# POST OCCUPATION EVALUATION OF LARKIN BUS TERMINAL

ASGAD FISAL ABDALLA MOHAMED KHIER

A partial fulfilment of the requirements for the award of a Master of Science degree in Transportation Planning of Universiti Teknologi Malaysia (UTM)

Faculty of Built Environment
Universiti Teknologi Malaysia

JANUARY 2012

# ABSTRACT

Effective public transportation depends on the system components efficiency and it's consider very essential to overall transportation network. Terminals as one of important component in the urban transport structure is selected to be the theme of this research, it is going to focus on bus terminal building in order to evaluate the nature of existing services and what is required to provide good transit services. The research is going to apply one of the famous building assessment concepts which is Post Occupation Evaluation (POE) in Larkin bus terminal as case study in order to have subjective and objectives feedback about the provided services, their quality and how to improve the terminals conditions. Due to urban transportation problems generally in Malaysia which is related to private transportation and poor utilities quality, the study emphasize on how to decline the private mobility and encourage more people to use public transport. The research seeks to study the bus terminal quality of services, performance and environment in order to attract more users to public transit services. To reach this, the study provides firstly proper review of terminal design specifications and considerations to identify the main attributes to be examined and assessed. Through 88 random samples, a survey had implemented in Larkin and structured to evaluated five attributes categories based on respondents satisfaction and importance which they are, Access and circulation, Internal and external environment, Passenger comfort and User information's. The demographic analysis of the respondents shows that majority of bus services users in Larkin are from low and moderate educated groups (school and university students). Importance- Satisfaction Analysis is used as analytical method which represent that among the five attributes safety and security groups considered as the most important one with high improvement priorities. In addition, the physical characteristics of the spaces are generally affecting the attributes evaluation, that lead to recommend more innovation of bus terminals design and transportation infrastructure concepts to take the users demands. Such evaluation studies will maintain providing a valuable information to public transport system, expose where the shortage, the loop and the needs for improvements.

# ABSTRAK

Pengangkutan awam yang berkesan bergantung kepada kecekapan komponen sistemnya dan ia sangat penting dalam rangkaian pengangkutan secara keseluruhan. Terminal sebagai salah satu komponen penting dalam struktur pengangkutan bandar dipilih untuk menjadi tema kajian ini, ia akan memberi tumpuan kepada bangunan terminal bas untuk menilai jenis perkhidmatan yang sedia ada dan apa yang diperlukan untuk menyediakan perkhidmatan transit yang baik. Kajian ini akan menggunakan salah satu konsep penilaian bangunan yang terkenal iaitu Post Occupation Evaluation (POE) di terminal bas Larkin sebagai kajian kes untuk mendapatkan maklum balas subjektif dan objektif mengenai perkhidmatan yang disediakan, kualiti dan bagaimana untuk memperbaiki keadaan terminal. Disebabkan masalah pengangkutan bandar secara amnya di Malaysia yang berkaitan dengan penggunaan pengangkutan persendirian yang tinggi dan kualiti penyediaan utiliti yang lemah, kajian ini menekankan kepada bagaimana untuk mengurangkan mobiliti persendirian dan menggalakkan lebih ramai orang menggunakan pengangkutan awam. Penyelidikan ini bertujuan untuk mengkaji kualiti perkhidmatan bas terminal, prestasi dan persekitarannya untuk menarik lebih ramai menggunakan perkhidmatan transit awam. Untuk mencapainya, kajian ini menyediakan kajian semula terhadap spesifikasi reka bentuk terminal dan pertimbangan untuk mengenal pasti ciri-ciri utama untuk diperiksa dan dinilai. Melalui 88 sampel rawak, satu kaji selidik telah dilaksanakan di Larkin dan distrukturkan kepada lima kategori untuk dinilai berdasarkan kepuasan responden dan kepentingan mereka, akses dan peredaran, persekitaran dalaman dan luaran, keselesaan penumpang dan maklumat pengguna. Analisis demografi responden menunjukkan bahawa sebahagian besar pengguna perkhidmatan bas di Larkin adalah dari kumpulan berpendapatan rendah dan berpendidikan sederhana (pelajar-pelajar sekolah dan universiti). Kepentingan-Analisis Kepuasan digunakan sebagai kaedah analisis yang menggambarkan bahawa di antara lima kriteria keselamatan, penyediaan pengawal keselamatan dianggap sebagai paling penting dengan keutamaan yang tinggi. Tambahan pula, ciri-ciri fizikal ruang secara umumnya memberi kesan kepada ciri-ciri

penilaian, yang membawa kepada cadangan penambahan idea inovasi terhadap reka bentuk terminal dan konsep infrastruktur pengangkatannya bagi mengambil kira keperluan pengguna. Penilaian ini akan penyediaan maklumat yang berharga kepada sistem pengangkutan awam, mengenal pasti kekurangannya, halangan dan keperluan untuk penambahbaikan.

# TABLE OF CONTENTS

# LIST OF TABLES

## LIST OF FIGURES

## LIST OF SYMBOLS

| | | |
|---|---|---|
| $N$ | - | The population size |
| $n$ | - | Sample size |
| $n_0$ | - | infinite sample size |
| $z\alpha/2^2$ | - | z value at confidence level 95% |
| P | - | percentage of respondents |
| E | - | desired margin of error which equal to 10% |

## GLOSSARY OF TERMS

| | | |
|---|---|---|
| POE | - | Post Occupation Evaluation |
| LOS | - | Level of Services |
| TCRP | - | Transit Cooperative Research Programme |
| TCQS | - | Transit capacity and quality of services manual -2nd edition |
| ISA | - | Importance Satisfaction Analysis |

# LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.0 Introduction

Transportation terminals and buildings are very substantial part of the spatial network and urban transport facilities. It is a point of services with certain criteria providing various transit facilities with central and intermediate locations in the movements of passengers and freight (Jean-Paul Rodrigue et al., 2006). Also it may be an interchange or transfer point between distinct routes of the same mode or different transportation modes as example from train to bus. The design characterise of terminal building is reflecting the quality of provided services, information's, spaces adequacy, circulations, security and appropriate facilities in order to satisfy the passengers demands. However, the reliability of those designs is defined by conditions when the building is under occupation, and how these terminals will sustain giving good quality of services. Terminal infrastructure planning and design is very important to support transportation system efficiency, reliability and system continuity.

The research is going to apply post occupation evaluation of the existing building properties in Larkin bus terminal to evaluate and monitor the quality of services. Looking forward to design perfect terminal facilities and to find proper

methods, to improve terminals design conditions and environment. By providing a high quality of services and proper conditions in bus terminals that will encourage more people to change their anticipation of public transportation and decline using of private automobiles. Awareness of design characteristic, required level of services and users adaptive behaviours now is the key for bus services and all mode of transport, to improve public transportation and detraction the recent movements and mobility striking troubles.

## 1.1 Background of Problem

Urban transportation in Malaysia facing dilemmas directly of private transportation which is generating high demand in traffic, causing congestion, injuries, and accidents and parking problems. Researches on public transportation behaviour in Kula Lumpur suggested the need of enhance efficient public transportation to attract more car owners all over the country, (Abdullah Nurdeen[1] et al., 2007) and (Zakaria et al., 2010). Bus terminal acts as core provide transit services support the economic and social development of surrounding area. Moreover poor quality of this utilities , design and building management such as waiting area ,bus departure and amenities will affecting the building performance and minimizing the number of passengers (see Figure 1-1) . The importance to enhance transit appraisal is to create comprehensive analysis framework, identifying the impact of cost and benefits for transit system, to diagnosis the existing problems in order to increase and improve the services (Institute,2011). According to (Program-TCRP19, 1996) defined that spacing, location and operation of bus terminal significantly influences transit system performance and customer satisfaction.

The concept of Post Occupation Evaluation is an assessment approach of building design performance from user's point of view. The most common definition was presented by Presiser and Rabinowitz (1988) that, post occupancy evaluation (POE) is the process of evaluating building in a systematic and rigorous manner after they have been built and occupied for some time. POE is providing subjective and objective feedback for both professionals and architects about design performance, user's demands, criticizing the critical problems and highlighting the expected solutions.

**Figure 1-1** Conditions in waiting areas.

In cases of bus terminal which is required to sustain space and services to fulfil the rider's needs, design factors like comfort, safety and efficiency are very important for passenger's transportation choices. Therefore, POE can play good role in defining the quality of services in those buildings and giving strong database and indicators for those who are designing, planning and managing transit services.

Also ,the design for bus terminal is quite different depending on diverse situations such as location, intended services, building capacity so and there is no specific slanders and information's for bus terminal because the concept of terminally tend to be in airports, train stations and central hubs. Therefore, it is needful to have feedback studies to define a minimum scale of required services to cover the recent needs and support transportation development. Terminal operational efficiency decides the whole efficiency of city transit system (ZHOU Xuemei et al., 2001) due to that , POE is expected to identify issues in bus terminals based on users perception in order to satisfy their needs, service improvements, encourage public transportation, cost effective and enhance good quality of life.

## 1.2 Problem Statement

Bus terminal issues in Malaysia are initially related to terminal locations because they are considered as central terminals that produced many congestion and safety problems. A research had taken place about Far side Terminal in Kula Lumpur, (Ahmed and Rahman, 2003) indicate the troubles symptoms in bus terminals in Malaysia generally related to three categories, Operators, Users and Authorities. Users problems directly highlighted to building design characterises and conditions ,stated that poor and insufficient in waiting areas ,safety environment, trip information and public amenities. A passenger being very sensitive to conditions while they are waiting for bus (Litman, 2007), may influence their transportation decisions. They tend to ignore public transportation and using their own cars or different modes because it is not comfort, not convenient and not safe, see Figure (1-2).

**Figure 1-2** Comfort and Convenience in Terminals

Stations valuation are presented to estimate and predict where the loop in the system and to have functional measurement based on certain criteria's. These criteria are based on what are the factors expected to influence passengers options to select or increase their frequency using public transportation infrastructure. This will lead to clear image about existing services, structuring solid database, locating the problems, searching for the solutions to support the transit improvements and facilities expansion.

Larkin bus terminal is one of important transport infrastructure in the southern part of Malaysia which is located in Johor Bahru and selected to be the observation site for this study. The building is attached to wet market and providing different internal and external trip within and from Johor to Singapore and other Malaysian states. The building as many terminals in the country is very congested and compacted due to continuous rising in trips demands that increased about 18,000 trip per day from 14,800 in trip per day. The Larkin management claimed that, they are expecting a 10% increasing in the travel demands especially in occasions and holidays that required a serious plan to take these requirements.

Based on the Larkin design nature as semi open terminal, Figure (1-3) shows a glance image of provided spaces and services  where people standing while waiting and queuing to get their buses. Larkin bus terminal is reflecting the situation in many terminals all over Malaysia, it could be consider as effective example to examine the existing services and apply POE concept.

**Figure 1-3** Waiting and departure area in Larkin terminal

## 1.3 Research Questions

Refer to status of public transportation, terminals are being poor in their surroundings, strangulated during certain times and repellent for user's. Bus terminals design and conditions are the main debate of this research in order to improve the bus transportation performance and encourage more people to use public services in Johor Baharu. These questions are what the research tries to find answers and solutions depend on the sampling unit which it is Larkin Bus Terminal. The questions are:

1. What are the factors and characterizes for ideal spaces in bus terminals that satisfy user's perceptions ?
2. Did the current level of services in the bus terminal is elevate the passengers perceptions of bus transportation?
3. What are the problems and how the terminal design affects the bus transport system?
4. What are the effective conditions in the building affecting the traveler's choices reducing taking public transportation?

## 1.4 Research Objectives

The objectives of this research is to studying Larkin bus terminal quality of services using **Post Occupation Evaluation (POE)** concept for assessing the level of services, building performance, improving the terminal conditions, environment and operational system. Also, to come up with specific design indicators for transit buildings.

The following are sub –objectives are:

1. To determinate the building spaces performance efficiency for both vehicles and passengers and what are the problems.
2. To evaluate certain attributes in the building and know the important factors that affect the building design and services
3. To appraisal the current building services and if they meet the passengers demand and perceptions.
4. To understand the existing architectural conditions of spaces and how they affecting the level of services

5. To propose a proper plans methods, techniques, and spacing to improve the bus terminal environment and passenger's quality of services.

The research will give a good knowledge of bus terminal design, guidelines and services. Developing and analysis of findings and recommendation will lead to build criteria for design evaluation and improving the nature of designing bus terminal.

## 1.5 Study Area profile

Larkin bus terminal was chosen as case study to implement Post occupation evaluation concept for this research. The main function is defined as (interstate and intercity) transportation facility; provide services to carry passengers in and out Johor city every day. The building is designed with wet market services which is located in MBJB municipal area in Mukim Bandar at the north of Central district. It is located from Johor city centre by 10 km, with 2.500 sq.

The terminal was built in 1994 and was located in the centre of Johor Bahru, but because of site problems and unsuitability the terminal shifted to the current location in 1995. The increase of urban people movement and massive development in city centre was the main reasons to shift the bus terminal to sub-urban area. Figure (1-4) shown in the location plan of the terminal.


**Figure 1-4** Larkin terminal location plan

There is a new proposed extension of the building according to Larkin management department because they expected this building will coop the demand just for 5 to less than 10 years. The extension about 3 acres, will include holding bay to 70 busses, passengers hostel and services area. Larkin bus terminal is very important to Johor Bahru community because it is provide different services and reflecting the image of public transportation in the city.

### 1.5.1 Current situation in the terminal

The building is providing services of bus terminal, web market, car parking, and bus platform and food courts. Users capacity estimated by 50,000 passengers per day in normal days, 30,000 for bus services and 2.000 for web market and 10,000 to 20,000 in public holidays as Chinese new year's and Hari Raya Aidilfitri, (Larkin Management Department survey. Larkin was designed as double story buildings with three levels (Figure 1-5), the first level for bus services platform, ticketing area,

waiting area with direct connection to the wet market. The second and third level providing retail shops, food services and public amenities.


**Figure 1-5** Main Building Entrance.

The building offering 969 car parks, 128 bus platforms and 300 motor cycles parking (Figure 1-6). There are a total of six local bus companies operating at the terminal and fifty buses ticketing offices which are located inside the building (refer to Figure 1-7). There is limited waiting area inside the building and there are limited seating facing the bus departure platform (refer to Figure 1- 8). It is connected by Pedestrians Bridge from two sites of parking area and offering two kinds of taxi services (short and long distances).

Larkin terminal is very important to Johor community because it is offers mixed used services of transit and economical activates and reflecting the transport efficiency in the city. The research is oriented to investigate and find the elements that can encourage more people to use public transport, improving the quality of services and reducing transport problems.


**Figure 1-6** Bus Parking and departure platform.

**Figure 1-7** Larkin Ticketing Windows


**Figure 1-8** Waiting Area

## 1.6 Scope of Research

The area of the research is limited on Bus terminal in, and according to the objective to improve the public transportation, encourage more riders and decrease using of private vehicles in Johor Baharu the research will focus on the following scope:

1. Larkin bus terminal as case study framework, and the surrounding area.
2. Passengers, pedestrians and building operators those are main users of the building for different targets and provided transit services.
3. Primary data will be collected through a survey on different days of the week, during 3 times of the day 8-10 am, 12-2 pm and 4-6pm.
4. Secondary Data of the building, the current services, spaces design, activates and the expected future plans.

## 1.7 Research Assumptions

In this research, researchers try also to approve that the bus terminal design and condition affecting the rider's choices to use the public transportation. In other hand it expose the recent setting at terminals and what are the main attributes and elements that are most important to passengers when they are using the building facilities. Finally it is aim to provide an evaluation based on passengers expectations in order to identify the improvement areas and help the authorities, management and designers to be more oriented when the designing for transit services.

## 1.8 Limitations of Research

Hence, the research will focus on the terminal building spaces design and layout, determinate the conditions level of services by using five attributes and to know the important satisfaction analysis of those factors within terminal design. The study did not include the pedestrian's level of services, and the bus operation efficiency on the terminal. The result outcome is directly related to the case study area, but is expected to introduce general indicators for terminal design and improvements in Malaysia and other developing countries.

## 1.9 Expected Contributions

The success of this research is expected to contribute the following:

1. Public transportation Passengers in Larkin Terminal
2. Terminal operators
3. Terminal management staff.
4. Show the image of public transportation in Johor Bahru,
5. Show the major elements that need improvements to attract more people to use public transport.

Provide proper concept to Architects, Engineers and Planners for transportation services with new terminologies will improve the efficiency of public transit framework.

## 1.10 Research Design

The research will be designed as follow:

### 1.10.1 Preliminary study

The first stage of this research tackling the suitable litterateur to understand the concept of terminal design ,conditions ,level of services ,travel behaviours and the performance evaluation .From this stage it can be defining the study variables and the methodology that will be used in order to reach the research objectives and scope .

### 1.10.2 Site visit and data collection

Survey on the site will start in parallel with the preliminary study, collecting the data from the Larkin terminal depending on the variables that will be examined in this building. The data will be collected from the passengers and the terminal management department. It will begin with pilot survey and quick interviews to calculate the sampling size and apply the questioner.

### 1.10.3 Analysis

Analysing the collected data from the previous stage through appropriate statistical methods .it will start by define, the important attributes ,satisfaction and the needs for development by using Important –Satisfaction analysis ISA depend on passengers evaluation .

### 1.10.4 Conclusion

Introducing the result and finding from the analysis stage and provide the final recommendation to be applied in further searches and terminal building applications.

## 1.11 Thesis Outlines

The research is structured in a way to reach the objectives and answering the research questions. Therefore, the thesis chapter's outlines will describe the following information's:

### 1.11.1 Chapter 1

This chapter is introducing the research Study, the problem background in bus terminal design and importance for public transportation. In addition is defining the problem statement, the research concept, study profile area, Assumptions and objectives trend.

### 1.11.2 Chapter 2

This chapter is providing Literature review of passengers issues in bus terminals, passengers comfort and convenience elements in terminals, terminals infrastructure, design information & passenger's amenities discussion. Although a comprehensive analysis of post occupation literature, concept and methods to be applied in terminal buildings. It will maintain a good knowledge of area of research to support the methodology and evaluation criteria.

### 1.11.3 Chapter 3

Chapter 3 outlines and illustrates the methodology concept, Data Collection details, sampling data and analytical technique. The methods will be used is Important-Satisfaction (IS) analysis to study and calculate the building performance and level of services indicators of Larkin Bus terminal. Five attributes will be examined building design are passengers comfort, internal and external environment, safety security, user information's and access and circulation.

### 1.11.4 Chapter 4

The chapter is about research findings, presenting the surveyed passengers information, their statistic descriptive with Comprehensive discussion based on IS-Analysis through the selected evaluation variables had shown.

### 1.11.5 Chapter 5

Chapter 5 is basically summarizing the information in the previous chapter, providing a full image about POE results and how passengers assessing the quality of services in Larkin terminal. Also it will offer solutions and general recommendations for transportation building design and operating, to answer the research questions, reach the targeted objectives and concluding the study.

## 1.12 Chapter Summary

The chapter has provided an introduction about bus terminal issues, problems, the role of the transportation building and the services to public transportation improvements. It is stated the status at terminals and the needs to apply post occupations evaluation in order to get what the research objective to. Also it is illustrating general information about the study profile area and how the study will be proceeding. Moreover it had implemented the concept of terminals evaluation from user's perspective to examine the current situation, transit buildings performance as main method to have strongly and effective final result. The next Chapter will attempt to structuring literature to understand the terminal design and evaluation Poe concept to know how will be contributed in this research.

**References**


ABDULLAH NURDEEN[1], RAHMAT[1,] R. A. O. K. & ISMAIL[1,] A. 2007. Modeling of Transportation Behavior of Coercive Measure for Car Driving in Kuala Lumpur. *Journal of Engineering and Applied Sciences,* 2

AHMED, Z. B. & RAHMAN, D. M. Y. A.-. 2003. FARSIDE TERMINATING EXPRESS BUS TERMINAL -KUALA LAMPUR. *PROCEEDING OF THE EASTREN ASIAN SOCIETY FOR TRANSPORTION STUDIES,* 4.

EDWARD, J. & BOWE, J. D. 1992. *Transportation Planning Handbook*, New Jersey
Institute of Transportation Engineers

HIGGINS, H. & IVONNE AUDIRAC 2008. Design Hand Book For Florida Bus Passenger Facilites *In:* II, V. (ed.). Florida Planning and Development Lab
Department of Urban and Regional Planning
Florida State University.

INSTITUTE, V. P. MAY 2011. TRANSIT EVALUATION *TDM Encyclopedia ] online*

INSTUITE-TMD, V. T. P. 2010. *Transit Staions Improvments -improving Public Transit Waiting conditions* [Online]. CANADA
Available: http://www.vtpi.org/tdm/tdm127.htm [Accessed].

ISEKI, H. & TAYLOR, B. D. 2007. NOT ALL TRANSFER ARE CREEATED EQUAL *TRANSPORT RESEARCH BOARD ANNUAL MEETING* WASHINGTON D.C.

JACK KLODZINISKI & HAITHAM, M., AL-DEEK 2001
New Methdology for Evalauating A Toll Plaza Level Of services. *ITE JOURNAL*

JEAN-PAUL RODRIGUE, COMTOIS, C. & SLACK, B. 2006. *The Geograpghy Of Transport Sytem*

KITTELSON & ASSOCIATES 2003. TRANSIT CAPCITY & QUALTY OF SREVICES MANUAL-2nd Edition (TCQ2) -Part 3. *In:* 100, T. R. (ed.) *STATIONS AND TERMINAL CAPCITY* WASHINGTON ,D.C: T.R.BOARD.

KURIEN, M. 2007. *Cleaning Managment of Larkin Bus Terminal* Master Universti Teknologi Malaysia

LITMAN, T. 2007. VALUING TRANSIT SERVICE QUALITY IMPROVMENTS *JOURNAL OF PUBLIC TRANSPORTION,* 11.

LITMAN, T. 2011. VALUING TRANSIT SERVICES QUALITY IMPROVMENTS CONSIDERING COMFORT AND CONVIENNCE IN TRANSPORT PROJECT EVLAUATION *Journal of Public Transportation,* 11**,** 43.

MARTILLA, J. A. & JAMES, J. C. 1977. Important-Satisfaction Analysis. *journal of Marketing* 2**,** 77-79.

MEIR, I. A. G., YAAKOV; JIAO, D. & CICELSKY, A. 2009. Post-Occupancy Evaluation: An Inevitable Step Toward Sustainability
*Advances in Building Energy Research* 3**,** 189-220.

PRIESER, W. E. 1995. How to make buildings work better *Facilities,* 13**,** 19-28.

PROGRAM-TCRP19, T. C. R. 1996. TCRP-19 Guidelines for the Location and Design of Bus Stops. *Transportation Research Board -National Research Council*

TONGE, J. & MOOR, S. A. 2007. Importance-satisfaction analysis for marine-park hinterlands: A Western Australian case study *International Journal of Tourism Management,* 28**,** 768-776

WOLFGANG F.E. PREISER & RABINOWITZ, H. Z., WHITE ,E.T 1988. *POST-OCCUPANCY EVALUATION* Van Nostrand Reinhold, New York.

ZAKARIA, Z., HUSSIN, Z. H., BATAU, M. F. A. & ZAKARIA, Z. 2010. Services Quality of Malaysian public transport :Acase Study in Malaysia *CROSS-CULTURAL COMMUNICATION,* 6**,** No2.

ZHOU XUEMEI, JI XIANGFENG & XIAOGUANG, Y. 2001. Evaluation of Importance Level of Public Transit Terminal based on

BA Scale-free Weighted Network

*2001 Third International Conference on Measuring Technology and Mechatronics Automation*