TRANSFORMATION OF BUS DEPOT
AT PEN, MH.

By

ADNAN HASWARE

A REPORT

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Architecture.

University of Mumbai

2017

AIKTC
SCHOOL OF ARCHITECTURE

CERTIFICATE

This is to certify that the Design Dissertation titled TRANSFORMATION OF BUS DEPOT AT PEN, MH . is the bonafide work of the student ADNAN IQBAL HASWARE from Final Year B. Arch of AIKTC School of Architecture and was carried out in college under my guidance.

Sign of the guide:

Name of the guide: Prof. SANDEEPKUMAR PRAJAPATI

Sign of the Dean: _____

Date:

DECLARATION

I hereby declare that this written submission entitled

"___TRANSFORMATION OF BUS DEPOT AT PEN, MH.__"

represents my ideas in my own words and has not been taken from the work of others (as from books, articles, essays, dissertations, other media and online); and where others' ideas or words have been included, I have adequately cited and referenced the original sources. Direct quotations from books, journal articles, internet sources, other texts, or any other source whatsoever are acknowledged and the source cited are identified in the dissertation references.

No material other than that cited and listed has been used.

I have read and know the meaning of plagiarism and I understand that plagiarism, collusion, and copying are grave and serious offenses in the university and accept the consequences should I engage in plagiarism, collusion or copying.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact source in my submission.

This work, or any part of it, has not been previously submitted by me or any other person for assessment on this or any other course of study.

_____

Signature of the Student:

Name of the Student: ADNAN IQBAL HASWARE

Roll No: 12ARC10

Date: Place:

INDEX

ACKNOWLEDGEMENT

1. ABSTRACT 1

2. TABLE OF CONTENT .....

2.1 Introduction 2

2.1.1 Background Study

2.1.2 History

2.1.3 Problem Statement

2.1.4 Objectives

2.1.5 Methodology For Case Studies

2.1.6 Scope

2.1.7 Limitations

2.1.8 Public Transport Benefits

2.2 Literature Review 30

2.2.1 Definitions and Descriptions

2.2.2 Motor Vehicle Act and RTC Act

2.2.3 Basic Research on MSRTC

2.2.4 User of MSRTC

2.2.5 Passengers

2.2.6 Capacity Relation

2.2.7 Finance

2.2.8 Maintenance and Services

2.2.9 Articles by Other Authers

2.2.10 Case Studies

2.2.11 Case Study Inferences

2.3 Research Design 63

2.3.1 Bus Standards.

2.3.2 Bus Bay.

2.3.3 Standards of Interlocking Bus Bay.

2.3.4 Bus Parking.

2.3.5 Platform Standards.

2.3.6 Typical Garage of MSRTC.

2.3.7 Fuel Pump.

2.3.8 Bus Washing Area.

2.3.9 Space Standards.

2.3.10 Signage.

2.3.11 Lighting.

2.3.12 Users.

2.3.13 Guideline for Bus Depot Design.

2.3.14 Usability Criteria.

2.3.15 Human Centric Design.

2.3.16 Regulations.

2.4 Site Selection and Analysis 91

2.4.1. Site Justification.

2.4.2. Site Identification.

2.4.3. About PEN City, Raigad.

2.4.4. Site Availability Information

2.4.5. Regional Context and Road Connectivity.

2.4.6. Site Analysis.

2.4.7. Site Condition.

2.4.8. Site Area and Dimension.

2.4.9. Existing Programme of Pen Bus Depot.

2.4.10. Site Photos.

2.4.11. Site Merits and Demerits.

2.4.12. Route Mapping of Pen Bus Depot.

2.4.13. Capacity Relationship.

2.4.14. Norm from DCR.

2.4.15. Climatology.

3. ARCHITECURAL SPACE PROGRAMME.....60

4. BIBLIOGRAPHY .....

ABSTRACT

Public Transport is mandatory and key feature in developing a well functioning and sustainable city. In Public Transport, Road Based Transport system is more accessible in Maharashtra as it is well connected from Rural Area to Urban. If Road Based Transport System is Crafted in Public Transport then the Need for Private Vehicle Reduces, Resulting in less Traffic Congestion, Low Co2 emission and Affordable Journey.

A Bus Depot is the Spine of any City, as it Serve the most Basic Necessity for the City that is Public Transportation. Infrastructure Aesthetic value and Comfort Attract Passengers and Increase Ridership. And also network and fare of Industry which is second part.

MSRTC is a Bright Industry in Public Transport Industry and is a reputed Brand Since 1948. To Maintain its Reputation, MSRTC has to Change according to the Modern Age, as his sister's Industry GSTRC and KSTRC Relying According to the Time. Because as Technology Changes, Customer Expectation also Changes by Time. Passengers Need more Comfortable, Good Functioning System and Facilities in their Daily Life.

Owning to this issue, MSRTC regularly upgrade their fleet so as to suit the travel requirements of everyone. But this is not enough to get emphasized. Depot is a driving structure of MSRTC other than buses. Structural facility also have to be upgrade to relay good performance and get benefited of. And also Transformation in Depot Design is Necessary by which Depot Infrastructure use Less Energy in its daily Services and Earn to get Maintain, And also make Profit in Business by adding Various Asset's (Commercial) according to the Site Context to the Infrastructure.

2.1. Introduction:

2.1.1. Background Study

Bus Depot is a station where Buses load and offload passengers and goods, and also where buses are maintained/repair and operate in the locality of tahasil and outside area.

Maharashtra economic development needs increasing mobility of people to access various activities and goods in its cities. A major part of mobility is by road based transport as compare to air-based and water-based in Maharashtra as air-based is expensive and road based is well connected from rural to urban. The Maharashtra State Road Transport Corporation (MSRTC) (also known as ST) is a state run bus service of Maharashtra. MSRTC plays an important role in mobility of people for various activities and goods in Maharashtra. MSRTC has 58 years experience in the road travel industry, and also have good position in public sector. MSRTC aim to provide its passengers with a comfortable transport means which should help them to travel to major town and cities in the state. Government of Maharashtra is the owner of MSRTC; And Headquarter of MSRTC (central office) is situated in Mumbai Central at 'Mumbai Vahatuk Bhavan'. According to the MSRTC website data, MSRTC serves 16,500 buses which ferry 70 lakh passenger every day, around 31 district bus stand and varies bus stops and has 18,700 routes which connects varies city, town and villages. They have a slogan: 'Where there is a road there is a ST bus. Truly in remote places that have no traffic, the ST bus will almost be there.'

MSRTC buses are structural core of road transport in Maharashtra. In past few years, there is no visible growth in their infrastructure. Because our government is not funding in buses infrastructure in transportation sector, our government is only funding in railway network in transportation (mono rail, metro and bullet train). Today there is a strong need to upgrade the infrastructure and facilities of depot to meet the requirements of public and operator.

Maharashtra economic development needs increasing mobility of people to access various activities and goods, which fulfil by MSRTC in Maharashtra and also connected to other selected states as Madhya Pradesh, Karnataka, Hyderabad(Andhra Pradesh) . MSRTC plays an important role in environmental sustainability by reducing co_2 emission, green house gases, traffic, etc. And depot / terminals are driving structure of MSRTC other than buses to facilitate passengers.

Towards Topic :

For developing sustainable transport systems; safety and comfortable public transport system are first condition. Bus systems in particular are extremely relevant since they form the finite number of public transport trips which provide more people to travel in a trip as compare to private vehicle. Improved bus services and developing infrastructure like bus terminals, depots and stops can attract users and increase ridership.

Public transport hold centre stage in the urban transport agenda. A well functioning and sustainable city cannot be achieved without strengthening its public transport system as transit oriented design is better than other. Infrastructure plays a vital role in the operation of an efficient, convenient and safe transit system. When transit infrastructure is designed to enhance passenger experience, its attractiveness is ensure by making it viable alternative to private motorized transport.

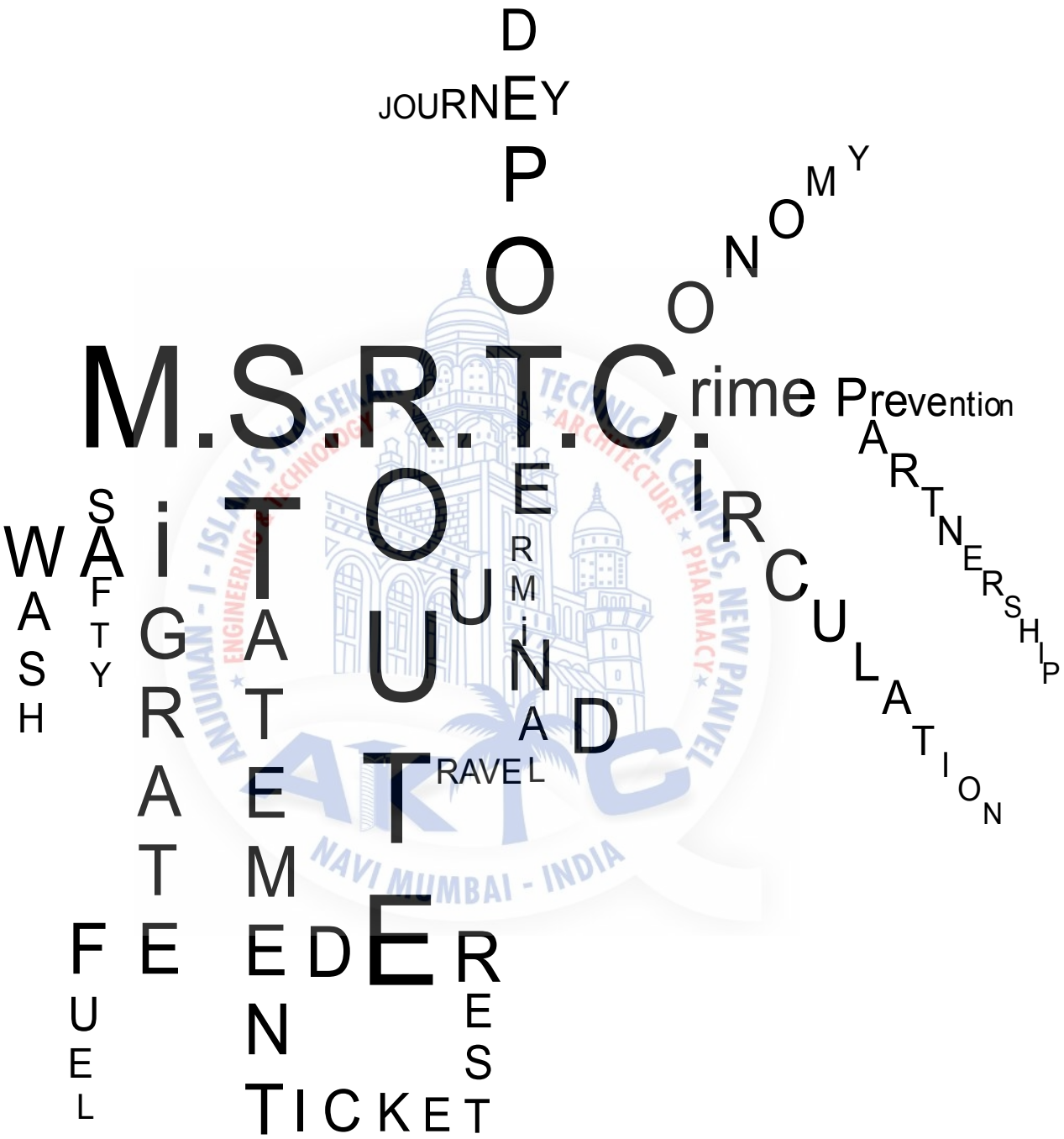
For good design of depot, it's access/approach should be barrier free and facilitate good internal circulation. The facility should be accessible for all, including handicap person, etc in a seamless manner with minimum effort.

Service offering Buses:

The luxury coaches and the air conditioned buses are furnished by better interiors while deluxe and semi-comfortable buses are also well maintained.

Now while going through his/her route, the passengers can take pleasure of the television. This bus transportation service have kept the modern norms in mind and hence offer MSRTC internet booking option via its website.

The services also offers concession to senior citizens, war widows, freedom-fighters, physically handicapped and student.



2.1.2. HISTORY

2.1.2.1. Past Transportation Modes in India :

1) Walking 2) Human -pulled Rickshaws
3) Bicycle 4) Cycle Rickshaws
5) Pala-quins 6) Ferries
7) Bullock Carts / Horse Carriages

2.1.2.2. History of MSRTC:

Evolution

From

Private to STB

then STB to BSRTC

then BSRTC to MSRTC

In 1920s, when various entrepreneurs started their operations in the public transport scenario. Till the Motor Vehicle Act came into being in 1939, there were no regulations monitoring their activities, and this resulted in arbitrary competition, unregulated fare. The implementation of the act rectified matters to an extent. The individual operators were asked to form a union on defined routes in particular area. This also proved to be beneficial for travellers as some sort of schedule set in, with a time table, pickup points, conductors and fixed ticket prices.

Thus continued the state of affairs till 1948, when the then Bombay State Government started its own state road transport service, called State Transport Bombay. And the first blue and silver-topped bus took off from Pune to Ahmednagar.

In 1950, a Road Transport Corporation Act was passed by the Central Government and it powers to states to form their individual road transport corporations with the Central Government contributing one-third of the capital. The Bombay State Road Transport Corporation (BSRTC) thus came into action, later changing its name to MSRTC with the re-organization of the state.

ST BUSES WERE ALSO KNOWN AS LIFE LINE OF MAHARASHTRA

And It is 'Life Line of Maharashtra'

2.1.2.3. About MSRTC :

The Maharashtra State Road Transport Corporation was established by State Government of Maharashtra. The MSRTC is operating its services by the approved scheme of road transport. The area covered by the scheme is entire area of the state of Maharashtra. The undertaking is operating stage and contract carriage services in the entire area of the state of Maharashtra except ST undertaking.

The Present Maharashtra State Road Transport Corporation (M.S.R.T.C.) merged of three streams for providing passenger road transport in the public sector. These related to the Pre-1956 Reorganization states of Bombay, Madhya Pradesh and Hyderabad.

2.1.2.4. About Bus Depot :

As in Olden day's there is no proper roads for travelling from one place to another; people has to sacrifice their level of comfort because of it. Buses of MSRTC are there to fulfil the needs of public to travel in Maharashtra. But bus, passengers, driver and conductor need halt in between to rest and release stress that develop while travelling on that unconditioned road. Buses need refuelling and maintenance regularly. while driver and conductor has to report their journey and refresh them self to carry further journey. And passenger need some food in between journey and want to relax. They all need a break in between their journey. So that Depot were formed.

Basically Depot's are used as fuelling point and garage for buses; check point for driver and conductor; Eatery and resting place for passengers, driver and conductor.

2.1.2.5. History of MSRTC Buses :

The first bus was flagged from the Pune to Ahmednagar. It is blue and silver-topped bus. The driver and conductor used to wear khaki uniforms and peak caps. There were 10 makes of buses in use then - Chevrolet, Ford, Bedford, Seddon, Studebaker, Morris Commercial, Albion, Leyland, Commer and Fiat. In the early 1950s, two luxury coaches were also introduced with Morris Commercial Chassis. These were called Neelkamal and Giriyarohini for Pune-Mahableshwar route. They had two by two seats, curtains, interior decoration, a clock and green tinted glasses.

The ST started with 30 Bedford buses having wooden bodies, coir seats. With time, the S.T. buses underwent many changes, including increasing the seating capacity from the original 30 to 45 to the present 54, introduction of all-steel bodies to replace wooden bodies to make them stronger and cushion seats for more comfort. In 1960, aluminium bodies were introduced as steel corrodes, especially in coastal areas, and the colour code also changed to red from the blue and silver.

Fig. No.1

Fig. No.2

Fig. No.3

Early Buses of MSTRC
(Source: www.msrtc.maharashtra.gov.in and Movie 'Tubelight')

The luxury transport services of the corporations on the Dadar-Pune-Dadar route started since 1981. As the traffic on this route has been becoming popular, the more rounds have been expanded. The overnight service and the semi-luxury class came into existence in 1982. Mumbai - Pune Railway Station 5 has been turned on air conditioning ashvamedha transport buses in 2002. The Volvo bus traffic passengers have been placed and new vatanukulita buses handling in the way that getting a good response, and from Dadar, Thane, Borivali-Sion, Nashik, Aurangabad to Swargate, and etc. Have been placed in the path of seeing the urgency of handling AC buses for passengers.

Fig. No.4

Fig. No.5

Fig. No.6

Fig. No.7

Fig. No.8

Early Buses of MSTRC
(Source: www.msrtc.maharashtra.gov.in)

2.1.2.6. MSRTC facilities and Services other than Passenger Accommodation :

The S.T. buses are also used for transportation of the postal mail, distribution of medicines, newspapers and even tiffin's sent by people from rural areas to their relatives in cities staying for study or doing job over there. Transporting goods of the farmers to cities from rural area, is also one of their jobs. A partial night service was launched in 1956.

According to the time, MSRTC parcel service add and subtract different facilities according to the usability. Today postal mail service, distribution of medicines and newspapers and tiffin is discontinued from parcel service of MSRTC.

Fig. No.9
Logo of MSTRC
(Source: www.msrtc.maharashtra.gov.in)

2.1.3. Problem Statement :

Road based transport system is more accessible in Maharashtra as compare to other transport system because it is well connected from rural area to the urban areas. And provide Good mobility of passengers as well as of goods.

Proposed 'Transformation of Bus Depot' is to understand the concept of transit system. And provide user-friendly and environmental sustainable design. If the road based transport system is crafted in public transport system then the need for private and other vehicle reduces. Therefore it rises environmental sustainable quality by reducing CO_2 emission, green house gases, traffic, etc. Also public transport system is affordable as compare to private and other vehicle services. It uses less energy resources and get advantage in Gross Domestic Product (GDP) of India.

MSRTC is only Government based transport system in rural area. Which connects rural area of Maharashtra to urban area of Maharashtra and selected city of other State like Madhya Pradesh and Karnataka, Hyderabad. This industry has a good reputation in transport system since 1948, to maintain this reputation, MSRTC has to be function better according to the modern age. As in modern age technology changes, customers expectation also changes by time. Passenger need more comfort, good functional system and facilities in their daily life. As other industries are giving good amount of care to it.

Owning to this issue, MSRTC (state owned road transportation services) regularly upgrade their fleet so as to suit the travel requirements of everyone. But this is not enough to get emphasized. Depot is a driving structure of MSRTC other than buses. Structural facility also have to be upgrade to relay good performance and get benefited of. By providing sufficient access to users and buses, operator. And providing various asset's for traveller. Therefore it become 'all needs at one point' centre/structure for traveller. And it will get emphasize by quality and various facilities for traveller (public).

A DEVELOPED COUNTRY IS NOT A PLACE WHERE THE POOR HAVE CARS;

IT IS WHERE THE RICH USES PUBLIC TRANSPORT

-Enrique Penalosa

Former Mayor of Bagotà, Colombia.

2.1.4. Objective's :

2.1.4.1. Architectural Design Objective's :

1) Arrange better functional interaction between passengers, buses/operator and feeder modes. And provide good understanding and fast flow of traffic.

2) Provide sufficient access to passenger and buses. According to the ergonomic of users and Design Standards for spaces.

3) Provide various asset's to get benefited of(Fund/Revenue). (Provide real estate according to the site context.)

Self-dependent structure, which earn to get maintained.

or use less energy

2.1.4.2. MSRTC Objective's :

4) Provide safe and affordable journey over Maharashtra state and selected neighbouring city.

5) Provide stops, depot and garage wherever require in their route.

like in/near village, town, city. (better circulation and functionality in it)

6) User Satisfaction is the prior objective.

2.1.5. Methodology for case-study

Understanding Basic Requirement of Design and its Limitation

Necessary Data Collection and Analysis for Buses and its Depot

p1 p2 p3

Site Study	Case-studies	Design Standards
- Site Analysis	- Internet Study on MSRTC and its Depot	- Geometric design standard for Buses
- Site context	- Book Case-Study on Depot in India	- Bus Parking Standards
- Capacity	- Live Case-Study in Raigad Region	- Bus Bay Standards
- Route Mapping	- Comparative Analysis	- Space Standards
Site Climate Study		

Table No. 1. Methodology

Finding Revenue Generation Assets According to the Site Context

Framing Requirement
Evolution of Design Concept
Design Solution

2.1.6. Scope :

Road Based Transport System is good accessible because it is well connected to rural area and also to urban area. Good mobility of passengers as well as goods. MSRTC is Only transport system in rural area of Maharashtra which connects both rural and urban; and also it is government based resulting in affordable fares.

2.1.6.2. Design Scope :

Create interaction between passengers, buses, operator and feeder mode. And provide access to passenger and buses according to the design standards. Gives easy to access way for user and create good experience of that space by safe and comfortable design.

2.1.6.3. Architectural Scope :

Developing state of art supporting infrastructure (Transit infrastructure) like bus terminals, depots and stops attract passengers and increase ridership. When transit infrastructure is designed to enhance passenger experience, it's attractiveness is ensure, making it possible alternative to private motorized transport.

2.1.6.4. Value :

A well functioning and sustainable city cannot be achieved without strengthening its public transport system and its infrastructure play a vital role in attracting ridership, which result to reduce in use of private vehicle. Hence it is a key feature for its city which help in reducing traffic congestion and Co2 emission resulting in good environment and leisure space.

2.1.7. Limitation

Topic Related Limitation

- Design of Bus is not the part of the design. (Design Depot according to the MSRTC Bus Standards.)
- Garage Area, Washing and Fuelling Station also Limit in Design.

Site Related Limitation

- Fixed Water Well location on site, which can interrupt vehicular circulation.
- Only two sided Access to the Site.
- B.U.A. = 13000 as F.S.I. = 1.
- Infrastructure Height Limitation is upto 12m = G+2 (3 Storey Structure)
- No Basement allowed.

Public Transport Benefits :

Public transportation in India is important part of the solution to the national economic, energy, and environmental challenges - helping to bring a better quality of life.

- Public transportation provides personal mobility and freedom for people from every walk of life.

Access to public transportation gives people transportation options to get to work, go to school, visit friends, or go to a doctor's office. And Public transportation provides access to job opportunities for millions of Users.

- Public Transportation Saves Fuel, Reduces Congestion.

- Public Transportation Saves Money.

Public transportation provides affordable journey, for many users, alternative to other transport system.

- Public Transportation Reduces Carbon Footprint by fulfilling 'n' number of passenger needs.

A single commuter switching his or her commute to public transportation can reduce a household's carbon emissions by 10 percent

- Public Transport has much lower Accident Rate hence it is safe.

Annually, Public transit prevent 200,000 deaths, injuries, and accidents had equivalent trips been made by car.

The National Safety Council estimates riding the bus as over 170 times safer than private car.

2.2. Literature Review :

2.2.1. Definition and Description :

There are main two spaces of depot : (viz. Workshop and Stand)

1) Workshop

Workshop is a space in depot where buses maintained by giving servicing to its engine (garage) and body; Also buses are cleaned / washed and fuelled and also provide shelter for buses. And also houses Administration block and Head office.

Design Element's of Workshop

- Cleaning Area

A area provided by depot to wash buses so that buses were ready for next journey. This area is equipped by water tank and pipe or whole washing machine according to the facility.

- fuelling area

A area provided to refuel a bus tank with diesel to continue its journey. A cabin and two fuel tower(min) are the content of it.

- Garage

It is a shaded area provided where MSRTC buses are serviced and repaired by mechanics.

- Head Office

A room provided for the head of the depot to keep watch on working of depot and its premises.

- Locker Room

A room or part of room is provided to store essential premises of employee and lock them for a while.

- Lodging

A room provide for bus and depot staff to stay their one night if their job is of next day and their home is not in that locality.

- Log office

A back office where daily attendance happen and responsible for all depot data book. (excluding financial)

- Meeting Room

A room provided for meeting beside head office to gather and discus various issue or do presentation.

- Resting Room

A room provided for MSRTC employee to take rest in between their work when they feel to take rest.

- Revenue Office

A back office that is responsible for financial matter.

- Security Cabin

It is a cabin of guard to restrict people to enter in restricted area's of depot, and also give information about that site.

- Storage

A room provided to store batteries, shock absorber and other elements of bus. It is a place where stock of this elements were kept.

- Bus testing lane/ground

A lane or ground is provided in workshop area to test bus after servicing it, and also for new driver to test their driving.

2) Stand

Stand is a space where people comes to get buses for their journey, and also Stand provide necessary amenities for user are as follow :

Design Element of Stand :

- Circulation Area

Separated Free movement area provided for buses as well as for people to do their action without any interruption.

- Dormitory

A large sleeping room containing several beds provided to the passengers so that they can stay over there for period of time.

- Eatery

It is a place where we get facility to eat food.

like canteen, stalls, etc.

- Enquiry and Announcing Counter

A counter where passenger come to ask about bus route and there time and also this counter act as a check point for bus staff to check in/out when they arrive at that depot, and also it announce about buses arrival and departure.

- Parking

A separated vehicular parking allotted for staff as well as for public to park there two wheelers, four wheelers without disturbing other circulation on site.

- Platform Ticket

A ticket required to enter depot premises. A cabin should be provided at the entry of depot for platform ticket. Act of revenue generation.

- Storage for name plate of routes

A room or a part in room provided to store name-plate of the route that name-plate use in buses to assign the route of bus that which bus is going where.

- Ticketing Booth

A counter provided to give ticket, passes and other schemes of bus to passenger.

(user : depot staff)

- Ticketing Queue Area

A area provided to stand and make a queue to get ticket and passes and not disturb other space in depot.

(user : passengers)

- Tourist Information

A counter allotted for peoples to get information about locality, nearby tourist places, and other travelling and staying information.

- Waiting Area

Area provided for the passenger to wait for there buses. Seating is provided in this area, and also infotainment is a good option.

Bus Bay Types

-Loading Bay

A Platform where buses park to load passengers and goods so that they start their journey.

- Offloading Bay

A platform where buses park to unload passengers and goods when the journey ended.

- Idle Parking Bay

A platform where buses can park when buses are not in action or at work.

- Feeder Mode

Facility to transfer passenger from or to depot, Creating a impression that the journey is continuous and without break. Feeder Mode Service Types are classified in to Feeder Lane, Feeder Bay and Intermodal.

feeder modes like cycle rickshaws, auto rickshaws, buses, minidoors, taxi, private vehicles etc.

Others :

- Headway

The Bus Starting from specific Depot, then that bus is headway to that specific Depot.

- ECS

Equivalent Car Space which is area required to part a car.

- Pax

Pax is a Unit which is use to calculate/denote the Number of Passengers.

- fares

A Sums Payable for a Season Ticket or in Respect to Hire a Bus.

Facilities

- Drinking Water Facility

Total 88 units of drinking water facility is built by MSRTC in Maharashtra. And more units are in progress by MSRTC. And private sector are also making such drinking water facility from MSRTC scheme in depot land.

- Toilets

MSRTC aimed 300 toilet blocks in Maharashtra, from which 126 toilet blocks are done and open to public. And this facility maintain by 'International Toilet' company.

- Parcel Service

MSRTC has availed a service for citizen to transport their goods, parcels or packages from one destination to another. This kind of service is also a good source of income for MSRTC. Considering this fact, MSRTC has availed parcel service's along with the passenger services since the beginning of the ST service.

MSRTC has appointed a single agent for entire state and the rights for finalizing the parcel service rates etc have been given to them.

All the major Bus Stands of MSRTC are having parcel service offices for providing a reliable, trustworthy and competitive parcel service.

Uncle Parcels & Forwarders Pvt. Ltd.(Authorised Agent of S.K. Translines Pvt. Ltd) is operator of parcel service for MSRTC.

Mumbai, Nagpur, Nashik, Pune, Aurangabad, Amravati are the parcel operators region in Maharashtra. And Indoor(M.P.), Sendawa, Burhanpur, Karnataka state, Belgaon, Bijapur are interstate operator region of parcel service for MSRTC.

BUSES of MSRTC :

Travelling by buses forms the most common mode of transportation in India. All cities are interconnected through a huge bus network run by state owned corporations. In general, the bus service is available between larger cities at short intervals and are very cheap when compared with other countries. Nearly all cities and towns have their own 'bus stand'

Fig. No.10

It is a Logo of MSRTC Placed on every single Bus of MSRTC must have this badge from local buses to air conditioned buses. Parivartan Bus is also called as ST in Local language.

The services have been implemented in the MSRT Corporation. The traffic is provided to the following types of traffic services in Maharashtra.

✧ **1) Parivartan** (Simple service) - (9.5 x 2.4 x 3.1, 10.15®, 39©)

Parivartan of MSRTC is a 2x2 ordinary bus service which offers comfortable service to mass passengers.

a) Fast service - bus service is running from the beginning

b) Night service - starting from 01.04.1968

Total quantity of this type buses = 14601 no.s

Fig No. 11. Parivartan Bus(Simple Service) Old Version

Fig No. 12. Parivartan Bus(Simple Service) New Version

✧ **2) Asiad -**

Fig. No.13. Asiad

Asiad is semi-luxury non air-conditioned 2x2 bus service.
Typically buses under this service are of white and green with blue band on it. Initially MSRTC started this service between Pune and Dadar which got very good response of passengers. After the success of this route, MSRTC start Asiad service in all cities of Maharashtra. In 2010 color of Asiad buses change to purple and shiny white.

✧ **3) Hirakani (Nimaram services)(Asiad)** - (9.59 x 2.5 x 3.2, 10®, 45©)
- since 1982

Total quantity of hirakani buses = 947 no.s

Fig. No.14. Hirakani

✧ : Service in Pen Depot

Air-condition service - From May 1996 (on the Dadar-Pune road)

4) Shivneri (Air-conditioned Volvo) - from December 28, 2002

This is an air-conditioned bus service of MSRTC which runs between major cities of Maharashtra. The service is run through world class Volvo B7R buses. Initially this service was started on Pune-Dadar route, after that extended to all major cities of Maharashtra. Few buses under Shivneri service are also connect Maharashtra to Bangalore, Hyderabad, Goa(Panjim) etc.

Total quantity of Shivneri buses = 106 no.s

Fig. No.15. Shivneri Bus

On rent basis (Shivneri) - From December 2002

5) Ashwamedh (On rent Sleeper Coach) - From 05.06.2013

Total quantity of this type buses = 2 no.s

Fig. No.16. Ashwamedh Bus 1

Fig. No.17. Ashwamedh Bus 2

6) Yashwanti (MIDI) service - since 2002

Total quantity of yashwanti buses = 476 no.s

Fig. No.18. Yashwanti (Green Bus)

7) sheetal (nimaram vatanukulita service) - from 27.09.2010
(Dadar - Pune route)
dated 08.03.2013 nimaarama buses "hirackni" that was renamed.

This service is one of the recent service of MSRTC. Under this service semi-luxury air conditioned 2x2 buses are used. The fare of Sheetal bus service is lower than Shivneri and higher than Asiad bus service. Till 2010 this service is on Pune-Dadar route, now MSRTC have plan to extend this service.

Total quantity of sheetal buses = 7 no.s

Fig. No.19. Sheetal Bus

8) City Bus

S.T. operates City Bus Service in 7 different cities of Maharashtra State. City Bus Service is operated in Nashik, Nanded, Ratnagiri, Miraj, Vasai, Nalasopara, Aurngabad & Chandrapur. City buses provide service to passenger of small town and semi-urban area.

Total quantity of city buses = 390 no.s

Fig. No.20. City Bus

9) Daily conducted tour :

A single day tour operated by Asiad or Hirakani buses. Route of Tours are available from Aurangabad to Ajanta and Ellora caves.

10) Yatra (festival service) :

The Yatra bus service is for passengers who want to visit various festivals of Maharashtra.

11) Tourism Package :

Tourism package is a service in which passenger buy a single ticket and visit selective group of tourist destination in Maharashtra. Group are created on the basis of tourist destinations of a district to which this service belong.

Interstate Buses :

Fig. No.21. showing Andhra Pradesh Route Bus

Fig. No.22. showing Karnataka route Bus

Parcel service vehicle of MSRTC

Fig. No.23. Parcel service (old version)

Fig. No.24. parcel service (new version)

Parcel Courier Service : This service is to provide courier and shipping cargo services.

Servicing Vehicle of MSRTC use in breakdown condition of service Bus

Fig. No.25. Service Vehicle of MSRTC

Type's of Buses :

- Simple Service : Local Red Parivartan, Yasvanti (MIDI).
- Semi Luxury : Asiad (Green, White), Hirakni nimaram (Purple, White).
- Luxury : Shevneri (AC), Ashwamedha (AC), Sheetal.

Semi-Luxury and Luxury buses will not be offered at discounted rates for student.

2.2.2. Motor Vehicle Act 1939 and RTC Act 1950 :

Motor Vehicle Act 1939

21A .Necessity for conductor's licence. (1) No person shall act as a conductor of a stage carriage unless he holds an effective conductor's licence issued to him authorizing him to act as such conductor; and no person shall employ or permit any person who is not so licensed to act as a conductor of a stage carriage. ---------- 1 Subs. by Act 20 of 1942, s. 6, for the original cl. 2 Ins. by Act 56 of 1969, s. 9 (w.e.f. 1-10-1970). 3 Ins. by Act 100 of 1956, s. 18 (w.e.f 1-8-1957). ---------- 43

Road Transport Corporations Act, 1950

3. Establishment of Road Transport Corporations in the States.

The State Government, having regard to

a. the advantages offered to the public, trade and industry by the development of road transport;

b. the desirability of coordinating any form of road transport with any other form of transport;

c. the desirability of extending and improving the facilities for road transport in any area and of

providing an efficient and economical system of road transport service therein; may, by notification in the Official Gazette, establish a Road Transport Corporation for the whole or any part of the State under such name as may be specified in the notification.

48. Transitional provision relating to Bombay State Road Transport Corporation.

Not with standing anything contained in section 47A, it shall be lawful for the Government of the State of Bombay to frame a scheme under sub-section (1) thereof and forward the same to the Central Government before the 1st day of May, 1960, and in such a case, the power conferred on the Central Government to make an order under sub-section (2) thereof may be exercised before that day but no order so made shall take effect till that day.]

1 Ins. by Act 11 of 1960, s 71, original s. 48 rep. by Act 36 of 1957, s. 2 and Sch.I.

2.2.3. Basic Research on MSRTC :

Transport in India consists of transport by land, water and air. Public transport remains the primary mode of transport for most of the livelihood in India, and India's public transport systems are among the most heavily used in the world.

Buses are an important means of public transport in India. Due to this social significance, bus transport is predominantly owned and operated by public agencies, and most state governments operate bus services through a State Road Transport Corporation. These corporations (MSRTC) have proven extremely useful in connecting villages and towns across the country.

Today's Network and Size of MSRTC

6	-	Regional Offices
31	-	Divisional Workshops
3	-	Central Workshop
250	-	Depots (Terminal)
3	-	Training Centre
9	-	Tyre Retreating Plant
597	-	Bus Depot
3639	-	Bus Stands / 4150 Bus Stops
104000	-	Worker/Employee
240	-	Books Stalls
935	-	Shops (fast food, canteen)
2253	-	other Amenities

Service Seasons :

- Crowded Season = March 01 to June 30 (4 Months)

- Less Crowded Season = July 01 to February 29 (8 Months)

Various Department's Of 'MSRTC'

1. **FINANCE AND ACCOUNTS DEPARTMENT**

Finance and Account department exercises financial control over financial activities of the corporation. Financial advisor and cheif account officer is head of department (HOD) of Accounts and Financial department and is appointed by State Government.

Functioning of Finance and Account Department

a) Finance
   i. Budgeting
   ii. Fixed Deposit Scheme and FD Rates

b) Accounts
   i. MSRTC C.P.F. / EDLI / Gratuity
   ii. Profit and Loss account and balance sheet (last)
   iii. Profit and Loss account and balance sheet (un-audit)

c) Audit
   i. Internal audit in MSRTC
   ii. Government audit in MSRTC

d) Information and Technology
   i. Online reservation system
   ii. Electronic ticket issuing system
   iii. Smart card
   iv. Vehicle tracking system
   v. Stores inventory control system
   vi. Provident Fund, Fixed Deposit, Gratuity, Financial and Vehicle Accounting

2. **TRAFFIC DEPARTMENT**

The functioning of Transport Department is carried out under the guidance of General Manager (Transport). It draft the buses timetable and route of buses for MSRTC.

3. **MECHANICAL DEPARTMENT**

The mechanical department planned to make available the required vehicles (buses) to operate schedule(timetable proposed by traffic department) at assigned route. And it also decide the maintenance and life of buses and purchase of new bus chassis.

4. PERSONNEL

The Personnel Department is dealing with the employees of the Corporation, right from recruitment up to termination and beyond termination to look after the terminal benefits of its employees.
viz. gratuity, provident fund, employees' pension etc.

Functions Of Personnel Department :-

a. Recruitment

b. Promotions

c. Seniority

d. Service Benefits-increments, selection grade etc.

e. Labour Settlements

f. Discipline & Appeal Procedure

g. Maintenance of Industrial Relations

The department is liable to frame policies of the Corporation for employees.

5. CIVIL

Civil Department in MSRTC is looking after construction works as demanded by Traffic Department, Mechanical Department and Administration.

It's main objective is to provide infrastructural facilities for functioning of Depots, Divisional Workshops, Bus Stations etc. by constructing required buildings and to maintain the constructed structures.

Similarly, the lands required for new establishments are acquired by Civil Department.

In addition to above functions, Civil Department is dealing with establishment of commercial complex on vacant lands and MSRTC premises where open land is available.

6. PLANNING AND MARKETING

Planning and Marketing Department		
Branch	**Planning**	**Marketing**
Object	Structural and Method of the Corporation	Framing of schemes to increase revenue of the Corporation
Function	- Inspection of various Unit. - Proposals for establishment of new Regional and Divisional office. - Proposals for restructuring of the Organizational setup of the Corporation - Proposals for decentralization. - Proposals for delegation of powers. - Action on Recommendations made by the committee appointed by State Government if any - Fixation of targets for important parameters of Traffic and Mechanical Department. - Review of operational parameters with reference to the targets and actual achieved. - Preparation of plan for Disaster Management during monsoon period. - Permission to students for collection of data for Ph.D. Study from Corporation.	- Advertisement of concessional schemes, various services and facilities offered by the Corporation to passenger at various places like Govt./Pvt. Offices, market place, Educational/Professional institute, IT hub, Grampanchayat, Hospitals etc through S.T. employees. - Introduction of various schemes to increase the revenue of the Corporation. - To frame the policy for increase in revenue of casual contract by offering maximum no. Of buses to various industries, institutes, private offices, resort and for tour packages, etc. - Marketing of the MSRTC services through Digital/Electronic media like audio, video system. Attractive colouring of buses, creation of brand, logo, tags line etc. By appointing professional consultant.

7. STATISTIC

Management Information System (MIS) is established to provide information of various operational performances to the management. Information is compiled at divisional, regional level & final compilation is done at Central Office, Mumbai.

Basic documents from depots and associated documents from Traffic, Mechanical, Accounts, Personnel & Stores Department are collected, scrutinized and complied to prepare various Statistical reports.

Parameter & Analysis -

To measure operational efficiency of Traffic & Mechanical department, various performance indicator are taken into account and those are as follow:

Traffic indicators- Route, Schedule, Effective Kilometre, Traffic Receipt, Earning per km. percent Load Factor, Vehicle Utilization, Crew Utilization etc.

Mechanical Indicators - percent Fleet Utilization, Rate of Breakdown, KPTL, KPL, Tyre consumption, Spring Consumption, etc.

This information analysis is made available to each unit using advanced "Geographical information system (GIS)". This information is useful for decision making.

8. LEGAL

Legal Department of MSRTC look after legalisation, cases in law court if any for the corporation.

9. PUBLIC RELATION

Publicity in public activities such as passenger transport is the unique general entity. The relationship is a link between corporation and traveller. Public Relation Department plays an important role in upholding the general body image.

10. SECURITY AND VIGILANCE DEPARTMENT.

The security and vigilance department of the corporation is referred to as "eyes and ears" of management. The main objective of the Department is to bring out the issues related to irregularities, financial irregularities and financial harm to corporations, and to prevent them from being exposed at the same time, so as to provide law and order to the passenger, pay attention to the law and order and to make these matters known to the corporation from time to time.

Incidents of violation of law and order and damage to the corporation are promptly communicated to the central office and at the level of the Corporation, contacting the concerned district police force should take immediate action against such incidents or take appropriate steps to prevent corporation and people from any harm, This is to work effectively to stay safe and secure.

Its Function:

-Protecting the property and the contents of the corporation.

-Help the Transport Department in carrying out illegal travel traffic.

-Inspection of night buses running on highways and exit areas.

-Roads to keep passengers safe. Do the drivers checking of alcohol.

-Investigations about the purchase of fuel, lubricant and store bags of billions of rupees, whether their arrivals / outward settlements are done and also investigate scrap material.

11. STORES AND PURCHASE

Deputy General Manager (Stores): - To control stock storage, to monitor the functioning of purchasing decentralized works, to facilitate functioning.

Senior Warehousing Officer (Self): - Procure purchase of spare parts for bus vehicles and make available necessary resources for them.

Senior Warehousing Officer (All-1): - Process of procurement of materials required for bus vehicles, processing of cloth for labourers and making available official material for office work and providing necessary resources for them.

Senior Supervisory Officer (All-2): - Fuel(Diesel) for buses, all types of automobile oils, tires, tubes, flaps, tire retreading material etc. Process of purchase and providing necessary resources for it.

About missing thing: To get back the missing and in custody belonging.

If any person left his/her belonging in bus, then he/she has to ask for it in respective depot of MSRTC to get back his/her missing thing. MSRTC / ST keep missing thing only for one month of period, Therefore he/she has only one month to get back that thing from MSRTC Depot. If people are careless then, After One month MSRTC give missing object to 'Auction-Mahamandal'. Auction-Mahamandal is a committee which create a auction environment in every year, as so many objects are missing in the year, but there is no storage or shortage of storage to store such bulk missing thing. But before auction, the owner of that missing thing came to get back his/her belonging in Auction-Mahamandal, then he/she has to proof that the missing thing is of his/her own property, then he/she has to pay 10% of the total price of that missing thing to the Auction-Mahamandal.

Charges at MSRTC Depot:

If the price of missing thing is less then Rs.100 then MSRTC charges 50 paisa per day upto Rs.5 .

If the price of missing thing is more then Rs.100 then MSRTC charges 50 paisa per day upto Rs.10 .

If passenger/customer demand to get that missing object to other location than that depot, then parcel charges will be applied to that missing object.

2.2.4. Users of MSRTC Depot :

A) Facilitator (Employee of MSRTC)

1. Terminal Staff in.
   - a) Min. 2 Person in Revenue Office.
   - b) Min. 2 Person in Terminal Office (Log Office)
   - c) 1+3 and 1 Secretary in Head Office
   - d) Min. 1 Person in each Block of Enquiry and Ticketing
   - e) Mechanic's According to the Pit in garage area (1person / Pit)
   - f) Depot Cleaning staff
   - g) Security

2. Bus Staff.
   - a) Driver
   - b) Conductor

B) Passengers. (Customer of MSRTC)

- a) Kids
- b) Working age (Men, Women)
- c) Old

(Medical conditioned, Poor, Rich)

Student

Employee

Migrant

Tourist

Shopping

2.2.5. PASSENGER:

Purpose of Visit to depot

People use bus service to get Work at Office, for School, College, or to interchange/change mode of Transport, for Municipal work, watching Movie in Theatre, Mall or Market for Shopping, Other Purpose According to the Site Context.

About 60% of passenger use transit for work, to go to office.

the second is 25% are Students who are go to school and colleges.

And 15% is of Medical trip, personal purpose and other purpose.(according to APTA)

When do people use public transit :

If the orientation of transit route match's to their office, school/college route. Then those people use public transit as it is affordable from other mode.

Basic Needs of passenger to get attracted towards depot :

- Seating area with shed
- Less distance Facilities
- Something time-pass like television or wifi
- Timetable announcing speaker/ screen
- Lighting
- Ventilation
- Good paving and flooring.

Passenger don't Want Congested Area :

Passengers are Sensitive Enough about their surrounding Space. When they feel space is compromised by crowding, they perceive it as a disintegrate of service. (Transportation Research Board 2011).

Off board information:

Off board information is provided to passengers at the time of Offloading at Depot. Usual up to date predictions provided include :
(Passenger Information System 2015)

- Which Route is Operated by the next bus to Arrive, Including its Expected Departure Time and Destination.
- General Announcement that may useful to the passenger in order to Understanding the Implications for their Travel Plans.

2.2.6. Capacity Relationship :

Trips :

Two Ways of Measuring a Trip

1) Unliked Trip = Number of People Boarding and Riding.

2) Liked Trip = Number of Trips taken by Bus.

The Transport Vehicle (Bus) Cycle :

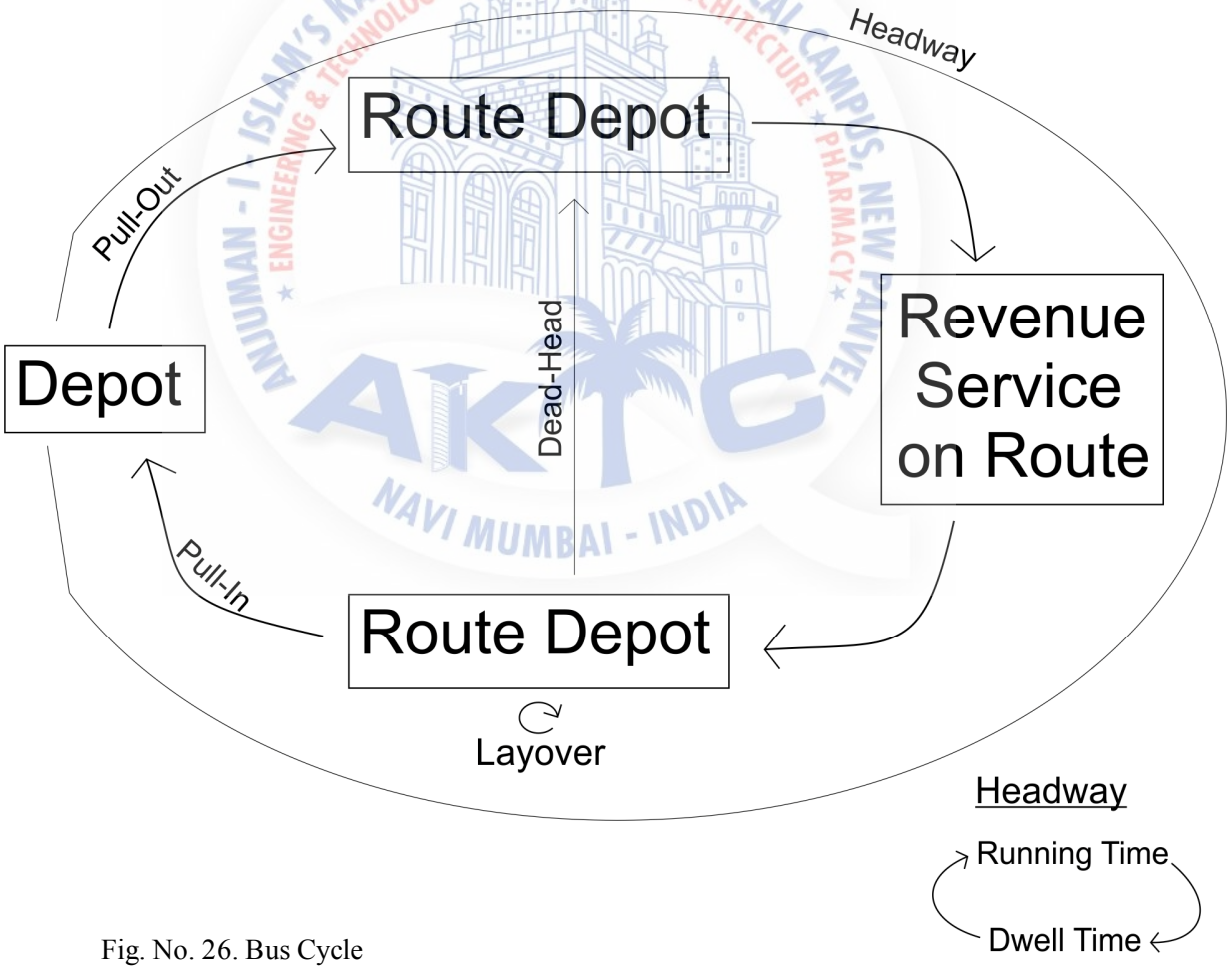


Fig. No. 26. Bus Cycle

How to Calculate Capacity and Footfall :

1) Frequency (vehicle/Hr.) = F = $\frac{60\text{min/Hr.}}{H}$

or

2) Headway (in Min) = H = $\frac{60\text{min/Hr.}}{F}$

Capacity (Passenger/hr) on the route = C_{route}

$C_{route} = F \times N_{car} \times C_{car}$

Where,

F = Frequency

N_{car} = Number of Coaches (1 for Bus)

C_{car} = Maximum Number of Passenger per Bus

(Source : Fundamental of Transport "Its Operation and Capacity".)

2.2.7. Financing :

Investments in infrastructure are very costly. Adding to this cost, once infra gets ready, it requires operating and maintenance cost also. In many cases governments subsidize infrastructure by providing it free.

Financing is Classified into Two Types :

1) Public Funding :

Governments subsidize public transport for environmental, political, social or economic reasons. Subsidies is the form of direct payments which is unprofitable for government, but owner of transport industry get benefit from subsidy to run its service. Further development in infrastructure include promoting business and economic growth to get benefited of.

The use of taxpayer capital to fund mass transit will ultimately save taxpayer money in other ways, and therefore, state-funded mass transit is a benefit to the taxpayer. Reduction in public transport results in more traffic, pollution, and road construction to accommodate more vehicles, this all costly to taxpayers; providing public transport system will negotiate these costs.

The main sources of financing in transport sector are ticket revenue, government subsidies and advertising. The revenue from passenger charges (percentage) is known as the fare box recovery ratio.

2) Public private Partnership (PPP) :

When public funds is low to meet the investment requirements, then a terminal infra project have to take public private partnership method to increase Investment.
Public private Partnership has many methods, most common is exchange of land rights related to the terminal site. This exchange means transferring a component of a site to the private partner, for Commercial Development and Ancillary functions.

2.2.8. Maintenance and Services :

Maintenance :

Maintenance of Depot Infrastructure is costly and time consuming because of ongoing transporting Service, It is a critical indicator of a Infra attractiveness. Creating a Maintenance Schedules is the only way to execute Maintenance of Depot Infra.

Services :

The Services is an Essential Component of Bus Depot Design. Services include lighting, drainage, fire fighting, and information systems, Without these services a good integrated design of a Depot is impossible.

1) Lighting :

Bus Depot Service continue beyond sunset which tends to need of lighting provisions. And lighting is also requires during day time when solid roofing of Infrastructure create inside Spaces dark and discomforting.

The main motto is to provide sense of personal security to the passengers. Lighting features are components of Crime Prevention and Avoid the use of Depot Space from non-bus Rider. Adequate lighting in the Depot helps operators in proper management of bus operation.

2) Drainage :

Water Logging on-site is a Major Problem in most Indian Bus Depot. It impacts Depot's Performance resulting in discomfort to commuters, and a reason of unattractive Depot. Also it generates additional Maintenance expenses. Thus large open spaces should incorporate the necessary Design profile, in order to avoid Water Logging and ensure easy flow drainage system, even in peak rainfall month.

3) Fire Fighting :

A Depot Space and Infrastructure should be Constructed, Equipped, Maintained and Operated in Fulfilment of the Need to avoid Unreasonable Danger to the Life and Safety of Users from fire, smoke and other panic, in the time period necessary for escape.

2.2.9.1. Times of India

Congress urges MSRTC to keep city buses running

TNN | Apr 26, 2017, 12.30 PM IST

NASHIK: The Maharashtra State Road Transport Corporation (MSRTC) bus services have been demanded to be continued by the city unit of Congress.

Keeping the trouble the absence of buses will cause for commuters, a delegation of the party submitted a memorandum to the Nashik division of the state transport utility on the issue on Monday.

"For commuters, the public transport service run by MSRTC is a lifeline. The buses are used by officer goers, students and labourers for commuting on a daily basis. Withdrawal of the bus service would create chaos and even lead to a law and order problem," said a Congress leader.

MSRTC plans to cut down the number of services to various routes in the city starting May 1, as schools are shut for vacations, which will be on till July. The state transport utility will not resume the services to until then.

Countering the decision, Congress led a delegation to MSRTC's Nashik division office and appealed to the officers to cancel the idea of giving lead to more private vehicles as this will cause more rush on the streets, accidents, pollution and autorickshaws will also start charging passengers at their own will.

Congress leader Jayprakash Chhajed said, "We would want the organisation, elected representatives and the civic body to come together and find a solution. We can even seek the intervention of chief minister Devendra Fadnavis," he said.

MSRTC make a successful turnout in Kolhapur district

TNN | Updated: Feb 23, 2017, 05.47 AM IST

(Representative image)

KOLHAPUR: The Pravasi Wadhva (attract passengers) campaign of the Maharashtra State Road Transport Corporation (MSRTC) has take a successful turn in Kolhapur division.

The campaign has successfully increased five lakh passengers in the month of January, 2017. As per figures of January 2016 MSRTC had a total of 1,30,82,000 passengers in Kolhapur district and after launching Pravasi Wadhva campaign in January this year, the number of passengers amplified to 1,35,69,000. MSRTC had successfully implemented this campaign across twelve depots last month.

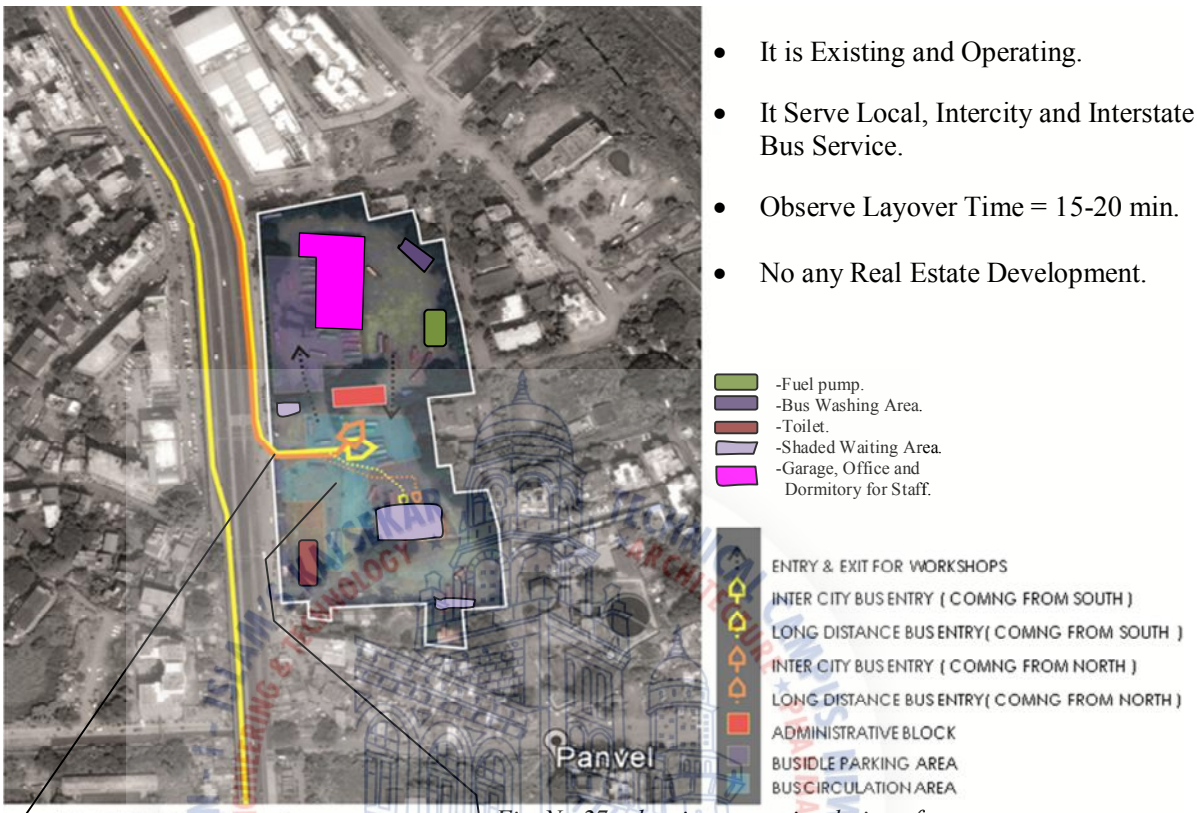
Divisional traffic inspector, D B Kadam, said, "In a span of one month, we have added as many as five lakh new passengers. The Kagal depot proved to be the most profitable after adding 1.05 lakh passengers followed by Sambhajinagar and Aajra depots with 97,000 and 75,000 passengers respectively. Remaining depots have added marginal passengers under this campaign."

He added, "We have been consistently working to increase the number of passengers in MSRTC buses. We have conducted meetings with drives and conductors for effective coordination at depot level. We are also allowing passengers to board the bus from our regular halts. Despite of the fatal accident of company workers in Kagal we have our permanent passengers there. Our campaign will run till the end of March. And the drivers and conductors will be getting financial rewards for their performance."

A transport expert said, "Instead of a three month campaign, MSRTC must continue this for the entire year. The conductors and the drivers are the major driving force of MSRTC. They should commit for increase passengers like their counterparts in Karnataka.Besides the official halts, the drivers must stop their buses wherever they

2.2.10. Case Study on Bus Depot :

2.2.10.1. Panvel Bus Depot : (Live Case Study)



- It is Existing and Operating.
- It Serve Local, Intercity and Interstate Bus Service.
- Observe Layover Time = 15-20 min.
- No any Real Estate Development.

Fig. No.27. showing entry circulation of bus and space allocation of depot

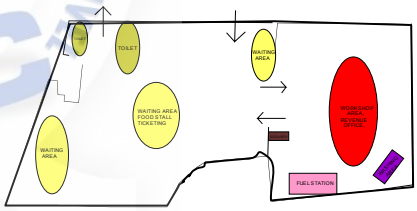


Fig. No.28.

Fig. No.29. Showing Depot Entry

Fig. No.30. Showing Bus Circulation Area

- No Proper Public Entry Exit to the Depot Provided.
- Pedestrian and Vehicular Circulation Intersect Each Other
- No Passenger safety.
- Common Bay for Loading and Offloading.
- Traffic Congestion as Public Vehicle also enter in Bus Circulation Area.
- No Division Between Vehicular and Pedestrian Access.
- Problem to Carry Luggage from drop-up Point to Feeder Service as there is no Paved Pathway.
- No drinking water facilities, washroom, Medical facilities near to the drop-up point

Fig. No.31.

Fig. No.32. showing passengers standing on bay

Fig. No.33. showing public vehicle entry on bus bay

Fig. No.34. showing passengers standing on bay and pedestrian, vehicular intersection

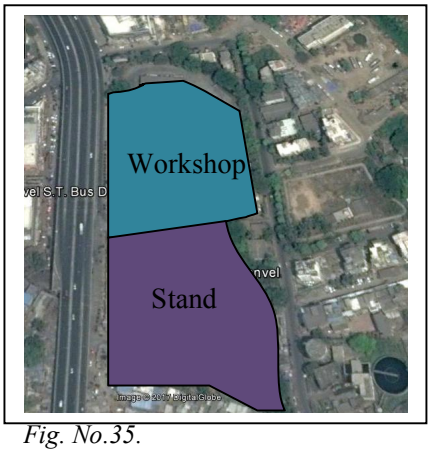


Fig. No.35.

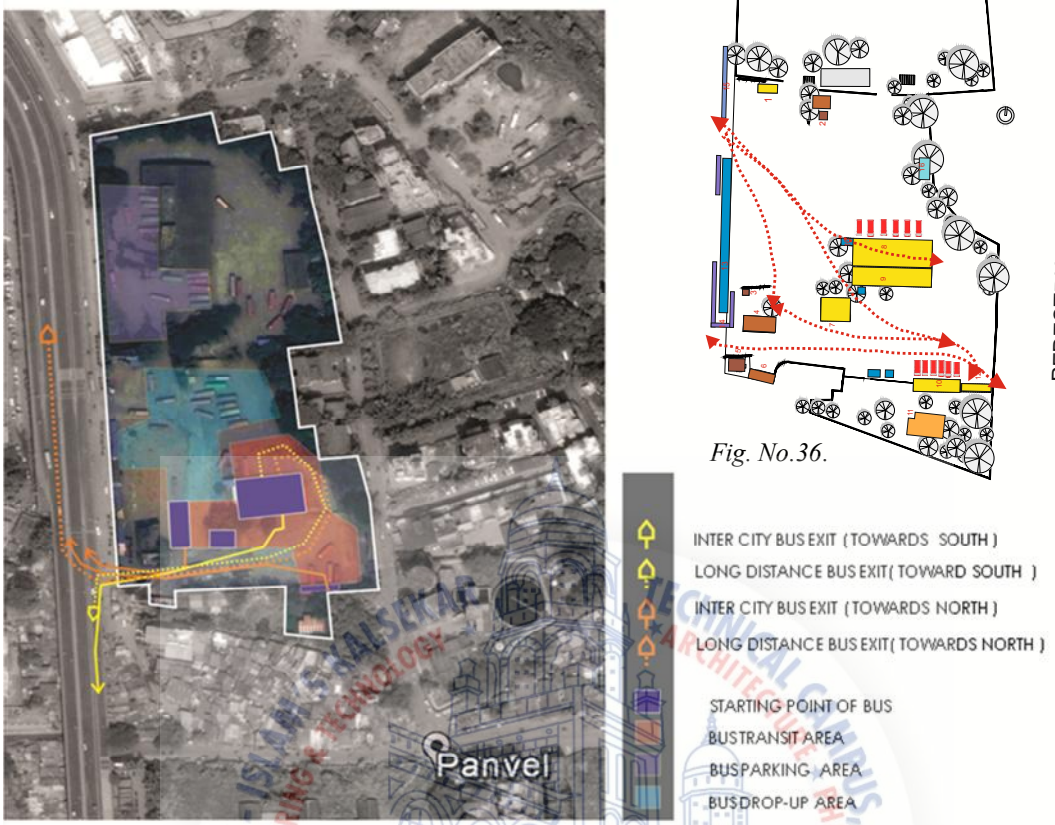


Fig. No.36.

Fig. No.37. showing exit point of panvel Depot

Fig. No.38. showing bird's eye view of exit point

Fig. No.39. showing Bird eye view of bus circulation area, waiting area and ticketing block

- Due to undefined Pedestrian Walkway, people walks within Bus Circulation area.
- Narrow Exit Leads to Traffic Congestion and also Toilet is Placed near it.

- No Adequate Shaded Waiting area provided for Passengers so people prefer to stand below trees.
- As Food Stalls are Placed along the Vehicular Path, it creates Congestion.

Fig. No.40. showing Waiting area (Mumbai route bay)

Fig. No.41. showing Inside of Waiting area (Dark Area)

- Dark Space in Waiting Area as Huge Roof on it and No Lighting provided

Fig. No.42. showing inside of Waiting area (Konkan route bay) Infotainment

Fig. No.43. showing Waiting area (Alibaug route bay) Nice Seating arrangement

Fig. No.44. showing Ticketing Block (Night View)

Fig. No.45. showing Ticketing Block (Day)

Fig. No.46. showing Passengers boarding in Queue (Night View)

Fig. No.47. showing Passenger boarding (not in queue)

- This means if we Create a sense/rule to follow certain discipline, Passengers follow it.
- We can Restrict Passengers from going in bus Circulation Area.

Workshop

Fig. No.48. showing Pit Area in Garage

Fig. No.49. showing entry to garage area with ramp

Fig. No.50. showing Bus parking in Garage area (back side to front / front side to front)

Fig. No.51. showing Buffer Area in Garage (Between storage and garage)

Fig. No.52. showing bus washing tower

Fig. No.53. showing washing bus with hand

Fig. No.54. showing washing

Fig. No.55. showing Bus Route Name Plate Rack beside Fuel Pump Cabin

Fig. No.56. showing Fuel Pump with Cabin

Fig. No.57. showing Fuel pump machine and buffer space where a person can stand

2.2.10.2. Alibaug Bus Depot :

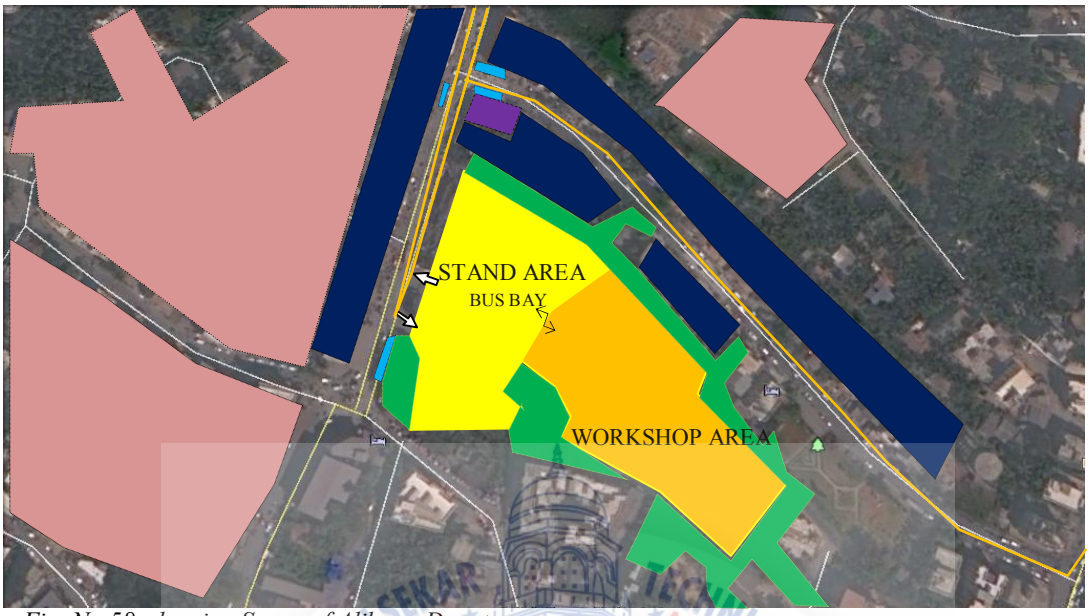


Fig. No.58. showing Space of Alibaug Depot

LEGENDS

BUS DEPOT BAY AREA	
BUS DEPOT WORKSHOP	
BUS ROUTE	
FEEDER	
GREEN AREA	
FERRY TICKET (Interchange)	
MIX-USE	
RESIDENCIAL	

- It is Existing and Operating.
- It Serve Local and Intercity Buses Service.
- Observe Layover Time = 5-10-20 min
- No any Real Estate Development on Site.
- Bus Flow Possible as per available Site area = 30
- Other Activity = Food and Book Stall, People Gather and form group on bus circulation area, Hoarding, Public Vehicle Entry and parking on Site, non-riders also roaming on site.

- ▪ Separate Entry and Exit to the Site.
- ▪ Single Entry, Exit to Workshop Area.
- ▪ Pay and Park Facility and also Irregular Parking of Public.
- ✓ Sufficient Waiting Area and Canteen Provided.
- ✓ Separate Offloading Bay Provided
- o Toilet are not Maintain
- ❖ Overall Nice Depot as Compare to other in my Live Case Study

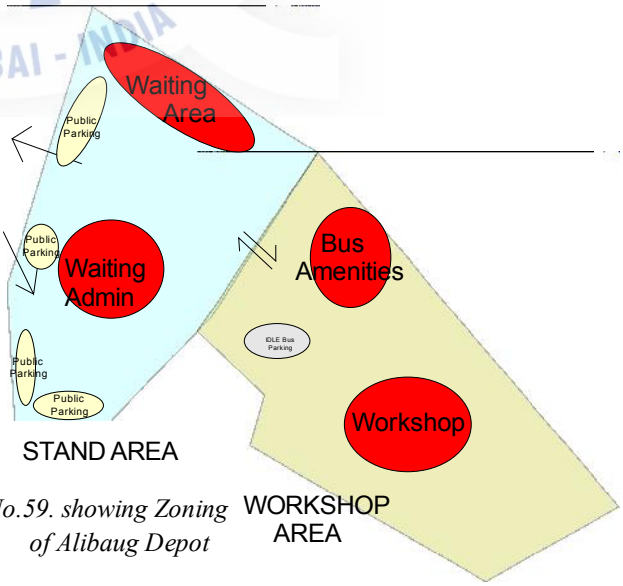


Fig. No.59. showing Zoning of Alibaug Depot

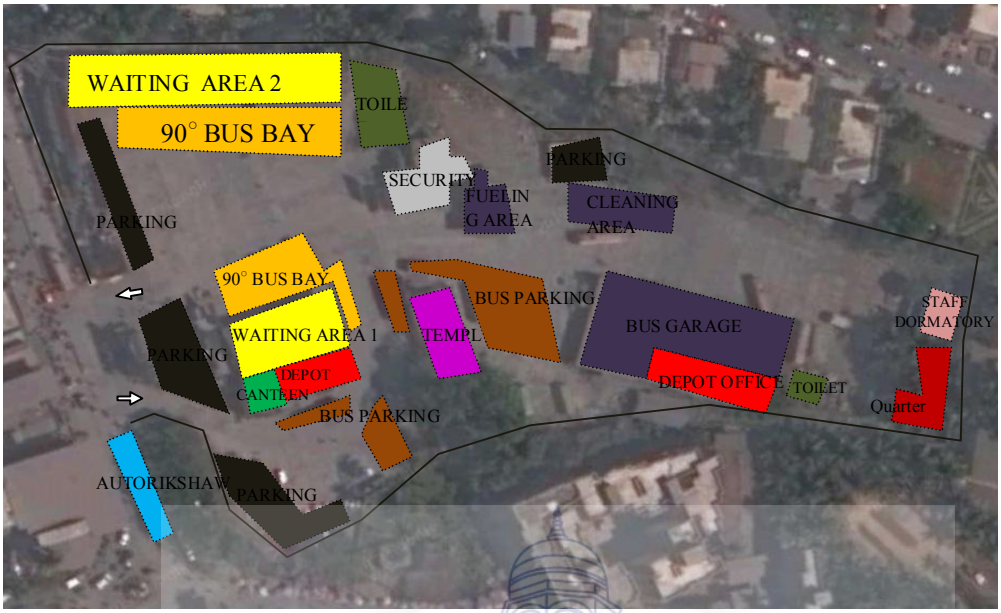


Fig. No.60. showing Hierarchy of Space (Alibaug Depot)

Fig. No.61. showing Stalls Public Parking at Entry point

Fig. No.62. showing Stalls and Randomly parked two

Fig. No.63. showing Stalls and Randomly parked four

Fig. No.64. showing Waiting Area 1 and its bay

Fig. No.65. showing Seating Form in Waiting Area 1

Fig. No.66. showing Panoramic View of Stand Area

Feeder Service (Auto Rickshaw Stand) :

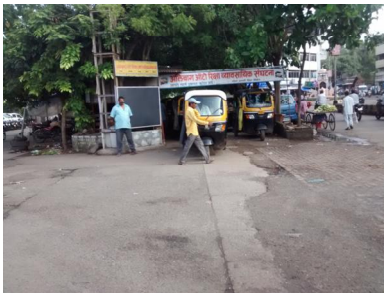


Fig. No.67.

Fig. No.68.

Offloading Bay :

Fig. No.69.

Pay and Park Facility :

Fig. No.70.

Fig. No.71.

Common Parking Without Pay :

Fig. No.72.

Fig. No.73.

Fig. No.74.

Back Side of Waiting Area 1 (Main Building of Stand Area) :

Fig. No.75.

Fig. No.76.

Fig. No.77.

Workshop :

Fig. No.78.

Fig. No.79.

Fig. No.80.

Fig. No.81.

Fig. No.82.

Fig. No.83.

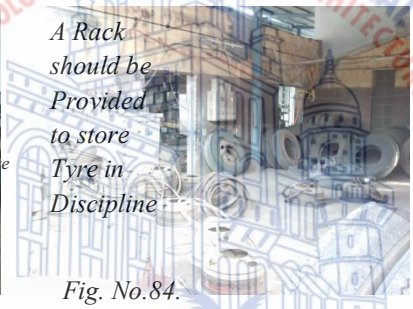


Fig. No.84.

Fig. No.85.

Fig. No.86.

Fig. No.87.

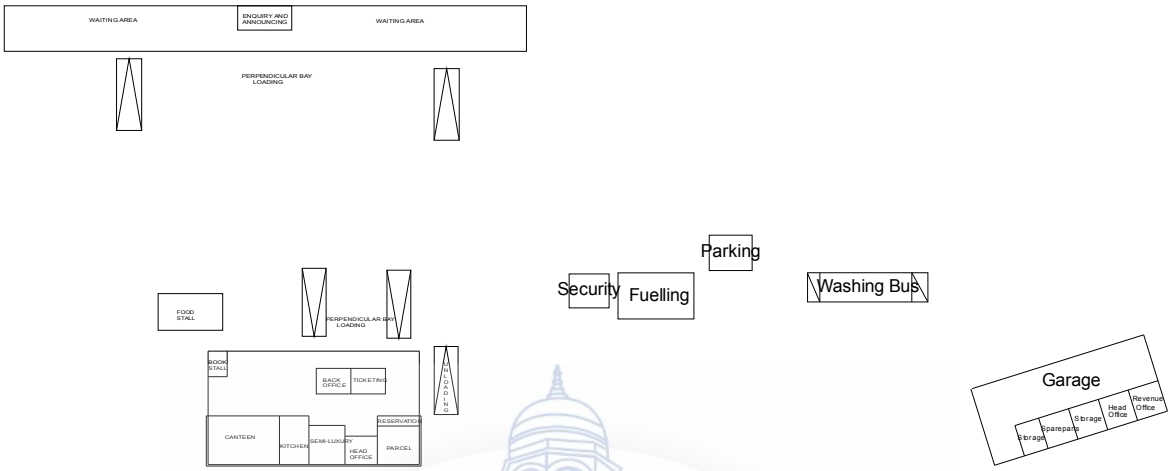
Fig. No.88.

Fig. No.89.

Fig. No.90.

Fig. No.91.

Building Plan of Alibaug Bus Depot (Sketch)



Programme of Alibaug Bus Depot :

Sr. No.	Space	Subspace	Number of User (Max)	Type of Space	Area (Sq.m.)
1	Terminal	Waiting Area	250	Public	1000
		Toilet (Male)	35	Public	20
		Toilet (Female)	35	Public	20
		Ticketing	5	Facilitator	20
		Enquiry/Announce	4	Facilitator	10
		Head Office	4	Facilitator	18
		Back Office(Log)	15	Facilitator	18
		Stall	10	Public	40
		Canteen	60	Public	150
		Parcel	5	Public	18
					1314
2	Workshop	Head Office	4	Facilitator	15
		Back Office(A/C)	7	Facilitator	15
		Resting Room	15	Facilitator	18
		Battery Room	-	Storage	18
		Spare Parts	2	Storage	18
		Suspension/Tyre	-	Storage	18
		Garage	10	Facilitator	250
		Washing Area	2	Facilitator	100
		Fuelling Area	5	Facilitator	200
					652

2.2.10.3. Uttam Nagar, Delhi : (Book Case Study)

- TERMINAL NAME = UTTAM NAGAR BUS TERMINAL.

- IT IS EXISTING AND OPERATING.

- IT IS LOCAL, INTRA CITY , INTERMODAL BUS TERMINAL.

- OBSERVED AVERAGE LAYOVER TIME = 37 MINS

- REAL ESTATE/COMMERCIAL = NO

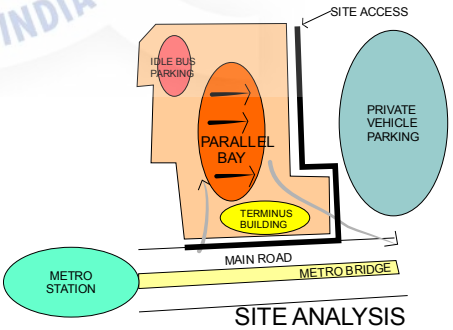
- BUS FLOW AS PER AVAILABLE SITE AREA = 52

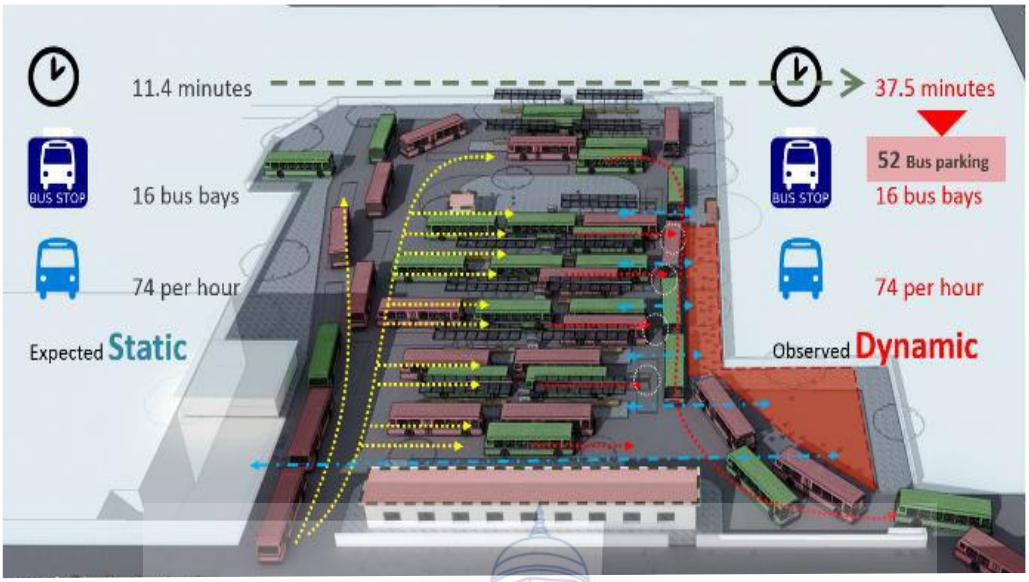
- NO PARKING AREA REQUIRE AS SAME IS ALLOCATED BESIDE BUS TERMINUS.

- ANCILLARY FUNCTION= NO.

- SITE AREA = 2.3 ACRE.

- AND HAS INFORMAL FEEDER PARKING.





- NO FIXED UNLOADING BAY.

- BUSES WAITING IN THE LOADING BAYS FOR LONGER DURATION.

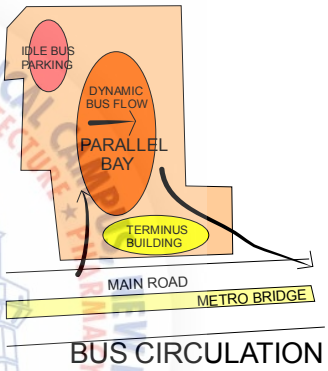
- DUE TO DYNAMIC NATURE OF THE TERMINAL INTERRUPTION IN THE MOVEMENT.

- MULTI MODAL INTEGRATION ABSENT.

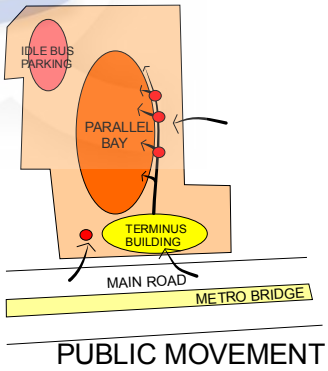
- NO CONNECTIVITY BETWEEN THE BAYS AND FOOTPATH.

- DILAPIDATED INFRASTRUCTURE.

- PEDESTRIAN BOARDING BUSES AT THE EXIT AND NOT FROM THE BAYS.



BUS CIRCULATION



PUBLIC MOVEMENT

2.2.11. Inference :

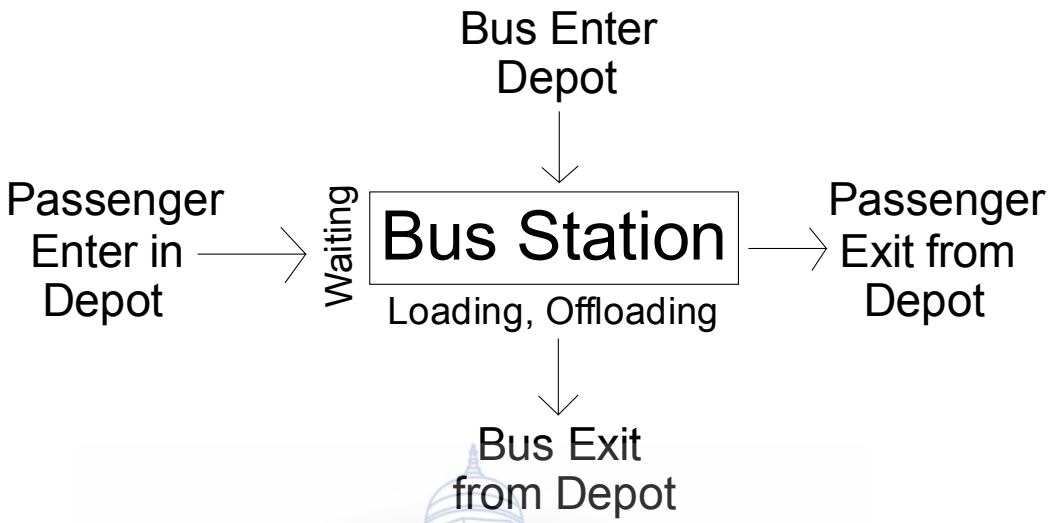


Fig. No.--. showing Bus Station Routine

Bus Depot is a Point where Passengers get transportation facility and Stock Holder get there Profit. Retail market Attracts Passenger activity, which tends to increase in Depot Footfall Resulting in more ridership to the MSRTC and also increase in business Profit.

Aesthetic value and comfort ability of Infrastructure and its Facility Attract People to Use it. The List of Facilities are listed on next page, And Facilities are allotted according to the Site Area and its Context. Also Vertical Construction of a Infrastructure helps in getting more vehicular circulation Space on Site.

Passengers are Conscious about their surrounding Space, Passengers want more Comfortable and Safe Space. Congested Public Area make a negative Sense about the Facility that we Provide to them. Hence The Future Capacity of that space has to be Calculated while Designing Public Space like Bus Depot. Easy Public flow and Vehicular Circulation with No or less Interruption is a Mandatory Care has to be taken while Designing a Bus Depot. And also access/approach to the site should be Design According to the Context where people can access that site easily.

Place Fuel Pump near Stand Area, so that Loaded Bus also take advantage of refilling Fuel Tank. Fuel Tank of a Parivartan and Asiad Bus is of 400Litre Capacity, which require 10-15 minute to fully refill it when it gets empty.

Depot Facilities are Classified into Three different Category, And allotted according to the Site Area, context and its Capacity.

The Classification of Depot Facilities are as follow:

1) Basic Facilities.

A. For Depot Staff
- Drinking water Facility
- Toilets
- Resting Room
- Canteen
- Revenue Office
- Storage
- Security Cabin
- Ticketing Booth
- Maintenance Staff Area (Garage)

B. For Bus Staff
- Drinking water Facility
- Toilets
- Resting Room
- Canteen
- Dormitory
- Locker Room

C. For Passenger
- Drinking Water Facility
- Toilets
- Concourse
- Waiting Area
- Eateries
- Tourist Information
- Cloak Room
- Ticketing and Queuing
- Enquiry Counter
- Dormitory
- Baggage Trolley's
- Circulation Area

D. For Buses
- Loading Bay
- Off-Loading Bay
- Idle Parking Bay
- Garage
- Bus Testing Lane (optional)
- Circulation Area
- Fuelling Area
- Washing and Cleaning Area

2) Ancillary Function
- Bank / ATM
- Post Office
- Railway Booking Office
- Freight Service
- Clinic

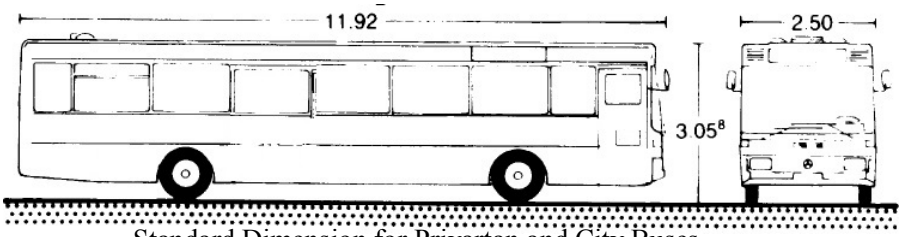
3) Commercial / Real Estate Development
- Shop
- Mall
- Office
- Gym
- etc,

According to the site Location, context and Density.

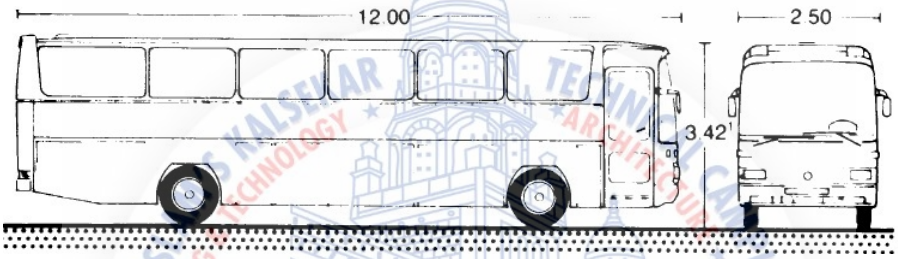
2.3. Design Research :

2.3.1. Bus Design Standards :

2.3.1.1. Geometric Design Standards for Bus :



Standard Dimension for Privartan and City Buses



Standard Dimension for Asiad and Hirakni Buses

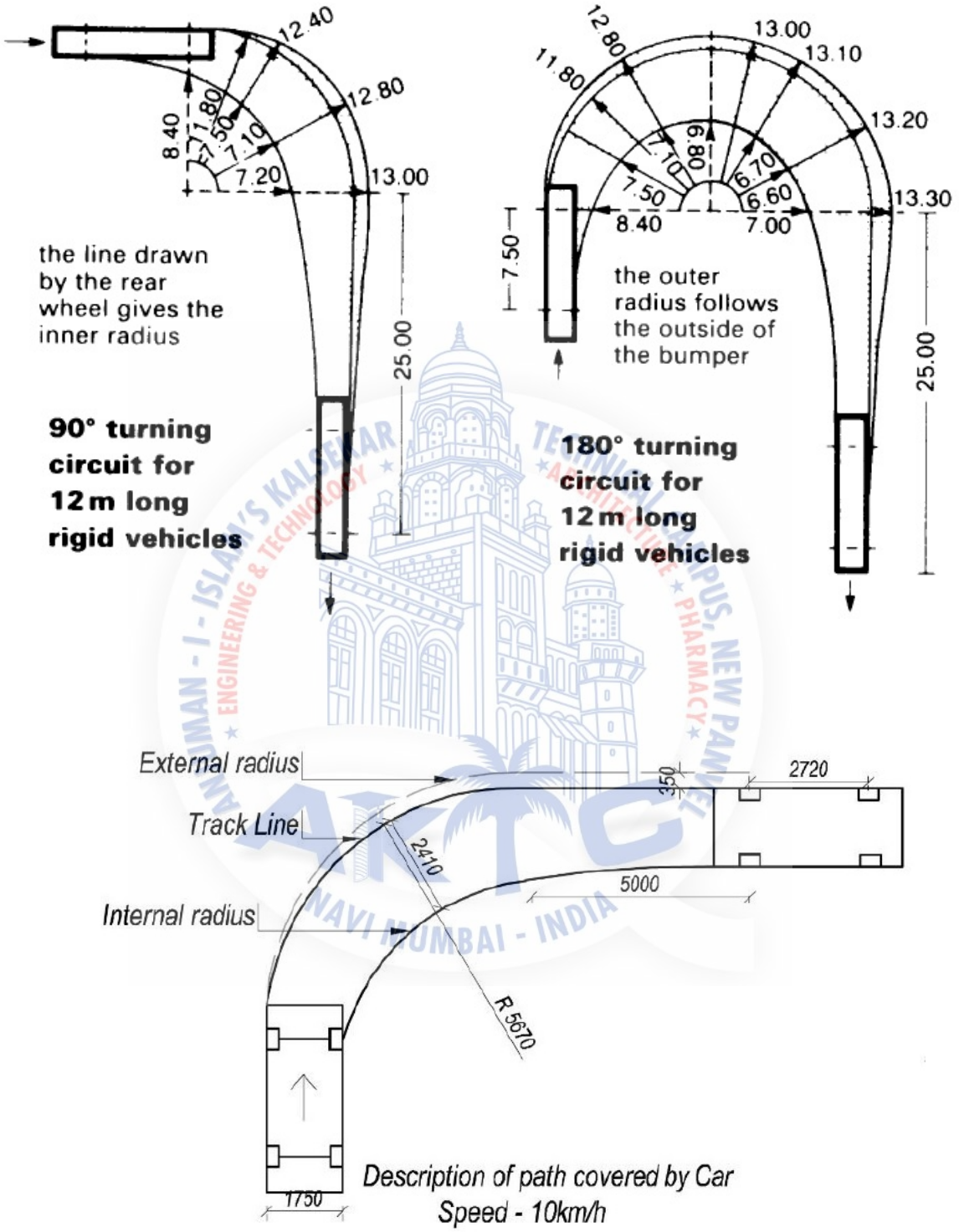
* First Step of bus (Passenger side) = 27-30cm

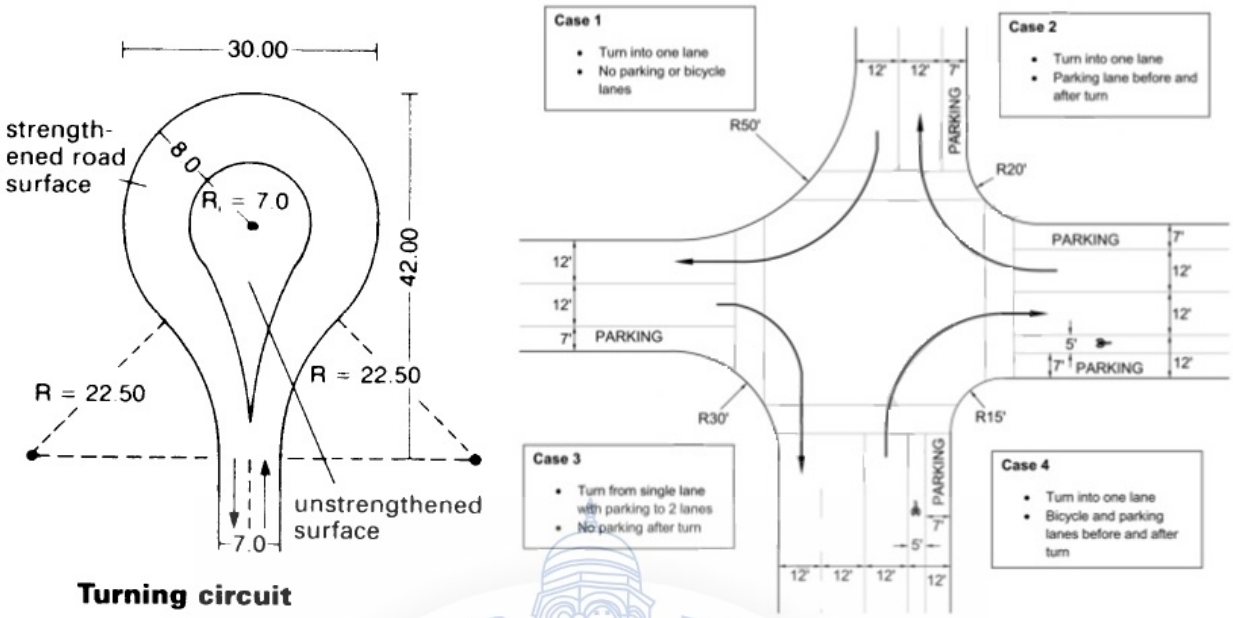
* Ground Clearance of Bus = 40cm

* Fuel Knob of bus = 80cm from ground and of 26cm.

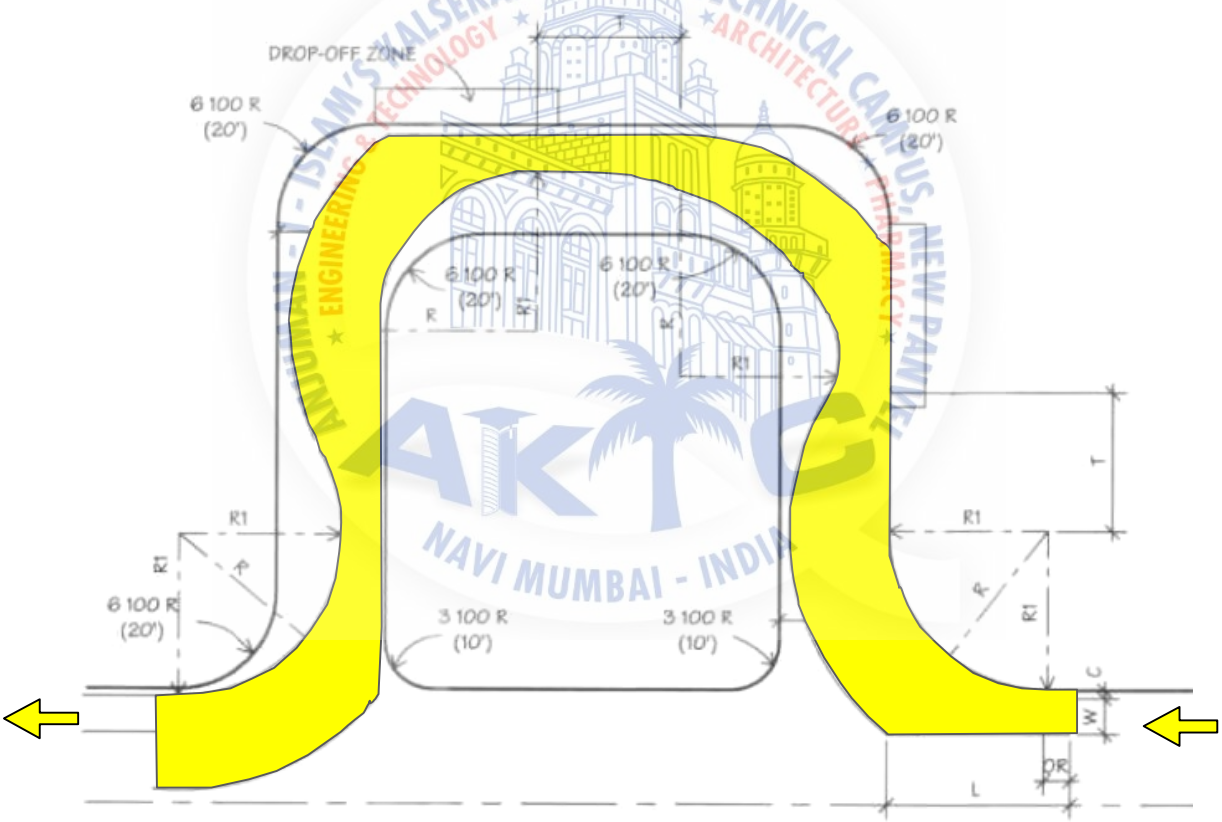
Sr.no.	Type's of Vehicle	Length	Width	Height	Turning Radius
1	Motor Cycle	2.2	0.7	1	1
2	Car	4	1.7	1.5	5.65
3	Refuse Collection Vehicle	1.47 7.64	2.5 2.5	3.3 3.3	7.8 9.25
4	Fire Engine	6.8	2.5	2.8	9.25
5	Standard Bus	11.9 12	2.5 2.5	3 3.45	10.25 11

2.3.1.2. Bus and car Circulation :





Turning circuit

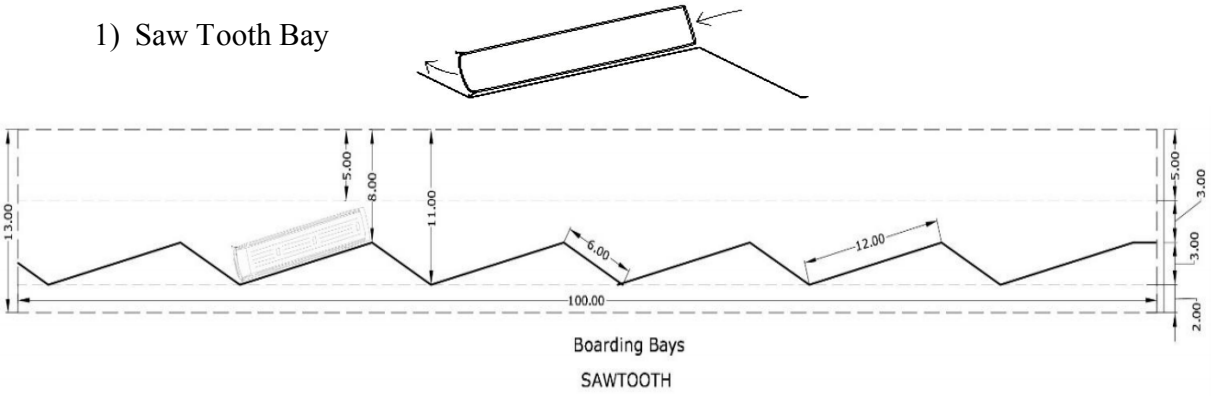


"U" Drive and Vehicle Turning Dimensions

Sr.no.	Vehicle	R	R1	T	D	C
1	Interstate Bus	16.8	10	9.14	6.9	0.255
2	City Bus	16.3	10	9.14	6.9	0.255
3	Fire Truck	14.6	10.5	9.14	4.8	0.255

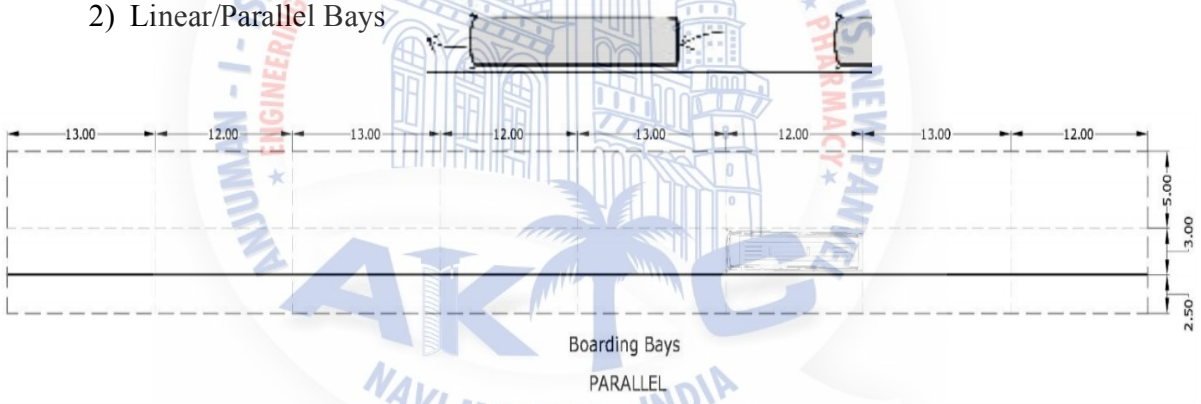
2.3.2. <u>Bus Bay</u> :

1) Saw Tooth Bay



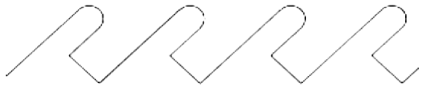
Saw tooth Bay	This arrangement allows easy docking of buses but requires long curb lengths. To avoid long continuous lengths, saw tooth bays maybe provided in parallel arrangement with passing lanes and connecting raised crossing for passenger access.	217sqm/bay (preferred for offloading bays)

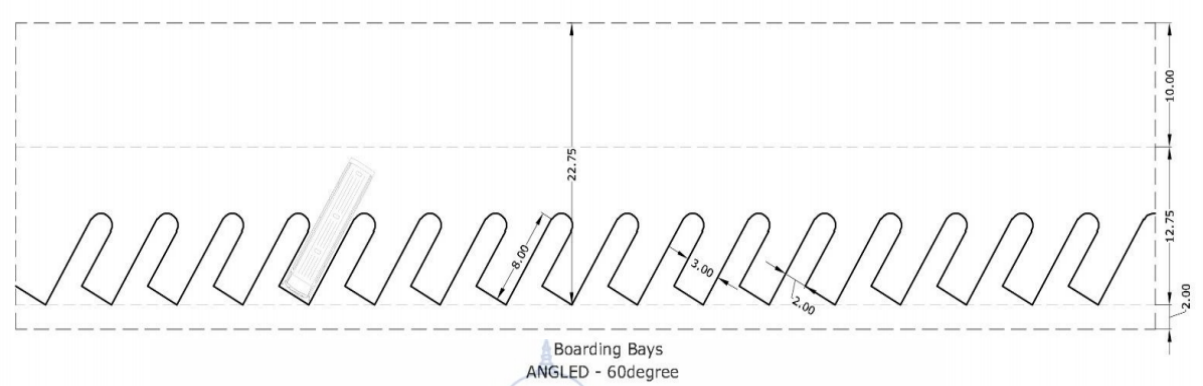
2) Linear/Parallel Bays



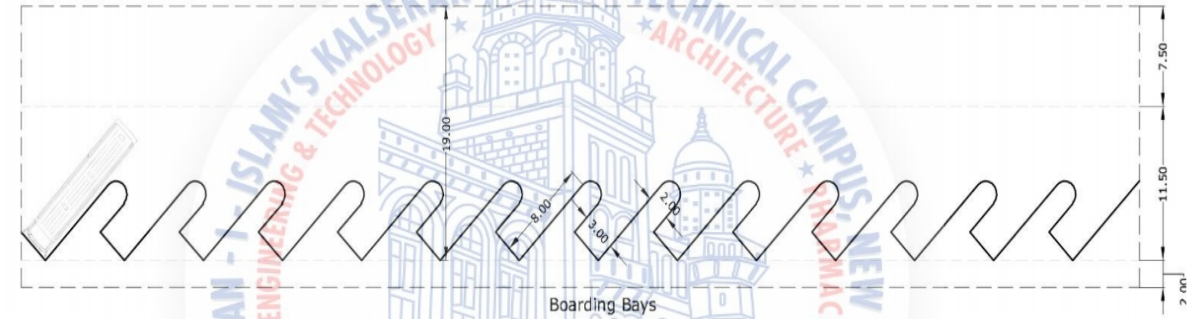
Linear/parallel bays	This arrangement requires longer curb length as buses are stacked one behind the other with adequate head space. There is an overtaking lane parallel to the bus bay. One may combine it with an-other adjacent parallel bay with overtaking lane in between.	262 sqm/bay

3) Angular Bays





Boarding Bays
ANGLED - 60degree

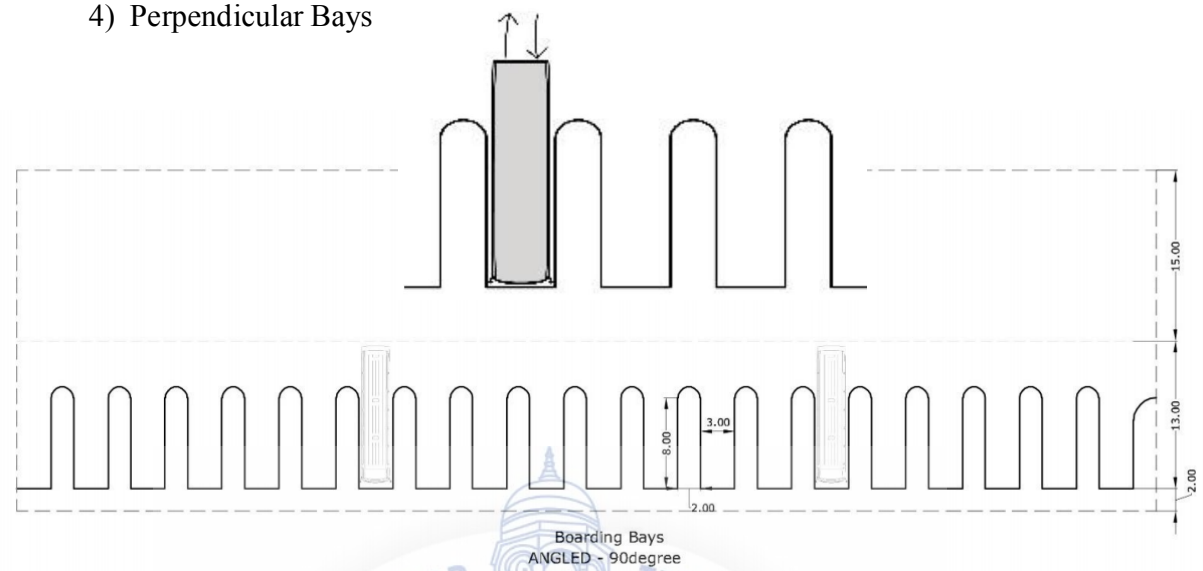


Boarding Bays
ANGLED - 45degree

Boarding Bays
ANGLED -30degree

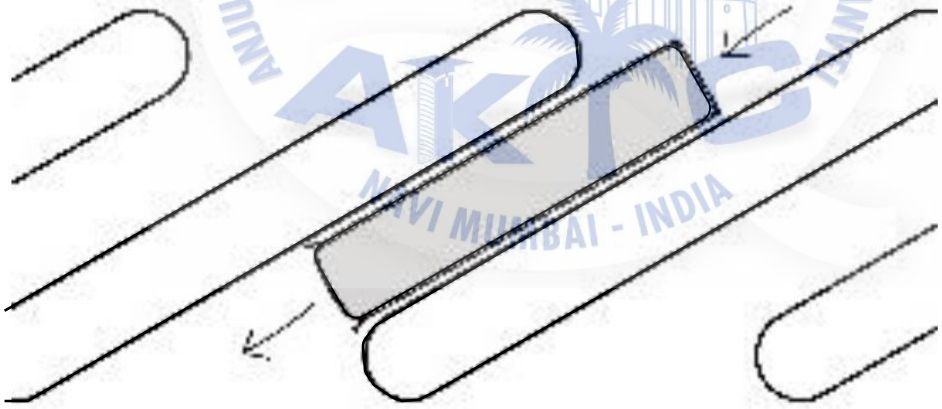
Angular bays 30○,45○,60○	This arrangement allows easy docking of buses with shorter curb length. This may be combined with parallel arrangement in terminals with lower bus flow	163 sqm/bay,150 sqm/bay,145 sqm/bay.

4) Perpendicular Bays



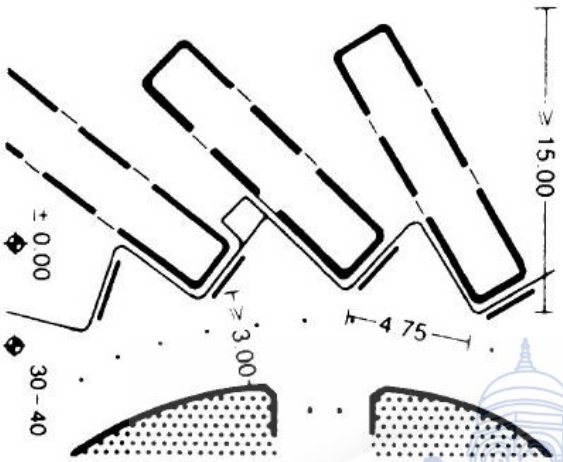
Perpendicular bays	Bays aligned perpendicular to concourse. Ideal arrangement for idle parking	150sqm/bay (Loading bays); 75 sqm/bay (Idle Parking)

5) Drive Through

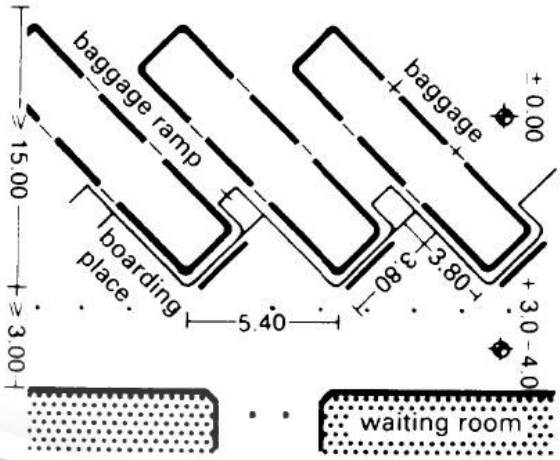


Drive through	The bays are parallel arrangement without passing lanes. Thus parallel boarding lanes are segregated from each other by their respective boarding bays	258 sqm/bay

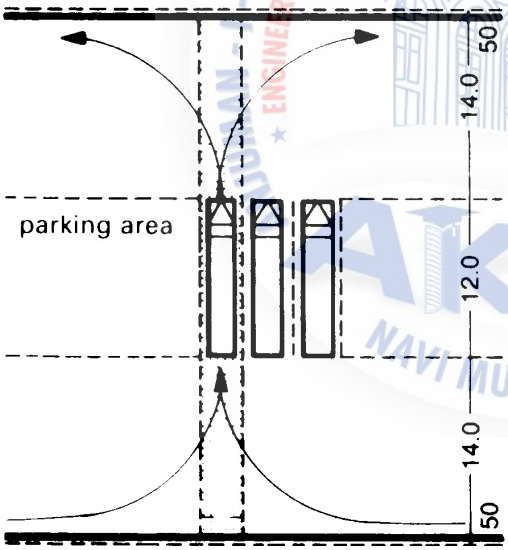
2.3.3. Standard of Interlocking Bus Bay :



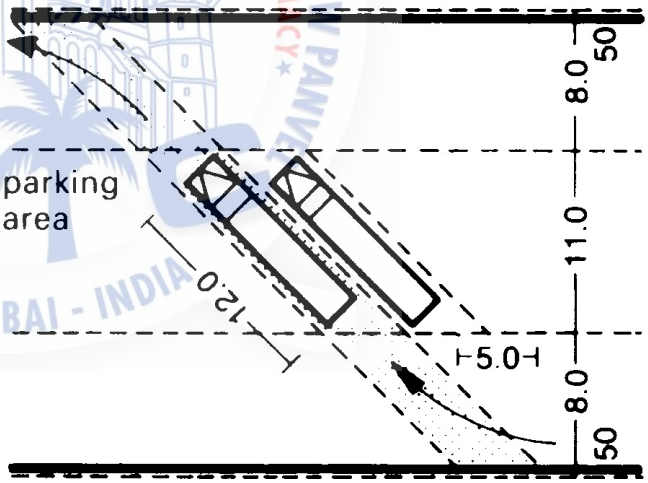
Angular to Bus Parking



Parallel to Bus Parking

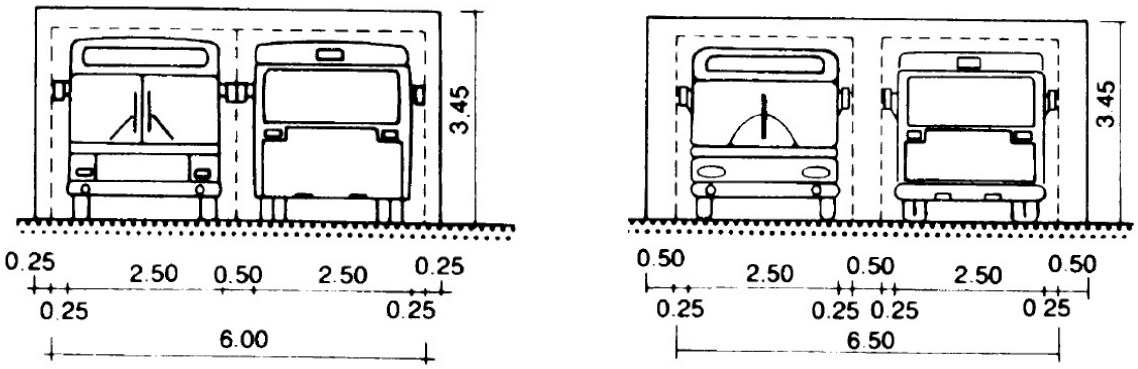


Parking at Right angle

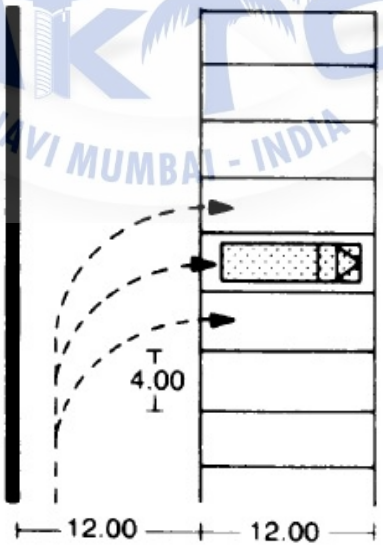


Parking at 45 angle

2.3.4. Bus Parking :

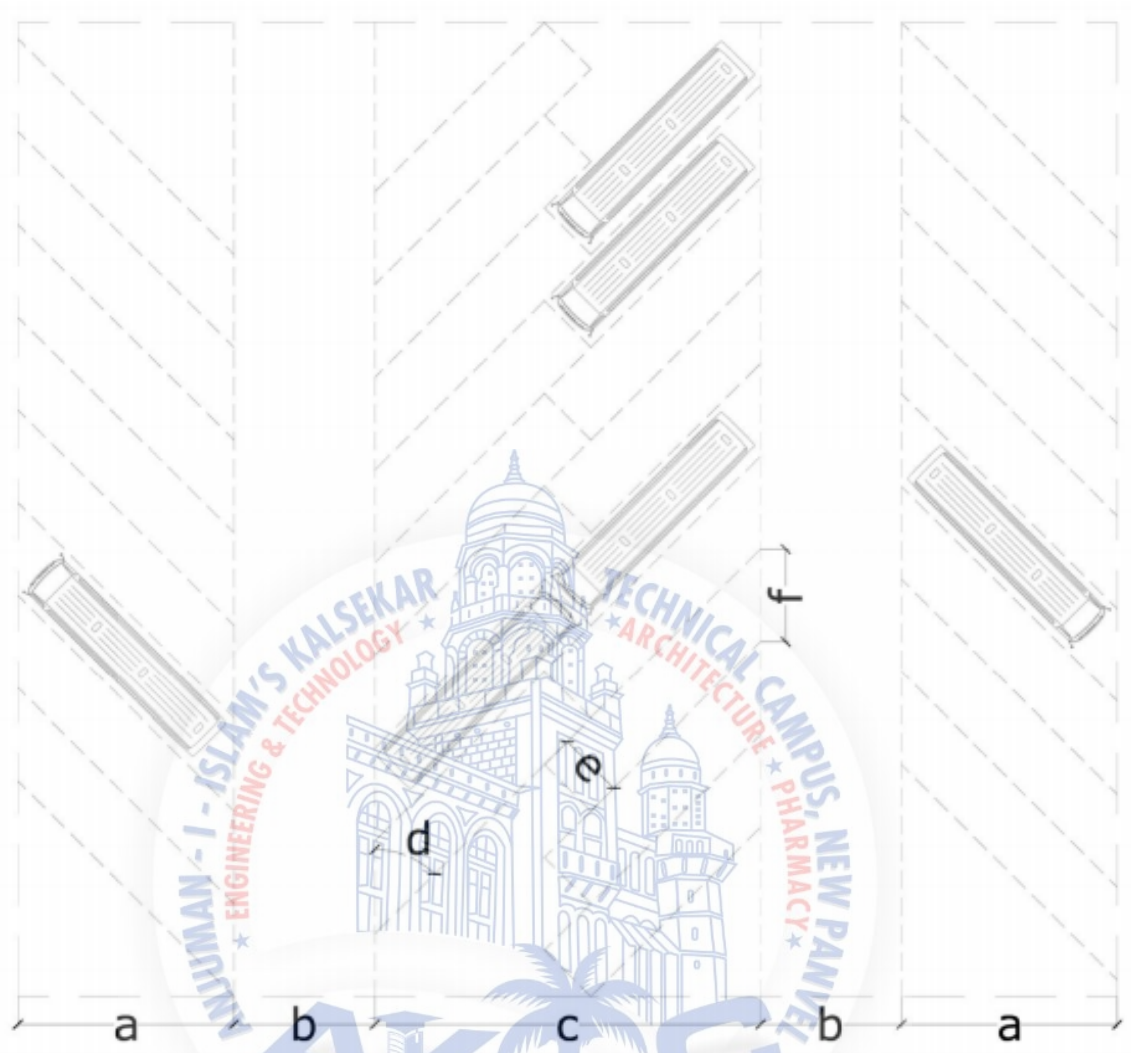


Relation to Line of Arrival	Parallel	at 45○		at 90○	
Length of parking Space	32	12	24	12	24
Parking Option	2 Buses	1 Bus	2 Buses	1 Bus	2 Buses
Width of Parking Space	3.5	3.5	3.5	3.5	3.5
Width of Arrival Lane	4	8	8	14	14
Parking Area incl. Roadway	88	135	89	140	91



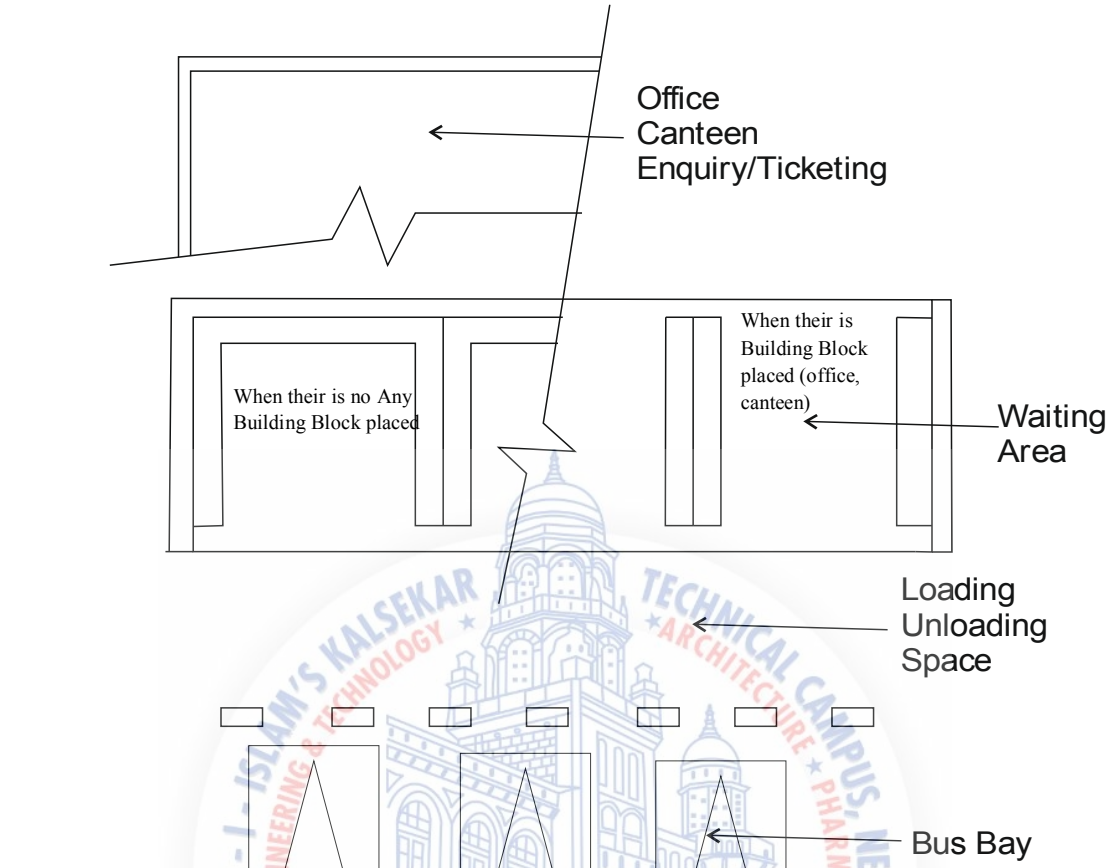
90° parking, a single truck

Angular IDLE Parking

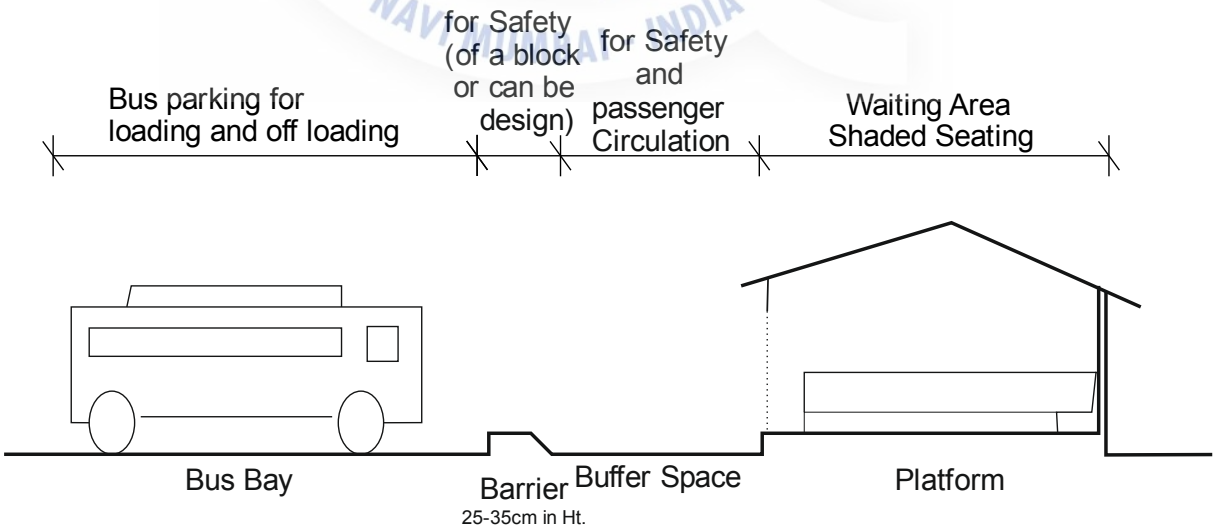


d	90	60	45	30
a	13m	12.75m	11.5m	9.75m
b	>=12m	>=10m	>=7.5m	>=4.5m
c	26m	23.75m	20.53m	16.47m
e	3.5m	3.5m	3.5m	3.5m
f	3.5m	4.04m	4.95m	7m

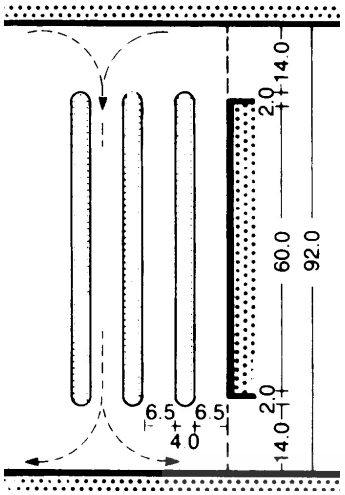
2.3.5. Platform Standards :



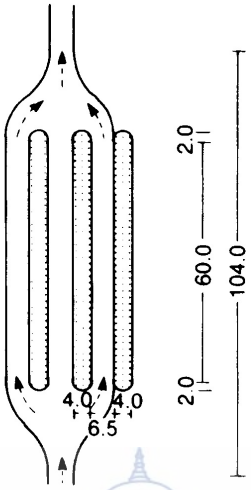
Typical Platform Area and Bay in Plan.



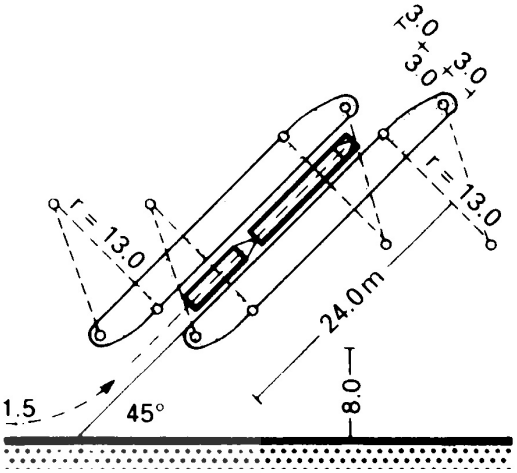
Typical Platform Area and Bay in Section.



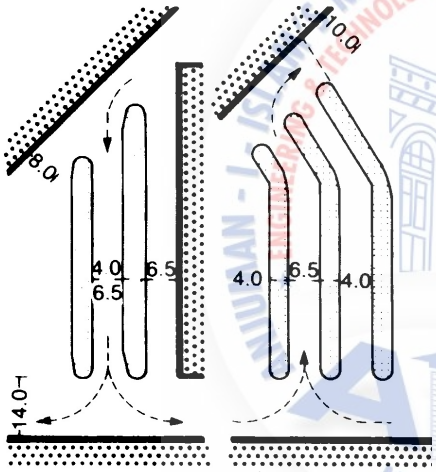
Platform at Right angle

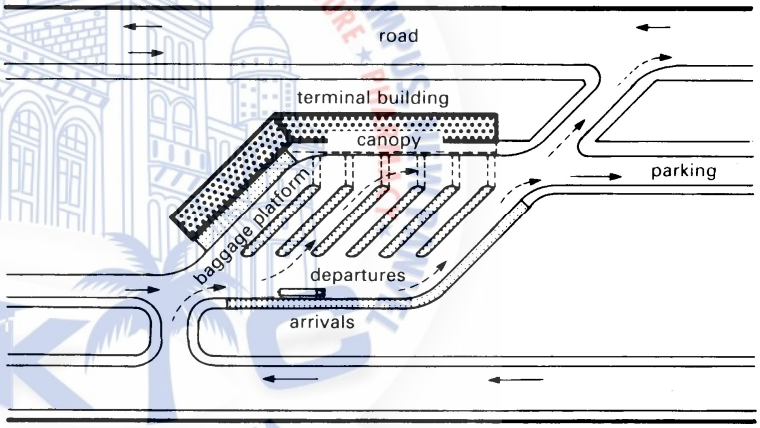


Long Platform with Passing Lane

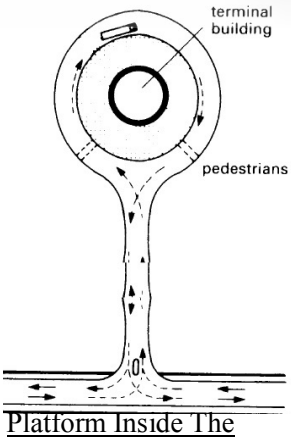


Oblique Alignment of Platform

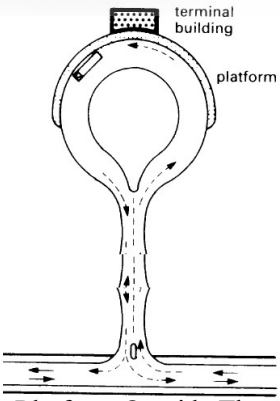




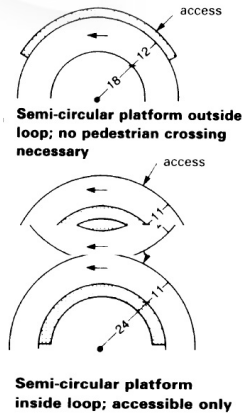
Departure at 90 angle



Platform Inside The Terminal Loop

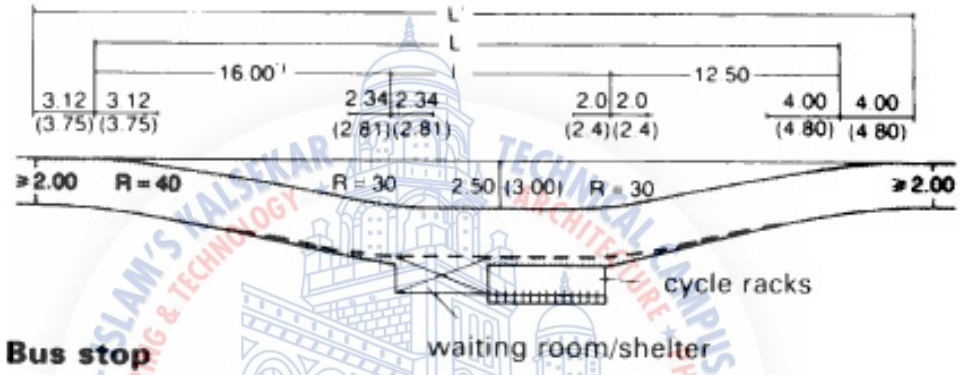


Platform Outside The Terminal Loop



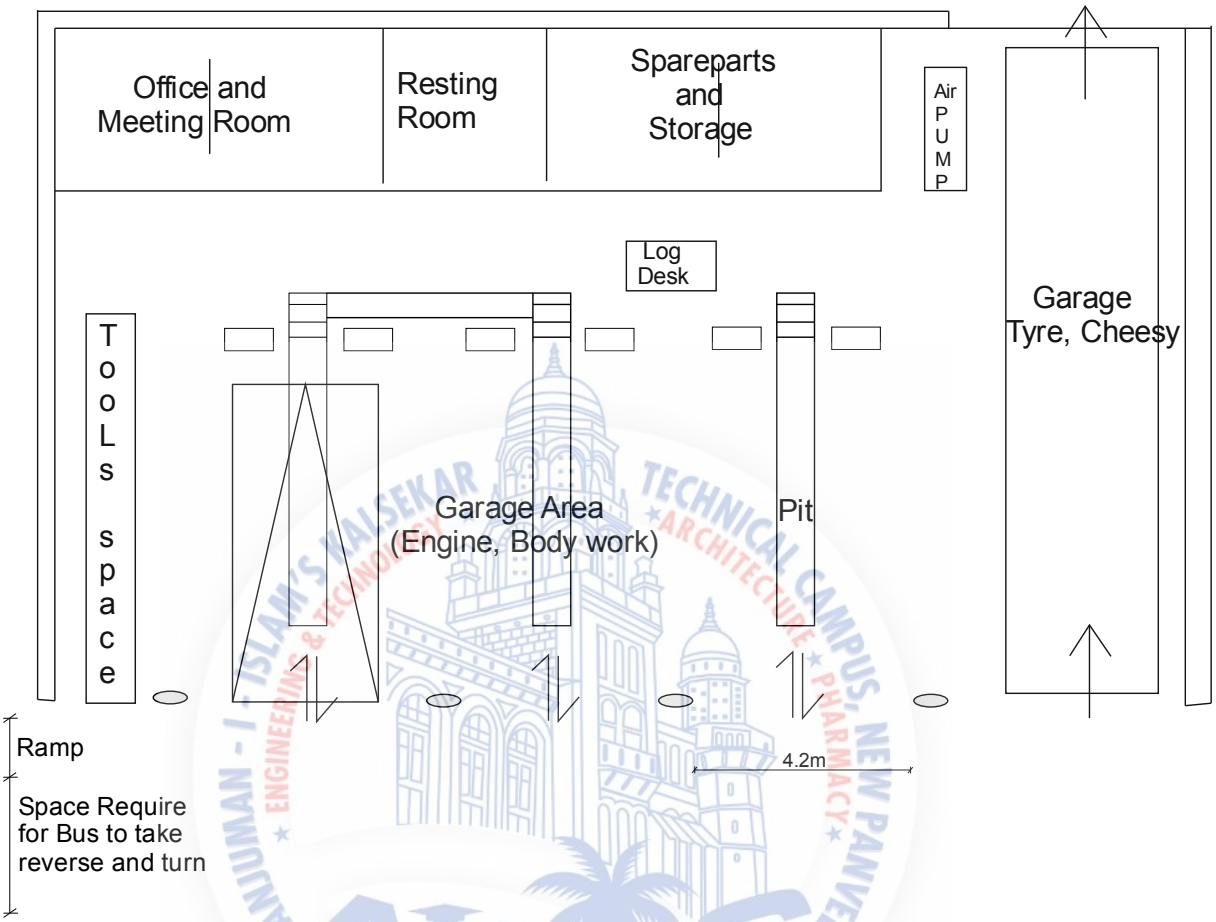
	l	L	L'
bus	12.00	40.50	47.62 (49.05)
two buses	25.00	53.50	60.62 (62.05)
articulated bus	18.00	46.50	53.62 (55.05)

for 3m wide bus stop bays
*) 25m for bus stop bays for articulated buses

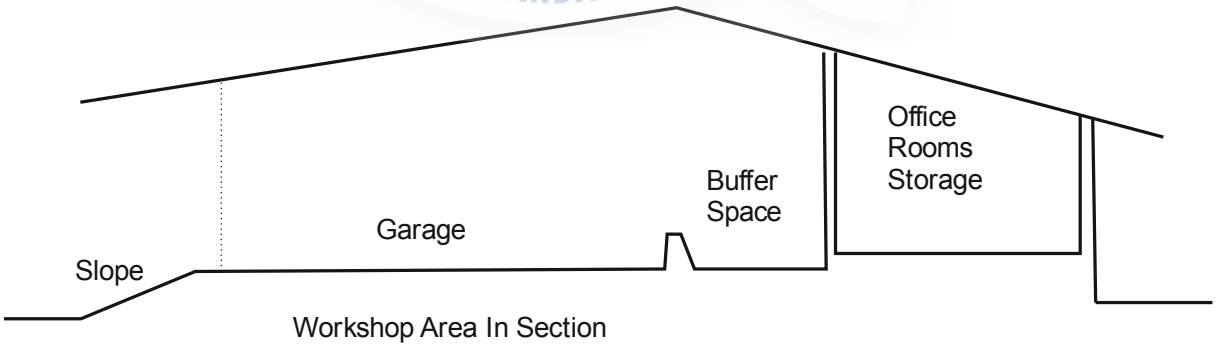


Platform Shape	Without Passing Lane			With Passing Lane		
	Aa	Ab	Ac	Ba	Bb	Bc
Layout of Arrival Line	Parallel	at 45○	at 90○	Parallel	at 45○	at 90○
Platform Length	24	24	24	36-60	36-60	36-60
Platform Width	3	3	3	3.5-4	3.5-4	3.5-4
Number of Loading Point	2	2	2	2-3	2-3	2-3
Area of Platform, Roadway and Arrival spur	138	176	189	293	296	313

2.3.6. Typical Garage of MSRTC :

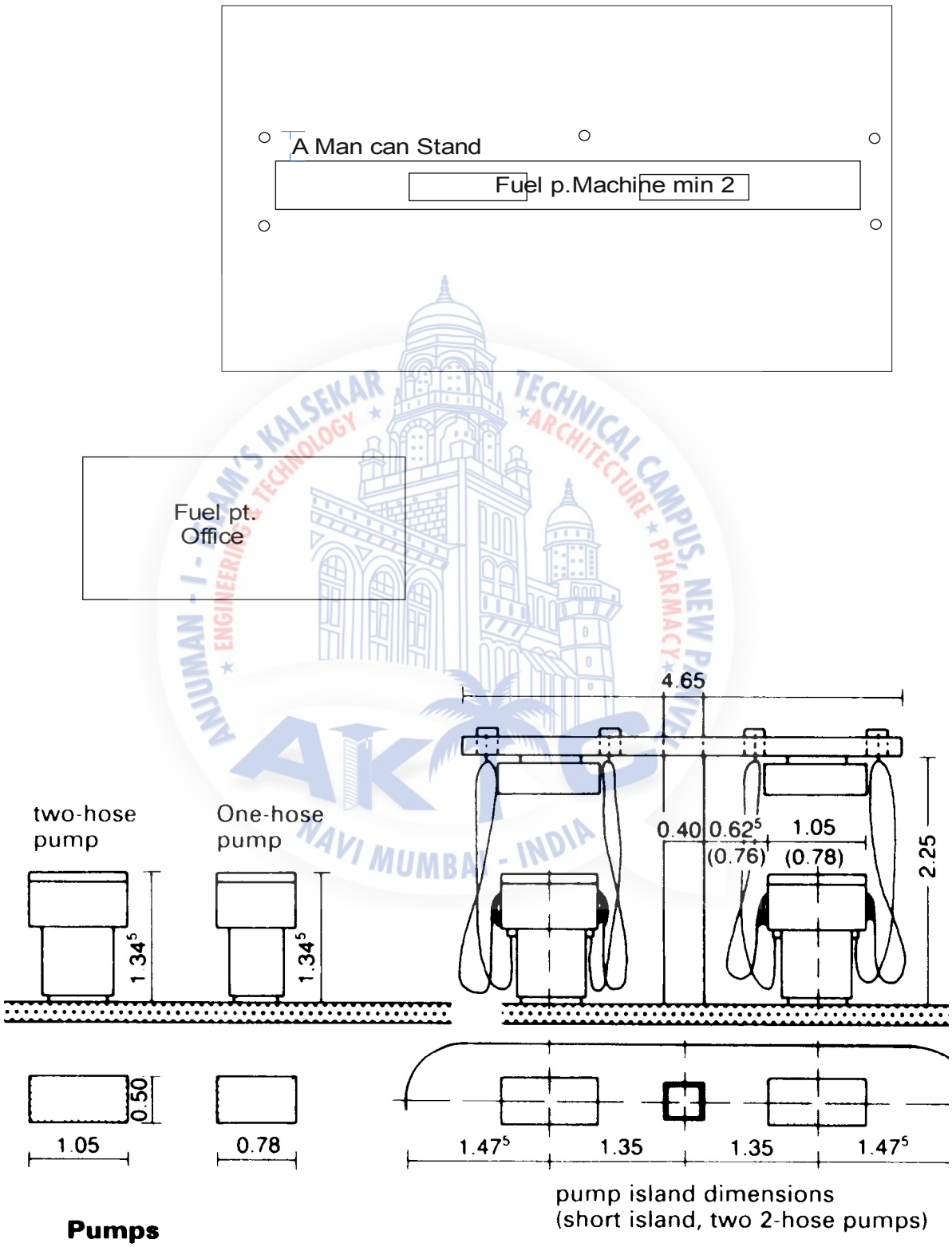


Typical Garage Area(Workshop) of MSRTC in Plan

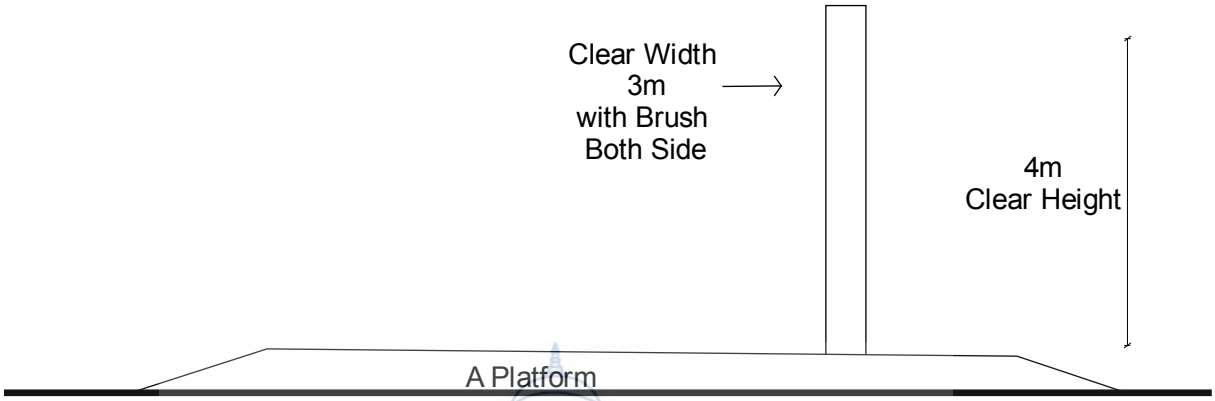


Typical Garage Area(Workshop) of MSRTC in Section

2.3.7. <u>Standards for Fuel Pump</u> :



2.3.8. Standards for Bus Washing Area :



Side Section

Cleaning/Washing Area

2.3.9. Space Standards :

Sr.no.	Spaces	Area Required
	Passenger Amenities	
1	Waiting Area	30% of footfall
2	Ticketing	22Sq.m/100pax
3	Eateries	1.5sqm/person for 15% terminal occupancy
4	Vendor/Hawker zone	4sqm/vendor
5	Dormitory (for night operations)	1bed/50pax; 6.31 sqm/bunk (Neufert, 2000)
6	Drinking Water	1.1 sqm/fixture 2/1000pax (DCR)
7	Toilet Male	3WC / 1000 pax 1WB / WC 4Urinals / 1000 Person
	Female	4WC / 1000pax add 1 Indian WC in each of above
8	Cloak Room	2 Sq.m / 100pax
9	Private Vehicle Parking	2ECS/100sqm for Terminal Building 3ECS/100sqm of commercial built-up
	Terminal Staff Amenities	
10	Revenue Office	10sqm/person
11	Terminal Office	10sqm/person
12	Resting room	2sqm/person
13	Garage	140 Sq.m / bay
	Bus Staff Amenities	Ramp for Bus = 30-40cm high
14	Dormitories	1bed/10 bus personnel; 6.31 sqm/bunk (Neufert, 2000)
15	Resting Room	2sqm/ bus personnel for 80% bus staff

2.3.10. Signage :

Signage play vital role in regulating vehicular and pedestrian movement. Signage should provide relevant information, warnings and give directions accordingly. Signage should be strategically placed and easy to Read.

1

1	Telephone	8	Escalator	15	Drinking Fountain
2	Mail	9	Stairs	16	Waiting Room
3	Currency Exchange	10	Lift / Elevator	17	Information
4	Cashier	11	Toilet, Men	18	Taxi
5	First Aid	12	Toilet, Women	19	Bus
6	Lost and Found	13	Toilet	20	Ground Transport
7	Baggage Locker	14	Nursery	21	Rail Transport

2

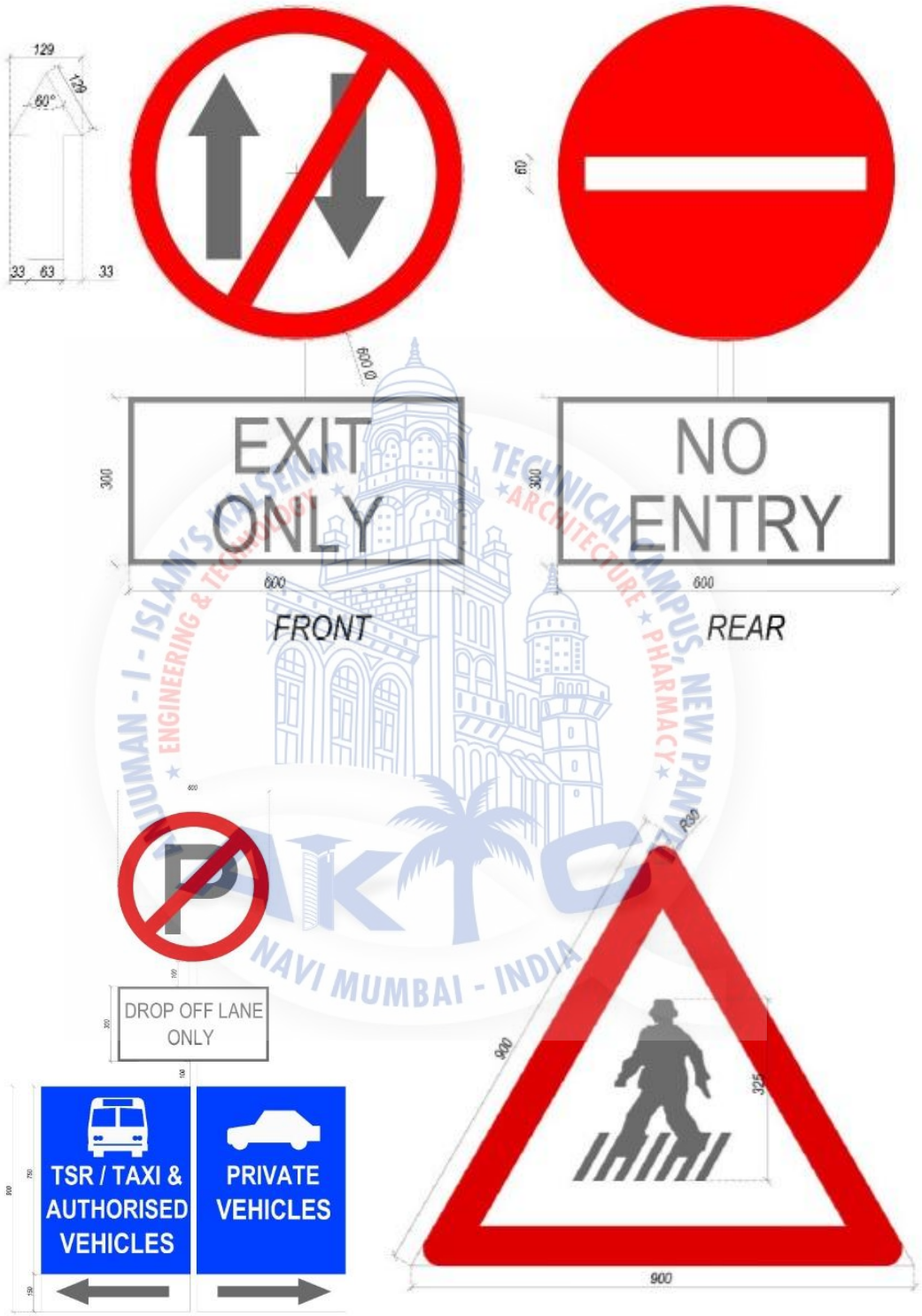
1	Car Rental	5	Shops
2	Restaurant	6	Barber shop/salon
3	Coffee Shop	7	Barber Shop
4	Bar	8	Beauty Salon

3

1	Ticket Purchase
2	Baggage Check-in
3	Baggage Claim
4	Customs

4

1	Smoking	4	No Parking	7	Exit
2	No Smoking	5	No Pets	8	Fire Extinguisher
3	Parking	6	No Entry	9	Litter Disposal



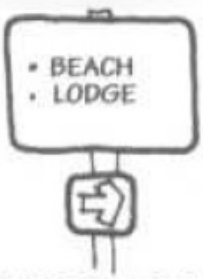
GRAPHIC PROPORTIONS

DROP OFF BAY

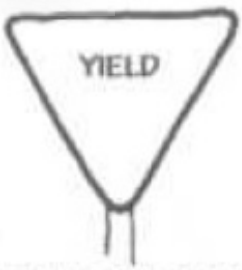
DESIGNATED DROP OFF BAY FOR ACCESSIBLE / DIFFERENTLY ABLED

DISPLAY OPTIONS

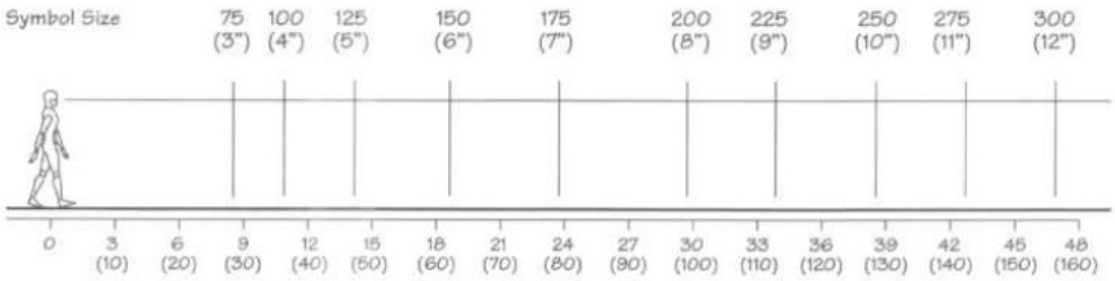
ENTRANCE SIGN



DIRECTIONAL SIGN



REGULATORY SIGN



Size of Symbol according to the Distance

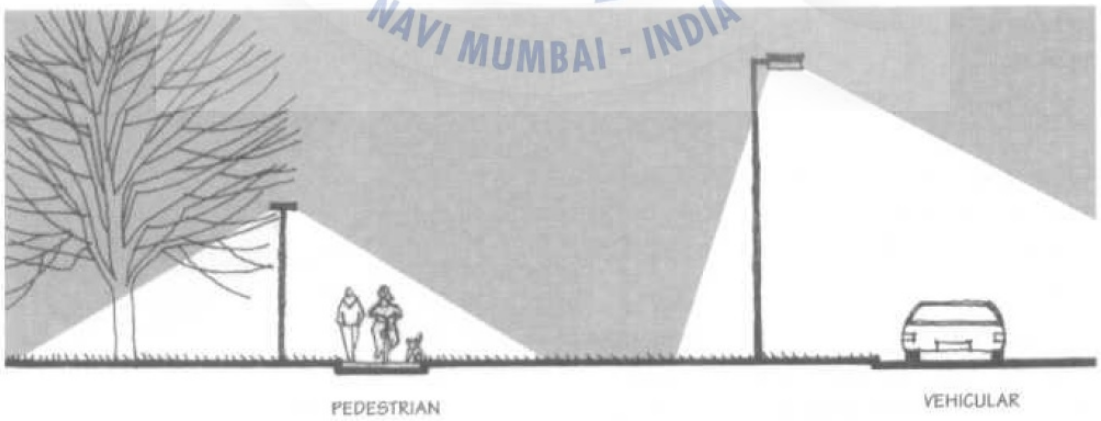
Size of Signage according to the Distance

Public art:

Visual space perception (mental copying sense of objects) helps people to recognize spaces in bus Depot Infrastructure. Elements like furniture, lighting, multimedia, graffiti and commercial art are used in this method.

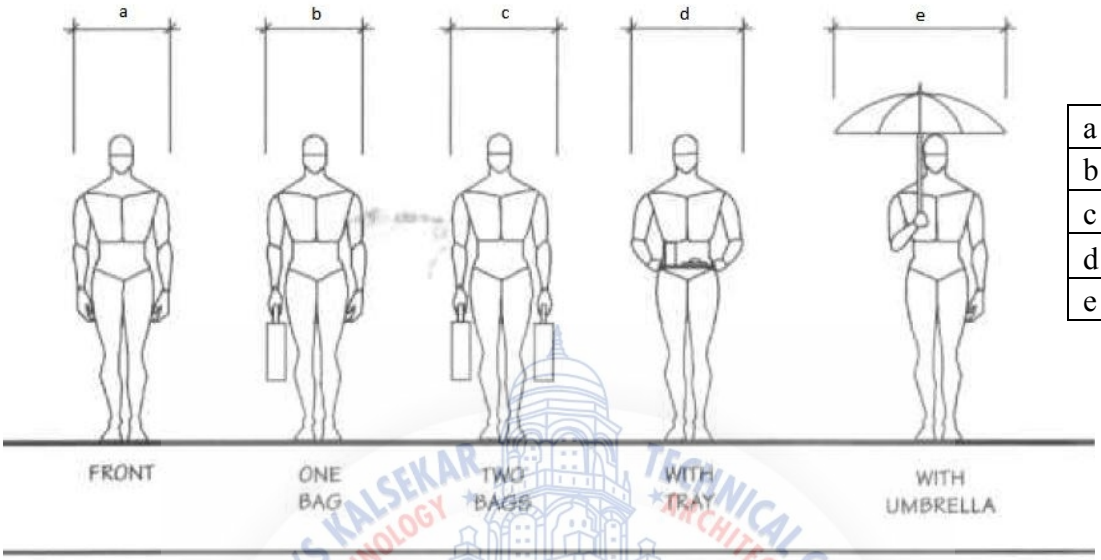
2.3.11. Lighting :

Sr.no.	Location of Use	Type of Lighting		
		Continuous	Standby	Mobile
1	Critical Infra access point		x	
2	Fare Gate	x		
3	Kiosk	x		
4	Parking Lot Open Area	x		x
5	Waiting Area	x		
6	Parking Structure Roof	x		
7	Plateform (outside canopy)	x		
8	Plateform (inside canopy)	x		
9	Pedestrian Pathway	x		x
10	Restricted Entry/Exit Area		x	
11	Station Entry / Exit	x		x
12	Ticketing Area	x		
13	Vehicle Approach	x		
14	Vehicle Staging Area	x		x



Height of Street Lighting For Pedestrian and Vehicle

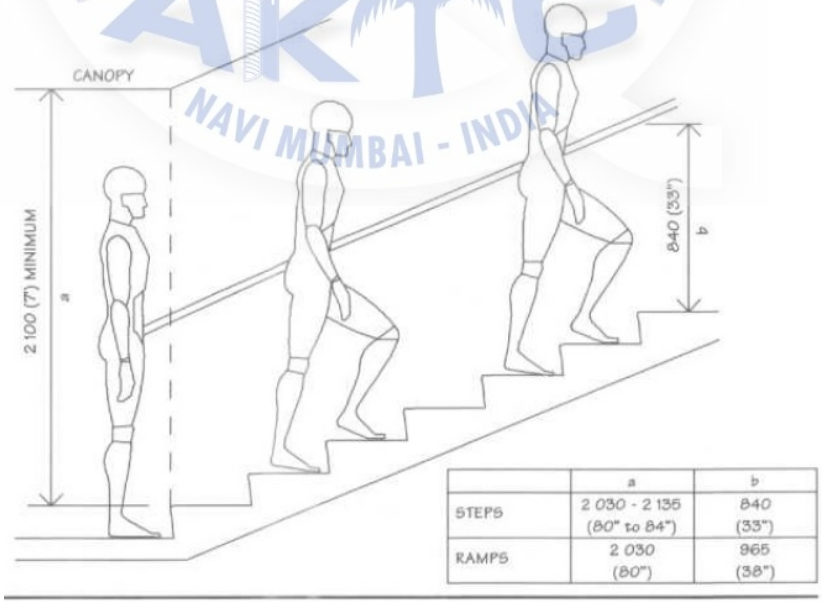
2.3.12. Users :



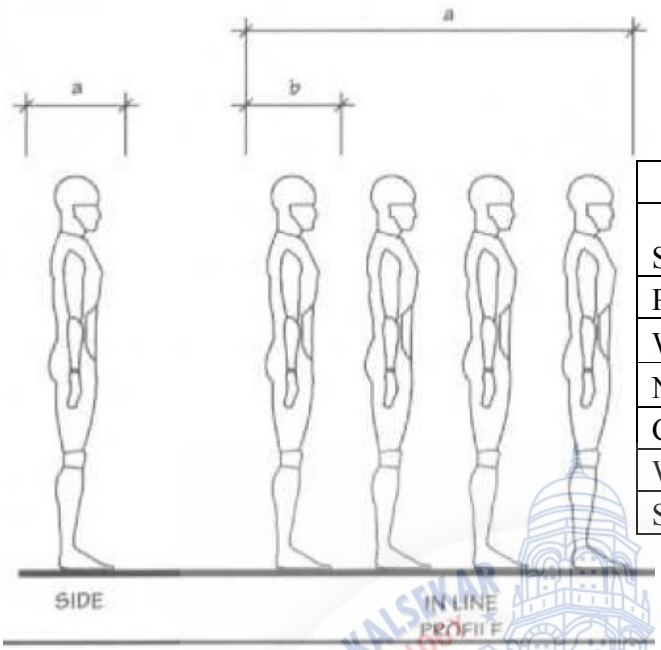
a	0.55
b	0.8
c	1.01
d	0.97
e	1.12

Width requirements for selected pedestrian activities.

Type		Width	Height
Walkway	min	1.8	2.1
	Preferred	2.7	2.4
Public Way	min	2.4	2.4
	preferred	3	3

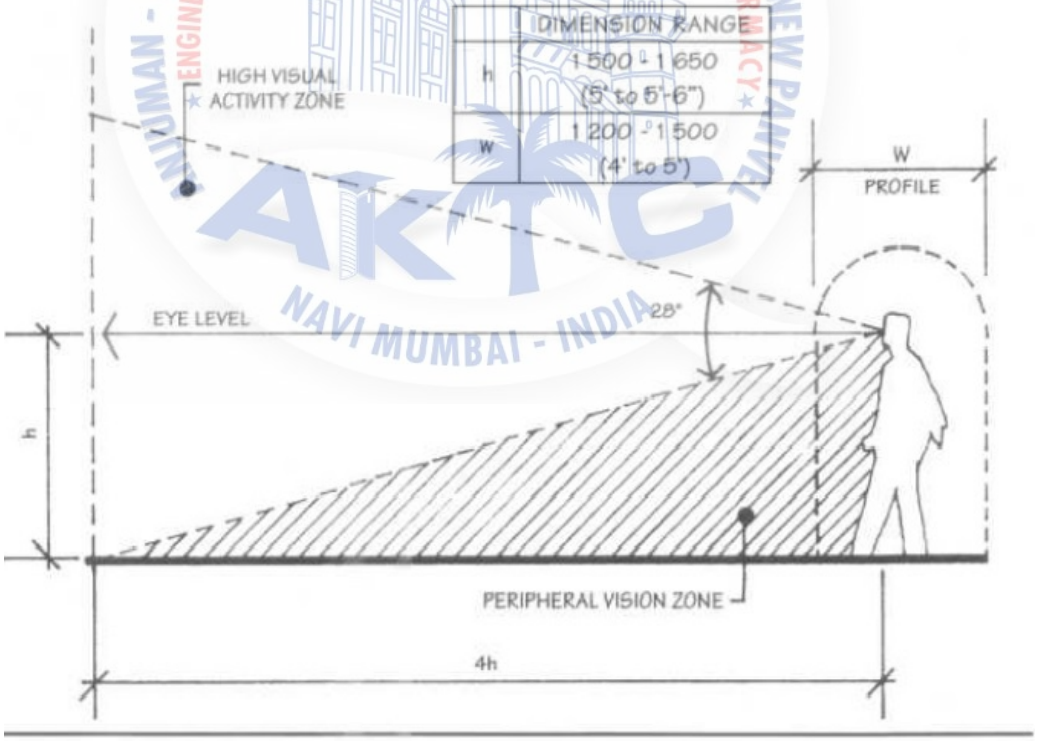


Covered stairway and ramp vertical clearances.



	a	b
Single Side	0.33	per person
Packed Normal	1.88	0.47
Waiting Line (with Gear)	3.05	0.76
Normal Line	2.14	0.53
Choir	2.03	0.51
Walking	2.54	0.64
Striding	3.5	0.88

Minimum queuing distances.



Pedestrian peripheral vision zone.

2.3.13. Guideline for Designing Bus Depot :

Access / Approach : Access to the Depot should be convenient, and Barrier free.

Location : - Centrally located depot in the city are inter-connected. Have Better interchange Opportunity.

- Depot located at the periphery of city work best in reducing dead mileage.

Operational Parameter : Design according to the route's to be catered and their peak hour, footfall, Idle parking.

Multi-Modal : Create the impression that the journey is continuous and without break by interchanging mode of transport.

Crime-Prevention : Effective Lighting, Barrier free Circulation, enhance Visibility, Sinages.

Circulation : - Reduce intersection between Pedestrian and Bus Circulation.
- Restrict Public vehicle to enter on Bus bay and circulation area.
- Create barrier for the passenger, so that they stay in waiting area.
(not disturbing bus circulation)
- Low Distance Amenities for User's.
- Place Toilets near Waiting Area, so that passenger from bus can easily use it.

2.3.14. Usability Criteria :

Seven Criteria that use to measure the usability of public transport,

The criteria are

1) speed,
2) comfort,
3) safety,
4) cost,
5) proximity,
6) timeliness and
7) directness.

Where,

Speed is calculated from total journey time.

Proximity means how long passengers must walk to began their journey and how close it leaves them to their desired destination.

Timeliness is waiting time required at terminus to get bus.

Directness records how far this bus journey deviates from the shortest route.

A people-Centric workplace : Good for Growth and Profits.

-Larissa Williams-Staples

People's are at the core of every organization,

and an organization's employees

- it's people-

are the most important investment it will make.

A review of bus terminal project from around the world suggest that the best practices in terminal planning and design are people centric. Provide high level of quality and comfort for people using it.

2.3.15. Human Centric Design :

Human-cantered design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, usability knowledge, and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance.

Human-centric design consists of three phases.

1) Inspiration Phase = you'll learn directly from the people you're designing for as you immerse yourself in their lives and come to deeply understand their needs.

2) Ideation Phase = you'll make sense of what you learned, identify opportunities for design, and prototype possible solutions.

3) Implementation Phase = you'll bring your solution to life, and eventually, to market. And you'll know that your solution will be a success because you've kept the very people you're looking to serve at the heart of the process.

2.3.16. Regulations :

-Food and Drink

Longer distance public transport sometimes sell food and drinks on board, or have a dedicated buffer car or dining car. However, some urban transport systems forbid the consumption of food, drink, or even chewing gum when riding on public transport. Sometimes only certain types of food are forbidden with a higher risk of making a mess, e.g. ice creams and chips, and sometimes crisps.

Some systems prohibit carrying open food or beverage containers, even if the food or beverage is not being consumed during the journey.

-Smoking

In India smoking is prohibited in most public transportation system due to health and safety issue. Generally smoking is not allowed on buses and trains, while rules concerning stations and waiting platforms differ from system to system. The situation in other countries varies widely.

-Noise

Many mass transit system prohibit the use of audio devices, such as radios, CD players and MP3 players unless used with earphones through which; only the user can hear the audio transmitted.

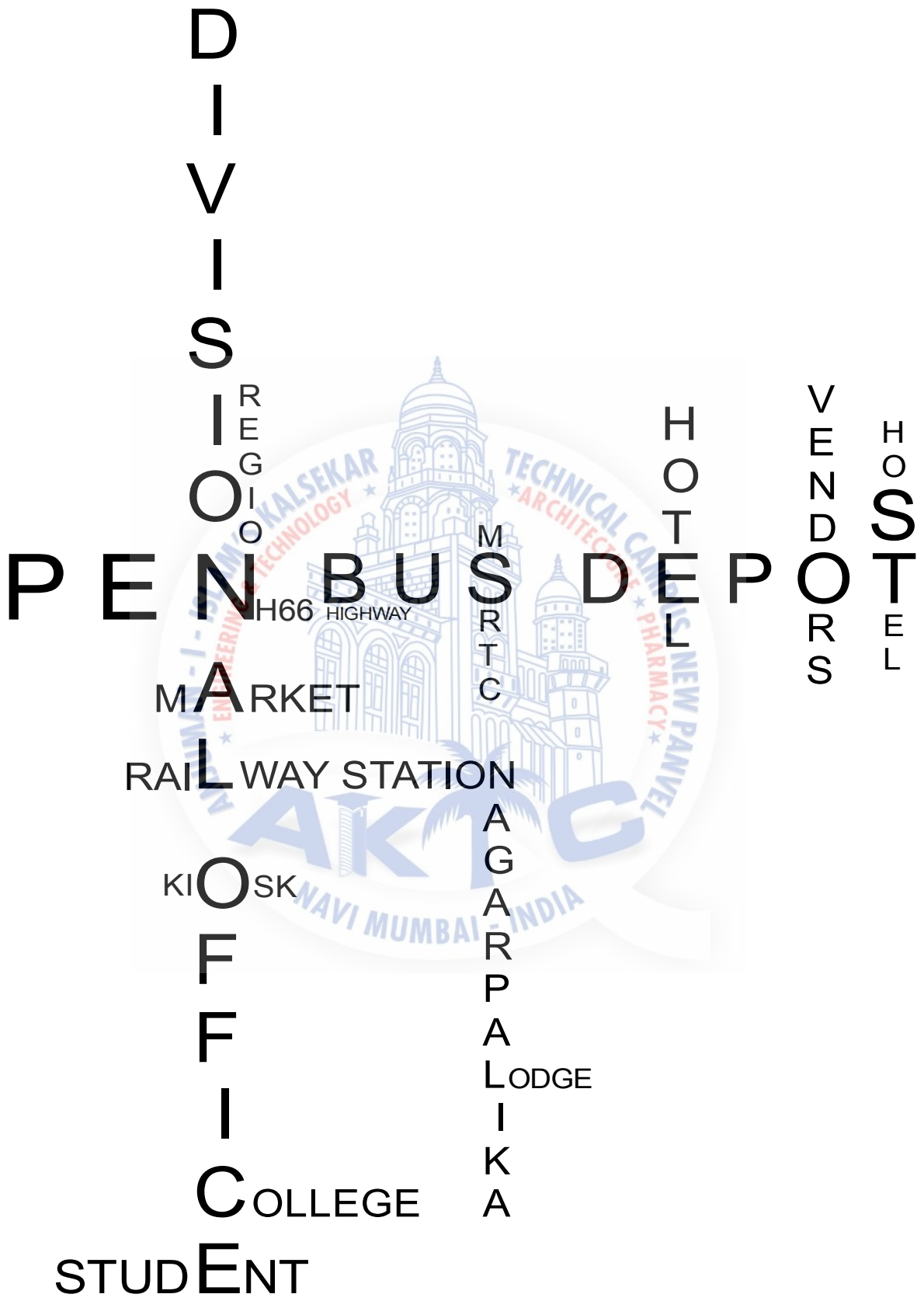
Some systems forbid passengers from engaging in conversation with the operator. Other require that passengers who engage in any conversation must keep the noise level low enough that it not be audible to other passengers.

-Banned items

Items considered to be problematic are prohibited. These include firearms and other weapons (unless licensed to carry), explosives, flammable items, or hazardous chemicals and substance.

Pets also prohibited on public transport. But allow those that are in carrying cases or other closed containers.

And large size items are prohibited, that may take up a lot of space, such as bicycle.


DIVISIONAL OFFICE
REGION
PEN
BUS DEPOT
H66 HIGHWAY
MARKET
RAILWAY STATION
KIOSK
COLLEGE
STUDENT
MSRTC
AGARPALIKA
LODGE
HOTEL
VENDORS
HOSTEL

2.4. Site Selection and Analysis

2.4.1. Site Justification :

Proposed Design Site Pen Bus Depot as Thesis site because the condition of infrastructure in pen bus depot is dilapidated, and also the main reason is because of its low capacity and resources on site, which tends to compromising amenities such as - no proper entry for passengers on site,
- dislocation of function,
- no proper bus circulation on site,
- rain water logging on site,
- insufficient waiting area for users,
- parking issue and lots of more issue
- Insufficient Platform Allotted in Relation with Bay

given further in analysis that's why I choose pen bus depot, which has huge amount of people using it.

Maharashtra State Road Transport Corporation (MSRTC)

Has Proposed to Develop **Pen Bus Depot** to Meet Modern Requirement of Passenger and Provide Better Facilities for User and increase ridership from that depot.

Facilities such as Basic Amenities of depot as well as Shops, Office Complex, Food Court, Gym, etc according to the context to generate good amount of revenue.

2.4.2. Site Identification.

Map of Raigad

Map of India

National Highway in India

Map of Maharashtra
Showing Districts and National Highway

Depot Name :-	Pen ST Stand
Site Location :-	MSRTC bus depot pen, near Municipal corporation pen, pen-khopoli road (SH-87), pen city, Taluka-Pen, Dist-Raigad, Maharashtra, India.

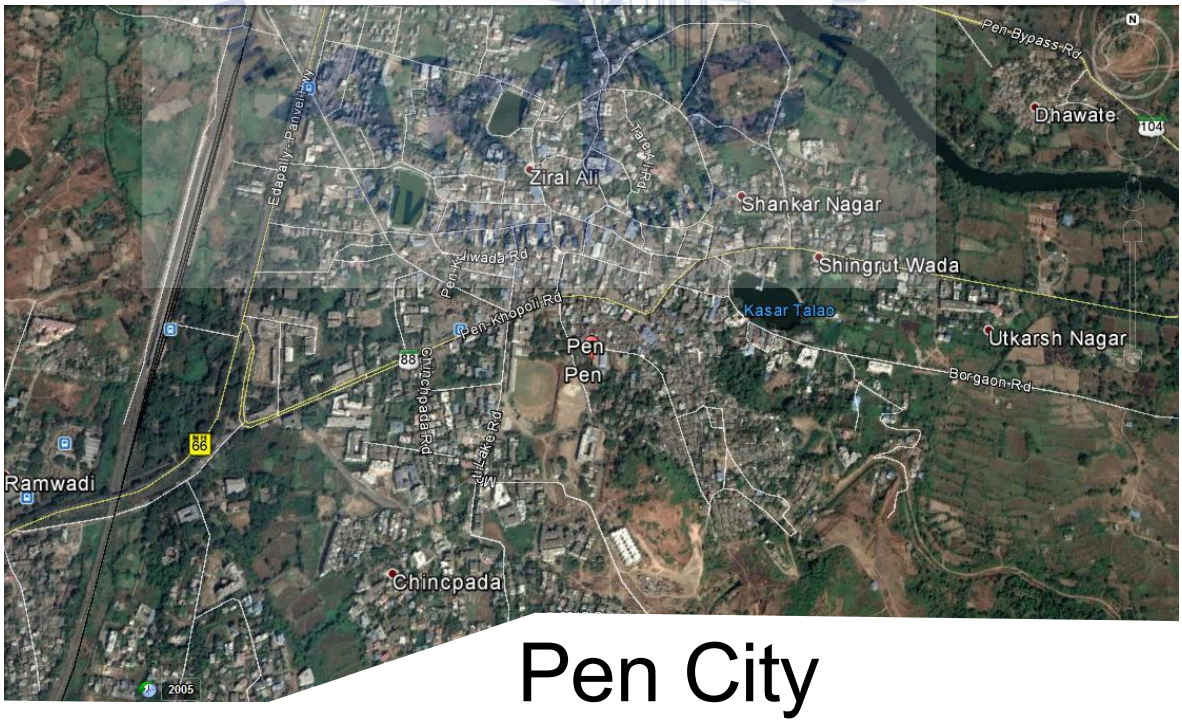
2.4.3. About PEN City, Raigad :

Pen is a town and taluka in the state of Maharashtra, India. It is industrial area on NH17. It is geographical and cultural centre in Raigad. It's Population is 38,000 and migrant students.

Pen is located at the outskirts of Mumbai Metropolitan Region 18°40'N, 73°05' E. It is 32km from Panvel, 80km from Mumbai, and also connect Pune and has central position in Raigad district. Area of Pen city is about 17.48 sq.km.

Important villages/town in Pen taluka are Pen, Vadkhal, Gagode, Vashi, Vadhav, Mothebhal, Varsai, Sanksai, Pabal, Dadar, Mahalmeera, Dharamtar, Kharoshi, Gadab, Pandapur, Balavali, Jite.

Employment in pen depends on various sectors such as education, banking, industries, services, papad making (women's co-operative), trade/business and most in Ganesh idol making. Villagers are depending on farming in monsoon and also in salt production. From Historic time, Pen was centre of education and culture in kokan region.



Pen City Google Earth Map

(Source : Google Earth)

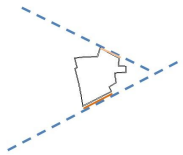
2.4.4. Site Availability Information

Area allotted for Pen bus depot is comes in "Transport and Communication" zone as per 2nd Revised development plan of pen. And it is existing and working depot for MSRTC.(Brown Field)

Governing Civil Body in Pen : Pen Municipal Corporation. ('C' class Municipal Council)

2nd Revised Development Plan of pen 2013

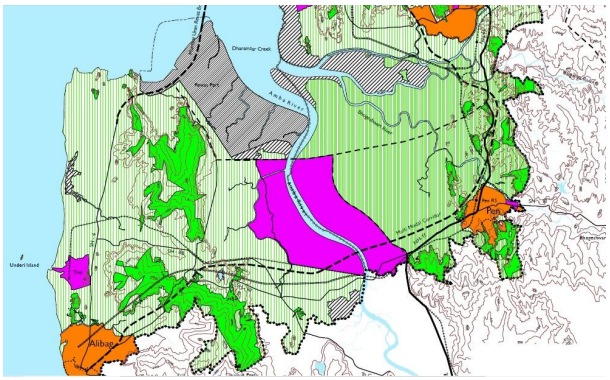
Zoom-out of 2nd Revised Development Plan of pen 2013



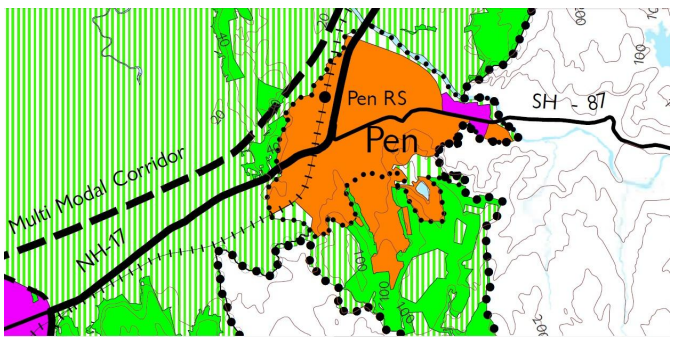
Site Area = 13252 Sq.m.

Site Accessible from two side

Pen City comes in 'Urbanisable Zone' in MMRP 2016-36 plan

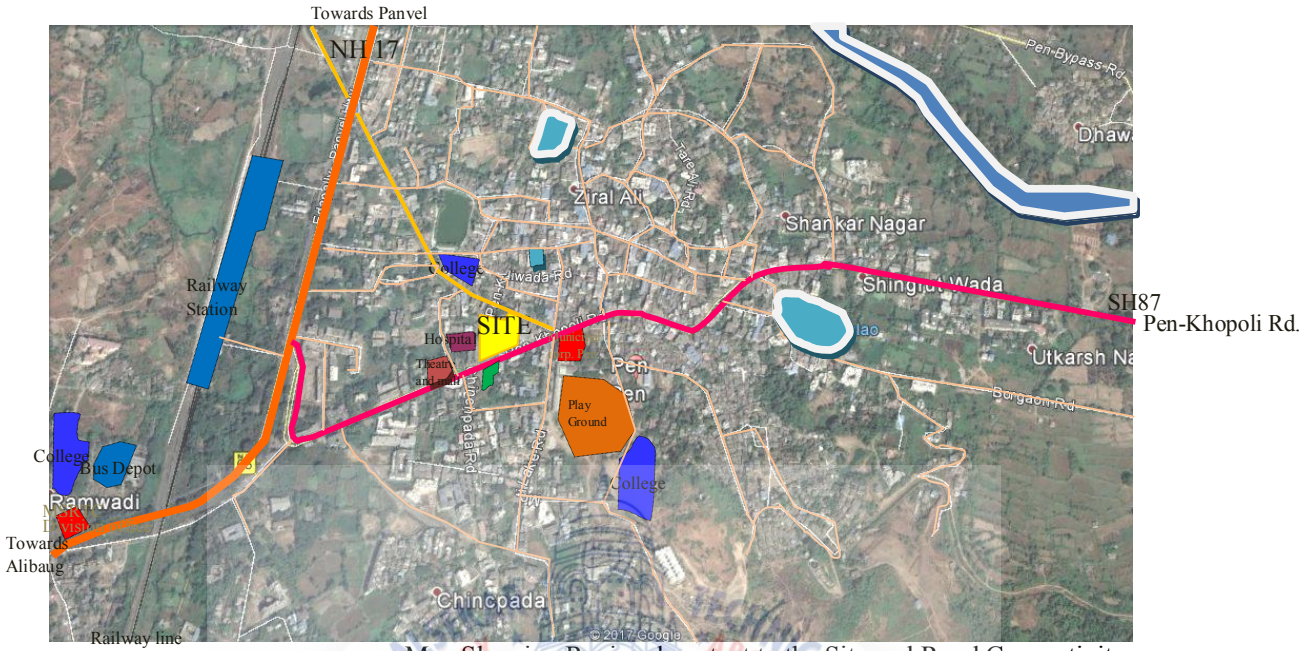


Mumbai Metropolitan Region Plan 2016-36



Zoom-out of Mumbai Metropolitan Region Plan 2016-36

2.4.5. Regional Context and Road Connectivity.



Map Showing Regional context to the Site and Road Connectivity

Nearby spaces / Landmark

- Pen Municipal Corporationz
- 2 Hospitals (Mhatre and Mahajan)
- Cinema theatre and Mall
- Feeder bay (Auto-Rickshaw and Minidoor)
- Various hotel, restaurant and lodge.
- Pen Railway Station (2.4km from depot)
- 6 Schools and colleges (KES school, Little Angle school, Sarvajanik vidyamandir, Yadavrao Tasgaonkar college, pen private high school and college, pen polytechnic)
- Medical
- 2 Bank (India overseas and Punjab National)
- 2-3 ATM (Axis, LIC)
- Play Ground
- Pen Market
- Public Library

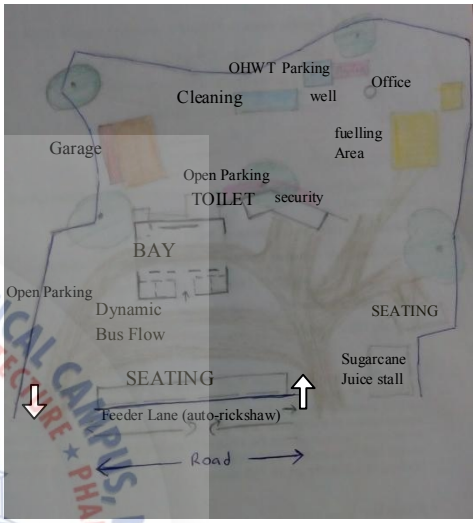
Nearby Bus Stand in 3km radius : Ramwadi Bus Stand

2.4.6. Site Analysis:

The subjected site is strategically located at the market area of pen city on pen-khopoli road (SH-87), near pen municipal corporation.

As site is located in market, it has vendors coming on site and is connected with various restaurant and lodge. A high density environment.

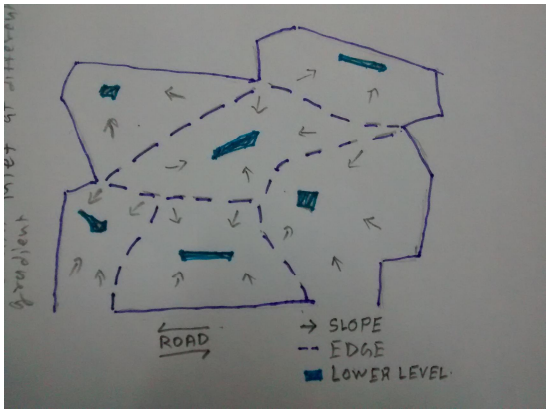
Map Showing Major Spaces of Depot

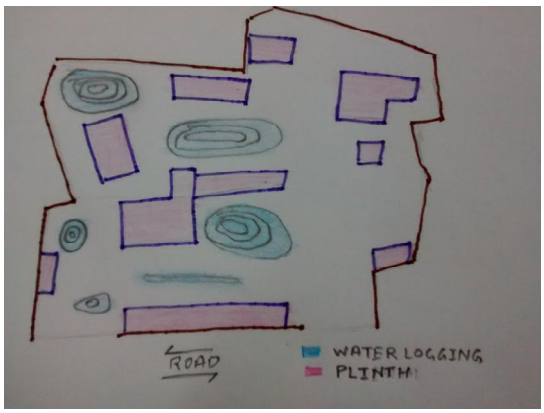


Map Showing Minor spaces of Depot

- Site Area : 13,252 Sq.m. (1.3 Hectare = 3.2 Acre)
- It is a Local Bus terminal (not ISBT).
- It is also act as interchange transit.
- Observed Bus Parking on Stand : 15-20 buses as per available site area.
- It is existing and operational.
- Observed average Layover time (min): 15-20min
- No any commercial/Real estate development on site.
- Hoardings advertisement.
- No Ancillary function
- Capital source for development 100% public funding
- Bus Maintenance Infrastructure (workshop) is on site.
- Staff parking is partly design and partly open
- No proper public parking area; two-wheeler parks in open area near site and building boundary.
- Feeder service is Lane for Auto-rickshaw and Bay for Minidoor.
- Other activities on site: Vendors, Roaming of people, waiting, hoarding.
- Passenger : Mainly Student, Local public, Traveller, etc. (high density)
- 231 Passenger capacity.

2.4.7. Site Condition :

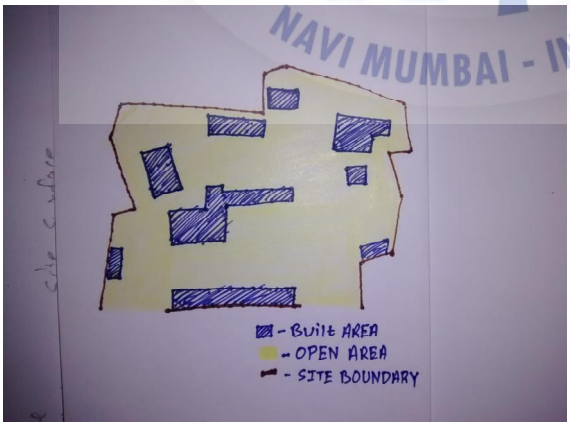




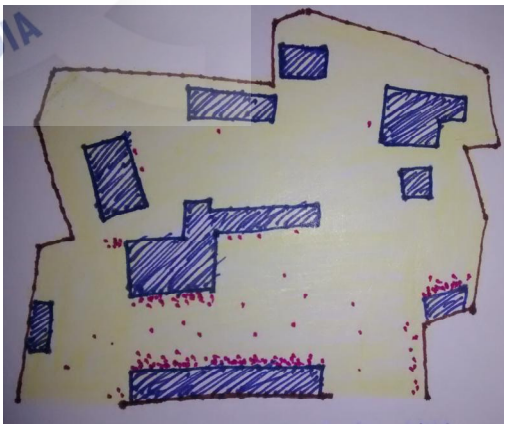
Topography = There is no physical slope on site, it is a flat land with negative bump (-0.3m) on it which result in rain water logging on site. The front Road is at higher level from site area.

Vegetation = Trees are at the periphery of workshop area, creating a natural boundary to the workshop area on site. And also on two side of stand area.

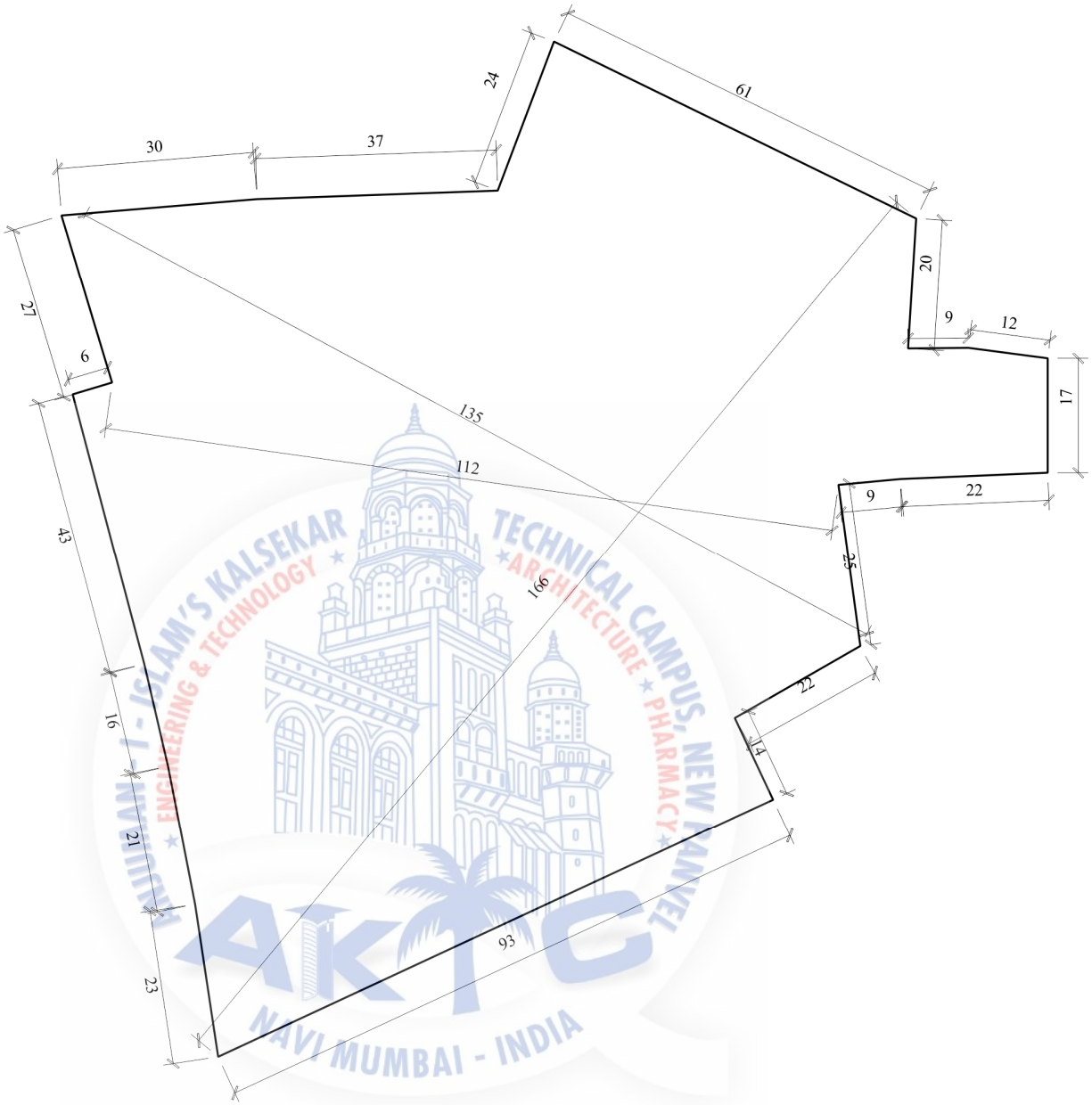
Services = Water Supply, Sewage line, Electricity cable, Telephone Line Running along the site (Road Side).
Site have a Water Well and also OHWT at Workshop Area.



Sketch Showing Built Area and Open Space on Site



Sketch Showing People Density on Site

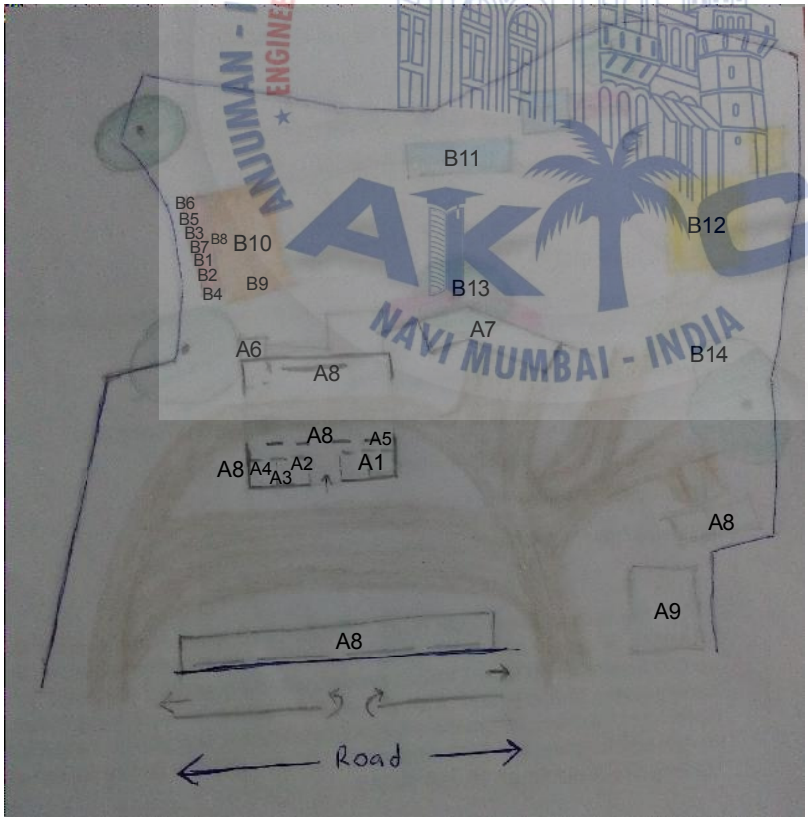


2.4.8. <u>Site Area and Dimension</u> :

2.4.9. Existing Programme of Pen Bus Depot :

A) Stand

1. Terminal office
   = 2+4 person
2. Enquiry/Announcing Cabin
   = 2-3 person
3. Locker Room
   = 0-1 person
4. Log storage
   = 0 person
5. Book/Newspaper stall
   = 1 person
6. Ticketing Counter
   = 1-2 person
7. Toilet
8. Waiting area
9. Sugarcane juice stall



B) Workshop

1. Head Office of Depot
   = 1+3 person
2. Revenue Office
   = 2+4 person
3. Spare-part storage
   = 2 person
4. Tyre and Battery storage
   = 0-2 person
5. Storage for oil
   = 0-1 person
6. Suspension storage
   = 0-1 person
7. Locker Room
   = 0-2 person
8. Log Desk
   = 1+2 person
9. Tools area
   = 0-1 person
10. Garage area
    = 8 person
11. Cleaning area
    = 0 person
12. fuelling area
    = 2 person
13. Staff parking
14. Security Block
    = 2 person

Feeder Service Minidoor

Entry1 Parking, Stall

Right side from Entry 1

Entry1 Vendors / Hoarding

Right side of entry 1 (Main Road Surface and Depot Paving)

Entry1 Parking, Paving

Left side from Entry 1

Main Building

Waiting Area 1

Entry 1

Pen-Khopoli Rd

Feeder Service

Waiting Area

Waiting Area 1 and Bay

Main Building

Panorama view of Stand Area From Waiting Area

Public Parking 1 on Site

Main Building(Stand) from Entry 1

Waiting Area2

Public Parking 2

Public Parking 2

Ticketing and Queuing

Workshop : Garage Entry

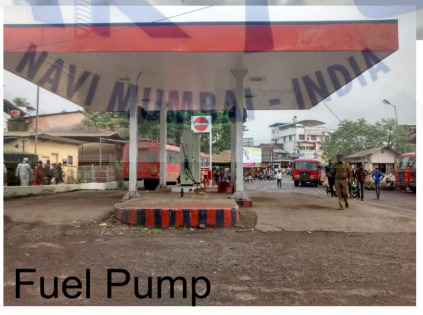
Idle Parking beside Garage

Entry to Workshop

Staff Parking and OHWT

Bus Washing Area

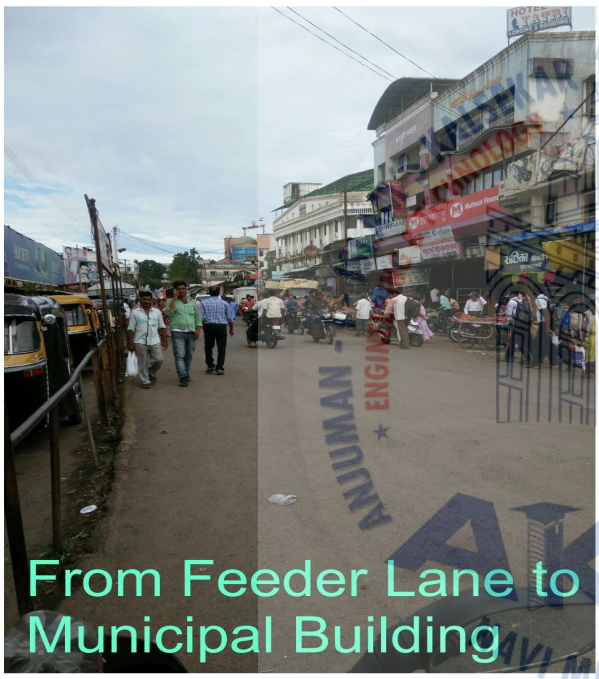
Fuel Pump

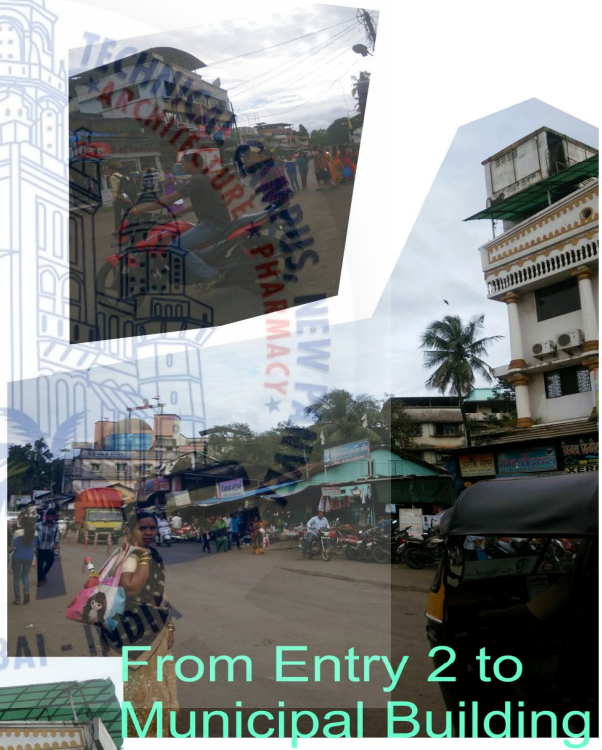


Fuel Pump

Idle Parking and Fuel Pump

Panorama of Workshop Area





Front of Depot
(Pen Khopoli Rd.)

2.4.10. Site Merits and Demerits :

Demerits :

- Low Capacity and Resources
- No adequate Seating provided
- Provided Seating Create Barrier to Access Bay
- No Proper Waiting Area
- Dilapidated Structure
- Dislocation of Function
- No proper Paving or concrete on site for Bus Circulation
- Rainwater Logging on site
- Irresponsive to passenger
- Public Parking Problem
- Insufficient Platform Allotted
- No Platform for Mumbai Route Bay.

Merits :

- Water Facility on Site (OHWT and Well)
- Fuelling Station onsite.
- Access/Approach from 2 side of Site.

2.4.11. Route Mapping of Pen Bus Depot :

2.4.12. Capacity Relationship (Current and Estimated)

Current Scenario

- 15 Buses Parking on Stand Area

  Of which only 9 Bus parking have Waiting Area

- 483 Buses in whole Day

- 15-20 min Layover Time

- Footfall (fc) = 16,301 person/Day (about 0.23% of MSRTC ridership)

  = 8150 on Peak hours

  = 906 /hr

  = 226 / 20min

- Seating Provided = 178 Seat's (Existing)

Demand Estimation for Horizon Year

- Seating Required according to the Footfall = 272 Seat's (2017)

- 94 Less Seats provided

- 5 Buses per 20min (Loading, offloading, Circulation)

Estimated Demand for Future

15% adding in Footfall

- Footfall (ff) = 18,746 person /Day

  = 9,373 peak hr's

  = 1041 /hr

  = 260 /20min

- Seating Requires = 312 Seats

- 6 Buses per 20min (Loading, offloading, Circulation)

2.4.13. Norm from DCR :

Assembly Buildings :- These shall include any building or part of building where groups of people congregate or gather for amusement, recreation or social, religious, patriotic, civil, travel and similar purposes, e.g. theatres, motion picture house, drive-in-theatres, multiplexes, assembly halls, city halls, town halls, auditoria, exhibition halls, museums, mangalkaryalaya, cultural centre, skating rinks, places of worship, dance theatres, club & gymkhana, passenger stations and terminals of air, surface and other public transportation services, recreation piers and stadia. (DCR for Municipal Council and Nagar Panchayats in Maharashtra)

Table No - 14

Sr. No.	Type of Building	Min. road width required	Min Open Spaces	Normal Permissible FSI on the net plot area	FSI with payment of premium	Other Stipulation
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Hospital, Maternity Homes, Health Club, Public-Semipublic buildings	12 m	6 m. on all sides	1.00	0.20	-
2.	Educational buildings					
	i) Pre-primary School	9m.& not more than 18 m.	As per Table No13	1.00	0.20	-
	ii) Primary School	9m.& not more than 18 m.	6 m. on all sides	1.00	0.20	-
	iii) Other Educational Buildings	15 m.	--do--	1.00	0.20	-
3.	Cinema Theatre/ Drama Theatre/ Assembly Hall/ Multiplex / Shopping Malls	15 m.	Front – 12 m. All sides – 6 m.	1.00	0.20	The minimum distance between boundary of site for Cinema Theatre /Drama Theatre/ Multiplex/Assembly Hall & boundary of educational & hospital buildings shall not be less than 60 m.

Commercial use of lands in the possession of Maharashtra State Road Transport Corporation :

Notwithstanding anything contained in these regulations or the Development Plan, land in the possession of Maharashtra State Road Transport Corporation shall be allowed to be developed for commercial use to the extent specified in Regulation 'The Land in possession of Maharashtra State Road Transport Corporation' Given Below. (from DCR)

The Land in possession of Maharashtra State Road Transport Corporation:-

Land in possession of Maharashtra State Road Transport Corporation shall be allowed to be developed for additional 0.5 FSI over and above the permissible FSI subject to following condition:

i)Out of total FSI, maximum 1.00 FSI shall be allowed to be developed for commercial use and remaining FSI shall be for the self use of the said Corporation permissible as per the Development Plan.

ii)For additional 0.5 FSI, premium shall not be charged.

Table 31
Airports and Railway Stations

Terminal Railway and Bus Stations			Domestic and International Airports	
Male	Female	Male	Female	
5	6	7	8	
4 for up to 1000 Add 1 per additional 1000 or part thereof	5 for up to 1000 Add 1 per additional 1000 or part thereof	Minimum 2 For 200 2 For 400 9 For 600 12 For 800 16 For 1000 18	Minimum 2 For 200 2 For 400 9 For 600 12 For 800 16 For 1000 18	
One in each water-closet	One in each water-closet	One in each water-closet	One in each water-closet	
6 for up to 1000 Add 1 per additional 1000	----	1 per 40 or part thereof	----	
1 per WC / Urinal	1 per WC	1 per WC / Urinal	1 per WC	
3 per 1000	----	4 per 1000		
3 per 1000 or part thereof		4 per 1000 or part thereof		
1 per toilet compartment with 3 WC's	1 per toilet compartment with 3 WC's	1 per toilet compartment with 3 WC's	1 per toilet compartment with 3 WC's	
1 per 4000	1 per 4000	1 per 4000 (Minimum 1)	1 per 4000 (Minimum 1)	

Permissible FSI = 1.5

Area of Site = 13,000 Sq. m

Total Built-Up Area = 1.5 x 13000 Sq. m.

= 19,500 Sq. m.

In which ,

Maximum FSI of 1 shall be used for Commercial, which is

1 x 13,000 = 13,000 Sq. m.

Height Limit = 12 m.

= upto G+2 (3 Storey Structure)

2.4.14. Climatology .

Pen, Maharashtra, IN.

18.74°N, 73.1°E, 22m asl

Warm-humid climate (Equatorial)

Average monthly temperature is between 18°C-26.9 °C in Pen and subclasses are defined by differences in seasonal rainfall distribution.

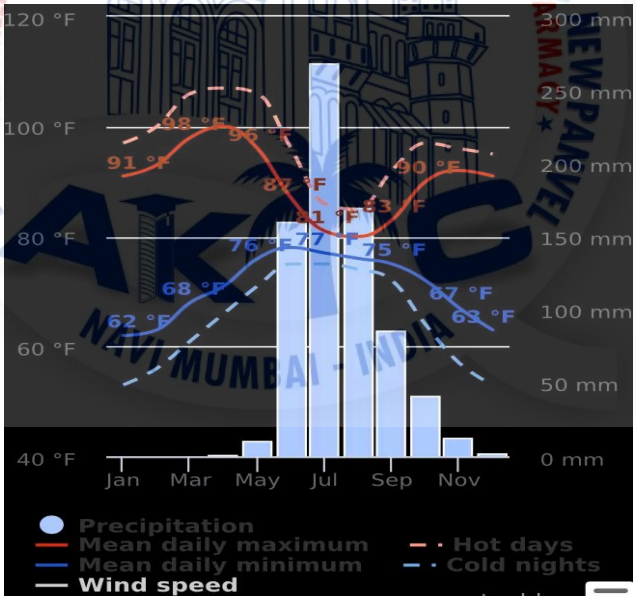
A warm-humid climate has a fairly constant temperature, both over the day and over the year.

Humidity and cloudiness make diffuse solar radiation important, and the potential for radiative sky cooling is lower.

Seasons are often determined by rainfall and winds.

Precipitation/rainfall in pen averages 3207 mm.

The climate is tropical in Pen. Most months of the year are marked by significant rainfall.



TEMPERATURE, PEN

With an average of 30.0 °C, May is the warmest month. The lowest average temperatures in the year occur in January, when it is around 23.6 °C.

CLIMATE, PEN

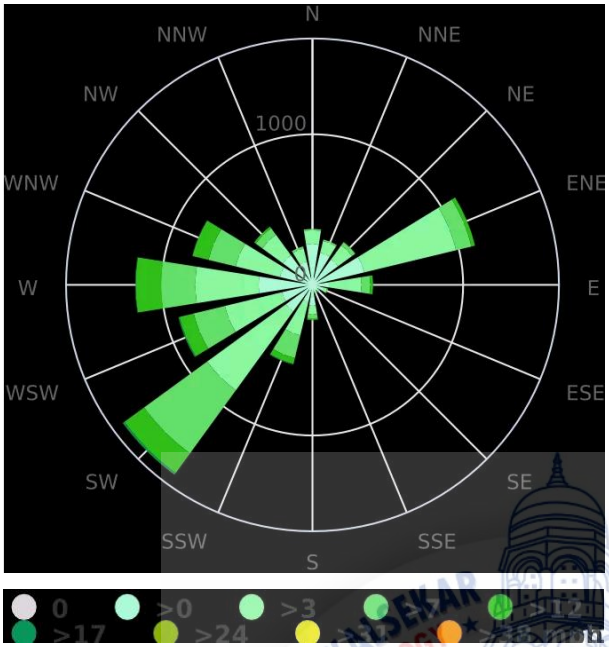
The driest month is January. There is 0 mm of precipitation in January. The greatest amount of precipitation occurs in July, with an average of 1247 mm.

PEN CLIMATE TABLE / HISTORICAL WEATHER DATA

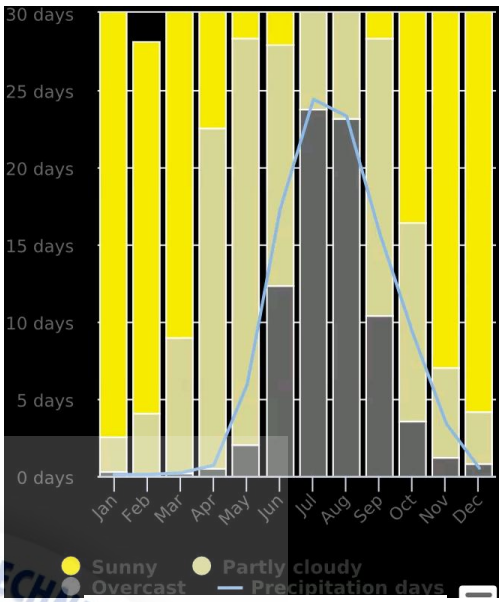
Month	Average Temperature (°C)	Average Temperature (°F)	Precipitation / Rainfall (mm)
January	23.6	74.5	0
February	24.1	75.4	0
March	26.4	79.5	0
April	28.7	83.7	2
May	30	86	12
June	28.9	84	589
July	27.4	81.3	1247
August	27.1	80.8	802
September	27.1	80.8	436
October	27.8	82	104
November	26.5	79.7	12
December	24.7	76.5	3

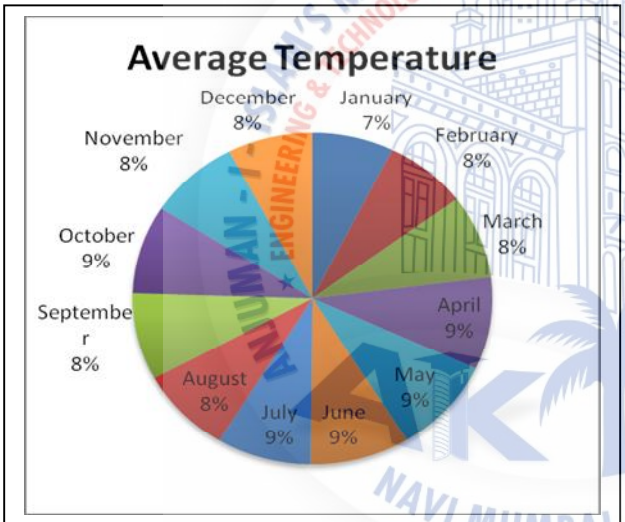
The precipitation varies 1247 mm between the driest month and the wettest month. The variation in temperatures throughout the year is 6.4 °C.

Wind Rose Diagram

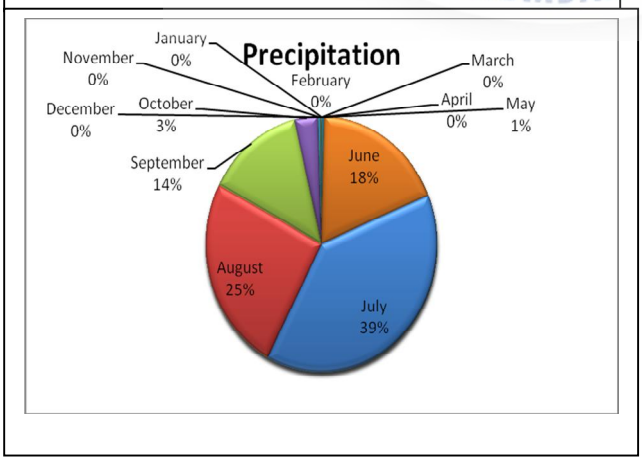


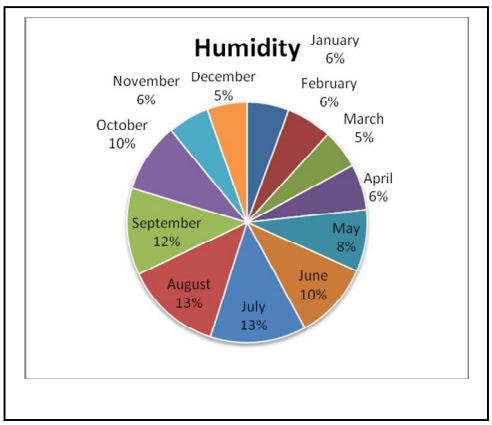
Cloudy, Sunny and Rainy days

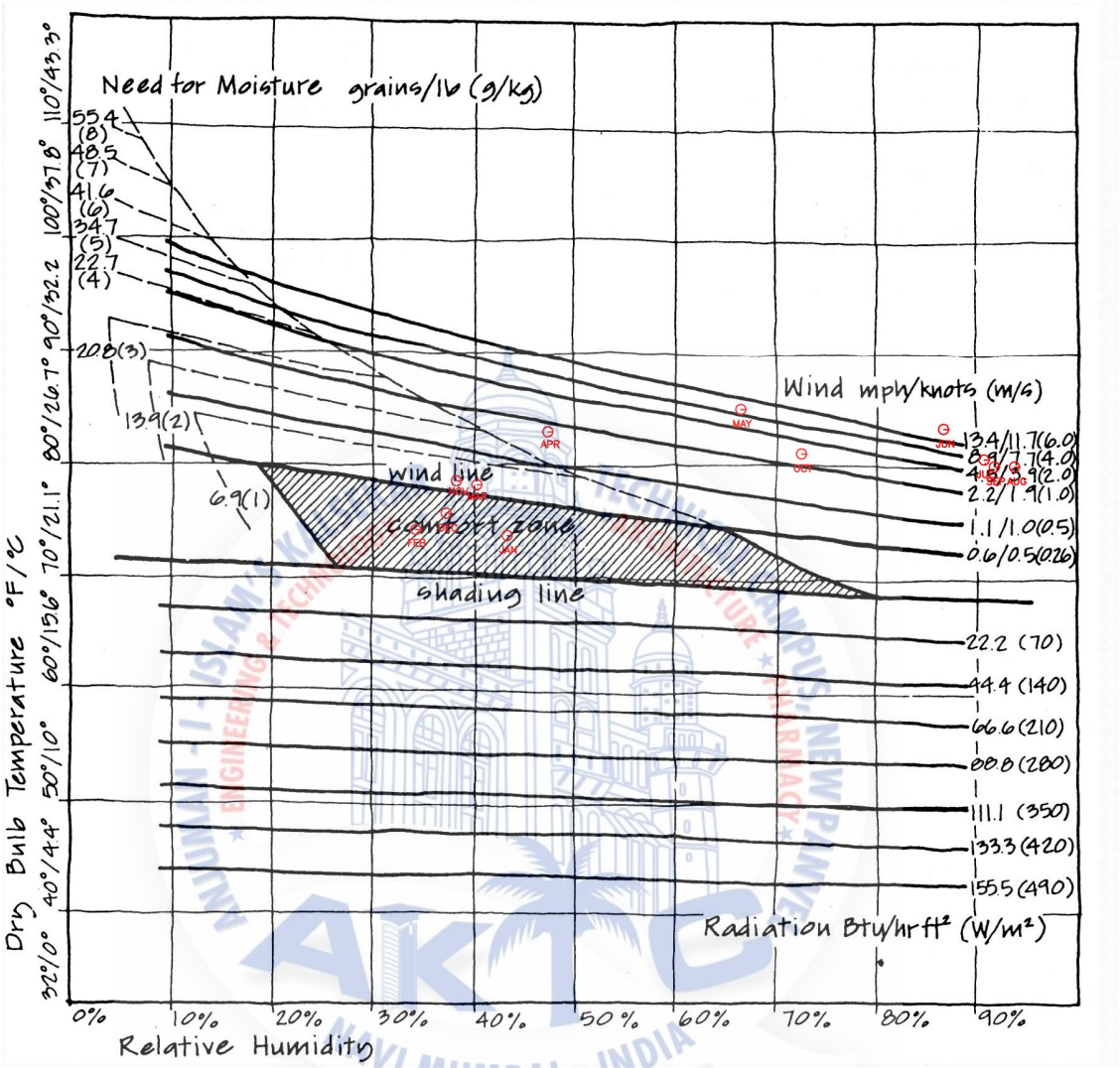




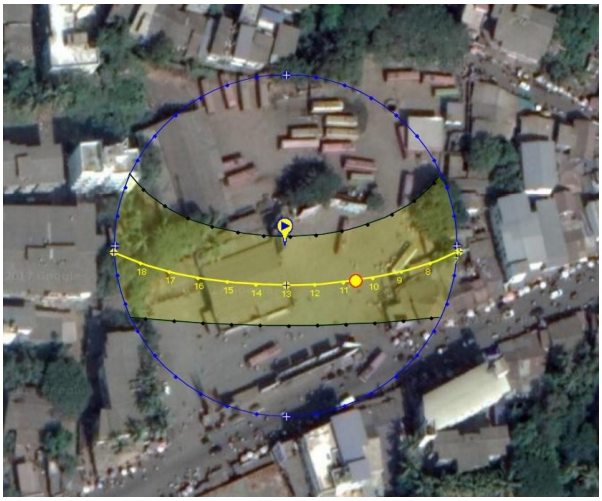
Month	Humidity
January	43.5
February	47.5
March	41
April	48
May	65
June	80
July	100
August	100
September	91
October	73
November	43
December	41.5

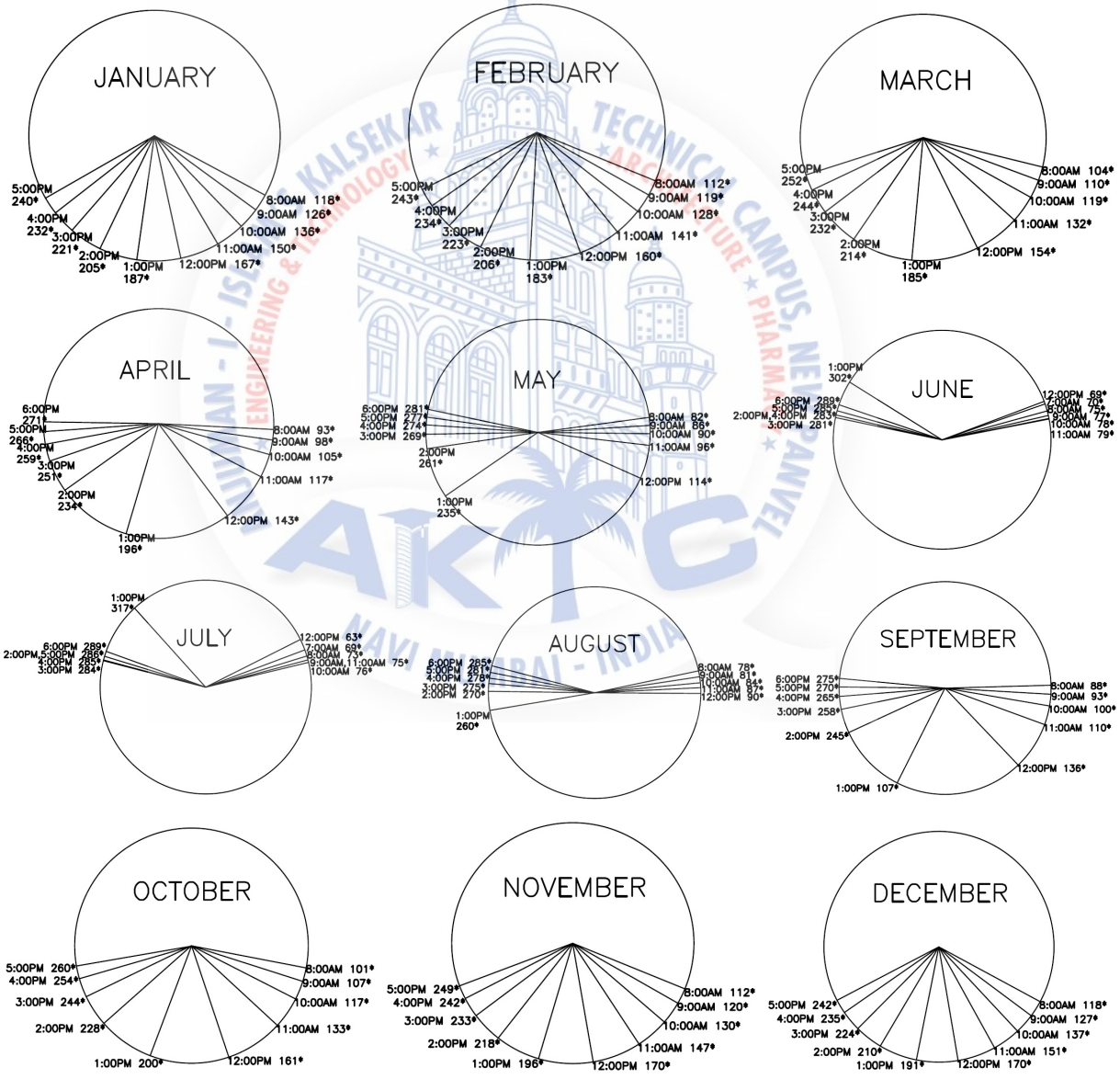






Bioclimatic Diagram of Pen City.





Sun Path Diagram of Pen City.

2.5. Architectural Space Programme :

2.5.1. Design Statement :

Terminal Typology = Inter-City and Local
Terminal Size = Small (<60 Buses per Hour)
Terminal Operation = Fixed Route Bay Allocation
Bay Type = Common Bay (Loading, Offloading)
= Perpendicular / Parallel as per Design

- Design for Footfall = 18,746
- Average Buses per 20 Min. = 6 Buses
- Layover Time of Bus = 15-20 min
- Offloading Time of Bus = 1 min
- Loading Time of Bus = 6 min
- Total Buses to be Handled by Depot = 576 Buses
- Number of Bay for Loading and Offloading = Total No. of Buses in peak hr.= 192 =8.
  Bay Capacity in 1 hr. 24

Important Points While Designing :

- Create Barrier for the Passenger, so that Passenger Stay in Waiting Area and not Roaming on Bay and Bus Circulation Area.
- Restrict Public Vehicle Entry on Bus Circulation Area.(in Depot Area)
- Low Distance Amenities.
- Place Toilet near Waiting Area / Bus Bay (Loading, Offloading) , so that Long Route Passenger or Passenger who are continuing their Journey can use it easily.

Bibliography

1) SGArchitects, Shakti Sustainable Energy Foundation, Bus Terminal Design Guidlines.(pdf)
2) National Building Code , 2nd revision, New Delhi: Bureau of Indian Standard, 2005, Print.
3) Bousmaha Baiche and Nicholas Walliman, Ernst and peter neufert Architects Data, 3rd Edition,2008.
4) Charles w.harris and Nicholas T.Dines, Time Saver Standards for Landscape Architecture, 2nd edition, 1998
5) Standardize Development Control and Promotion Regulation for Municipal Council and Nagar Panchayats in Maharashtra : government of maharashtra urban development department 2013.
6) www.Climate-Data.org
7) 'Climatic Design of Buildings using Passive Techniques' by Hans Rosenlund
8) www.Meteoblue.com
9) Bus Stop Design Guide 6 - on street physical characteristic.
10) www.apta.com
11) www.MSTRC.com