Research Paper Engineering

Punctuality Index for the city bus service

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ABSTRACT

Public bus service plays a significant role in our society to facilitate travels within towns and districts. Public bus renders poor service.Punctuality index is one of the performance parameters in determining the service reliability.This study concentrates on evaluating the reliability performance of bus operation using punctuality index assessment.

KEYWORDS Punctuality Index, Reliability Performance, Service Performance,PIR,DIS,EIR

I. INTRODUCTION

PUBLIC transport has a crucial role in supporting modal shift, i.e., underpinning alternative to private vehicles and to provide quality transport for those without private vehicle. It is well-known for the use to support sustainable access,better road safety and improved air quality [1]. The public bus is an important component of the public transportation industry. It provides access to facilities, which contribute to social inclusion, thus becoming the backbone to a city performance. In order to fulfill the role as one of the essential public transport, public bus must serve quality means of travel and, from the passengers' viewpoint, can be evaluated with various measures. In particular, issues of reliability and punctuality should be assessed. Measuring the reliability of transit service is significant because both the transit passengers and the transit provider value reliable service. In addition, an accurate picture of service performance can provide passengers beneficial information to help them become active contributors in the transit policy and decision-making process and give agencies (or operators) input to identify and investigate service problems

This study concentrates on reviewing the reliability performance of a bus service using the punctuality index calculation,Punctuality of bus service is a quantitative measure of reliability. Punctuality, in particulars, is the comparison of actual departure times with scheduled departure times at station or stops. Chen et al considered three types of bus reliability measures, taking into account on reliability assessment on route, stop, and network level with different formulations related to one another. These are punctuality index based on routes (PIR), deviation index based on stops (DIS), and evenness index based on stops (EIS). PIR is defined as the probability of a bus to arrive at the terminals in a given time period. DIS is the ability to maintain headways and minimize a typical passenger's waiting time at stop level, and EIS is the ability to determine consistency and evenness of the headway between vehicles.

The punctuality index P1 is an index indicating the magnitude of a time gap between actual arrival time and scheduled arrival time, punctuality index P2 as magnitude of a time gap between actual headway and scheduled headway, and punctuality index P3 is an index indicating the magnitude of a time gap between average headway of a day and each headway of successive buses. Several studies have been conducted on punctuality index and on-time performance analysis of public bus service. A case study in Seoul concludes that the punctuality index during weekends when there was no traffic congestion is higher than those of the weekdays. Longer route length, more stops, and more number of passengers are among factors of punctuality to be worse. Another study in Perak, Malaysia has revealed that punctuality index of the public bus varies throughout the day at peak hour and off-peak hour due to traffic congestion, which led to higher travel time. However, punctuality index during weekdays and weekends are not significantly different.

METHODOLOGY

A. On-Board Data Collection Data collection is achieved using on board methodology where required input is recorded during bus rides. The collected data are scheduled departure time, actual departure time, departure and arrival time at each significant stop and at final destination along with the number of passengers boarding and alighting. These data will be employed to generate the punctuality index, travel time, passenger loading, and reasons of delays. The author can also distinguish the bus condition, driver's conduct, road and traffic characteristics, as well as passenger's behavior. This lead to questionnaire survey which aim to determine passenger's travel characteristics and satisfaction . Another method for this type of research is off-board methodology or referred as 'point check'. During a point check, checker is stationed at bus stop and records required data. This method captures more trips per hour but is usually more cost-effective than ride checks

B. Formulation

This study applies the formulation of punctuality index P1 as in (1) and (2) because data collected only complies with the specific formula. The formulation however, is taken into account with respect to departure time at the bus station. The reason is, occasionally a bus will arrive earlier than scheduled departure time, and therefore, the driver will wait until said scheduled time before departing. Besides, bus timetable at the bus station is based on departure time, not arrival time. Punctuality index, P=0 if all buses arrive on time, and P=1 for complete random arrival. For convenience, punctuality index, P can be converted into percentage value as in

$P\,(\%) = (1–P) \times 100$

This makes P=100% if all buses arrive on time, and P= 0% for the worst service

RESULTS AND ANALYSIS

In this study passengers from different parts of the city which are not covered by city buses can use the service provided by connecting buses (44-seater bus). These city buses are low-

floored bus with 27 seats and seven standing passengers' capacity; however, passengers loading could exceed the

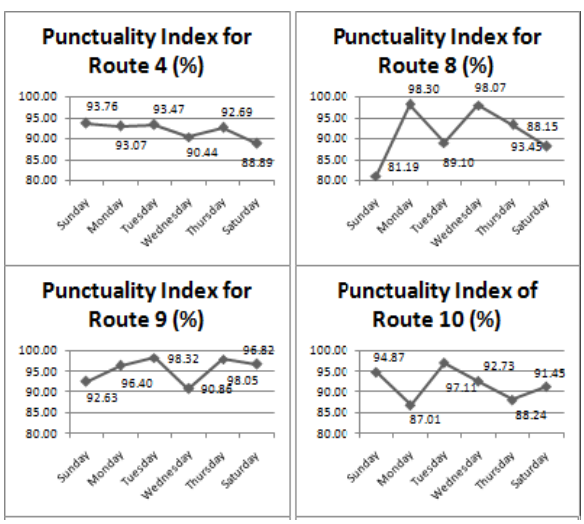
capacity during peak hour. The buses operate fixed-route service in mixed traffic, implying that there is no specific bus lane for the service. The mixed-traffic operation is straightforward for planning and political purposes, except resulted in buses being subject to delays caused by traffic. In mixed-traffic, a bus is exposed toautomobile traffic congestion and slows the automobile as itstops to serve passengers.

There are certain parts not covered by the service because the routes are already reserved for connecting bus service. If connecting buses routes overlap with city bus's routes, the buses will have to share passengers which are not good for business. Sharing route will ease passengers in affected areas

due to options of buses that can be boarded, however it is not fair for the passengers in the non-affected area. The reason is that, logically, when serving busy station during peak hour, the bus that departs first will be crowded. Therefore, the travel time will be greater due to traffic condition (peak hour) and the loading and unloading of passengers. This will eventually affect the punctuality of the bus for the next trip. Passengers who do not have other route

options might miss the first bus due to crowded passengers and have to wait longer for the next trip. This condition will affect passenger's satisfaction on the service in the long run. From information recorded during on-board data collection,

punctuality index as in (1) for each route is calculated and presented in Table III. Note that Pday is the punctuality index for the day, and Proute is the punctuality index for each route in a week. It is observed that punctuality index for the city bus routes are significantly high.



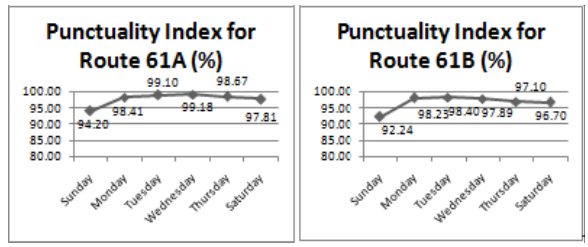


Figure 1 The Punctuality Index for six city bus routes by week.

Table 1
Punctuality Index For All Routes(%)

DAY	Route 4	Route 8	Route 9	Route 10	Route 61A	Route 61B	Pday
Sun	93.76	81.19	92.63	94.87	94.20	92.24	91.48
Mon	93.07	98.30	96.40	87.01	98.41	98.41	95.23
Tue	93.47	89.10	98.32	97.11	99.10	99.10	95.91
Wed	90.44	98.07	90.86	92.73	99.18	99.18	94.86
Thur	92.69	93.45	98.05	88.24	98.67	98.67	94.70
Sat	88.89	88.15	96.82	91.45	97.81	97.81	93.30
Proute	92.05	91.38	95.51	91.90	97.87	97.89	94.25

The information in Table I is demonstrated graphically in Fig. 1 for a comprehensive view on the punctuality index in this study. From observation, the punctuality indexes are not uniform due to traffic, driver and passenger's behavior because the characteristics vary randomly throughout the week.

From observation, the punctuality indexes are not uniform due to traffic, driver, and passenger's characteristics, as the characteristics vary randomly throughout the week. From Fig. 1, the punctuality index is most uniform for Route 61A with lowest punctuality on 94.20%. Punctuality index for Route 8 and Route 10 fluctuates throughout the week.

CONCLUSION:

On-board methodology is used to document required data to determine the punctuality index for the city bus service . The analysis done reveals that punctuality index for the whole city bus service network is 94.25% confirming that the punctuality index for city bus service in this study is satisfactory.

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This is the place to admit that while there appears only one author on the cover, this work is a product of the interaction and support from many people. I am thankful to all of them specially my parents & friends for their help and support during my entire work.

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