

Feasibility of Long Haul Bus Terminal (LHBT) on Chala Bypass in Thiruvananthapuram City

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ABSTRACT: Most of the public transport and transit systems especially unorganized private buses operating large sized and long haul buses are lacking adequate infrastructure facilities like parking bays, public information system, and passenger amenities. In the absence of adequate parking facilities especially at city centers, they are found to be one of the causes of chaotic traffic situation. It is necessary to provide off-road bus station facilities for the convenience of passengers and to reduce traffic congestion. A well-equipped bus terminal catering to the large sized long haul buses can better fit within constrained city centre locations and make for improved integration of transport and land use, essential to supporting the economic, social and environmental objectives of the transport infrastructure. The main beneficiaries of compact bus terminals and interchanges are the public and the transport facility managers. Appropriate selection of location and designs based on scientific demand assessment is attempted in this paper to deliver a Long Haul Bus Terminal compatible with other sustainable transport goals. Compact interchanges are envisioned here which will require more intensive use of space but ultimately this planning and design approach will also result in increased ridership and better durability.

KEYWORDS: Public transport facility, Long Haul bus terminal, Demand assessment, parking accumulation, Design of terminals, Integration with modes

I. INTRODUCTION

Thiruvananthapuram has a well-connected bus service to all the cities of Kerala and many cities in the States of Karnataka, Tamil Nadu and Andhra Pradesh. Regular long distance bus service to the cities such as Bengaluru, Chennai, Coimbatore, Mumbai, Hyderabad, Ernakulam, Thrissur, Kozhikode, Velamkanni and Madurai are operated by both State owned Kerala State Road Transport Corporation (KSRTC) and many private operators. In this regard, Thiruvananthapuram Development Authority (TRIDA) proposes to establish a Long Haul Bus Terminal (LHBT) in 5.5 acres of land owned by TRIDA at Chala near Attakulangara – Killippalam Bypass (Figure 1) and entrusted NATPAC the task of assessing the viability of Long Haul Bus Terminal along with other components like conventional centre and commercial blocks in the proposed location. Viability of a facility is determined by aspects like commercial patronage, technical design, economic and social benefits, financial returns etc. In the present study, commercial patronage and technical design are considered while financial returns are not evaluated although provision for commercial facilities is made in the design.

NATPAC, based on detailed assessment of large sized buses operating from Thiruvananthapuram city, has conducted a scientific study and presented alternative design options for the identified location to cater to the bus bay requirements of long sized buses during peak hour along with other auxiliary facilities for the operating centre. This could be adopted as a rational approach for similar transportation planning studies.

II. SCOPE AND OBJECTIVES OF THE STUDY

The scope of the study is limited to the number of large sized buses operating from Thiruvananthapuram central area. The main objectives of the study are:

- Assessment of the existing number of large sized buses operating from Thiruvananthapuram city to different destinations
- Estimation of the future demand for the next 20 years
- Conceptual layout design for the LHBT
- Assessing the technical feasibility of establishing a LHBT within the available land at Chala



Fig 1: Location of proposed Long Haul Bus Terminal in Thiruvananthapuram City

III. DEM AND ASSESSMENT OF LARGE SIZED BUSES

Assessment of the potential demand for the large sized buses is the prerequisite for planning and designing of the infrastructure. Demand estimates are also critical for planning operations, and predicting the financial viability of the system.

The demand analysis considered both existing demand and the future demand and includes the following steps;

1. Compiling daily operation of various large sized buses through the study region according to their origin and destination.
2. Compiling the time wise schedule of the operation of large sized buses and identify the peak time of service and the peak time demand
3. Estimation of total large sized buses in operation in existing scenario and future forecasting

Operation of Large sized buses – Present Scenario (2015):

Major operators of large sized bus services from Thiruvananthapuram are SRM Transports, Kallada Travels, A1 Travels, Golden Pearl Travels, Greenline Kerala, Royal Travels, Bharathi Travels, Mookambika Travels, Standard Travels, Universal Travels, Bethlehem Transports etc as shown in figure 2.



Fig 2: Volvo buses parked in city centre

The different bus types available from Thiruvananthapuram to different destinations are Volvo A/C Multi Axle, Volvo A/C Multi Axle Semi Sleeper, Volvo A/C -Multi Axle Semi-sleeper, Non A/C Seater, Volvo A/C Multi Axle Semi-Sleeper.

Departure of buses:As on 2015, it was found that 56 bus services were operated from Thiruvananthapuram city between 01.00PM and 10.30PM in a day. The highest number of 12 buses was departing between 09.00 PM and 09.30 PM.

Arrival of buses:Regarding arrival of these 56 large sized buses, it is found that they arrived in the city between 04.30 AM and 11.00 AM in the morning, the highest of 16 buses arriving between 06.00AM and 06.30 AM.

Idle Parking of buses:The buses during non-operating time park their vehicles in their own premises located around Thampanoor area. It is found that more than 90 percent of the large sized buses were in idle parking between the day hours of 9:00:00 AM and 4:00:00 PM. All the 56 large sized buses were observed to be idle parked between 10:30:00 AM and 1:00:00 PM. Parking accumulation observed in the vicinity of the city central areas is shown in the Figure 3.



Fig 3: Parking accumulation of large sized buses during the day time

Operation of Large sized buses– Future Scenario:

Future demand for large-sized buses is estimated by projecting the existing demand for various horizon years using growth rate method. A conservative growth rate of 3% is adopted by considering the following factors.

- Traffic growth on major roads in Thiruvananthapuram City, have varied between 2% and 5% as per different studies conducted by NATPAC during the last 25 years
- Growth of population is hovering around 0.55% during the last decade in Thiruvananthapuram city
- Vehicle population is growing at an average rate of 11% per annum
- State Gross Domestic Product has witnessed a growth of 15% during 2014-15.

- The average trip length in Thiruvananthapuram city is 7km in 2016 which is showing an increasing trend. However, the per capita trip rate remains steady at 1.07.
- The share of public transport modes is about 40% in Thiruvananthapuram as per study conducted by NATPAC in 2016, of which long distance trips constitute about 15% of the public transport trips.

Table 1 depicts the future demand of large sized buses.

Table 1: Demand Assessment for Future Years

Design period(years)	Projected Year	No of large sized bus operations per day	No of large sized bus in peak time interval (30 minutes)	No of bays required (with service time of 15 minutes)
0	2015	56	12	6
5	2020	65	14	7
10	2025	75	16	8
15	2030	87	19	9
20	2035	101	22	11

It is estimated that 75 buses per day will be in operation in the year 2025 and 101 buses per day in the year 2035. It was found from the analysis that the peak time of departure of large sized buses will be between 9.00pm and 9.30pm with a total number of 12 large sized buses departing from the proposed terminal. Considering a service time of 15 minutes for each bus a total number of six bus bays will be sufficient to meet this peak demand. The peak demand for the projected years of 2025 and 2035 are 16 and 22 respectively. Hence peak demand of the number of bus bays will be respectively eight and 11.

IV. LOCATION, LAYOUT AND DESIGN OF TERMINAL

Design considerations

It is essential that stations are not only constructed to a suitable design and with adequate capacity, but also that they are suitably located. Layout of LHBT was prepared taking care of the human accessibility as well as better circulation of the buses housed in it. The bus terminal design was adapted to facilitate the mobility of various types of users including differently abled people. The trade-off between the operating flexibility and curb length has been evaluated. The following aspects were incorporated in the alternative designs prepared.

- Integration with other modes for first and last mile connectivity
- Segregated Parking Facilities
- Auto rickshaw and taxi Stand
- Pedestrian sidewalk and crossing with raised table top crossings
- Universal Accessibility

The major static characteristics or dimensions which are of concern in designing bus bay layouts are as listed in Table 2.

Table 2: Static Characteristic of Large sized Buses

Particulars	Maximum values
Length	13.8 m
Width	2.55 m
Height	3.7 m
Turning radius	10.5 m
Capacity	49 heads

Financial considerations

Provision for commercial spaces and priced parking spaces are incorporated in the terminal for generating adequate revenue so as to make the construction, operation and maintenance of various facilities in the terminal self-supporting and self-sustaining. Located close to the Chala market, East Fort city bus station, and Padmanabha Swamy temple, which attracts thousands of people of everyday from within the city and outside, the patronage for the commercial activities are almost assured and it is expected that commercial spaces would generate adequate revenue.

Proposed design of Long Haul bus terminal

Three alternative layouts have been worked out for the proposed terminal with minor variations from the general layout. The general layout design proposed for the LHBT consists of multi-storied complex with facilities for parking

bays for 16 buses at a time in the ground level and commercial area in other floors. While the bus-bay is proposed in the middle, a multi-level parking is provided in the northern part of the plot, and entrance building in the southern side which comprise of lobby, ticketing area, information centre, waiting area, restaurant, bus office and toilet area. Taxi and auto stand along with garage and fuelling pump is on the western side of the plot. Number of floors for the terminal complex as well as multi-level car parking can be decided by TRIDA based on requirement as well site specific characteristics and FAR.

Each level of the multi-level parking area can cater 164 four wheelers and 96 two wheelers. Ramps are proposed for entry/ exit of parking vehicles for each floor. Taxi and auto stand can cater 20 taxis and 19 autos at a time. Drop-off area is given in the front area where all vehicles can drop-off passengers or shoppers. Stair and lifts are provided in the commercial and parking block.

In each of the design alternatives, a separate entry/ exit lane is given for the personalized mode users to enter/ exit the multi storey car parking in the LHBT. This has been done to reduce the conflicts likely to be experienced during the arrival/ departure of large sized buses.

Among the three alternative designs, the following deviations from the general design are incorporated.

Alternate Design1:

Alternate design 1 is shown in Figure 4. Movement of buses inside terminal design 1 is in clockwise direction. Vehicular entry and exit has been segregated to avoid conflicts. The bus bay area is in double storey height. Bus-bays are angular which makes it necessary to reverse before exiting. Ample circulation space is provided to ensure smooth manoeuvrability of buses.

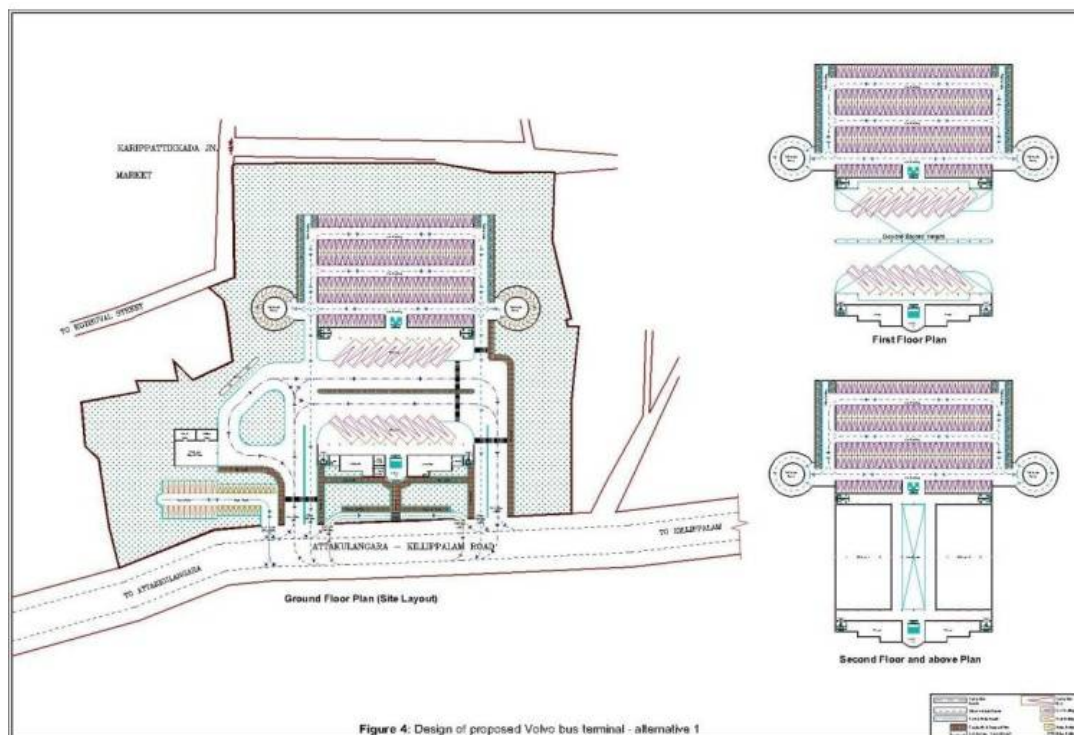


Fig 4: Design of proposed Volvo bus terminal- alternative 1

Alternate Design 2 Alternate design 2 is shown in Figure 5. Unlike Design 1, a single vehicular entry and exit is provided so as to avoid pedestrian conflict with vehicles. Accordingly, the positioning of bus bays is modified.

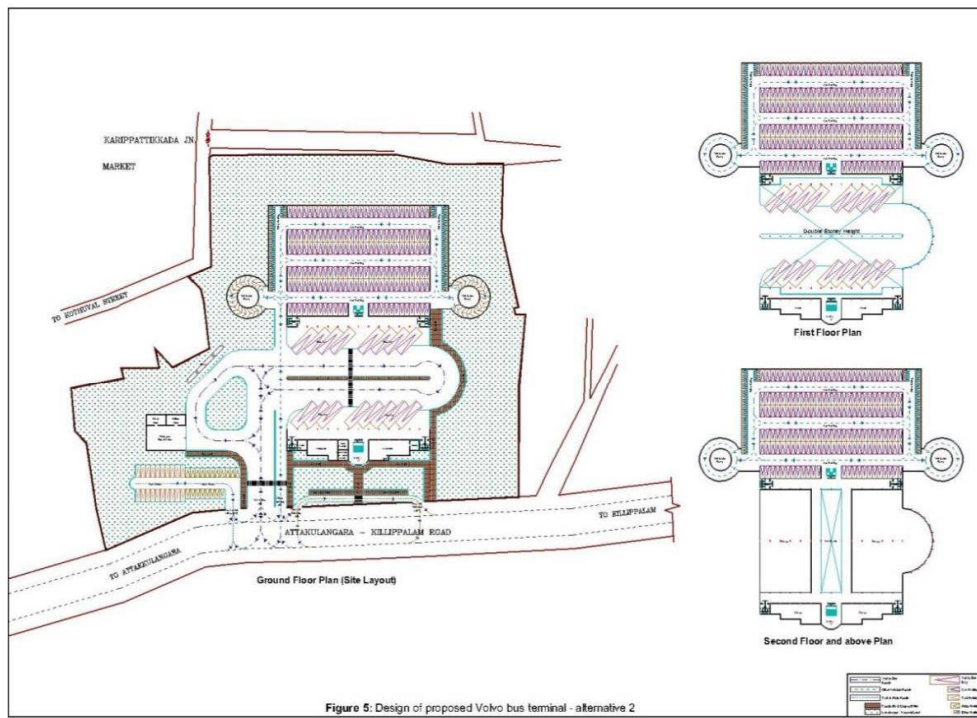


Fig 5: Design of proposed Volvo bus terminal- alternative 2

Alternate Design 3: Alternate design 3 is shown in Figure 6. The major difference of this design from the other two is that the bus bay is designed in such a way that the whole area is separated from both the commercial part and the parking area by means of the bus passage. Relevant passenger amenities are also been provided in that area.

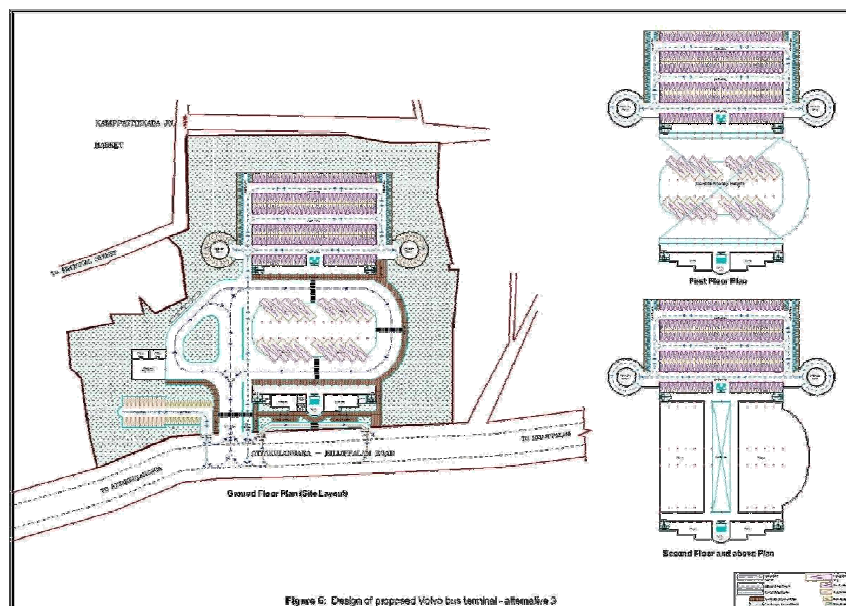


Fig 6: Design of proposed Volvo bus terminal- alternative 3

V. EVALUATION

The existing demand of large sized buses at the central area of Thiruvananthapuram city, was found to be 56 which is projected to 101 in the horizon year of 2035. To cater to the demand, the LHBT proposed by TRIDA on 5.5 acres of land along the Chala bypass between Attakulangara and Killippalam have been evaluated in terms of the bus bay requirements, auxiliary facilities like parking lots, garage, passenger amenities and other design considerations. Accordingly, three alternative designs of bus terminals have been proposed for the identified location which also incorporates commercial areas within the available land. Adequate open spaces have been provided to allow for future expansion also. A total of 16 bus bays have been demarcated in the alternative design options of the proposed LHBT

which can satisfactorily meet the demand for the next 20 years as well. Revenue generating sources are incorporated in the design so as to make the terminal self-supporting.

REFERENCES

- [1] Public Transport Authority, Govt of Western Australia, "Design and Planning Guidelines for Public Transport Infrastructure", 2003.
- [2] A Framework for Supporting Transit in Western Australia, "A Practitioners Guide to Bus Movement and Priority." March, 2011.
- [3] National Transportation Planning and Research Centre (2014), Report on "*Technical Study on the Proposed Bus Station at TechnoparkinThiruvananthapuram*", 2014