Research Paper Engineering

PERFORMANCE ASSESSMENT OF SELECTED BUS ROUTES AT TRANSFER TERMINALS

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ABSTRACT

Mass Transit System is gaining popularity in the modern times due to increase in the fuel costs, traffic congestion due to more private vehicles, cheap fares and many more reasons. There are many problems associated with these systems like routing, scheduling and bunching of buses at the terminals. This research involves the performance assessment of selected bus routes at transfer terminals like Kalupur and Paldi which cater the maximum passenger demand of the major public transportation system AMTS (Ahmedabad Municipal Transport Services).. Arrival and departure pattern of the selected routes at the terminals is studied.. Multiple regression analysis correlating various parameters like overall travel time, route length, number of bus stops and number of intersections is performed and effect of intersections causing delay is determined. This research gives the idea of the performance of the terminals during different periods of the day.

KEYWORDS performance assessment, bunching, dwell time, multiple regression analysis.

INTRODUCTION

Public transport is a shared passenger transport service which is available for use by the general public, as distinct from modes such as taxicab, carpooling or hired buses which are not shared by strangers without private arrangement. One of the most common mode of service used in mass transit system are public transport bus services. They are generally based on regular operation of transit buses along a route calling at agreed bus stops according to a published public transport timetable. Some of the problems associated with public transport system are the problem of routing, scheduling and bunching of buses. Bunching of buses takes place when two successive buses have zero headway between them due to variation in traffic conditions and passengers embarking and disembarking so the leading bus has to serve more passenger demand and the following bus has to serve less demand as a result of which the leading bus is delayed and ultimately groups up with the following bus. These may be the core reasons affecting the terminal performance to a great extent and hence the system reliability must be ensured on the basis of its performance as mass transit caters 60% of the population demand for any country.

NEED OF STUDY

AMTS is one of the major modes of public transport in the city of Ahmedabad. Hence the study of this system's performance is needed so that better idea can be obtained about the system at the major transfer terminals which operate more than 150 routes of the city covering the entire network of the city.

OBJECTIVE OF STUDY

- To study the bus arrival pattern from different routes.
- To study the effect of probable number of intersections causing delay on bunching phenomenon.

REVIEW OF LITERATURE

Oded Cats and Azhar Al- Mudhaffar (2014) presented a regularity driven scheme by analyzing and testing two field experiments in Stockholm in which real time control strategy was to be obtained and investigated how it can be in accommodated in the business models. Headway distribution was considered as fundamental input for computing regularity indicators. Simulation by real time control strategies increased level of service and performance remarkably. Results showed that the time savings, reduced production costs and schedule adherence could be achieved.

Dejan Paliska, Jurij Kolence (2008) used a statistical approach and four statistical models to examine the bus system reliability in the city of Koper and considered bus bunching as the major cause of reducing service capacity. Multiple regression analysis was performed to determine the significant factors which affect transit service reliability. Estimation results indicated that delay variation at previous time point and cumulative distance were primary causes of service unreliability and not passenger demand.

STUDY AREA

Two terminals are selected as study area- Kalupur and Paldi. Kalupur terminal being the on street terminal carries huge traffic volume not only during the peak hours but also during off peak hours. AMTS, BRTS, ST and GSRTC buses all following the particular stretch along with the vehicular traffic cause severe congestion problems in this area. Paldi is commercial hub as well as a centre for various transport services like AMTS, GSRTC and various private operators. Paldi terminal is an off-street terminal at the Paldi Intersection.

DATA COLLECTION

The data like bus route number, actual arrival and departure time of bus from the terminal, scheduled time from the origin, number of bus stops between origin and destination, number of intersections between origin and destination passenger demand per year was collected from the concerned authorities and entered into Excel Sheet for the selected routes passing through Kalupur and Paldi.

DATA ANALYSIS

The arrival and departure time was arranged in ascending order to find the headway between successive buses and a distribution was obtained indicating the pattern of arrival and departure.

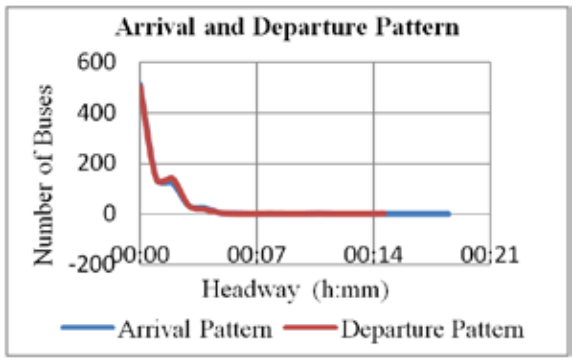

Figure 1: Arrival and Departure Pattern at Kalupur.

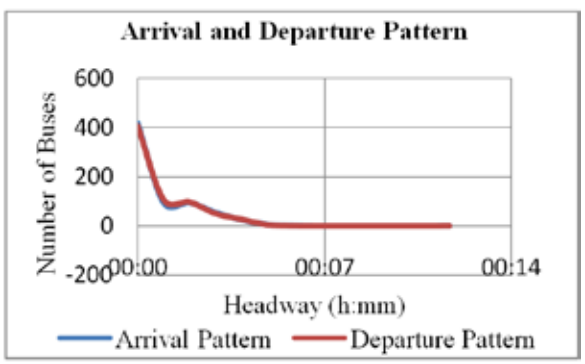

Figure 2: Arrival and Departure Pattern at Paldi.

MODEL DEVELOPMENT

Multiple Regression analysis was performed to get relation between parameters like route length, number of stoppages and number of intersections and the observed travel time by taking samples of selected routes. The equation obtained is as follows-

$Y=0.036874\ X_1+1.055547\ X_2+0.244245\ X_3+8.4725$

Where Y = Observed Travel Time

X_1 = Route length in meters

X_2 = Number of intersections

X3 = Number of bus stops

This equation yields a satisfactory value of R^2= 0.775 and can be used to study the effect of various parameters.

EFFECT OF INTERSECTION

The effect of intersection causing delay can be obtained assuming the average speed of bus as 30kmph and determining the time required to cover the route length at that speed. The difference between the observed time and the predicted time gives the time lost intersections. Different combinations of intersections are taken along with varying time lost. The pattern obtained for different number of intersections.

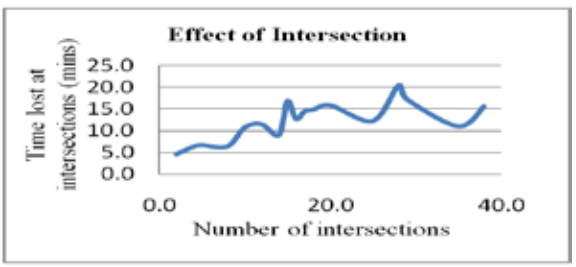

Figure 3: Effect of intersections causing delay

CONCLUSION

- It can be inferred from the graph of arrival and departure pattern that 95% of the headway intervals are between 0-2 minutes for Kalupur and 95% of headway intervals for Paldi are between 0-4 minutes which means that the buses have relatively small headway and can affect the terminal performance.
- The time lost at intersections increases with the number of intersections upto certain extent but there are cases when the intersections are more and time lost is less, since these routes may be longer routes and also may be away from the CBD (Central Business District) and may have less effect of intersections. The intersections away from CBD are minor ones: they do not have predominant effect on the delay.
- This delay can be one of the causes of bunching phenomenon.

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