Retraction

Retraction: Assessing the Demand of Road Infrastructure Adjacent to Terminal Stations (*IOP Conf. Ser.: Mater. Sci. Eng. 1145 012011*)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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Assessing the Demand of Road Infrastructure Adjacent to Terminal Stations

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Abstract. The aim of the research work is to find out factors affecting the road improvements for the roads adjacent to the bus terminals. Transport is the basic utility which serves for the people in the aspects of daily demand. The traffic existing around the core area of the city is usually high when compared with roads connecting city with highways. Bus transportation is the basic need for public transportation of a city. The demand of bus transportation increases day by day due to more usage of peoples migrates from various locations to the city area. The infrastructure development in bus terminus is still a big question mark whether the terminus improvement exists as per the increase in traffic capacity or not. The reason behind the analysis is that the improper arrangement of existing road furniture’s without any possibility for future expansion as per increase in demand. The solution for the traffic problem occurs around the bus terminuses was identified and the standards for the terminal elements were made. This helps the pedestrians and vehicles to make a smooth flow of traffic around the terminal area.

1. Introduction
In many cities, the road adjacent to the terminal stations like Bus terminus, Railway station and Airports carries heavy traffic due to the activities of passengers, commercial hubs and most economical activities. This leads to the reduction of traffic handling capacity of roads. Therefore, in order to improve the terminal access areas, there may be some changes required in terms of engineering point of view. The traffic operations costs are also to be analysed when the traffic behaviour becomes more critical at a particular location [1]. The identification of risk factor one of the most important stages in order to allocate the risk. The observations made from this study are that the risk factors are classified based on the factors affecting the expansion and changes in alteration such as land acquisition and overall operating cost [2]. In case the signal is located nearby the terminus the Traffic Congestion becomes more vulnerable.

2. Literature review
The [3] describes a capacity-based bus dwell time based on the three components such as,

- Curb side spaces (Single buses can stop for loading and unloading)
- Bus stops including one or more loading areas

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Bus facilities such as roadways used by buses at stops along their length

In the work [4] states that the capacity of the bus terminus based on loading areas for reliability and accessibility of public transport. To understand the capacity of the terminal the starting point is the loading area capacity. Dwell time is used as a starting point with the model includes average dwell time, clearance time, effect of traffic signals behind or in front of bus stop and queuing of buses formulation. The [5] describes the methodology using bi-level optimizing model for assigning the routes of public transport to increase the capacity. It focuses the optimal route stop assignment shows that the 10% average increase in speed and 5% reduction in user cost.

3. Demand of Terminal Infrastructure
This research work expresses the demand of terminals in terms of infrastructure with design elements and terminal movements. The review of the current situation explains that the lacking in resource materials and handling capacity of buses [6]. Detailed planning and guidelines for designing the bus the bus terminus cannot be arrived easily but the demand for external factors can be arrived based on the analysis of existing traffic conditions. The terminal infrastructure further focuses on arriving the building capacity of passengers. The roads adjacent to terminal stations decide the traffic behaviour inside the terminal area [7]. At once stage, the design of terminal elements restricted due to a smaller number of spaces available. In some situations, it can adoptable for the present condition but comparing with future handling capacity this will be a big question mark. The major challenges that the transportation Engineers facing to design the external terminal elements are entry and exit turning radius of a bus terminus. The problem behind the single entry/exit terminals is there is no separate path for pedestrians and vehicles [8]. A well-functioning bus terminus having separate path for entry and exit with separate path for pedestrians and vehicles.

4. Guidelines and Suggestions of the Study
As per NUTP (National Urban Transport Policy) the following documents were mentioned,

- Increasing the usage of public and non-motorized transport mode through central financial assistance.
- Establishing the quality based multi modal transport system in public access to provide the best transport service among all other modes.
- Establishing effective regulation and enforcement mechanism to all the operation for transport services and enhanced safety for the transport system users.

This guideline helps to meet the terminal recommendations and different types of terminal complex elements [9]. With reference to the above-mentioned guidelines this study suggests the below mentioned guidelines to be framed for improving the research on quality based public bus terminal infrastructural design.

- Design of terminal elements layout should be prepared based on the demand of land availability, passenger capacity and bus operational services.
- Peak time movement of vehicles (both inside and outside) must be ensured with proper traffic management measures.
- Dwell time and half time must be taken into account while deciding the number of bays allocating for arrival and departure of buses.
- Index values must be framed based on the terminal size, location and handling capacity of the terminus.
- Ensuring safety and streamlined traffic movements with all the amenities have to be framed.
- Provision of safe and easy access for both vehicles and passengers, to and from the terminal. The following Figure 1 explains the difficulty in entry of buses from Erode Bus terminus.

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- Provision of safe and easy access for both vehicles and passengers, to and from the terminal. The following Figure 1 explains the difficulty in entry of buses from Erode Bus terminus.
The entry of Erode central bus terminus is provided with barricades for restricting the private movement of vehicles. The movement of private vehicles occurs due to non-availability of two-wheeler parking system [10]. The road adjacent to bus terminal is Mettur road which is having a PCU value of 4500/hr. Therefore, the buses coming from the West and South directions enter in this way. While taking the right turn from Mettur road to enter the bus terminus there is a huge delay due to traffic in opposite direction [11]. Thereby queuing of vehicle occurs which causes the traffic jam at long time. The remedy for the bus terminus as suggested by the researchers was shifting the bus terminus to various locations at the outer periphery of the city.

5. Design Consideration of Terminal Adjacent Roads

5.1. Index value

Index value is the value that represents the change in nominal values relative to the base value. The tolerance limit for each terminus has mentioned below based on the capacity of the terminus. These index values are analysed after collecting data from 100 bus terminus in various locations of the country [12]. The roads adjacent to the bus terminus handling traffic influences the outer terminal elements such as Kiss and Ride parking, Passage of city bus services, Road furniture’s and pedestrian movements [13].

| Type of Bus terminus | Capacity of the terminus | Index value | Severity |
|----------------------|--------------------------|-------------|----------|
| Integrated bus terminus | 10bays                  | 0           | Low      |
|                       | 10 – 25 bays             | 1           | Medium   |
|                       | >25 bays                 | 2           | High     |
| Intercity bus terminus | 10bays                  | 0           | Low      |
|                       | 10 – 25 bays             | 1           | Medium   |
|                       | >25 bays                 | 2           | High     |
| Intra city bus terminus | Bays not applicable | It can be defined based on the space availability of the bus terminus or based on the allocation of buses in various routes. | NA       |
Note: The capacity of the bus terminus can be defined based on number of bays.

**Table 2.** Index values of bus terminus based on the area

| Type of Bus terminus     | Area of the bus terminus | Number of bays | Index value | Severity |
|--------------------------|--------------------------|----------------|-------------|----------|
| Integrated bus terminus  | 1 acre                   | 10bays         | 0           | Low      |
|                          | 1.5 acre                 | 10 – 25 bays   | 1           | Medium   |
|                          | >1.5 acres               | >25 bays       | 2           | High     |
| Intercity bus terminus   | 10bays                   | 10bays         | 0           | Low      |
|                          | 10 – 25 bays             | 10 – 25 bays   | 1           | Medium   |
|                          | >25 bays                 | >25 bays       | 2           | High     |
| Intra city bus terminus  | Bays not applicable      | Bays not applicable | It can be defined based on the space availability of the bus terminus or based on the allocation of buses in various routes. | NA |

The above Tables 1 and 2 represents the capacity of the terminus based on the minimum index value to serve the people. The requirement must be satisfied before analysing the design of traffic in adjacent roads and its widening terms. This should not interfere with the traffic movement inside and outside the bus terminus [14]. For example, the road expansion of the adjacent roads outside the terminal area may interfere with the inner area of bus terminus in the form of flyovers or underpasses sometimes the road has to be constructed inside the terminal area [15]. Therefore, while considering these facts the external elements of the terminus with respect to adjacent road developments should meet the value of minimum terminal requirements as mentioned above.

5.2. Calculation of Terminal area segregation based on demand of any type of Bus Terminus

**Table 3.** Calculation of Terminal area segregation

| Bus terminus type     | Area               | Area distribution percentage |
|-----------------------|--------------------|------------------------------|
| Integrated bus terminus | Buildings          | 20%                           |
|                       | Terminal operation | 60%                           |
|                       | Public utilities   | 5%                            |
|                       | Parking            | 5%                            |
|                       | Passenger dropping | 5%                            |
|                       | Passages for city buses | 5%                        |
### Table 3: Calculation of Terminal area segregation

|                      | Buildings | Terminal operation | Public utilities | Parking | Passenger dropping | Passages for city buses |
|----------------------|-----------|--------------------|------------------|---------|--------------------|-------------------------|
| **Intercity bus terminus** |           |                    |                  |         |                    |                         |
|                      | 20%       | 60%                |                  | 5%      | 5%                 | 9%                      |
|                      |           |                    |                  |         |                    |                         |
| **Intra city bus terminus** |           |                    |                  |         |                    |                         |
|                      | 10%       | 60%                |                  | 1%      | 1%                 | 10%                     |

The above Table 3 shows the Calculation of Terminal area segregation.

### 6. Factors Deciding the Terminal Capacity

In general, the terminal capacity is affected by the following mentioned factors,

- Type of bus terminus
- Size and shape of the terminus
- Area of the terminus
- Volume of passengers
- Location of the terminus (land area slope or flat)
- Availability of construction and maintenance materials
- Accessibility/Location of bus terminus for easy access
- Basic public utilities
- Design of subway
- Economical factors

The above-mentioned factors are related to the planning factors for bus terminus. The below mentioned are the factors affecting the operational requirements.

- Design speed inside the terminal area.
- Platform design such as (distance between two platforms, width of the platform, structural design and aesthetical view).
- Bay design and width.
- Parallel offset between bays.
- Perpendicular offset between bays.
- Turning radius of a bus and other vehicles.
- Passage requirements of a city bus and the space allocation (area requirements).
- Subway design for passenger movements.
- Kiss and Ride parking.
7. Conclusion
The rapid growth of population increases the services of public transportation both in intercity and intra city routes from the past two decades. The infrastructural planning along with improvement in service is a major threat in many terminals of India. The road adjacent to the terminal affects the design of both inner and outer terminal elements. The reason behind this concept is that there are no standards followed based on the demand for designing the bus terminus in terms of both structural design concepts and transportation planning concepts. This research focussed on the factors affecting terminals based on terminal area and traffic surrounding the terminus with the help of analysing traffic from 100 bus terminuses from various locations of India. The above values help the researchers to conduct a study on identifying the problems involved in designing the bus terminus at various location to meet the demand of terminal elements.

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