Capacity Analysis and Planning For Bus Terminus in Erode City

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***Abstract*— Erode is a well-developed and 7th largest city in Tamilnadu with rapid increase in population. It is one among the 98 smart cities proposed in India. The city is surrounded by many small and large scale industries. Due to poor infrastructure and inappropriate town planning, transportation has become a major threat in the city. So, proper infrastructure planning with efficient use of space is necessary. Bus transportation is very important mode of transport of the city. Erode Central Bus Terminus is located in the heart place of the city. It serves for city bus services, mofussil bus services and mini bus services. Currently it exceeds the handling capacity of buses; therefore there is no proper traffic management and passenger facility inside the terminus. The circumstances road of the bus terminus carries heavy traffic flow. The objective of the project is to plan new terminals at various locations for Mofussil bus services to reduce the traffic congestion in the existing terminal. Thus the existing terminal serves only for city bus routes along with few Mofussil routes which cannot be operated in the new terminals that are going to be planned. Thus the overall traffic vulnerability in the city gets reduced.**

***Index Terms*— Bus station or terminus, Traffic congestion, Platforms, Bay**

I. INTRODUCTION

A Bus station or Bus terminus is a public area from where bus starts or ends its scheduled routes. It serves for the public in the city for bus transportation. Bus transport is the main mode of transport next to rail transport for transporting from one place to another in India. The size of the terminus can be decided by analysing its operational conditions, bus routes, scheduled timings and basic facility needs. It may be designed for interstate routes or intercity routes. A Bus terminus is a structure larger than bus stop where the bus stops to pick up and drop off the passengers. It may be located in the centre or outer area of the city for providing easy access for the people from various directions. Bus terminus is the common landmark for the public coming from various cities. Bus Terminus Complex includes individual terminals for mofussil bus services, city bus services, omni bus services and Mini bus services. Bus terminus are provided with other facilities such as Shopping Complexes, toilet, drinking water, restaurant, hotels, water treatment plant, hospital, police terminus, auto stand, taxi stand, shopping malls, ATM. Bus terminus for a city may be either an integrated bus terminus or an individual bus terminus based on routes. Therefore, proper planning of terminus for effective handling of buses becomes necessary.

1.1 Objective of the study

- To select a bus terminus which is serving mofussil bus services, city bus services, omni bus services, and mini bus services simultaneously.
- To collect the appropriate data of the bus terminus
- To analyse the capacity of the bus terminus and identify the problems involved
- To suggest suitable measures for efficient handling of buses
- To prepare the layout for the new bus terminus

II. STUDY AREA

Erode central bus terminus was chosen as a study area due to improper traffic management and uncontrolled flow of buses. Erode central bus terminus is main bus terminus for Erode city. It is located in the junction called "Swastik Circle". So, this bus terminus is also termed as "Swastik Bus Terminus". It serves for city bus services, Mofussil bus services and mini bus services. The bus transportation is the main mode of transport of the city. The central bus terminus has uncontrolled traffic flow of buses inside the terminus due to increases in number of buses, improper traffic management and inadequate platform facilities. This increases the possibility of accidents, risks of passengers, delay of buses, reduces the free movement of buses and increases the passenger roaming time inside the terminus area. The satellite image of the existing bus terminus was shown in Fig 2.1 & Fig 2.2.

Fig 2.1 Satellite Image of Erode Central BusTerminus-1

Fig 2.2 Satellite Image of Erode Central Bus Terminus-2

III. DATA COLLECTION AND ANALYSIS

3.1 Volume count analysis

The volume count survey was conducted on December 20th 2015 from Morning 6.00A.M to December 21st Morning 6.00A.M. The traffic count was done at every 10 minutes interval. The counted value was used to find out the peak hour traffic flow and critical entrance/exit.

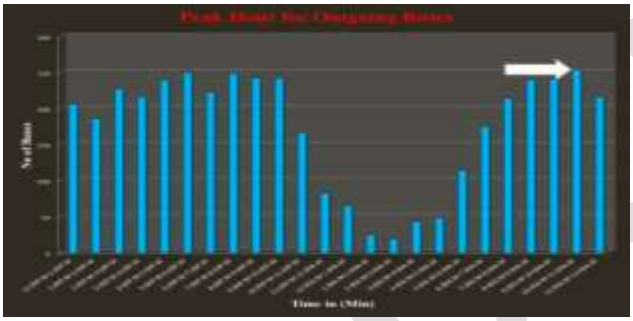


Fig 3.1 Peak Hour for Outgoing Buses

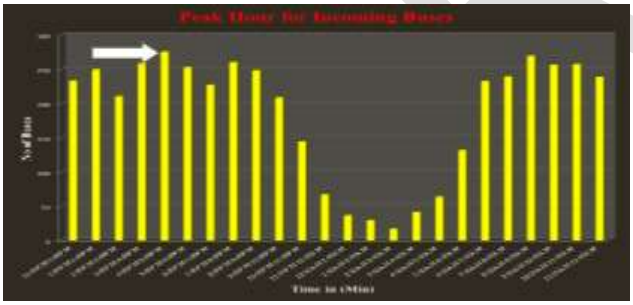


Fig 3.2 Peak Hour for Incoming buses

Note: Peak hour for incoming buses is 4.00 P.M – 5.00 P.M and for outgoing buses 10.00 A.M -11.00 AM

3.2 Platform survey analysis

Platform survey was conducted on February 25th 2016 Morning 10.00A.M to 11.00A.M. From volume count survey, the time period 10.00A.M to 11.00A.M was identified as the time interval at which maximum number of buses leaves the bus terminus. Platform survey was conducted for finding the ultimate handling capacity of a platform. The platform consists of number of bays. In Platform count survey, each platform was counted separately. The sum of occupancy time and waiting time is commonly called as 'Dwell time'.

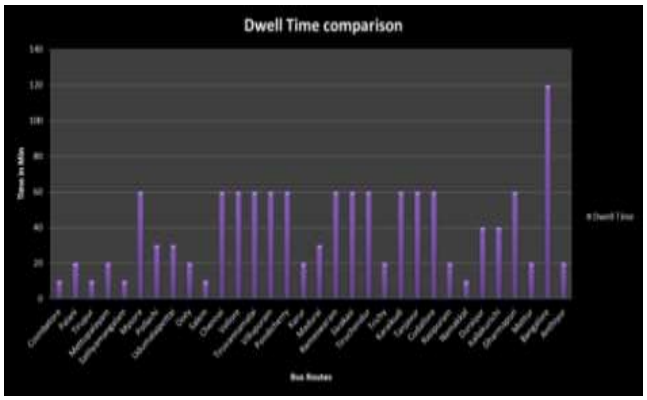


Fig 3.3 Dwell Time Comparison

3.3 Bus analysis

Analysing the bus services is essential for calculating number of bay need for each bus services.

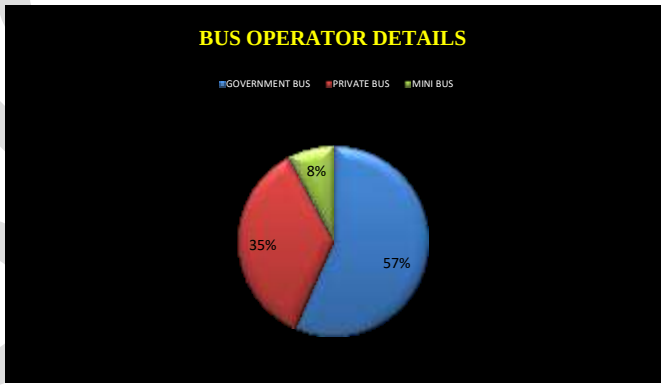


Fig 3.4 Bus Operator Details

Table 3.1 Bus Service Percentage

Town bus	Mofussil bus	Mini bus
1669	2491	306

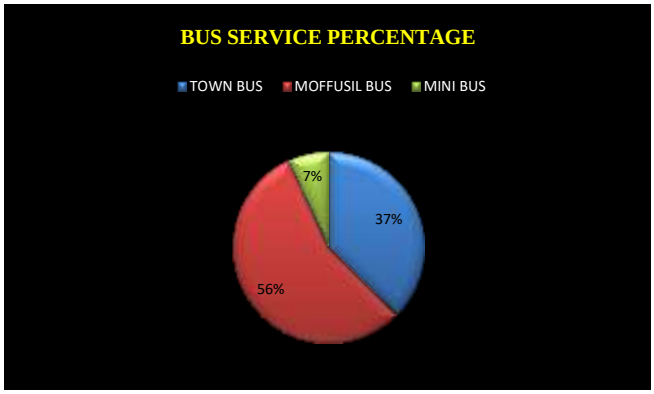


Fig 3.5 Bus Service Percentage

3.4 Bay Separation

For allocating the buses in a platform, route wise bay separation is necessary. The table 3.2 shows the bay allocation for each bus routes.

Table 3.2 Bay Allocations of Bus Route

Route	No of Platforms
Coimbatore	5
Palani	2
Tirupur, Sathy	4
Mysore, Anthiyur	2
Mettupalayam, Ooty	1
Salem	7
Madurai/South	4
Trichy/East	6
Duraiyur, Attur	1
Omalur, Namakkal	2
Kallakurichi	1
Mulanur, Karur	2
Mettur, Dharmapuri	2

3.5 Need for new bus terminus

Erode central bus terminus was designed for handling a maximum capacity of 200 buses inside the terminus. 4000 buses using the terminus everyday as of February 2016. Number of buses coming inside the terminus during the peak hour is 276 and at the same time leaving is 252. The results from the volume count survey shows that the handling capacity of buses inside the terminus exceeds. Increase in number of buses increasing the demand of the platform. Erode bus terminus is provided with 73 bays. This is not sufficient for handling the present capacity of buses. It increases the traffic congestion inside the bus terminus. Also, the passenger flow is heavy in the terminus. An average of 1 lakh persons using this terminus every day.

3.6 Location of New Terminus

Erode city is well connected in bus service with all the districts in Tamilnadu and also provided with well access to nearby states such as Kerala, Karnataka, Andhra Pradesh, Pondicherry. Therefore planning for new bus terminus in three locations is necessary to integrate all the city bus routes. The newly selected locations are Solar, Thindal and Chittode.

3.7 Present Terminal Usage in Future

The existing central bus terminus may be used for city bus services along with few mofussil routes of Tiruchengode direction buses.

3.8 Population forecasting

For this study the population was forecasted for next 5 decades from the year 2011. The population forecasting was done for Erode city, Bhavani, Perundurai, Pallipalayam, Poondurai and Kumarapalayam. Population expected in 2061 is 26, 41,145.

IV. LAYOUT

4.1 Layout of Solar bus terminus

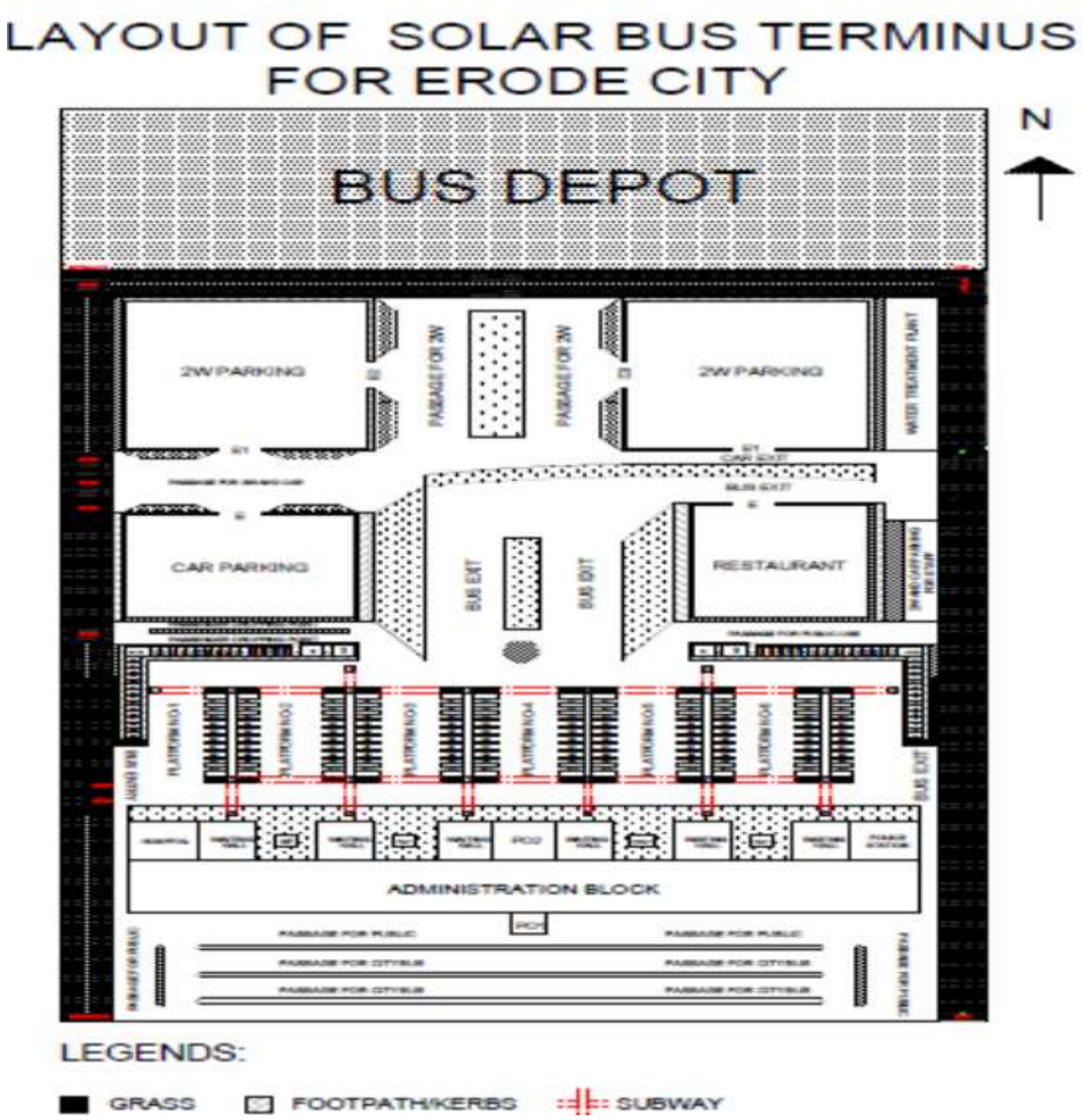
Route Separation Madurai, Trichy and Palani direction buses

Table 4.1 Bay Separations and Time Interval

Route	Time interval In (Min)	No of Bays	
		Waiting buses	Departure buses
Madurai, Vellore	15	4	4
Dindigul, Kambam, Kumuli	30	2	2
Rameswaram, Sivakasi, Rajapalayam, Paramakudi, Nagercoil, Tirunelveli, Thoothukudi, Udangudi, Tenkasi, Kovilpatti, Ramanathapuram, Tiruchendur, Ervadidharha, Senkottah, Thondi	15	8	8
Palani, Kodaikanal	20	10	10
Karur, Trichy, Mulanur, Vellakovil	10	5	5
Tanjavur	30	2	2
Ottanchattiram, Dharapuram	10	5	5
Other Trichy directions	15	8	8

4.1.1 Detailing and Dimensions

- Total No of Bays provided as per the requirement based on routes is 120
- Male toilet: Washbasin 2’ x 2’ Toilet 3’ x 4’ Urinals1.5’ x 2’ Male toilet 24’ x 22’
- Female Toilet: Wash basin 2’ x 2’ Toilet 3’ x 4’ Female toilet 27’ x 22’
- Parking capacity of cars is 3125. Two separate building of size 190’ x 260’ having 4000 racks of automated car parking
- Parking capacity of bike is 43750. 2 buildings of size 275’ x 275’ having 7300 racks of automated bike parking.
- ATM (7NOS) of size 20’x20’
- Shop (50NOS) of size 400 ft^2
- Restaurant with an area 7600 ft^2
- For convenience of passengers, kiss and ride facility is provided for passengers coming from taxi, auto etc.,



4.2 Layout of Thindal bus terminus

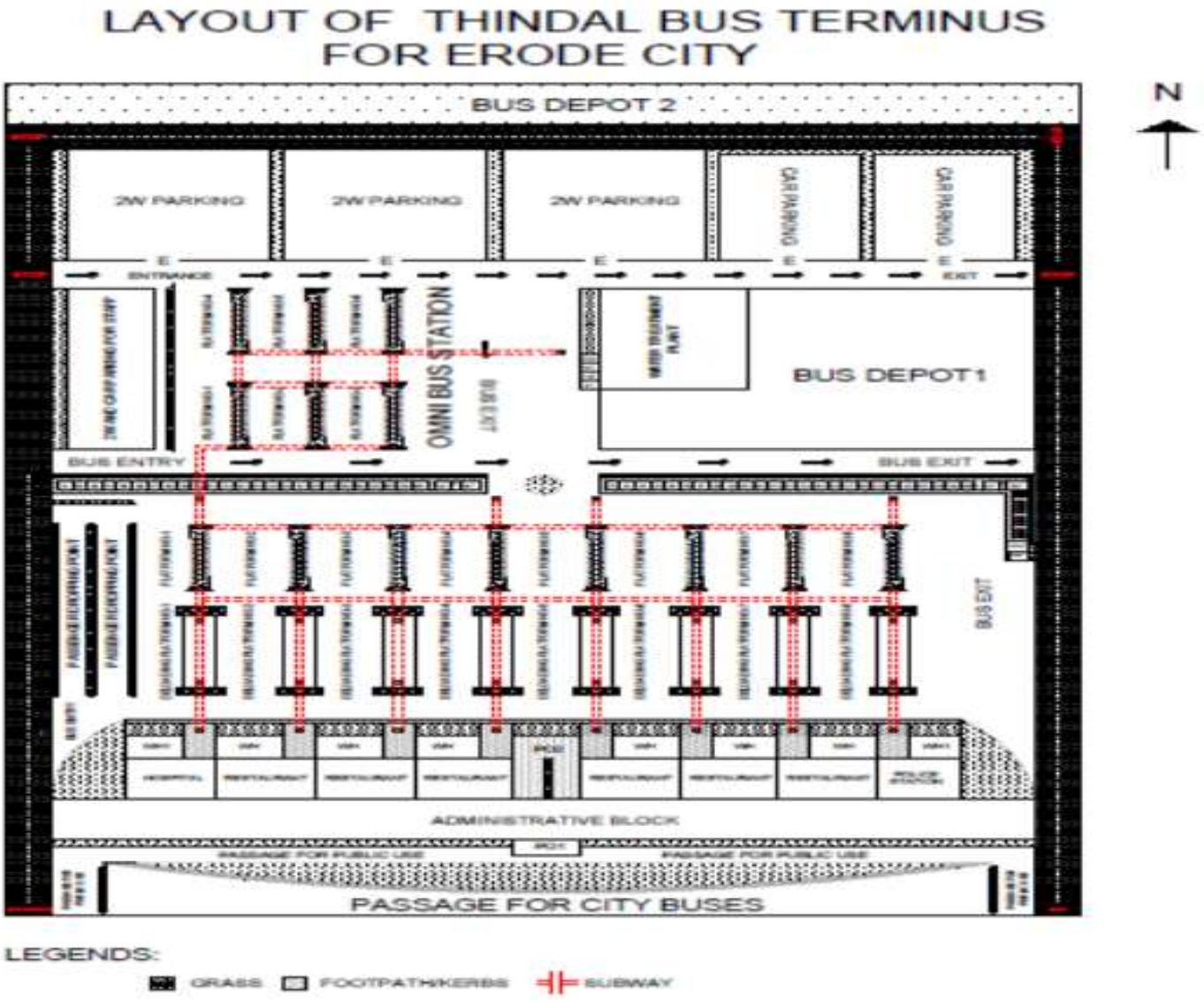
Route Separation Coimbatore, Tirupur and Mettupalayam direction buses

Table 4.3 Bay Separations and Time Interval of Buses

Route	Time interval In (Min)	No of Bays	
		Waiting buses	Departure buses
Coimbatore	3	20	20
Palakkad	30	2	2
Valparai, Guruvayur,Ernakulam, Tirussur	60	1	1
Tirupur	3	20	20
Ooty, Palladam, Pollachi	10	5	5
Udumalpet	15	4	4
9Mettupalayam	5	12	12
Kothagiri, Nanjanadu, Thalur, Gudalur	15	4	4

4.2.1 Detailing and Dimensions

- Total No of Bays provided as per the requirement of scheduled number of buses is 160
- Male toilet: Washbasin 2' x 2' Toilet 3' x 4' Urinals 1.5' x 2' Male toilet 24' x 22'
- Female Toilet: Wash basin 2' x 2' Toilet 3' x 4' Female toilet 27' x 22'
- Parking capacity of cars is 5209. 2 buildings of size 190' x 260' having 4000 racks of automated car parking
- Parking capacity of bike is 73000. 3 buildings of size 275' x 275' having 7300 racks of automated bike parking
- ATM (7NOS) of size 20'x20'
- Shop (50NOS) of size 400 ft^2
- Restaurant with an area 13500 ft^2
- For convenience of passengers, kiss and ride facility is provided for passengers coming from taxi, auto etc.,



4.3 Layout of Chittode bus terminus

Route Separation Chittode and Salem Direction buses

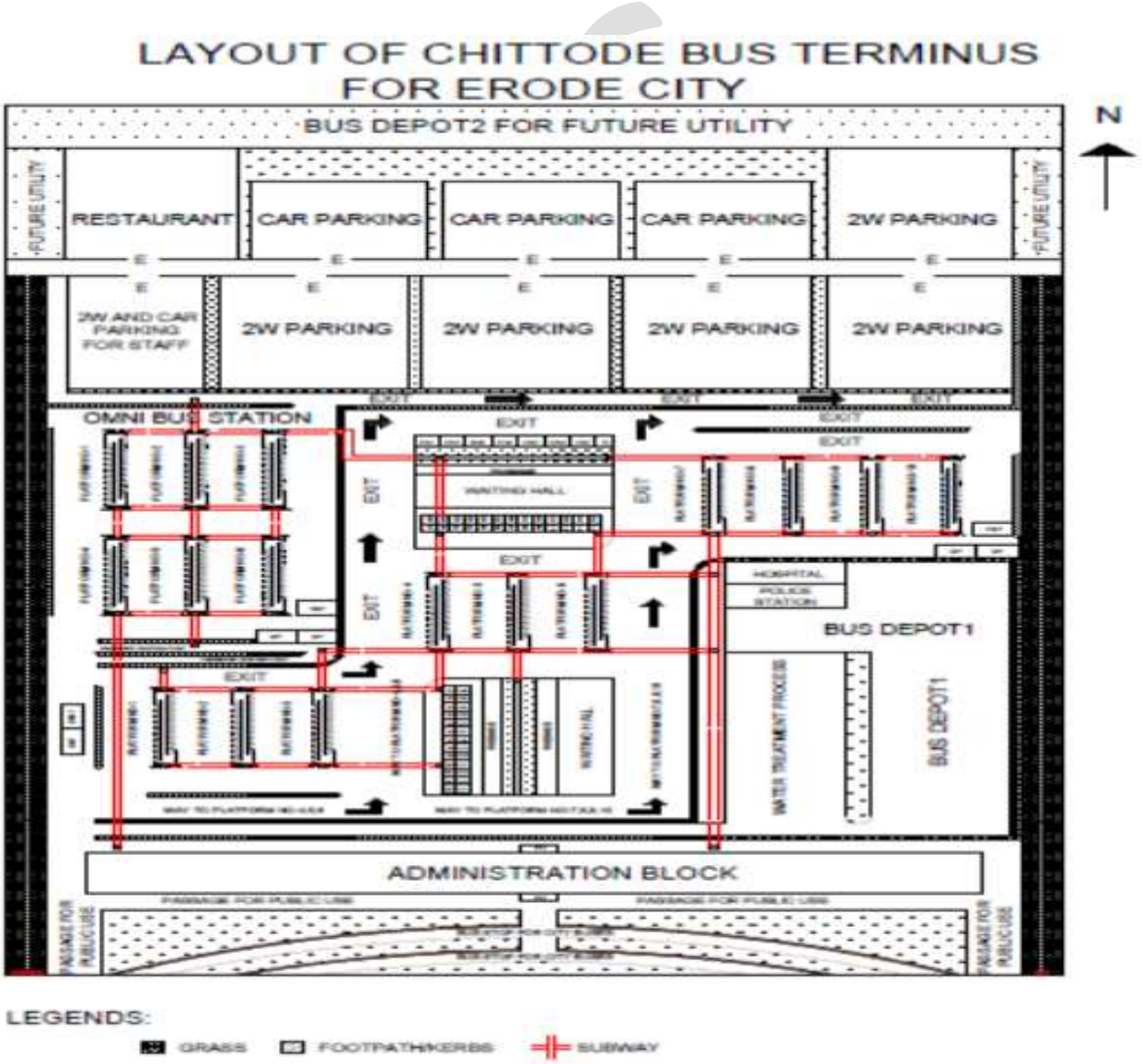
Table 4.5 Bay Separations and Time Interval of Buses

Route	Time interval In (Min)	No of Bays	
		Waiting buses	Departure buses
Sathy, Salem	3	20	20

Gobichettipalayam	5	12	12
Mysore	30	2	2
Dharmapuri	15	4	4
Krishnagiri, Hosur	60	1	1
Bangalore	75	1	1
Mettur, Karkegandi, Anthiyur	5	12	12
Thalavadi, Bannari, Panahalli	60	1	1
Edappadi	10	5	5
Poolampatti, Vanavasi, Kolathur	30	2	2
Nerinjipettai, Madeswaran Malai, Hokenakkal	120	1	1

4.3.1 Detailing and Dimensions

- Total No of Bays provided as per the requirement of scheduled number of buses is 200
- Male toilet: Washbasin 2’ x 2’ Toilet 3’ x 4’ Urinals 1.5’ x 2’ Male toilet 24’ x 22’
- Female Toilet: Wash basin 2’ x 2’ Toilet 3’ x 4’ Female toilet 27’ x 22’
- Parking capacity of cars is 7350. 3 buildings of size 190’ x 260’ having 4000 racks of automated car parking
- Parking capacity of bikes is 105000. 5 buildings of size 275’ x 275’ having 7300 racks of automated bike parking
- ATM (7NOS) of size 20’x20’
- Shop (50NOS) of size 400 ft^2
- Restaurant with an area 67500 ft^2
- For convenience of passengers, kiss and ride facility is provided for passengers coming from taxi, auto etc.,



V. CONCLUSION

The rapid increase in growth of population and migration of people from rural areas for various aspects increases the need of bus transportation. The bus services are increasing rapidly for the past two decades. It leads to more traffic congestion on the roads and inside the bus terminus. It causes hindrances to the safe movement of buses and passengers inside the terminus. In order to reduce the traffic vulnerability and traffic congestion and to enhance the safe movement of buses it is necessary to plan the terminal at various locations in and around the city limit. In this project, a Central bus terminus in Erode City was chosen as a study area because of high traffic congestion and passenger density. The terminus was analysed and planned for safe and efficient movement of buses and suitable measures are suggested. Finally, this project helped to gain a practical knowledge in the field of Infrastructure Engineering in Civil Department during the work. This project would give a better suggestion for Erode Bus Terminus.

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