

Development of a Framework to evaluate the use of Passenger Amenities of the Bus Terminals in India

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Abstract — User satisfaction of bus terminals depends on the physical aspects of people and psychological state of mind. Better public transportation network contributes to the nation's development. Evaluation of user satisfaction help design a better public transport. This paper describes a framework to evaluate the user perspectives of good passenger bus terminal. By referring to the extensive literature, constructs and items of user satisfaction are shaped into a questionnaire survey tool. Methods of data collection, validation and analysis of the framework are discussed in the subsequent sections of the paper.

Index Terms — Passenger satisfaction, bus terminal, questionnaire, accessibility, comfort, safety, passenger services

I. INTRODUCTION

Passenger satisfaction is an important term, that will change from person to person and companies to companies. Evaluation of passenger satisfaction is complicated, as it is related to the physical aspects of people and psychological state of mind. Studies are conducted to understand passenger attitude and passenger's satisfaction for the services availed [1]. It will worth to list out the knowledge that drives customer satisfaction and dissatisfaction in public transport domain. This will help design a better and profitable public transport. A good public bus transportation framework is a significant factor for the development of a nation [2]. The limitations of the public transport system shall

open areas for improvement, and will aid to the advancement of the nation.

II. STATEMENT OF THE PROBLEM

Review of the literature, observation of bus terminals and hearing the complaints of the amenities have indicated that the present state of art / management of public bus terminals in India is generally poor. Public buses are operated by the Government and private bus service providers. Gap between passengers wants and provision of the available facilities is reason for people to shift towards other mode of transport which offers safer and comfortable services. But own transport is expensive, train, metro and water transport are not widely applicable [3].

Public bus transport services, being the most indispensable, help the people for mobility. Every passenger wants to avail better and comfortable travel. Study of the passenger amenities and layout of bus terminals will list out the gap (difference between that is needed and that is available for a convenient, safe and user's friendly passenger experience). Evaluation of the operation of the selected bus terminals, based on selected check points will provide avenues for improvement.

A. Need of the Study

- Bus terminals are very important mode of passenger transport.
- Users expect safe, accessible, convenient and comfortable transport.
- Lack of facilities prompt people to migrate to other transport modes.

- Collecting passenger opinion, observing the working and analysis of data can contribute ideas for the betterment of service.

B. Objectives of the Study

1. To assess satisfaction of passenger amenities and facilities of the selected bus terminals.
2. To propose solutions that will enhance passenger amenities and facilities

III. METHODOLOGY

This study aims to measure the passenger satisfaction and evaluate the data for evolving betterment suggestions. Review of the existing literature, theory of facilities layout design and contemporary research literature help identify the measurable constructs and methods. User satisfaction can be revealed by questionnaire surveys and hence a structured questionnaire is the main tool of the study. Indicators are identified from similar studies. Physical observation and expert discussion are also used.

Data collection is planned by distributing questionnaires as Google form. The data is sorted, screened, tabulated, coded and analyzed with IBM SPSS Statistics and AMOS.

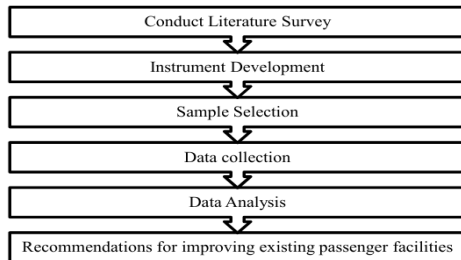


Figure 1
Methodology

IV. MAIN POINTS OF LITERATURE REVIEW

A. Passenger Satisfaction - It is a measurement of how a given service fulfils the passengers’ expectations. In the context of public transport, satisfaction is defined as a customer’s overall experience with a service compared to his or her pre-defined expectations [4]. Service quality is the only consideration, which will affect the choice of passenger. In order to be successful, they should aim at improving their service and its quality

Singh (2016) identified the areas for improvement of passenger satisfaction with public bus transport services [5]. Among the five factors used, comfort and safety are got most impact on overall satisfaction. To retain existing passengers and attract people, understand the problems of commuters and adapt changes to improve satisfaction level are needed.

Kumar & Anand measured the level of customer satisfaction of services offered by Uttar Pradesh State Public Transport Corporation [6]. They classified the factors most critical to satisfaction and decision making towards opting a service and surveyed data with a questionnaire.

Ghosh & Ojha (2017) measured passenger satisfaction of platform-based amenities [7]. Regression analysis, service quality performance and user satisfaction index applied. Results confirm poor state of amenities at Kanpur Central Station.

Del Castillo *et al.* (2013) surveyed the quality of public transport [8]. Questions were asked to people and the ratings were recorded, factors of quality of services were identified and these factors are then ranked. Important items identified are line reliability, adequacy of bus stops, punctuality, connection with other operators and service frequency

Abou-Zeid & Fujii (2016) evaluated levels of significance [9] and satisfaction experienced by passengers for conveniences on amenities of platform at Allahabad Junction, India.

B. Bus Terminals

A bus terminal is the point where a bus route starts or ends, where vehicles stop, turn or reverse, and wait before departing on their return journeys. It is where passengers board and alight from vehicles. It provides a convenient point where services can be controlled [10]. The size and nature of a terminal may vary, from a roadside bus stop with no facilities for passengers or bus crews, to a purpose - built off-road bus station offering a wide range of facilities.

There are five considerations when designing a good terminal i.e. terminal capacity, passenger level of service, accessibility, commuter safety and passenger amenities. This translates into an environment that facilitates quick, comfortable, and safe movement of people within and around terminals.

From the literature four factors identified to measure passenger satisfaction of a bus terminal are:

1. Accessibility
2. Comfort
3. Safety and Security
4. Passenger Services

V. SCHEME / PLAN OF STUDY

1. Three bus terminals are selected for the conduct of study. After physical visit, review of literature and theory, necessary terms for the evaluation of passenger satisfaction are understood. CAD drawings of the bus station layouts are prepared.
2. Facilities of the bus stations such as display of time table board, Drinking water, Toilets (ladies & gents), Seating arrangements (waiting), Enquiry counter, Public address system, Cycle / Scooter Stand, Suggestions & complaint book, Refreshment room, Tea stall / Cool drinks stall, Book Stall, Advance reservation facility, Weighing machines, Telephone Booths, Closed Circuit Television, Porter trolley facility, Wheel chair facility, ramp for easy walking, safer heights of platforms for entry and exit, facilities for the physically challenged, first aid facilities are listed [3], [7], [8], [9].
3. Questions are phrased with multi choice option. Five - point Likert's scale questions are prepared in Google form.
4. Pilot study conducted and necessary corrections have been done after discussing with experts from academics.
5. Data collected from the users of three bus terminals, screened, coded and tabulated.
6. T- tests and Chi-square tests are used to test hypotheses (assess passenger satisfaction).
7. Cross case evaluation of the condition of three bus terminals are to be done.
8. Listing the priorities of bus terminals by ranking the conditions of the amenities and services. Suggestions are formulated
9. Conclusions are to be made by summing up the suggestions for improvement.

A. Sampling and Data Collection

Convenience sampling is used. Students and people available online are used for the survey. Google forms are circulated online and responses are recorded in Excel sheet.

B. Design of the Questionnaire

The questionnaire is divided into two sections. First part is personal data of the respondent and the second part is based on four factors of passenger satisfaction. Five point Likert's scale is used (with options ranges from Very Poor to Very Good).

Demographic factors include age, gender, occupation and purpose and frequency of journey. Accessibility of bus terminal is revealed by asking two questions. Thirteen questions are formulated to infer comfort. Perception of passenger services are inferred by asking four questions. Three questions are used to measure safety and security of passenger terminal. One direct question is used to measure overall passenger satisfaction.

VI. TYPE OF ANALYSIS FOLLOWED

Data collected are analyzed in three sections using IBM SPSS Statistics software and AMOS.

In the first section pie charts and bar charts are used to indicate opinion about demographic factors. In the second section, validity and reliability and normality tests are conducted. Then descriptive analysis was carried out based on the respondent's details. Chi-square and t-tests are done to check whether the indicators of passenger satisfaction show significant difference from reference values chosen.

Reliability analysis - (Cronbach's alpha is used to assess whether the questionnaire is meaningful to the respondent [11]. Correlation between sub-items is used to check collinearity. For the descriptive analysis, mean, median and quartiles of each indicator items are used. Convergence of the indicators to a single construct are checked with exploratory factor analysis.

Ratings can be summed up for each indicator and mean scores can be calculated. Positive and negative attributes can be segregated. Negative attributes (responses less than neutral = 3, in the Likert's scale are concerns. Values more than 3 are plus points). Significant difference in opinions from the mean score (reference score is 3, Neutral) can be tagged with the application of Chi-square tests and t-tests [12].

Attributes can be ranked on the basis of mean scores. Common limiting factors can be studied and suggestions for improvement for the bus terminals in

general can be drawn. A regression model is formed with the constructs, Accessibility, Comfort, Security and Passenger Service as independent variables and overall satisfaction as dependent variable. The framework is shown in the Figure II. This model and framework is tested with AMOS Software. Each path coefficient represent the regression scores (linkage with overall satisfaction). The coefficients can be evaluated.

Cross case analysis can be done by comparing the responses for three bus terminals. By the application of industrial engineering tools, such as layout charts and analysis of facilities layout, specific solutions for improving the services of three bus terminals can be listed. Cross case studies can be conducted by choosing demographics such as Age, Gender and Occupation of the user and conclusions can be drawn.

VII. FRAMEWORK AND HYPOTHESES

The following framework is used for the conduct of study and subsequent analysis:-

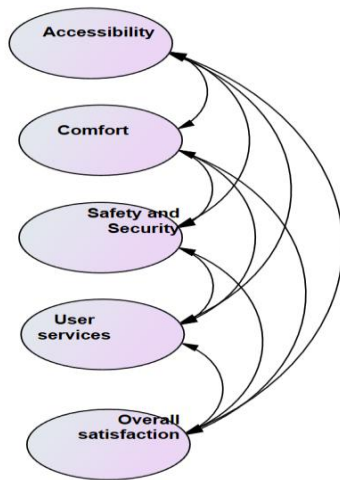


Figure 11
Measurement Model

A measurement model and structural model is used for testing and conformation of the proposed theory. It is basically a regression model. Four independent variables, namely Passenger accessibility of bus terminal, Comfort, Safety and security and Passenger Services are the dependent variables. With a multiple regression model, above mentioned four dependent variables are used to predict the dependent variable

“Overall passenger satisfaction”. The multiple regression equation is given by,

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4,$$

where, Y represents the numerical score of overall passenger satisfaction and X₁, X₂, X₃, X₄ respectively are the numerical scores of the dimensions of passenger satisfaction.

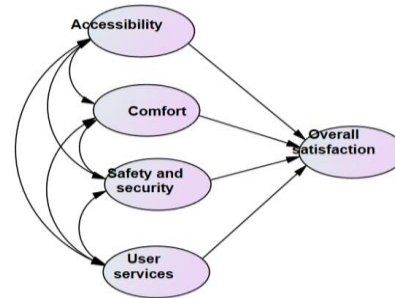


Figure III
Structural Model

Following hypotheses are used to test the influence of variables on customer satisfaction:-

H_{1/2/3/4}: There is no significant influence of Gender / Age of passenger / Occupation / frequency of travel on the satisfaction of bus terminal amenities

H_{5/6/7/8}: There is no significant difference in the satisfaction levels of the constructs (Accessibility, comfort, safety and passenger services) from the reference scores selected

H_{9/10/11/12}: The constructs of passenger satisfaction have got significant influence on overall usage level by the passenger

VIII. CONCLUSION

The study of the user satisfaction of bus terminals is important because it leads to the identification of bottlenecks and making further improvement. The paper describes a plan and framework to evaluate the user satisfaction level of passenger bus terminals and subsequent analysis with the support of industrial engineering theory.

The responses of the users to the items asked in the questionnaire are valuable, as it indicates the level of

physical, physiological and psychological need satisfaction by the user. After testing the hypotheses and inferring the results, suitable alternatives for improving the present condition can be evolved. This will result in the betterment of facilities available to the citizens of the nation.

We have started the pilot testing of the questionnaire. Analysis results and cross case comparisons will be reported in another paper.

REFERENCES

- [1] Aklilu Workie, - Evaluation on inter city bus terminal in Addis Ababa M.Sc. thesis, College of Business Technology, Kotebe University, Adis Ababa, Ethiopia, January 2025.
- [2] Witjaksono, A. D. (2018, January). Analysis of Bus Station Services with Importance Performance Analysis: Empirical Results of Gerbangkertosusila Region. In IOP Conference Series: Materials Science and Engineering (Vol. 288, No. 1, p. 012004). IOP Publishing.
- [3] B.Jagadesh, G. Nagasubramaniyan (2017). "Assesment of Service Quality of public Bus Transport system (TNST) Tiruchirappalli". International journal for research in Applied Science & Engineering Technology, Volume 5 Issue v.
- [4] Logeswaran (March 2017). Design standards for planning a bus terminus. International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST) Vol.3, Special Issue.24.
- [5] Singh, S. (2016). Assessment of passenger satisfaction with public bus transport services: A case study of Lucknow City (India). Studies in Business and Economics, 11(3), 107-12.
- [6] Kumar, M., Anand, V., & Srivastava, A. (2016). Public Transport Service Quality and Passenger Satisfaction: A Case of UPSRTC, Agra, India. Pacific Business Review International, 8(11), 82-92
- [7] Ghosh, P., & Ojha, M. K. (2017). Determining passenger satisfaction out of platform-based amenities: A study of Kanpur Central Railway Station. Transport Policy, 60, 108-118
- [8] Del Castillo, J. M., & Benitez, F. G. (2013). Determining a public transport satisfaction index from user surveys. Transportmetrica A: Transport Science, 9(8), 713-741.
- [9] Abou-Zeid, M., & Fujii, S. (2016). Travel satisfaction effects of changes in public transport usage. Transportation, 43(2), 301-314.
- [10] Jay S. Pandya1, Prof. Yogesh Patel (2018) of Gandhinagar bus terminal a Case study International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 01 Redesign.
- [11] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson and R.L. Tatham, "Multivariate Data Analysis", Pearson Education, 2011, New Delhi..
- [12] Norman Blaikie (2003), "Analyzing Quantitative Data: From description to explanation", SAGE Publication, London.
- [13] J, Podder, M. A. Ahamed, A. Abid and A. Noman, - A Case Study on the Satisfaction of Passengers and the Facilities of Bus Terminal in Dhaka City, Journal of Transportation Engineering and Traffic Management, 2025, Volume 6 Issue 1, e-ISSN: 2584-1823 DOI: <https://doi.org/10.5281/zenodo.14274331>
- [14] Darren George, SPSS for Windows (2008): Pearson Education, New Delhi.