MODELLING OF PARK AND RIDE PROGRAMME FOR PENANG BRIDGE EXPRESS SHUTTLE TRANSIT (BEST)

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MODELLING OF PARK AND RIDE PROGRAMME FOR PENANG BRIDGE EXPRESS SHUTTLE TRANSIT (BEST)

by

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In The Name Of Allah The Most Gracious and The Most Merciful.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
BEST	Bridge Express Shuttle Transit
CCTV	Close Circuit Television
FTZ	Free Trade Zone
HOV	High Occupancy Vehicle
IA	Index of Agreement
KMO	Kaiser Meyer Olkin Measure
LRT	Light Railway Transit
MIROS	Malaysian Institute of Road Safety Research
MLR	Multiple Linear Regression Model
MBPP	Majlis Bandaraya Pulau Pinang (City Council of Penang Island)
MPSP	Majlis Perbandaran Seberang Perai (Municipal Council of Seberang Perai)
NAE	Normalised Absolute Error
O-D	Origin – Destination

PA	Prediction Accuracy
PCA	Principal Component Analysis
PI	Performance Indicator
R2	Coefficient of Determination
RMSE	Root Mean Square Error
SPSS	Statistical Package for the Social Science

LIST OF SYMBOLS

μ_1	Ridership route A
μ_2	Ridership route B
μ_3	Ridership route C
μ_i	Mean of route ridership
H_1	Alternate hypothesis
Ho	Null hypothesis
$\beta_1, \beta_2, \beta_3, \beta_4$	Coefficients
D_{t1}	Travel time - 5.30 am – 6.30 am
D_{t2}	Travel time - 6.30 am – 7.30 am
D_{t3}	Travel time - 7.30 am – 8.30 am
D_{t1}	Travel time - 4.30 pm – 5.30 pm
D_{t2}	Travel time - 5.30 pm – 6.30 pm
D_{t3}	Travel time - 6.30 pm – 7.30 pm
D_{d1}	Travel day (Monday, Tuesday, Wednesday and Thursday)
D_{d0}	Travel day (Friday)

βd	Constant (Departure)
β_r	Constant (Return)
D_{r1}	Route A
D_{r2}	Route B

PEMBANGUNAN MODEL *PARK AND RIDE* BAGI PROGRAM PENANG *BRIDGE EXPRESS SHUTTLE TRANSIT* (BEST)

ABSTRAK

Pada masa kini, kebanyakan bandar-bandar besar di Malaysia berhadapan dengan masalah kesesakan lalu lintas terutamanya pada waktu-waktu puncak. Pertambahan bilangan kenderaan di jalan raya di Malaysia menjadikan masalah ini semakin besar. Oleh kerana kapasiti jalan raya yang sedia ada tidak dapat menampung beban kapasiti kenderaan, keadaan traffik menjadi lebih teruk. Sebagai contoh, pengguna jalan raya perlu mengambil masa yang lama dalam perjalanan setiap hari dan ini adalah perkara yang menyebabkan produktiviti dan kualiti hidup terjejas. Oleh itu, penggunaan pengangkutan awam adalah sangat penting bagi mengatasi masalah ini. Walaubagaimanapun, sistem pengangkutan awam terlebih dahulu perlu dilengkapkan, dinaiktaraf dan berkesan supaya dapat menarik pengguna yang ramai. Penggunaan konsep *Park and Ride* masih belum meluas dipraktikkan di Malaysia. Kebanyakan penggunaan sistem *Park and Ride* ini adalah melibatkan sistem Rel. Kerajaan Negeri Pulau Pinang telah bekerjasama dengan Rapid Penang bagi memperkenalkan konsep bas baru untuk program *Park and Ride* yang digunakan khas untuk pekerja-pekerja kilang di kawasan *Free Trade Zone* (FTZ) di Bayan Lepas. Tujuannya adalah untuk mengurangkan tahap kesesakan lalu lintas terutama di Jambatan Pulau Pinang, mengurangkan bilangan kenderaan persendirian yang memasuki Pulau Pinang dan juga menggalakkan penggunaan pengangkutan awam di Pulau Pinang. Perkhidmatan ini dibiayai sepenuhnya oleh Kerajaan Negeri Pulau Pinang dan telah dilaksanakan sejak Mac 2011. Kajian ini dijalankan untuk melihat

prestasi program *Penang Bridge Express Shuttle Transit* (BEST) sedia ada dan juga membangunkan model penggunaan sistem *Park and Ride*.

Hasil kajian menunjukkan program BEST FTZ ini telah berjaya. Secara keseluruhannya program ini mencapai 60%-70% penggunaan daripada sasaran Kerajaan Negeri iaitu seramai 1000 pengguna sehari. Kajian ini menunjukkan terdapat tiga faktor utama yang mempengaruhi penggunaan program BEST FTZ ini, iaitu masa perjalanan dan kos pengangkutan, lokasi perhentian bas dan infrastruktur yang menyokong sistem pengangkutan awam. Akhir sekali, hasil daripada kajian ini satu model yang boleh digunakan untuk membuat anggaran penumpang bagi penggunaan program BEST FTZ di masa hadapan telah dibangunkan. Namun begitu, berdasarkan prestasi sedia ada, terdapat ruang dan peluang bagi menambahbaik perkhidmatan ini disamping mendapat input terus daripada pengguna dalam mengetahui masalah dan cabaran sebenar dilapangan. Dalam masa yang sama, Kerajaan Negeri Pulau Pinang juga ingin mencari formula yang terbaik untuk mengekalkan dan meningkatkan tahap penggunaan perkhidmatan ini.

MODELLING OF PARK AND RIDE PROGRAMME FOR PENANG BRIDGE EXPRESS SHUTTLE TRANSIT (BEST)

ABSTRACT

Currently, most big cities in Malaysia are confronted with traffic congestion, especially during the morning and evening peak hours. This may be attributed to the nation's rapid growth in vehicle population. As the existing road capacity is unable to accommodate the vehicle capacity, the traffic situation is getting worse. Drivers have to face longer travel times on a daily basis, and this adversely affects productivity, and quality of life. The role of public transport is very essential in solving this problem. However, the public transport system must be in place and it has to be efficient to attract the public. In Malaysia, the Park and Ride concept is quite new. Currently, the Park and Ride system is mainly applied to rail based public transport. The Penang State Government is collaborating with Rapid Penang for a new bus service concept with the Park and Ride program especially for factory workers in the Free Trade Zone (FTZ) area in Bayan Lepas. The purpose of this program is to reduce the severity of traffic jams especially on the First Penang Bridge to reduce the number of private vehicles entering Penang and also to promote the usage of public transport in Penang. This service is fully subsidized by the Penang State Government and has been operating since March 2011. This study was conducted to see the performance of the existing Penang Bridge Express Shuttle Transit (BEST) program and also to develop the Park and Ride model.

The results show that the BEST FTZ program has been successful, as a whole, reaching 60%-70% of Penang State's target of 1,000 users per day. The study also shows that there are three main factors affecting the use of this BEST FTZ program,

namely; travel time and transportation cost, bus stop location and infrastructure supporting the public transport system. Finally, as a result of this study, models that can be used to estimate the future usage of BEST FTZ program were developed. However, based on existing performance, there is room for improving this service as well as getting direct input from users in real-time problems and challenges. At the same time, the Penang State Government is looking for the best formula to maintain and improve the level of use of this service.

CHAPTER ONE

INTRODUCTION

1.1 Background

According to the Penang Transport Master Plan (PTMP) (2013), the usage of public transport in Penang was 11% of the total vehicle registered in 2012. The mode of public transport includes public buses, school buses and factory buses. The State Government of Penang aims to achieve 40% of mode share using public transport in Penang by year 2030 (PTMP, 2013). Therefore, to achieve this aim, many programs and initiatives were made to promote and support the usage of public transport including the Penang Bridge Express Shuttle Transit (BEST) in the Free Trade Zone (FTZ) area. This program is expected to reduce the level of traffic congestion on the First Penang Bridge in addition to encourage Penangites to use public transport.

1.2 Transportation in Pulau Pinang

Rapid Penang Sdn. Bhd. is a government owned company set up to operate PUBLIC bus services in Penang and has begun operations since 31st July 2007. Rapid Penang Sdn. Bhd. is the second public transport operating company set up by the Malaysian government. The first was RapidKL, which was set up in year 2004 to take over light rail transit operations and a large portion of the bus network in Kuala Lumpur. Rapid Penang was funded by the Ministry of Finance Incorporated and is a wholly owned subsidiary of Syarikat Prasarana Negara Berhad. Like Rapid KL, the assets to be operated by Rapid Penang belong to Syarikat Prasarana Negara Berhad.

According to Rapid Penang Official Website (2013), Rapid Penang now operates 350 buses with 47 routes including the Park and Ride services. All buses are built with low flooring to be friendly for the elderly and the disabled customers. Rapid Penang services does not only focus on profitable routes but also provide services in rural areas, where they are known as “social routes” because such routes are not profitable in view of the number of ridership and operation cost.

Rapid Penang is the only stage bus operator in Penang Island, while for mainland, there are few bus operators still competing with Rapid Penang such as City Liner and Rangkaian Setia.

However, Rapid Penang is the first stage bus operator in Malaysia that provides call centres where passengers can call to request for bus availability and expected time of arrival. All buses are equipped with GPS where it can be monitored from the control centre. This service shows improvement on stage bus operation and service to reduce passenger’s uncertainty and lure the public to use the public transport service.

City Liner mainly serves the mainland area and it is the subsidiary of Konsortium Transnasional Berhad (KTB). From the KTB official website (2013), the company has 32 buses plying over the main stream and also social routes. However, currently, these services are not much profitable and sometimes the Penang State Government has to subsidise City Liner to give the services to Penang citizens. Their main profit comes from the express buses that ply from Penang to other states in Malaysia. The services given by City Liner normally were different routes from the Rapid Penang

and will give a good business for them but they will have to compete with other operators in order to get passengers if they are plying on the same route. It's not a very healthy competition because the usage of public transport especially in the Seberang Perai area is low compared to Penang Island.

1.3 Bridge Express Shuttle Services (BEST)

This program was initiated by the Penang Transport Council back in 2010. The Penang Chief Minister fully supported the program and it was launched officially on 1st March 2011. The main purpose of the program is to reduce traffic jams on Penang Island and also reduce the number of vehicles using the Penang Bridge during peak hour especially in the morning. The operational cost for this service was subsidized by the Penang State Government. The BEST services started with 16 buses plying from Sunway Carnival to the FTZ, Bayan Lepas area. In the FTZ area, BEST operates on 3 major routes, namely; BEST A, BEST B and BEST C. Each route will ply with its own dedicated route to cover almost all of the FTZ area as shown in Figures 1.1 to 1.3 for Routes A, B and C respectively.

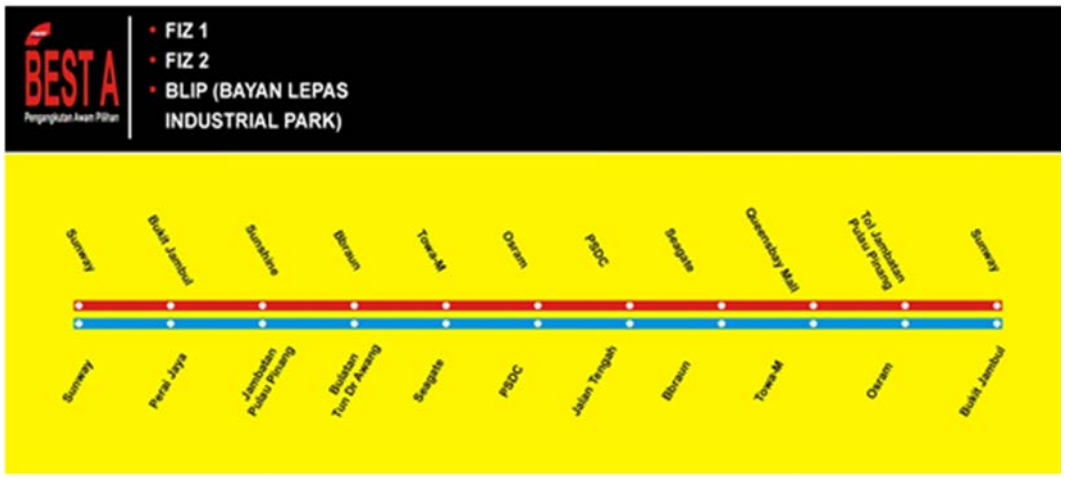

Figure 1.1: BEST FTZ Route A

Figure 1.2: BEST FTZ Route B

Figure 1.3: BEST FTZ Route C

1.4 Public Transport Usage in Penang

1.4.1 Bus Service Capacity

In Penang, local bus services are operating at or near to their maximum capacity for many parts of the day, on at least six days per week. This can be seen in the high proportion of services that carry standing passengers up to the legal maximum for

vehicles, and in many cases exceed the maximum. This is particularly true on more popular routes such as 101, 104 and 801.

The problem is at its worst at peak periods when, as a result of high levels of traffic congestion, bus operators are unable to maintain their normal frequencies. As a result, services level is reduced. Thus, at this point in time the bus service network has little or no space in capacity terms to act as an instrument of public transport policy unless ways can be found to increase its capacity especially by adding more buses for popular routes during the peak hours.

Also, this problem is at its worst for movements to and/or from Georgetown and to overcome this problem, Rapid Penang has provided some routes that depart or terminate in other urban areas in Penang. However, on the mainland, problems of service capacity appear to be less significant, although many journeys have been observed to carry passenger loads at capacity, notably to or from the ferry terminal during the morning and evening peak periods. There are also a large number of individual bus services operating in the Butterworth, Perai and Bukit Mertajam areas. Many of these are at relatively low frequencies, in part a reflection of the more dispersed, lower density development on the mainland.

1.4.2 Bus Service Reliability

Service reliability is essential if bus services are to be promoted as a viable and attractive alternative to the private car. The actual and perceived reliability are affected by several factors.

Traffic delays are the major source of unreliability, as described above, resulting in a decrease in service frequency at the periods of highest demand as buses take up 50% longer to complete a journey. In addition, as mentioned in the Penang Transport Master Plan (2013), bus operators have also reported that significant amount of mileage are lost as a result of staff shortage or staff absenteeism especially the bus captain.

The operators blame staff shortages on their inability to maintain a full schedule. They cite delays in recruiting new drivers due to administrative delays in the driver's test, and the difficulties in retaining drivers once trained. Absenteeism is also a major and unpredictable cause of services unreliability, and two operators blame labour laws, which they claim are too heavily biased in favour of the employee, notably in terms of the various appeals procedures available against dismissal.

1.4.3 Bus Service Comfort

The perceived and real difficulties with passengers and driver comfort are likely to have a major bearing on the attitude of existing and potential passengers to using buses. If these issues are not seriously addressed by operators and authorities, the bus will become the "mode of last resort", used mainly by those too young to drive, the elderly and also tourists.

Buses are perceived as dirty, hot, fume laden and uncomfortable. This is observed to be true for a large part of the local fleet. Until relatively recently, most service buses were built on commercial truck chassis or derivatives, resulting in vehicles with very high floors, a poor ride quality and high internal noise levels. These comments apply