

**COMPARATIVE ASSESSMENT OF ROAD NETWORK TRIP  
DISTRIBUTION USING GROWTH FACTOR AND GRAVITY MODELING  
TECHNIQUES**

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DEDICATION

To my beloved mother and father  
**(FATTANEH PAKSHIR AND ALI REZA PAKSHIR)**

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## ABSTRACT

Growth factor and gravity model techniques are useful in sequential forecasting of travel demand on any road network. Both have commonalities in terms of independent parameters, however, growth factors relies on historic growth rate for prediction while gravity model relies on socio-economic variables or friction factor. Trip distribution is an iterative procedure. Based on the data from recent trip generation study in Skudai town, Malaysia, the number of trips generated by one zone and attracted to another zone would be computed using both the growth factor and gravity model techniques. The outcomes would then be compared and contrasted. It is hoped that the project would shed light on the advantages and disadvantages of these technique, in essence point to the appropriate method employable in a given situation.

Keywords: Trip Distribution, Growth Factor, Growth Rate, Gravity Model, Friction Factors, Socio-Economic Variables.

## ABSTRAK

Faktor Pertumbuhan dan teknik graviti model yang berguna dalam meramalkan berurutan permintaan berlepasan pada setiap rangkaian jalan. Keduanya mempunyai persamaan dalam hal parameter bebas, bagaimanapun, faktor pertumbuhan bergantung pada laju pertumbuhan bersejarah bagi ramalan sedangkan model graviti bergantung pada pembolehubah-pembolehubah sosial-ekonomi atau faktor gesekan. Trip edaran merupakan prosedur iterasi. Berdasarkan data dari generasi perjalanan kajian baru-baru ini di bandar Skudai, Malaysia, jumlah perjalanan yang dihasilkan oleh satu zon dan zon lain yang tertarik akan dikira menggunakan kedua-dua faktor pertumbuhan dan teknik graviti model. Keputusan kemudian akan dibandingkan dan perbezaan. Diharapkan bahawa projek akan menjelaskan keuntungan dan kerugian dari teknik ini, di titik intinya dengan kaedah yang tepat dipekerjakan dalam suatu situasi tertentu.

Kata kunci: Trip Edaran, Faktor Pertumbuhan, Laju Pertumbuhan, model graviti, Faktor Gesekan, Variabel Sosial-Ekonomi.

**TABLE OF CONTENTS**

<b>CHAPTER</b>	<b>TITLE</b>	<b>PAGE</b>
	<b>DECLARATION OF THE STATUS OF THESIS</b>	
	<b>SUPERVISOR'S DECLARATION</b>	
	<b>TITLE PAGE</b>	<b>i</b>
	<b>DECLARATION</b>	<b>ii</b>
	<b>DEDICATION</b>	<b>iii</b>
	<b>ACKNOWLEDGEMENTS</b>	<b>iv</b>
	<b>ABSTRACT</b>	<b>v</b>
	<b>ABSTRAK</b>	<b>vi</b>
	<b>TABLE OF CONTENTS</b>	<b>vii</b>
	<b>LIST OF TABLES</b>	<b>xii</b>
	<b>LIST OF FIGURES</b>	<b>Xv</b>

	<b>LIST OF APPENDICES</b>	xvi
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1. Background	1
	1.2. Need Of the Study	3
	1.3. Purpose Of the Study	4
	1.4. Objectives Of the .Study	5
	1.5. Scope Of the Study	5
	1.6. Significance Of the Study	6
	1.7. Proposed Research Methodology	6
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>7</b>
	2.1 Introduction	7
	2.2 Transportation Planning Process	8
	2.2.1 Sketch Tool	11
	2.2.2 Traditional Tools	11
	2.2.3 Micro-Analysis Tools	12
	2.3 Trip Distribution	15

2.3.1	Trip Matrix	18
2.3.2	Growth Factor Technique	20
2.3.2.1	Uniform Growth Factor	20
2.3.2.2	Average Factor Method	21
2.3.2.3	Fratar Method	22
2.3.3	Gravity Model	23
2.4	Vehicle Growth in Malaysia	26
2.5	Summary	29
<b>3</b>	<b>RESEARCH METHODOLOGY</b>	<b>30</b>
3.1	Introduction	30
3.2	Study Area	31
3.3	Data Collection	32
3.3.1	Existing Inventories	33
3.3.2	Zoning System	33
3.4	Survey Procedure	37
3.4.1	Sample Size	37



3.4.2	Origin and Destination Interview Survey	39
3.4.3	Household Survey	39
3.4.4	Questionnaire Design	42
3.5	Analysis of Data	42
3.6	Methodology in Trip Distribution Estimation	43
3.6.1	Growth factor	44
3.6.1.1	Trip Matrix	44
3.6.1.2	Relative Growth Rate	45
3.6.1.3	Fratar Technique	45
3.6.2	Gravity Model	48
<b>4</b>	<b>RESULT AND DISCUSSION</b>	<b>52</b>
4.1	Introduction	52
4.2	Trip Distribution	54
4.3	Trip Distribution based on Growth Factor	56
4.3.1	Population Growth	56
4.3.1.1	Relative Population Growth among 2000-2005	58

4.3.1.2	Relative Population Growth among 2005-2009	58
4.3.1.3	Relative Population Growth among 2009-2014	59
4.3.1.4	Average Relative Population Growth	60
4.3.2	Fratar Technique	61
4.4	Gravity Model	66
4.4.1	Travel Time	66
4.4.2	Friction Factor	67
4.4.3	Socio-Economic Factor	68
4.5.	Discussion	74
4.6.	The Way Forward	77
<b>5</b>	<b>CONCLUSION</b>	<b>80</b>
	<b>REFERENCES</b>	<b>82</b>

**LIST OF TABLES**

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Notation of a Trip Matrix	19
2.2	Motor Vehicle Enrolment in 1996	27
2.3	Motor Vehicle Registration Malaysia 1987-1996	28
3.1	Distribution Area	36
3.2	Sample Size	38
3.3	Survey Data	41
4.1	Trip Distribution Observation	55
4.2	Basic Data for Skudai town in year 2000	57
4.3	Population Growth	61
4.4	Trip production with the Production Growth Rate	62
4.5	Production Growth Factor & Attraction Growth Factor	63

4.6	Trip Distribution with the Growth Factor of Production and Attraction	64
4.7	Multiple of Attraction Growth in each cell	64
4.8	Multiple of Production Growth Factor in each cell	65
4.9	Trip Distribution based on Fratar Technique in 2014	65
4.10	Travel Time	67
4.11	Friction Factors versus Travel	68
4.12	Friction Factors among Zones	69
4.13	Production and Attraction	69
4.14	Multiply of each Attraction cell to Friction Factor and Socioeconomic Factor of each cell	70
4.15	Gravity model for the first iteration	70
4.16	Modify Attraction Value	71
4.17	Multiply of each Attraction cell to Friction Factor and Socioeconomic Factor of each cell	72

4.18	Gravity Model for Second Iteration	73
4.19	Number of Trips Distribution Zonal Interchange based on Gravity Model in 2014	73

**LIST OF FIGURES**

<b>FIGURE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Transportation Planning Process	10
2.2	Planning Tools Relationship	12
2.3	Four Steps of Transportation Planning Process	14
3.1	Fratar Method	47
3.2	Gravity Model	50

**LIST OF APPENDICES**

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
A	Study Area	85
B	Number of Houses	87
C	Sample Size	93
D	Survey Data	116
E	Residential Household Survey Form	142
F	Trip Generation	144
G	Trip Distribution based on Singly Uniform Growth	152
H	Trip Distribution based on Average Growth Factor	154

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1. Background**

Urban congestion is one of the most significant and critical problems that is happened in most of large cities especially in developing countries. This may include the high urbanization and increase in the number of vehicles, quickly population growth, enhancing income, inefficient public transportation, and etc especially in most Asian developing countries that is lead to affect of increasing urbanization and motorization. Delay, congestion, environmental pollution and vibration are some of the problems.

Transportation has played a major function in the human race. The first necessary for transportation has been financial, travel to search food or work, travel for exchange of goods, exploration, personal fulfillment, and to make better of a populace or a country.

Mobility is a permanent change in the term of both amount and spatial models. The process of transportation planning involves establishing a transportation schedule for an urban region. It is a continuous process that pursues to address the transport requirements of residents of the area, with the help of a process of advising



with all relevant groups, and struggle to identify and implement a suitable plan to meet these needs.

Two important factors which influence the Modern Civilization are urbanization and industrialization. Urbanization attracts the extra labor from rural areas and uses it runs the various services which are critical for the living of city.

With the development of cities, the need for a sufficient and adequate transport network also increases. The responsibility of transport network to the high demand goes to shifting of activities at the edges of the city where load is still favorable and transportation capacity is available for any movement of people and goods. Therefore, the performance of transportation can be distinguished, but as mentioned above, it develops worried about over congestion, physical deteriorating, accident and etc. current raise momentous issues for transportation planners.

Accordingly, urban transportation planning is a series of acts that drive to the future of the region travel in the terms of environmental resources, policy and program that is directly dependent on the prediction of future of travel demand. Transportation planning process can be lead to arrange supply for the long-range transportation pattern and transportation planning is used to all area that has the population over 50,000. By focusing travel characteristics, exactly identify to forecast how many trips will be produced, where they will attract, with which mode of transport system and also by which specific route. Therefore, travel demand determines quantity of travel on transportation system and provides useful information on the amount and location of future activity. In addition travel demand could say the amount of the reduction in car use which would happen in response to a new taxation policy of Central Parking Area. On the whole, transportation planning can be affected by population, land use, travel, economic activity, financial and transportation system value.

Furthermore, in Malaysia, the car ownership has being rising quickly everywhere in recent year. The similar location has happened in the Skudai town which is located in Johor state. This orientation appeared to be enduring in the future

if the condition also remains expanding in progression as before. In addition, increased accordingly, as a developing country, the growth of the economy of the country in terms of technology, engineering and other developments, requirements of experts are necessary in the direction of population, facilities, equipment and infrastructures that including transport and transport networks.

However, proportionately attentions to parking and transportation issues were placed in Skudai town. Such issues are necessary as future guideline in transportation are exposed to and affected by these transport systems. Therefore, in this study, Skudai town is selected because it is one of the fastest growth cities in Malaysia.

## **1.2. Need Of the Study**

The critical affects of developing urbanization and increasing traffic, is congestion on street. The requirement results in focus traffic demand, both in time and space. Space is unbearable in some areas of city. Congestion results in delay and time losses which lead to driver stresses. In fact, the need for transport planning largely taken for granted.

Descriptions of where the trip will be attracted are one of the important and necessary part especially in Asian countries because of the supply is unmatched with demand among these countries. New construction can affect the people's daily activity for distribution of travel from one place to another place. Therefore, trip distribution is an important part for the planner in the term of new constructed such as residential, commercial, industrial, political, school, mosque and church. The determination on particular purpose is directly related to the accessibility and rate of attractiveness of destination area. Therefore, the functional of forecasting trip

distribution is depended on trip production, trip attraction, travel time, travel time factors, socio-economic variables and growth rate.

As mentioned above, trip distribution model is used to predict where the trip will be attracted. Modeling trip distribution is a challenging task, because Different modeling technique often results in different outcomes, so it is important to assess the merits and demerits of the two well established modeling techniques for trip distribution (average growth factor and gravity model) and one that is required for rational planning and evaluation of transportation systems in the area of study. Without a proper planning of distribution trips among the zones will cause of a lot unwanted transport issues such as delay, lack of parking space and green zones, environmental pollution might be raised.

This study focuses on two techniques of analyzing trip distribution: growth factor which is related to historic growth rate to prediction and gravity model that is depended on socio-economic variables and friction factor.

### **1.3. Purpose Of the Study**

The purpose of the study is to compare average growth factor and gravity modeling techniques of distributing trips on a network.

#### **1.4. Objectives Of the Study**

The purpose of the study is to assess comparatively growth factor and gravity modeling methods based on trip generation data from Skudai Town Malaysia. In order to achieve that, the following objectives are set:

1. Determine Trip Distribution Matrix of Skudai town based on Growth Factor using historic growth rate from previous studies.
2. Determine Trip Distribution matrix of Skudai town based on Gravity Model Method.
3. Compare Outcomes from both Methods

#### **1.5. Scope Of the Study**

The main focus of this study is on the considering of distribution production and attraction of Skudai town based on the growth factor technique and gravity model. Furthermore to accomplish the foregoing objectives, the scope of the study is defined to include following:

- To provide valid knowledge of land use and number of population growth;
- To provide current traffic and transport system available and policy establishment;
- To verify trip distribution among the zoning areas within the boundary of study area based on the growth factor that is depended on the historical growth rate and origin-destination trip matrix;
- To verify trip distribution among the zoning area based on the gravity model which is depended on the trip production, trip attraction, spatial separation between zonal interchange.

## **1.6. Significance Of the Study**

Trip distribution is one of the important parts in transportation planning process. It can be used to forecast the land use, economic, travels, growth rate, travel time, socio-economic variable and impedance factor. By forecasting trip distribution can forecast the modal choice and trip assignment.

## **1.7. Proposed Research Methodology**

This proposed study intends to consider the distribution of trips that are produced in one area (origin zone) and attracted to another zone (destination zone) in the terms of trip production, trip attractions, population growth, travel time, accessibility, travel times factors and socioeconomic variables.

Methodology of this study based on the four fundamental steps which consist of data collection, survey, analysis and model building phase; a forecasting phase, and an estimation phase. In order to form of a transportation model, there is a usual fundamental approach which can be implemented to all forms of transportation planning, involving planning for local transport policy.

This study concentrates on the first phase of the process, the survey, analysis and model building phase. The description of the methodology of this study is discussed in Chapter Three.

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