupant load in other building areas.

Table 6-20: Water Requirement for ISBT (Terminal Area)

A - For Terminal (Passenger Area)			
Sl. No.	**Parameter**	**Qty.**	**Unit**
1	Footfall per day	78000	persons
2	Water requirement as per NBC clause 4.1.2 and 4.1.3	25	litres per capita per day
3	Daily water demand	1950000	litres
4	Factor increase if any (1 day storage capacity since bore well is the water source)	1950000	litres
5	**Tank Requirement A (@50%, assuming the tank could be filled twice in a day)**	**975000**	litres

B - For Terminal (offices and staff)			
Sl. No.	**Parameter**	**Qty.**	**Unit**
1	Area in Sqm	5836	sqm.
2	Number of persons in commercial area (1 person per 10 sqm)	583.6	persons
3	Number of bus stand staff	50	persons
4	Total persons	633.6	persons
5	Water requirement as per NBC clause 4.1.2 and 4.1.3	45	litres per capita per day
6	Daily water demand	28512	litres
7	Factor increase if any (1 day storage capacity)	28512	litres
8	**Tank Requirement B**	28512	litres
9	**Total tank requirement for terminal (A+B)**	1003512	litres
Underground tank capacity (66.6% of total capacity as per NBC)		668338.99	litres
Overhead water tank capacity		335173.01	litres

Table 6-21: Water Requirement for ISBT (Commercial Area)

C1 - Retail/Office			
Sl. No.	**Parameter**	**Qty.**	**Unit**
1	Area in Sqm	12241	sqm.
2	Number of persons in commercial area (1 person per 10 sqm)	1224.1	persons
3	Number of staff	20	persons
4	Total persons	1244.1	persons
5	Water requirement as per NBC clause 4.1.2 and 4.1.3	25	litres per capita per day
6	Daily water demand	31102.5	litres
7	Factor increase if any (1 day storage capacity)	31102.5	litres
8	**Tank Requirement C1**	31102.5	litres

C2 - Restaurants			
Sl. No.	**Parameter**	**Qty.**	**Unit**
1	Area in sqm.	2108	sqm.
2	Number of persons in restaurant(1 person per 3 sqm)	421.6	persons
3	Number of staff	50	persons
4	Total persons	471.6	persons
5	Water requirement as per NBC clause 4.1.2 and 4.1.3	70	liter per capita per day
6	Daily water demand	33012	liters
7	Factor increase if any (1 day storage capacity)	33012	liters
8	**Tank Requirement C2**	**33012**	**liters**
Total Tank Requirement for Terminal (C1 + C2)		**64114.5**	

C2 - Restaurants			
Sl. No.	**Parameter**	**Qty.**	**Unit**
Underground Tank Capacity (66.6% of total capacity as per NBC)		**42700.257**	**liters**
Overhead Water Tank Capacity		**21414.243**	**liters**

Effluent Treatment Plant [ETP] for Bus Wash

The bus wash will be provided with appropriate capacity skid mounted ETP so that the waste water is recycled and wastage of fresh water is minimized.

Sl. No.	Description	Cap in cu.m.
(I)	Effluent Treatment Plant (for bus wash)	2

6.12.12.3 Water Distribution System

Basic Treatment for Potable Water

Separate network and RO units for operational area and commercial area shall be provided. RO plant shall be designed to meet IS: 10500-2012.

Water Supply System

The present source of water supply is groundwater, and in the existing system wastewater recycling is not practiced. To optimize the water demand and minimize impacts on the environment, it is recommended to recycle the wastewater generated from site. For an efficient water supply scheme, it is essential to have an integrated approach that would meet the future demand in a sustainable manner.

Water Quality

Drinking water quality shall conform to IS: 10500-2012.

Source

The current source of water supply for the Bus stand is underground water/ Municipal supply.

Network

Drinking water demand of the bus station including offices and catering shall be fetched from RO units and Drinking water requirement of commercial area will be fulfill by water treatment plant near the underground water tank. For bus washing treated effluent shall be recycled and a portion of water demand shall be fulfilled by raw/ municipal water.

Water demand for horticulture and flushing shall be met through treated sewage effluent (TSE).

6.12.13 Sewage Treatment Plant

Sewage generated from the building will be treated in centralized sewage treatment plant (STP) Treatment will be done to achieve treated effluent to permissible limit to reuse for various non-domestic applications. The technology used in the proposed system is MBBR. This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm. Additionally, the biofilm attached to the mobile bio-carriers within the system automatically responds to load fluctuations.

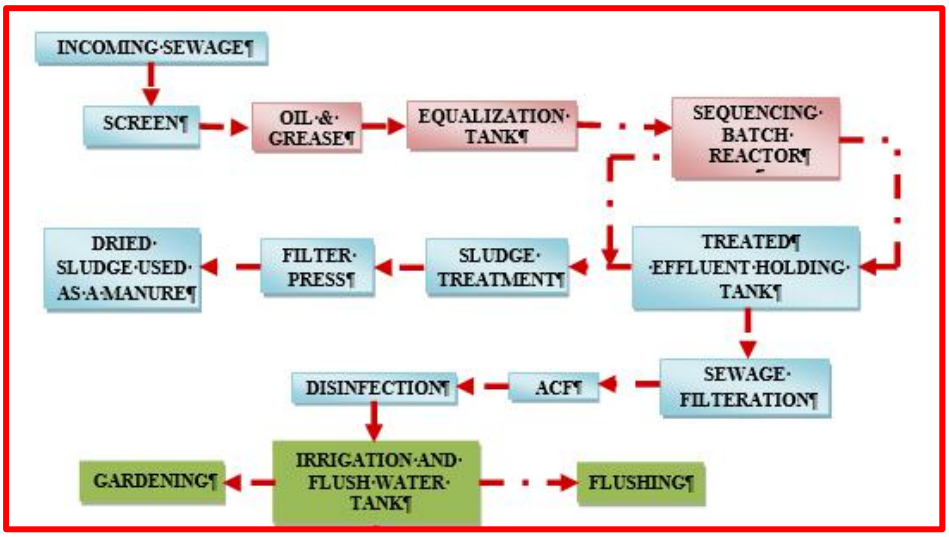


Figure 6-46: Process

Table 6-22: Sewerage Treatment Plant Capacity

Sl. No.	Description	Cap in cu.m.
(I)	Sewerage Treatment Plant For bus terminal, commercial infrastructure within bus terminal and workshop	1000 (approx.)

6.12.14 Rain Water Harvesting System

Rain water from the roof top of buildings and balcony will be drained out to the rain water stacks located at strategic positions within the shaft or at exposed positions as directed by the building Architect or as per building profile. These vertical pipes will be brought up to the basement ceiling and diverted to the external storm water line along the periphery of building.

At surface level storm water drain along with road gully/catch basin will be located at strategic location depending upon the landscaping and ground levels. Water collected through this storm water drain along with rain water from the roof will be diverted to rain water harvesting arrangement.

Due to urbanization of the land and sharp growth in population and thus increase in water demand for various uses, the fresh water is becoming scarce in most regions. In certain areas due to almost total dependency on the ground water and over extraction aquifer is depleting in an alarming way. Saline water intrusion into the aquifer has been witnessed in many developed areas. Also due to increase in paved surface/roof areas, the amount of natural percolation of rain water is reducing.

Therefore, it has become very necessary to harvest the rain water as maximum as possible and either store the harvested water for use or use the harvested water for recharging aquifer. The drainage system needs to be planned with a view to incorporate rainwater harvesting to recharge the aquifer. Ministry of Environment and Forest has made it mandatory to harvest the rain water.

CHAPTER 7

Market Assessment & Best Option Study

7. Market Assessment and Best Option Study

7.1 Market Assessment and Demand Assessment Study

7.1.1 Introduction

To assess the project requirements and demand we have conducted a market assessment and demand assessment study at micro level (at the existing Bus Terminal and in the neighbouring areas) and at macro level.

7.1.2 Objectives of the Study

The objective of the is to undertake Market Assessment, formulate Real Estate Development Strategy and suggest the best option for the redevelopment of bus terminal at Baramunda, Bhubaneswar. Subsequent to that conduct financial feasibility assessment based on the various options for the product mix for the project.

7.1.3 Scope of Market Assessment Study

The scope of service shall involve two stages. While the stage I will involve market assessment and best option study, the stage II of Market assessment Study shall involve financial viability assessment.

The broad scope of market assessment as follows:

Stage I – Market Assessment Study

a. Assess the real estate potential and trend in the region to establish the demand for commercial/real estate/ any other development at the site.
b. Option analysis of at least three scenarios with different product mix; i.e. commercial/ real estate/ any other development.

Stage II- Financial Viability Assessment

a. Undertake broad financial viability assessment of the various scenarios to ascertain the most financially viable product mix:
b. Absorption rates for each product mix component.
c. Return on Investment, Net Present Value, and Internal Rate of Return including risk and sensitivity analysis.
d. Achievable pricing for different product mix components.
e. Recommendations on the best use option.

7.1.4 Limitations to the Market Assessment Study

a. The interpretation of real estate key trends is based on rapid market survey and with interactions with limited key players in the catchment area of the site i.e. brokers and developers. Hence they are indicative of the situations prevalent at the time of conducting the study.
b. The development market options prescribed in the study are result of our assessment of the indicative demand and supply as could be captured within the time period allotted for the study.
c. The development options prescribed are indicative of what may be most practical, marketable and remunerative for the client. The anticipated returns have been worked out in a realistic mode.

Disclaimer

In most cases, DIMTS has relied on market information, whether from public and private sources, and has ensured to the best of its ability the correctness and the validity of the same, by cross checking from various sources. However, real estate markets in Indian cities continue to be plagued by misinformation, non-disclosure and fragmentation, wherein almost inevitably some information is withheld in every case.

To mitigate this, we have spoken to multiple players in each segment/ area and corroborate the information with data from secondary sources. Whilst every effort has been taken to provide authentic data and analysis, DIMTS or any of its employees are not responsible for any loss, major or minor incurred on the basis of the information and analysis provided or are liable to any damages in any form or shape.

7.2 Approach to the Study

7.2.1 Stage I: Market Assessment and Best Option Study

This stage shall involve market assessment, best option study and real estate development strategy including:

a. Introduction on growth dynamics around the subject site and its regional context, including demographic assessments;
b. Connectivity and Linkages in the study region;
c. Subject-site specific SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis for the proposed re-development

d. Important present and upcoming developments and events those are likely to impact demand for commercial, retail, hospitality, residential and leisure & entertainment development;

e. Present real estate trends and pricing for commercial, retail, hospitality, residential and leisure & entertainment sectors including their occupancy and absorption rates;

f. Demand and supply scenario for the above mentioned real estate sectors in close proximity to the subject site, based on:

- Catchment area analyses
- Projected population growth for area
- Primary surveys of select property brokers / real estate agents, development authority, urban local body, and local planning offices, among others, wherever required.
- Mapping of commercial, retail, hospitality, residential and leisure & entertainment real estate supply.

g. Derivation of various product-mix scenarios for commercial, retail, hospitality, residential and leisure & entertainment development;

7.2.2 Stage II: Financial Feasibility Analysis and Implementation strategy

1. Preparation of Financial Feasibility for the project based on the best option selected and considering the inputs from the Design team
   - Estimation of Revenue based on absorption rates and pricing.
   - Estimation capital expenditure and other expenditures.
   - Phasing of investment based on prioritization of phased elements in the project.
   - Analysis of Financial Feasibility and determine various financial indicators such as IRR, NPV for the project.
   - Sensitivity Analysis by identifying the most critical factors for the project.
2. Implementation strategy
   - EPC Suitability analysis for the Project.
   - Listing down of all approvals and clearances required
   - Risk Analysis and Mitigation

7.3 Bhubaneswar – City Profile

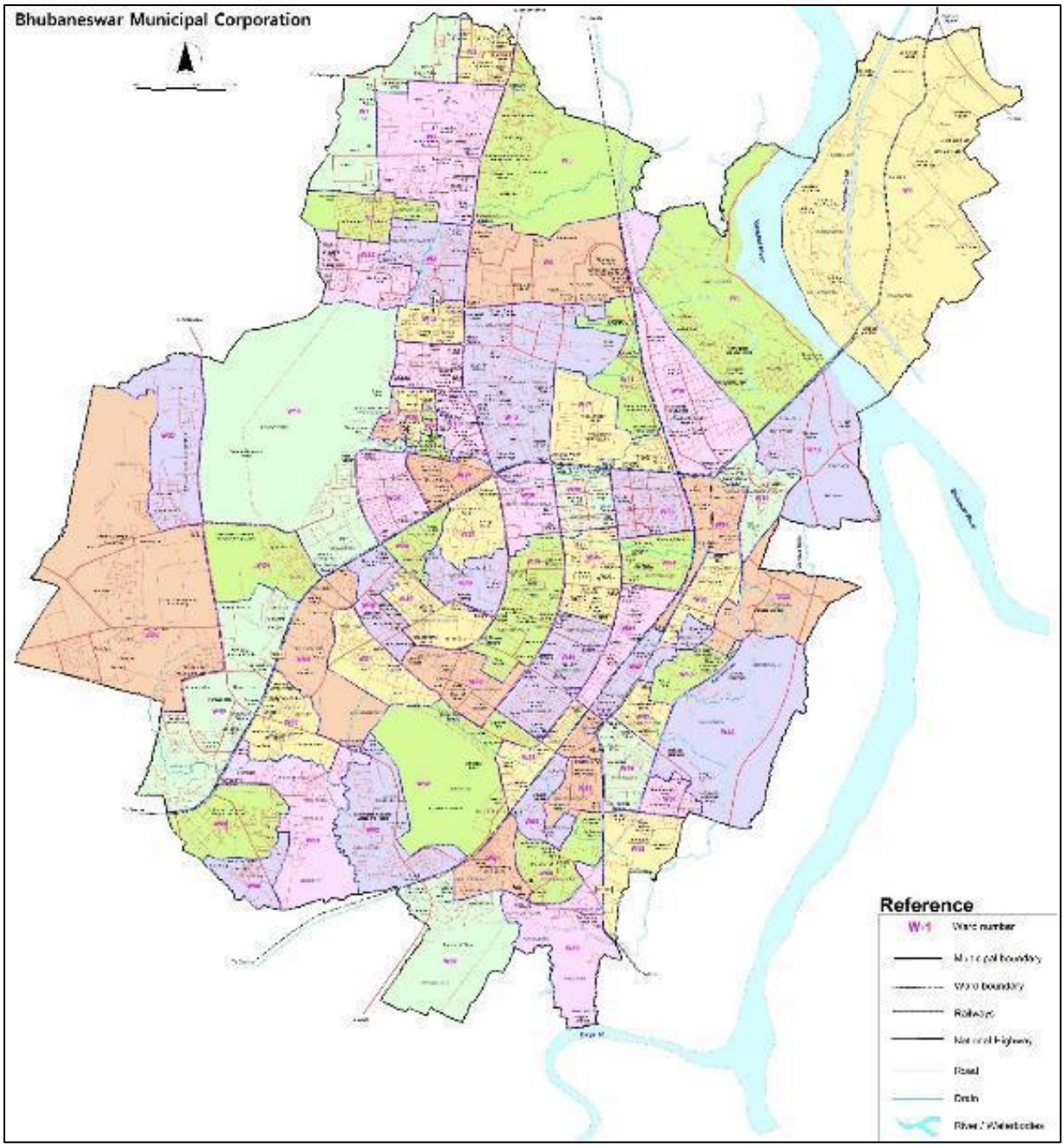


Figure 7-1: Bhubaneswar Boundaries

7.3.1 Economic Profile of the city

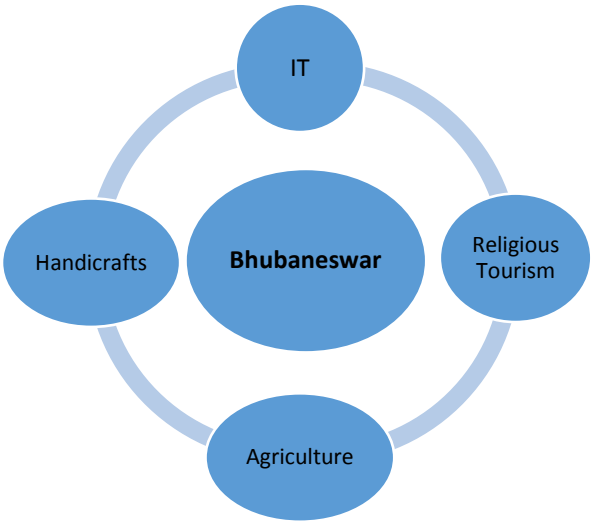
Bhubaneswar after being instated as the capital of Odisha after independence was intended to be developed as an industrial power house owing to large mineral resources. However, the small and medium manufacturing units spurred and later decreased their influence on the city's economy.

After the economic liberalization in 1991, the city received huge investments in IT telecommunication and engineering sectors. Companies like Infosys, TCS etc. have shaped the economy of the region and also the educational preferences in the city. The city has several engineering colleges and institutes that cater to the booming job market in the city. Because of the abundance of iron and other minerals, steel and other manufacturing industries like SAIL, Jindal Steel, Bhushan Steel, TAT group etc have increased the region's economic prominence.

With basic manufacturing industries and development of IT parks and SEZs, Bhubaneswar is starting to gain economic standing with the only disadvantage of floating populace mainly from the neighbouring states like Andhra Pradesh and Jharkhand.

Main economic activities in the city are IT with many employed in software companies like Infosys, Wipro etc. The city is also dependent on basic economic activities like agriculture, horticulture and sericulture. Religious and recreational tourism also form a major source of activity for the citizens of the city indirectly supporting the hospitality industry. With private investment being encouraged by the government, IT parks have sprouted in and around the city attracting foreign interest. In addition, the city has strong industrial and trade activities.

While old industries producing the traditional Oriya handicrafts at large scale are phasing out of business due to stricter pollution norms, several of them have found an alternative business opportunity in the growing electronics industry in the city. In 2005, the city had about 88 industries operating in and around the city with majority of them being small scale. Important industries included electronic goods, textiles, ship buildings, chemicals, cement processing etc.



Endowed with a rich cultural heritage and natural beauty in the form of historical temple sites and national parks respectively in its vicinity, Bhubaneswar attracts approximately 1.7 billion tourists each year. The trade and commercial sectors operate in several pockets of the city in organized and unorganized and informal markets. The products for sale vary from food products to mechanical tools and equipment.

Over the past two decades, Bhubaneshwar has emerged as one of the fastest growing economic hubs of eastern India. The city was ranked among the best places to do business by the World Bank in 2014. Bhubaneswar has been traditionally home to handicrafts industry, including silver filigree work, appliqué work, stone and wood carvings and patta painting, which significantly contributes to the city's economy. Until the 1990s, the economy was dominated by retail and, small and medium scale industries.

7.3.2 Industrial Expansion

Bhubaneswar was intended to house manufacturing plants and industrial units around the city, the city has experienced stunted growth until the economic liberalization. However, the incidence of steel based enterprises has raised the industrial profile of the city and has made Bhubaneswar an important industrial city as well. Following is the snapshot of the industrial profile of the city captured through a survey. Some of the actual industrial setup in Bhubaneshwar are:

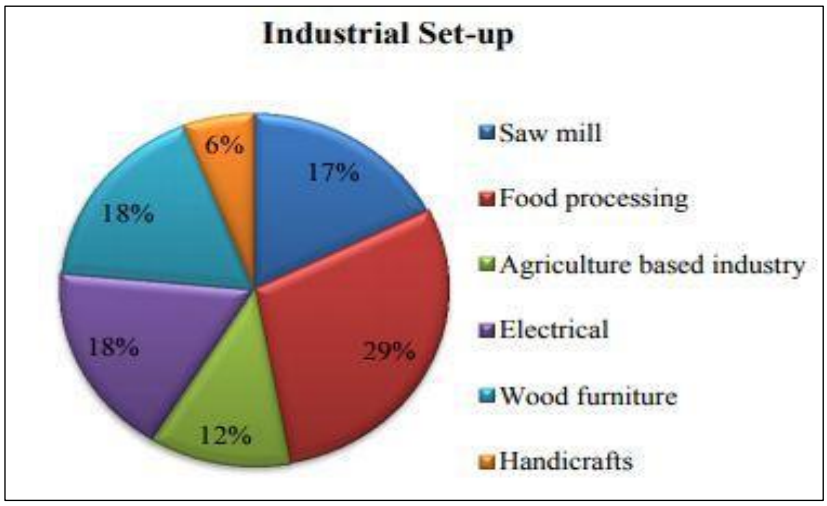


Figure 7-2: Industrial Set-up of Bhubaneswar

The Central Statistical Organisation has estimated the average growth of the Gross State Domestic Product (GSDP) of Odisha for the period 2009 - 10 to 2013 - 14 and 2010 - 11 to 2014 - 15 at around 4.42 per cent and 5.13 per cent, respectively.

7.4 Demographic cum Spatial Growth Information of the city

7.4.1 Demographic Information

Bhubaneswar forms a larger urban conglomerate and is counted as one of the most populous urban areas in India with a total population of 881, 998 persons. The decadal growth of Bhubaneswar has indicated a declining trend with 57.46% in 2001 and 36% in 2011. The jurisdictional area under the Corporation on account of integration of peri-urban area on the city's fringes has undergone several changes. The following table indicates the population demographics under Bhubaneswar Municipal Corporation area.

Table 7-1: Demographic Growth Information

Sl. No.	Year	Population
1.	1951	16512
2.	1961	38211
3.	1971	105491
4.	1981	219211
5.	1991	411542
6.	2001	648032
7.	2011	837737
8.	2012	843,202
9.	2013	858,009
10.	2014	879,211
11.	2015	891,624
12.	2016	905,339

According to 2011 census there are about 465410 males and 372327 females and the current sex ratio is 883 females for 1000 males. The literacy rate of Bhubaneswar is 93%. The present population of Bhubaneshwar in 2017 is estimated to be around 9, 17,766.

The populace density of Bhubaneswar is 2131 persons per square kilometres. The population growth of the city has been really good in the recent years and it has been that as compared to the previous decade, the population has jumped up at a faster pace. The city has been helped by the enormous growth rate of the state and the trend is set to continue in the coming years.

7.4.2 Spatial Growth Trend

Bhubaneswar witnessed rapid development during the past two decades. Analysis of remote sensing data of the years 1990, 2000 and 2009 showed a doubling of built-up land in the area of interest. The map shows that this seems to be due to two effects: firstly, the building up of

formerly unbuilt areas within the city limits; secondly, suburbanization tendencies that lead to the growth of settlements along the bigger roads that lead out of/into town. These are common trends of Indian urbanization. However, what makes Bhubaneswar a special case is the fact that there are wide areas inside the city limits that can be developed into modern urban, densely populated quarters rather than allowing the city to sprawl excessively. As per the satellite image city is growing towards south & south west and north.

Figure 7-3: Spatial Growth Trend

7.5 Land Usage Trends

7.5.1 Status of Land Usage Breakup year 2000, 2005 & 2011

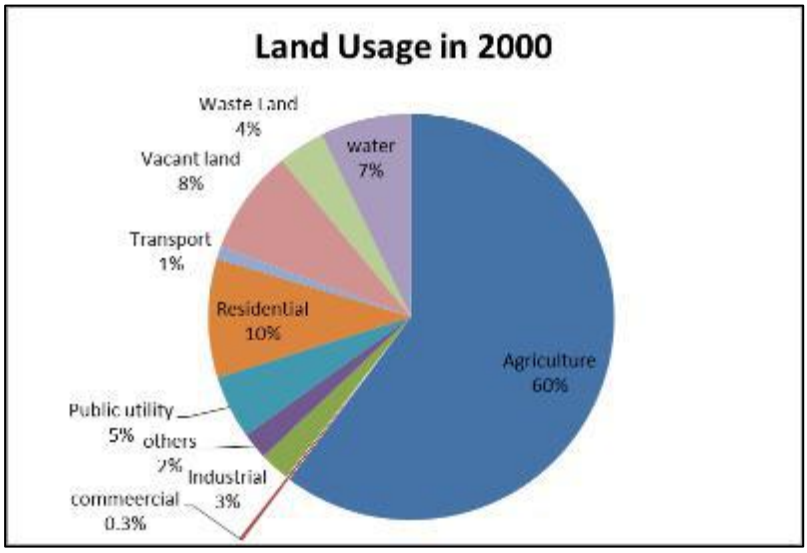


Figure 7-4: Land Usage in 2000

Area of land use in 2000 is shown above. As we can see that agricultural areas contributed the highest areas during this period. Vacant land and residential areas contribute the same areas.

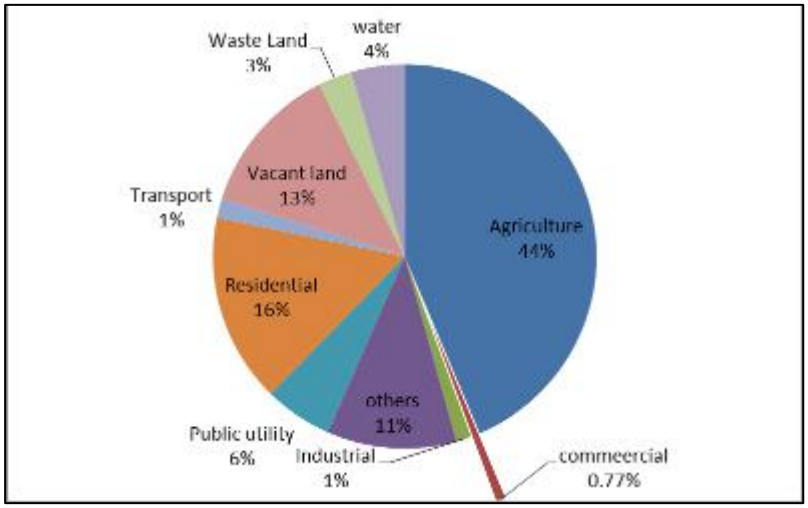


Figure 7-5: Land Usage in 2005

During year 2005, the trend changes in the land use areas. Agricultural areas have a downward trend while there is increase in residential and public utilities.

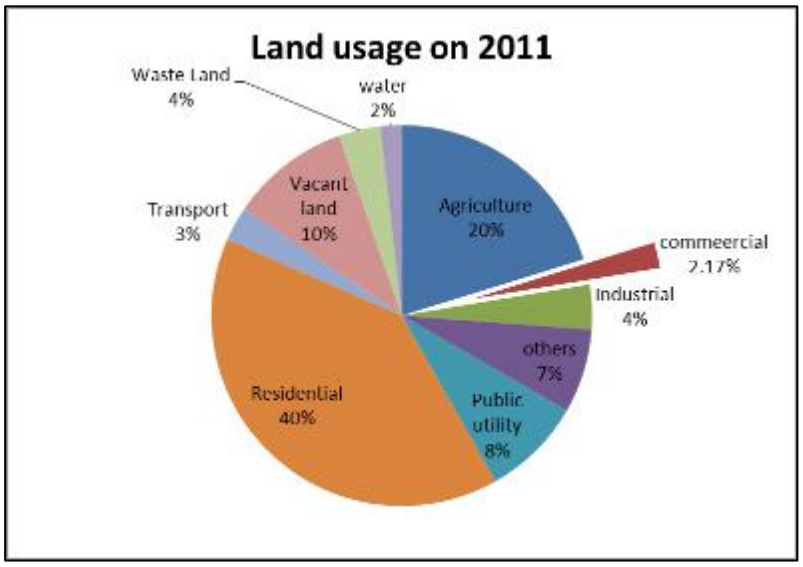


Figure 7-6: Land Usage in 2011

7.5.2 Status of Land Usage

The fast growing population is creating sprawl effect in the adjacent agricultural and others vacant land. Thus the city is experiencing haphazard growth and leads to increasing pressure on open land, agricultural lands and urban infrastructural facilities. The demand for land within the fringe areas and peri-urban areas of Bhubaneswar Municipal Corporation (BMC) is growing as more and people prefer to live in the areas adjacent to the main city. As a result land value is gradually getting higher. It is also observed that the nature of land use is mixed in general in most part of the city. The functions like trade and commerce, open spaces, recreational areas, agriculture and industries etc. are encroaching upon the existing areas of residential and other such purposes.

The land use map of 1972 and 2014 visualize the drastic change in land use pattern. The open land of the western part decreased drastically and the built up areas in the entire city area has been increased noticeably. To understand the pattern of urban built up area the gradient approach is adopted for a circular region of 9 km radius from the centre dividing it into concentric zones of incrementing radii of 1 km. This visualize the land use changes at every 1 km distance. This also helped in identifying the causal factors and the degree of urbanization (in response to the economic, social and political forces) at local levels and visualizing the forms of urban sprawl. The spatial built up density in each circle is monitored through regression analysis for the year 2014.

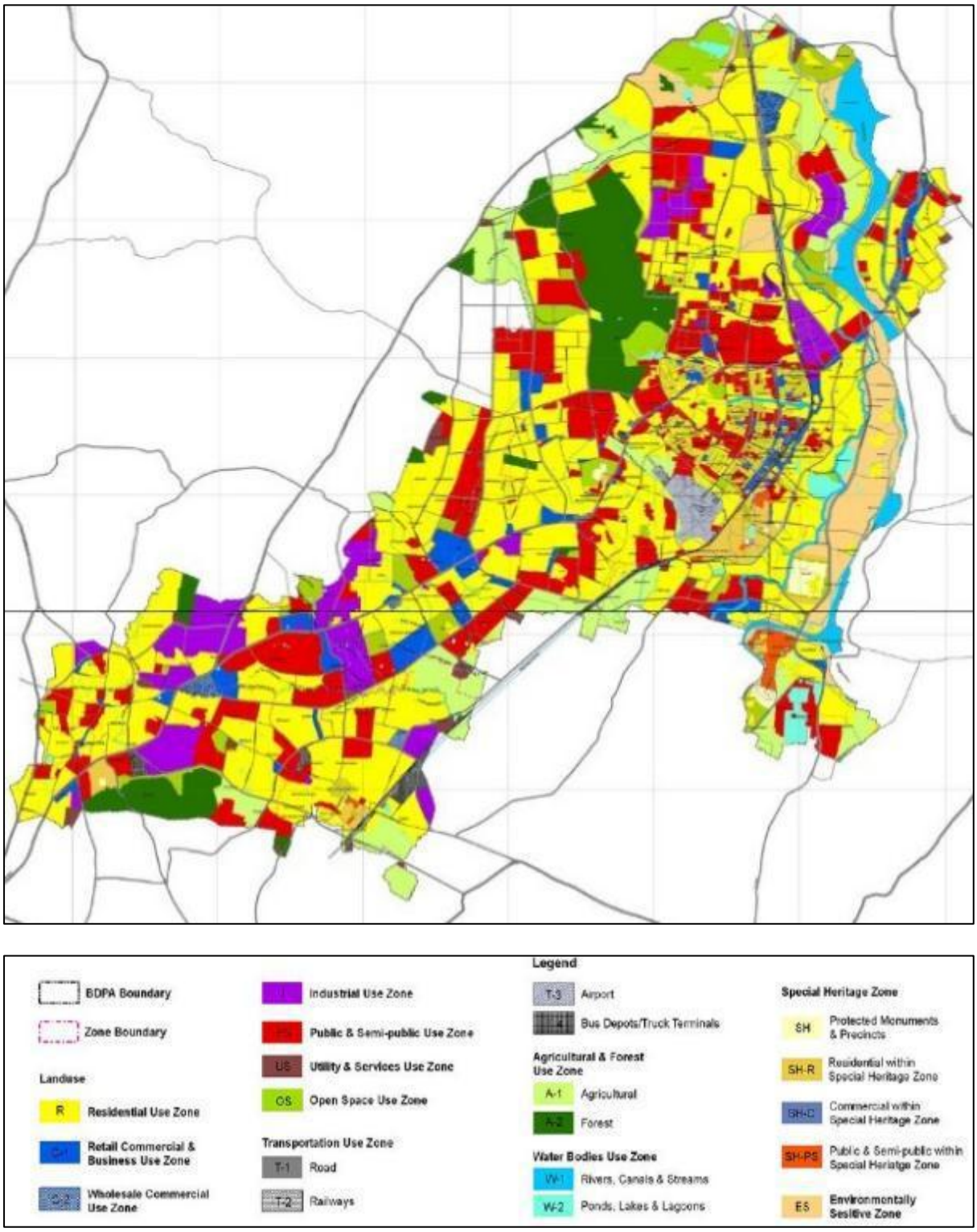


Figure 7-7: Land-use Map of Bhubaneswar

7.6 Project Site Analysis

The site has been studied in the context of its neighbourhood, type of developments and growth trends in the area, its connectivity and its potential to become a successful destination.

Site location and analysis in terms of available linkages and connectivity to other areas in the city, available infrastructure, neighbourhood developments and characteristics and suitability for development are the important aspects of site location analysis.

Figure 7-8: Satellite View of the Site

7.6.1 Study Region Location

The site extent for the proposed development shall be of approximately 15.5 acre parcel, as shown in the above figure. The site is located close to NH 16 and is located towards its west. The region is well connected by road and also well connected to other established prominent areas of Bhubaneswar.

7.6.2 Neighbourhood & Linkage

Subject site can be easily accessed from major transport nodes, such as Town Bus stand, Bhubaneswar Railway station & Biju Pattnaik International Airport. Popular Lingaraj Temple of Bhubaneshwar is located in close proximity of 8 Km to subject site. Also, Bhubaneshwar is educational hub for famous institutes like IMI, IIIT Bhubaneshwar and new campus of IIT Bhubaneswar.

Table 7-2: Neighbouring Landmarks

Sl. No.	Landmarks	Approximate distance from site (in km.)
1	Railway Station	8
2	Airport	6
3	Lingaraj Temple	8.5
4	IIT	24
5	IMI	8.3
6	Mukteshwara Temple	8
7	ISKCON Temple	3
8	Kalinga stadium	4.5
9	Odissi Research Centre	6
10	Rajrani Temple	8.5
11	Nandankanan Zoological Park	16
12	Rupali Square	7
13	Jaydev Vihar	5.5
14	Chandrashekharpur	9.4
15	Raj Mahal	7
16	Master Canteen	8
17	Vani Vihar	7
18	Sriya Square	8
19	Ram Mandir Square	8
20	Rasulgarh Chhak	9.5
21	Nayapalli	3.5
22	City Centre	8.5

7.6.3 Catchment Profile

The catchment for any particular site is seen as the potential population that is likely to visit the site. This will vary in quantum for residential / township development, commercial development and retail development as each of the usages define their own areas of influence. Generally the catchments of retail developments are the smallest and have the minimum travel time, followed by catchments for place of work and then residential. As a township, the site can be considered to have the entire city as its catchment. So is the case with this as a work place destination since it is within 20-35 minutes driving time from most parts of the city.

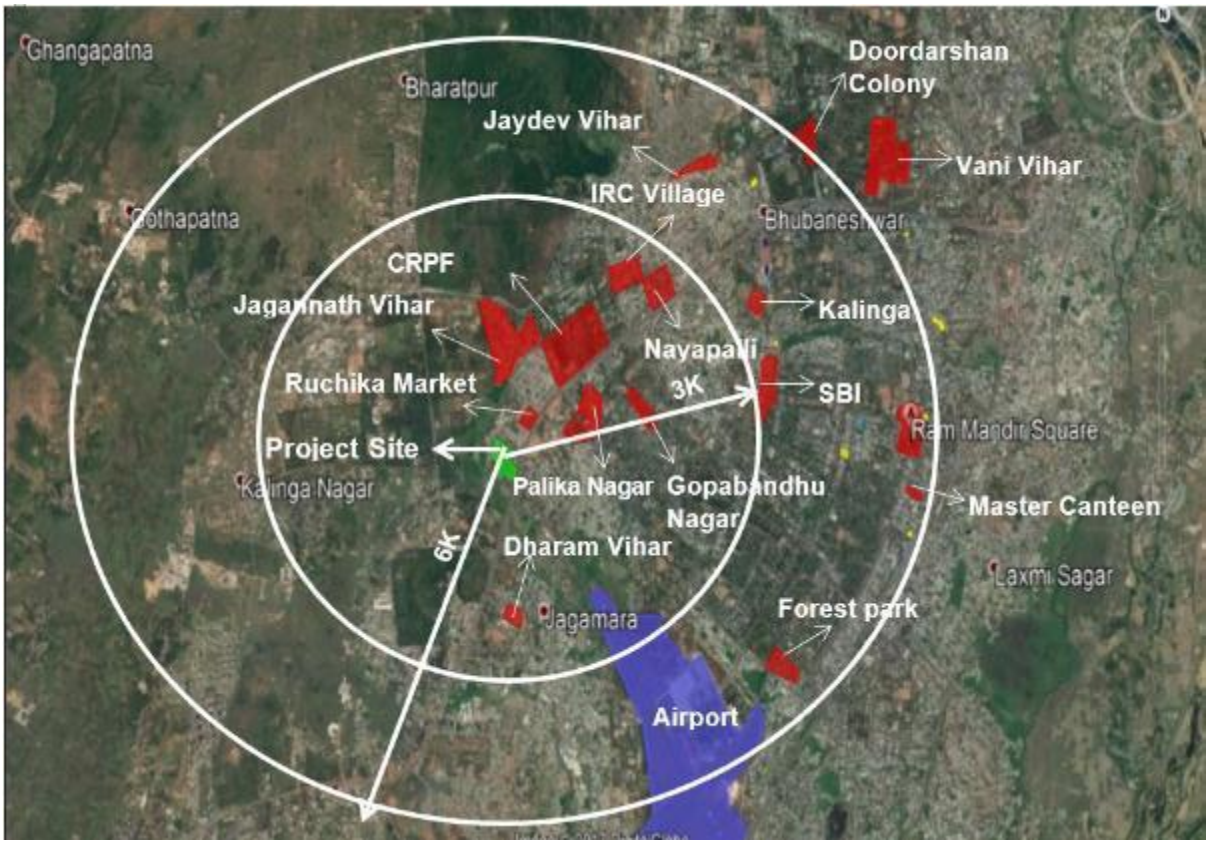


Figure 7-9: Catchment Area

The primary catchment retail is considered within a distance of 3km from the subject site which is about 5-15 minutes driving time. Within this zone the areas include Nayapalli, Jagannath Vihar, IRC Village, Survey of India, etc. The secondary catchment lies within a distance of 6km (which corresponds to 20-25 minutes of driving time), which will include Arya Village, Mancheshwar, Forest Park, Acharya Vihar, Janpath, Bapuji Nagar, etc.

7.6.4 SWOT Analysis

Strengths	Weaknesses
a. Well connected with roads. b. Vicinity of NH 16 c. Both side station entrance. d. Growing average no. of passengers. e. Large contiguous land parcel	a. Far from the city centre b. Low Parking Space for Four Wheelers c. Poor circulation of buses d. Unorganized retail outlets
Opportunities	**Threats**

Strengths	Weaknesses
a. Scope of higher Adda Fee b. Well-designed organized retail commands premium	a. Presence of Bus Operations Unions b. Rental Appreciation may be less.

7.7 Macro Real Estate Market Trends

7.7.1 Introduction

Being the capital city of Odisha, Bhubaneswar has attracted a lot of attention due to its expanding industrial belt. However it's the realty sector here that's gotten everyone talking. Infrastructural developments and completion of various realty projects are leading to the growth of Bhubaneswar's realty market.

The recent realty developments have been attributed to the presence of many IT companies, reputed educational institutions and health-care units. Physical infrastructure too has played a pivotal role in ensuring the demand remains consistent. Localities like Patrapada and Khandagiri have emerged as the most preferred residential hotspots. The presence of many schools and colleges here has attracted a pool of students who are now showing a keen interest in renting out spaces here, thus creating a robust rental market.

Upcoming corridors like the Jatni Road and neighbourhoods along the Khordha and Bhubaneswar stretch have witnessed a lot of realty related developments. The upcoming IT office spaces and campuses of many reputed educational institutions have encouraged growth in the region. Property developers are now purchasing large tracts of land to come up with residential projects and gated communities. On an average, flats for sale in Bhubaneswar especially along these stretches are cited to cost anywhere between INR 2,700 and INR 3,200 per square feet.

Despite being an end-user driven market, the region's realty sector is fast moving towards becoming a favourable destination for investors. With over 80% of the realty demand coming from working professionals, investors are purchasing inventories in large number only to let them out on rent. Apart from just rental returns, high return on investment is another factor that is luring many investors to Bhubaneswar. The existence of many affordable plots across many suburbs has enticed many second time home buyers and several offshore investors to purchase residential plots here. Localities like Oltapur, Dasapur and Laxmi Vrundavan offer plots for as low as INR 6 lakhs.

7.7.2 Land Value

The land rates mentioned below constitute residential as well as prime commercial parcels with good frontage and accessibility.

Table 7-3: Land value trend as per the distance from the site

Sl. No.	Location	Area (sqft.)	Rates. (Rs. per sqft)	Distance from site (in km.)	Remarks
1	VSS Nagar (3.4 km)	16000	3000	3.4	
2	Dumduma (3.5 km)	3500	2200	3.5	Residential Land
3	Nayapalli (6.5 km)	2268	4400	6.5	Commercial land
4	ITER College lane 4 (8 km)	1313	2700	8	Residential Land
5	Andharua (9 km)	1600	500	9	
6	Jayadurga (9.4 km)	5100	5900	9.4	
7	Badaraghunathpur (9.5 km)	2400	500	9.5	Agricultural Land
8	Chandrashekharpur (10 km)	2416	12000	10	Commercial land
9	Chandrashekharpur (10 km)	3270	4880	10	Residential Land
10	Rasulgarh (10 km)	1500	1450	10	

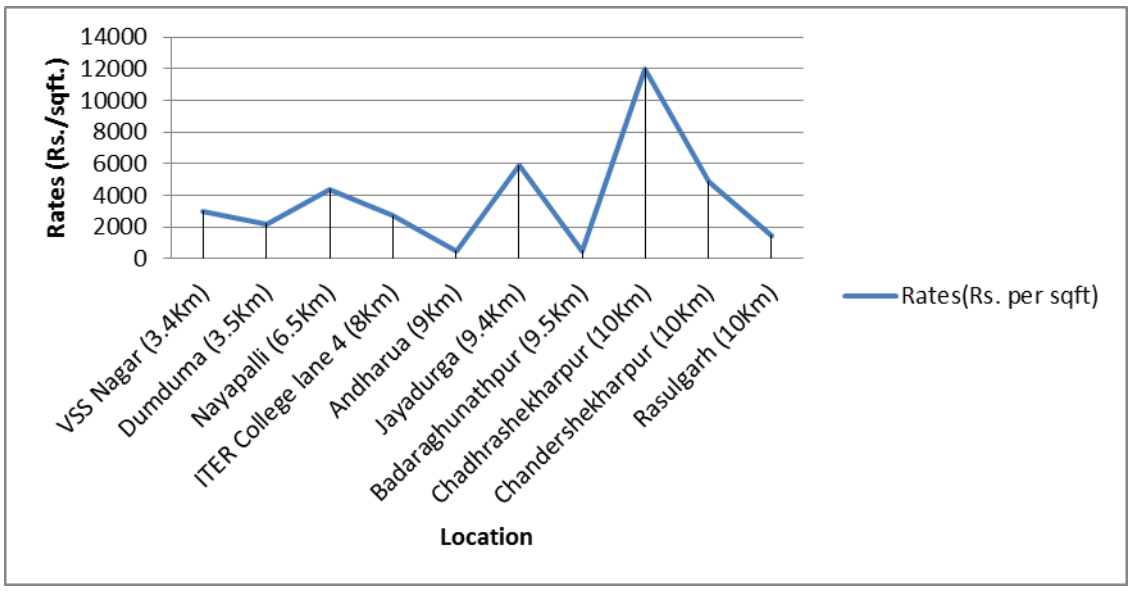


Figure 7-10: Land value trend as per the distance from the site

7.7.3 Commercial Real Estate Trend

Bhubaneshwar has witnessed a remarkable growth in real estate business, thanks to a predominantly Tourism-driven industry and the retail industry growth over the last few years spurring commercial activity. The real estate prices have however spiralled only in some hotspots of the city, in other parts both in terms of off take and value, a flat growth is witnessed. A few of the industry segments like Hospitality companies, other industrial activities and retail businesses are spurring fresh activity in the city. There is a significant boom in the retail sector,

with a number of organized shopping district coming in; and presence of existing malls as well, which is triggered by the growth in retail business compared to other cities.

7.7.4 Organised Commercial Areas/ Places

Bhubaneshwar is also progressing towards a mall culture, and has witnessed many retail malls including Forum Mall, Bhawani Mall, Pal Heights Mall, The World, Central, etc.

Table 7-4: Mall Information

Sl. No.	Name	Distance from Project site (in km.)	Occupancy (in %)	Rental Rates (in Rs. /sq. ft.)
1.	Pal Heights Mall	5.4	90+	100-120
2.	The World	5.8	90+	90-120
3.	Central	6.3	90+	100-120
4.	Bhubaneshwar One	7.3	90+	70-100
5.	INOX Bhawani	8	90+	70-100
6.	Bhubaneshwar Central	8	90+	100-120
7.	Forum Mall	8.6	90+	110-130
8.	OSRTC Mall	9	90+	70-100

7.8 Tourism Business

Bhubaneshwar with a plethora of local attractions of historical and cultural significance, remains one of the leading tourist destinations in the country.

With regards to hotel performance, the hotels in the Luxury segment continue to thrive of both occupancies and average rates. Moreover, due to burgeoning middle class, the upscale and mid- scale hotels have witnessed a steady increase in occupancy, albeit with correspondingly muted average rates. While the Leisure segment is the primary demand generator for the hotels, the city's reputation as wedding destination as well as suitable location for small conferences and commercial events has resulted in the growth of the Meetings and Conferences demand.

Given the subdued anticipated supply tracked for the next five years and the small base of existing quality accommodation, Bhubaneshwar presents excellent opportunities for investment in the mid- scale space.

Table 7-5: Major Hotels present within and outside the catchment

Sl. No.	Hotel Name	Tariff/day	Distance from site	Category
1	Hotel Retreat	1000	0.5 km	Budget
2	Hotel Trident	9500	7 km	5 star

Sl. No.	Hotel Name	Tariff/day	Distance from site	Category
3	Hotel Hindustan	5000	16 km	4 star
4	Hotel Pal Heights	3600	5 km	3star
5	Hotel Pushpak	2600	7 km	2 star
6	Ginger Hotel	3000	6 km	3 Star
7	Hotel Excellency	2200	10 km	2 Star
8	Hotel Urmee	10000	8 km	Budget
9	Hotel Arvind Inn	1500	6 km	Budget
10	Hotel Rajdhani	750	12 km	Budget
11	Mango Hotel Prangan	2500	8 km	2 Star
12	Mayfair Lagoon	10000	6 km	5 Star
13	Hotel Kalinga Ashok	2500	7 km	3 Star
14	VITS Hotel	3000	10 km	3 Star

CHAPTER 8

Financial Assessment

8. Financial Assessment

8.1 Development Options

8.1.1 Introduction

Based on the preliminary investigations in the micro-market and the overall developments that are expected in the city as a whole, a tentative product mix has been derived. It has been observed that the most common type of property development that may be successful consists of small format retail office and Commercial Shopping Complex.

8.1.2 Product Mix Options

The following option derivation takes into account the pros and cons, positioning as per the market trends and the micro market activity level:

a. Retail development
b. Leisure and entertainment development
c. Other Amenities and facilities

8.1.2.1 Mall & Entertainment Multiplex

There are multiple retail malls in the city. Government owned malls like OSRTC mall, Bhawani Mall are also present. In last few years about five malls have come and are located within catchment area of 5 km. Some of these malls are co-located with the cinemas like INOX and etc.

The introduction of a multiplex along with the Mall will also provide a good image and recognition to the site. Therefore, a multiplex on the site can be a potential value adding resource and should be incorporated in the development along with the mall.

8.1.2.2 Food courts/ Restaurants

The catchment area does not boast of branded high quality food destinations. Restaurant or a food court is a desired activity in the development but cannot sustain as a stand-alone activity. Therefore it is important to integrate this activity with shopping mall and multiplex.

These entertainment and retail activities will attract footfalls, which will automatically be diverted to the food courts.

8.2 Commercial Area and Tentative Product Mix

As detailed out in the previous chapters the site is classified in 2 parts the terminal building and the commercial building. The Terminal Building is proposed to be developed with G+2 structure. The land for commercial development is proposed to be developed with a G+2 structure.

The Commercial Areas their usage and assessed usage is provided in the table below:

Table 8-1: Commercial Areas and Usage

Terminal Area (G+2)		Commercial Area	Usage
Ground Floor (Stilt)		702 sqm	Shops
Ground Floor Kiosks		513sqm	Kiosks
First floor (food court)		2108 sqm	Food Court
Second floor		-	Rest Rooms & Admin office
Total		**3323sqm**	
Commercial Area (G+2)			
Ground Floor		1000sqm	Retail
First floor		5796 sqm	Retail + Restaurant
Second Floor		4935sqm	Office/ Retail
Total		**11731sqm**	

8.3 Cost Estimation

8.3.1.1 Block Cost Estimate

As provided in the earlier chapters, the block cost of the project is given below:

Table 8-2: Terminal Block Cost

Sl. No.	Description	Amount
A) Civil & Finishing Works		
1	Dismantling	1,21,45,608
2	Earth Work	3,72,81,442
3	Concrete Work	89,61,279
4	RCC Work	39,87,85,464
5	Brick Work	2,22,87,357
6	Finishing Work	1,68,78,863
7	Roofing Works	2,49,34,542
8	Flooring	4,71,19,217
9	Steel Works	1,38,79,844
10	Wooden Works	84,52,970
11	Aluminium Works	59,82,662
12	Water Supply	1,50,07,725
13	Sanitary Installations	3,38,14,168
14	Road Work	8,91,24,534
15	Horticulture	7,90,800
16	Sewerage & Storm Water System	4,35,61,071
17	Canopy	3,06,47,955
18	Tube Well	6,63,416
19	Rain Water Harvesting	42,59,838
20	Miscellaneous Works	12,88,09,911
	Sub Total (A)	**94,33,88,665**
B) Services Work		
1	Internal Electrical	4,29,93,953
2	Electrical Substation	6,90,56,435
3	Fire Detection Alarm System	46,94,640
4	Fire Fighting System	1,36,06,322
5	Passenger Information Display System	85,87,696
6	Public Address System	37,31,508
7	Parking Management System	84,49,061
8	CCTV System	31,96,509
9	Water Treatment System	56,12,347
10	Solar Power System	1,55,13,784
11	HVAC System	15,17,29,486
12	Sewage Treatment Plant	2,30,00,000
13	Elevators and Escalators	2,44,23,125
14	BMS System	56,59,113
15	Electrical Energy Connection Installation	50,00,000
	Sub Total (B)	**38,52,53,979**
C) Utility Shifting		1,00,00,000
	Sub Total (C)	**1,00,00,000**
	TOTAL(A+B+C)	**1,33,86,42,644**
	Add Project Contingencies @ 1%	**1,33,86,426**

Sl. No.	Description	Amount
	Add Quality @ 1%	**1,33,86,426**
	Add GST @ 12%	**16,06,37,117**
	Add 10% Pro-rata	**13,38,64,264**
	GRAND TOTAL	**1,65,99,16,878**

The total project cost including Interest during construction (IDC) component is estimated at Rs 178.62 crores.

8.4 Assumptions for Financial Viability Assessment

8.4.1 Inputs for revenue estimation

Rentals taken for commercial assessment are provided in the following table:

Table 8-3: Rental Assumptions for Commercial Areas

Terminal Area (G+2)	Rentals (Rs/sqft/month)	Commercial Area	Usage
Ground Floor (Stilt)	125	702 sqm	Shops
Ground Floor Kiosks	125	513 sqm	Kiosks
First floor (food court)	70	2108 sqm	Food Court
Total		**3323 sqm**	
Commercial Area(G+2)			
Ground Floor	90	1000 sqm	Retail
First floor	60	5796 sqm	Retail + Restaurant
Second Floor	40	4935 sqm	Office/ Retail
Total		**11731 sqm**	

Other inputs assumed for revenue estimate are given below:

Table 8-4: Other revenue assumptions

Sl. No.	Assumptions	Unit	Value
1	Increase in rentals	%	15% every 3 years
2	Revenues from advertisement, parking and kiosks	% of total revenues	5%

Charges from Bus operators at actual shall be / can be added in above revenue as applicable

8.4.2 Inputs for Operations and Maintenance (O&M) Cost Estimation

The table below provides the inputs to the O&M cost estimates the project.

Table 8-5: O&M Cost Assumptions

Sl. No.	Assumptions	Unit	Value
1	O&M cost for bus terminal	% of capital cost	0.05
2	Increase in O&M cost for bus terminal	%	5% p.a.
3	O&M cost for commercial space	%	Cost neutral with O&M charges from leaseholder
4	Other cost for Commercial Space (marketing, asset management, insurance, property tax etc.) as % of rentals	%	0.05

8.5 Financial Assumptions

The table below provides the financial assumption inputs for estimation of project viability:

Table 8-6: Financial Assumptions

Sl. No.	Assumptions	Unit	Value
1	Years for Construction	No. of years	2
2	Max Depreciation Rate for Accounts - SLM	%	95%
3	Max Depreciation Rate for Taxation - WDV	%	100%
4	Debt	%	60%
5	Equity	%	40%
6	Long Term Loan Interest Rate	%	13%
7	Repayment Period	Years	10
8	Corporate Tax	%	34%
9	MAT	%	20%

8.6 Financial Viability

The financial viability of the project has been estimated for a period of 30 years.

Assessment of Project IRR and NPV for the project (Net Surplus estimated @18% IRR)

Bus Terminal Component	
Base cost of bus terminal and commercial	Rs 165.99 crores
Total Cost of Project including IDC	Rs 178.62 crores
Project IRR for a 30 year estimation period	6.01%
Equity IRR for a 30 year estimation period	4.96%
Net Gap for an Equity IRR of 18%	Rs 72.30 crores

Table 8-7: Revenue Projections for 30 Years

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Rentals inside the bus terminal	Rs Lakhs	445	445	445	512	512	512	588	588	588	676	676
Rentals for commercial building	Rs. Lakhs	566	660	849	1085	1085	1085	1248	1248	1248	1435	1435
Revenues from Advertisement, Parking and Kiosks	Rs Lakhs	22	22	22	26	26	26	29	29	29	34	34
Total Revenues	Rs Lakhs	**1033**	**1127**	**1316**	**1622**	**1622**	**1622**	**1865**	**1865**	**1865**	**2145**	**2145**

		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Rentals inside the bus terminal	Rs Lakhs	676	778	778	778	895	895	895	1029	1029	1029
Rentals for commercial building	Rs. Lakhs	1435	1650	1650	1650	1898	1898	1898	2182	2182	2182
Revenues from Advertisement, Parking and Kiosks	Rs Lakhs	34	39	39	39	45	45	45	51	51	51

		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Total Revenues	Rs Lakhs	**2145**	**2467**	**2467**	**2467**	**2837**	**2837**	**2837**	**3263**	**3263**	**3263**

		2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Rentals inside the bus terminal	Rs Lakhs	1183	1183	1183	1361	1361	1361	1565	1565	1565	1799
Rentals for commercial building	Rs. Lakhs	2510	2510	2510	2886	2886	2886	3319	3319	3319	3817
Revenues from Advertisement, Parking and Kiosks	Rs Lakhs	59	59	59	68	68	68	78	78	78	90
Total Revenues	Rs Lakhs	**3752**	**3752**	**3752**	**4315**	**4315**	**4315**	**4962**	**4962**	**4962**	**5706**

Table 8-8: Operational Expenditure for 30 Years

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost of Maintenance of Bus Depot	Rs lakhs	362	380	399	419	440	461	485	509	534	561	589

		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Cost of Maintenance of Bus Depot	Rs lakhs	618	649	682	716	752	789	829	870	914	959

		2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Cost of Maintenance of Bus Depot	Rs lakhs	1007	1058	1111	1166	1224	1286	1350	1417	1488	1563

CHAPTER 9

Implementation Plan

9. Implementation Plan

The project is proposed to be implemented on Engineering, Procurement and Construction (EPC) mode.

The EPC Contactor would be required to undertake detailed designs and prepare a comprehensive Project Implementation Plan (PIP).

This plan should envisage

a) Traffic Control and Safety

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the road under improvement.

b) Precautions from Construction Operations

The contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor shall also comply with the national Building Code for this purpose.

Other precautionary measures to be taken in to account by the Contractor as a part of the EPC contract have been detailed and listed in the RFP document.

Annexure - 3(A)

Bhubaneswar Development Authority
Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar
Bus Count and OD Survey

Road:
Location :
Direction **Entry** ____ **Exit** ____
Weather: Fine/Cloudy/Rainy

Name of Enumerator:
Shift No.:
Date & Day:
Sheet No.:

Sr. No	Time (Hr : min)	Bus Type								Vehicle Registration Number	Origin	Destination	Occupancy	
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%
		1	Mini Bus	3	Govt.Inter City Bus	5	Pvt. City Bus	7	Pvt. Inter State Bus				25%	75%
		2	Govt.City Bus	4	Govt. Inter State Bus	6	Pvt. Inter City Bus	8	Others				50%	100%

Annexure - 3(B)

Bhubaneswar Development Authority
Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar
Passenger Count Survey

Name & Sign of the Enumerator:

Terminal: **Date:**
Location : **Sheet :**
Gate No. : **Landmark:** **Shift:**

Time Period	In	Out
.00 to .15		
.15 to .30		
.30 to .45		
.45 to .00		
.00 to .15		
.15 to .30		
.30 to .45		
.45 to .00		

DIMTS LTD. Name of the Supervisor:

Bhubaneswar Development Authority

Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar

ORIGIN DESTINATION SURVEY (COMMUTER SURVEY AT BUS TERMINAL)

Location:
Platform No.:
Weather: Fine/Cloudy/Rainy

Name of Enumerator:
Shift:
Date:

				1	2	3	4				5				6	7		8		
Sl. No.	Bus Type		Boarding/ Alighting	Origin	Destination	Time Spent at Bus Stop (min.)	Purpose				Mode Choice (Access/ Dispersal)				Visitors to Pick/Drop	Facilities preference		Income/ Month levels		
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				
	1	Mini Bus		Area:	Area:	0-10	1	Work	8	Health	1	2 Wheeler	7	Govt. City Bus		1	Food outlet	1	High	Above 30000
	2	Govt.City Bus				10-20	2	Business	9	Home	2	Car	8	Govt. Inter City Bus		2	Drinking Facilities	2	Medium	20k - 30K
	3	Govt.Inter City Bus				20-30	3	Education	10	Others	3	Taxi	9	Pvt.City Bus		3	Seprate toilets	3	Low	10k to 20K
	4	Govt Inter State Bus		District:	District:	30-45	4	Social			4	Auto	10	Pvt.Inter City Bus		4	Seating area	4	Very Low	lessthan 10K
	5	Pvt. City Bus				45-60	5	Shopping			5	Shared Auto	11	Cycle		5	Waiting room			
	6	Pvt. Inter City Bus				>60	6	Tourism			6	Mini Bus	12	Cycle Rickshaw		6	Porter service			
	7	Pvt. Inter State Bus					7	Religious					13	Walk		7				

Name of Surveyor & Signature: **Name of Supervisor & Signature:**

Annexure - 3(C)

Bhubaneswar Development Authority

Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar

Parking Accumulation

Location : **Date :**

Landmark: **Sheet No :**

Time: From To

Time Period	Cars	2- Wheeler	Auto & Vikram	Tata Magic	Cycle Rickshaw	Cycle
	1	2	3	4	5	6
Total						
Total						

Sign of Supervisor:

Annexure - 3(D)

Bhubaneswar Development Authority

Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar

Bus Terminal Survey

Name of the Interviewer :	Zone :
Date of Interview :	Sheet :

A) Identification of Location:

1. Name & Address: _____

2. Type

Inter-City	Intra-city	Inter-State	Intra -State

3. Abutting Land Us

Residential	Commercial	Public/Semi-publi	Industrial	Institutional	Parks & Open Spaces

Others (Specify)

4. Number of Entries & Exits to the Site

Vehicles Type	Entries	Exits
Buses		
2-Wheeler		
Car / Jeeps		
Cycles		
Auto		
Others		

B) Physical Details

1. Site Area _____ Sq. m
2. Built up Area (Floor Area) _____ Sq. m
3. Hard Standing _____ Sq. m
4. BQS _____ Sq. m

5. Land Use (Sq.m)
   - i) Loading & Unloading Area _____
   - ii) Repair and Servicing _____
   - iii) Idle Parking _____
   - iv) Utilities & Services _____
   - v) Circulation _____
   - vi) Others (Specify) _____

6. Use Details of Built up Area (Sq.m.)
   - i) Godown/Stage _____
   - ii) Total Built up Area _____
   - iii) Commercial _____
   - iv) Offices _____
   - v) Others (Specify) _____

7. Passenger Facilities

Wash Rooms (Gents)	Wash Rooms (Ladies)	Drinking Water	Shops	Canteen	Wating Rooms	Enquiry Office

Ticketing Advance Booking	Ticketing Booths	Time Table Boards	Fire Fighting Equipments	Police Control Office	Lost and Found Offices	Security Arrangement

Public Address System	Estate Maneger Office	Traffic Control System	Lighting System	Clock Room	Crew Facilities	Others

C) Operational Details

1. Passengers handled every day at the terminal

Incoming	Outgoing

2. Potential for Commercial exploitation

Offices	Shops	Commercial Establishment	Hotels	Others

3. Details of daily bus movement into the Terminal

(To be collected from records of Terminal or by conducting Primary survey at entry/exit points)

Time	IN	OUT
	Number	Number

Time	IN	OUT
	Number	Number

4. Terminal Entry fee (Rs.)

LCV | HCV | Others (specify)

5. Parking fee

Vehicle Type	DAY TIME		NIGHT TIME	
	Rupees	Duration (hrs.)	Rupees	Duration (hrs.)
LCV				
HCV				
Car/Jeep				
2-Wheeler				
Cycle				
Others (specify)				

6.Capicty of Terminal

No. of Buses per Day	No. of Bus Bay	No. of Places for Idle Parking of Buses	Passenger Alighting	Passenger Boarding

7. Time of Vehicles

Dwell Time						
Buses	Taxis	2-Wheeler	Car / Jeeps	Cycles Rickshaws	Auto	Others
Idle Parking awaiting Time						
Night Time Parking						

D) Financial Details

1. Captal Cost of Terminal (Lakh Rupees) _____
2. Maintenance Cost (Lakh Rupees) _____
3. Monthly Revenues (Rupees)

Rental | Entry Fee | Other (Specity)

Advertisement | Parking Fee

E) Management Details

1. Ownership _____
2. Management Structure _____
3. No. of Employees

_____

Annexure - 6(A)

TITLE : DAILY WATER REQUIREMENT AND STORAGE FORPROPOSED INTER STATE BUS TERMINAL (ISBT) AT BARMUNDA, BHUBANESHWAR										
DESCRIPTION	COVERED AREA IN SQ MTR	POPULATION BASIS	POPULATION	BASIS OF TOTAL WATER REQUIREMENT		TOTAL WATER REQUIREMENT	BASIS OF WATER REQUIRED		WATER REQUIRED	
							DOMESTIC	FLUSHING	DOMESTIC	FLUSHING
							@ %	@ %	Ltrs	Ltrs
A) DAILY WATER REQUIREMENT										
FOR TERMINAL PASSENGER										
PARKING	-	NBC clause 4.1.2 and 4.1.3	78000	25	lts/person	1950000.00	60	40	1170000.00	780,000.00
B) DAILY WATER REQUIREMENT										
FOR TERMINAL (OFFICES AND STAFF)	5400	1person/10sqm	590.0	45	lts/person	26550.00	60	40	15930.00	10,620.00
										-
C) DAILY WATER REQUIREMENT										
FOR ISBT COMMERCIAL	10575	1person/10sqm	1077.50	25	lts/person	26937.50	60	40	16162.50	10,775.00
RETAIL & OFFICES										
D) DAILY WATER REQUIREMENT	4381.00	1person/3sqm	926	70	lts/person	64834.00	60	40	38900.40	25,933.60
FOR RESTAURANTS										
E) DAILY WATER REQUIREMENT										
FOR BUDGET HOTELS	90	2person/room	180	180	lts/person	32400.00	60	40	19440.00	12,960.00
	(ROOMS)									
BUDGET HOTEL STAFF	50	50	50	180	lts/person	9000.00	60	40	5400.00	3,600.00
TOTAL DAILY WATER DEMAND										
					SAY	**2109721.50**			1265832.90	843888.60

TOTAL DAILY WATER DEMAND											
a) DOMESTIC USE	*1,265,833*	*LTRS.*									
b) FLUSHING USE	*843,889*	*LTRS.*									
C) LANDSCAPING	*20,000*	*LTRS.*									
GRAND TOTAL	***2,129,722***	*LTRS.*									
B) SEWAGE FLOW											
DESCRIPTION	*DOMESTIC USE*	*FLUSHING USE*									
TOTAL DAILY REQUIREMENT IN LTRS.	*1,265,833*	*843,889*									
RATE OF FLOW TO SEWER	*@ 80%*	*@ 100%*									
FLOW TO SEWER IN LTRS./DAY	*1012666.32*	*843,889*									
TOTAL SEWAGE FLOW IN LTRS./DAY		*1,856,555*									
CAPACITY OF STP IN KLD		***1,857***									
WATER AVAILABLE FOR RECYCLING IN KLD		***1763.727174***									
D) SOURCE OF WATER											
a) STP RECYCLED	*1,763,727*	*LTRS/DAY*									
b) FRESH WATER	*365,994*	*LTRS/DAY*									
TOTAL REQUIREMENT	*2,129,722*	*LTRS/DAY*									

TITLE : DAILY WASTE GENERATION AND STORAGE FOR PROPOSED ISBT AT BARMUNDA,						
DESCRIPTION	**COVERED AREA IN SQ MTR**	**POPULATION BASIS**	**POPULATION**	**BASIS OF TOTAL WASTE GENERATION**		**TOTAL WASTE GENERATION KG/DAY**
A) DAILY WASTE GENERATION						
FOR TERMINAL PASSENGER						
PARKING	-	NBC clause 4.1.2 and 4.1.3	78000	0.1	Kgperson	7800.00
B) DAILY WASTE GENERATION						
FOR TERMINAL (OFFICES AND STAFF)	5400	1person/10sqm	590.0	0.25	Kgperson	147.50
C) DAILY WASTE GENERATION						
FOR ISBT COMMERCIAL	10575	1person/10sqm	1077.50	0.25	lts/person	269.38
RETAIL & OFFICES						
D) DAILY WASTE GENERATION	4381.00	1person/3sqm	926	1	Kgperson	926.20
FOR RESTAURANTS						
E) DAILY WASTE GENERATION						
FOR BUDGET HOTELS	90	2person/room	180	0.5	Kgperson	90.00
	(ROOMS)					
BUDGET HOTEL STAFF	50	50	50	0.5	Kgperson	25.00
TOTAL DAILY WASTE GENERATION						
					SAY	**9258.08**

Annexure - 6(B)

BHUBANESWAR DEVELOPMENT AUTHORITY

AKASH SHOVA BUILDING,
PANDIT JAWAHARLAL NEHERU MARG, BHUBANESWAR – 751001
PABX No.0674-2392801 / 0998 / 6437, FAX No.0674-2390633 / 085
Visit us at: http://bdabbsr.in/

Ref. No. (COE) 645/EM Date. 19-06-2018

To

The General Manager (Service) (DIMTS)
Delhi Integrated Multi Modal Transit System Ltd.
1st floor, Maharanapratap (ISBT) Building.
Kashmere Gate Delhi -110006 (India)

Sub: Architectural/Urban Design for development of proposed Interstate Bus Terminal (ISBT) at Baramunda, Bhubaneswar.

Sir,

In inviting a reference to the above subject, it is to inform that for this project AAI (Airport Authority of India) has restricted the highest above NGL up to 15.17m, whereas, the concept plan/BOQ etc prepared by your firm was for 28.75 m. As such, your BOQ/drawings cannot be useful for finalization of tender as there will be huge deviation in the scope of work. The Vice-Chairman, BDA has kindly desired to have a meeting with your Architects & Technical Personals on the revised design, concept plan & BOQ for above work based on recent AAI clearance immediately, preferably during this week, as the Govt. has fixed up deadline as this month end to finalise all these issues in detail.

Hence, you are requested to take urgent steps in this regard & intimate the date to this office for kind concern of the Vice-Chairman, BDA.

The copy of letter received from AAI in this regard is enclosed herewith for your reference.

Encl:- As above

Yours faithfully.

19.6.18

Chief Engineer-cum-Engineer Member,
Bhubaneswar Development Authority.

Memo No._____/BDA., Bhubaneswar the th 2018.
Copy forward to the P.S. to Vice-Chairman, BDA for kind information of V.C., BDA.

Chief Engineer-cum-Engineer Member,
Bhubaneswar Development Authority.

Memo No._____/BDA., Bhubaneswar the th 2018.
Copy to Executive Engineer-I, BDA, Bhubaneswar for information and necessary action.

Chief Engineer-cum-Engineer Member,
Bhubaneswar Development Authority

(167/18)

भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

Executive Engineer,Div-I,Bhubaneswar Development Authority
Akash Sobha Building, Sachivalaya Marg, Bhubaneswar-751001

Date: 01-06-2018
Valid Upto: 31-05-2026

No Objection Certificate for Height Clearance

1. This NOC is issued by Airports Authority of India (AAI) in pursuance of responsibility conferred by and as per the provisions of Govt. of India (Ministry of Civil Aviation) order GSR751 (E) dated 30th Sep. 2015 for Safe and Regular Aircraft Operations.

2. This office has no objection to the construction of the proposed structure as per the following details:

NOC ID :	**BHUB/EAST/B/052418/309114**
Applicant Name*	**Shailaja**
Site Address*	**Plot No.116/2331,116, 109/2330, 109,110,102,101,96(pt),108,105,104,98,99,103,100,97, 109/2332, 115,113,111,89(pt),90(pt),91(pt),83,84,85,95,94,93,92,86,87,283(pt),284(Pt),285(pt),278,281,286,291(pt),290(pt),289(288,287,273,274, 275, 275/2311, 279,272,271,Plot no.270(pt), 88(pt), 89(pt),90(pt), 91(pt),96(pt), 279/2310 Plot no.53/2337,53/2336, 53/2335, 53/2334,53(pt),52(Pt),277(pt), 276, Plot no-282 ,Mz-Baramaunda, Bhubaneswar.The existing Bus Depot is being developed as a ISBT,Baramunda**
Site Coordinates*	85 47 27.1-20 16 30.7, 85 47 29.2-20 16 20.0, 85 47 35.0-20 16 27.1, 85 47 35.7-20 16 18.6
Site Elevation in mtrs AMSL as submitted by Applicant*	**40 M**
Permissible Top Elevation in mtrs Above Mean Sea Level(AMSL)	**55.17 M (Restricted)**

*As provided by applicant

3. This NOC is subject to the terms and conditions as given below:

a. Permissible Top elevation has been issued on the basis of Site coordinates and Site Elevation submitted by Applicant. AAI neither owns the responsibility nor authenticates the correctness of the site coordinates & site elevation provided by the applicant. If at any stage it is established that the actual data is different, this NOC will stand null and void and action will be taken as per law. The office in-charge of the concerned aerodrome may initiate action under the Aircraft (Demolition of Obstruction caused by Buildings and Trees etc.) Rules, 1994"

b. The Site coordinates as provided by the applicant in the NOC application has been plotted on the street view map and satellite map as shown in ANNEXURE. Applicant/Owner ensure that the plotted coordinates corresponds to his/her site.In case of any discrepancy,Designated Officer shall be requested for cancellation of the NOC

c. The Structure height (including any superstructure) shall be calculated by subtracting the Site elevation in AMSL from the Permissible Top Elevation in AMSL i.e. Maximum Structure Height = Permissible Top Elevation minus (-) Site Elevation.

d. The issue of the 'NOC' is further subject to the provisions of Section 9-A of the Indian Aircraft Act, 1934 and any notifications issued there under from time to time including the Aircraft (Demolition of Obstruction caused by Buildings and Trees etc.) Rules 1994

e. No radio/TV Antenna, lighting arresters, staircase, Mumtee, Overhead water tank and attachments of fixtures of any kind shall project above the Permissible Top Elevation of 55.17 M (Restricted) , as indicated in para 2.

f. Only use of oil fired or electric fired furnace is permissible, within 8 KM of the Aerodrome Reference Point.

g. The certificate is valid for a period of 8 years from the date of its issue.One time revalidation without assessment may be allowed, provided construction work has commenced,subject to the condition that such request shall be made within the validity period of the NOC and the delay is due to circumstances which are beyond the control of the developer.

h. No light or a combination of lights which by reason of its intensity, configuration or colour may cause confusion with the aeronautical ground lights of the Airport shall be installed at the site at any time, during or after the construction of the building. No activity shall be allowed which may affect the safe operations of flights

i. The applicant will not complain/claim compensation against aircraft noise, vibrations, damages etc. caused by aircraft operations at or in the vicinity of the airport.

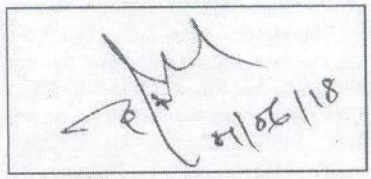
j. Day markings & night lighting with secondary power supply shall be provided as per the guidelines specified in chapter 6 and appendix 6 of Civil Aviation Requirement Series B Part I Section 4, available on DGCA India website: www.dgca.nic.in

k. The applicant is responsible to obtain all other statutory clearances from the concerned authorities including the approval of building plans. This NOC for height clearances is to ensure the safe and regular aircraft operations and shall not be used as document for any other purpose/claim whatsoever, including ownership of land etc.

l. This NOC has been issued w.r.t. the Civil Airports. Applicant needs to seek separate NOC from Defence, if the site lies within their jurisdiction.

m. In case of any discrepancy/interpretation of NOC letter, English version shall be valid.

n. In case of any dispute w.r.t site elevation and/or AGL height, top elevation in AMSL shall prevail.



महा प्रबंधक (वायानी) पू.क्षे.
General Manager(ATM)ER
भा.वि.प.प्रा./A.A.I.
न.सु.च.बो.अ. हवाई अड्डा/N.S.C.B.I. Airport
कोलकाता/Kolkata 700052

	Name / Designation / Sign with Date
Prepared By :	Deepshikha
Verified By :	Choudhury.

Chairman NOC Committee

Region Name: EAST

Address: General Manager Airports Authority of India, Regional Headquarter, Eastern Region, N.S.C.B.I Airport, Kolkata-700052

Email ID: gmatmer@aai.aero

Contact No: 033-25111293

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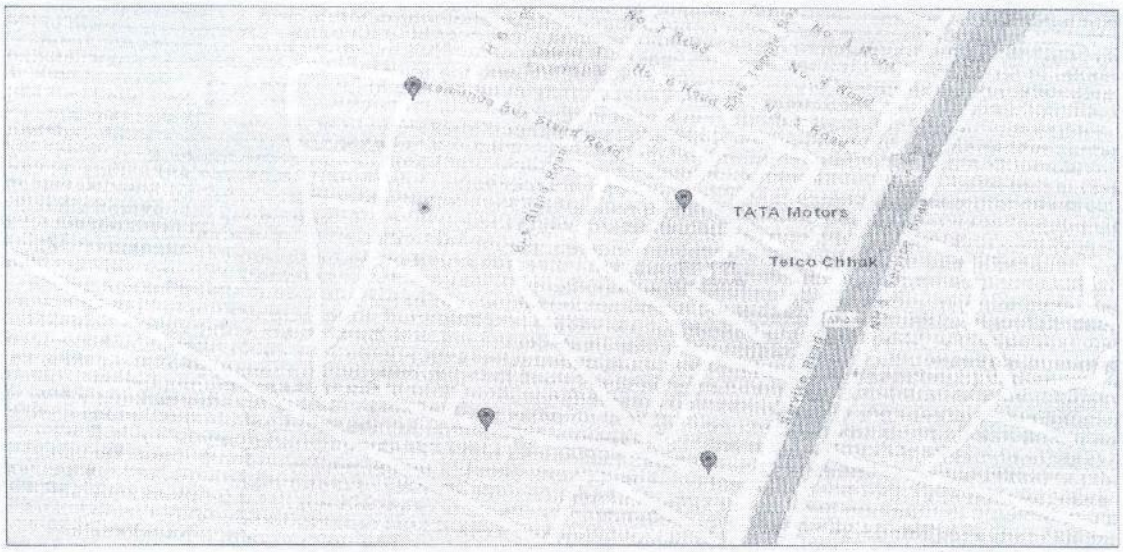
ANNEXURE

Distance From Nearest Airport And Bearing

Airport Name	Distance (Meters) from the Nearest Runway	Bearing (Degree)
Bhubaneshwar	3856.96	315.44
Cuttack	32478.97	200.29
Konarak	55135.31	324.65

Street view



May 24, 2018

Satellite View

May 24, 2018

BHUBANESWAR DEVELOPMENT AUTHORITY

BHUBANESWAR DEVELOPMENT AUTHORITY (BDA)

Architectural and Urban Design for Developing Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar

Environmental & Social Impact Assessment Report

August 2018

A Joint Venture of The Government of National Capital Territory of Delhi & The IDFC Foundation.
An ISO Certified Company

DIMTS
We help people move

1st Floor, ISBT Building, Kashmere Gate
Delhi - 110006 | Tel.: +91-11-43090100
E-mail: info@dimts.in | Website : www.dimts.in

Revised Final Report

ISBT Baramunda - Environmental & Social Impact Assessment

Submitted by.

SAMNE ASSOCIATES PRIVATE LIMITED (SAPL)

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Annexure

1 INTRODUCTION

1.1 Preamble

Early identification and characterization of critical environmental impacts allow the public and the government to form a view about the environmental acceptability of a developmental project and what conditions should apply to mitigate or reduce those risks and impacts.

EIA is a technical exercise, to establish baseline environmental condition to predict environmental impact, assess their significance and provide recommendations for their mitigation. The impact assessment covers both construction and operation phase of the development. The report covers areas such as noise, air quality, ecology, water quality, hydrology, local architecture, landscape & visual character, sustainability and socio-economics. Early identification and characterization of critical environmental impacts allow the public and the Government to form a view about the environmental acceptability of a developmental project and what conditions should apply to mitigate or reduce those risks and impacts. The report describes how the project has been improved through the EIA process.

This report has been prepared as per the EIA Notification, 2006 & its amendments, EIA Guidance Manual for Building, Construction, Group Housing and Area Development projects as guiding documents.

1.2 General Information on Project

The overall design of the terminal should trace the circulation of the passengers from arrival to departure ensuring that each juncture required in the movement of the passenger is as seamless as possible. The Bus stand/ terminal shall be visually appealing; open, spacious, well-lit and consistent with the environment. The space and facilities here shall satisfy functional requirements in the peak hour for the target year under all operating conditions.

Bhubaneswar Development Authority (BDA), has started to develop a Inter State Bus Terminal (ISBT) on a land measuring 15.5 Acre or 6.27 Ha. The designed Bus terminology which is a transport hub would be user-friendly with amenities for commuters such as help line for buses, taxi and auto rickshaw passengers, a unified bus time-table, route guide maps / folders, directory of chartered bus services, fare charts from point to point, prepaid taxis / auto rickshaw booths.

- The design of the bus system shall have the following features:
- Zoning for placement of Interstate bus movement related activities, City bus parking & movement activity and parking and movement activity of Taxis/Autos/ private vehicles
- Segregation of pedestrian and vehicular traffic
- Strategy for ensuring pedestrian connectivity between Inter-State Bus Stand, Local Bus Parking and local modes of transportation

- Strategy for planning the inter-state bus movement zone in terms of workshop area / Alighting/ Active bus parking area / idle bus parking area / Local Bus parking/ building area, any commercial building etc.
- Maximum Commercial exploitation, within the framework of Planning and Building Standards Regulations, for increasing the viability of the project for development
- Adequate provisioning for infra utilities (power supply, water supply, water treatment, sewerage, sewage treatment, storm water drainage, solid waste management, etc.)

1.3 Environmental Clearance Process

As per EIA Notification, 2006 & its amendments, all building construction and area development projects covering an area of 50 ha or greater and/ or built up area greater than 1,50,000 m2 are designated as 8 (b) projects and are required to obtain prior environmental clearance from State Environmental Impact Assessment Authority (SEIAA). The application for environmental clearance comprises submission of Form 1, Form 1A, and Conceptual Plan in SEIAA

Since, the project covers an area of **6.27 Ha**, the project is categorized as 8(a) project, under the EIA Notification, 2006 & requires environmental clearance from the SEIAA, Orrisa. As per the requirement of EIA notification. The baseline was carried out during non-monsoon season Feb 2018 to March 2018.

1.4 Validity of Environmental Clearance

As per the provisions of the EIA Notification, 2006 & its amendments, the environmental clearance granted is for a period of seven years. This may be extended by a maximum of seven years, provided an application is submitted to the regulatory authority within the validity period with updated Form 1, Form 1A and Conceptual Plan having Environmental Impact Assessment Report

1.5 Post Environmental Clearance Monitoring

It shall be mandatory for the project management to submit half-yearly compliance report in respect of the stipulated prior environmental clearance terms and condition in hard and softcopies to the regulatory authorities concerned on 1st June and 1st December of each calendar year. All such compliance report submitted by the project management shall be public documents. Copies of the same shall be given to any person on application to the concerned regulatory authority.

1.6 Transferability of Environmental Clearance

A prior environmental clearance granted for a specific project or activity to an applicant may be transferred during its validity to another legal person entitled to undertake the project or activity on application by the transferor or the transferee with a written “no objection” by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which the prior environmental clearance was initially granted, and for the same validity period.

1.7 Generic Structure of Environment Impact Assessment

The environmental impact assessment has been carried out to assess the impact of the Proposed Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar on various environmental components. The methodologies and findings of the study are detailed in the EIA Report along with other relevant information under the different chapter headings as under:

Introduction- provides background information about the project falls in the category as defined in EIA Notification 2006 and the amendment made thereof based on area statement and the developers along with the legal environmental requirements of the project. The scope and EIA methodology adopted in preparation of EIA report have also been described in this chapter.

Project Description– briefly discusses the project features while elaborating on components bearing environmental consequences.

Description of the Environment– Discusses the baseline data of environmental attributes such as air, water, soil, noise and socioeconomic environment of the area based on primary and secondary data collection at the site. Study of existing environment at the site and in the study area comprising base-line and environmental quality after receiving of new development during construction & operation of the project.

Anticipated Environmental Impacts & Mitigation Measures – Predicts the environmental impacts of the various components of the project during construction and operation phases to highlight concern areas requiring mitigation measures. Accordingly, it also suggests controls and mitigation measures to offset/ minimize the adverse impact while optimizing the positive benefits from the project.

Analysis of Alternatives (Technology and site) – Explores the alternative sites and plans that have been considered for the project and evaluates the different scenarios in the environmental context.

Environmental Monitoring Program – Outlines a monitoring program for the different environmental components during the construction and operation phase for evaluation of the environmental status of the region against the project development.

Additional Studies – Discusses any study that has been carried out for the purpose of better understanding of the environmental impacts of the project. It also highlights any pertinent findings from the study that will aid decision-making.

Project Benefits – Brings out the positive impacts from the project.

Environmental Management Plan – Organizes the suggested mitigation measures to aid implementation through formulation of performance indicators, reporting structure and pronounced implementation periods.

Summary & Conclusion – Summarizes the important report findings and concludes on the environmental sustainability of the project.

Disclosure of Consultants engaged – gives the names of the technical team involved in the report preparation with accreditation of consultant from the quality council of India.

1.8 Brief Description of Project

The Proposed Inter State Bus Terminal (ISBT) is located at Baramunda, Bhubaneswar, Odisha. The project will be developed over an area of **15.5 Acre** & built up area **28,124 sqmt.** The coordinates of the site are 854727.1 - 201630.7, 854729.2 – 201620.0, 854735.0 – 201627.1 and 854735.7 – 201618.6. There is neither any litigation (s)pending against the project and / or any directions or order passed by any court of law/any statutory authority against the project that can be detailed out.

All reputed and accredited consultants are involved in the project providing their inputs and expertise altogether required for a proper and authentic Environmental Impact Assessment study.

A proposal consisting of Form-I, Form IA and Conceptual plan was submitted.

Existing Site Infrastructure : The terminal spread over 15.5 acre lacks basic passenger amenities and the environment is unhygienic. The roads at the entry and exit have many potholes leading to traffic jams. The auto rickshaws and private vehicles add to the chaos.

The bus terminal is at a distance of 8 kilometers from the city centre, from where OSRTC and private operators (Rajdhani Association, etc.) run buses connecting Bhubaneswar to cities in Odisha and with the neighboring states of Andhra Pradesh, Jharkhand, West Bengal and Chhattisgarh. The bus terminal is connected to the rest of Odisha and India by National Highways-NH 5, which is a part of the Kolkata-Chennai prong of the Golden Quadrilateral, NH 203, State Highway 13 (Odisha) and State Highway 27 (Odisha).

It is located at a distance of 6 km from Biju Pattnaik International Airport (Bhubaneswar) and 8 km from Bhubaneswar Railway Station.

Figure 1- 1: Ariel view of ISBT

1.9 Applicable Legal Requirements

Under the Environment Impact Assessment Notification, 2006, the project will obtain environment clearance. The project shall abide by all applicable provisions of the Environment Protection Act,

1986 and rules formed there under. As per the Air (Prevention & Control of Pollution) Act 1981, Water (Prevention & Control of Pollution) Act 1974, and Hazardous Wastes (Management, and Handling) Rules, 1989 and its amendments the project shall obtain No Objection Certificate from Odisha State Pollution Control Board (OSPCB) and continue to obtain yearly Consent for Operation from the same during the operation period.

1.10 Need of the EIA Study

The project activities must co-exist in harmony with its surrounding environment, to reduce the environmental impact, which is likely to arise during various project activities. To safeguard the environment from adverse effects of developmental activities, the MoEF has issued regulations to optimize the use of natural resources and protect environment for sustainable development. As per the MoEF notification dated 14.09.06, Environmental Clearance is mandatory for any construction projects with built-up area of more than 20,000 m^2 and EIA/EMP will be carried out for the Projects covering an area of 50 ha and/ or built up area greater than 1,50,000 m^2.

The built-up area of the project is **28,124 sqm** which is less than 1,50,000 sqm and comes under category 8 (a). The study would facilitate Proposed Inter State Bus Terminal (ISBT) at Baramunda to obtain Environmental Clearance (EC) from the SEIAA, Odisha.

2 PROJECT DESCRIPTION

The bye-laws referred to while planning the ISBT is "Planning and Building Standards Regulations (2017)", Bhubaneswar Development Authority. The designed bus terminology which is a transport hub would be user-friendly with amenities for commuters such as help line for buses, taxi and auto rickshaw passengers, a unified bus time-table, route guide maps / folders, directory of chartered bus services, fare charts from point to point, prepaid taxis / auto rickshaw booths.

The concept plan for the bus terminal is explained as follows:

1. Approximately 4 acre of land has been demarcated on the front towards National highway side for commercial purpose and this area is not included in ISBT land.

2. The terminal and its related facilities are planned at the rear side (existing depot) of the site having the bus entry from the existing exit side, i.e., southern side access road.

3. The bus depot facilities, i.e., bus parking and workshop facilities are planned at the rear area, open to sky.

4. The private vehicle entry/ exit for the terminal is kept from the northern access road, thus integrating the terminal and non-terminal activities.

5. The terminal building has the minimum mandatory facilities on the ground floor and the remaining administrative facilities for terminal have been proposed on the first and the second floor, i.e., Driver's rest room, Administrative offices, Cloak rooms, etc.

6. Portion of the First floor are reserved for some amount of commercial activities like food court, restaurants and Retail spaces.

7. Portion of the second floor is reserved for Retail or office space (commercial space for revenue generation).

8. This commercial area within the terminal building has been provisioned with retail spaces, restaurants (fine dining), and offices.

9. Dedicated space for repair bays, bus wash and service pits have been at the rear area.

10. Ample space for private parking as per requirement is planned near the private vehicle drop off @ 42.5 m LVL

11. Dedicated auto lanes and taxi lanes near the drop off @ 45.65 m LVL have been planned for smooth movement of these modes of transport.

12. Dedicated access is kept for the commercial area from the northern access road.

2.1 Site Detail

The proposed "Inter State Bus Terminal (ISBT)" will be located at Baramunda, Bhubaneswar. Environmental Clearance will be applied for total plot area of 15.5 Acre out of which ISBT area will be on plot size of 11.48 Acre and commercial/office area will be on plot of 4.02 Acre. The Total built up area of the proposed project is **28,124 sqm**, hence the project falls under the category 8 (a) of EIA notification, 2006. The total estimated cost of the project is Rs. 134 crore.

Figure 2- 1: Road Network and the existing ISBT location at Baramunda, Bhubaneswar

Table 2- 1: Site detail

Si #	Description	Details	Unit
GENERAL			
1.	Total Plot Area	62726.27	Sq. mtr.
2.	Proposed Built Up Area	28,124	Sq mtr.
3.	Number of Building Blocks	Two (Terminal & Commercial block)	-
4.	Max Height of Building upto Terrace	Terminal block (G + 2) : 15 Commercial block (B + G + 2) : 15	mtr

5.	Max No of Floors	Terminal block : G + 2 Commercial block : B + G + 2	-
6.	Cost of Project	Approx. 134	crores
7.	Expected Population (All floating)	78000	-
AREAS			
8.	Permissible Ground Coverage Area	15%	-
9.	Proposed Ground Coverage Area	9.6%	-
10.	Permissible FAR Area	1	FAR
11.	Total Basement Area	5130 (in commercial block)	Sq mtr.
12.	Total Parking Area	30 % of FAR	-
13.	Terminal & Commercial Area	Terminal area : 15883 Commercial area : 12241	Sq mtr.
WATER			
14.	Total Water Requirement	1288	KLD
15.	Fresh water requirement	772	KLD
16.	Waste water Generation	979	KLD
17.	Proposed STP Capacity	1000	KLD
18.	Treated Water Available for Reuse	930	KLD
19.	Recycled Water used	535	KLD
20.	Surplus treated water	395	KLD
PARKING			
21.	Total Parking Required as / Building Bye Laws	3738 (30 % of FAR)	Sq mtr.
22.	Proposed Total Parking : Terminal	4359	Sq mtr.
23.	Required parking for commercial facilities	3672 (30 % of Built up area)	Sq mtr.
24.	Proposed Parking in Basement : Commercial	5130	Sq mtr.
GREEN AREAS			
25.	Required Green Area	15 %	-
26.	Proposed Green Area	18 %	-
WASTE GENERATION			
27.	Municipal Solid Waste Generation	9000	Kg/day
28.	Quantity of Hazardous waste Generation	2	Ltr/day
29.	Quantity of Sludge Generated from STP	10	Kg/day
POWER			
30.	Total Power Requirement	3000	KVA

31.	DG set backup	3 × 750	KVA
CONNECTIVITY			
32.	Rail	Bhubaneswar railway station at 8 Km SE	KM
33.	Air	Biju Pattnaik International Airport at a distance of 6 Km SE	KM
34.	Road	Road Density :11.82	Sq. Km

2.2 Connectivity

The site has good connectivity with various transport facilities as shown in table below.

Table 2- 2: Connectivity Details

Features	Description	Distance & Direction
Nearest Railway Station	Bhubaneswar railway station	8 KM at SE
Nearest Airport	Biju Pattnaik International Airport	6 KM at SE
Nearest Highway	National Highway no. 16	0.5 Km at SE

2.3 Population Details

According to the 2011 statistics of India, Bhubaneswar had a population of 837,737. Talking about population, in order to check out the population of Bhubaneswar in 2017, we need to have a look at the population of the past 5 years. They are as per the following:

A. 2012 – 843,202
B. 2013 – 858,009
C. 2014 – 879,211
D. 2015 – 891,624
E. 2016 – 905,339

Taking a look at the population of Bhubaneswar from the year 2012-16, it has been noticed that there has been an increase of 62,137 in the past 5 years. Therefore, it has been seen that every year the population increases by 12,427. Hence, the population of Bhubaneswar in 2017 is forecasted to be 905,339 + 12,427 = 917,766. So, the population of Bhubaneswar in the year 2017 as per estimated data = 917,766. The populace density of Bhubaneswar is 2131 persons per square kilometer

2.4 Power Supply

Electrical power supply to the ISBT will be provided by Central Electricity Supply Utility of Odisha (CESU).

Table 2- 3: Power Details

Power Requirement	3000 KVA
Source of Power	BDA supply
Back up Source	3 DG Sets of 750 KVA each

Power will be sourced from Central Electricity Supply Utility of Odisha (CESU). The Maximum Power demand for the project is estimated to be as around 3000 KVA. Three D.G. sets of Capacity: 750 KVA are proposed to meet requirement of power back up during power failure.

Transformer Size: The 33 KV power received shall be stepped down to 415 Volts which is the operating voltage, by installing 33KV/ 415 Volt Transformer. As per the calculations enclosed in the report the total transformer capacity required for Bus Terminal Building is approx. 3000 KVA. standby Power Generation : Considering the DG set for 80% power backup the total DG capacity required for the building is 2250 KVA. DG sets shall be provided with Acoustic Enclosure as per CPCB norms and shall be radiator cooled and inbuilt diesel tank. Stack height of DG sets will be above the roof level of the ISBT building.

To avoid total darkness during changeover time between Grid Power and DG power Centralized UPS with 15 minutes' battery backup is proposed which shall be connected to selected light fixtures in the common area specially staircase, exit points etc.

2.5 Requirement of Natural Resources and Their Sources

It is proposed to use environment friendly construction materials for the project that are locally available to reduce concerns related to transportation of materials as well as achieve cost effectiveness.

Fly ash mixed cement and bricks are being used for the construction of the project. The use of timber is minimal, with the provision of aluminum frames for windows. Paints with low VOC and no ammonia are proposed to be used for all residential buildings.

All means of reducing water consumption during project construction are being undertaken through the use of low water consuming material.

2.6 Design Consideration

2.6.1 Architectural Perspective

For public architecture, this project is indisputably a significant and exciting opportunity for the city. We will grasp this opportunity and create architecture of greatness which will enhance the terminal's contribution to the urban environment and vastly improve the experience passengers.

2.6.2 Minimize conflicting passenger flows

It is necessary to separate flows and avoid cross-flows and contra-flows as much as possible. Circulation must have adequate space and routes which are clear, direct and obvious, particular at 'decision points' and where bi-directional flows are inevitable. For passenger movements of this magnitude, alternative circulation planning concepts must be developed, and reference will be made to the most modern bus terminals.

2.6.3 Maximize accessibility and interchange

Proper integration of terminal and improved connectivity to the other transport networks in the surrounding area is critical to the success of the new master plan. The terminal must be made more accessible by foot, taxis, auto-rickshaws and two-wheelers. More spacious pickup/drop-off facilities should be provided so the experience of passengers arriving and departing is greatly improved. Efficiency of the road / transport network feeding the terminal must be improved.

2.6.4 Minimize Disruption to the operational elements

The works shall be planned and staged in such a way that effects on terminal operation are minimized. Some key issues are: safety of bus movements, passengers and staff, transport links to be maintained; trees and religious structures to be protected; impacts on existing facilities to be minimized.

2.6.5 Architectural Concept - Bus Terminal

The overall design of the terminal should trace the circulation of the passengers from arrival to departure ensuring that each juncture required in the movement of the passenger is as seamless as possible. The Bus stand/ terminal shall be visually appealing; open, spacious, well-lit and consistent with the environment. The space and facilities here shall satisfy functional requirements in the peak hour for the target year under all operating conditions

Station interiors shall be designed with partition walls that are amenable for flexible space usage for retails, offices, and other passenger amenities.

The overall target is a 'state-of-the-art' terminal, for which we list key design objectives:

- Attractive, modern, iconic architecture with civic dignity.
- Comfort and convenience of the users of the facilities.
- User-friendly facilities & services for convenience of users.
- Special amenities for the physically challenged and special needs passengers.
- Circulation to have adequate space and routes which are direct and obvious.
- Planning to have good lines of sight, avoiding cross-flows and congestion.
- Provide a variety of amenities in a clean and pleasant environment.
- Entrances to be well coordinated with other forms of transport.
- All public areas to be visually open, welcoming and well lit.
- Retail and service areas to be modern, successful, and well-coordinated within the design.
- Utilize leading edge technologies and innovative services.
- Service access and emergency vehicle access to be coordinated within the design.

- Master plan to improve urban design and transport links in the entire area of terminal environs.
- Sustainable considerations in the development
- Commercial Property Development to be optimized and integrated within the overall design.

As per Comprehensive Development Plan, Bhubaneswar Development Plan Area this designated Bus stand falls under Transportation Land use as Bus depots/ Truck terminal.

As per Planning and Building Standards Regulations, 2008 (updated 2017) the following development control norms shall be followed for Transportation land use.

- FAR (Floor Area Ratio)
- As per Clause 34 (3) " In case of transport related activities such as; railway yards, railway station, bus stands, bus shelters, transport depot, airport, special ware housing, cargo terminals, the maximum permissible FAR shall be **1.00**
- Height as per the restriction shall be **15.17 m** as it is about 1.5 km from the nearest runway end. (refer clause 35)
- Parking to be at 30% of total built up area (assumed Assembly building since the parking criteria table is silent on transportation buildings.) Also Assembly building may be defined as "Assembly Building" refers to a building or part of a building where group of people not less than 50 congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes for example, theaters, motion picture houses, assembly halls, auditoria, exhibition halls, museum, skating rinks, gymnasium, restaurants, places of worship, dance halls, club rooms, passenger stations and terminals of air, surface and marine public transportation services, recreation piers and stadia, Baarat Ghar and Kalyan Mandap, etc.

2.6.6 Project Layout

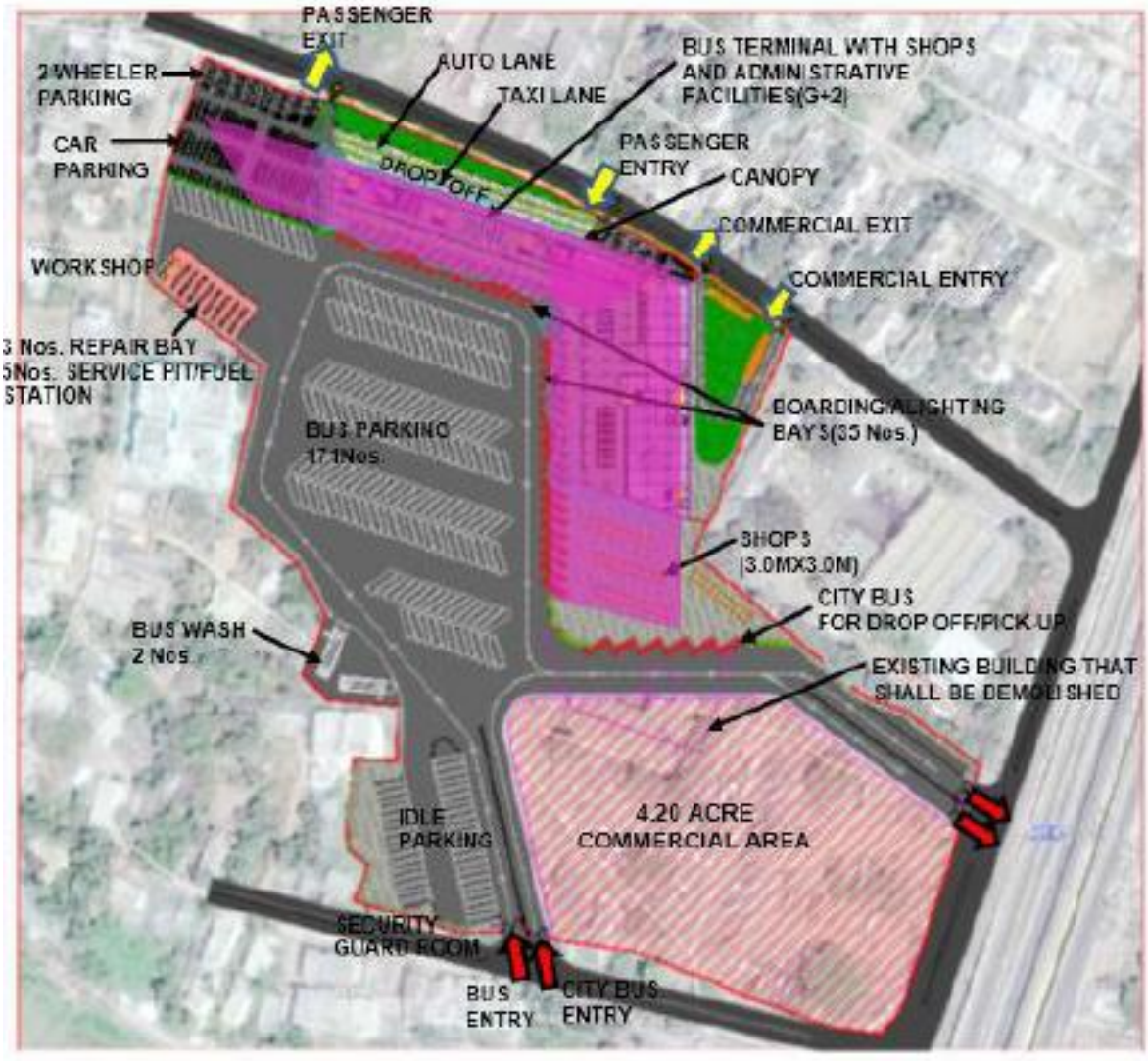


Figure 2- 2: Concept Plan

2.6.7 Parking

Table 2- 4: Car Parking Calculation

Description	Required area (sq. m.) / NO.	Provided area (sq. m.)
Required parking for terminal facilities (30 % of Built up area)	3738 sq m	4359 sq m (including drop off lanes)
Required parking for buses	300 Nos.	35 bus bays 191 idle bus parking (open)
Required parking for commercial facilities (30 % of Built up area)	5130 sq m (basement)	5130 sq m (basement)

The buses that enter drop off the passengers or park at the respective bay along the terminal building and then either move to the respective idle parking in the island. Parking for private vehicles, i.e., cars and two wheelers is proposed near the private drop off point at the surface level. Minimum waiting space is provisioned for taxis and autos. Dedicated parking for the commercial facilities is planned at the basement level.

2.6.8 Entry & Exit

- For the terminal, the bus entry is from the southern access road @ +40 m LVL and exit is on to the main highway service lane
- Dedicated entry/ exit gate and lane has been planned for local city buses
- The private cars and public transport like auto/ taxis enter from the rear (northern side) access @ surface level of that approach road, i.e., +45.65 m LVL
- The commercial area entry / exit is from the northern access road with a ramp down and the drop off is created @ + 42.15 m LVL

2.6.9 Vehicular Movement

- The intercity/ interstate buses enter from the southern access road, move along the boundary towards the respective bays along the terminal building
- The local buses enter from its dedicated lane and move right directly to their respective bays
- Private vehicles enter and exit from the northern access road and have a drop off along the other side of the terminal building
- Segregation of terminal and non-terminal activities/ traffic
- Private entry and exit for the commercial area is also from the northern access road

2.7 Water Supply and Sewage Treatment Plan

The total water requirement will be approx. 1288 KLD, out of which total domestic water fresh water requirement will be approx. 772 KLD. The flushing use water requirement will be 515 KLD and water required for horticulture would be 20 KLD

The daily water requirement calculation is given below in **Table 2.5**

Table 2- 5: Daily Water Requirement and Storage for Proposed ISBT

DESCRIPTION	COVERED AREA IN SQ MTR	POPULATION BASIS	POPULATION	BASIS OFTOTAL WATER REQUIREMENT		TOTAL WATER REQUIREMENT (in Liters)	BASIS OF WATER REQUIRED		WATER REQUIRED (in Liters)	
							DOMESTIC	FLUSHING	DOMESTIC	FLUSHING
							@ %	@ %	Ltrs	Ltrs
A. FOR TERMINAL PASSENGER PARKING										
DAILY WATER REQUIREMENT	-	NBC clause 4.1.2 and 4.1.3	78000	15	lts/person	1170000.00	60	40	702000.00	468000.00
B. FOR TERMINAL (OFFICES AND STAFF)										
DAILY WATER REQUIREMENT	5400	1person/10sqm	590	45	lts/person	26550.00	60	40	15930.00	10620.00
C. FOR ISBT COMMERCIAL RETAIL & OFFICES										
DAILY WATER REQUIREMENT	10575	1person/10sqm	1077	25	lts/person	26937.00	60	40	16162.00	10775.00
FOR RESTAURANTS										
DAILY WATER REQUIREMENT	4381.00	1person/3sqm	926	70	lts/person	64834.00	60	40	38900.00	25933.00
TOTAL DAILY WATER DEMAND					SAY	12,88,320			7,72,992	5,15,328

Table 2- 6: Daily Water Requirement and Storage

a) DOMESTIC USE	7,72,992	LTRS.	
b) FLUSHING USE	5,15,328	LTRS.	
C) LANDSCAPING	20,000	LTRS.	
GRAND TOTAL	13,08,320	LTRS.	
B) SEWAGE FLOW			
DESCRIPTION	**DOMESTIC USE**	**FLUSHING USE**	
TOTAL DAILY REQUIREMENT IN LTRS.	**7,72,992**	**5,15,328**	
RATE OF FLOW TO SEWER	@ 60%	@ 100%	
FLOW TO SEWER IN LTRS./DAY	4,63,795	5,15,328	
TOTAL SEWAGE FLOW IN LTRS./DAY		9,79,123	
CAPACITY OF STP IN KLD		979	
WATER AVAILABLE FOR RECYCLING IN KLD		930	
D) SOURCE OF WATER			
a) STP RECYCLED	9,30,166	LTRS/DAY	
b) FRESH WATER	358,370	LTRS/DAY	
TOTAL REQUIREMENT	**12,88,536**	**LTRS/DAY**	

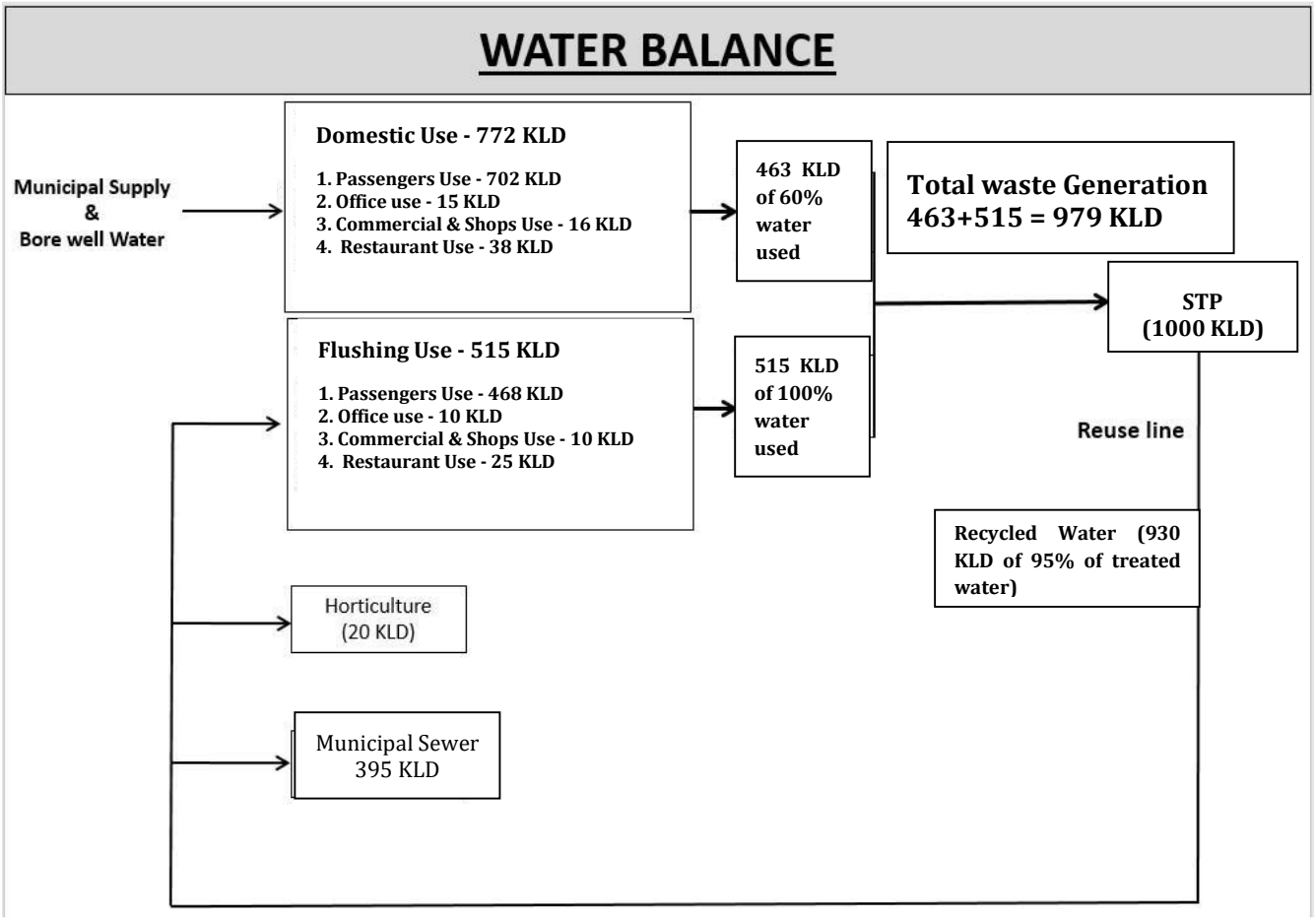


Figure 2-3: Water Balance

The waste water generated during the operation phase of the project is estimated to be 979 KLD and all the waste water generated will be treated to sewage treatment plant (STP) of 1000 KLD.

Sewage generated from the building will be treated in centralized sewage treatment plant (STP) Treatment will be done to achieve treated effluent to permissible limit to reuse for various non-domestic applications. The technology used in the proposed system is MBBR. This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm. Additionally, the biofilm attached to the mobile bio-carriers within the system automatically responds to load fluctuations.

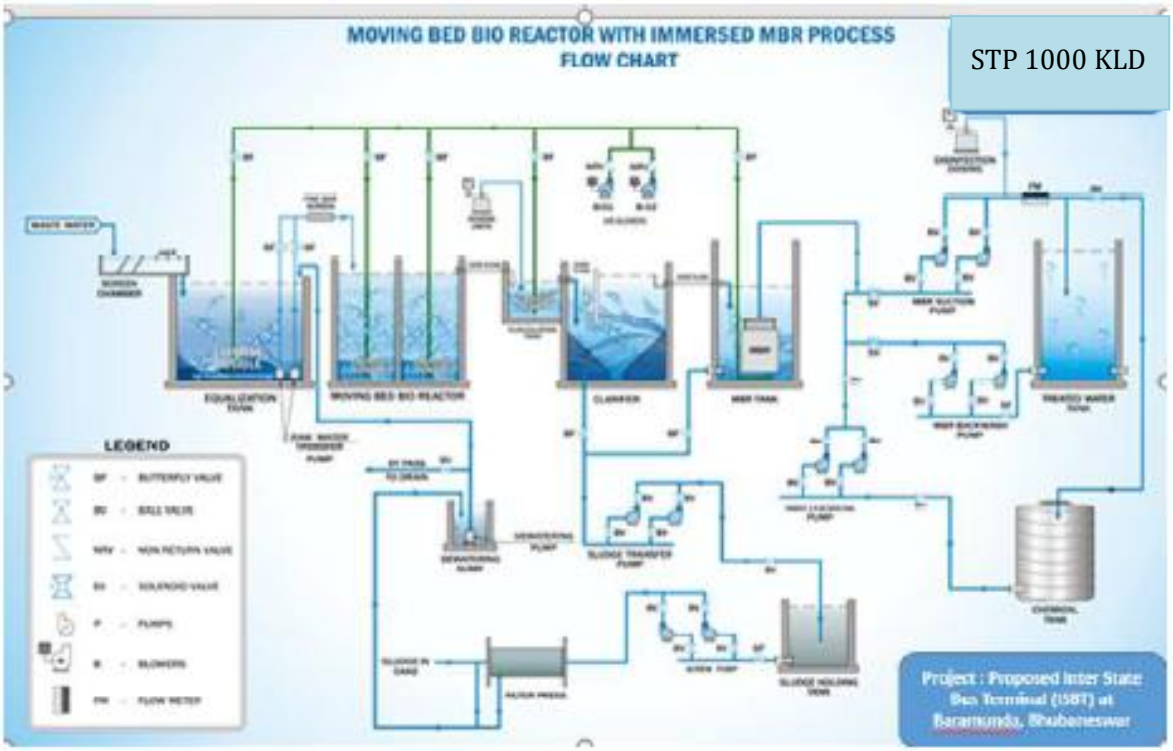


Figure 2- 4: STP Process

Sludge Details

- Daily load : 979 KLD
- Duration of flow to STP : 24 hours
- Temperature : Maximum 32°C
- pH : 7 to 9.5
- Colour : Mild
- T.S.S. (mg/l) : 100-400 mg/l
- BOD5 (mg/l) : 200-300 mg/l
- COD (mg/l) : 500-700 mg/l

b. Final discharge characteristics

- pH : 6.5 to 7.5
- Oil & Grease : < 10 mg/l
- B.O.D. : < 10 mg/l
- C.O.D. : < 30 mg/l

- Total Suspended Solids : <10 mg/l

2.7.1 Advantages of MBBR system

The MBBR system is considered a biofilm process. Other conventional biofilm processes for waste water treatment are called trickling filter, rotating biological contactor (RBC) and biological aerated filter (BAF). Biofilm processes in general require less space than activated sludge systems because the biomass is more concentrated, and the efficiency of the system is less dependent on the final sludge separation. A disadvantage with other biofilm processes is that they experience bio-clogging and build-up of head-loss.

- MBBR systems don't need a recycling of the sludge, which is the case with activated sludge systems.
- The MBBR system is often installed as a retrofit of existing activated sludge tanks to increase the capacity of the existing system. The degree of filling of carriers can be adapted to the specific situation and the desired capacity. Thus an existing treatment plant can increase its capacity without increasing the footprint by constructing new tanks.
- When constructing the filling degree can be set to, for example, 40% in the beginning, and later be increased to 70% by filling more carriers. Examples of situations can be population increase in a city for a municipal waste water treatment plant or increased waste water production from an industrial factory.

2.7.2 Benefits of Using MMR Technology

The sewage treatment scheme offers some distinct advantage over other processes. The scheme is proven, under a variety of operating conditions, and is highly flexible in operation.

Small space requirement

The concept of compact MMR based sewage treatment plants is used so that expensive land requirement is reduced. A conventional treatment requires large space, and large operating force. The MMR based plants individually occupy much less space, making the plants more manageable.

Lower operating power requirements

The system utilizes aeration tanks of much smaller size, thereby reducing the overall power required in aerating the raw sewage. Since the reactor depth is more, efficient transfer of oxygen takes place, thereby reducing the overall power consumed in treatment.

Low temperature sustaining capability.

One of the very important parameters in selecting a particular process is that the system must operate in low temperatures, which are experienced for at least 5 – 8 months in a year. The temperature can drop to nearly 2-30C. This system is adopted with latest and proven technology, have much smaller reactor area. Additionally, hot air is bubbled for the purpose of aeration.

Simplicity in operation and maintenance

The system adopted has much less moving parts (only pumps and blowers, and centrifuge). Further there is no moving part inside the reactor. This gives the advantage of continuously running the reactor

system, under widely fluctuating conditions. All the pumps / blowers and centrifuges are manufactured in India only, and hence there is no problem of availability of spares. All the maintenance on the mechanical systems can be done with normal skilled mechanics available.

The system is unique in operation, such that, only inlet and outlet parameters (i.e. raw sewage BOD / COD / TSS /TP and treated sewage BOD / COD / TSS / TP etc.) need to be analyzed. **Since the reactor is self-sustaining, there is no requirement of recycling the biomass from the secondary clarifier. Hence, analysis such as MLSS / MLVSS / SVI (sludge volume index) / F / M ratio etc. is not required to be done. This greatly reduces the analytical load on the plant chemist / supervisor, and makes the system very simple to operate and control.**

E-coli (coliform) removal

The reactor system adopted in STPs is provided with removal of disease causing E-coli bacteria Coliform removal. The outlet BOD of the bio-reactor system being very low (in other words, hardly any food is available to the E-coli), most of the coliform are killed in the reactor itself. Remaining coliform are killed by using UV treatment .The treated sewage from outlet will conform to WHO standards.

Sludge handling

The sludge generated in the reactors is totally digested. Since the F / M ratio in the reactors is very low, the excess sludge generation is very low. The excess sludge is dewatered in filter press.

2.8 Rainwater Harvesting

Rain water harvesting has been catered to and designed as per the guideline of CGWA. Peak hourly rainfall has been considered as 50 mm/hr. The effective length, breadth and depth, of a Recharge pit is 4.0 m, 1.3 m and 3.5 m respectively and effective length, breadth and depth of a desilting chamber 2.0 m, 1.3 m and 1.25 m respectively is constructed for recharging the water, also the rainwater harvesting tank of 2 m, 3 m and 2 m have been proposed. The bottom of the recharge structure will be kept 5 m above ground water level. At the bottom of the recharge well, a filter media is provided to avoid choking of the recharge bore. Design specifications of the rainwater harvesting plan are as follows:

- Catchments/roofs would be accessible for regular cleaning.
- The roof will have smooth, hard and dense surface which is less likely to be damaged allowing release of material into the water. Roof painting has been avoided since most paints contain toxic substances and may peel off.
- All gutter ends will be fitted with a wire mesh screen and a first flush device would be installed. Most of the debris carried by the water from the rooftop like leaves, plastic bags and paper pieces will get arrested by the mesh at the terrace outlet and to prevent contamination by ensuring that the runoff from the first 10-20 minutes of rainfall is flushed off.
- No sewage or wastewater would be admitted into the system.
- No wastewater from areas likely to have oil, grease, or other pollutants has been connected to the system.

2.8.1 Storm Water Drainage

The storm water collection system for the premises shall be self-sufficient to avoid any collection/stagnation and flooding of water. The amount of storm water run-off depends up on many factors such as intensity and duration of precipitation, characteristics of the tributary area and the time required for such flow to reach the drains. The drains shall be located near the carriage way along either side of the roads. Taking the advantage of road camber, the rainfall runoff from roads shall flow towards the drains. Storm water from various plots/buildings shall be connected to adjacent drain by a pipe through catch basins. Therefore, it has been calculated to provide 4 rainwater harvesting pits and 12 tanks at selected locations, which will catch the maximum run-off from the area.

- Since the existing topography is congenial to surface disposal, a network of storm water pipe drains is planned adjacent to roads. All building roof water will be brought down through rain water pipes.
- Storm water system consists of pipe drain, catch basins and seepage pits at regular intervals for rain water harvesting and ground water recharging.
- Peak Hourly Rainfall of 50 mm/hr shall be considered for designing the storm water drainage system.
- Pits will be used to store water form roof top area and tanks will be proposed to store water from green and paved areas.

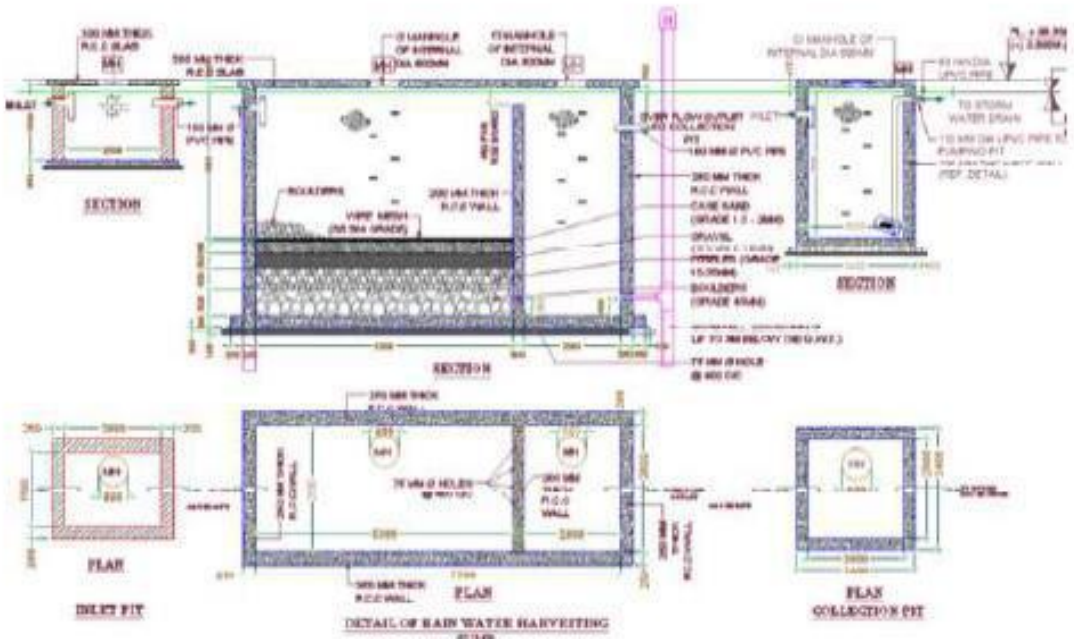


Figure 2- 5: Rain Water Harvesting

It shall be therefore concluded that there is no significant impact on surface water quality & hydrology of the area. The proposed rainwater-harvesting scheme will stabilize the groundwater table in the area

2.9 Waste Generation, Collection, Transport and Disposal

Solid waste would be generated both during the construction as well as during the operation phase. The solid waste expected to be generated during the construction phase will comprise of excavated materials, used bags, bricks, concrete, MS roads, tiles, wood etc. The following steps are to be followed for the management solid waste:

- Construction yards are used for storage of construction materials.
- The excavated material such as topsoil and stones will be stacked for reuse during later stages of construction.
- Excavated top soil will be stored in temporary constructed soil bank and will be reused for landscaping of the Project.
- Remaining soil will be utilized for back filling / road work /raising of site level at Locations

2.9.1 Waste generation during Operation Phase

During operation phase municipal solid waste would be generated from the project. The quantification of different type of waste likely to be generated are given below intable:5 below

Table 2- 7: Quantity of Daily Waste Generation During Operation Phase

DESCRIPTION	COVERED AREA IN SQ M	POPULATION BASIS	POPULATION	BASIS OF TOTAL WASTE GENERATION		TOTAL WASTE GENERATION KG/DAY
A. FOR TERMINAL PASSENGER						
PARKING	-	NBC clause 4.1.2 and 4.1.3	78000	0.1	Kg/person	7800.00
B. FOR TERMINAL OFFICES AND STAFF						
DAILY WASTE GENERATION	5400	1person/10sqm	590.0	0.25	Kg/person	147.50
C. FOR ISBT COMMERCIAL RETAIL & OFFICES						
DAILY WASTE GENERATION	10575	1person/10sqm	1077.50	0.25	Kg/person	269.38
D. FOR RESTAURANTS						
DAILY WASTE GENERATION	4381.00	1person/3sqm	926	1	Kg/person	926.20
TOTAL DAILY WASTE GENERATION					**SAY**	**9143.08**

2.9.2 Solid Waste Management

Following arrangements will be made at the site in accordance to Municipal Solid Wastes (Management and Handling) Rules, 2000 and amended Rules, 2008.

Collection and Segregation of waste

- Biodegradable & non biodegradable waste shall be separately collected to ensure segregation at source.
- Adequate number of colored bins separate for Bio-degradable and Non Biodegradable will be placed at planned location.

- Litter bin will also be provided in open areas like parks etc.

Treatment of Bio-Degradable wastes

Biodegradable /Organic and Horticultural Waste would be handed over to authorized vendor for treatment.

Non-Biodegradable waste

Recyclables, such as plastic, rubber, wood pieces, glass etc will be segregated from non-biodegradable waste & sold to authorize vendors for recycling & remaining inert waste shall be sent to land fill site through authorized vendor as per the guidelines of Municipal Solid Wastes (Management and Handling) Rules, 2000 and amended Rules, 2008. STP sludge will also be used for horticultural purposes as manure.

Hazardous waste management

Hazardous waste is a waste with properties that make it dangerous or potentially harmful to human health or the environment. The universe of hazardous wastes is large and diverse. Hazardous wastes can be liquids, solids, contained gases, or sledges. They can be the by-products of manufacturing processes or simply discarded commercial products, like cleaning fluids or pesticides. All hazardous wastes are required to be treated and disposed off in the prescribed manner. The main objective is to promote safe management and use of hazardous substances including hazardous chemicals and hazardous wastes, in order to avoid damage to health and environment

Table 2- 8: Hazardous Waste

Type of Waste	Colours of Bins	Category	Disposal Method	Total Waste
Used Oil	Black With Label	Hazardous Waste	*Waste shall be collected in leak proof containers at isolated place and then it will be given to approved vendor of CPCB as per Hazardous Wastes (Management, Handling and Transboundry Movement) Rules, 2008 and Amended till date.*	2 lit/day
Electronic	Black With Label	Hazardous Waste	*It will be disposed off through approved vendor of CPCB as per Electronic Wastes (Management & Handling) Rules, 2011.*	4 kg/day

E-Waste Management & Disposal

"E-waste" is a popular, informal name for electronic products nearing the end of their "useful life". E-wastes are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem.

Reducing e-waste requires that we reduce, reuse, recycle and recover.

The goal is nothing less than zero land fill. Network of scrap dealers will be motivated to procure from door to door for the smaller quantities. Only hazardous waste to be generated from project site is used oil from D. G. sets. Used oil will be stored in HDPE containers and will be disposed as per hazardous waste (Management, Handling and trans-boundary movement) rules, 2008.

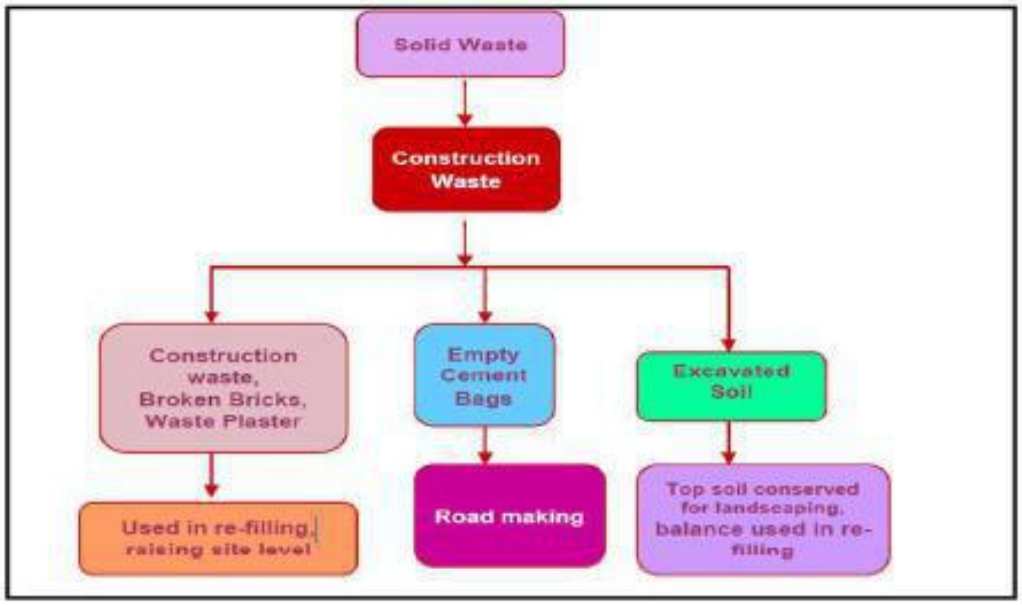


Figure 2- 6: Solid Waste Management during Operational Phase

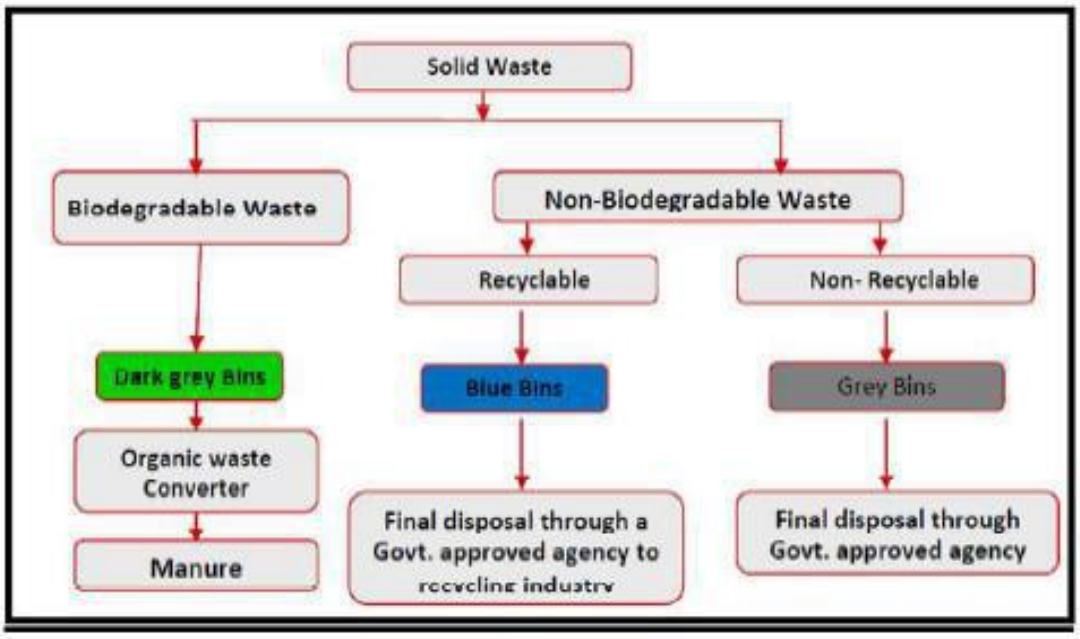


Figure 2- 7: Solid Waste Management during Operational Phase

2.10 Fire-Fighting System

Type of the Building - Assembly + Commercial + Business

2.10.1 Wet Riser & Hydrants System

The firefighting system shall be designed as per National Building Code of India 2005, other relevant I.S codes and recommendation of Local Fire Brigade.

- Two Static Underground storage fire tank and terrace tank of capacity as per NBC-2005 depending on the height of the block
- Wet-riser system with landing hydrant valves and fire hose cabinet shall be provided as per NBC part IV depending upon final architectural layouts. Each Fire Hose Cabinet shall consist of:
  - ✓ One Number Fire Hydrant/Landing Valve
  - ✓ 2 nos., 63 mm dia. and 15m long rubberized fabric lined hose pipe.
  - ✓ SS male and female instantaneous type coupling
  - ✓ SS branch pipe with nozzle
  - ✓ First-aid fire hose reels with 20 mm dia. 35m long thermos-plastic hose and with 5mm bore SS nozzle.
  - ✓ Fireman's axe

2.10.2 Sprinkler System

- Sprinkler System shall be provided in all the areas in the terminal as

well as commercial building

- Pendant/Upright/Sidewall type sprinklers shall be used with a center to center spacing of 3 meters
- Upright sprinklers shall be provided at basement and for any false ceiling areas in Lobbies/common areas etc. which are greater than 800 mm in height
- The sprinklers shall be automatically activated at 68 degree centigrade by breaking of the glass bulb in the event of fire
- The sprinkler line shall be always pressurized. Sprinkler pump shall have the backup of main electrical and diesel engine driven fire pumps
- Necessary accessories such as Alarm Valves, Flow Switches, Inspector's Test Valve Assembly, and Annunciation Panel, etc. shall be provided as per the requirements

2.10.3 Fire Pumps

There will be two numbers of electrical motor driven fire pumps of 2280 LPM capacity, for wet riser system and for sprinkler system. Similar capacity diesel engine driven pump will be provided as common standby. One number electrical motor driven jockey pumps of 180 LPM will be used to maintain line pressure in pump rooms.

2.10.4 Fire Extinguishers

Hand held type extinguisher shall be according IS: 15683. The location of extinguisher shall be at easily accessible place

2.11 Details of Construction Materials

List of building materials that are being, and will be used at site is as follows:

- Coarse sand
- Fine sand
- Stone aggregate
- Stone for masonry work
- Stone for under floor soling
- Cement
- Reinforcement steel
- Plywood & steel shuttering
- Pipe scaffolding (cup lock system)
- Bricks
- Crazy (white marble) in grey cement
- P.V.C. conduit
- Indo-Asian MCBs

- PVC overhead water tanks
- 1/2'' thick red colour paver tiles
- 'B' class GI pipe (ISI marked)
- PVC wastewater lines
- S.W. sewer line upto main sewer
- PVC rain water down take
- Stainless steel sink in kitchen
- 5mm thick plane glass
- 3mm thick ground glass in toilets
- Joinery hardware- ISI marked

2.11.1 List of Machinery Used During Construction

- Dumper : Shall be used for mud and material handling
- Concrete mixer with hopper : For RCC work
- JCB : Shall be used for digging and earth work
- Cranes : For lifting and moving of materials.
- Road roller : For compacting the earth
- Bulldozer : For dismantling

3 DESCRIPTION OF ENVIRONMENT

3.1 Introduction

Information on the existing environmental status is essential for assessing the likely environmental impacts of the project. In order to get an idea about the existing state of the environment, various environmental attributes such as meteorology, air quality, water quality, soil quality, noise level, ecology and socio-economic environment have been studied/monitored.

3.2 Study Period

Baseline environmental data generation for air, water, noise and soil quality monitoring around the project site was conducted from March 2018 to April 2018 for Proposed Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar as per EIA Notification 2006 & its amendments, which is approx. 2.27 kms from our project site.

Apart from field monitoring, additional data was also collected from secondary sources like irrigation department, India Meteorological Department (IMD), Central Ground Water Board, Geological Survey of India, State Ground Water Department, State Pollution Control Board, Census of India and Local Forest Department, Non - Governmental Agencies etc.

3.3 Study Area

The present report covers baseline environmental data generated in the study area (10 Km radius all around the project site for land use and the sample selection for monitoring are done within 5 km radius of the project site).

3.4 Baseline Monitoring of Environmental Components

In order to get an idea about the existing state of the environment, various environmental attributes such as meteorology, air quality, water quality, soil quality, noise level, ecology and socio-economic environment have been studied/monitored.

3.4.1 Meteorology

Meteorological data was generated during the March 2018 to May 2018. The following parameters were recorded at hourly intervals continuously during monitoring period:

- Air Temperature
- Wind speed

Table 3- 1gives summarized meteorological data for the monitoring period (March 2018 to April 2018).

Figure 3- 1gives the wind-rose diagram for the monitoring period.

Table 3- 1: Meteorological Data for March 2018 to April 2018

Month	Wind Speed (m/s)			Temperature (C)		Relative Humidity (%)	
	Max	Min	Avg	Max	Min	Max	Min
Mar 2018	7.7	1.5	3.2	39.5	33	77	55
Apr 2018	9.2	1.6	2.5	40	33.5	79	68

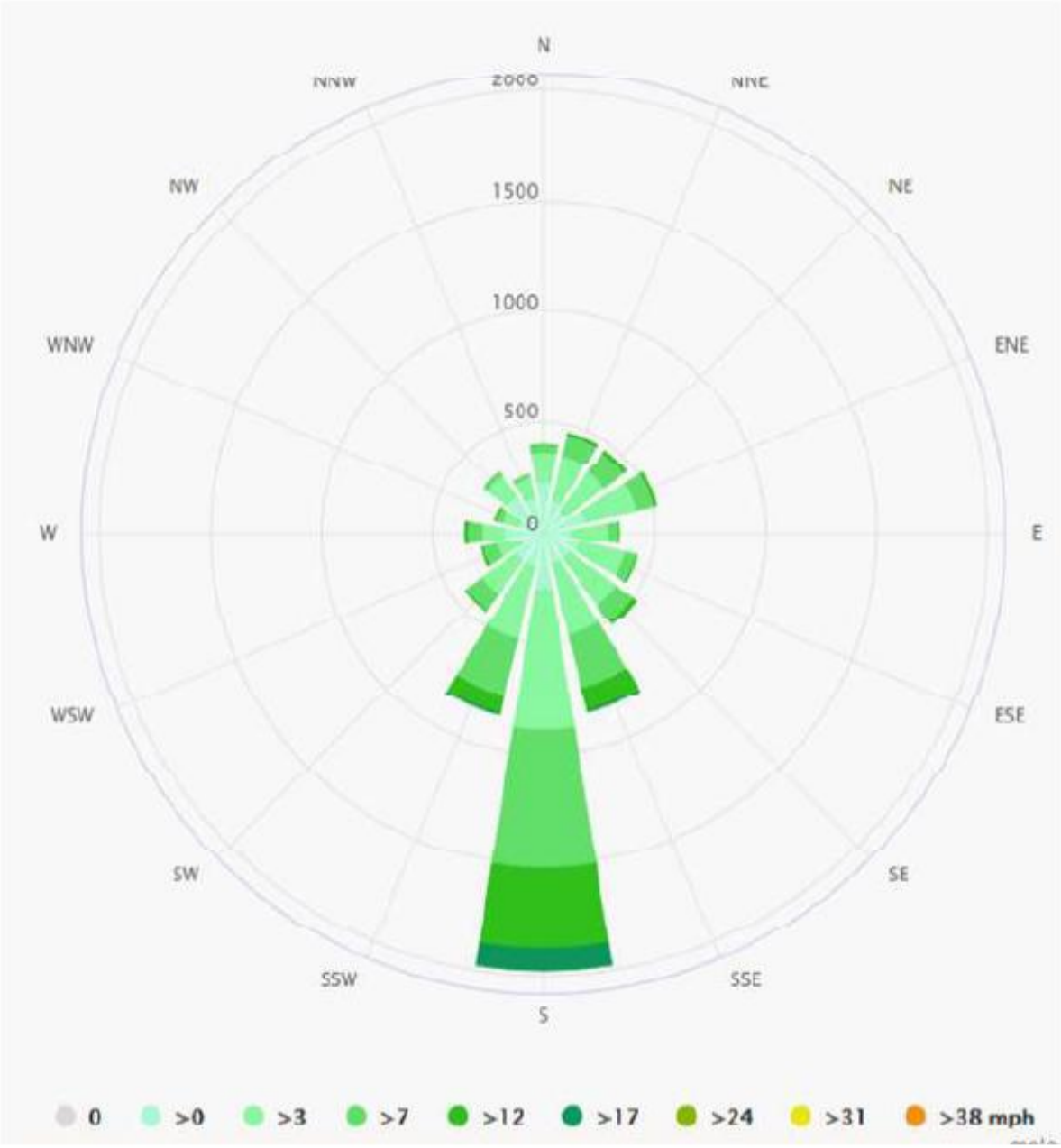


Figure 3- 1: Wind-Rose diagram for One year (Apr. 17 – Mar. 18)

The wind rose for Bhubaneswar shows how many hours per year the wind blows from the indicated direction.

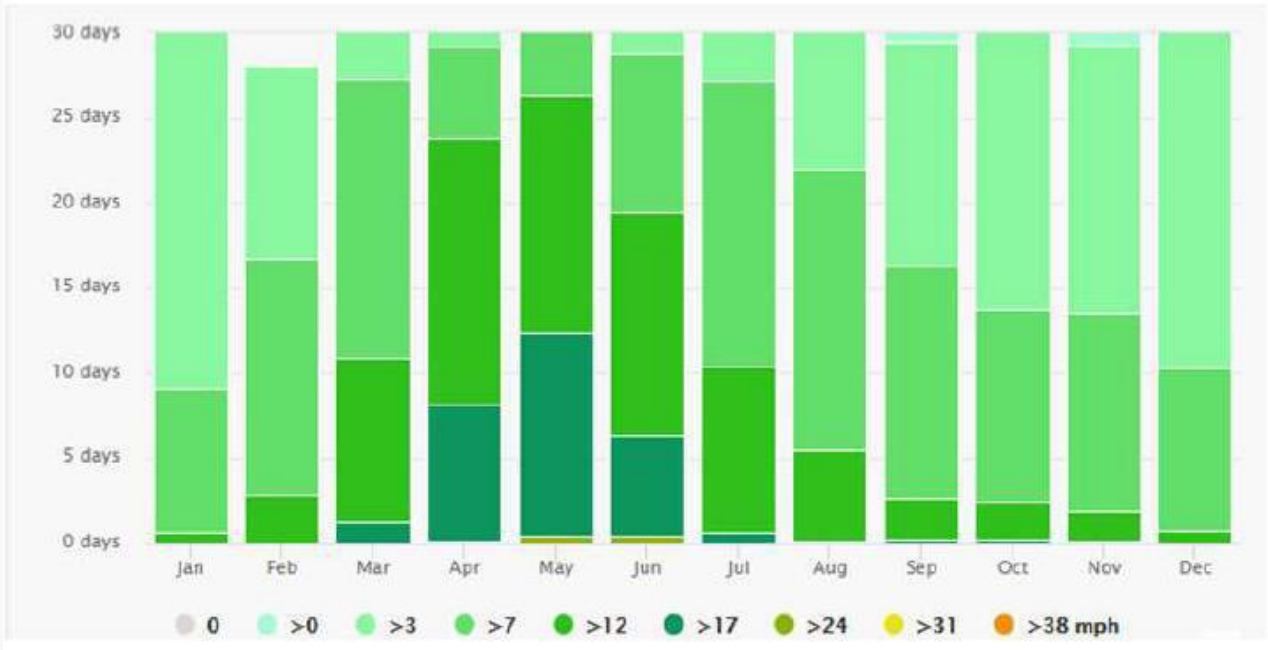


Figure 3- 2: Wind Speed Diagram for 1 year (Apr. 17 – Mar. 18)

The diagram for Bhubaneswar shows the days per month, during which the wind reaches a certain speed.

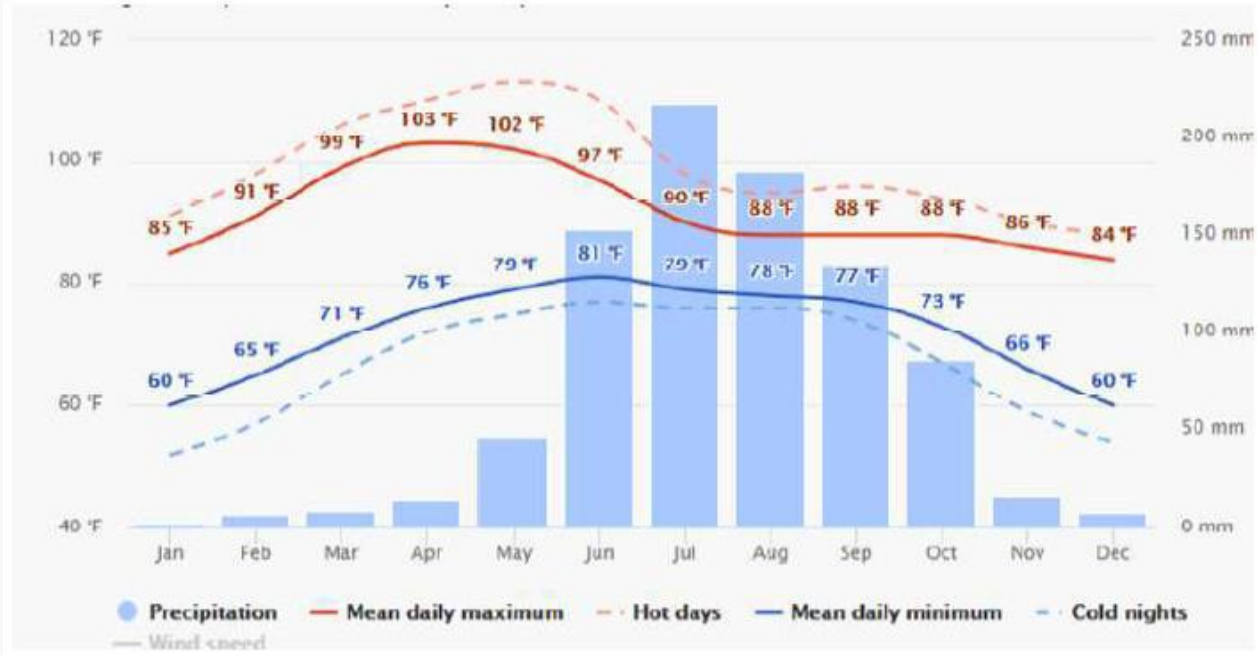


Figure 3- 3: Average temperatures and precipitation

The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Bhubaneswar. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years.

3.4.2 Air Environment

The prime objective of the baseline study with respect to ambient air quality is to establish the present air quality and its conformity to National Ambient Air Quality Standards. This data has been further used during impact assessment to predict the final air quality. This section describes the sampling locations, frequency of sampling and methodology adopted for monitoring ambient air quality.

To quantify the impact of the project on the ambient air quality, it is necessary at first to

- Evaluate the existing ambient air quality of the area. The existing ambient air quality, in terms of Particulate Matter – 10 (PM10), Particulate Matter- 2.5 (PM2.5), Sulphur-dioxide (SO2),Oxides of Nitrogen (NO2), and Carbon Monoxide (CO), has been measured through a planned field monitoring.
- To assess the ambient air quality level, 2 (two) monitoring stations were set up. Table - 3.2 gives location of the ambient air quality monitoring stations wrt to project"

Monitoring Schedule

Ambient air quality monitoring was carried out twice a week with a frequency of 24 hours for12 weeks.

Methods of Sampling and Analysis

The brief methodology of the parameter analyzed is as follows:

- Particulate Matter (PM2.5): (CPCB Method) Particulate Matter (PM2.5) was analyzed by Fine particulate Sampler Envirotech Model APM 550. PM 2.5 was collected on 47mmdiameter filter paper. The mass concentration of (PM2.5) fine particles in ambient air was calculated as the total mass of collected particles divided by the volume of air sampled.
- Particulate Matter (PM10): Particulate Matter (PM10) was carried out by respirable dust sampler envirotech Model APM 460 BL. The cyclone of this instrument is used for fractionating the dust into two fractions. PM 10 dust is accumulated on the filter paper(8"×10" size) while coarse dust is collected in a cup placed under the cyclone.PM 10 was calculated as per IS: 5182 (Part 23):2006. The mass of these particles was determined by the difference in filter weight prior to and after sampling. The concentration of PM 10 in the designated size range was calculated by dividing the weight gain of the filter by the volume
- Sulphur dioxide (SO2): SO2 was monitored with the help of APM 411 assembly attached with APM 460 BL using the impinge. It was absorbed by aspirating a measured air sample through a solution of Potassium tetra chloromercurate (TCM). This procedure resulted in the formation of a dichlorosulphitemercurate complex. The complex was made to react with pararosaniline and methylsulphonic acid. The absorbance of the solution was measured by means of spectrophotometer.

- Nitrogen Dioxides: NO2 was monitored with the help of APM 411 assembly attached with APM 460 BL using the impinge. It was collected by bubbling air through a solution of sodium hydroxide and sodium arsenite. The concentration of nitrite ion produced during sampling was determined colorimetrically by reacting with the nitrite ion with phosphoric acid, sulphanilamide and NEDA and absorbance of highly colored azo-dye was measured at540nm.
- Carbon Monoxide: It is measured using CO Analyser. This analyser is used to measure CO in ambient air, in the range of 0-200 ppm (220 mg/m3) to a sensitivity of 0.05 ppm(55 µ g/m3). The Serinus 30 combines the benefits of Microprocess control with Non-Dispersive Infrared Spectrophotometry technology. CO concentration is automatically corrected for gas temperature and pressure changes. CO was monitored on hourly basis whereas other parameters were monitored on 24 hourly bases

Results and Discussions

The monitoring reports are enclosed as **Annexure- IV** and summarized in the tabular form below. The results when compared with National Ambient Air Quality Standards

(NAAQS) of Central Pollution Control Board (CPCB) for "Industrial, Residential, Rural and Other Areas" show that the average values of ambient air quality parameters are well within the stipulated limit.

The results of ambient air quality monitoring for March-April 2018 for ISBT Baramunda project are summarized in the Tables below:

Ambient Air quality Station

PM 2.5

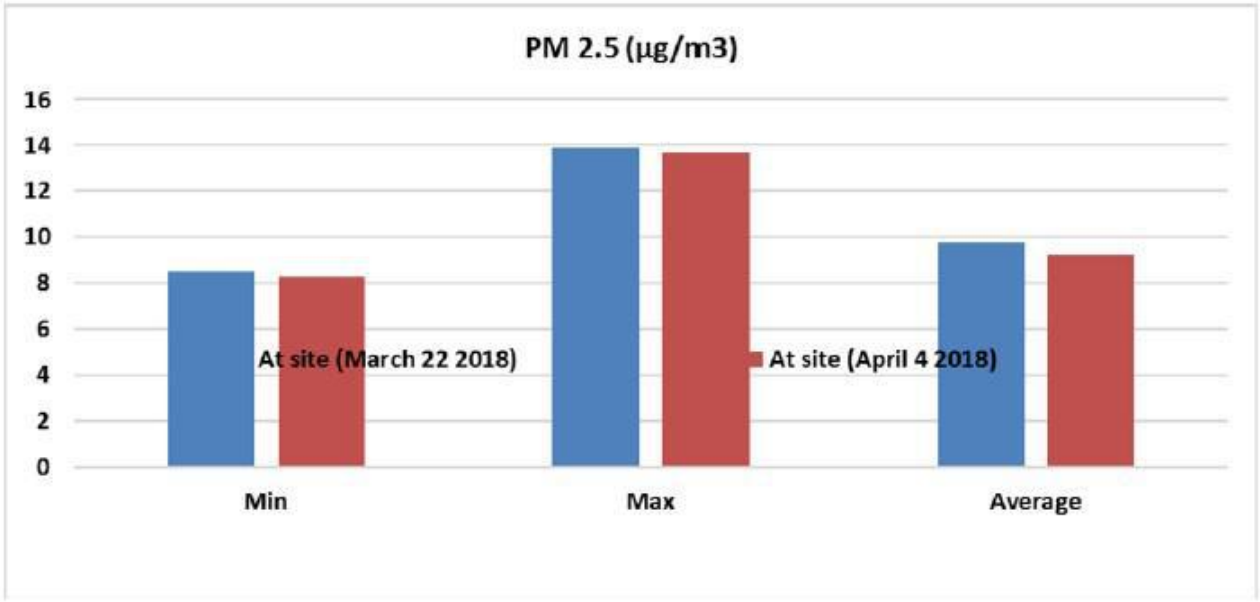


Figure 3- 4: Concentration of PM 2.5

Table 3- 2: Ambient Air Quality with respect to PM2.5

PM 2.5 (µg/m3)

Time	At site (March 22 2018)	At site (April 4 2018)
10:00 AM to 6:00 PM	168.4	187.4
6:00 PM to 2:00 AM	175.0	174.1
02:00 AM to 10:00 AM	115.1	154.5

The concentration of PM 2.5 in the study Area is presented as above table. It was observed that 98 percentile of PM2.5 is higher than standard prescribed by Standard CPCB.

PM 10

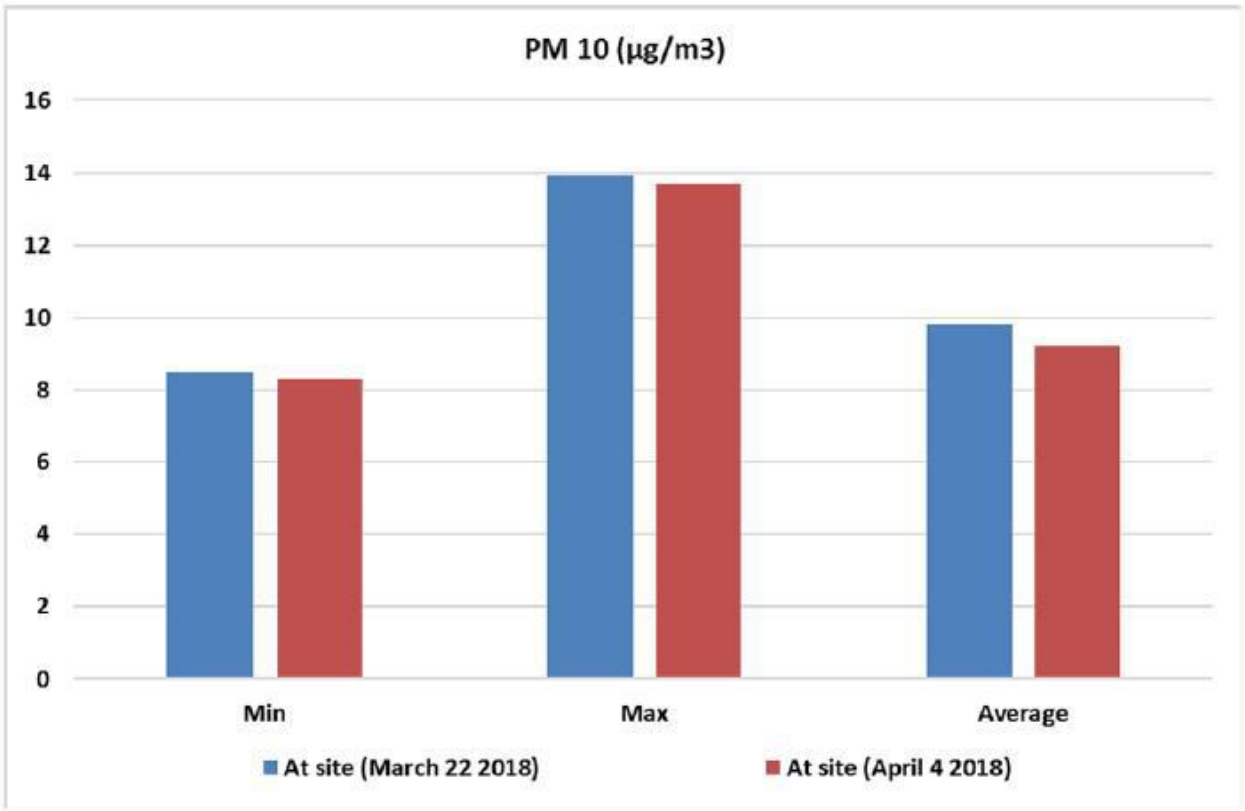


Figure 3- 5: Concentration of PM10

Table 3- 3: Ambient Air quality with respect of PM10

PM 10 (µg/m3)		
Time	At site (March 22 2018)	At site (April 4 2018)
10:00 AM to 6:00 PM	126.4	145.7
6:00 PM to 2:00 AM	133.3	162.4
02:00 AM to 10:00 AM	103.6	122.5

The concentration of PM10 in the study Area is presented as above table. It was observed that 98 percentile of PM10 is higher than standard prescribed by Standard CPCB.

Sulphur Dioxide

Table 3- 4: Ambient Air quality with respect of SO_2

SO_2 (ug/m^3)		
Location	At site (March 22 2018)	At site (April 4 2018)
Min	8.5	8.3
Max	13.9	13.7
Average	9.81	9.21

The concentration of SO_2 in the study Area is presented as above table. It was observed that 98 percentile of SO_2 is Very low than standard prescribed by Standard CPCB.

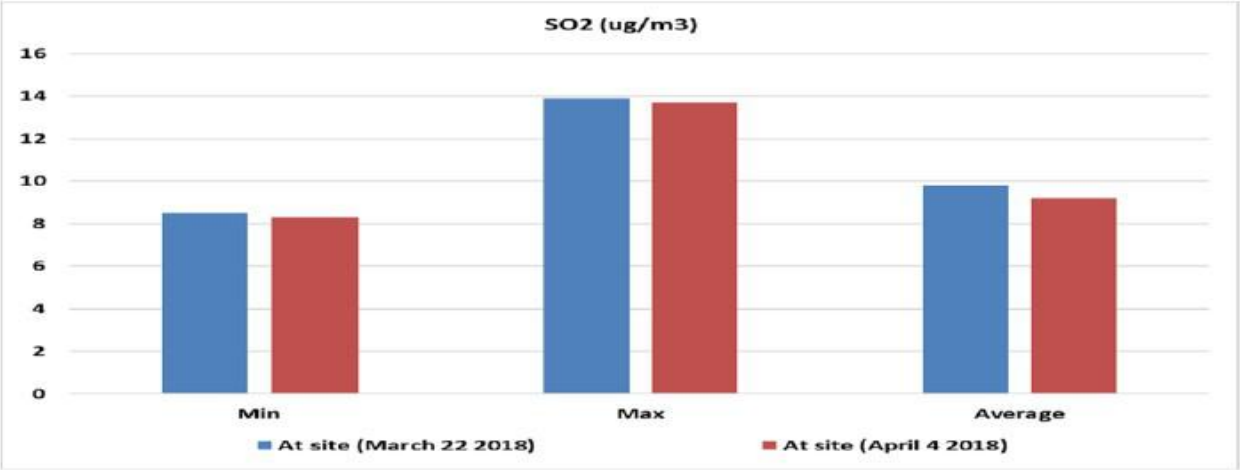


Figure 3- 6: Concentration of SO2

NOx

Table 3- 5: Ambient Air quality with respect of NOx

NOx (ug/m³)		
Location	**At site (March 22 2018)**	**At site (April 4 2018)**
Min	13.2	12.5
Max	17.5	18.7
Average	15.1	14.4

The concentration of NO_2 in the study Area is presented as above table. It was observed that 98 percentile of NO_2 is Very low than standard prescribed by Standard CPCB.

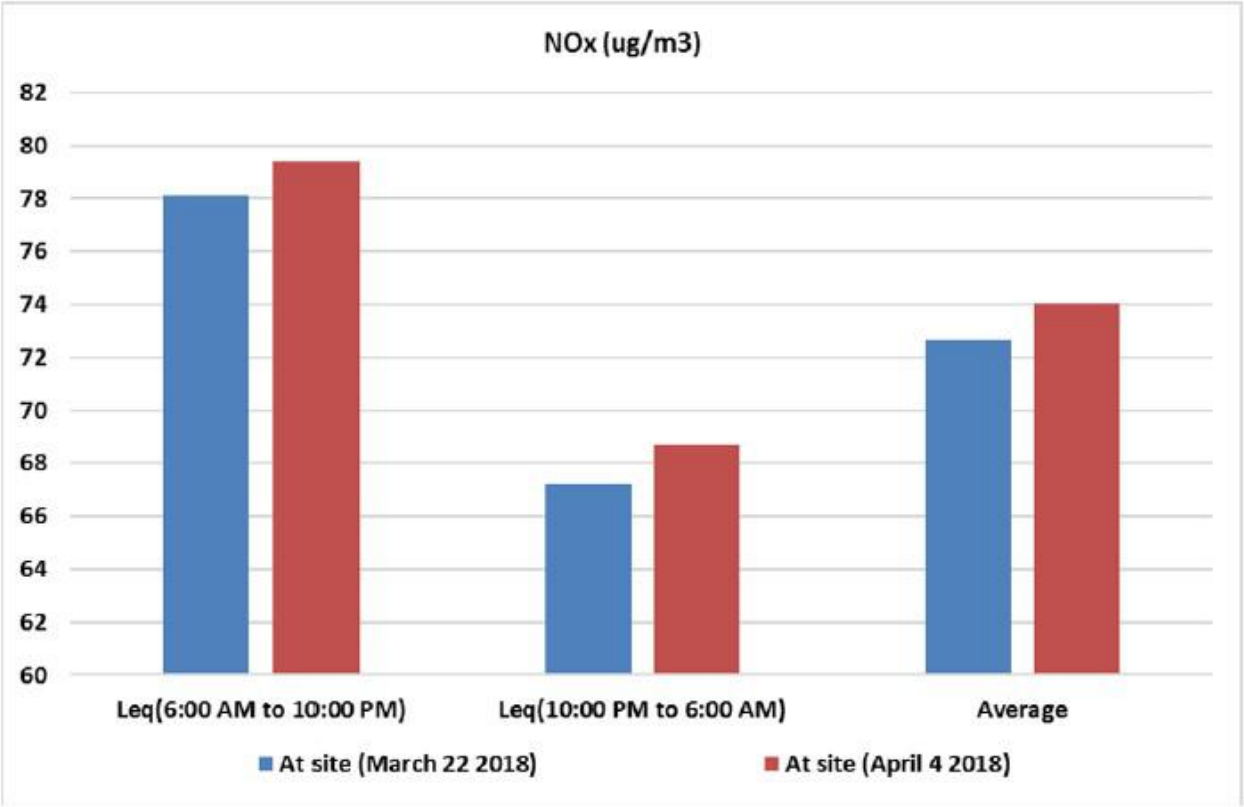


Figure 3- 7: Concentration of NOx

From the summarized monitoring result it is clear that in all case, the 24 Hourly 98 percentile level of SO2and NO2 were observed to be within the limits of 80 µg/m3 .whereas for the other components it was observed higher than the limit

The results of Air Quality Monitoring at site location during the study period are presented in *ANNEXURE 3: Air Monitoring Reports*

3.4.3 Noise Levels

Noise is one of the most undesirable and unwanted by-products of our modern life style. It may not seem as insidious or harmful as air and water pollutants but it affects human health and well-being and can contribute to deterioration of human well-being in general and can cause neurological disturbances and physiological damage to the hearing mechanism in particular. It is therefore, necessary to measure both the quality as well as the quantity of noise in and around the site.

To assess the ambient noise quality level, 5 (five) monitoring stations were set up. Table -3.4(a) gives location of the ambient noise quality monitoring stations with respect to spring meadows as project site and a map showing the ambient noise quality monitoring stations.

Methodology

The intensity of sound energy in the environment is measured in a logarithmic scale and is expressed in a decibel, dB (A) scale. In a sophisticated type of sound level meter, an additional circuit (filters) is provided, which modifies the received signal in such a way that it replicates the sound signal as received by the human ear and the magnitude of sound level in this scale is denoted as dB (A). The sound levels are expressed in dB (A) scale for the purpose of comparison of noise levels, which is universally accepted by the international community.

Noise levels were measured using an Integrating sound level meter manufactured by Pulsar Instruments Plc, Model No. 91 (SL.No.B21625). It has an indicating mode of Lp and Leq.

Keeping the mode in Lp for few minutes and setting the corresponding range and the weighting network in "A" weighting set the sound level meter was run for one hour time and Leq was measured at all locations.

The day noise levels have been monitored during 6.00 am to 10.00 pm and night noise levels, during 10.00 pm to 6.00 am at all the 5 locations, which covers residential areas, commercial, industrial areas, silence area if available within 5 km radius of the study area.

Sampling Locations

A preliminary survey was undertaken to identify the major noise generating sources in the area. The noise survey was conducted to assess the background noise levels in different zones. Gazette Notification (S.O. 123(E)) of MoEF dated December 14, 2000 on ambient air quality standards has different noise levels for different zones viz. project site, industrial, and residential zones. Two sampling locations were selected for the sampling of noise levels. The sampling locations are given in Table - 3.4 below. The noise quality at the site was monitored during March 2018 and April 2018.

Ministry of Environment & Forests (MoEF) has notified the noise standards vide gazette notification dated December 14, 2000 for different zones under the Environment Protection Act (1986). These standards are given in Table - 3.9.

Table 3- 6: Ambient quality standard with respect of Noise

Area Code	Category of Area	Noise dB (A) L_{eq}	
		Daytime	Night time
A	Residential Area	55	45
B	Industrial Area	75	70
C	Silence Zone	50	40
D	Commercial Area	65	55

Note:

- Daytime is from 6.00am to 10.00 pm and Night time is from 10.00 pm to 6.00 am.
- Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle hours, loud speakers and bursting of crackers are banned in these zones.

Table 3- 7: Ambient Noise Level

Time	At site (March 22 2018)	At site (April 4 2018)
Leq(6:00 AM to 10:00 PM)	78.1	79.4
Leq(10:00 PM to 6:00 AM)	67.2	68.7
Average	72.65	74.05

The noise data compiled on noise levels during March -April 2018 is given in Table - 3.6. It can be seen that the night time Leq (Ln) varies from 67.2 to 68.7 dB (A) and the daytime Leq varies from 78.1 to 79.4 dB (A) within the study area. Noise level at the site is slightly higher as compare to the CPCB limits of the residential, commercial and industrial area.

The results of Noise Monitoring at site location during the study period are presented in *ANNEXURE 5*

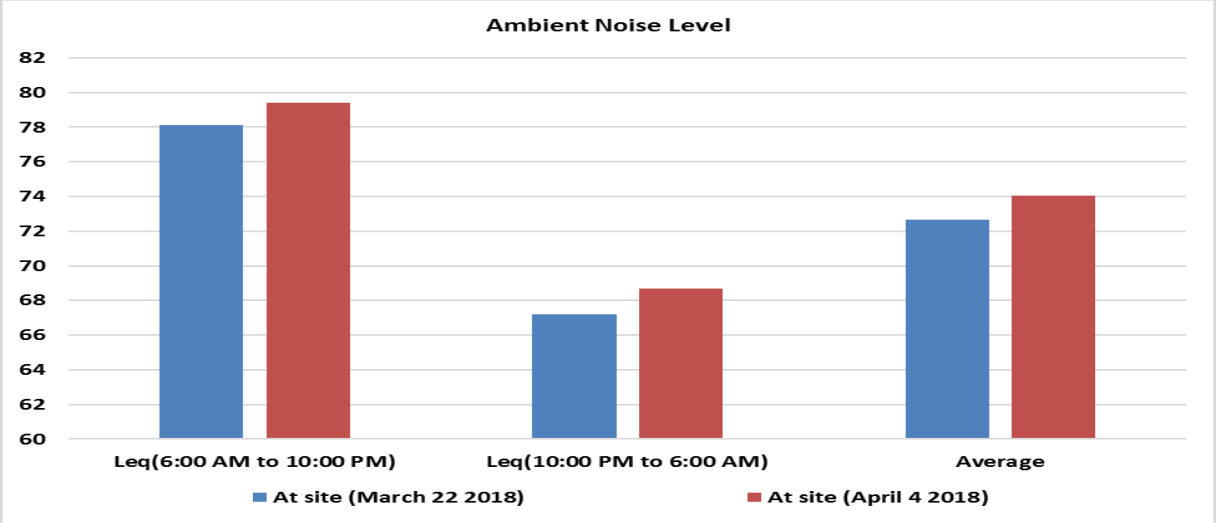


Figure 3- 8: Ambient Noise Level

3.4.4 Water Environment

Water Quality

Water quality assessment is one of the essential components of EIA study. Such assessment helps in evaluating the existing health of water body and suggesting appropriate mitigation measures to minimize the potential impact from development projects. Water quality of ground water has been studied in order to assess proposed water-uses in construction, drinking, cooling and horticulture purpose.

The water quality at the site and other locations within the 10 km impact zone was monitored during March 2018 – April 2018. The locations of the monitoring sites are given in Table - 3.7 and a map showing the ground water and surface water quality monitoring stations also attached as **Annexure –VI (c) and Annexure-VI (d).** Result of the monitoring and analysis of ground and surface water is presented in the ***ANNEXURE 4***

Sampling Frequency and Sampling Techniques

Samples were studied at monthly intervals in the study period. Quality of ground water was compared with IS: 10500: 1991 (Reaffirmed 1993 with Amendment No.3 July 2010) for drinking purposes. Surface water quality was analyzed for parameters as mentioned in the 'Annexure IV of CPCB guidelines' and it was rated according to the CPCB Water Quality Criteria (Designated Best Use). Water samples were collected in a 5 liter plastic jerry can and500 ml sterilized clean glass bottles for physio-chemical and bacteriological tests respectively.

GW sampling was done after flushing out the source (minimum 10 minutes) to get the fresh ground water and grab sampling method was used. River water samples were collected about 10cm below the water surface. All sampling, preservative and sample handling techniques were in accordance with APHA for Examination of Water & Waste water/ IS: 3025 (Part-1)/ IS:1622. The samples were analyzed as per Indian standard/APHA latest edition. The surface water quality is compared with CPCB water quality criteria mentioned in *Table 3- 8*

The water quality in the impact zone was assessed through physico-chemical and bacteriological analysis of ground samples. The results have been compared with the drinking water quality standards specified in IS: 10500.

Table 3- 8: Ground Water Quality

S NO.	Parameter	Unit	Limit(IS-10500:1991)		GW1	GW2
			Desirable	Permissible	Project site	Project site
1.	Colour	Hazen	5	15	<5	<5
2.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable
3.	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity	NTU	5	10	1.9	1.7
5.	pH	-	6.5-8.5	No Relaxation	7.8	7.2
6.	Total Hardness(as $CaCO_3$)	Mg/l	300	600	1925	1845
7.	Iron (as Fe)	Mg/l	0.3	1.0	0.24	0.23

S NO.	Parameter	Unit	Limit(IS-10500:1991)		GW1	GW2
			Desirable	Permissible	Project site	Project site
8.	Chlorides(as Cl)	Mg/l	250	1000	712	822
9.	Fluoride (as F)	Mg/l	1	1.5	0.6	0.7
10.	TDS	Mg/l	500	2000	4304	4217
11.	Calcium(as Ca2+)	Mg/l	75	200	23	22
12.	Magnesium (as Mg2+)	Mg/l	30	100	144	143.6
13.	Copper (as Cu)	Mg/l	00.05	1.5	<0.01	<0.01
14.	Manganese (as Mn)	Mg/l	0.1	0.3	<0.01	<0.01
15.	Sulphate (as SO4)	Mg/l	200	400	1251	1211
16.	Nitrate (as NO_3)	Mg/l	45	No Relaxation	17.5	16.54
17. a	Phenolic Compound (as C6H5OH)	Mg/l	0.001	0.002	<0.001	<0.001

Results and Conclusion

The water quality in the impact zone was assessed through physic- chemical and bacteriological analysis of ground and surface water samples. The results have been compared with the drinking water quality standards specified in IS: 10500. It was observed that the physio chemical parameters such as total hardness, sulphates, chlorides and total hardness exceed the IS standard and heavy metals such as magnesium also exceed the stipulated drinking water standards and desirable standards.

All the ground water samples analyzed can be considered fit for drinking purpose in the absence of alternate sources Comparing the values of pH, DO, BOD and total coliform with 'Use based classification of surface waters' published by Central Pollution Control Board; it can be seen that the analyzed surface water sample when compared with class 'A', 'B','C', 'D' & 'E', it is found meeting requirements of 'D' & 'E' only. The presence of high coliforms may be due to human activities observed during the study period.

4 SOCIO ECONOMIC ENVIRONMENT

This section is focused on the baseline scenario of social and economic environment of the ISBT Baramunda, Bhubaneswar site and the overall anticipated impact of the proposed project impact on social-economic activities of the dwellings with their socio demographic profile, economic activity, literacy rate, land use and infrastructure. Social-economic effects of the project refers to the physical, psychological, economic, cultural and other lifestyle prediction, impacts and their anticipated mitigations for the people and society.

4.1 SOCIO DEMOGRAPHIC PROFILE

As per the 2011 census of India, Bhubaneswar had a population of 837,737, while the metropolitan area had a population of 881,988. The populations in the last five years has been as below;

Table 4- 1: Population growth of Bhubaneswar

Year	Population	Growth %
2012	843,202	-
2013	858,009	1.75
2014	879,211	2.47
2015	891,624	1.41
2016	905,339	1.53

Taking a look at the population of Bhubaneswar from the year 2012-16, it has been noticed that there has been an increase of 62,137 in the past 5 years. Therefore, it has been seen that every year the population increases by 12,427. Hence, the population of Bhubaneswar in 2017 is forecasted to be 905,339 + 12,427 = 917,766. So, the population of Bhubaneswar in the year 2017 as per estimated data = 917,766. The population density of Bhubaneswar is 2131 persons per square kilometre. The population growth of the city has been really good in the recent years and it has been that as compared to the previous decade, the population has jumped up at a faster pace. The city has been helped by the enormous growth rate of the state and the trend is set to continue in the coming years.

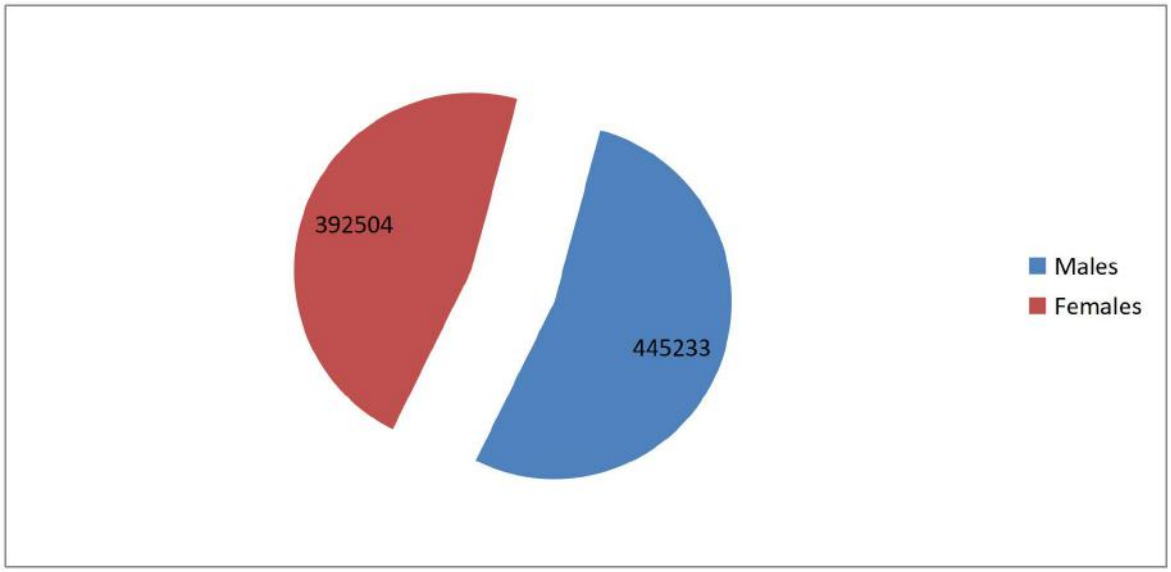


Figure 4- 1: Sex ratio of Bhubaneswar as per the Census of India, 2011

As of 2011, the number of males was 445,233, while the numbers of females were 392,504. The decadal growth rate was 45.90 per cent.

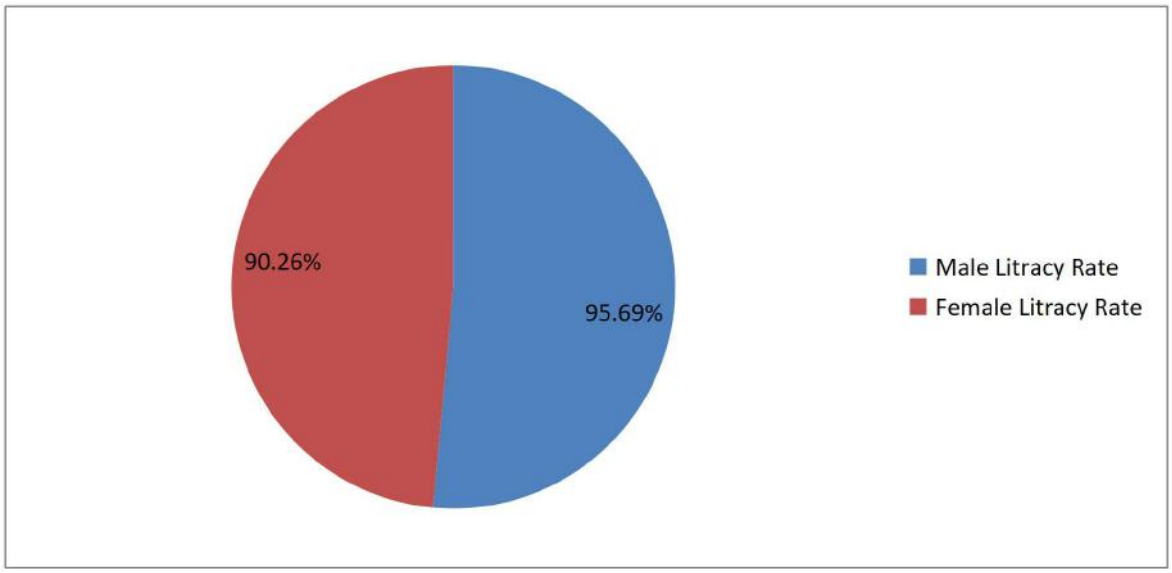


Figure 4- 2: Literacy rate of Bhubaneswar as per the Census of India, 2011

Effective male literacy was 95.69 per cent, while female literacy was 90.26 per cent. About 75,237 were under six. Bhubaneswar's literacy rate is 93.15 per cent—significantly higher than the national average of 74.04 per cent.

Most of the people live in nuclear families 52% to be precise. 75% of the people own their own houses. Apart from this almost 75% of the houses are single storeyed.

The main language spoken in the city is Odia, however, Hindi and English are understood by most residents. Although Odisha comprise the vast majority, migrants from other states also live there. Growth in the information technology industry and education sector in Bhubaneswar changed the city's demographic profile; likely infrastructure strains and haphazard growth from demographic changes have been a cause of concern.

4.2 ECONOMIC PROFILE OF THE CITY

Bhubaneswar after being instated as the capital of Odisha after independence was intended to be developed as an industrial power house owing to large mineral resources. However, the small and medium manufacturing units spurred and later decreased their influence on the city's economy.

After the economic liberalization in 1991, the city received huge investments in IT telecommunication and engineering sectors. Companies like Infosys, TCS etc. have shaped the economy of the region and also the educational preferences in the city. The city has several engineering colleges and institutes that cater to the booming job market in the city. Because of the abundance of iron and other minerals, steel and other manufacturing industries like SAIL, Jindal Steel, Bhushan Steel, TAT group etc have increased the region's economic prominence.

With basic manufacturing industries and development of IT parks and SEZs, Bhubaneswar is starting to gain economic standing with the only disadvantage of floating populace mainly from the neighbouring states like Andhra Pradesh and Jharkhand.

Main economic activities in the city are IT with many employed in software companies like Infosys, Wipro etc. The city is also dependent on basic economic activities like agriculture, horticulture and sericulture. Religious and recreational tourism also form a major source of activity for the citizens of the city indirectly supporting the hospitality industry. With private investment being encouraged by the government, IT parks have sprouted in and around the city attracting foreign interest. In addition, the city has strong industrial and trade activities.

While old industries producing the traditional Oriya handicrafts at large scale are phasing out of business due to stricter pollution norms, several of them have found an alternative business opportunity in the growing electronics industry in the city. In 2005, the city had about 88 industries operating in and around the city with majority of them being small scale. Important industries included electronic goods, textiles, ship buildings, chemicals, cement processing etc.

Endowed with a rich cultural heritage and natural beauty in the form of historical temple sites

and national parks respectively in its vicinity, Bhubaneswar attracts approximately 1.7 billion tourists each year. The trade and commercial sectors operate in several pockets of the city in organized and unorganized and informal markets. The products for sale vary from food products to mechanical tools and equipment.

Over the past two decades, Bhubaneshwar has emerged as one of the fastest growing economic hubs of eastern India. The city was ranked among the best places to do business by the World Bank in 2014. Bhubaneswar has been traditionally home to handicrafts industry, including silver filigree work, appliqué work, stone and wood carvings and patta painting, which significantly contributes to the city's economy. Until the 1990s, the economy was dominated by retail and, small and medium scale industries.

Sectoral Composition of Odisha's Economy 2014-15 at 2004-05 prices(at factor cost)(in percent)

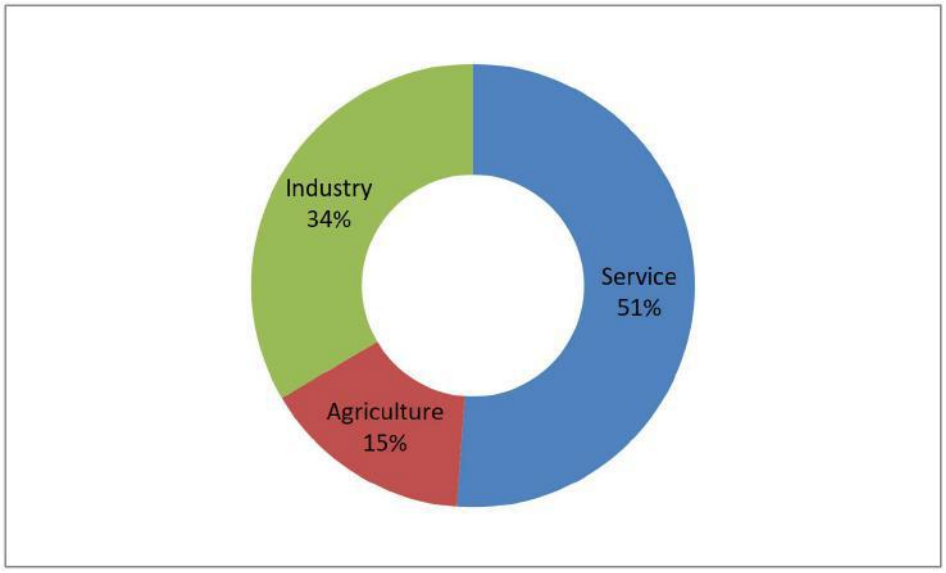


Figure 4- 3: Sectoral composition of Odisha's Economy 2014-2015

4.3 SPATIAL GROWTH INFORMATION OF THE CITY

Status of Land Usage:

The fast growing population is creating sprawl effect in the adjacent agricultural and others vacant land. Thus the city is experiencing haphazard growth and leads to increasing pressure on open land, agricultural lands and urban infrastructural facilities. The demand for land within the fringe areas and peri-urban areas of Bhubaneswar Municipal Corporation (BMC) is growing as more and people prefer to live in the areas adjacent to the main city. As a result land value is gradually getting higher. It is also

observed that the nature of land use is mixed in general in most part of the city. The functions like trade and commerce, open spaces, recreational areas, agriculture and industries etc. are encroaching upon the existing areas of residential and other such purposes.

Land Usage Trends:

As we can see that agricultural areas contributed the highest areas during this period. Vacant land and residential areas contribute the same areas. During year 2005, the trend changes in the land use areas. Agricultural areas have a downward trend while there is increase in residential and public utilities.

Neighbourhood & Linkage:

Subject site can be easily accessed from major transport nodes, such as Town Bus stand, Bhubaneswar Railway station &BijuPattnaik International Airport. Popular Lingaraj Temple of Bhubaneshwar is located in close proximity of 8 Km to subject site. Also, Bhubaneshwar is educational hub for famous institutes like IMI, IIIT Bhubaneshwar and new campus of IIT Bhubaneswar.

Commercial Activities Operating From The Construction Site Area;

- Shopping Complex -30Nos.
- Self Finance Scheme -24Nos.
- Stalls -22Nos.
- Open Space -48Nos.
- Samplal Kiosks -1No.
- Dormitory -2Nos.
- Owner Association -2Nos.
- Labour Union -1No.
- HPMC Fruit Juice -1No.
- Store -1No.
- Kuchcha Shops -17Nos.

Total -149No.

- Mobile Vendors-25Nos.

Types Of Shops;

- Dhabas
- Mobile Phone Shops
- General Merchant
- Saloons

- Fruit Sellers
- Automobile Spares Shops
- ATMs

Dormitory;

- Shakti Guest House
- Pooja Lodge
- Devi Lodge

Bus Associations;

- Rajdhani Bus Owners Association
- Rajdhani Labour Association
- Bus Owner Association

Common Properties;

- Sulabh -3Nos.
- Administrative Block -1No.
- Police Post -1No.
- Waiting Hall -1No.
- Urinals -1No.
- Old Age Home - 1No.

4.4 SOCIAL ISSUES AND MITIGATION MEASURES

Since this is an upgradation/expansion project where land acquisition is not required, the issue of displacement of people does not arise. Therefore compensation and relocation is not taken up here in this report.

Table 4- 2: Social issues & proposed mitigating measures

S.No.	Issues/Concerns	Mitigation measures

1	Urban traffic congestion can occur due to construction activities or increased construction machinery traffic on some roads near the construction sites.	The impacts on urban traffic will be temporary and manageable, provided close cooperation with the relevant urban infrastructure departments is established. The Project Management Office will develop a traffic management plan to prevent congestion and traffic jams by consulting with the Traffic Control Department.
2	The construction can cause temporary interruptions or increased loads for such urban systems as water supply, natural gas pipelines, sewerage, energy, communication lines.	Temporary electric and water supply schemes should be developed in coordination with the relevant authorities to supply construction works with electricity and water. Information on the urban construction status will be provided through television, radio, and newspapers. Bulletin boards will be set up to publicize the objectives of the projects, construction timetable, and grievance hotline.
3	The traffic interruptions will cause traffic jams which will threaten the safety of pedestrian traffic around the construction sites.	Safety measures will be adopted for pedestrians' and residents' safety and convenience. These will include footbridges, fences, and appropriately situated lighting.
4	During the construction stage, jobs will not go to locals.	Local labour will be engaged to the extent possible.
5	Due more number of buses after expansion, crossing the roads leading or coming out of the ISBT will become difficult.	Underpasses should be build to facilitate people cross roads at critical points to avoid accidents.

6	Nearly 149 shops/business units are running from within the existing old building will be removed. This will cause a loss of business for the owners of such shops or business units.	Provisions should be made to accommodate such shops in the expansion program. Construction may be taken up in parts to enable relocation in installments to minimize the impact on the their business.
7	Common places such as ➢ Sulabh-3 ➢ Administrative Block-1 ➢ Police Post1-No. ➢ Waiting Hall-1 ➢ Urinals-1 Are necessary as they are essential. Thier removal will cause a lot of inconvenience to paubli/passenger/staff etc.	Alternate makeshift arrangements has to be made before their removal in Environment Management Plan itself.
8	Bus association offices situated within the construction area as below will be shifted; Rajdhani Bus Owners Association Rajdhani Labour Association Bus Owner Association	These offices are necessary for an ISBT and therefore alternate arrangement have to be made to be made nearby. They may be relocated temporarily during construction phase. For their permanent arrangement provision has to be made in the development plan.
9	Dormitory are also very important and essential part of any ISBT and hence the removal of following existing dormitories will cause inconvenience to overnight passengers; • Shakti Guest House • Pooja Lodge • Devi Lodge	These may be relocated nearby area for the construction phase while a provision be made in the development plan.

10	Relocation of Old Age Home at the suitable place	The site is a busy Bus Terminal with heavy traffic of buses is at present and shall increase within the future course. The air pollution and noise pollution level is also high at the site. Considering safety and health of the old age people, it is recommended to shift the facility to the other suitable place.

The project impact will result in some positive social impacts such as;

- Employment opportunities during construction as well as operation stage,
- Better transport facilities will make and create better business,
- More and more industries will come to the town leading to better employment opportunities,

5 ENVIRONMENTAL MANAGEMENT PLAN

This section outlines the key environmental management and safeguards that will be initiated by the project proponent to manage the project's key environmental concerns. Environmental Management Plan (EMP) is the mechanism to ensure that environmental considerations are integrated into the project survey and design, contract documents and project supervision and monitoring. These are tools for mitigating or offsetting the potential adverse environmental impacts resulting from various activities of the project. The environmental management plan (EMP) mainly consists of integrating potential impacts (positive or negative), environmental mitigation measures, implementation schedule, and monitoring plans.

The potential environmental impacts and proposed management associated with each stage of the project development are described here. The primary objective of this proposed environmental management and monitoring program is to control environmental impacts to levels within acceptable standards, and to minimize possible impact on the community and the workforce of foreseeable risks during the construction and subsequent operation phases of the project.

Also, it is very important to highlight here that such environmental mitigation measures shall be used in conjunction with good management practices and good engineering design, construction and operation practices.

The EMP will be a working document that personnel on site need to both understand and undertake environmental management. It will be ensured personnel are in a position to adequately manage the environmental concerns of the site and effectively monitor for and mitigate impacts.

The Environment Management Plan consists of the set of mitigation measures for the management, monitoring and reduction of environment impacts due to proposed project. The potential environmental impacts and proposed management associated with each stage of the project are described here. The primary objective of the proposed environment management and monitoring program is to control environment impacts to levels within acceptable standards and to minimize possible impact on the community during the construction and operation phases of the project.

5.1 EMP for Air Pollution Control

5.1.1 During Construction Phase

Various construction activities especially related to loose material are likely to generate dust that will impact the air quality of the surrounding area of the project sites and also due to movement of vehicle for transportation construction goods. To minimize such impact following mitigation measures shall be taken: -

- All the loose and dusty materials shall be regularly sprinkled with water and covered with the sheets.
- Sprinklers shall be provided for the same.
- Vehicles used for the transportation of construction materials will have Pollution under Control certificates and will be covered when delivering loose and fine materials.

- Transportation of the construction materials will be carried out during non-peak hours of 11:00 AM-5:00 PM.
- All vehicles and machineries used for the construction will be regularly maintained.
- Wind breakers would be provided at the area where loose material.
- A trained person having the knowledge of medical aid facility will always be present at the site during construction activity.
- Painting activity and tile cutting shall be carried out in closed areas.
- The project will take adequate measure to prevent danger from electrical equipment. All necessary fencing and lighting will be provided to prevent the accidents.
- Medical cum First Aid Kit shall be provided.

5.1.2 During Operation Phase

- **AIR EMISSIONS: -** Three DG sets of 750 KVA will be provided as a source of power back up. Stacks will be provided for releasing emissions from the DG set. The stacks of DG set is raised according to the following formula specified as :.

$H = 0.2 \times \sqrt{kVA}$

$= 0.2 \times \sqrt{750} = 5.47$ mtr.

Where,

H is total height of stack required (m)

KVA is the total power generation capacity of the DG set.

DG set of 750 KVA has a height if 6 mtr above acoustic enclosure.

Mitigation Measures for Controlling Vehicular Emission

To control the emissions from the movement of vehicular traffic, following measures shall be adopted: -

- Proper maintenance of the internal roads.
- Adequate greenbelt shall be developed and maintained
- Informatory sign shall be provided to encourage vehicle owners to maintain their vehicle and follow the emission standards fixed by Government Authorities

5.2 EMP for Noise Pollution Control

5.2.1 During Construction Phase

During the construction stage, expected noise levels shall be in the range of 80-100 dB(A), which will decrease with increase in distance. Hence all the construction activities shall be carried out during the daytime. Careful planning of machinery operation and scheduling of operations shall be done to minimize such impact. Following are the mitigation measures that will be taken:-

- Construction shall be carried out in accordance to standard procedures.

- Construction activity shall be carried out during the day time of 9:00 AM to 6:00 PM
- Onsite DG sets will have an acoustic enclosure to confirm with noise emission standards
- Use of machineries which creates high level of noise shall be strictly prohibited during night hour.
- Ear muffs. Plugs shall be provided to construction workers to prevent occupational health hazards when working with high emitting noise level machinery.
- Regular servicing of all the construction equipments shall be carried out in a periodic manner.
- All the equipments operated within specified design parameters.
- As far as possible unleaded / sulphur free petrol will be used for petrol driven vehicles.
- Vehicles hired for the transportation of construction materials shall be operated during non peak hours.

5.2.2 During Operation Phase

All the equipment, which will be used in proposed project, shall be designed to have a noise level not exceeding 85-90 dB(A) as per the requirement of OSHA (Occupational Safety and Health Administration)Standards. Adequate protective measures in the form of ear muffs/ earplugs shall be given to workers working in these areas of the high noise level such as pumping room, STP area etc. Greenbelt development shall further attenuate the noise generated from the vehicular movement.

Noise from DG sets:-As per the Environment (Protection) Rules, 1986, the maximum permissible sound pressure level for new diesel generator sets with rated capacity upto 1000 KVA on or after the 1st January 2005 shall be 75 dB(A) at 1 meter from the enclosure surface. The DG sets would be provided with integral acoustic enclosure for minimum 25 dB(A) insertion loss or for meeting the ambient noise standards. The DG sets be provided with exhaust mufflers with insertion loss of minimum 25 dB(A). Following mitigation measures to minimize the noise level shall be carried out:-

- Acoustic enclosure is provided to the DG sets t conform the above noise levels.
- Noise barriers in the form of thick plantation will be carried out.
- All the noise generating sources in the complex will be equipped with adequate noise control measures.

5.3 EMP for Water Pollution Control

5.3.1 During Construction Phase

- During the construction operation, Runoff from the construction site shall not be allowed to enter into the roadside or nearby drain. Adequate measures shall be taken to collect the run off. All attempts will be made to reuse it. To minimize the usage of water for construction purpose, Ready Mix Concrete will be used.
- Potable movable toilets, separately for men and women shall be provided to maintain the hygienic sanitation conditions. Sewage from theses toilets will be channelized to external sewage network.
- Stagnation of water shall not be allowed in or around the project side to prevent the breeding of mosquitoes.
- Good housekeeping, including regular maintenance of equipment and prompt replacement of leaking pump seals and pipeline valves will regularly be carried out to reduce emissions to a minimum.

5.3.2 During Operation Phase

In order to mitigate adverse impacts on water environment due to the surface run off, waste water, etc. provisions for adequate infrastructure facilities such as drainage system, wastewater collection and conveyance including treatment and reuse have been developed in the project.

5.3.3 Sewage Treatment Plant (STP)

Waste water quality generated from the project during operation phase shall be generally be of domestic sewage characteristics and of quantity 979 KL/day. Hence Sewage Treatment Plant of 1000 KLD is proposed for the project with the treatment upto tertiary level with the provision of reuse of the treated water to its full capacity, thus attaining zero discharge.

The STP system is based on the biodegradation and sedimentation technology, which is unique due to its compactness and performance in respect of volumetric efficiency. These technologies are combined in a prefabricated; skid mounted and standardized tank system with variable length. Standard systems are designed for indoor location in closed rooms with draft ventilation. Smaller systems may be placed outdoor under shelter with natural ventilation. Since the systems are excessively aerated, the smell caused by anaerobic rotting is negligible.

Treated water from STP shall be transferred and stored to overhead tank from where it will be used for toilet flushing, horticulture and HVAC make up water.

5.3.4 Rain Water Harvesting System

There is one number of rain water harvesting storage tanks exist in the campus. Another one rain water storage tank has been proposed. The collected rainwater after passing through de-silting-cum-filter chambers would be stored for the purpose of usage in horticulture. Overflow from the storage tanks will be injected into the groundwater aquifer-through percolation boreholes. Oil and grease separators will be provided prior to the desilting-cum-filter chambers to arrest and separate any trace oil present in the rainwater.

5.4 EMP for Waste Management

5.4.1 During Construction Phase

Excavated earth, debris etc. will be collected and disposed off to Municipal land fill site as guarded by the local authority. Cement bags, waste paper and cardboard packing materials will be sold off to recyclers.

Mitigation measures:-

- The project will take prior permission from the competent authority for disposal of construction waste on secure land fill site.
- No construction spoils of any material will be allowed to dispose off on roadside or any other neighbor areas.
- Cement bags, waste paper and cardboard packing materials will be sold off to recyclers.
- Excavated earth will be used for landscaping and construction debris will be disposed off to Municipal land fill site as guarded by the local authority.

5.4.2 During Operation Phase

Municipal Solid Waste generated during operation phase is estimated to be around 9000 kg/day. Two different types of bins (biodegradable & non-biodegradable) at various points on every floor will be provided from where it will be collected and segregated into biodegradable & recyclable material. Biodegradable waste will mostly be constituted of kitchen waste from college canteen, food court & mess area of the hostel. Organic waste convertor will be installed in campus to convert the food waste into manure which will be used as compost in the horticulture. The inorganic wastes comprising recyclable materials such as paper, plastic, glass, packaging material etc., will be sold to recyclers. Paper recycling unit is also proposed for the waste paper. It is estimated that approx 10 Kg/day of STP sludge will be generated which will be used for horticulture purpose.

Hazardous Waste like DG waste oil and its barrels will be sold to CPCB approved hazardous waste recycler. Before selling them to the authorized recycler they will be kept in isolated and separately marked area.

E-waste like IT/ telecom sources, insulation, wires, cables, fluorescent lamps, batteries, external electric cables and CFL bulbs will be generated from the commercial activity shall be collected at common point and be given to authorized e-waste recyclers.

Table 5- 1: EMP Waste Management

S. No.	SOLIDWASTE	CONSTRUCTION PHASE	OPERATION PHASE
1.	Nature	Excavated earth, debris, packaging material etc.	**Organic Wastes:** Vegetables and waste foods. **Inorganic Wastes:** Papers, cartons, thermocol, plastics, polythene sheets etc. **E-waste:** IT/ telecom sources, insulation, wires, cables, fluorescent lamps, batteries, external electric cables and CFL bulbs. **Hazardous Waste:** Used Oil from DG sets and empty oil barrels
2.	Collection and disposal	Excavated earth will be used for landscaping and construction debris will be disposed off Municipal land fill site as guarded by the local authority.	The solid wastes generated will be a segregated into organic and / inorganic components and collected in separate bins. The organic biodegradable wastes (waste vegetables, foods etc.) will be converted into compost by organic waste convertor. Dewatered/ dried sludge from STP will be used as manure for horticulture purpose
3.	Recycling	Cement bags, waste paper and cardboard packing materials will be sold off to recyclers	**The inorganic wastes** comprising recyclable materials, such as paper, plastic, glass etc., will be sold to prospective buyers. **Paper recycling unit** will be installed for the waste paper. **E-Waste** shall be given to authorized e-waste recycler. **Hazardous Waste** i.e. used Oil from DG sets and empty oil barrels will sent to CPCB authorized hazardous waste recyclers

5.5 Environment Monitoring Plan

Table 5- 2: Environmental Monitoring Plan

S No.	Testing /Monitoring type	Parameter	Frequency	Recurring cost /Annum rupees
During Construction Phase				
1.	Ambient Air quality	PM2.5 PM10, SO_x, co	Quarterly	25000
2.	Ambient Noise	24 hours	Monthly	36000
3.	Ground Water	Biochemical, physiochemical	Quarterly	26000
	TOTAL			**87000**
During Operational Phase				
1.	Ambient Air quality	PM2.5 PM10, SO_x, co	Quarterly	25,000
2.	Ambient Noise	24 hours	Quarterly	12,000
3.	Generators	Noise	Quarterly	10,000
4.	STP treated Water	pH, Oil and grease, BOD, COD, TSS, Ammonical Nitrogen as N, Disolved Phosphate, Nitrate, Nitrogen	Monthly	48,00
5.	Ground Water	Biochemical, physiochemical	Quarterly	26,000
	TOTAL			**1,21,000**

ANNEXURE 1: FORM 1

(See paragraph – 6)

(I) Basic Information

ANNEXURE 1: FORM 1

(I) Basic Information

S.No.	Items	Details
1	Name of the Project	Proposed Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar
2.	S.No. in the schedule	8 (a)
3.	Proposed capacity/area/length/tonnage to be handled/ command area/lease area/number of well to be drilled	Plot Area: 15.5 acre (62726 sqm) Proposed Built up Area: 28,124 sqm
4.	New/ Expansion/ Modernization	New
5.	Existing Capacity/ Area etc.	Old bus terminal
6.	Category of Project i.e. 'A' or 'B'	'B'
7.	Does it attract the general condition? If yes, please specify.	No
8.	Does it attract the specific condition? If yes, please specify	No
9.	Location	Baramunda, Bhubaneswar
	Plot/Survey/Khasra No.	-do- Copy Enclosed
	Village	Baramunda
	Tehsil	Bhubaneswar
	District	Khordha
	State	Orissa
10.	Nearest railway station/ airport along with distance in kms.	Bhubaneswar railway station at 8 Km SE BijuPatnaik International Airport at a distance of 6 Km SE
11.	Nearest Town, City, District Headquarters along distance in kms.	Project is proposed within the city of Bhubaneswar, District : Khordha
12.	Village Panchayat, ZillaParishad, Municpal Corporation, Local body (complete postal address with telephone nos. To be given)	Bhubaneswar Development Authority AkashShova Building, Sachivalaya Marg Bhubaneswar-751001 Odisha, India
13.	Name of the applicant	M/s Bhubaneswar Development Authority
14.	Registered Address	Bhubaneswar Development Authority AkashShova Building, Sachivalaya Marg Bhubaneswar-751001
15	Address for correspondence	Bhubaneswar Development Authority

Assistant Engineer (C) Division No. I, BDA, Bhubaneswar.

Executive Engineer Division No-1, B.D.A.

S.No.	Items	Details
		AkashShova Building, Sachivalaya Marg Bhubaneswar-751001
	Name	Sitanshu Kumar Rout
	Designation (Owner/ Partner/CEO)	Secretary.
	Address	Bhubaneswar Development Authority
	Pin Code	751001
	E-mail	Secy@bda.bbsr.in
	Telephone No.	0674-2392280
	Fax no.	0674 2390633
16.	Detail of Alternative Sites examined, if any. Location of these sites should be shown on a topo sheet	N/A
17.	Interlinked Projects	No
18.	Whether separate application of interlinked project has been submitted	- ✓
19.	If yes, date of submission	- ✓
20.	If no, reason	- ✓
21.	Whether the proposal involves approval/ clearance under: If yes, detail of the same and their status to be given (a) The Forests(Conservation) Act, 1980? (b) The Wild Life (Protection) Act, 1972: (c) The C.R.Z. Notification, 1990?	No
22.	Whether there is any Government order/policy relevant/ relating to the site?	Yes Copy Enclosed
23.	Forest Land Involved (Hectares)	No
24.	Whether there is any litigation pending against the project and/or land in which the project is proposed to be setup? (a) Name of the Court (b) Case No. (c) Order/directions of the Court, if any and it relevance with the proposed project	No

- Note:- Information filled in above table from S.no. 1 to 24 needs to be checked & reconfirmed please.

Executive Engineer
Division No-1, B D A

Annexure-A

Land Schedule of OSRTC/ORT GARRAGE and BUS STAND in Mouza Baramunda, Unit No. 19 (1987-88 settlement)

Sl. No.	Khata No.	Plot No.	Kisam	Area in Acs.	Proposed Area	
					Plot No	Area in Acs
1	2	3	4	5	6	7
1	855	116/2331	Gharabari-2	0.048	116/2331	0.048
2	855	116	Gharabari-2	0.040	116	0.040
3	855	109/2330	Gharabari-2	0.113	109/2330	0.113
4	855	109	Gharabari-2	0.108	109	0.108
5	855	110	Gharabari-2	0.188	110	0.188
6	855	102	Gharabari-2	0.297	102	0.297
7	855	101	Gharabari-2	0.484	101	0.484
8	855	96	Gharabari-2	0.212	96(Pt.)	0.190
9	855	108	Gharabari-2	0.048	108	0.048
10	855	105	Gharabari-2	0.010	105	0.010
11	855	104	Gharabari-2	0.025	104	0.025
12	855	98	Gharabari-2	0.079	98	0.079
13	855	99	Patita	0.040	99	0.040
14	855	103	Gharabari-2	0.046	103	0.046
15	855	100	Gharabari-2	0.083	100	0.083
16	855	97	Gharabari-2	0.072	97	0.072
17	855	109/2332	Patita	0.349	109/2332	0.349
18	855	115	Gharabari-2	0.097	115	0.097
19	855	113	Gharabari-2	0.259	113	0.259
20	855	111	Patita	0.103	111	0.103

1	2	3	4	5	6	7
21	855	89	Gharabari-2	0.198	89(Pt.)	0.140
22	855	90	Gharabari-2	0.329	90(Pt.)	0.130
23	855	91	Gharabari-2	0.180	91(Pt.)	0.010
24	855	83	Gharabari-2	0.125	83	0.125
25	855	84	Gharabari-2	0.095	84	0.095
26	855	85	Gharabari-2	0.140	85	0.140
27	855	95	Gharabari-2	0.042	95	0.042
28	855	94	Gharabari-2	0.575	94	0.575
29	855	93	Gharabari-2	0.129	93	0.129
30	855	92	Gharabari-2	0.236	92	0.236
31	855	86	Gharabari-2	0.136	86	0.136
32	855	87	Gharabari-2	0.565	87	0.565
33	855	283	Patita	0.775	293(Pt.)	0.075
34	855	284	Patita	0.578	284 (Pt.)	0.010
35	855	285	Patita	1.562	285(Pt.)	1.240
36	855	278	Patita	0.252	278	0.252
37	855	281	Patita	0.498	281	0.498
38	855	286	Patita	0.682	286	0.682
39	855	291	Patita	0.093	291(Pt.)	0.075
40	855	290	Patita	0.168	290(Pt.)	0.138
41	855	289	Gharabari-2	0.338	289(Pt.)	0.220
42	855	288	Patita	0.151	288	0.151
43	855	287	Gharabari-2	0.287	287	0.287
44	855	273	Gharabari-2	0.074	273	0.074

1	2	3	4	5	6	7
45	855	274	Gharabari-2	0.169	274	0.169
46	855	275	Gharabari-2	0.132	275	0.132
47	855	275/2311	Gharabari-2	0.074	275/2311	0.074
48	855	279	Patita	0.325	279	0.325
49	855	272	Patita	0.914	272	0.914
50	855	271	Gharabari-2	0.548	271	0.548
51	855	270	Patita	0.803	270(Pt.)	0.471
52	855	88	Patita	1.051	88(Pt.)	0.724
53	855	89	Gharabari-2	0.198	89(Pt.)	0.058
54	855	90	Gharabari-2	0.329	90(Pt.)	0.199
55	855	91	Gharabari-2	0.180	91(Pt.)	0.170
56	855	96	Gharabari-2	0.212	96(Pt.)	0.022
57	855	279/2310	Gharabari-2	0.186	279/2310	0.186
58	857	53/2337	Gharabari-2	0.056	53/2337	0.056
59	857	53/2336	Gharabari-2	0.056	53/2336	0.056
60	857	53/2335	Gharabari-2	0.065	53/2335	0.065
61	857	53/2334	Gharabari-2	0.062	53/2334	0.062
62	857	53	Patita	1.846	53(Pt.)	1.580
63	857	52	Patita	1.66	52(Pt.)	0.460
64	857	277	Patita	2.102	277(Pt.)	1.870
65	857	276	Gharabari-2	0.062	276	0.062
66	66 (Sritiban)	282	Gharabari-2	0.413	282	0.413
						Total Ac=17.320

Government of Odisha
Housing & Urban Development Department
***

No.HUD-TP-SCH-002/2018 / 5928 /HUD , Bhubaneswar, the 28-2-2018

From
Sri S.P. Das
Special Secretary to Government.

To
The Vice-Chairman
Bhubaneswar Development Authority,
Bhubaneswar.

Sub: - Development of Inter State Bus Terminal (ISBT) at Baramunda , Bhubaneswar .

Sir ,

In inviting a reference to your letter No.5526/BDA, dt.21.02.2018.on the subject noted above I am directed to say that Government in Housing & Urban Development has been pleased to approve the aforesaid proposal **in principle** subject to condition that the said proposal must be approved by the Authority in it s next meeting .

You are further requested to do due diligence at your level observing all formalities before taking up the Project.

Yours faithfully,

Special Secretary to Government

Memo No. 5929 /HUD, dt. 28-2-2018

Copy forwarded to P. S. to Minister ,H & U D & Industries / P.S. to Chief Secretary / P.S. to Commissioner-cum-Secretary H & U D / P.S. to Special Secretary , H & U D Department for information and necessary action.

Joint Secretary to Government

Estate Member/Engineer Member/
Finance Member/Planning Member/
Environment Member/Enforcement Member/
Secretary

Government of Odisha
Housing & Urban Development Department
***

File No.: HUD-TP-SCH-0002-2018 5087 Date: 22.2.18

From
Sri Anil Kumar Pattnaik,
Joint Secretary to Government,

To
The Principal Secretary to Government, Finance Department
The Commissioner, Rail Co-ordination and Special Secretary
Commerce & Transport Department.
Vice-Chairman, BDA, Bhubaneswar.
Vice-President, Engineering Division, DIMTS, New Delhi
(E-mail : **info@dimts.in**)

Sub: - Proceedings of the meeting held on 15.01.2018 at 10.30 A.M. in Second Floor Conference Hall of Odisha Secretariat for Development of ISBT, Baramunda, Bhubaneswar under the chairmanship of Chief Secretary, Odisha.

Sir,

In inviting a reference to the subject cited above I am directed to forward herewith the proceedings of meeting held on 15.01.2018 under the Chairmanship of Chief Secretary, Odisha for your kind information and necessary action.

Yours faithfully,

Joint Secretary to Government

Memo. No. 5088 /HUD Dt. 22.2.18

Copy along with copy of proceedings forwarded to P.S. to Chief Secretary / P.S. to Commissioner-cum-Secretary to Govt., H & U.D. Deptt./. for information & necessary action.

Joint Secretary to Government

PROCEEDINGS OF THE MEETING HELD UNDER THE CHAIRMANSHIP OF CHIEF SECRETARY, ODISHA ON 15.01.2018 AT 10.30 A.M. IN 2ND FLOOR CONFERENCE HALL OF STATE SECRETARIAT REGARDING BARAMUNDA ISBT PROJECT

The list of members present is at Annexure-I.

At the outset Commissioner-cum-Secretary, H & U.D. Department welcomed Chief Secretary, Odisha and other senior officials present in the meeting and brought to the notice of every one about the importance of the project in improving transport infrastructure in the city and state. Thereafter, Vice-Chairman, Bhubaneswar Development Authority, gave a detailed presentation on the Concept Plan and other implementation issues. After detailed discussion, following decisions were taken:

1. It was discussed that at present the traffic circulation near Baramunda bus stand is not smooth and same needs to be examined by Consultant appointed by BDA. It should be ensured that after development of new ISBT Baramunda, traffic circulation including movement of buses becomes more smooth and rule based.

2. It was further discussed that the project will be executed on Engineering Procurement & Construction (EPC) mode by BDA and tender documents (RFP) may, accordingly be prepared.

3. The design of the building may incorporate design alignments from Temple Architecture, Odisha Textiles etc. Accordingly, within over all concept design and facilities to be created, bidders may be allowed to suggest improvements and modifications during the tendering stage.

4. With respect to financing of ISBT, Baramunda, it was discussed that same may be taken up with support from State Government, loan to be taken by BDA and CIDF in proportion of 40:40:20. The estimated cost of the project is likely to be

1 |

Rs.183 Crores as per draft DPR submitted by the Consultant. On basis of above, BDA will submit a proposal to H & U.D. Department for Government approval. Accordingly, H & U.D. Department will make budgetary provisions in financial year 2018-2019.

5. Total land of about 17 acres which was allotted for Baramunda Bus stand and OSRTC garage shall be allotted in favour of BDA for taking up this project. For replacement of OSRTC garage; G.A. Department shall locate a suitable alternative land for allotment to OSRTC.

6. Alternative plan for the purpose of idle bus parking during the construction period shall also be prepared by BDA. BDA to take advance steps in this regard.

7. This bus terminal would be redeveloped and managed by BDA. But as OSRTC was earning some revenue from the same, accordingly, OSRTC may make a proposal to Commerce and Transport Department, Government of Odisha for giving compensatory grant to offset any loss which may accrue to OSRTC for taking over of this project by BDA as per decision taken above.

8. BDA shall expedite the process for floating of RFP by end of Feb, 2018.

The meeting ended with vote of thanks to & from the Chair.

Chief Secretary,
Odisha

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	Proposed ISBT is as per local building plan which is as per the "Planning and Building Standards Regulations (2017)", Bhubaneswar Development Authority. Proposed project will be done according to sanctioned.
1.2	Clearance of existing land, vegetation and buildings?	Yes	Existing old bus terminal will be completely demolished to build proposed new bus terminal. No clearance of existing vegetation is proposed. Biodiversity of the surrounding area will be maintained with well-planned landscape and tree plantation.
1.3	Creation of new land uses?	No	-
1.4	Pre-construction investigations e.g. bore houses, soil testing?	No	Detailed feasibility studies and Investigation was carried out for the proposed project. Soil test report is attached in Annexure -A
1.5	Construction works?	No	Construction yet not started. The major construction works are given below: ▪ Site Development ▪ Road Development ▪ Internal roads Utilities/Services ▪ Water Supply ▪ Sewerage ▪ Drainage ▪ Rain Water Harvesting Structures and Pits ▪ Power supply and back up facility, Buildings ▪ ISBT building ▪ Commercial/retail offices
1.6	Demolition works?	Yes	Proposed project require demolition of existing old bus terminal.
1.7	Temporary sites used for construction works or housing of construction workers?	No	-
1.8	Above ground buildings, structures or earthworks including linear	Yes	Building comprises ▪ Terminal Area (G+2)

	structures, cut and fill or excavations		▪ Commercial Area (B+G+2) The earthwork will require for foundation and basement. Excavated soil will be used for site levelling, back filling in raft and road construction. Top layer of soil will be stored and used for landscaping / horticulture development work
1.9	Underground works including mining or tunnelling?	Yes	Proposed commercial building will have one level of basement which would require underground construction
1.10	Reclamation works?	No	N/A
1.11	Dredging?	No	N/A
1.12	Offshore structures?	No	N/A
1.13	Production and manufacturing processes?	No	It is a construction project.
1.14	Facilities for storage of goods or materials?	Yes	Temporary facilities will be developed during construction phase for storage of construction materials. During operation phase facility for storage of HSD will be constructed at a specified place within the premises.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Solid Waste- No Liquid effluent- Yes	**Solid Waste** **Construction Stage** : The construction stage solid waste will comprise mainly of construction waste. The construction debris generated will be reused within the site for various construction works. Domestic waste generated from temporary labor camp construction labors. It will be ensured will be sent to nearest designated waste storage bins. **Operation Stage** : **Collection and Segregation of waste** • Biodegradable & non biodegradable waste shall be separately collected to ensure segregation at source. • Adequate number of colored bins separate for Bio-degradable and Non Biodegradable will be placed at planned location. • Litter bin will also be provided in open areas like parks etc. **Treatment of Bio-Degradable wastes** • Biodegradable /Organic and Horticultural Waste would be handed over to authorized vendor for treatment. **Non Biodegradable waste** • Recyclables, such as plastic, rubber, wood pieces, glass etc will be segregated from non biodegradable waste & sold to authorize vendors

			for recycling & remaining inert waste shall be sent to land fill site through authorized vendor as per the guidelines of Municipal Solid Wastes (Management and Handling) Rules, 2000 and amended Rules, 2008. STP sludge will also be used for horticultural purposes as manure. **Sewage Treatment Plant** of capacity 1000 KLD for treatment of sewage will be installed. Detail given in Conceptual plan.
1.16	Facilities for long term housing of operational workers?	No	-
1.17	New road, rail or sea traffic during construction or operation?	No	-
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	Yes	Proposed project is for new Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	Yes	Proposed project is for new Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar.
1.20	New or diverted transmission lines or pipelines?	Yes	Old bus terminal will be demolished and all the associated transmission lines and pipelines too will be demolished to make way for new transmission lines form new bus terminal
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	No	-
1.22	Stream crossings?	No	-
1.23	Abstraction or transfers of water form ground or surface waters?	Yes	Two numbers of bore well will be used for extraction of ground water during construction and operation phase.
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	Yes	There will not be any change in the drainage pattern. It will be improved by well planned development.
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Construction materials shall be transported from nearest local market. The personnel would preferably be engaged from nearby areas. Precaution will be taken to reduce the impact of vehicular movement by trying to avoid the vehicular trips during peak hours. Labours and personnel shall commute via public transport system
1.26	Long-term dismantling or decommissioning or restoration works?	No	-
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	Yes	Demolition of old ISBT building will have an impact on air environment around the project site for short time period.

1.28	Influx of people to an area in either temporarily or permanently?	Yes	Influx of people will greatly increase due to operation of new ISBT building, commercial space and offices.
1.29	Introduction of alien species?	No	-
1.30	Loss of native species or genetic diversity?	No	-
1.31	Any other actions?	No	-

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	Yes	Presently land has an old ISBT Building of G+2 structure
2.2	Water (expected source & competing users) unit: KLD	Yes	**WATER REQUIREMENT& SOURCE** Construction phase: 30KLD Source : BDA municipal supply/ Outside water tankers/ bore-well Operation Phase :1288 KLD Source : BDA municipal supply/ bore-well
2.3	Minerals (MT)	No	-
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	Construction materials shall be taken from nearest local market. Steel-100 MT, Cement-50,000 bags, Stone Aggregate-18,700 cum, Sand-106,500 cum, Bricks-118,000 cum.
2.5	Forests and timber (source – MT)	Yes	Source shall be form Local Market.
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	3000 KVA electricity load will be supplied by Central Electricity Supply Utility of Odisha (CESU). 3 nos. of DG sets of 750 KVA each.
2.7	Any other natural resources (use appropriate standard units)	Yes	

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	No	This is a project of Proposed Inter State Bus Terminal (ISBT) at Baramunda and no storage of hazardous chemicals (as per MSIHC rules) will be made, apart from limited quantity of HSD storage (for DG sets).
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	During the construction period, adequate precaution will be taken to avoid stagnation of water to avoid mosquito breeding. Labour will be provided with purified water to avoid spread of waterborne diseases. Contamination of ground water will be avoided through proper drainage and housekeeping surface runoffs will be secured by efficient flow management
3.3	Affect the welfare of people e.g. by changing living conditions?	Yes	Positive impact due to enhanced and hygienic living conditions on surrounding area. Aesthetic value of area will be improved; it will provide employment opportunities to the local people in terms of skilled and unskilled labour during construction and service personnel during operational phase.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Noise and air pollution control measures will be implemented so as to minimize the impacts on the nearby village residents.
3.5	Any other causes	No	-

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Excavated top soil was properly stacked it will be reused as top layer for horticulture development. Remaining soil will be used for site leveling, back filling/filling in raft and road construction
4.2	Municipal waste (domestic and or commercial wastes)	Yes	There would be both bio-degradable and non bio-degradable solid waste produced during the operational phase, which will be as follows: MSW: 9000 kg/day Biodegradable waste: 7000 kg/day Non-biodegradable waste: 2000 kg/day STP sludge : 10 kg/day Garden waste: 20 kg/day Detailed Solid Waste Management plan is given in Environment Management Plan
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	**During Construction phase**: Used oil whenever generated from the DG sets shall be kept in an isolated area and in leak proof container and shall be sent to approved recycler. **During Operation Phase**: Used oil from diesel generators will be carefully stored in HDPE drums in isolated covered facility. The used oil will be sold to vendors authorized by Central Pollution Control Board for the treatment of the same. Suitable care will be taken so that spills / leaks of used oil from storage could be avoided. E-waste shall be collected and given to approved recycler of SPCB.
4.4	Other industrial process wastes	No	N/A
4.5	Surplus product	No	N/A
4.6	Sewage sludge or other sludge from effluent treatment	Yes	About 10 Kg/day of dried sludge will be generated from STP within complex during operation phase and this sludge will be passed through filter press where it will be dewatered/ dried to form a cake and then will be used as manure in green areas. The unused manure shall be given to farmers or nursery.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
4.7	Construction or demolition wastes	Yes	Solid waste during the construction phase would comprise mainly the excavated earth, concrete debris, steel scrap, scrap from/of insulation material for air-conditioning and packaging material. Cement bags, waste paper and cardboard packing material will be sold off to recyclers. Unusable steel scrap will also be collected at site and sold to recyclers. Excavated earth and construction debris will be disposed as per debris management plan to authorized dumping sites
4.8	Redundant machinery or equipment	No	All equipment used for construction will be of standard quality and maintained on regular basis. In case of redundant machinery it will be sold to authorized vendors.
4.9	Contaminated soils or other materials	No	N/A
4.10	Agricultural wastes	No	N/A
4.11	Other solid wastes	Yes	**E-waste:** IT/ telecom sources, insulation, wires, cables, batteries, external electric cables, CFL bulbs etc.

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources.	Yes	**DG Sets Emissions.** Expected emission rate from DG sets are as:- PM : 0.05 Kg/hr SO2 : 0.82 Kg/hr NOx : 0.31 Kg/hr CO : 0.005 Kg/hr **During construction phase**: exhaust emissions from vehicles and other construction machinery like excavators, compressors, concrete pumps, etc. During Operation Phase: The only source of emission from combustion of fuel will be DG sets of 3 x 750 KVA. Hence, to avoid the emissions stack height of exhausts is 6 mtr above roof level for each D.G. Sets shall be provided to reduce the air emissions meeting all the norms prescribed by CPCB.
5.2	Emissions from production processes	No	There is no production as the proposed project is for ISBT building
5.3	Emissions from materials handling including storage or transport	Yes	Dust shall be generated during construction from the movement of transport vehicles. The effect will be restricted to construction phase only. Water sprinklers shall be used for dust suppression. Material will be stored under Tarpaulin cover.
5.4	Emissions from construction activities including plant and equipment	Yes	RMC shall be used in the complex. Dust & emissions is likely to be generated during construction activities which shall be reduced by sprinkling of water in a specific time interval & timely maintenance scheduled for machinery. Also the machines will be shut down during idle period.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	**Construction phase** Fugitive dust emissions will be generated due to movement of vehicles and material handling. Odour may be there from diesel emissions from vehicles and construction machinery. Activities like site clearance and excavation will generate dust which will be controlled by sprinkling of water **Operation phase** During operation phase, emissions will be generated from operation of DG sets. In case of malfunction of STP odour may be emitted. Adequate mitigation plans are prepared for such problems.
5.6	Emissions from incineration of waste	No	N/A
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris).	No	Open burning of biomass/ other material will be strictly prohibited.
5.8	Emissions from any other sources.	No	N/A

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

<table>
<tr><th>S.No.</th><th>Information/ Checklist confirmation</th><th>Yes/ No</th><th>Details thereof (with approximate quantities/ rates, wherever possible) with source of information data</th></tr>
<tr><td>6.1</td><td>From operation of equipment e.g. engines, ventilation plant, crushers</td><td>Yes</td><td>Noise is expected to be generated during construction phase mainly from operation of heavy machinery, DG sets, and traffic. The indicated noise levels from certain construction
plants/equipment are indicated below :
<table><tr><th>S.no.</th><th>Type of Equipment</th><th>Noise Level - dBA</th></tr><tr><td>1.</td><td>Concrete Mixer</td><td>85</td></tr><tr><td>2.</td><td>Generator</td><td>75</td></tr><tr><td>3.</td><td>Pumps</td><td>90 - 95</td></tr><tr><td>4.</td><td>Trucks</td><td>85 – 90</td></tr></table>
For control of noise following measures shall be
adopted:
• Properly maintained equipment with mufflers will be used.
• High noise generating construction
• Workers working near high noise construction machinery would be supplied with ear muffs/ear plugs.
• During operation noise from operation of DG sets is envisaged. However, the generator sets
• installed will operate at noise level less than 75 dB (A) as the generators will be placed either in acoustic chambers or a canopy as per CPCB norms</td></tr>
<tr><td>6.2</td><td>From industrial or similar processes</td><td>No</td><td>N/A</td></tr>
</table>

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
6.3	From construction or demolition	Yes	As there will be demolition work, there will be noise or vibration impacts from the demolition activities. There will be noise and vibration issues due to various construction activities like excavation, hammering, noise from construction machinery, etc. For each activity, adequate precautions will be taken to keep the noise and vibration levels within the prescribed limits. Noise producing activities will be staggered to reduce the cumulative impacts. Such operations will further be restricted to day time.
6.4	From blasting or piling.	Yes	Piling activity will create noise during construction activity.
6.5	From construction or operational traffic	Yes	Vehicles like earth movers, compactors, trucks etc. will generate noise during construction phase. Vehicles for parking at ISBT will generate noise during operation phase.
6.6	From lighting or cooling systems	Yes	HVAC device creates noise
6.7	From any other sources	No	-

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	Yes	The hazardous waste generated will be Used oil only and it will be stored in HDPE drums and kept in covered rooms under lock and key and will be sold to authorized vendors only. Special care will be taken to prevent leakages and spills. E-waste generated from the complex shall be given to approved recycler of SPCB.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	During operational phase, STP will be installed for treating the waste water & the treated water will be used in flushing, gardening, DG cooling and Misc. Excess treated water will be given to tanker supplier.
7.3	By deposition of pollutants emitted to air into the land or into water	No	Dust generation during construction phase from earthworks and movement of vehicles was a temporary phenomenon and will have short term impact during construction phase. Appropriate fugitive dust control measures including water sprinkling of exposed areas and dust covers for trucks, will be provided to minimize any impacts. DG exhaust will be discharged at height stipulated by CPCB. Height of stack of exhaust will be 6 mtr above the terrace of tallest tower. Treated sewage water will be recycled and reused, whereas the surplus treated water will be sent to sewer line.
7.4	From any other sources	No	N/A
7.5	Is there a risk of long term build-up of pollutants in the environment from these sources?	No	N/A

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	From the diesel storage in a site for the purpose DG sets. Adequate measures are taken to prevent the accidents.
8.2	From any other causes	No	-
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	Yes	The project falls under seismic zone- III as per is1893 (part-1):2002, care will be taken in designs to withstand earthquake of maximum Richter scale in that area. Further it is not flood prone or landslide prone areas. Hence, no risk due to natural hazards is envisaged.

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
9.1	Lead to development of supporting. facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other	Yes	The proposed ISBT project will be equipped with dedicated internal road, parking, internal water distribution system, fire-fighting system, internal sewage collection & treatment facility, lighting facilities, solar lighting, and power backup facility & solid waste collection & treatment facility. The project involves construction of road infrastructure around the site which would provide efficient commutation for buses and other vehicles to ISBT This is a planned development hence social as well as physical infrastructure like roads, power, waste has already been considered by planning department, Bhubaneswar and waste water will be treated onsite will have negligible impacts on environment
9.2	Lead to after-use of the site, which could have an impact on the environment	No	-
9.3	Set a precedent for later developments	Yes	This is a judicial project there will be generation of employment during construction & operation phase.
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Impacts on water availability, availability of electricity, traffic congestion etc.

(III) Environmental Sensitivity

S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.
1.	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value.	Yes	**Nandankanan Zoological Park** : 14 Km NE **Chandaka Forest**, : 13 Km NW **Shikharchandi Hill Forest** : 13 Km NE
2.	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	Bindu Sagar : 8.0 Km at SE Godabari Pond : 7 Km at SE Ekamra Kanan Botanical Gardens : 5 Km NE
3.	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration.	No	-
4.	Inland, coastal, marine or underground waters.	No	-
5.	State, National boundaries	Yes	**National Highway 16 : 0.5 Km at SE** **National Highway 316 :10.0 Km at NE**
6.	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas.	No	-
7.	Defence installations	No	-
8.	Densely populated or built-up area	Yes	***Bhubaneswar Population 2017 – 917,766 (Estimated)*** The populace density of Bhubaneswar is 2131 persons per square kilo meter

S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.

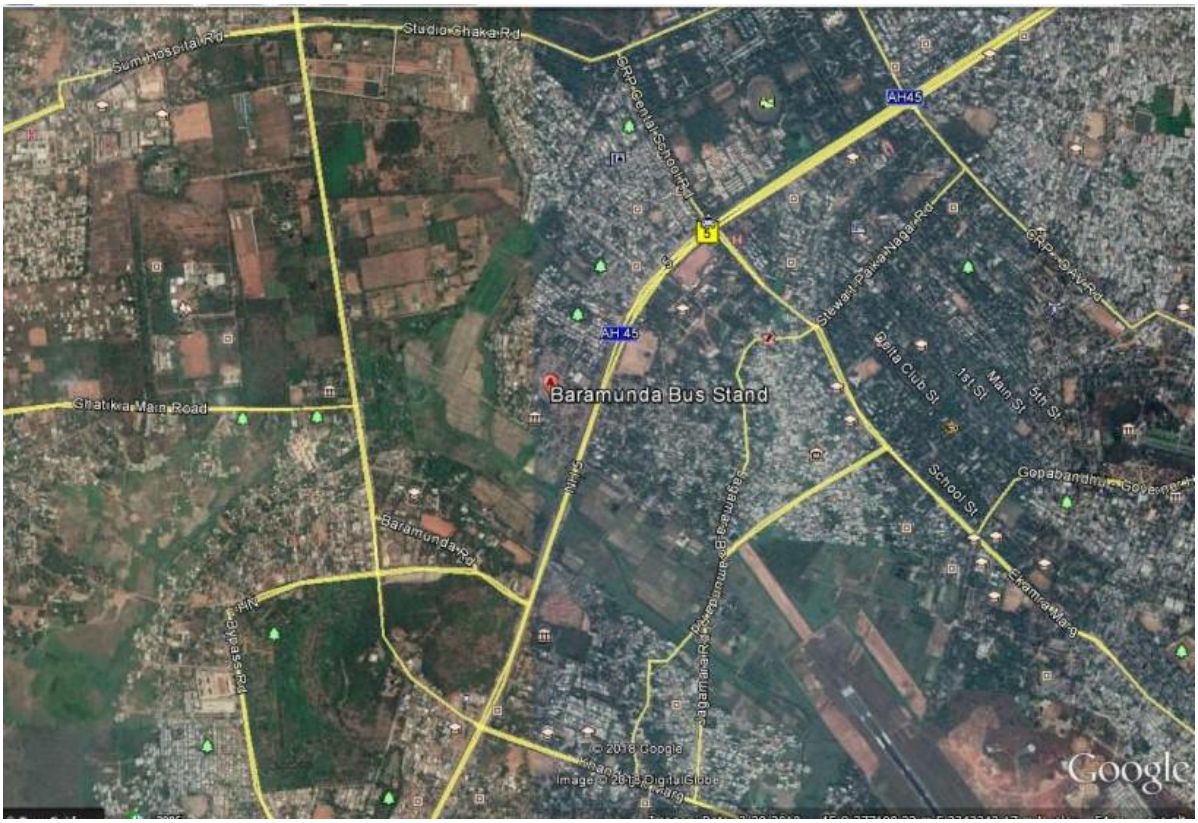
S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.
			Rd, Nageswar Tangi, Old Town, Bhubaneswar
			Odisha State Museum, BJB Nagar, Lewis Road, Near Kalpana Square, Bhubaneswar, 7.2 SE
10.	Areas containing important, high quality or scarce resources*(ground water resources, surface resources forestry, agriculture, fisheries, tourism, minerals)*	No	-
11.	Areas already subjected to pollution or environmental damage. *(those where existing legal environmental standards are exceeded)*	No	-
12.	Areas susceptible to natural hazard which could cause the project to present environmental problems(*earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)	No	-

ANNEXURE 2: FORM-1 A

(Only for construction projects listed under item 8 of the Schedule) (See paragraph 6)

CHECK LIST OF ENVIRONMENTAL IMPACTS

1. LAND ENVIRONMENT



1.1. Will the existing land use get significantly altered from the project that is not consistent with the surroundings? (Proposed land use must conform to the approved Master Plan/ Development Plan of the area. Change of land use if any and the statutory approval from the competent authority be submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii)the site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans.

Presently the area is used as a bus terminal spread over 15.5 acre. The Terminal Building is a G+2 structure, situated at the centre of the bus terminal area. The ground floor of the building accommodates ticket counters, platforms, ATMs and an old-age home. OSRTC has taken up office space in the first and second floors. The second floor also houses certain number of guest houses.

The depot spreads across an area of 1 acre and is located to the right of the current entry gate of the terminal. Right next to Gate-1, there is a small 2-wheeler parking area which does not follow a systematic order for parking of the vehicles.

- Some authorized (88) and unauthorized (approx. 20-30) shops are located towards the exit gate of the bus stand.
- Panoramic view of the project site is attached in ANNEXURE 1 above

1.2. List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

Table 1: FEATURE

Si #	Description	Details	Unit
GENERAL			
1.	Total Plot Area	62726.27	Sq. mtr.
2.	Proposed Built Up Area	28,124	Sq mtr.
3.	Number of Building Blocks	Two (Terminal & Commercial block)	-
4.	Max Height of Building upto Terrace	Terminal block (G + 2) : 15 Commercial block (B + G + 2) : 15	mtr
5.	Max No of Floors	Terminal block : G + 2 Commercial block : B + G + 2	-
6.	Cost of Project	Approx. 134	crores
7.	Expected Population (All floating)	78000	-
AREAS			
8.	Permissible Ground Coverage Area	15%	-
9.	Proposed Ground Coverage Area	9.6%	-
10.	Permissible FAR Area	1	FAR
11.	Total Basement Area	5130 (in commercial block)	Sq mtr.
12.	Total Parking Area	30 % of FAR	-
13.	Terminal & Commercial Area	Terminal area : 15883 Commercial area : 12241	Sq mtr.
WATER			

14.	Total Water Requirement	1288	KLD
15.	Fresh water requirement	772	KLD
16.	Waste water Generation	979	KLD
17.	Proposed STP Capacity	1000	KLD
18.	Treated Water Available for Reuse	930	KLD
19.	Recycled Water used	535	KLD
20.	Surplus treated water	395	KLD
PARKING			
21.	Total Parking Required as / Building Bye Laws	3738 (30 % of FAR)	Sq mtr.
22.	Proposed Total Parking : Terminal	4359	Sq mtr.
23.	Required parking for commercial facilities	3672 (30 % of Built up area)	Sq mtr.
24.	Proposed Parking in Basement : Commercial	5130	Sq mtr.
GREEN AREAS			
25.	Required Green Area	15 %	-
26.	Proposed Green Area	18 %	-
WASTE GENERATION			
27.	Municipal Solid Waste Generation	9000	Kg/day
28.	Quantity of Hazardous waste Generation	2	Ltr/day
29.	Quantity of Sludge Generated from STP	10	Kg/day
POWER			
30.	Total Power Requirement	3000	KVA
31.	DG set backup	3 × 750	KVA
CONNECTIVITY			
32.	Rail	Bhubaneswar railway station at 8 Km SE	KM
33.	Air	Biju Pattnaik International Airport at a distance of 6 Km SE	KM
34.	Road	Road Density :11.82	Sq. Km

1.3. What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use, disturbance to the local ecology).

The project is being developed in accordance with building bye laws of Bhubaneswar Development Authority (BDA) and approved building plans. Existing facilities within the site will be completely demolished and new structure of ISBT building will come up within the site. This would help to decongest the space-starved city and haphazard parking, the BDA is planning to

build inter-state bus terminal (ISBT) at Baramunda, Bhubaneshwar. The terminal will provide private buses a parking spot, which could help decongest roads across the city. The proposed activity will improve the basic infrastructure facilities of the surrounding area. The development will not cause any disturbance to local ecology and surrounding establishments. Peripheral green belt will be developed. Proposed project will provide all the basic utilities such as proper drainage, sewerage treatment & water supply system, Structures to recharge ground water aquifer, green area development and sufficient parking so that it will not have negative impact on the surroundings.

1.4. Will there be any significant land disturbance resulting in erosion, subsidence &instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc may be given).

The proposed site is almost flat and is not prone to erosion. The proposed construction will involve cutting and filling operations. The project would involve construction of paved areas and development of green areas, which would reduce the chances of erosion. Excavation carried out for foundation & basement would be protected with strutting and shoring where ever required.

Details of soil type, slope analysis, vulnerability to subsidence, seismicity is attached in soil report

1.5. Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site).

There will not be alteration to natural drainage system. No alteration of natural drainage. Proper storm water drainage will be provided to prevent flooding.

Contour map showing the natural drainage near the proposed project site attached.

1.6. What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc.)

During construction phase, excavation was envisaged in order to provide foundations to the proposed structure. The excavated top soil will be stored & preserved separately for reusing the same for landscaping, and remaining soil will be properly stored at site under cover and will be reused for backfilling purpose, road construction etc. There will be no requirement to bring materials for filling from outside

1.7. Give details regarding water supply, waste handling etc during the construction period.

Water Requirement for the construction period is assumed to be 30,000 liters per day which will be met from ground water/municipal supply Construction waste shall be disposed off to Municipal land fill site. Detail about the waste generation and their disposal is given in table 2.

Table 2. SOLID WASTES COLLECTION, RECYCLE AND DISPOSAL

SOLID WASTE	COLLECTION AND DISPOSAL	RECYCLING
Excavated earth, debris, packaging material etc.	Excavated earth will be used for landscaping and construction debris will be disposed off Municipal land fill site as guarded by the local authority.	Cement bags, waste paper and cardboard packing materials will be sold off to recyclers.

1.8. Will the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity)

There is no low lying area in the proximity of the project site.

1.9. Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)

The construction debris and waste are non-hazardous in nature and will not cause any health hazards. Table 3 shows the type of construction waste and their disposal method.

Table 3. TYPE OF CONSTRUCTION WASTE

Si. No.	SOLID WASTE	CONSTRUCTION PHASE	Approx. Quantity
1.	Nature	Packaging material etc	50kg/day
2.	Collection and disposal	Construction debris will be disposed off to municipal land fill site.	60kg/day
3.	Recycling	Cement bags, waste paper and cardboard packing materials will be given to recyclers.	50kg/day

The waste generated will be collected and disposed of through an authorized agency. Approx. 250 labors per day will be employed during the construction period. Required sanitary facilities will be provided to Construction laborers through mobile toilets. Wash areas will be constructed and good hygienic conditions will be maintained for labour camp

2. WATER ENVIRONMENT

2.1. Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement met? State the sources &quantities and furnish a water balance statement.

Construction Phase: Approx. 30,000 ltrs/day of the water shall be used for the construction activity, source of which shall be ground water & municipal supply

Operation Phase:

TOTAL DAILY WATER DEMAND (LTRS)

a) DOMESTIC USE	**7,72,992**
b) FLUSHING USE	**5,15,328**
C) LANDSCAPING	**20,000**
GRAND TOTAL	**13,08,320**

SOURCE OF WATER (LTRS/DAY)

a) STP RECYCLED	**7,72,992**
b) FRESH WATER (MUNICIPAL SUPPLY + BORE WELL)	**358,370**
TOTAL REQUIREMENT	**12,88,536**

Water Requirement Estimation Detail during operation phase of the project along with water balance diagram is attached in Annexure-D

2.2. What is the capacity (dependable flow or yield) of the proposed source of water?

During Construction phase, the source of water will be municipal supply and bore well.

During Operation phase the prime source of water shall be municipal supply, bore well and STP recycled water.

2.3. What is the quality of water required, in case, the supply is not from a municipal source?(Provide physical, chemical, biological characteristics with class of water quality).

Water quality for the construction activity should conform as per IS 456:2000, given in table 4.

Table 4: Water Quality as per IS 456 :2000

S.No.	Type of Solids	Permissible Limits
1.	Organic	200 mg/l
2.	Inorganic	3000 mg/l
3.	Sulphates (as SO_3)	400 mg/l
4.	Chlorides (as Cl)	2000 mg/l for concrete not containing embedded steel and 500 mg/l for reinforced concrete work
5.	Suspended Matter	2000 Mg/l

- Water quality for domestic usage should conform to IS10500:1991.
- Standard for IS 10500:1991 is given in Annexure-D.

2.4. How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

- The sewage generation from the proposed project is estimated to be 979 KLD. For sewage treatment, Sewage Treatment Plant of capacity 1000 KLD will be provided. It is estimated that 930 KLD of water requirement can be met by recycling of water through STP. 515 KLD of recycled water can be reused in flushing requirement of the project while 20 KLD of water requirement can be met for landscaping.
- Water Requirement Estimation Detail during operation phase of the project along with water balance diagram is attached in Annexure-D

2.5. Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)

- No, there will be no diversion of water from existing users is expected by the proposed project. The prime source of water supply during operation phase will be municipal supply and bore well.

2.6. What is the incremental pollution load from waste water generated from the proposed activity? (Give details of the quantities and composition of waste water generated from the proposed activity)

- There shall be incremental pollution load from proposed project in terms of waste water quantity since total waste water generation from the project during operation 1820 KLD and reused for flushing and landscaping requirements. The quality of raw and treated sewage is as under:

Table 5: Expected water quality of raw and treated sewage

Sr. No.	Parameter	Unit	Raw sewage characteristics	Treated sewage Characteristics
1	pH	--	6.5 – 8.5	6.5 – 7.5
2	SS	mg/l	100 - 150	10
3	BOD	mg/l	200 - 300	10
4	COD	mg/l	200 – 350	20
5	Oil & Grease	mg/l	20 - 25	< 5

2.7. Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

Rain water from the roof top of buildings and balcony will be drained out to the rain water stacks located at strategic positions within the shaft or at exposed positions as directed by the building Architect or as per building profile. These vertical pipes will be brought up to the basement ceiling and diverted to the external storm water line along the periphery of building.

At surface level storm water drain along with road gully/catch basin will be located at strategic location depending upon the landscaping and ground levels. Water collected through this storm water drain along with rain water from the roof will be diverted to rain water harvesting arrangement. Four numbers of rain water harvesting pits shall be constructed for recharging of the ground water.

2.8. What would be the impact of the land use changes occurring due to the proposed projection the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

No, adverse impact is envisaged due to change in land use by the project since ground water recharging is proposed to control surface run off. It will not cause problems of flooding and water logging in the nearby area. The rain water run-off will be channelized properly through storm water drain and will be diverted to Infiltration well

2.9. What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)

There will be no significant adverse impact on ground water since ground water recharging is proposed to control surface runoff and conserve rain water. The prime source of water supply during operation will be municipal supply. The average depth of ground water table at site is around 18 to 20 meters from ground surface. There will be two numbers of bore-well for emergency use of water requirement.

2.10. What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts)

Following measures are proposed in project to control run off from construction site:

- Proper storm water drainage system comprising of lined drains is proposed.
- Boundary wall will be constructed around the site.
- Soak pits are proposed for safe disposal of domestic waste water during construction phase.
- Prevent the mixing of storm water runoff and sewage from labour camps.
- Use of leak proof containers for storage oil to avoid contamination of runoff.
- Environment Management Plan (EMP) is developed and best practices will be followed to check the run-off from the construction activities.
- Please refer EMP attached in Annexure-H

2.11. How is the storm water from within the site managed?(State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)

Effective storm water drainage system has been proposed within the site. Ground water recharging through percolation pits is proposed to control surface run off at site. The storm water shall be channelized through storm water drains to finally join ground water recharge pits and the Excess Storm Water free from runoff Contamination is lead to External Drains. Further rain water from terrace will be stored in underground tanks to reduce fresh water requirement.

2.12. Will the deployment of construction laborers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)

No, there will be no unsanitary conditions arising since adequate sanitation facilities i.e. toilets will be provided for labors. Sewage generated from labor toilets will be disposed off through septic tank/soak pit.

2.13. What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of waste water generation, treatment capacities with technology & facilities for recycling and disposal)

Total sewage generation during operation will be 979 KLD. There will be provision of an onsite STP of 1000 KLD which shall handle total flow. The treated water will be reused for Landscape & Flushing requirements. The process flow diagram and details of STP are furnished in conceptual plan.

Water Requirement Estimation Detail during operation phase of the project along with water balance diagram is attached in Annexure-D

2.14. Give details of dual plumbing system if treated waste used is used for flushing of toilets or any other use.

The project will have Dual Plumbing Systems so as to utilize treated sewage for flushing & gardening requirements. Adequate care shall be taken by providing a separate pipe line to convey the treated sewage directly to water closets and urinals. This will ensure that there is no contact of fresh drinking water pipe/tank. Separate pipe line for domestic water will be supplied to all other fixtures for domestic usage.

3. VEGETATION

3.1. Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with its unique features, if any)

There is no threat to the biodiversity due to the proposed project since no endangered / rare species are found nearby project site. Further adequate plantation of endemic species is proposed so as to retain diversity.

There are trees in the periphery of the project site of the variety Azadica Indica, Eucalyptus etc which would be retain as a part of the green coverage. List of Tree Species around the Project site is given in table 6 which would not be disturbed in any form.

TABLE 6. LIST OF TREE SPECIES

Sl. No.	Name of Plants	Nos
1	Champa	5
2	Neem	9
3	Ashoka	7
4	Amaltash	4
5	Nilamphakas	2
6	Shahtut	2
7	Semar	2
8	Gulmohar	2
9	Banyan	5
10	Kaner	5
11	Botal brush	9
12	Kaner	4
13	Sadabhar	6
14	Botal Pam	4
15	Siras	4
16	Tikona	5
17	Shirisha	8
	Total	83

3.2. Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

There're few existing trees few of which will be retained, cut and transplanted as per the NOC from concerned authority. Biodiversity of the surrounding area will be maintained with well-planned landscape and tree plantation.

3.3. What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc along with a layout plan to an appropriate scale)

Landscape features in the form of soft and hard scapes have been provided. Ground cover and shrubs within the parking area and roundabouts have been provided. Ground cover in the form of Iresene would be used. Shrubs like Wedeleia Trilobata and Clerodendrome Inerme will be used. These plantations will add colour to the soft scapes. A lot of trees are also panted at the periphery for shade and greenery. The kerb edges are lined with bougainvillea trees

4. FAUNA

4.1. Is there likely to be any displacement of fauna- both terrestrial and aquatic or creation of barriers for their movement? Provide the details.

There will be no displacement of aquatic animals by the proposed project. There will be insignificant displacement of burrowing organisms from the project site to near-by areas. To mitigate the adverse impact, adequate number of trees will be planted at site and green cover shall be provided for shelter of fauna.

4.2. Any direct or indirect impacts on the avifauna of the area? Provide details.

No direct or indirect impact on avifauna is envisaged since no tree cutting is involved, further plantation of additional trees shall serve as abode for the avifauna.

4.3. Prescribe measures such as corridors, fish ladders etc to mitigate adverse impacts on fauna

Not applicable.

5. AIR ENVIRONMENT

5.1. Will the project increase atmospheric concentration of gases & result in heat islands?(Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions).

Ambient Air Quality Monitoring for 24 Hours was carried out at the project site on and following observation are being made for various air pollutants (Refer Annexure-I for test reports):-

- At site, PM 2.5 and PM 10 were measured at 3 times at an interval of 8 hours. It was observed that PM 10 had maximum value of 80.07µg/m^3 and PM 2.5 had maximum value of 43.79µg/m^3 during 3PM-11PM interval. Both the values were below National Ambient Air Quality (NAAQ) standards of 100µg/m^3 and 60µg/m^3 respectively.
- Value of Sulphur Dioxide was 18.95 µg/m^3.The values of SO_2 monitored in the study area are well within the limits of NAAQ standards for residential as well as sensitive areas.
- Ambient air quality status monitored for nitrogen dioxides in the study area was 33.84µg/m^3. The value of NO_2 monitored in the study area was well within the limits of NAAQ standards for residential as well as sensitive areas.
- CO concentration at the location was found to be less than 2mg/m3.

During operation phase of the project, DG sets emission prediction is given in table 6.

Table 6: EMISSION PREDICTION

Pollutants	Concentration, µg/m^3		
	Without Project	With project	Total
PM 2.5	43.79	.08	43.87
PM 10	80.07	.08	80.15
SO_2	18.95	2.15	21.1
NO_X	33.84	3.40	37.24
CO	< 0.2	< 0.2	< 0.2

Note: the above calculations are assumptions that three DG sets of 750 KVA will be operational for 6 hours and the emission factors have been calculated.

5.2. What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters.

Smoke will be generated from three DG sets of 750 KVA each. Adequate stack height of exhaust will be 6 m above roof level is provided. Odorous fumes and hazardous gases are not anticipated from the proposed construction activity. Construction activities could result in dusting that can

lead to high particulate matter concentration in local area. However to control dust, smoke and gases concentration following mitigation measures are proposed:

- Barricade the site periphery by corrugated tin sheets.
- Sprinkle water on roads.
- Dust mask to be provided to workers.
- Flue gas emission from DG set to be well within the limits
- Adequate stack height of DG sets will be provided for better dispersion of pollutants.

5.3. Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.

There will not be shortage of parking space as the proposed project is for Interstate bus terminal. Adequate number of parking space has been provided for the project. It is proposed to provide parking management system to provide information to the bus driver/ conductor, collection of revenue, management of bus parking in ISBT premises. Motorized Boom Barriers shall be provided at the entrance and exit points

5.4. Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.

There will be separate entry/exit in the project with sufficiently wide internal roads and pedestrian pathways. Adequate provisions have been made in the internal roads, for smooth vehicles entry and exit and as well as pedestrian movements. Details are enclosed in the conceptual plan attached.

5.5. Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

As the entry and exit will be made safe and smooth, there will be no significant increase in noise and vibrations due to increased traffic. During construction activity vehicular movement will be the major source. While during operational phase D.G sets and vehicular movement will be source of noise. Moreover, noise shall be substantially reduced by plantation of trees within & periphery of the site and DG sets shall be provided with adequate acoustic enclosure.

5.6. What will be the impact of DG sets & other equipment on noise levels & vibration in &ambient air quality around the project site? Provide details.

The sound pressure level generated by noise from DG sets and pumps decreases with increase in distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its vibration with objects in the transmission path. The noise levels from the equipment are given in table 7:-

Table 7 :EQUIPMENT NOISE LEVEL

S.no.	Type of Equipment	Noise Level-dB(A)
1.	DG-Sets	70-75
2.	Pumps	65-70

Noise level at a distance of 100 meters radius of the society is comes out to be around 40-45 dBA. Detail of the emission characteristics from DG sets is given in table 8:-

Table 8 :STACK AND EMISSION CHARACTERISTICS

PARTICULARS	DG-750 KVA
Fuel Consumption	40 ltr/hr
Nos. of stacks.	1
Stack height above ground level. (m)	15.17 mtr
Stack height above roof level.(m)	7 mtr
Stack Diameter (m)	0.200 mm
Flue gas temperature (°C)	>300
Flue gas exit velocity m/s)	>20

6. AESTHETICS

6.1. Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

Proposed project will not result in the obstruction of a view, scenic amenity or landscapes. The architectural plan of the building is approved by competent authority

6.2. Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?

Existing building structure will be completely demolished. The various factors considered while designing the building are as under:

- The road network catering to the present and proposed terminals.
- Important towns, villages, factories and industrial centers around the Bhubaneswar city.
- Administrative boundaries of districts and states.
- Carrying capacity of existing road.
- Future vehicular density
- Parking requirement.

6.3. Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

The design of the project is influenced by the regulation set out by local authority and modern needs of the society. The project is designed in accordance with Development Control regulations of the concerned authority and following features are incorporated in project like Building Setback, Building height and open space reservation, etc.

6.4. Are there any anthropological or archaeological sites or artefacts nearby? State if any other significant features in the vicinity of the proposed site have been considered.

The archaeological remains at Dhauli, and hills of Udayagiri and Khandagiri give evidence of both Jain and Buddhist settlements around Bhubaneswar in the first two centuries BC.The temple building reached the zenith of its glory between 7th and 12th centuries when thousands of sandstone temples were erected around the Bindu Sagar, earning it the title 'The city of Temples'. The period under the Gangas saw emergence of Vaishnavism to prominence. The southern suburbs of the city have remnants of some of the striking temples, like the Lingaraja Temple, the Muktesvara Temple, etc., together with the famous archaeological and historical sites of Dhauli, Khandagairi and Udayagiri.

7. SOCIO-ECONOMIC ASPECTS

7.1. Will the proposal result in any changes to the demographic structure of local population? Provide the details.

There will be no change to the demographic structure of local population due to the proposed activity

7.2. Give details of the existing social infrastructure around the proposed project.

The capital city of Odisha, Bhubaneswar is located in the 'Khordha' district. Khordha is the most urbanized of all the districts of Odisha. Khordha Road, the railway station that serves the town is also the divisional headquarters of the East Coast Railway of the Indian Railways. Khordha is known for its brass utensils, cottage industries, railway coach manufacturing, and cable manufacture. Details of the existing social infrastructure is given in conceptual plan.

7.3. Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

No adverse effect on local communities, disturbance to sacred sites or other cultural values are envisaged due to proposed construction activity. Adequate safeguard measures have been proposed in EMP.

8. BUILDING MATERIALS

8.1. May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

ISI marked building materials of reputed brands to be procured within 100 km range as far as possible. Preference will be given to locally available building materials which conserve low energy in entire processes of manufacture. Use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas will be as per guidelines provided in NBC 2005.

Some of them are given below:

- Building material with low embodied energy will be given preference.
- Ready mix concrete with fly ash 15 to 20%.
- Some of the alternate materials for openings in construction are:-
- Use of rapidly renewable timber for doors where ever wooden doors are proposed.
- Use of steel manufactured from recycled content of smaller diameter.
- Saw dust based particle board for panels.
- Use Ceramic tile in flooring.
- The use of the above alternative building materials will help reduce the use of non-renewable resources.

Concrete

In accordance with IS 456-2000 following grade of concrete has been used for moderate conditions of exposure for different components:

Member	Grade
Footing/Column	M 25/30
Slab	M 25/30
Beam	M 25/30

Reinforcement Steel

The grade of steel reinforcement shall be Fe 500 for HYSD bars.

IS Codes

Following code shall be referred in design of structure.

- IS 456 – 2000 - for Concrete structure design
- IS 800 – 2007 - for Steel structure design
- IS 13920 - 1993 – for ductile detailing of reinforced concrete structures
- IS 875 - 1987 – Part 2 - for Imposed loading (other than earthquake)

Part 3 - for Wind loading

- IS 1893 – 2002 - for earthquake resistant design of structures
- Sp -16 - 1980 – for column design

8.2. Transport and handling of materials during construction may result in pollution, noise &public nuisance. What measures are taken to minimize the impacts?

Transport and handling of materials during construction will be covered. Vehicles plying for the transportation will have Pollution under Control (PUC) certificate which will be regularly checked. Transportation of the construction materials will be carried out during non-peak hours of 11:00 AM-5:00 PM. Also refer EMP attached

8.3. Are recycled materials used in roads and structures? State the extent of savings achieved?

Fly ash based cement will be used during all the construction period. Locally available recycled materials would be given preference. Bricks made from the fly-ash will be used for construction of pavements, side walls, boundaries for parks etc. Readymade concrete (RMC) will be used in construction. This will result in significant saving

8.4. Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

Municipal Solid Waste is generated in the form of biodegradable & non-biodegradable waste Biodegradable waste is disposed off to nearest Municipal Dhalao of the area.

Non-biodegradable waste which mostly comprises of the inorganic material is recyclable in nature such as paper, plastic, glass etc. are thus sold to recyclers.

Hazardous Waste like DG waste oil and its barrels will be sold to CPCB approved hazardous waste recycler. Before selling them to the authorized recycler they are kept in isolated and separately marked area.

E-waste like IT/ telecom sources, insulation, wires, cables, batteries, external electric cables and CFL bulbs will be generated from the commercial activity shall be collected at common point and be given to authorized e-waste recyclers.

9. ENERGY CONSERVATION

9.1. Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

Table 9: POWER DETAILS

Power Requirement	3000 KVA
Source of Power	BDA supply
Back up Source	3 DG Sets of 750 KVA each

Power will be sourced from Central Electricity Supply Utility of Odisha (CESU). The Maximum Power demand for the project is estimated to be as around 3000 KVA. Three D.G. sets of Capacity: 750 KVA are proposed to meet requirement of power back up during power failure.

Energy Conservation Measures & Management Plan:

During operation phase, appropriate energy conservation measures & management plan will be adopted in order to minimize the consumptions of conventional energy. The following measures are suggested to be adopted. Details of energy saving measure:

- Incorporate solar passive techniques in a building design to minimize load on conventional systems.
- Day light provision to all regularly occupied areas.
- Use of high frequency, high power factor, electronic ballasts in place of conventional copper-iron ballasts in light fixture.
- Use energy efficient light fixtures with good photometric properties.
- Use LEDs in areas such as staircases, corridors & lift lobbies.
- Using LEDs in basements & underground parking areas.
- Putting external lighting control on time switch/time control.
- Using time switch control/time control for common area & basements lighting.
- Using high efficiency motors 'EF1' for pumps & ventilation fans.
- Use of Fly Ash in RMC.
- Minimum 4 star energy appliances will be used.

9.2. What type of, and capacity of, power back-up to you plan to provide?

Three numbers of DG sets of capacity 750 KVA are provided as a source of power back up in case of power failure.

9.3. What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

Respective U values for the Glass meet the prescribed standards of Energy Conservation Building Code and this it is concluded that heat gain to the building will be minimum.

S.no.	TYPE OF MATERIAL	U Value as per ECBC (W / m2K)	U Values of the assembly(W / m2K)
1	GLASS (double glass with air gaping of 12 mm)	≤0.290	1.59

9.4. What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.

Passive solar architectural features are considered while designing the buildings in respect of orientation of building for thermal insulation aspects in case of wall with fenestration & roof etc as per ECBC 2007 Guideline. Orientation of Buildings and Elevation Features are planned to provide shading effect. The proposed project will permit maximum daylight to interior to minimize overall energy consumption. These features will also minimize the impact of climate both in summer and in winter and as a result, the use of electricity will likely to be reduced.

Passive solar architectural feature-

- Optimizing building envelope & window design to reduce cooling demand (selection of energy efficient low U value materials for envelop is application of high reflecting white china mosaic tiles to terraces).
- Day light integrated to reduce artificial lighting demand.
- Shading devices provide shade to windows & external façade.
- Adopting low energy passive cooling strategies:
- Landscaping to alter micro climate for better condition – Large green areas, peripheral plantation and avenue plantation provided to shed the hard areas & reduce heat island effect, reduction of noise & air pollution & provide buffer to sun heat.

9.5. Does the layout of streets & buildings maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

Yes, the layout of streets & buildings has been designed to maximize the potential for solar energy devices. Further, solar energy will also be used for common area lighting. Solar lighting is proposed for common areas. It is anticipated that approx 50% of the external landscape lights shall be on solar energy.

9.6. Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?

A major portion of the project shall be such oriented so that most of the façades face North – South thus reducing glare & prolonged sun exposure. On the South façade glazing is proposed to be restricted to less than 40% of the total surface area.

Use of high reflective coatings on the terraces above provides a layer of heat insulation to reduce heat gain through the roofs.

Passive solar architectural measures have been adopted to provide shades to windows and roof which would effectively reduce heating of building envelope. Sunshades, balconies & buffer space designed on external façade will protect external façade from heat gain & reduce heat gain/energy consumption.

9.7. Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.

Building is partly centrally air conditioned. However energy efficient (low U Value) materials shall be used. Conventional GSL/ fluorescent lamps have been replaced with energy efficient LED lamps. This reduces lighting power density 0.95 or higher power factor shall be maintained This will reduce electrical power distribution losses in the installation. Pumps & Motors: shall be of BEE 4 star rating. Elevators shall be operated with intelligent group control. Energy efficient Air conditioning system shall be installed. All cables shall be de-rated to avoid heating during use. This also indirectly reduces losses and improves reliability.

The 33 KV power received shall be stepped down to 415 Volts which is the operating voltage, by installing 33KV/ 415 Volt Transformer. As per the calculations enclosed in the report the total transformer capacity required for Bus Terminal Building is approx. 3000 KVA.

Centralized cooling system has not been provided in the -. CFL bulbs for lighting are used which reduces energy consumption.

9.8. What are the likely effects of the building activity in altering the micro-climates? Provide a self-assessment on the likely impacts of the proposed construction on creation of heat island& inversion effects?

There will be no adverse effect on micro-climate by the building activity. Also it will not have any significant impact on creation of heat island and inversion effects owing to following reasons:

- Adequate open spacing shall be provided.
- Selection of proper building materials.
- Adequate green belt around the structure.

9.9. What are the thermal characteristics of the building envelope? (a) roof; (b) external walls; and (c) fenestration? Give details of the material used and the U-values or the R values of the individual components.

Thermal characteristics of the building envelope is as :

S.no.	TYPE OF MATERIAL	U Value as per ECBC (W / m2K)	U Values of the assembly (W / m2K)
1.	EXTERNAL WALLS made of thermal insulation + bricks + External finish	≤0.440	0.40
2.	ROOF made of expanded polystyrene insulation + water proofing + thick concrete + Roof tiles	≤0.409	0.37
3.	GLASS (double glass with air gaping of 12 mm)	≤0.290	1.59
Respective U values for the Walls, Roofs, and Glass meet the prescribed standards of Energy Conservation Building Code and this it is concluded that heat gain to the building will be minimum.			

9.10. What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.

The basic system for Fire Fighting shall be designed as per the provisions of the NATIONAL BUILDING CODE OF INDIA, PART 4, FIRE AND LIFE SAFETY-2005. Following are the fire safety provision for type of the building : Assembly + Commercial + Business that has been proposed for the project:-

- **Water Tanks**

  Underground Domestic Water Tanks to the overhead fire tanks with a adequate capacity will be provided. It will be ensured that water is full in these tanks throughout the life of the project site.

- **Automatic Sprinklers System**

  Sprinkler System shall be provided in all the areas in the terminal as well as commercial building Pendant/Upright/Sidewall type sprinklers shall be used with a center to center spacing of 3 meters Upright sprinklers shall be provided at basement and for any false ceiling areas in Lobbies/common areas etc. which are greater than 800 mm in height The sprinklers shall be automatically activated at 68 degree centigrade by breaking of the glass bulb in the event of fire The sprinkler line shall be always pressurized. Sprinkler pump shall have the backup of main electrical and diesel engine driven fire pumps. Necessary accessories such as Alarm Valves, Flow Switches, Inspector's Test Valve Assembly, and Annunciation Panel, etc. shall be provided as per the requirements

- **Wet Riser & Hydrants System**

  The firefighting system shall be designed as per National Building Code of India 2005, other relevant I.S codes and recommendation of Local Fire Brigade.

  ✓ Two Static Underground storage fire tank and terrace tank of capacity as per NBC-2005 depending on the height of the block

- ✓ Wet-riser system with landing hydrant valves and fire hose cabinet shall be provided as per NBC part IV depending upon final architectural layouts
- ✓ Each Fire Hose Cabinet shall consist of:
- ✓ One Number Fire Hydrant/Landing Valve
- ✓ 2 nos., 63 mm dia. and 15m long rubberized fabric lined hose pipe.
- ✓ SS male and female instantaneous type coupling
- ✓ SS branch pipe with nozzle
- ✓ First-aid fire hose reels with 20 mm dia. 35m long thermos-plastic hose and with 5mm bore SS nozzle.
- ✓ Fireman's axe

- **Fire Extinguisher**

Fixed extinguishing installations shall be provided as per the relevant specifications in the premises. Fire extinguishers of suitable type e.g. CO2, Foam and Water Co2 will be provided in the building as per BIS norms Fire fighting equipments shall be suitably located and clearly marked by luminous signs. Hand held type extinguisher shall be according IS: 15683. The location of extinguisher shall be at easily accessible place

- **Fire Pumps**

There will be two numbers of electrical motor driven fire pumps of 2280 LPM capacity, for wet riser system and for sprinkler system. Similar capacity diesel engine driven pump will be provided as common standby. One number electrical motor driven jockey pumps of 180 LPM will be used to maintain line pressure in pump rooms.

- **Fire Alarm System:**

All buildings with height of 15m or above are required to have manually operated electrical fire alarm (MOEFA) system and automatic fire alarm system in accordance with good practice the floor. The first aid firefighting equipment shall be provided on all floors, including basements, Lift rooms etc, in accordance with good practice. They will be the wall mounted type fixed at a height of 1.4m above the floor level.

- **Hose Reel :**

In addition to wet riser or down comer first aid hose reels shall be installed on all the floors of buildings of 15m in height or more, and shall be in accordance with accepted standards. The first aid hose reel shall be connected directly to the riser. Diameter of the hose reel shall be 19 mm and length will be 36.5 mtr.. There will be 4 numbers of hose reel on basement-2, basement-1, & Ground Floor and 3 numbers on each upper floors (1st to 8th). Bore of nozzle fitted with each hose reel will be 5 mm of gunmetal type.

- **Internal hydrant:**

The internal hydrant is proposed to be provided with 2 numbers RRL hose pipes of 38 mm dia with 63 mm standard instantaneous coupling along with associated branch pipes and cabinet and a first aid hose reel of 25 mm dia, length 45 m and fitted with 6.5 mm nozzle.

Two internal hydrants are proposed to be provided on each platform in such a way so that most of the platform is covered by hose. In addition, hydrant shall be provided in commercial areas also. One hydrant shall be provided at entry of each station at ground floor for providing the coverage to the parking area.

- **Lift Enclosure/lifts:**

  Walls of lift enclosures shall have a fire rating of two hours. Lift shafts shall have a vent at the top of area not less than 0.2 sq m. A sign shall be posted and maintained on every floor at or near the lift indicating that in case of fire, occupants shall use the stairs unless instructed otherwise. The sign shall also contain a plan for each floor showing the location of the stairways. Floor marking shall be done at each floor on the wall in front of the lift-landing door.

9.11. If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.

Low emissivity glass will be used. It will have the following specifications:

For Glass – U Value: .88 Btu/hr/ Sqft. /F. for ¼ Gray - reflective Glass.

Glass Shading Coefficient : 0.88 Btu/hr/Sqft./F

9.12. What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.

Proper ventilation will be providing in rooms. Air changes/hour is as per Bureau of Indian Standards (National Building Code, 2005). it is essential to have control on air filtration. With use of modern building Materials & technology it is possible to make air tight construction and control air infiltration rate. Application of sealants/weather-strips proposed shall take care of this aspect. For entrance door it is less than 5 l/s-m2 and for other fenestration it is less than 2l/s-m2

9.13. To what extent the non-conventional energy technologies are utilised in the overall energy consumption? Provide details of the renewable energy technologies used.

The following measures are suggested to be adopted for maximizing the use of non-conventional energy such as solar :

- Incorporate solar passive techniques in a building design to minimize electrical and heating load.
- Solar lighting must be adopted in open areas
- The hot water requirement must be met through solar water heating devices
- Solar photo voltaic cells for solar electricity would further significantly reduce the overall electricity consumption.

10. Environment Management Plan

The Environment Management Plan would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site including fire.

Environment Management Plan in attached in **Section 5ENVIRONMENTAL MANAGEMENT PLAN** of the report

ANNEXURE 3: Air Monitoring Reports

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TEST REPORT

Ambient Air Quality Analysis

Report Code : 40005061773 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Air (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 23/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-AAQ/15
Analysis Duration	: 22/03/2018 to 23/03/2018
Sampling Time	: 24 Hrs.
Ambient Temperature (deg°C)	: 38
Average Flow Rate of SPM (m^3/min)	: 1.1
Average Flow Rate of Gases (lpm)	: 1.0
Weather Conditions	: Clear

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Particulate Matter (PM_{10})	IS:5182 Part 23-Gravemetric		
	(10:00 AM to 6:00 PM)		126.4	µg/m^3
	(6:00 PM to 2:00 AM)		133.3	µg/m^3
	(02:00 AM to 10:00 AM)		103.6	µg/m^3
2.	Particulate Matter ($PM_{2.5}$)	CPCB NAAQS Guideline Vol.1		
	(10:00 AM to 6:00 PM)		168.4	µg/m^3
	(6:00 PM to 2:00 AM)		175.0	µg/m^3
	(02:00 AM to 10:00 AM)		115.1	µg/m^3
3.	Sulphur Dioxide (as SO_2)	IS : 5182 Part II-West & Gaeke	9.81	µg/m^3
4.	Nitrogen Dioxide (as NO_x)	IS : 5182 Part VI-Jacob & Hieocher	15.1	µg/m^3
5.	Carbon Monoxide (as CO)	IS : 5182 Part X - GC	<1.0	mg/m^3
6.	Lead (as Pb)	IS : 5182 Part 22-AAS	<0.1	µg/m^3

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

(Checked by)

For E.E.S.P.L.T.

(Authorised Signatory)

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TEST REPORT

Ambient Air Quality Analysis

Report Code : 40005061773 — Issue Date : 06/04/2018

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Air (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 03/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-AAQ/15
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Time	: 24 Hrs.
Ambient Temperature (deg°C)	: 38
Average Flow Rate of SPM (m^3/min)	: 1.1
Average Flow Rate of Gases (lpm)	: 1.0
Weather Conditions	: Clear

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Particulate Matter (PM_{10})	IS:5182 Part 23-Gravemetric		
	(10:00 AM to 6:00 PM)		145.7	µg/m³
	(6:00 PM to 2:00 AM)		162.4	µg/m³
	(02:00 AM to 10:00 AM)		122.5	µg/m³
2.	Particulate Matter ($PM_{2.5}$)	CPCB NAAQS Guideline Vol.1		
	(10:00 AM to 6:00 PM)		187.4	µg/m³
	(6:00 PM to 2:00 AM)		174.1	µg/m³
	(02:00 AM to 10:00 AM)		154.5	µg/m³
3.	Sulphur Dioxide (as SO_2)	IS : 5182 Part II-West & Gaeke	9.21	µg/m³
4.	Nitrogen Dioxide (as NO_x)	IS : 5182 Part VI-Jacob & Hieocher	14.4	µg/m³
5.	Carbon Monoxide (as CO)	IS : 5182 Part X - GC	<1.0	mg/m³
6.	Lead (as Pb)	IS : 5182 Part 22-AAS	<0.1	µg/m³

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
8. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
9. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
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For E.E.S.P.L.

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ANNEXURE 4: Ground Water Monitoring Reports

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TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 22/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 22/03/2018 to 25/03/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.9	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.8	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1925	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	23.2	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	712.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4304	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	144.2	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.33	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1251.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	17.50	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.70	mg/l	5.0	15.0

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Report Code : 10029061775 **Issue Date : 28/03/2018**

25.	Chromium (as Cr^{+6})	IS : 3025 (P-52)	<0.05	mg/l	0.05	No relaxation
26.	Cadmium (as Cd)	IS : 3025 (P-41)	<0.01	mg/l	0.01	No relaxation
27.	Aluminum (as Al)	IS : 3025 (P-55)	<0.03	mg/l	0.03	0.2
28.	Alkalinity (as $CaCO_3$)	IS : 3025 (P-23)	204.7	mg/l	200	600
29.	Mineral Oil	IS : 3025 (P-39)	<0.01	mg/l	0.01	0.03
30.	Boron (as B)	IS : 3025 (P-57)	0.55	mg/l	1.0	5.0
31.	Anionic Detergents (as MBAS)	APHA 5540-C	<0.05	mg/l	0.2	1.0
32.	Total Coilform	IS : 1622 :1981	< 2	MPN/100ml	--	10.0

**End of report **

Notes :

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For E.E.S.P.L

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TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 06/04/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.7	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.2	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1845	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	22.42	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	822.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4217	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	143.6	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.29	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1211.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	16.54	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.67	mg/l	5.0	15.0

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TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 06/04/2018**

Issued To	: M/s Saamne Associates Private Ltd. Baramunda ISBT, Bhubaneswar Odisha
Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.7	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.2	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1845	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	22.42	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	822.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4217	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	143.6	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.29	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1211.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	16.54	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.67	mg/l	5.0	15.0

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ANNEXURE 5: Noise Monitoring Reports

Contact : +91 - 9810243342

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Noise Monitoring

Report Code : 70029061774 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Noise (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 23/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Sampling Time	: 24 Hrs.
Environmental Conditions	: Normal
Analysis Duration	: 22/03/2018 to 23/03/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Leq (6:00 AM to 10:00 PM)	CPCB Method	78.1	dB(A)
2.	Leq (10:00 PM to 6:00 AM)	CPCB Method	67.2	dB(A)

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.S.P.L

(Checked by) (Authorised Signatory)

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Contact : +91 - 9810243342

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Noise Monitoring

Report Code : 70029061774 **Issue Date : 06/04/2018**

Issued To	: M/s Saamne Associates Private Ltd. Baramunda ISBT, Bhubaneswar Odisha
Sample Description	: Ambient Noise (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 03/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Sampling Time	: 24 Hrs.
Environmental Conditions	: Normal
Analysis Duration	: 02/04/2018 to 03/04/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Leq (6:00 AM to 10:00 PM)	CPCB Method	79.4	dB(A)
2.	Leq (10:00 PM to 6:00 AM)	CPCB Method	68.7	dB(A)

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
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9. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
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For E.E.S.P.L

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ANNEXURE 6: Soil Monitoring Reports

Contact : +91 - 9810243342

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TEST REPORT
Soil Quality

Report Code : 70029061778 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Soil Quality
Sample Drawn on	: 22/03/2018
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 22/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Environmental Conditions	: Normal
Analysis Duration	: 22/03/2018 to 24/03/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Sand	IARI	67.0	%w/w
2.	Silt	IARI	36.0	%w/w
3.	Clay	IARI	15.0	%w/w
4.	Texture	IARI	Sandy loam	-
5.	pH (of 10% slurry)	IS 2720 (pt-26)	7.9	-
6.	Conductivity (of 10% slurry)	IARI	125	µs/cm
7.	Moisture	IARI	23.0	%w/w
8.	Bulk Density	IARI	1.66	gm/cc
9.	Total Organic Matter	IS 2720 (pt-26)	1.2	%w/w
10.	Total Organic Carbon	IS 2720 (pt-26)	0.54	%w/w
11.	Total Nitrogen (as N)	IS 14684	0.79	%w/w
12.	Potassium (as K)	IARI	38.0	mg/kg
13.	Phosphorus (as P)	IARI	2.82	%
14.	Iron (as Fe)	By AAS	6.8	mg/kg

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.P.P.L

(Checked by) (Authorised Signatory)

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Soil Quality

Report Code : 70029061778 **Issue Date : 06/04/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Soil Quality
Sample Drawn on	: 02/04/2018
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Environmental Conditions	: Normal
Analysis Duration	: 02/04/2018 to 04/04/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Sand	IARI	66.0	%w/w
2.	Silt	IARI	35.0	%w/w
3.	Clay	IARI	14.0	%w/w
4.	Texture	IARI	Sandy loam	-
5.	pH (of 10% slurry)	IS 2720 (pt-26)	7.2	-
6.	Conductivity (of 10% slurry)	IARI	124	µs/cm
7.	Moisture	IARI	22.0	%w/w
8.	Bulk Density	IARI	1.56	gm/cc
9.	Total Organic Matter	IS 2720 (pt-26)	1.1	%w/w
10.	Total Organic Carbon	IS 2720 (pt-26)	0.47	%w/w
11.	Total Nitrogen (as N)	IS 14684	0.75	%w/w
12.	Potassium (as K)	IARI	37.0	mg/kg
13.	Phosphorus (as P)	IARI	2.42	%
14.	Iron (as Fe)	By AAS	6.1	mg/kg

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
8. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
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For E.E.S.P.L.
(Authorised Signatory)

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ANNEXURE 7: Site Photographs






O.S.R.T.C.

FORM 1

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	Proposed ISBT is as per local building plan which is as per the "Planning and Building Standards Regulations (2017)", Bhubaneswar Development Authority. Proposed project will be done according to sanctioned.
1.2	Clearance of existing land, vegetation and buildings?	Yes	Existing old bus terminal will be completely demolished to build proposed new bus terminal. No clearance of existing vegetation is proposed. Biodiversity of the surrounding area will be maintained with well-planned landscape and tree plantation.
1.3	Creation of new land uses?	No	-
1.4	Pre-construction investigations e.g. bore houses, soil testing?	No	Detailed feasibility studies and Investigation was carried out for the proposed project. Soil test report is attached in Annexure -A
1.5	Construction works?	No	Construction yet not started. The major construction works are given below: ▪ Site Development ▪ Road Development ▪ Internal roads Utilities/Services ▪ Water Supply ▪ Sewerage ▪ Drainage ▪ Rain Water Harvesting Structures and Pits ▪ Power supply and back up facility, Buildings ▪ ISBT building ▪ Commercial/retail offices
1.6	Demolition works?	Yes	Proposed project require demolition of existing old bus terminal.
1.7	Temporary sites used for construction works or housing of construction workers?	No	-
1.8	Above ground buildings, structures or earthworks including linear	Yes	Building comprises ▪ Terminal Area (G+2)

	structures, cut and fill or excavations		▪ Commercial Area (B+G+2) The earthwork will require for foundation and basement. Excavated soil will be used for site levelling, back filling in raft and road construction. Top layer of soil will be stored and used for landscaping / horticulture development work
1.9	Underground works including mining or tunnelling?	Yes	Proposed commercial building will have one level of basement which would require underground construction
1.10	Reclamation works?	No	N/A
1.11	Dredging?	No	N/A
1.12	Offshore structures?	No	N/A
1.13	Production and manufacturing processes?	No	It is a construction project.
1.14	Facilities for storage of goods or materials?	Yes	Temporary facilities will be developed during construction phase for storage of construction materials. During operation phase facility for storage of HSD will be constructed at a specified place within the premises.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Solid Waste- No Liquid effluent- Yes	**Solid Waste** **Construction Stage** : The construction stage solid waste will comprise mainly of construction waste. The construction debris generated will be reused within the site for various construction works. Domestic waste generated from temporary labor camp construction labors. It will be ensured will be sent to nearest designated waste storage bins. **Operation Stage** : **Collection and Segregation of waste** • Biodegradable & non biodegradable waste shall be separately collected to ensure segregation at source. • Adequate number of colored bins separate for Bio-degradable and Non Biodegradable will be placed at planned location. • Litter bin will also be provided in open areas like parks etc. **Treatment of Bio-Degradable wastes** • Biodegradable /Organic and Horticultural Waste would be handed over to authorized vendor for treatment. **Non Biodegradable waste** • Recyclables, such as plastic, rubber, wood pieces, glass etc will be segregated from non biodegradable waste & sold to authorize vendors

			for recycling & remaining inert waste shall be sent to land fill site through authorized vendor as per the guidelines of Municipal Solid Wastes (Management and Handling) Rules, 2000 and amended Rules, 2008. STP sludge will also be used for horticultural purposes as manure. **Sewage Treatment Plant** of capacity 1000 KLD for treatment of sewage will be installed. Detail given in Conceptual plan.
1.16	Facilities for long term housing of operational workers?	No	-
1.17	New road, rail or sea traffic during construction or operation?	No	-
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	Yes	Proposed project is for new Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	Yes	Proposed project is for new Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar.
1.20	New or diverted transmission lines or pipelines?	Yes	Old bus terminal will be demolished and all the associated transmission lines and pipelines too will be demolished to make way for new transmission lines form new bus terminal
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	No	-
1.22	Stream crossings?	No	-
1.23	Abstraction or transfers of water form ground or surface waters?	Yes	Two numbers of bore well will be used for extraction of ground water during construction and operation phase.
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	Yes	There will not be any change in the drainage pattern. It will be improved by well planned development.
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Construction materials shall be transported from nearest local market. The personnel would preferably be engaged from nearby areas. Precaution will be taken to reduce the impact of vehicular movement by trying to avoid the vehicular trips during peak hours. Labours and personnel shall commute via public transport system
1.26	Long-term dismantling or decommissioning or restoration works?	No	-
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	Yes	Demolition of old ISBT building will have an impact on air environment around the project site for short time period.

1.28	Influx of people to an area in either temporarily or permanently?	Yes	Influx of people will greatly increase due to operation of new ISBT building, commercial space and offices.
1.29	Introduction of alien species?	No	-
1.30	Loss of native species or genetic diversity?	No	-
1.31	Any other actions?	No	-

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	Yes	Presently land has an old ISBT Building of G+2 structure
2.2	Water (expected source & competing users) unit: KLD	Yes	**WATER REQUIREMENT& SOURCE** Construction phase: 30KLD Source : BDA municipal supply/ Outside water tankers/ bore-well Operation Phase :1288 KLD Source : BDA municipal supply/ bore-well
2.3	Minerals (MT)	No	-
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	Construction materials shall be taken from nearest local market. Steel-100 MT, Cement-50,000 bags, Stone Aggregate-18,700 cum, Sand-106,500 cum, Bricks-118,000 cum.
2.5	Forests and timber (source – MT)	Yes	Source shall be form Local Market.
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	3000 KVA electricity load will be supplied by Central Electricity Supply Utility of Odisha (CESU). 3 nos. of DG sets of 750 KVA each.
2.7	Any other natural resources (use appropriate standard units)	Yes	

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	No	This is a project of Proposed Inter State Bus Terminal (ISBT) at Baramunda and no storage of hazardous chemicals (as per MSIHC rules) will be made, apart from limited quantity of HSD storage (for DG sets).
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	During the construction period, adequate precaution will be taken to avoid stagnation of water to avoid mosquito breeding. Labour will be provided with purified water to avoid spread of waterborne diseases. Contamination of ground water will be avoided through proper drainage and housekeeping surface runoffs will be secured by efficient flow management
3.3	Affect the welfare of people e.g. by changing living conditions?	Yes	Positive impact due to enhanced and hygienic living conditions on surrounding area. Aesthetic value of area will be improved; it will provide employment opportunities to the local people in terms of skilled and unskilled labour during construction and service personnel during operational phase.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Noise and air pollution control measures will be implemented so as to minimize the impacts on the nearby village residents.
3.5	Any other causes	No	-

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Excavated top soil was properly stacked it will be reused as top layer for horticulture development. Remaining soil will be used for site leveling, back filling/filling in raft and road construction
4.2	Municipal waste (domestic and or commercial wastes)	Yes	There would be both bio-degradable and non bio-degradable solid waste produced during the operational phase, which will be as follows: MSW: 9000 kg/day Biodegradable waste: 7000 kg/day Non-biodegradable waste: 2000 kg/day STP sludge : 10 kg/day Garden waste: 20 kg/day Detailed Solid Waste Management plan is given in Environment Management Plan
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	**During Construction phase**: Used oil whenever generated from the DG sets shall be kept in an isolated area and in leak proof container and shall be sent to approved recycler. **During Operation Phase**: Used oil from diesel generators will be carefully stored in HDPE drums in isolated covered facility. The used oil will be sold to vendors authorized by Central Pollution Control Board for the treatment of the same. Suitable care will be taken so that spills / leaks of used oil from storage could be avoided. E-waste shall be collected and given to approved recycler of SPCB.
4.4	Other industrial process wastes	No	N/A
4.5	Surplus product	No	N/A
4.6	Sewage sludge or other sludge from effluent treatment	Yes	About 10 Kg/day of dried sludge will be generated from STP within complex during operation phase and this sludge will be passed through filter press where it will be dewatered/ dried to form a cake and then will be used as manure in green areas. The unused manure shall be given to farmers or nursery.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
4.7	Construction or demolition wastes	Yes	Solid waste during the construction phase would comprise mainly the excavated earth, concrete debris, steel scrap, scrap from/of insulation material for air-conditioning and packaging material. Cement bags, waste paper and cardboard packing material will be sold off to recyclers. Unusable steel scrap will also be collected at site and sold to recyclers. Excavated earth and construction debris will be disposed as per debris management plan to authorized dumping sites
4.8	Redundant machinery or equipment	No	All equipment used for construction will be of standard quality and maintained on regular basis. In case of redundant machinery it will be sold to authorized vendors.
4.9	Contaminated soils or other materials	No	N/A
4.10	Agricultural wastes	No	N/A
4.11	Other solid wastes	Yes	**E-waste:** IT/ telecom sources, insulation, wires, cables, batteries, external electric cables, CFL bulbs etc.

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources.	Yes	**DG Sets Emissions.** Expected emission rate from DG sets are as:- PM : 0.05 Kg/hr SO2 : 0.82 Kg/hr NOx : 0.31 Kg/hr CO : 0.005 Kg/hr **During construction phase**: exhaust emissions from vehicles and other construction machinery like excavators, compressors, concrete pumps, etc. During Operation Phase: The only source of emission from combustion of fuel will be DG sets of 3 x 750 KVA. Hence, to avoid the emissions stack height of exhausts is 6 mtr above roof level for each D.G. Sets shall be provided to reduce the air emissions meeting all the norms prescribed by CPCB.
5.2	Emissions from production processes	No	There is no production as the proposed project is for ISBT building
5.3	Emissions from materials handling including storage or transport	Yes	Dust shall be generated during construction from the movement of transport vehicles. The effect will be restricted to construction phase only. Water sprinklers shall be used for dust suppression. Material will be stored under Tarpaulin cover.
5.4	Emissions from construction activities including plant and equipment	Yes	RMC shall be used in the complex. Dust & emissions is likely to be generated during construction activities which shall be reduced by sprinkling of water in a specific time interval & timely maintenance scheduled for machinery. Also the machines will be shut down during idle period.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	**Construction phase** Fugitive dust emissions will be generated due to movement of vehicles and material handling. Odour may be there from diesel emissions from vehicles and construction machinery. Activities like site clearance and excavation will generate dust which will be controlled by sprinkling of water **Operation phase** During operation phase, emissions will be generated from operation of DG sets. In case of malfunction of STP odour may be emitted. Adequate mitigation plans are prepared for such problems.
5.6	Emissions from incineration of waste	No	N/A
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris).	No	Open burning of biomass/ other material will be strictly prohibited.
5.8	Emissions from any other sources.	No	N/A

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

<table>
<tr><th>S.No.</th><th>Information/ Checklist confirmation</th><th>Yes/ No</th><th>Details thereof (with approximate quantities/ rates, wherever possible) with source of information data</th></tr>
<tr><td>6.1</td><td>From operation of equipment e.g. engines, ventilation plant, crushers</td><td>Yes</td><td>Noise is expected to be generated during construction phase mainly from operation of heavy machinery, DG sets, and traffic. The indicated noise levels from certain construction
plants/equipment are indicated below :
<table><tr><th>S.no.</th><th>Type of Equipment</th><th>Noise Level - dBA</th></tr><tr><td>1.</td><td>Concrete Mixer</td><td>85</td></tr><tr><td>2.</td><td>Generator</td><td>75</td></tr><tr><td>3.</td><td>Pumps</td><td>90 - 95</td></tr><tr><td>4.</td><td>Trucks</td><td>85 – 90</td></tr></table>
For control of noise following measures shall be
adopted:
• Properly maintained equipment with mufflers will be used.
• High noise generating construction
• Workers working near high noise construction machinery would be supplied with ear muffs/ear plugs.
• During operation noise from operation of DG sets is envisaged. However, the generator sets
• installed will operate at noise level less than 75 dB (A) as the generators will be placed either in acoustic chambers or a canopy as per CPCB norms</td></tr>
<tr><td>6.2</td><td>From industrial or similar processes</td><td>No</td><td>N/A</td></tr>
</table>

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
6.3	From construction or demolition	Yes	As there will be demolition work, there will be noise or vibration impacts from the demolition activities. There will be noise and vibration issues due to various construction activities like excavation, hammering, noise from construction machinery, etc. For each activity, adequate precautions will be taken to keep the noise and vibration levels within the prescribed limits. Noise producing activities will be staggered to reduce the cumulative impacts. Such operations will further be restricted to day time.
6.4	From blasting or piling.	Yes	Piling activity will create noise during construction activity.
6.5	From construction or operational traffic	Yes	Vehicles like earth movers, compactors, trucks etc. will generate noise during construction phase. Vehicles for parking at ISBT will generate noise during operation phase.
6.6	From lighting or cooling systems	Yes	HVAC device creates noise
6.7	From any other sources	No	-

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	Yes	The hazardous waste generated will be Used oil only and it will be stored in HDPE drums and kept in covered rooms under lock and key and will be sold to authorized vendors only. Special care will be taken to prevent leakages and spills. E-waste generated from the complex shall be given to approved recycler of SPCB.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	During operational phase, STP will be installed for treating the waste water & the treated water will be used in flushing, gardening, DG cooling and Misc. Excess treated water will be given to tanker supplier.
7.3	By deposition of pollutants emitted to air into the land or into water	No	Dust generation during construction phase from earthworks and movement of vehicles was a temporary phenomenon and will have short term impact during construction phase. Appropriate fugitive dust control measures including water sprinkling of exposed areas and dust covers for trucks, will be provided to minimize any impacts. DG exhaust will be discharged at height stipulated by CPCB. Height of stack of exhaust will be 6 mtr above the terrace of tallest tower. Treated sewage water will be recycled and reused, whereas the surplus treated water will be sent to sewer line.
7.4	From any other sources	No	N/A
7.5	Is there a risk of long term build-up of pollutants in the environment from these sources?	No	N/A

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	From the diesel storage in a site for the purpose DG sets. Adequate measures are taken to prevent the accidents.
8.2	From any other causes	No	-
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	Yes	The project falls under seismic zone- III as per is1893 (part-1):2002, care will be taken in designs to withstand earthquake of maximum Richter scale in that area. Further it is not flood prone or landslide prone areas. Hence, no risk due to natural hazards is envisaged.

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality.

S.No.	Information/ Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
9.1	Lead to development of supporting. facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other	Yes	The proposed ISBT project will be equipped with dedicated internal road, parking, internal water distribution system, fire-fighting system, internal sewage collection & treatment facility, lighting facilities, solar lighting, and power backup facility & solid waste collection & treatment facility. The project involves construction of road infrastructure around the site which would provide efficient commutation for buses and other vehicles to ISBT This is a planned development hence social as well as physical infrastructure like roads, power, waste has already been considered by planning department, Bhubaneswar and waste water will be treated onsite will have negligible impacts on environment
9.2	Lead to after-use of the site, which could have an impact on the environment	No	-
9.3	Set a precedent for later developments	Yes	This is a judicial project there will be generation of employment during construction & operation phase.
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Impacts on water availability, availability of electricity, traffic congestion etc.

(III) Environmental Sensitivity

S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.
1.	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value.	Yes	**Nandankanan Zoological Park** : 14 Km NE **Chandaka Forest**, : 13 Km NW **Shikharchandi Hill Forest** : 13 Km NE
2.	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	Bindu Sagar : 8.0 Km at SE Godabari Pond : 7 Km at SE Ekamra Kanan Botanical Gardens : 5 Km NE
3.	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration.	No	-
4.	Inland, coastal, marine or underground waters.	No	-
5.	State, National boundaries	Yes	**National Highway 16 : 0.5 Km at SE** **National Highway 316 :10.0 Km at NE**
6.	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas.	No	-
7.	Defence installations	No	-
8.	Densely populated or built-up area	Yes	***Bhubaneswar Population 2017 – 917,766 (Estimated)*** The populace density of Bhubaneswar is 2131 persons per square kilo meter

S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.

S.No.	Areas	Name/ Identity	Aerial distance(within 15 km) Proposed project location boundary.
			Rd, Nageswar Tangi, Old Town, Bhubaneswar Odisha State Museum, BJB Nagar, Lewis Road, Near Kalpana Square, Bhubaneswar, 7.2 SE
10.	Areas containing important, high quality or scarce resources*(ground water resources, surface resources forestry, agriculture, fisheries, tourism, minerals)*	No	-
11.	Areas already subjected to pollution or environmental damage. *(those where existing legal environmental standards are exceeded)*	No	-
12.	Areas susceptible to natural hazard which could cause the project to present environmental problems(*earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)	No	-

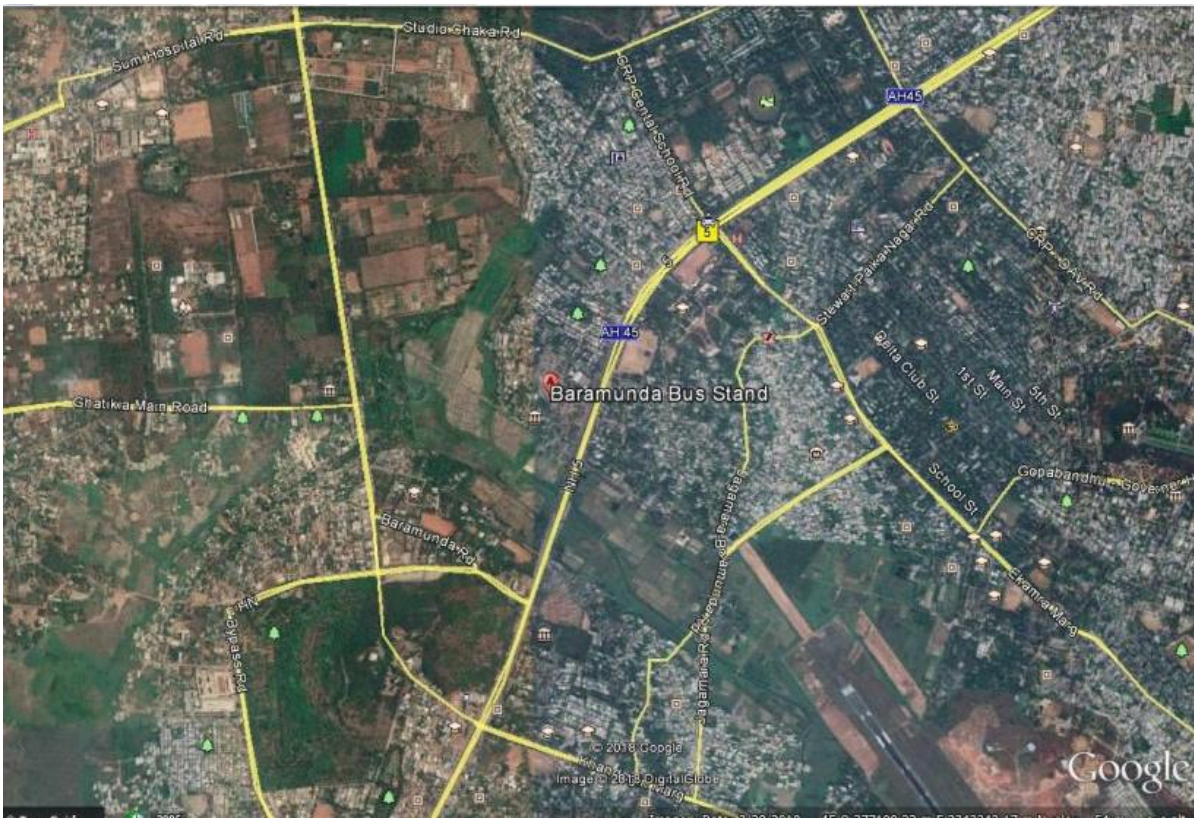
FORM 1A

ANNEXURE 2: FORM-1 A

(Only for construction projects listed under item 8 of the Schedule) (See paragraph 6)

CHECK LIST OF ENVIRONMENTAL IMPACTS

1. LAND ENVIRONMENT



1.1. Will the existing land use get significantly altered from the project that is not consistent with the surroundings? (Proposed land use must conform to the approved Master Plan/ Development Plan of the area. Change of land use if any and the statutory approval from the competent authority be submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii)the site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans.

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1.2. List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

Table 1: FEATURE

Si #	Description	Details	Unit
GENERAL			
1.	Total Plot Area	62726.27	Sq. mtr.
2.	Proposed Built Up Area	28,124	Sq mtr.
3.	Number of Building Blocks	Two (Terminal & Commercial block)	-
4.	Max Height of Building upto Terrace	Terminal block (G + 2) : 15 Commercial block (B + G + 2) : 15	mtr
5.	Max No of Floors	Terminal block : G + 2 Commercial block : B + G + 2	-
6.	Cost of Project	Approx. 134	crores
7.	Expected Population (All floating)	78000	-
AREAS			
8.	Permissible Ground Coverage Area	15%	-
9.	Proposed Ground Coverage Area	9.6%	-
10.	Permissible FAR Area	1	FAR
11.	Total Basement Area	5130 (in commercial block)	Sq mtr.
12.	Total Parking Area	30 % of FAR	-
13.	Terminal & Commercial Area	Terminal area : 15883 Commercial area : 12241	Sq mtr.
WATER			

14.	Total Water Requirement	1288	KLD
15.	Fresh water requirement	772	KLD
16.	Waste water Generation	979	KLD
17.	Proposed STP Capacity	1000	KLD
18.	Treated Water Available for Reuse	930	KLD
19.	Recycled Water used	535	KLD
20.	Surplus treated water	395	KLD
PARKING			
21.	Total Parking Required as / Building Bye Laws	3738 (30 % of FAR)	Sq mtr.
22.	Proposed Total Parking : Terminal	4359	Sq mtr.
23.	Required parking for commercial facilities	3672 (30 % of Built up area)	Sq mtr.
24.	Proposed Parking in Basement : Commercial	5130	Sq mtr.
GREEN AREAS			
25.	Required Green Area	15 %	-
26.	Proposed Green Area	18 %	-
WASTE GENERATION			
27.	Municipal Solid Waste Generation	9000	Kg/day
28.	Quantity of Hazardous waste Generation	2	Ltr/day
29.	Quantity of Sludge Generated from STP	10	Kg/day
POWER			
30.	Total Power Requirement	3000	KVA
31.	DG set backup	3 × 750	KVA
CONNECTIVITY			
32.	Rail	Bhubaneswar railway station at 8 Km SE	KM
33.	Air	Biju Pattnaik International Airport at a distance of 6 Km SE	KM
34.	Road	Road Density :11.82	Sq. Km

1.3. What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use, disturbance to the local ecology).

The project is being developed in accordance with building bye laws of Bhubaneswar Development Authority (BDA) and approved building plans. Existing facilities within the site will be completely demolished and new structure of ISBT building will come up within the site. This would help to decongest the space-starved city and haphazard parking, the BDA is planning to

build inter-state bus terminal (ISBT) at Baramunda, Bhubaneshwar. The terminal will provide private buses a parking spot, which could help decongest roads across the city. The proposed activity will improve the basic infrastructure facilities of the surrounding area. The development will not cause any disturbance to local ecology and surrounding establishments. Peripheral green belt will be developed. Proposed project will provide all the basic utilities such as proper drainage, sewerage treatment & water supply system, Structures to recharge ground water aquifer, green area development and sufficient parking so that it will not have negative impact on the surroundings.

1.4. Will there be any significant land disturbance resulting in erosion, subsidence &instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc may be given).

The proposed site is almost flat and is not prone to erosion. The proposed construction will involve cutting and filling operations. The project would involve construction of paved areas and development of green areas, which would reduce the chances of erosion. Excavation carried out for foundation & basement would be protected with strutting and shoring where ever required.

Details of soil type, slope analysis, vulnerability to subsidence, seismicity is attached in soil report

1.5. Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site).

There will not be alteration to natural drainage system. No alteration of natural drainage. Proper storm water drainage will be provided to prevent flooding.

Contour map showing the natural drainage near the proposed project site attached.

1.6. What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc.)

During construction phase, excavation was envisaged in order to provide foundations to the proposed structure. The excavated top soil will be stored & preserved separately for reusing the same for landscaping, and remaining soil will be properly stored at site under cover and will be reused for backfilling purpose, road construction etc. There will be no requirement to bring materials for filling from outside

1.7. Give details regarding water supply, waste handling etc during the construction period.

Water Requirement for the construction period is assumed to be 30,000 liters per day which will be met from ground water/municipal supply Construction waste shall be disposed off to Municipal land fill site. Detail about the waste generation and their disposal is given in table 2.

Table 2. SOLID WASTES COLLECTION, RECYCLE AND DISPOSAL

SOLID WASTE	COLLECTION AND DISPOSAL	RECYCLING
Excavated earth, debris, packaging material etc.	Excavated earth will be used for landscaping and construction debris will be disposed off Municipal land fill site as guarded by the local authority.	Cement bags, waste paper and cardboard packing materials will be sold off to recyclers.

1.8. Will the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity)

There is no low lying area in the proximity of the project site.

1.9. Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)

The construction debris and waste are non-hazardous in nature and will not cause any health hazards. Table 3 shows the type of construction waste and their disposal method.

Table 3. TYPE OF CONSTRUCTION WASTE

Si. No.	SOLID WASTE	CONSTRUCTION PHASE	Approx. Quantity
1.	Nature	Packaging material etc	50kg/day
2.	Collection and disposal	Construction debris will be disposed off to municipal land fill site.	60kg/day
3.	Recycling	Cement bags, waste paper and cardboard packing materials will be given to recyclers.	50kg/day

The waste generated will be collected and disposed of through an authorized agency. Approx. 250 labors per day will be employed during the construction period. Required sanitary facilities will be provided to Construction laborers through mobile toilets. Wash areas will be constructed and good hygienic conditions will be maintained for labour camp

2. WATER ENVIRONMENT

2.1. Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement met? State the sources &quantities and furnish a water balance statement.

Construction Phase

Operation Phase:

TOTAL DAILY WATER DEMAND (LTRS)

a) DOMESTIC USE	7,72,992
b) FLUSHING USE	5,15,328
C) LANDSCAPING	20,000
GRAND TOTAL	13,08,320

SOURCE OF WATER (LTRS/DAY)

a) STP RECYCLED	7,72,992
b) FRESH WATER (MUNICIPAL SUPPLY + BORE WELL)	358,370
TOTAL REQUIREMENT	12,88,536

2.2. What is the capacity (dependable flow or yield) of the proposed source of water?

2.3. What is the quality of water required, in case, the supply is not from a municipal source?(Provide physical, chemical, biological characteristics with class of water quality).

Table 4: Water Quality as per IS 456 :2000

S.No.	Type of Solids	Permissible Limits
1.	Organic	200 mg/l
2.	Inorganic	3000 mg/l
3.	Sulphates (as SO_3)	400 mg/l
4.	Chlorides (as Cl)	2000 mg/l for concrete not containing embedded steel and 500 mg/l for reinforced concrete work
5.	Suspended Matter	2000 Mg/l

2.4. How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

-

2.5. Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)

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2.6. What is the incremental pollution load from waste water generated from the proposed activity? (Give details of the quantities and composition of waste water generated from the proposed activity)

-

Table 5: Expected water quality of raw and treated sewage

Sr. No.	Parameter	Unit	Raw sewage characteristics	Treated sewage Characteristics
1	pH	--	6.5 – 8.5	6.5 – 7.5
2	SS	mg/l	100 - 150	10
3	BOD	mg/l	200 - 300	10
4	COD	mg/l	200 – 350	20
5	Oil & Grease	mg/l	20 - 25	< 5

2.7. Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

2.8. What would be the impact of the land use changes occurring due to the proposed projection the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

No, adverse impact is envisaged due to change in land use by the project since ground water recharging is proposed to control surface run off. It will not cause problems of flooding and water logging in the nearby area. The rain water run-off will be channelized properly through storm water drain and will be diverted to Infiltration well

2.9. What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)

There will be no significant adverse impact on ground water since ground water recharging is proposed to control surface runoff and conserve rain water. The prime source of water supply during operation will be municipal supply. The average depth of ground water table at site is around 18 to 20 meters from ground surface. There will be two numbers of bore-well for emergency use of water requirement.

2.10. What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts)

Following measures are proposed in project to control run off from construction site:

- Proper storm water drainage system comprising of lined drains is proposed.
- Boundary wall will be constructed around the site.
- Soak pits are proposed for safe disposal of domestic waste water during construction phase.
- Prevent the mixing of storm water runoff and sewage from labour camps.
- Use of leak proof containers for storage oil to avoid contamination of runoff.
- Environment Management Plan (EMP) is developed and best practices will be followed to check the run-off from the construction activities.
- Please refer EMP attached in Annexure-H

2.11. How is the storm water from within the site managed?(State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)

Effective storm water drainage system has been proposed within the site. Ground water recharging through percolation pits is proposed to control surface run off at site. The storm water shall be channelized through storm water drains to finally join ground water recharge pits and the Excess Storm Water free from runoff Contamination is lead to External Drains. Further rain water from terrace will be stored in underground tanks to reduce fresh water requirement.

2.12. Will the deployment of construction laborers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)

No, there will be no unsanitary conditions arising since adequate sanitation facilities i.e. toilets will be provided for labors. Sewage generated from labor toilets will be disposed off through septic tank/soak pit.

2.13. What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of waste water generation, treatment capacities with technology & facilities for recycling and disposal)

Total sewage generation during operation will be 979 KLD. There will be provision of an onsite STP of 1000 KLD which shall handle total flow. The treated water will be reused for Landscape & Flushing requirements. The process flow diagram and details of STP are furnished in conceptual plan.

Water Requirement Estimation Detail during operation phase of the project along with water balance diagram is attached in Annexure-D

2.14. Give details of dual plumbing system if treated waste used is used for flushing of toilets or any other use.

The project will have Dual Plumbing Systems so as to utilize treated sewage for flushing & gardening requirements. Adequate care shall be taken by providing a separate pipe line to convey the treated sewage directly to water closets and urinals. This will ensure that there is no contact of fresh drinking water pipe/tank. Separate pipe line for domestic water will be supplied to all other fixtures for domestic usage.

3. VEGETATION

3.1. Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with its unique features, if any)

There is no threat to the biodiversity due to the proposed project since no endangered / rare species are found nearby project site. Further adequate plantation of endemic species is proposed so as to retain diversity.

There are trees in the periphery of the project site of the variety Azadica Indica, Eucalyptus etc which would be retain as a part of the green coverage. List of Tree Species around the Project site is given in table 6 which would not be disturbed in any form.

TABLE 6. LIST OF TREE SPECIES

Sl. No.	Name of Plants	Nos
1	Champa	5
2	Neem	9
3	Ashoka	7
4	Amaltash	4
5	Nilamphakas	2
6	Shahtut	2
7	Semar	2
8	Gulmohar	2
9	Banyan	5
10	Kaner	5
11	Botal brush	9
12	Kaner	4
13	Sadabhar	6
14	Botal Pam	4
15	Siras	4
16	Tikona	5
17	Shirisha	8
	Total	83

3.2. Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

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3.3. What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc along with a layout plan to an appropriate scale)

Landscape features in the form of soft and hard scapes have been provided. Ground cover and shrubs within the parking area and roundabouts have been provided. Ground cover in the form of Iresene would be used. Shrubs like Wedeleia Trilobata and Clerodendrome Inerme will be used. These plantations will add colour to the soft scapes. A lot of trees are also panted at the periphery for shade and greenery. The kerb edges are lined with bougainvillea trees

4. FAUNA

4.1. Is there likely to be any displacement of fauna- both terrestrial and aquatic or creation of barriers for their movement? Provide the details.

4.2. Any direct or indirect impacts on the avifauna of the area? Provide details.

4.3. Prescribe measures such as corridors, fish ladders etc to mitigate adverse impacts on fauna

5. AIR ENVIRONMENT

5.1. Will the project increase atmospheric concentration of gases & result in heat islands?(Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions).

Ambient Air Quality Monitoring for 24 Hours was carried out at the project site on and following observation are being made for various air pollutants (Refer Annexure-I for test reports):-

- At site, PM 2.5 and PM 10 were measured at 3 times at an interval of 8 hours. It was observed that PM 10 had maximum value of 80.07µg/m^3 and PM 2.5 had maximum value of 43.79µg/m^3 during 3PM-11PM interval. Both the values were below National Ambient Air Quality (NAAQ) standards of 100µg/m^3 and 60µg/m^3 respectively.
- Value of Sulphur Dioxide was 18.95 µg/m^3.The values of SO_2 monitored in the study area are well within the limits of NAAQ standards for residential as well as sensitive areas.
- Ambient air quality status monitored for nitrogen dioxides in the study area was 33.84µg/m^3. The value of NO_2 monitored in the study area was well within the limits of NAAQ standards for residential as well as sensitive areas.
- CO concentration at the location was found to be less than 2mg/m3.

During operation phase of the project, DG sets emission prediction is given in table 6.

Table 6: EMISSION PREDICTION

Pollutants	Concentration, µg/m^3		
	Without Project	With project	Total
PM 2.5	43.79	.08	43.87
PM 10	80.07	.08	80.15
SO_2	18.95	2.15	21.1
NO_X	33.84	3.40	37.24
CO	< 0.2	< 0.2	< 0.2

Note: the above calculations are assumptions that three DG sets of 750 KVA will be operational for 6 hours and the emission factors have been calculated.

5.2. What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters.

lead to high particulate matter concentration in local area. However to control dust, smoke and gases concentration following mitigation measures are proposed:

- Barricade the site periphery by corrugated tin sheets.
- Sprinkle water on roads.
- Dust mask to be provided to workers.
- Flue gas emission from DG set to be well within the limits
- Adequate stack height of DG sets will be provided for better dispersion of pollutants.

5.3. Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.

There will not be shortage of parking space as the proposed project is for Interstate bus terminal. Adequate number of parking space has been provided for the project. It is proposed to provide parking management system to provide information to the bus driver/ conductor, collection of revenue, management of bus parking in ISBT premises. Motorized Boom Barriers shall be provided at the entrance and exit points

5.4. Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.

There will be separate entry/exit in the project with sufficiently wide internal roads and pedestrian pathways. Adequate provisions have been made in the internal roads, for smooth vehicles entry and exit and as well as pedestrian movements. Details are enclosed in the conceptual plan attached.

5.5. Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

As the entry and exit will be made safe and smooth, there will be no significant increase in noise and vibrations due to increased traffic. During construction activity vehicular movement will be the major source. While during operational phase D.G sets and vehicular movement will be source of noise. Moreover, noise shall be substantially reduced by plantation of trees within & periphery of the site and DG sets shall be provided with adequate acoustic enclosure.

5.6. What will be the impact of DG sets & other equipment on noise levels & vibration in &ambient air quality around the project site? Provide details.

The sound pressure level generated by noise from DG sets and pumps decreases with increase in distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its vibration with objects in the transmission path. The noise levels from the equipment are given in table 7:-

Table 7 :EQUIPMENT NOISE LEVEL

S.no.	Type of Equipment	Noise Level-dB(A)
1.	DG-Sets	70-75
2.	Pumps	65-70

Noise level at a distance of 100 meters radius of the society is comes out to be around 40-45 dBA. Detail of the emission characteristics from DG sets is given in table 8:-

Table 8 :STACK AND EMISSION CHARACTERISTICS

PARTICULARS	DG-750 KVA
Fuel Consumption	40 ltr/hr
Nos. of stacks.	1
Stack height above ground level. (m)	15.17 mtr
Stack height above roof level.(m)	7 mtr
Stack Diameter (m)	0.200 mm
Flue gas temperature (°C)	>300
Flue gas exit velocity m/s)	>20

6. AESTHETICS

6.1. Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

Proposed project will not result in the obstruction of a view, scenic amenity or landscapes. The architectural plan of the building is approved by competent authority

6.2. Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?

Existing building structure will be completely demolished. The various factors considered while designing the building are as under:

- The road network catering to the present and proposed terminals.
- Important towns, villages, factories and industrial centers around the Bhubaneswar city.
- Administrative boundaries of districts and states.
- Carrying capacity of existing road.
- Future vehicular density
- Parking requirement.

6.3. Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

The design of the project is influenced by the regulation set out by local authority and modern needs of the society. The project is designed in accordance with Development Control regulations of the concerned authority and following features are incorporated in project like Building Setback, Building height and open space reservation, etc.

6.4. Are there any anthropological or archaeological sites or artefacts nearby? State if any other significant features in the vicinity of the proposed site have been considered.

The archaeological remains at Dhauli, and hills of Udayagiri and Khandagiri give evidence of both Jain and Buddhist settlements around Bhubaneswar in the first two centuries BC.The temple building reached the zenith of its glory between 7th and 12th centuries when thousands of sandstone temples were erected around the Bindu Sagar, earning it the title 'The city of Temples'. The period under the Gangas saw emergence of Vaishnavism to prominence. The southern suburbs of the city have remnants of some of the striking temples, like the Lingaraja Temple, the Muktesvara Temple, etc., together with the famous archaeological and historical sites of Dhauli, Khandagairi and Udayagiri.

7. SOCIO-ECONOMIC ASPECTS

7.1. Will the proposal result in any changes to the demographic structure of local population? Provide the details.

There will be no change to the demographic structure of local population due to the proposed activity

7.2. Give details of the existing social infrastructure around the proposed project.

The capital city of Odisha, Bhubaneswar is located in the 'Khordha' district. Khordha is the most urbanized of all the districts of Odisha. Khordha Road, the railway station that serves the town is also the divisional headquarters of the East Coast Railway of the Indian Railways. Khordha is known for its brass utensils, cottage industries, railway coach manufacturing, and cable manufacture. Details of the existing social infrastructure is given in conceptual plan.

7.3. Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

No adverse effect on local communities, disturbance to sacred sites or other cultural values are envisaged due to proposed construction activity. Adequate safeguard measures have been proposed in EMP.

8. BUILDING MATERIALS

8.1. May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

ISI marked building materials of reputed brands to be procured within 100 km range as far as possible. Preference will be given to locally available building materials which conserve low energy in entire processes of manufacture. Use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas will be as per guidelines provided in NBC 2005.

Some of them are given below:

- Building material with low embodied energy will be given preference.
- Ready mix concrete with fly ash 15 to 20%.
- Some of the alternate materials for openings in construction are:-
- Use of rapidly renewable timber for doors where ever wooden doors are proposed.
- Use of steel manufactured from recycled content of smaller diameter.
- Saw dust based particle board for panels.
- Use Ceramic tile in flooring.
- The use of the above alternative building materials will help reduce the use of non-renewable resources.

Concrete

In accordance with IS 456-2000 following grade of concrete has been used for moderate conditions of exposure for different components:

Member	Grade
Footing/Column	M 25/30
Slab	M 25/30
Beam	M 25/30

Reinforcement Steel

The grade of steel reinforcement shall be Fe 500 for HYSD bars.

IS Codes

Following code shall be referred in design of structure.

- IS 456 – 2000 - for Concrete structure design
- IS 800 – 2007 - for Steel structure design
- IS 13920 - 1993 – for ductile detailing of reinforced concrete structures
- IS 875 - 1987 – Part 2 - for Imposed loading (other than earthquake)

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8.2. Transport and handling of materials during construction may result in pollution, noise &public nuisance. What measures are taken to minimize the impacts?

8.3. Are recycled materials used in roads and structures? State the extent of savings achieved?

8.4. Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

Municipal Solid Waste

Non-biodegradable waste

Hazardous Waste

E-waste Æ Æ Æ Æ

9. ENERGY CONSERVATION

9.1. Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

Table 9: POWER DETAILS

Power Requirement	3000 KVA
Source of Power	BDA supply
Back up Source	3 DG Sets of 750 KVA each

Energy Conservation Measures & Management Plan:

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9.2. What type of, and capacity of, power back-up to you plan to provide?

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9.3. What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

Respective U values for the Glass meet the prescribed standards of Energy Conservation Building Code and this it is concluded that heat gain to the building will be minimum.

S.no.	TYPE OF MATERIAL	U Value as per ECBC (W / m2K)	U Values of the assembly(W / m2K)
1	GLASS (double glass with air gaping of 12 mm)	≤0.290	1.59

9.4. What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.

Passive solar architectural features are considered while designing the buildings in respect of orientation of building for thermal insulation aspects in case of wall with fenestration & roof etc as per ECBC 2007 Guideline. Orientation of Buildings and Elevation Features are planned to provide shading effect. The proposed project will permit maximum daylight to interior to minimize overall energy consumption. These features will also minimize the impact of climate both in summer and in winter and as a result, the use of electricity will likely to be reduced.

Passive solar architectural feature-

- Optimizing building envelope & window design to reduce cooling demand (selection of energy efficient low U value materials for envelop is application of high reflecting white china mosaic tiles to terraces).
- Day light integrated to reduce artificial lighting demand.
- Shading devices provide shade to windows & external façade.
- Adopting low energy passive cooling strategies:
- Landscaping to alter micro climate for better condition – Large green areas, peripheral plantation and avenue plantation provided to shed the hard areas & reduce heat island effect, reduction of noise & air pollution & provide buffer to sun heat.

9.5. Does the layout of streets & buildings maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

Yes, the layout of streets & buildings has been designed to maximize the potential for solar energy devices. Further, solar energy will also be used for common area lighting. Solar lighting is proposed for common areas. It is anticipated that approx 50% of the external landscape lights shall be on solar energy.

9.6. Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?

A major portion of the project shall be such oriented so that most of the façades face North – South thus reducing glare & prolonged sun exposure. On the South façade glazing is proposed to be restricted to less than 40% of the total surface area.

Use of high reflective coatings on the terraces above provides a layer of heat insulation to reduce heat gain through the roofs.

Passive solar architectural measures have been adopted to provide shades to windows and roof which would effectively reduce heating of building envelope. Sunshades, balconies & buffer space designed on external façade will protect external façade from heat gain & reduce heat gain/energy consumption.

9.7. Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.

Building is partly centrally air conditioned. However energy efficient (low U Value) materials shall be used. Conventional GSL/ fluorescent lamps have been replaced with energy efficient LED lamps. This reduces lighting power density 0.95 or higher power factor shall be maintained This will reduce electrical power distribution losses in the installation. Pumps & Motors: shall be of BEE 4 star rating. Elevators shall be operated with intelligent group control. Energy efficient Air conditioning system shall be installed. All cables shall be de-rated to avoid heating during use. This also indirectly reduces losses and improves reliability.

The 33 KV power received shall be stepped down to 415 Volts which is the operating voltage, by installing 33KV/ 415 Volt Transformer. As per the calculations enclosed in the report the total transformer capacity required for Bus Terminal Building is approx. 3000 KVA.

Centralized cooling system has not been provided in the -. CFL bulbs for lighting are used which reduces energy consumption.

9.8. What are the likely effects of the building activity in altering the micro-climates? Provide a self-assessment on the likely impacts of the proposed construction on creation of heat island& inversion effects?

There will be no adverse effect on micro-climate by the building activity. Also it will not have any significant impact on creation of heat island and inversion effects owing to following reasons:

- Adequate open spacing shall be provided.
- Selection of proper building materials.
- Adequate green belt around the structure.

9.9. What are the thermal characteristics of the building envelope? (a) roof; (b) external walls; and (c) fenestration? Give details of the material used and the U-values or the R values of the individual components.

Thermal characteristics of the building envelope is as :

S.no.	TYPE OF MATERIAL	U Value as per ECBC (W / m2K)	U Values of the assembly (W / m2K)
1.	EXTERNAL WALLS made of thermal insulation + bricks + External finish	≤0.440	0.40
2.	ROOF made of expanded polystyrene insulation + water proofing + thick concrete + Roof tiles	≤0.409	0.37
3.	GLASS (double glass with air gaping of 12 mm)	≤0.290	1.59
Respective U values for the Walls, Roofs, and Glass meet the prescribed standards of Energy Conservation Building Code and this it is concluded that heat gain to the building will be minimum.			

9.10. What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.

Water Tanks

Automatic Sprinklers System

Wet Riser & Hydrants System

- ✓ Wet-riser system with landing hydrant valves and fire hose cabinet shall be provided as per NBC part IV depending upon final architectural layouts
- ✓ Each Fire Hose Cabinet shall consist of:
- ✓ One Number Fire Hydrant/Landing Valve
- ✓ 2 nos., 63 mm dia. and 15m long rubberized fabric lined hose pipe.
- ✓ SS male and female instantaneous type coupling
- ✓ SS branch pipe with nozzle
- ✓ First-aid fire hose reels with 20 mm dia. 35m long thermos-plastic hose and with 5mm bore SS nozzle.
- ✓ Fireman's axe

- **Fire Extinguisher**

  Fixed extinguishing installations shall be provided as per the relevant specifications in the premises. Fire extinguishers of suitable type e.g. CO2, Foam and Water Co2 will be provided in the building as per BIS norms Fire fighting equipments shall be suitably located and clearly marked by luminous signs. Hand held type extinguisher shall be according IS: 15683. The location of extinguisher shall be at easily accessible place

- **Fire Pumps**

  There will be two numbers of electrical motor driven fire pumps of 2280 LPM capacity, for wet riser system and for sprinkler system. Similar capacity diesel engine driven pump will be provided as common standby. One number electrical motor driven jockey pumps of 180 LPM will be used to maintain line pressure in pump rooms.

- **Fire Alarm System:**

  All buildings with height of 15m or above are required to have manually operated electrical fire alarm (MOEFA) system and automatic fire alarm system in accordance with good practice the floor. The first aid firefighting equipment shall be provided on all floors, including basements, Lift rooms etc, in accordance with good practice. They will be the wall mounted type fixed at a height of 1.4m above the floor level.

- **Hose Reel :**

  In addition to wet riser or down comer first aid hose reels shall be installed on all the floors of buildings of 15m in height or more, and shall be in accordance with accepted standards. The first aid hose reel shall be connected directly to the riser. Diameter of the hose reel shall be 19 mm and length will be 36.5 mtr.. There will be 4 numbers of hose reel on basement-2, basement-1, & Ground Floor and 3 numbers on each upper floors (1st to 8th). Bore of nozzle fitted with each hose reel will be 5 mm of gunmetal type.

- **Internal hydrant:**

  The internal hydrant is proposed to be provided with 2 numbers RRL hose pipes of 38 mm dia with 63 mm standard instantaneous coupling along with associated branch pipes and cabinet and a first aid hose reel of 25 mm dia, length 45 m and fitted with 6.5 mm nozzle.

Lift Enclosure/lifts:

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9.11. If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.

9.12. What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.

9.13. To what extent the non-conventional energy technologies are utilised in the overall energy consumption? Provide details of the renewable energy technologies used.

10. Environment Management Plan

The Environment Management Plan would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site including fire.

Environment Management Plan in attached in **Section 5ENVIRONMENTAL MANAGEMENT PLAN** of the report

ANNEXURE 3: Air Monitoring Reports

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Ambient Air Quality Analysis

Report Code : 40005061773 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Air (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 23/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-AAQ/15
Analysis Duration	: 22/03/2018 to 23/03/2018
Sampling Time	: 24 Hrs.
Ambient Temperature (deg°C)	: 38
Average Flow Rate of SPM (m^3/min)	: 1.1
Average Flow Rate of Gases (lpm)	: 1.0
Weather Conditions	: Clear

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Particulate Matter (PM_{10})	IS:5182 Part 23-Gravemetric		
	(10:00 AM to 6:00 PM)		126.4	µg/m^3
	(6:00 PM to 2:00 AM)		133.3	µg/m^3
	(02:00 AM to 10:00 AM)		103.6	µg/m^3
2.	Particulate Matter ($PM_{2.5}$)	CPCB NAAQS Guideline Vol.1		
	(10:00 AM to 6:00 PM)		168.4	µg/m^3
	(6:00 PM to 2:00 AM)		175.0	µg/m^3
	(02:00 AM to 10:00 AM)		115.1	µg/m^3
3.	Sulphur Dioxide (as SO_2)	IS : 5182 Part II-West & Gaeke	9.81	µg/m^3
4.	Nitrogen Dioxide (as NO_x)	IS : 5182 Part VI-Jacob & Hieocher	15.1	µg/m^3
5.	Carbon Monoxide (as CO)	IS : 5182 Part X - GC	<1.0	mg/m^3
6.	Lead (as Pb)	IS : 5182 Part 22-AAS	<0.1	µg/m^3

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.S.P.L.T.
(Checked by) (Authorised Signatory)

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TEST REPORT

Ambient Air Quality Analysis

Report Code : 40005061773 — Issue Date : 06/04/2018

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Air (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 03/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-AAQ/15
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Time	: 24 Hrs.
Ambient Temperature (deg°C)	: 38
Average Flow Rate of SPM (m^3/min)	: 1.1
Average Flow Rate of Gases (lpm)	: 1.0
Weather Conditions	: Clear

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Particulate Matter (PM_{10})	IS:5182 Part 23-Gravemetric		
	(10:00 AM to 6:00 PM)		145.7	µg/m^3
	(6:00 PM to 2:00 AM)		162.4	µg/m^3
	(02:00 AM to 10:00 AM)		122.5	µg/m^3
2.	Particulate Matter ($PM_{2.5}$)	CPCB NAAQS Guideline Vol.1		
	(10:00 AM to 6:00 PM)		187.4	µg/m^3
	(6:00 PM to 2:00 AM)		174.1	µg/m^3
	(02:00 AM to 10:00 AM)		154.5	µg/m^3
3.	Sulphur Dioxide (as SO_2)	IS : 5182 Part II-West & Gaeke	9.21	µg/m^3
4.	Nitrogen Dioxide (as NO_x)	IS : 5182 Part VI-Jacob & Hieocher	14.4	µg/m^3
5.	Carbon Monoxide (as CO)	IS : 5182 Part X - GC	<1.0	mg/m^3
6.	Lead (as Pb)	IS : 5182 Part 22-AAS	<0.1	µg/m^3

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
8. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
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For E E S P L

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ANNEXURE 4: Ground Water Monitoring Reports

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TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 22/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 22/03/2018 to 25/03/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.9	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.8	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1925	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	23.2	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	712.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4304	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	144.2	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.33	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1251.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	17.50	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.70	mg/l	5.0	15.0

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Report Code : 10029061775 **Issue Date : 28/03/2018**

25.	Chromium (as Cr^{+6})	IS : 3025 (P-52)	<0.05	mg/l	0.05	No relaxation
26.	Cadmium (as Cd)	IS : 3025 (P-41)	<0.01	mg/l	0.01	No relaxation
27.	Aluminum (as Al)	IS : 3025 (P-55)	<0.03	mg/l	0.03	0.2
28.	Alkalinity (as $CaCO_3$)	IS : 3025 (P-23)	204.7	mg/l	200	600
29.	Mineral Oil	IS : 3025 (P-39)	<0.01	mg/l	0.01	0.03
30.	Boron (as B)	IS : 3025 (P-57)	0.55	mg/l	1.0	5.0
31.	Anionic Detergents (as MBAS)	APHA 5540-C	<0.05	mg/l	0.2	1.0
32.	Total Coilform	IS : 1622 :1981	< 2	MPN/100ml	--	10.0

**End of report **

Notes :

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For E.E.S.P.L

(Checked by)

(Auhorised Signatory)

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 06/04/2018**

Issued To	: M/s Saamne Associates Private Ltd. Baramunda ISBT, Bhubaneswar Odisha
Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.7	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.2	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1845	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	22.42	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	822.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4217	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	143.6	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.29	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1211.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	16.54	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.67	mg/l	5.0	15.0

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EKO PRO ENGINEERS PVT. LTD.
(Analytical Division)
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TEST REPORT

Water Sampler Analysis

Report Code : 10029061775 **Issue Date : 06/04/2018**

Issued To	: M/s Saamne Associates Private Ltd. Baramunda ISBT, Bhubaneswar Odisha
Sample Description	: Ground Water
Sample Drawn By	: EESPL (Mr.Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-W/66
Analysis Duration	: 02/04/2018 to 03/04/2018
Sampling Quantity	: 1.0 Litre
Environmental Conditions	: Normal

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT	LIMIT AS PER DESIRABLE	(IS : 10500-1991) PERMISSIBLE
1.	Color	IS : 3025 (P-4)	< 5.0	Hazen	5.0	25
2.	Odour	IS : 3025 (P-5)	Unobjectionable	--	Unobjectionable	--
3.	Taste	IS : 3025 (P-7)	Agreeable	--	Agreeable	--
4.	Turbidity	IS : 3025 (P-10)	1.7	NTU	5.0	10.0
5.	pH	IS : 3025 (P-11)	7.2	--	6.5-8.5	--
6.	Total Hardness (as CaCO3)	IS : 3025 (P-21)	1845	mg/l	300.0	600.0
7.	Calcium (as Ca)	IS : 3025 (P-40)	22.42	mg/l	75.0	200.0
8.	Iron (as Fe)	IS : 3025 (P-53)	0.24	mg/l	0.3	1.0
9.	Chloride (as Cl^-)	IS : 3025 (P-32)	822.4	mg/l	250.0	1000.0
10.	Chlorine Residual	IS : 3025 (P-26)	<0.2	mg/l	0.2	--
11.	Fluoride (as F^-)	IS : 3025 (P-60)	<1.0	mg/l	1.0	1.5
12.	Total Dissolved Solids	IS : 3025 (P-16)	4217	mg/l	500.0	2000
13.	Magnesium (as Mg)	IS : 3025 (P-46)	143.6	mg/l	30.0	100.0
14.	Copper (as Cu)	IS : 3025 (P-42)	0.29	mg/l	0.05	1.5
15.	Manganese (as Mn)	IS : 3025 (P-59)	<0.01	mg/l	0.1	0.3
16.	Sulphate (as $SO4^{--}$)	IS : 3025 (P-24)	1211.7	mg/l	200.0	400.0
17.	Nitrate (as $NO3^-$)	IS : 3025 (P-34)	16.54	mg/l	45	No relaxation
18.	Phenolic Compounds (as C_6H_5OH)	IS : 3025 (P-43)	<0.001	mg/l	0.001	0.002
19.	Mercury (as Hg)	IS : 3025 (P-48)	<0.001	mg/l	0.001	No relaxation
20.	Selenium (as Se)	IS : 3025 (P-56)	<0.01	mg/l	0.01	No relaxation
21.	Arsenic (as As)	IS : 3025 (P-37)	<0.01	mg/l	0.01	No relaxation
22.	Cyanide (as Cn)	APHA 4500 CN-C	<0.01	mg/l	0.05	No relaxation
23.	Lead (as Pb)	IS : 3025 (P-47)	<0.05	mg/l	0.05	No relaxation
24.	Zinc (as Zn)	IS : 3025 (P-49)	0.67	mg/l	5.0	15.0

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ANNEXURE 5: Noise Monitoring Reports

Contact : +91 - 9810243342

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Noise Monitoring

Report Code : 70029061774 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Ambient Noise (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 23/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Sampling Time	: 24 Hrs.
Environmental Conditions	: Normal
Analysis Duration	: 22/03/2018 to 23/03/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Leq (6:00 AM to 10:00 PM)	CPCB Method	78.1	dB(A)
2.	Leq (10:00 PM to 6:00 AM)	CPCB Method	67.2	dB(A)

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.S.P.L

(Checked by) (Authorised Signatory)

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Contact : +91 - 9810243342

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Noise Monitoring

Report Code : 70029061774 **Issue Date : 06/04/2018**

Issued To	: M/s Saamne Associates Private Ltd. Baramunda ISBT, Bhubaneswar Odisha
Sample Description	: Ambient Noise (24 Hrs.)
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 03/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Sampling Time	: 24 Hrs.
Environmental Conditions	: Normal
Analysis Duration	: 02/04/2018 to 03/04/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Leq (6:00 AM to 10:00 PM)	CPCB Method	79.4	dB(A)
2.	Leq (10:00 PM to 6:00 AM)	CPCB Method	68.7	dB(A)

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
8. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
9. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
10. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.S.P.L.

(Checked by) (Authorised Signatory)

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ANNEXURE 6: Soil Monitoring Reports

Contact : +91 - 9810243342

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT
Soil Quality

Report Code : 70029061778 **Issue Date : 28/03/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Soil Quality
Sample Drawn on	: 22/03/2018
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 22/03/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Environmental Conditions	: Normal
Analysis Duration	: 22/03/2018 to 24/03/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Sand	IARI	67.0	%w/w
2.	Silt	IARI	36.0	%w/w
3.	Clay	IARI	15.0	%w/w
4.	Texture	IARI	Sandy loam	-
5.	pH (of 10% slurry)	IS 2720 (pt-26)	7.9	-
6.	Conductivity (of 10% slurry)	IARI	125	µs/cm
7.	Moisture	IARI	23.0	%w/w
8.	Bulk Density	IARI	1.66	gm/cc
9.	Total Organic Matter	IS 2720 (pt-26)	1.2	%w/w
10.	Total Organic Carbon	IS 2720 (pt-26)	0.54	%w/w
11.	Total Nitrogen (as N)	IS 14684	0.79	%w/w
12.	Potassium (as K)	IARI	38.0	mg/kg
13.	Phosphorus (as P)	IARI	2.82	%
14.	Iron (as Fe)	By AAS	6.8	mg/kg

**End of report **

Notes :

1. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
2. This test report will not be used for any publicity/ legal purpose
3. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
4. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
5. Responsibility of the laboratory is limited to the invoiced amount only.

For E E P P L
(Checked by) (Authorised Signatory)

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Telefax :+91-120-2867831, 2867840, 9711159566, 9711159117, 9711159102

TEST REPORT

Soil Quality

Report Code : 70029061778 **Issue Date : 06/04/2018**

Issued To : M/s Saamne Associates Private Ltd.
Baramunda ISBT, Bhubaneswar
Odisha

Sample Description	: Soil Quality
Sample Drawn on	: 02/04/2018
Sample Drawn By	: EESPL (Mr. Amit)
Sample Received on	: 02/04/2018
Sampling Location	: Baramunda ISBT
Sampling Plan & Procedure	: SOP-N/01
Environmental Conditions	: Normal
Analysis Duration	: 02/04/2018 to 04/04/2018

RESULTS

S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	Sand	IARI	66.0	%w/w
2.	Silt	IARI	35.0	%w/w
3.	Clay	IARI	14.0	%w/w
4.	Texture	IARI	Sandy loam	-
5.	pH (of 10% slurry)	IS 2720 (pt-26)	7.2	-
6.	Conductivity (of 10% slurry)	IARI	124	µs/cm
7.	Moisture	IARI	22.0	%w/w
8.	Bulk Density	IARI	1.56	gm/cc
9.	Total Organic Matter	IS 2720 (pt-26)	1.1	%w/w
10.	Total Organic Carbon	IS 2720 (pt-26)	0.47	%w/w
11.	Total Nitrogen (as N)	IS 14684	0.75	%w/w
12.	Potassium (as K)	IARI	37.0	mg/kg
13.	Phosphorus (as P)	IARI	2.42	%
14.	Iron (as Fe)	By AAS	6.1	mg/kg

**End of report **

Notes :

6. The results given above are related to the tested sample, for various parameters as observed at the time of sampling. The customer asked for the above tests only.
7. This test report will not be used for any publicity/ legal purpose
8. This test report will not be generated again either wholly or in part without prior written permission of the laboratory.
9. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.
10. Responsibility of the laboratory is limited to the invoiced amount only.

For E.E.S.P.L

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DIRECTORATE GENERAL
FIRE SERVICE, HOME GUARDS AND CIVIL DEFENCE, ODISHA
NUAPATNA, CUTTACK-753001
***

FORM-II
[See rule-12 (5)]
Fire Safety Recommendation

File No. C-793-2018

1. Address of the proposed building/premises:- Interstate Bus Terminal (ISBT), over Plot number 116/2331, 109/2330 & others, Mouza - Baramunda, Unit-19, Bhubaneswar.
2. Name and Address of the Applicant:- Executive Engineer, Division No-I, BDA, Bhubaneswar
3. Date of Receipt of Application:- Dt.03.05.2018
4. Proposed occupancy (Type of building):- As per BDA (P & BS) Regulations, 2008 (Amended-2013) - Public Utility Building. As per NBCI-2016 - Mixed Occupancy of Assembly (D) Residential A-5 (Hotel), Business (E) and Mercantile (F)
5. Area with plot no and. khata no:- Site area - 15.5 Acre, Plot number 116/2331, 109/2330 & others
6. Date of Inspection:- Dt.21.05.2018
7. Recommendation:

The site abuts on a public road of required width. There is proposal for construction of an Interstate Bus Terminal (ISBT) with provision of a B+G+5 floors building. The entire building has been divided into two parts. The first part (G+3 floors) is meant for Terminal Area and the second part (B+G+5 floors) will be used for commercial occupancy. Both parts of the building are interconnected at ground floor level only. As both parts constitute a single building, required fire and life safety measures have been recommended considering the most restrictive provisions applicable for individual occupancies. The proposed height of the building is 28.75 mtrs. The details of the building as mentioned in the plan are furnished below: -

Part of the building	Floor Area		Proposed Occupancy
Terminal Area	Ground floor	1832 sqm	BMS Room, Electric Room, Toilets, Ticket Counter, Office & Information Desk.
	1st floor	-do-	BMS Room, Electric Room, Counters, Food Court & Toilets.
	2nd floor	-do-	BMS Room, Electric Room, Toilets, Dormitories, Resting Rooms and Waiting Rooms.
	3rd floor	-do-	BMS Room, Electric Room, Toilets, Offices & Waiting Room

Commercial Area	Basement floor	9000 sqm	Parking
	Ground floor	4381 sqm	LT Room, Services, Ticket Counter, Office, Shops, Cloak Room & Retail Space.
	1st floor	-do-	Restaurants and Services.
	2nd floor	-do-	Retail Space
	3rd floor	-do-	Offices
	4th floor	3325 sqm	Guest Rooms
	5th floor	-do-	-do-

A. ACCESS WAYS, OPEN SPACE, EXITS AND MEANS OF ESCAPE:-

The width of the main entrance shall not be less than 06 mtrs. If compound wall is constructed then the entrance gate shall fold back against the compound wall of the premises. If the main entrance at the boundary wall is built over, the minimum clearance shall be 5 mtrs.

Provision of following open space around the building have been shown in the plan:-

Front- more than 50 mtrs Rear-10.66 mtrs Left-10.15 mtrs Right-56.96 mtrs

Provision of open space and setbacks applicable for the building shall be as approved by appropriate authority of BDA, Bhubaneswar.

Drive way of width 06 mtrs. with turning radius of 09 mtrs shall be provided around the building. The drive way shall be made hard surface capable of taking the mass of fire tender, weighing 45 ton minimum. As shown in the plan, the roof of the basement extends beyond the plinth line into the driveway, hence roof of the basement shall have also load bearing capacity 45 ton minimum and load bearing capacity certificate from the competent authority shall be obtained to that effect.

Adequate number of exits/staircases and protected escape routes as per provisions of Bhubaneswar Development Authority Planning & Building Standards Regulations-2008 (amended-2013) and NBCI-2016 shall be provided in the building on all floors to enable its occupants to reach place of safety in case of emergency and in no case there shall be at least two exits to provide direct access in separate directions from any point in the area served on every floor. The exits/staircases shall be placed as remote from each other as possible and also comply to other provisions regarding dimension, permissible travel distance, dead end corridor length in exit access, occupant load, egress capacity etc, as per the provisions of Bhubaneswar Development Authority, Planning and Building Standards Regulations, 2008 (amended-2013) and NBCI-2016. Provision of adequate numbers of exit doorways of required dimension shall be made in the building as per Bhubaneswar Development Authority, Planning and Building Standards Regulations, 2008 (amended-2013) and NBCI-2016. The minimum width of the exit doorways for the places of assembly in the building like restaurants, waiting rooms, food courts etc shall be not less than 2 mtrs each. All the exit doorways shall have height 2.1 mtrs minimum. All the corridors & passageways in the building shall be of width not less than the calculated aggregate width of exit doorways leading from them in the direction of travel to the exit, but shall be not less than the width specified in Bhubaneswar Development Authority, Planning and Building Standards Regulations, 2008 (amended-2013) and NBCI-2016. The minimum number of exits required on every floor of the buildings and their dimensions shall be determined as per clause-4.2.1 to 4.4.2.4.2 of Part-IV, NBCI-2016 & BDA Regulations.

The use of glass shall not be permitted in enclosures for exits & exit passage way. The glazing and glass façade if provided shall be done in accordance with Clause-3.4.10 of Part-4, NBCI-2016. The finishing materials used for various surfaces & décor shall be such that it shall not generate toxic smoke/fumes.

Panic bars shall be provided in the fire exits of guest rooms portion of the building. Panic bars shall be located at a height 865 mm and 1200 mm from the floor level. Besides, horizontal - sliding doors shall not be used for door openings across corridors

The escape routes should be well ventilated and provided with safety lighting and free from obstructions. Exits shall be clearly visible and the routes to reach the exit shall be clearly marked and sign posted to guide the population of the floor concerned. Signs shall be illuminated and wired to an independent electrical circuit on an alternative source of supply. Exit signs shall be provided such that no point in an exit access is more than 30mtrs from a visible exit directional sign. Provision of escape lighting and exit signage shall be made in accordance to

28/12

Clause-3.4.7.1 to 3.4.7.4 of Part-4, NBCI-2016 & relevant BIS. Floor exit plan shall be provided in each floor to determine the movements of traffic by most expeditious route.

B. CONSTRUCTION: - Non-combustible materials with appropriate fire resistance rating shall be used for construction of the building. Load bearing steel beams & columns of building having total covered area of 500 m^2 & above shall be protected against failure / collapse of structure in case of fire. A door way or opening in a fire resistance wall on any floor shall be limited to 5.6 m2 in area with a maximum height / width of 2.75 mtrs. Every wall opening shall be protected with fire resisting doors, having the fire rating of not less than 120 min. The openings in the floors shall be protected by vertical enclosures extending above and below such openings, such enclosures having a fire resistance of not less than 120 min. & all openings therein being protected with a fire resisting assembly. The vertical enclosures shall have a clear height of 2100 mm in the exit access.

Different floors of the building shall be compartmented / zoned with area of each compartment shall be not more than the value specified below:-

Basement Parking-3000 m^2 Mercantile or assembly -2000 m^2

Business -3000 m^2 Residential-750 m^2

- The occupancy categories mentioned above are as per NBCI-2016.

There shall be requirement of a minimum of two compartments if the floor plate size is equal or less than the areas mentioned above. The fire barrier of each compartment shall have fire resistance rating of 120 min. Compartmentation of floors in the building shall be done as per the provisions given in clause 4.5, part-4, NBCI-2016.

Compartmentation of basement parking shall be done with fire barrier or with water curtain nozzle (K-23) or with combination thereof. Automatic deluge system comprising deluge valve, piping nozzles, etc shall be used to zone the compartment in case of water curtain system. In case of water curtain, required additional provision of water with independent electric pump of adequate capacity shall be made. Parking facilities in basement shall comply with provisions given in Annexure-H of Part-IV, NBCI-2016.

There shall be provision of at least one firefighting shaft in each compartment of the building which has not been shown in the plan. The protected area of the firefighting shaft shall have 120 min. fire resistance rating & comprising of protected lobby, staircase & fireman's lift. It shall have connectivity directly to exit discharge or through exit passageway with 120 min fire resistance walls at the level of exit discharge to exit discharge. The respective floors shall be approachable from it. It shall have provision of 120 min. fire doors. Besides, it shall have provision of fireman talk back, wet riser & landing valve in its lobby. Staircase & fire lift lobby of firefighting shaft shall be smoke controlled. Provision of Horizontal exits shall be planned in the building. Horizontal exits shall be made in the building by way of separation of floors with the refuge area or adjoining compartment through 120 min. fire barrier. A horizontal exit shall be through a fire door of 120 min rating in a fire resistance wall. Doors in horizontal exits shall be openable at all times from both sides. Refuge area shall be so planned as to accommodate the occupants of two consecutive floors by considering area of 0.3 m^2 per person for the calculated number of occupants and shall include additionally to accommodate one wheelchair space of an area of 0.9 m^2 for every 200 occupants, portion thereof, based on the occupant load served by the area of refuge or a minimum of 15 m^2 whichever is higher. The refuge area shall be provided on the periphery of the floor and open to air at least on one side protected with suitable railings. Refuge area shall be provided at / or immediately above 24 m and thereafter every 15 m or so. Refuge area shall connect to firefighting shaft. Refuge area shall have provision of first-aid box, fire extinguishers, Public address speaker, fireman talk back and adequate emergency lighting as well as drinking water facility. Provision of firefighting shaft and horizontal exits shall be made in accordance to Clause-2.24 and Annexure- E, Part-4, NBCI-2016.

Refuse chutes, if any provided in the building, shall have opening at least 1 m above roof level for venting purpose and they shall have an enclosure wall of non-combustible material with fire resistance of not less than 120 min. They shall not be located within the staircase enclosure or service shafts, or air conditioning shafts. Refuse chutes inspection panel and doors shall be tight fitting with 60 min fire resistance. Sprinkler protection system shall be provided for the refuse chutes. Refuse chutes shall be at least 6 m away from exits.

The construction and use of the basement shall be strictly in accordance to provision of Bhubaneswar Development Authority, Planning and Building Standards Regulations, 2008. Only one vehicle ramp has been proposed for basement as shown in the plan. Adequate provision of exits and ramps shall be made in the basements as per Bhubaneswar Development Authority (Planning and Building Standards) Regulations, 2008 (Amended 2013) and NBCI-2016 considering other provisions regarding dimension, permissible travel distance,

occupant load, egress capacity etc. The ramp providing access to basement shall be constructed leaving required open space around the building for driveway. Door openings leading to basement, where there is direct approach from any occupancy above to the basement, shall need to be protected with fire doors with 120 min. fire rating except for exit discharge doors from the basements.

Exits access corridors in areas of guest rooms shall be provided with 60 minute fire resistant wall and 20 minute self-closing fire doors along with all fire stop sealing of penetrations. Smoke exhaust system having make-up air and exhaust air system or alternatively pressurization system with supply air system for the exit access corridors shall be provided. Smoke exhaust system shall also be provided for large lobbies and which have exit through staircase leading to exit discharge. All exit passageways (from exit to exit discharge) shall be pressurized or naturally ventilated. The mechanical pressurization system shall be automatic in action with manual controls in addition. Doors provided in such exit passageway shall be fire rated doors of 2 hrs rating. Provision of adequate ventilation shall be made in the basement. Vents with cross-sectional area (aggregate) not less than 2.5 percent of the floor area spread evenly round the perimeter of the basement shall be provided in the form of grills or breakable stall board lights or pavement lights or by way of shafts. Alternatively, a system of mechanical ventilation shall be provided so as to permit 12 air changes per hour in case of fire or distress call. Ventilation system shall start automatically on actuation of detector provided in the basement area. Smoke exhaust and pressurization of areas shall be done as per the provisions given in clause- 4.6 of part-4, NBCI-16

C. STAIRCASE:- Provision of 03 staircases having connectivity from ground floor to terrace have been shown in the plan in each part of the building i.e Commercial part and terminal part. The staircases shall be placed as remote from each other as possible and shall be arranged to provide direct access in separate directions from any point in the area served and also comply to other provisions regarding dimension, permissible travel distance, dead end corridor length in exit access, occupant load, egress capacity etc as per the provisions of Bhubaneswar Development Authority (Planning and Building Standards) Regulations, 2008 (Amended 2013) and NBCI-2016 .Further, additional staircases if necessary shall be provided to comply with required provisions of exit as mentioned above. The staircases shall not be arranged round the lift shafts. Photo luminescent markings shall be done along with the width and length of the treads in all enclosed exit staircases with exit directional arrow on the wall.

The access to the basement shall be separate from the main and alternative staircase providing access & exit from higher floors. Where the staircase is continuous in the case of buildings served by more than one staircase the same shall be of enclosed type serving as fire separation from the basement floor and higher floors. The clear width of each staircase shall not be less than 02 mtrs each. The minimum width of treads without nosing shall be 30 cm. The treads shall be constructed and maintained in a manner to prevent slipping. The maximum height of riser shall be 15 cm for all buildings. Construction of staircases & their dimension shall be as per Bhubaneswar Development Authority (Planning and Building Standards) Regulations, 2008 (Amended 2013) and NBCI-2016.

The internal staircases not constructed with external wall shall be pressurized. The internal staircases constructed with external wall shall be Cross-ventilated or pressurized. The natural ventilation requirement of the staircases shall be achieved thorough opening at each landing of an area 0.5 m^2 in the external wall. A cross-ventilated staircase shall have 02 such openings in opposite/adjacent walls or the same shall be cross-ventilated through the corridor. Access to the staircases at each floor level shall be through fire door of 120 mins fire resistance rating. Pressurization of the staircase shall be done as per Clause-4.4.2.5, 4.6, 6.1.1.3 &Annexure-E of Part-4, NBCI-2016.

D. LIFT:- Proposed provision of lifts in the building have not been mentioned in the plan. There is requirement of a fire lift in each firefighting shaft. Required number of lifts shall be provided the building as per the provisions of Bhubaneswar Development Authority Planning and Building Standards Regulations, 2008 (amended 2013) and NBCI-2013.

The Lifts shall not open in staircase landing. Grounding switch (es) at ground floor level shall be provided to enable the fire service to ground the lifts. Besides, telephone / talk back communication facilities shall be provided.

The lift lobbies shall be pressurized or Cross-ventilated. However, lift lobby segregation and pressurization shall be provided for lifts which will communicate from ground to basement. Pressurization of the lifts shall be done as per the provisions given in Clause-4.4.2.5 of Part-4, NBCI-2016.

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भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

Executive Engineer,Div-I,Bhubaneswar Development Authority
Akash Sobha Building, Sachivalaya Marg, Bhubaneswar-751001

Date: 01-06-2018
Valid Upto: 31-05-2026

No Objection Certificate for Height Clearance

1. This NOC is issued by Airports Authority of India (AAI) in pursuance of responsibility conferred by and as per the provisions of Govt. of India (Ministry of Civil Aviation) order GSR751 (E) dated 30th Sep. 2015 for Safe and Regular Aircraft Operations.

2. This office has no objection to the construction of the proposed structure as per the following details:

NOC ID :	BHUB/EAST/B/052418/309114
Applicant Name*	Shailaja
Site Address*	Plot No.116/2331,116, 109/2330, 109,110,102,101,96(pt),108,105,104,98,99,103,100,97, 109/2332, 115,113,111,89(pt),90(pt),91(pt),83,84,85,95,94,93,92,86,87,283(pt),284(Pt),285(pt),278,281,286,291(pt),290(pt),289(288,287,273,274, 275, 275/2311, 279,272,271,Plot no.279(pt), 88(pt), 89(pt),90(pt), 91(pt),96(pt), 279/2310 Plot no.53/2337,53/2336, 53/2335, 53/2334,53(pt),52(Pt),277(pt), 276, Plot no-282 ,Mz-Baramaunda, Bhubaneswar.The existing Bus Depot is being developed as a ISBT,Baramunda
Site Coordinates*	85 47 27.1-20 16 30.7, 85 47 29.2-20 16 20.0, 85 47 35.0-20 16 27.1, 85 47 35.7-20 16 18.6
Site Elevation in mtrs AMSL as submitted by Applicant*	40 M
Permissible Top Elevation in mtrs Above Mean Sea Level(AMSL)	55.17 M (Restricted)

*As provided by applicant

3. This NOC is subject to the terms and conditions as given below:

a. Permissible Top elevation has been issued on the basis of Site coordinates and Site Elevation submitted by Applicant. AAI neither owns the responsibility nor authenticates the correctness of the site coordinates & site elevation provided by the applicant. If at any stage it is established that the actual data is different, this NOC will stand null and void and action will be taken as per law. The office in-charge of the concerned aerodrome may initiate action under the Aircraft (Demolition of Obstruction caused by Buildings and Trees etc.) Rules, 1994"

b. The Site coordinates as provided by the applicant in the NOC application has been plotted on the street view map and satellite map as shown in ANNEXURE. Applicant/Owner ensure that the plotted coordinates corresponds to his/her site.In case of any discrepancy.Designated Officer shall be requested for cancellation of the NOC

c. The Structure height (including any superstructure) shall be calculated by subtracting the Site elevation in AMSL from the Permissible Top Elevation in AMSL i.e. Maximum Structure Height = Permissible Top Elevation minus (-) Site Elevation.

d. The issue of the 'NOC' is further subject to the provisions of Section 9-A of the Indian Aircraft Act, 1934 and any notifications issued there under from time to time including the Aircraft (Demolition of Obstruction caused by Buildings and Trees etc.) Rules 1994

e. No radio/TV Antenna, lighting arresters, staircase, Mumtee, Overhead water tank and attachments of fixtures of any kind shall project above the Permissible Top Elevation of 55.17 M (Restricted) , as indicated in para 2.

f. Only use of oil fired or electric fired furnace is permissible, within 8 KM of the Aerodrome Reference Point.

g. The certificate is valid for a period of 8 years from the date of its issue.One time revalidation without assessment may be allowed, provided construction work has commenced,subject to the condition that such request shall be made within the validity period of the NOC and the delay is due to circumstances which are beyond the control of the developer.

h. No light or a combination of lights which by reason of its intensity, configuration or colour may cause confusion with the aeronautical ground lights of the Airport shall be installed at the site at any time, during or after the construction of the building. No activity shall be allowed which may affect the safe operations of flights

i. The applicant will not complain/claim compensation against aircraft noise, vibrations, damages etc. caused by aircraft operations at or in the vicinity of the airport.

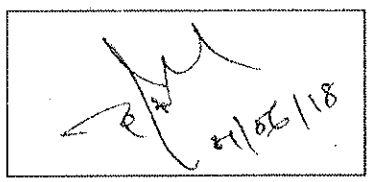
j. Day markings & night lighting with secondary power supply shall be provided as per the guidelines specified in chapter 6 and appendix 6 of Civil Aviation Requirement Series B Part I Section 4, available on DGCA India website: www.dgca.nic.in

k. The applicant is responsible to obtain all other statutory clearances from the concerned authorities including the approval of building plans. This NOC for height clearances is to ensure the safe and regular aircraft operations and shall not be used as document for any other purpose/claim whatsoever, including ownership of land etc.

l. This NOC has been issued w.r.t. the Civil Airports. Applicant needs to seek separate NOC from Defence, if the site lies within their jurisdiction.

m. In case of any discrepancy/interpretation of NOC letter, English version shall be valid.

n. In case of any dispute w.r.t site elevation and/or AGL height, top elevation in AMSL shall prevail.



महा प्रबंधक (वायवी) पू.क्षे.
General Manager(ATM)ER

	Name / Designation / Sign with Date
Prepared By :	
Verified By :	

Chairman NOC Committee

Region Name: EAST

Address: General Manager Airports Authority of India, Regional Headquarter, Eastern Region, N.S.C.B.I Airport, Kolkata-700052

Email ID: gmatmer@aai.aero

Contact No: 033-25111293

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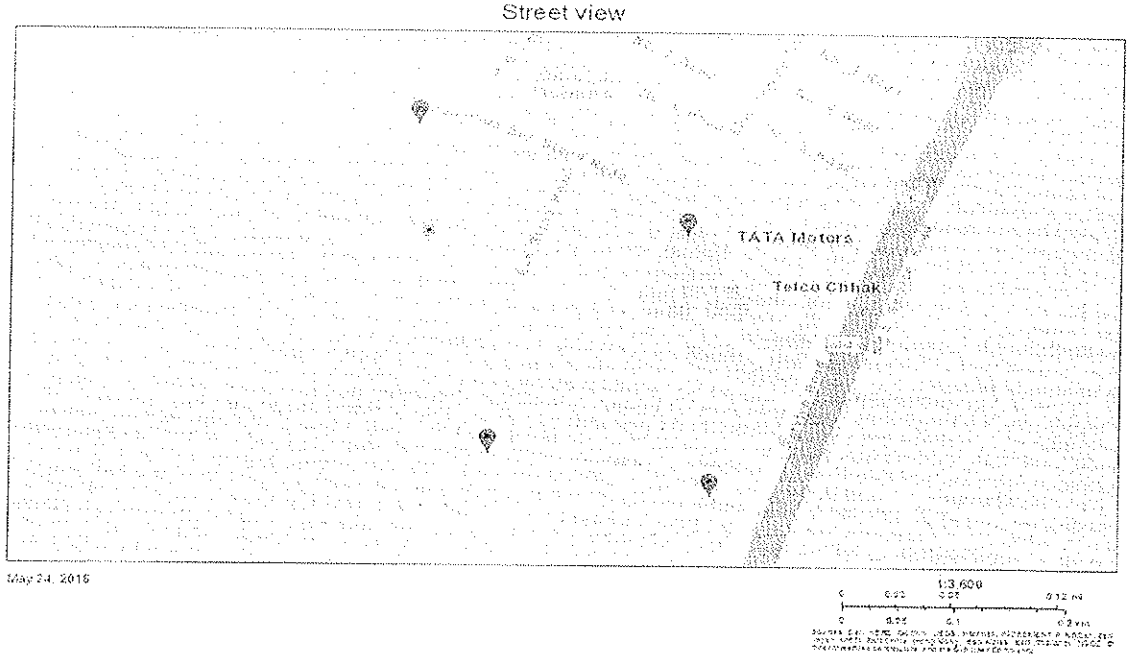
ANNEXURE

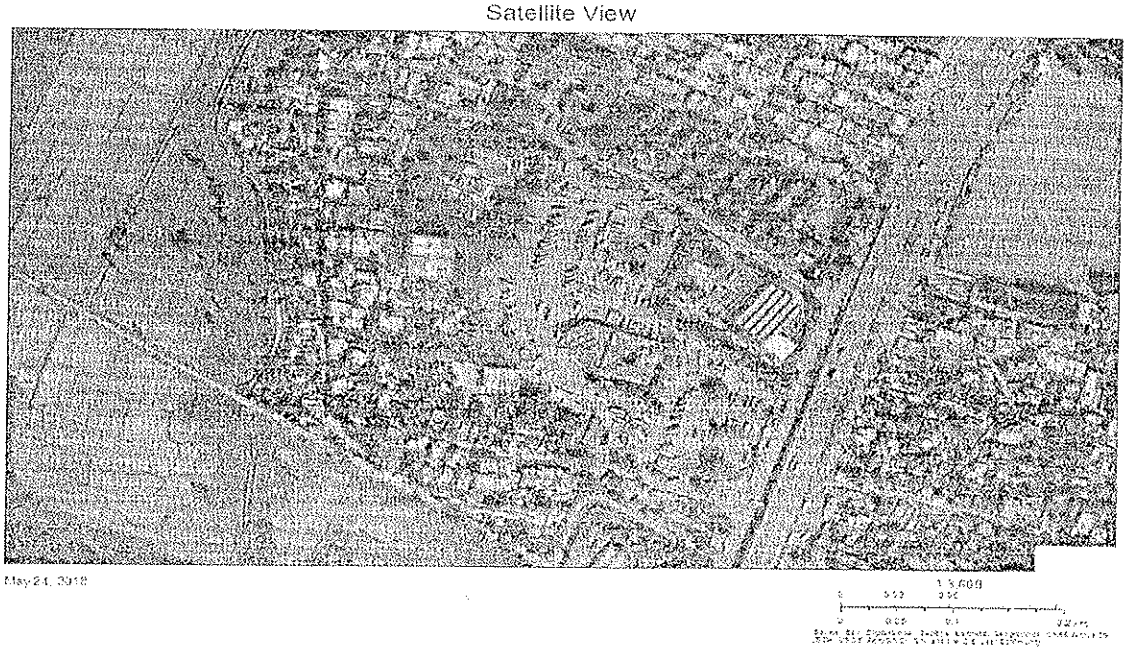
Distance From Nearest Airport And Bearing

Airport Name	Distance (Meters) from the Nearest Runway	Bearing (Degree)
Bhubaneshwar	3856.96	315.44
Cuttack	32478.97	200.29
Konarak	55135.31	324.65

Street view



Satellite View



Dr. Krishan Kumar, IAS
/ICE-CHAIRMAN, BDA &
MUNICIPAL COMMISSIONER
BHUBANESWAR MUNICIPAL CORPORATION

ଡା. କୃଷନ କୁମାର, ଭା.ପ.ସେ.
ଉପାଧ୍ୟକ୍ଷ, ଭୁବନେଶ୍ୱର ଉନ୍ନୟନ କର୍ତ୍ତୃପକ୍ଷ ଏବଂ
ମ୍ୟୁନିସିପାଲ କମିଶନର,
ଭୁବନେଶ୍ୱର ମ୍ୟୁନିସିପାଲ କର୍ପୋରେସନ

D.O. No. 17395 /BDA, Dated 21.07.17
L-9/91(pt)

Sub- **Transfer of Baramunda Bus Stand land to BDA for redevelopment.**

Ref:- Minutes of the Review Meeting held under the Chairmanship of Chief Secretary on review of City Bus Service on 21.03.2017.

Respected Sir,

In inviting a reference to the subject cited above, I am to say that in the meeting held on 21.03.2017 under the Chairmanship of Chief Secretary, it was decided that redevelopment of Baramunda Bus Stand shall be done by BDA. Accordingly Govt. in Commerce & Transport (Transport) Department vide their letter No.3946,dt-03.06.2017 allowed BDA for redevelopment of Baramunda Bus Stand into an international class facility.

G.A.Department have allotted Ac.15.900 land in favour of BDA free of premium for construction of Baramunda Bus Stand and Rehabilitation of S.T. encroachers vide order No.18199,dt.28.10.1988.(For Bus Stand Ac.14.436 and for Rehabilitation of S.T. encroachers Ac.1.470)

Baramunda Bus Stand was handed over to OSRTC with effect from 01.01.1992 as per decision in the High Level Committee Meeting held on 21.12.91 under the Chairmanship of Hon'ble Minister,Commerce & Transport.

As lease deed has not yet been executed in respect of above allotted land, it may be kindly be transferred u/s-75 of ODA Act in favour of BDA free of premium under the provision of para-5 (C) of CLIP'2015 for redevelopment of Baramunda Bus Stand.

With regards,

Yours sincerely

(Dr.Krishan Kumar)

C/C

Shri Ashok K.K.Meena,IAS
Special Secretary to Govt.
G.A. & P.G.Department,Govt. of Odisha,Bhubaneswar

BHUBANESWAR DEVELOPMENT AUTHORITY
Akash Shova Building, Pandit Jawaharlal Neheru Marg,
Bhubaneswar-751 001, Odisha
Tel: +91-674-2396124, Fax: +91-674-2390633
E-mail: vc@bdabbsr.in, Website: www.bdabbsr.in

(WL)

BHUBANESWAR DEVELOPMENT AUTHORITY.
BHUBANESWAR.

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No. 335 /EE-I /BDA, Bhubaneswar the 23rd April' 2018.

From: The Executive Engineer,
Division No.I, BDA,
Bhubaneswar.

To

The Executive Engineer,
P.H.Division No.II,
Bhubaneswar.

Sub:- Issue of NOC for the work Construction of ISBT at Baramunda, Bhubaneswar.

Sir,

In enclosing herewith a copy of site plan of above site, it is to inform that the DP & BP Committee of BDA held on 20.04.2018 has approved the plan for above project with a condition that the work to be taken up only after obtaining NOC from your organization.

It is therefore, requested to take up a detail field inspection to above site and send your views on issue of NOC to this office immediately for taking further necessary action at this level.

Encl:- 1)Site Plan.
2)Building Plan.
3)Copy of proceedings of 222nd DP&BP committee meeting.

Yours faithfully,

23.04.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

Memo No. 336/EE-I /BDA., Dt. 23.04.2018

Copy forwarded to Executive Engineer, P.H. Division No.I, Bhubaneswar for information and necessary action with a request to take up immediate action on this matter.

23.04.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

Memo No. 337/EE-I /BDA., Dt. 23.04.2018

Copy submitted to the S.E, PHEO, Bhubaneswar for favour of kind information and necessary action.

23.04.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

Memo No. 338/EE-I /BDA., Dt. 23.04.2018

Copy submitted to the C.E-cum-E.M, BDA for kind information.

23.04.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

BHUBANESWAR DEVELOPMENT AUTHORITY.
BHUBANESWAR.

No 333(W)/EE-I/BDA, Bhubaneswar the 23rd April' 2018.

From: The Executive Engineer,
Division No I, BDA,
Bhubaneswar.

To

The Chief Fire Officer,
(Fire Prevention Wing),
Cuttack.

Sub:- **Issue of NOC**/Recommendation for the work Construction of ISBT at Baramunda, Bhubaneswar.

Sir,

In enclosing herewith a copy of site plan of above site, it is to inform that the DP & BP Committee of BDA held on 20.04.2018 has approved the plan for above project with a condition that the work to be taken up only after obtaining NOC from your organization.

It is therefore, requested to take up a detail field inspection to above site and send your views on issue of NOC to this office immediately for taking further necessary action at this level.

Encl:- 1)Site Plan.
2)Building Plan.
3) Copy of proceedings of 222nd DP&BP Committee Meeting.

Yours faithfully,

23.4.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

Memo No. 334(W)/EE-I/BDA., Dt. 23.04.2018

Copy submitted to the C.E-cum-E.M, BDA for kind information.

23.4.2018
Executive Engineer,
Division No.I, BDA,Bhubaneswar.

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BHUBANESWAR DEVELOPMENT AUTHORITY

AKASH SHOVA BUILDING,
PANDIT JAWAHARLAL NEHERU MARG, BHUBANESWAR – 751001
PABX No.0674-2392801 / 0998 / 6437, FAX No.0674-2390633 / 085
Visit us at: http://bdabbsr.in/

Ref. No. 352 Date. 27.4.2018

To

The Director,
OGDC, Survey of India,
Bhubaneswar.

Sub: WGS-84 Co-ordinate of the proposed site with MSL-Height and Distance from the Airport for obtaining NOC for Building Plan Approval for Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar.

Sir,

With reference to the subject cited above, this is to intimate that Bhubaneswar Development Authority has been entrusted for construction of Inter State Bus Terminal (ISBT) at Baramunda, Bhubaneswar. In this connection it is requested to kindly supply the WGS-84 Co-ordinate of the proposed site with MSL-Height and Distance from the Airport for obtaining NOC from Airport Authority for approval of building plan of the above project (G+3) terminal building and (G+5) commercial building over the existing bus stand at Baramunda.

You are therefore requested to please intimate this office the amount of fees required to be deposited for the above purpose.

An early action in the matter is requested.

Yours faithfully.

27.4.2018

Executive Engineer,
Division No.I, BDA.

Memo No.. 353 /BDA., Bhubaneswar the 27 th April 2018.

Copy submitted to C.E.-Cum-Engineer Member, BDA for favour of kind information and necessary action.

27.4.2018

Executive Engineer,
Division No.I, BDA.