



**ANALYSIS OF PARKING DEMAND ON THE PARK  
AND RIDE FACILITY AT PUTRAJAYA PUBLIC  
TRANSPORTATION TERMINAL**

**BY**

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**A thesis submitted in fulfilment of the requirement for the  
degree of Master of Science (Built Environment)**

**Kulliyyah of Architecture and Environmental Design  
International Islamic University Malaysia**

**SEPTEMBER 2015**

## ABSTRACT

The spatial mismatch between the residential developments at the outskirts and the job concentration in the Centre Business District (CBD) has further contributed to the commuting patterns of morning and evening peak hours. This situation has led to traffic congestion on the major highways leading into and out of the city. Park and ride scheme was introduced in many countries, geared towards encouraging commuters to use public transport especially on their journeys to the city centre. The focus of the research is to evaluate the parking usage and characteristics of park and ride users at the multi-storey and surface parking as well as to identify the factors that influence the usage of the park and ride facility at the Putrajaya public transportation terminal. A parking inventory survey was conducted to acquire data on parking supply and the physical condition of the park and ride facility. Another parking utilization survey was employed to determine the number of parked vehicles at regular intervals over a period of time, and a questionnaire survey was conducted to gather data on the characteristics and perceptions of parking users. A total of 254 samples were required involving 177 samples from multi-storey and 77 samples from surface parking users. From a total of 350 distributed questionnaires, 185 completed questionnaires with usable data were returned, corresponding to a response rate of 52.9%. The findings on parking utilization survey show that parking demand on weekdays was higher than the weekend and surface parking shows a higher demand than multi-storey parking both on weekdays and weekends. The average parking occupancy at the surface parking on weekdays was 84.5% as compared to level 1 (25%), level 2 (50%) and basement (20%) of the multi-storey parking. The parking duration showed that a majority of the weekday users parked for more than 9 hours as they were traveling for work purposes, and the average parking duration at surface parking area was lower than that of the multi-storey parking. Principal Component Analysis (PCA) was adopted to explore the principal factors on parking related characteristics and ordinal probit regression model were developed to estimate the effects of the socioeconomic, travel and parking characteristics on the frequency of parking in a month. The factors of monthly income, car ownership and employment sector were among the socioeconomic characteristics that found significant as the parameter estimates of parking demand. The significant factors from the travel characteristics were car occupancy, monthly public transport cost, public transport fare payment method and monthly parking fees. Parking duration, arrival time at the park and ride facility, parking availability, parking charge and operation, and lack of destinations' parking were among the significant factors of parking characteristics that associated in predicting the monthly parking frequency. One of the recommendations to encourage more people to utilize this facility is the promotion on the park and ride facility should be more comprehensive.

## خلاصة البحث

وقد ساهم عدم توافق التخطيط العمراني بين المشاريع السكنية في ضواحي المدينة وتركيز العمل في وسط المدينة على أنماط التنقل في ساعات الذروة في الصباح والمساء. وقد أدى هذا الوضع إلى ازدحام حركة المرور على الطرق السريعة الرئيسية المؤدية من وإلى المدينة. عرض مشروع ركن وقيادة السيارات في العديد من البلدان من أجل تشجيع الركاب على استخدام وسائل النقل العامة وخصوصاً في رحلاتهم إلى وسط المدينة. محور هذا البحث هو تقييم استخدام مواقف السيارات وخصائص المستخدمين لهذه المواقف في مواقف السيارات المتعددة الطوابق والسطحية فضلاً عن التعرف على العوامل التي تؤثر على استخدام مشروع ركن وقيادة السيارات في محطة النقل العام في بوتراجايا. أجري استبيان لجرد مواقف السيارات للحصول على بيانات عن كمية وحالة المواقف المعروضة لمشروع ركن وقيادة السيارات. أجري استبيان عن استخدام مواقف السيارات لتحديد عدد السيارات المتوقفة على فترات منتظمة على مدى فترة من الزمن، كما أجري استبيان لجمع بيانات عن خصائص وتصورات المستخدمين لهذه المواقف. تتطلب البحث 254 عينة تشمل 177 عينة لمستخدمي مواقف السيارات متعددة الطوابق و 77 عينة لمستخدمي مواقف السيارات السطحية. من مجموع 350 استبيان وزع، أعيد 185 استبياناً مع البيانات القابلة للاستخدام، أي ما يعادل معدل استجابة 52.9%. تظهر نتائج استبيان استخدام مواقف السيارات بأن الطلب على مواقف السيارات المتعددة الطوابق في أيام الأسبوع أعلى من الطلب في عطلة نهاية الأسبوع كما تظهر النتائج بأن الطلب على المواقف السطحية مرتفع عن الطلب على المواقف متعددة الطوابق على حد سواء خلال أيام الأسبوع وعطلة نهاية الأسبوع. كان متوسط الإشغال لوقوف السيارات في المواقف السطحية على أيام الأسبوع 84.5% بالمقارنة مع متوسط الإشغال للطابق الأول (25%)، و متوسط الإشغال للطابق 2 (50%)، ومتوسط الإشغال للبدروم (20%). لمواقف السيارات متعددة الطوابق. وأظهرت نتائج مدة وقوف السيارات في المواقف متعددة الطوابق في أيام الأسبوع بأن السيارات كانت متوقفة لأكثر من 9 ساعات وذلك لأن المستخدمين يستخدمون المواقف لأغراض العمل، كما أظهرت النتائج بأن متوسط مدة وقوف السيارات في المواقف السطحية كان أقل من متوسط مدة وقوف السيارات في المواقف متعددة الطوابق. وقد اعتمد تحليل المكون الرئيسي لاستكشاف العوامل الرئيسية ذات الصلة بخصائص مواقف السيارات واستخدم نموذج ترتيب احتمالية الانحدار لتقدير آثار العوامل الاجتماعية والاقتصادية وعوامل الرحلة وخصائص المواقف على وتيرة وقوف السيارات في غضون شهر. وكانت عوامل الدخل الشهري، وملكية السيارة وقطاع التوظيف بين الخصائص الاجتماعية والاقتصادية التي وجدت ذات أهمية كعامل متغير لتقدي الطلب على مواقف السيارات. كما كانت العوامل ذات الأهمية من خصائص الرحلة هي اشغال السيارة، تكلفة وسائل النقل العام الشهرية، وسيلة الدفع لأجرة النقل العام ورسوم مواقف السيارات. وكانت مدة وقوف السيارات، وقت وصول السيارات إلى مرفق موقف وقيادة السيارات، توافر مواقف السيارات، رسوم تشغيل مواقف السيارات، وعدم توافر مواقف سيارات إلى الجهات المعنية من بين العوامل الهامة لخصائص السيارات التي ترتبط في التنبؤ بالتردد الشهري على مواقف السيارات. من التوصيات لتشجيع المزيد من الناس للاستفادة من هذا المرفق هو بأن الترويج لمنشأة مواقف الركن والقيادة ينبغي أن يكون أكثر شمولاً.

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Built Environment)

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## DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Sharifah Adibah Alyia Bt Syed Adnan

Signature .....

Date .....

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Date

## ACKNOWLEDGEMENTS

In the name of Allah S.W.T, the Most Gracious, the Ever Merciful. Praise is to Allah, Lord of the Universe and Peace and Prayers be upon His final Prophet and Messenger Muhammad S.A.W. Alhamdulillah, I would like to express my most gracious gratitude to Allah S.W.T for all ni'mah that were given to me. Without His Will, I would not be able to complete this thesis.

I would like to express a gratitude and appreciation to my supervisor, Assoc. Prof. Dr. Abdul Azeez Kadar Hamsa, for all his guidance, comments, advices, and encouragement during the preparation of this thesis. Without his support and continuous guidance throughout this process, this effort would not have been possible. I also would like to thank my examiners, Asst. Prof. Dr. Syahriah Bachok and Assoc. Prof. Dr. Norlida Abdul Hamid for all their comments and suggestions. Apart from that, my thanks also goes to all the other IIUM lecturers and individuals whose names I did not mention here, for all the help, advices and support for me in completing this study.

A special thanks goes to my beloved parents Syed Adnan and Raja Aasmah for your endless Doa', advices, support, loves and cares for me throughout my study which can never be repay enough. Special thanks also goes to my beloved siblings and relatives who always help and give support to me which I am really appreciate it.

In addition, I would like to express my deepest gratitude and thanks to all the friends who always help and support me. Thank you very much to my best buddy; Farah Diyanah who always help, motivates and support me during my toughest time in completing this thesis. My appreciation also goes to my fellow friends, Umami Aqilah, Syazwani Sahrir, Nur Shazwani, Tuminah, Alyani, Nuraihan, Aulia, Aida, Azza, Aisyah, Ainaa, Munirah, Hazirah and Azizi. Thank you very much to all of you for all the help and support.

I would like to express my thanks to Research Management Centre (RMC), for providing research funding for this research. I also would like to take this opportunity to express my gratitude to all the participants who involved in the questionnaire survey and to all who directly or indirectly involved in this research.

## TABLE OF CONTENTS

Abstract .....	ii
Abstract in Arabic .....	iii
Approval Page.....	iv
Declaration .....	v
Copyright Page.....	vi
Acknowledgements .....	vii
List of Tables .....	xiii
List of Figures .....	xvi
List of Symbols / Equations .....	xviii
List of Maps .....	xix
List of Abbreviations .....	xx
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 Problem Statements .....	4
1.2.1 The Rise of Private Vehicle Ownership.....	4
1.2.2 Parking Demand in Putrajaya .....	8
1.3 Research Objectives.....	9
1.4 Research Questions.....	10
1.6 Background of the Study Area .....	12
1.6.1 Public Transportation Modes in Putrajaya Sentral .....	13
1.6.1.1 Rail Service.....	13
1.6.1.2 Bus and Taxi Services .....	14
1.7 Limitations of Research.....	16
1.8 Significance of Research .....	17
1.9 Structure of the Research Report.....	17
1.10 Conclusion .....	21
<b>CHAPTER TWO: LITERATURE REVIEW .....</b>	<b>22</b>
2.1 Introduction.....	22
2.2 Defining the Term “Park and Ride” .....	22
2.3 The Park and Ride Concept .....	24
2.4 Types of Park and Ride.....	25
2.5 The Effectiveness of the Park and Ride Facilities .....	30
2.6 Parking Demand .....	31
2.6.1 parking Characteristics.....	31
2.7 Factors influencing the Utilisation of park and Ride.....	34
2.7.1 Socioeconomic Characteristics .....	34
2.7.2 Travel Characteristics .....	36
2.7.3 Parking Related Characteristics .....	39
2.7.4 Spatial Characteristics.....	40

<b>CHAPTER THREE: RESEARCH METHODOLOGY .....</b>	<b>43</b>
3.1 Introduction.....	43
3.2 Research Design .....	43
3.3 Data Collection .....	46
3.3.1 Primary Data .....	46
3.3.1.1 Parking Utilization Pattern .....	47
3.3.1.2 The Characteristics and Perceptions of the Park and Ride Users .....	47
3.3.2 Secondary Data .....	50
3.4 Sampling Design.....	52
3.4.1 Population Size .....	52
3.4.2 Sample Size.....	53
3.4.3 Sampling Method.....	55
3.5 Method of Data Collection .....	57
3.5.1 Primary Data .....	57
3.5.1.1 Observation Method .....	57
3.5.1.2 Pilot Survey .....	58
3.5.1.3 Parking Inventory Survey.....	60
3.5.1.4 Parking Utilization Survey .....	62
3.5.1.5 Questionnaire Survey .....	63
3.5.1.5.1 Administration of Questionnaire Survey.....	68
3.5.1.5.2 Response Rate .....	69
3.5.2 Secondary Data .....	72
3.6 Method of Data Analysis .....	72
3.6.1 Analysis on Parking Inventory.....	73
3.6.2 Analysis on Parking Utilization .....	73
3.6.3 Univariate Analysis.....	75
3.6.4 Bivariate Analysis .....	76
3.6.4.1 Cross Tabulation.....	76
3.6.4.2 Mann Whitney U-Test.....	77
3.6.5 Multivariate Analysis.....	77
3.6.5.1 Principal Component Analysis .....	78
3.6.5.2 Ordinal Regression .....	79
3.7 Conclusion .....	81
 <b>CHAPTER FOUR: PARKING UTILIZATION PATTERN OF PARK AND RIDE FACILITY .....</b>	 <b>83</b>
4.1 Introduction.....	83
4.2 Physical Characteristics of the Park and Ride Facility.....	83
4.2.1 Location of the Park and Ride Facility .....	83
4.2.2 Parking Supply .....	84
4.2.3 Types and Categories of Parking .....	86
4.2.4 Parking Geometrics.....	86
4.2.5 Related Facilities and Services .....	91
4.2.6 Parking Operation .....	91
4.2.7 Summary of Multi-storey and surface Parking Characteristics ....	92
4.3 Undesignated parking .....	93
4.4 Parking Utilization Pattern .....	94
4.4.1 Parking Accumulation.....	94

4.4.1.1 Surface Parking.....	95
4.4.1.2 Multi-storey Parking.....	96
4.4.2 Parking Occupancy .....	100
4.4.2.1 Surface Parking.....	100
4.4.2.2 Multi-storey Parking Level 2.....	102
4.4.2.3 Multi-storey Parking Level 1.....	102
4.4.2.4 Multi-storey Parking Basement Level.....	103
4.4.3 Parking Volume .....	106
4.4.4 Parking Turnover .....	108
4.4.5 Parking Duration .....	120

**CHAPTER FIVE: PARK AND RIDE USERS CHARACTERISTICS AND FACTORS INFLUENCING THE USE OF PARK AND RIDE.....124**

5.1 Introduction.....	124
5.2 Socioeconomic Characteristics.....	124
5.3 Travel Characteristics .....	127
5.4 Parking Characteristics .....	132
5.5 Perceptions of Park and Ride Users on Parking Related Characteristics .....	136
5.6 Determinants of Park and Ride Parking Demand.....	144
5.7 Association Between Socioeconomic Characteristics and Parking Demand.....	147
5.7.1 Relationship between Gender and Monthly parking Frequency by Parking Type.....	147
5.7.2 Relationship between Gender and Perception towards Parking Safety by Parking Type .....	148
5.7.3 Relationship between Gender and Perception towards Parking Convenience by Parking Type.....	149
5.7.4 Relationship between Monthly Income and Monthly Parking Frequency by Parking Type.....	150
5.8 Association Between Travel Characteristics and Parking Demand .....	151
5.8.1 Relationship between Travel Purpose and Monthly parking Frequency .....	152
5.8.2 Relationship between Total Travel Time to Destination and Monthly Parking Frequency by Parking Type .....	153
5.9 Association Between Parking related Characteristics and Parking Demand.....	151
5.9.1 Relationship between Arrival Time at the Park and Ride Facility and Perception toward Ease of Obtaining Parking Space by Parking Type .....	154
5.9.2 Relationship between Arrival Time at the Park and Ride Facility and Perception toward Parking Adequacy by Parking Type .....	156
5.9.3 Relationship between Parking Duration and Travel Purpose by Parking Type.....	157
5.9.4 Relationship between Perceptions toward Satisfaction on Parking Charge and Parking Frequency by Parking Types .....	158
5.9.5 Relationship between Perceptions toward Satisfaction on Parking Safety and Parking Frequency by Parking Types .....	159

5.9.6 Relationship between Perceptions toward Satisfaction on Parking Convenience and Parking Frequency by Parking Types .....	160
5.9.7 Relationship between Perceptions toward Satisfaction on Parking Availability and Parking Frequency by Parking Types ..	161
5.10 Identification of Principal factors on Parking Related Characteristics .....	163
5.10.1 Surface Parking .....	163
5.10.2 Multi-storey Parking .....	169
5.11 Modelling the Parking Demand of the Park and Ride Facility.....	171
5.12 Ordinal regression Model .....	171
5.13 Estimation Result of Ordinal regression Model Toward Parking Demand.....	176
5.13.1 Methods of Selecting Predictors Variables.....	178
5.13.2 Estimations Result of Probit Model.....	180
5.13.3 Parameter Estimates on Parking Frequency at Surface Parking.....	184
5.13.4 Parameter Estimates on Parking Frequency at Multi-storey Parking.....	185
5.13.5 Parameter Estimates on Parking Frequency at Surface and Multi-storey Parking.....	188

**CHAPTER SIX: SUMMARY OF RESEARCH FINDINGS, RECOMMENDATIONS AND CONCLUSION.....191**

6.1 Introduction.....	191
6.2 Summary of the Research.....	191
6.2.1 The Characteristics of Park and Ride Facility .....	192
6.2.2 Parking Utilization Pattern of Park and Ride Facility .....	193
6.2.3 Socioeconomic, Travel and Parking Characteristics of Park and Ride User .....	195
6.2.4 Surface and Multi-storey Parking Users Pereptions on Parking Related Characteristics .....	197
6.2.5 Determinants of Park and Ride Parking Demand .....	199
6.2.6 Association of Socioeconomic, Travel and Parking Characteristics towards Parking Demand .....	199
6.2.7 Parameter Estimates for “Surface”,” Multi-storey” and “Surface and Multi-storey” parking .....	201
6.3 Recommendations.....	203
6.3.1 Improvement of the Facility Within the parking Area .....	203
6.3.2 Introduction of Integrated Public Transport Fare System .....	204
6.3.3 Improvement of Public Transport Service .....	206
6.3.4 Enforcement on Illegally Parked Vehicles.....	206
6.3.5 Promotion of the Park and Ride Facility.....	207
6.4 Conclusions .....	208

<b>REFERENCES.....</b>	<b>210</b>
APPENDIX A: QUESTIONNAIRE FORM .....	220
APPENDIX B: CALCULATION OF PROPORTIONAL ALLOCATION SAMPLING .....	229
APPENDIX C: CALCULATION OF THE PARKING OCCUPANCY .....	230
APPENDIX D: CALCULATION OF PARKING VOLUME .....	232
APPENDIX E: CALCULATION OF PARKING TURNOVER.....	234
APPENDIX F: CALCULATION OF PARKING DURATION.....	236
APPENDIX G: TRAVEL ORIGIN AND DESTINATION OF THE PARK AND RIDE USERS DURING WEEKDAY AND WEEKEND .....	238
APPENDIX H: FREQUENCY DISTRIBUTION OF PARKING CHARACTERISTICS AND DETERMINANTS OF PARK AND RIDE DEMAND .....	240
APPENDIX I: TEST OF MANN WHITNEY ASSUMPTION ON SHAPE DISTRIBUTION .....	242
APPENDIX J: CORRELATION MATRIX OF SURFACE AND MULTI- STOREY PARKING USERS PERCEIVED ON PARKING CHARACTERISTICS .....	245
APPENDIX K: HISTOGRAM OF NORMALLY DISTRIBUTED ON THE MONTHLY PARKING FREQUENCY .....	247
APPENDIX L: SKEWNESS, KURTOSIS VALUES, AND STANDARD ERROR FOR MULTI-STOREY AND SURFACE PARKING DATA.....	248
APPENDIX M: TEST OF MULTICOLLINEARITY.....	250
APPENDIX N: CORRELATION MATRIX OF VARIABLES ON “SURFACE”, “MULTI-STOREY” AND “SURFACE AND MULTI-STOREY” PARKING DATA.....	251

## LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
1.1	Number of Newly Registered Motor Vehicles in Kuala Lumpur From 2005 to 2013	6
2.1	Identifying Areas for Park and Ride Facilities	29
2.2	Categories of Parking Duration	33
3.1	Total number of populations retrieved for the study area according the parking types	53
3.2	Sample sizes for different sizes of the population at a 95 confidence level (assuming data are collected from all cases in the sample)	55
3.3	Proportional Allocation of Sample according to Types of Parking	56
3.4	Breakdown of Survey Response Rates	70
3.5	Response Rate by Survey Method	71
4.1	Parking supply at park and ride facilities in Putrajaya Sentral	84
4.2	Category of parking at park and ride facilities in Putrajaya Sentral	86
4.3	Summary of the Parking Characteristics at Putrajaya Sentral Park and Ride Facility	93
4.4	Parking turnover at Putrajaya Sentral park and ride facility	111
4.5	Duration of parking at Putrajaya Sentral	122
4.6	Summary of the Parking Characteristics at the park and ride facility on weekday and weekend	123
5.1	Summary of the park and ride users socioeconomic characteristics	126
5.2	Summary of the park and ride users' travel characteristics	129
5.3	Frequency of park and ride use in a month by surface and multi-storey parking	134
5.4	Distribution of parking arrival time by types of parking and day use	135
5.5	Distribution of parking duration by types of parking and day use	135

5.6	Mann-Whitney U Test Results for Testing the Difference of Park and ride Users' Perceptions on Parking Characteristics between Multi-storey and Surface Parking	143
5.7	Relationship between gender and monthly parking frequency by parking type	148
5.8	Relationship between monthly income and monthly parking frequency by parking type	151
5.9	Relationship between travel purpose and monthly parking frequency by parking type	153
5.10	Relationship between travel time and monthly parking frequency by parking type	154
5.11	Relationship between parking duration and travel purpose by parking type	158
5.12	Relationship between perceptions toward satisfaction on parking charge and parking frequency by parking types	159
5.13	Relationship between perceptions toward parking safety and parking frequency by parking types	160
5.14	Relationship between perceptions toward parking convenience and parking frequency by parking types	161
5.15	Relationship between perceptions toward satisfaction on parking availability and parking frequency by parking types	162
5.16	Total Variance Explained	168
5.17	Results of Varimax Rotated Principal Component Matrix for Parking Related Characteristics at Surface Parking	168
5.18	Total Variance Explained	170
5.19	Results of Varimax Rotated Principal Component Matrix for Parking Characteristics at Multi-Storey Parking	170
5.20	Summary of significant correlation between variables and Monthly frequency of Parking for Surface Parking users' Responses	179
5.21	Summary of significant correlation between variables and Monthly frequency of Parking for Multi-storey Parking Data	182
5.22	Summary of significant correlation between variables and monthly frequency of surface and multi-storey park and ride data	182

5.23	Parameter Estimates on parking frequency at the surface parking Facility	185
5.24	Parameter Estimates on parking frequency at the multi-storey parking Facility	186
5.24	Parameter Estimates on parking frequency at the park and ride Facility	190

## LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1.1	Number of Newly Registered Motor Vehicles in Kuala Lumpur From 2005 to 2013	6
1.2	Structure of the Research Report	20
2.1	Theoretical framework of research	42
3.1	Research Flowchart	45
4.1	Parking accumulations at surface parking	96
4.2	Parking accumulations at multi-storey parking on weekday	98
4.3	Parking accumulations at multi-storey parking on weekend	100
4.4	Parking occupancy of surface parking	101
4.5	Parking occupancy of multi-storey parking level 2	102
4.6	Parking occupancy of multi-storey parking level 1	103
4.7	Parking occupancy of multi-storey parking level basement	104
4.8	The percentage of parking occupancy at multi-storey and surface parking on weekday and weekend at Putrajaya Sentral	105
4.9	The average parking occupancy between surface and multi-storey parking	106
4.10	Average Hourly Parking Volume	107
4.11	Average Hourly Parking Volume According to Parking Types	108
4.12	Average parking Turnover at the Study Area	110
4.13	Average parking Turnover by Parking Types	110
4.14	Average Parking Duration for Putrajaya Sentral	121
4.15	Average Parking Duration by Parking Types	122
5.1	Travel purpose of the park and ride users by weekday and weekend	128
5.2	Monthly parking frequency of the park and ride users	122
5.3	Actions taken if unable to find a parking space	136

5.4	Mean rank of parking related characteristics by types of parking	140
5.5	Average rank of determining factors of park and ride demand on weekday and weekend	105
5.6	Relationship between Gender and Perceptions towards parking safety by Parking Type	149
5.7	Relationship between gender and perceptions towards parking convenience by parking type	150
5.8	Relationship between users' arrival time at the park and ride facility and perceptions toward ease of obtaining parking space by parking type	155
5.9	Relationship between users' arrival time at the park and ride facility and perceptions toward parking adequacy by parking type	156

## LIST OF SYMBOLS / EQUATIONS

<u>Equations No.</u>		<u>Page No.</u>
3.1	Proportional Allocation Formula	56
3.2	Response Rate Calculation	69
3.3	Average Parking Occupancy	74
3.4	Average Parking Volume	74
3.5	Average Parking Turnover	75
3.6	Average Parking Duration	75
3.7	Latent Variables of Ordinal Probit Model	80
3.8	Threshold Values of dependent variables	80
3.9	Cumulative probability function of the standard normal distribution	80
3.10	Cumulative probability function by Probit Link	80
4.1	Average Parking Volume	106
4.2	Average Parking Turnover	108
4.3	Average Parking Duration	120
5.1	Latent variable of ordinal probit model	175
5.2	Threshold values for Monthly Parking Frequency categories	175
5.3	Cumulative probability function of the standard normal distribution	175
5.4	Cumulative probability function of the Probit Link	176

## LIST OF MAPS

<u>Map No.</u>		<u>Page No.</u>
1.1	Location of Study Area	15
3.1	Route taken during Parking Survey at Surface Parking	64
3.2	Route taken during Parking Survey in Level P2	65
3.3	Route taken during Parking Survey in Level P1	66
3.4	Route taken during Parking Survey level Basement	67
4.1	Location of Park and Ride Facility	85
4.2	Types of Parking and Parking categories at Surface Parking	87
4.3	Types of Parking and Parking categories at Level P2	88
4.4	Types of Parking and Parking categories at Level P1	89
4.5	Types of Parking and Parking categories at Level Basement	90
4.6	Parking Turnover at Surface Parking (Weekday)	112
4.7	Parking Turnover at Level P2 (Weekday)	113
4.8	Parking Turnover at Level P1 (Weekday)	114
4.9	Parking Turnover at Level Basement (Weekday)	115
4.10	Parking Turnover at Surface Parking (Weekend)	116
4.11	Parking Turnover at Level P2 (Weekend)	117
4.12	Parking Turnover at Level P1 (Weekend)	118
4.13	Parking Turnover at Level Basement (Weekend)	119

## **LIST OF ABBREVIATIONS**

CBD	Centre Business District
ERL	Express Rail Link
KLIA	Kuala Lumpur International Airport
KTM	Keretapi Tanah Melayu
PPJ	Perbadanan Putrajaya
TDM	Travel Demand Management
SOV	Single Occupancy Vehicle
HOV	High Occupancy Vehicle

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

The increasing number of population and vehicle ownership in Malaysia has contributed to various transportation problems. Numerous major transportation problems have been widely discussed among transportation scholars. One of the eminent transportation related issues is traffic congestion occurring at major roads connecting to the Central Business District (CBD), especially during peak hours. Prabuwno and Idris (2008) mentioned that an increase in car ownership, changes in traffic arrangements and densification of land have contributed to the diminishing supply of parking facility, especially in the CBD. Hence, promoting public transportation is a way to reduce the use of private cars in urban areas, thereby reducing the adverse impacts of transportation (Banister, 2000). One such strategy that is widely applied towards encouraging commuters to use public transport is through the implementation of the park and ride scheme, which is seen as a Transportation Demand Management (TDM) strategy. The purpose of TDM is to reduce the number of single occupant vehicles using the road system while providing a variety of mobility options. Put in another way, TDM measures increase the carrying capacity of the transportation system without the expense and inconvenience of adding new roads. The park and ride facility is one of many TDM tools created to improve efficiency, reduce energy consumption and provide options to the single-occupant vehicle trip. Furthermore, Knowles (1997) also suggest that the actions to reduce long term traffic congestion cannot depend on the establishment of public transportation alone as the light rail but also setting up the park and ride and other travel demand management

methods. It is believed that, when executed consequently and efficiently, the park and ride service can be one of the several alternative policies that would be the answer to resolving the issue of urban congestion and convenience in the long term (TDM Encyclopedia, 2010).

By definition, park and ride is a change of mode facility that provides a common location for drivers to transfer from low occupancy vehicles (i.e. private cars) to high occupancy vehicles (i.e. bus and train) (Noel, 1988). This would allow a greater number of person trips to access into the urban area without increasing the number of vehicle movements while using the existing road space. Park and ride facilities increase the effectiveness of transit service by expanding the catchment areas of the transit users. Commuters living beyond walking distance of an established transit station can drive to the park and ride and use the transit system, instead of driving long distances to their destination. This is relevant to the spatial mismatch of the current residential and employment locations, in which there is far distance between suburban areas and the city centre. A longer travel distance has contributed to the increase of travel time and cost. Therefore, park and ride facilities enable employees to reach their work places at less travel time and cost by parking their vehicles at transit stations located in the outskirts of the city and continuing their journey to the city centre by reliable public transport.

Park and ride has been widely introduced in many countries as one of the TDM strategies in solving transportation related issues. Park and ride facilities are usually introduced to expand the catchment area of public transport and to attract car users to travel by more sustainable transport modes (Bolger 1995; Noel 1988). This is particularly significant in suburban or outer-urban areas where residential densities are too small to support adequate feeder services on their own (Hamer, 2010). Basically,

the provision of park and ride emerged in the 1930's as a means of increasing and maintaining public transport patronage. Park and ride facilities have been in existence in North America for over 30 years (Spillar, 1997), whereas some have noted that park and ride began in the United Kingdom during the 1960s (Cairns, 1997). Roberts et al. (1996) refer to how in many of the historic towns and cities of the UK, park and rides are increasingly seen as conserving the environment, improving accessibility and providing an alternative to the car as a means of travel for whole trips. On the East Asian region side, for countries such as Malaysia, the park and ride concept only began to emerge in the transportation industry around the year 1994 while Hong Kong, on the other hand, started the scheme in 1998 (Lam et al., 2001).

Currently, with the increasing number of private vehicles entering the city centre of Kuala Lumpur, the Kuala Lumpur City Plan 2020 initiative towards managing the supply of parking and its distribution includes a requirement that future land use developments adjacent to existing and planned transit stations, hubs or terminals shall provide 'park-and-ride' facilities within the proposed development site (Kuala Lumpur City Hall, 2010).

The public transportation terminal in Precinct 7, Putrajaya known as "Putrajaya Sentral" is equipped with a huge park and ride facility. This is pertinent to the policy highlighted in the Putrajaya Transport Action Plan, which is to limit the entry of vehicles to main areas with the strategy of providing park and ride facilities that will encourage people to travel by public buses from park and ride stations to main areas and vice versa. Nor et al. (2006) reported that the current transportation mode in Putrajaya was dominated by private cars. Thus, the provision of the park and ride facility at the main transportation hub of Putrajaya Sentral, helps to reduce the

number of cars going into congested areas in Putrajaya (for those from outside Putrajaya) as well as cars heading to Kuala Lumpur.

Consequently, as a step toward providing an understanding on the current usage of the park and ride facility, this research attempts to explore and evaluate the aspects of parking demand at the park and ride facility and the characteristics of the park and ride users. The characteristics of park and ride users include factors such as socio-economic, travel and parking characteristics on the use of park and ride. The detailed elements on each of the characteristics studied are explained in chapter 3.

## **1.2 PROBLEM STATEMENTS**

### **1.2.1 The Rise of Private Vehicle Ownership**

The rapid growth of economic development has contributed to numerous employment opportunities. With the upsurge of the working population, travel demand into the Central Business District (CBD) has extremely increased. Central Business District (CBD) is described as the heart of a city with centralized economic activities such as commercial and office buildings. As a result of having centralized economic activities located in the city centre, new housing areas have begun to be developed within the outskirts, which are farther in distance from the city centre. This has then contributed to spatial mismatch, where high density and cheaper residential developments are built in the outskirts, whereas jobs are concentrated in the city centre. Hence, this increases the travel demand and travel distance of these communities that live farther from the city centre. According to Ferreira and Ginn (1994), the trend in residential development has moved away from the central business core. More and more people have moved into the suburban fringe to access larger family blocks, often at a cheaper price than inner city living, yet the vast majority of these people travel to work alone.