MEASURING URBAN TRAFFIC CONGESTION ON THE EFFECT OF A NEWLY DEVELOPED COMMERCIAL AREA AT TAMAN TAS

TAN WOEI LIANG

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG



SUPERVISOR'S DECLARATION

I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the degree of *Doctor of Philosophy/ Master of Engineering/ Master of Science in Civil Engineering.

(Superv	visor's Signature)
Full Name	:
Position	:
Date	:

(Co-	supervisor's Signature)
Full Name	:
Position	:
Date	:



STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

(Student's Signature) Full Name : TAN WOEI LIANG ID Number : AA13124 Date : 9 JUNE 2017

MEASURING URBAN TRAFFIC CONGESTION ON THE EFFECT OF A NEWLY DEVELOPED AREA AT TAMAN TAS

TAN WOEI LIANG

Thesis submitted in fulfillment of the requirements for the award of the Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources UNIVERSITI MALAYSIA PAHANG

JUNE 2017

ACKNOWLEDGEMENTS

First of all, I would like to present my gratitude toward University Malaysia Pahang for the valuable experience and opportunity of Final Year Project. Then, I also like to show my appreciation to my supervisor Dr. Intan Suhana Binti Mohd Razelan for her guidance and encouragement along the study. The research would not be complete without her idea and help.

Besides, I am also grateful toward the lab assistance in University Malaysia Pahang, Traffic and Highway Lab for their assistance and advice. Their kindness and enthusiastic is indeed a big help to complete this research. Beside, academic staff who ever provide any helping hand for me especially Dr. I Putu Mandiartha as my software consultant.

Next, I would like to express my gratitude toward everyone that direct or indirectly provide aid to my research. Other than that, many thanks to my research friends, especially Chan Kien Chong and Chua Zhen Yang, who constantly support and motivate me along the research. Last but not least, my sincere gratitude to my parent for their patience, sacrifice and moral support throughout my entire life.

TABLE OF CONTENT

DECLARATION

TITLE P	PAGE		
ACKNO	WLEDGEN	IENTS	iii
ABSTRA	K		iv
ABSTRA	CT		v
TABLE	OF CONTE	NT	vi
LIST OF	TABLES		X
LIST OF ABBREVIATIONS ii			ii
СНАРТІ	ER 1 INTRO	DUCTION	1
1.1	Backgr	ound	1
1.2	Probler	n Statement	3
1.3	Objecti	ve	4
1.4	Scope of	of Work	4
1.5	Researc	ch Significant	4
CHAPTI	ER 2 LITER	ATURE REVIEW	5
2.1	Introdu	ction	5
2.2	Traffic	Congestion	5
	2.2.1	Speed	6
	2.2.2	Travel Time	7
	2.2.3	Speed and Travel Time	9
	2.2.4	Level of Service	10

2.3	Automatic Traffic Count		17
	2.3.1	Speed Analysis	17
	2.3.2	Classification of Vehicle	19
	2.3.3	Traffic Volume	19
2.4	Urban a	and Suburban Arterial	20
	2.4.1	Free-flow Speed	21
	2.4.2	Average Travel Speed	21
2.5	Aimsur	1	21
2.6	Summa	ıry	22

CHAPTER 3 METHODOLOGY

23

3.1	Introdu	iction	23
3.2	Traffic	Survey	25
	3.2.1	Metrocount Device System Approach	25
	3.2.2	Metrocount 5600 Programme Setup	25
	3.2.3	Rod Tube Preparation and Installation	28
	3.2.4	Traffic Data Reporting and Extraction	29
3.3	Field S	Survey	34
3.4	Analys	is of LOS using Malaysia Highway Capacity Manual	34
	3.4.1	Establish the Location and Length of Road to be Consider	35
	3.4.2	Arterial Classification for Free-flow Speed	35
	3.4.3	Determine the Running Speed	36
	3.4.4	Establish the Speed-traffic Flow Relationship	36
	3.4.5	Determine the Geometry Data	37
	3.4.6	Determine the LOS of the Arterial	37

vii

3.5	Aimsun	Software Approach	39
3.6	Summar	у	46
CHAPTER 4	RESUL	TS AND DISCUSSION	48
4.1	Introduc	tion	48
4.2	Traffic (Condition	48
4.3	Variatio	n of Weekday Peak Traffic Volume	51
4.4	Variatio	n of Weekend Peak Traffic Volume	53
4.5	Geomet	ry Data for Investigated Road Segment	55
4.6	Ratio Di	stribution at Each Junction	56
4.7	LOS		58
	4.7.1	Cycle length	58
	4.7.2	Free-flow Speed	62
	4.7.3	Running Time	62
	4.7.4	Speed –flow Relationship	63
	4.7.5	Calculation of LOS	64
4.8	Aimsun	Simulation Approach	68
	4.8.1	Propose Improvement to Jalan Gambang – Jalan Kuantan	69
	4.8.2	Problem Encounter during Simulation	70
4.9	Summar	у	71
CHAPTER 5	CONCI	LUSION	72
5.1	Conclus	ion	72
5.2	Recomn	nendation for Future Work	73
REFERENC	ES		74

viii

APPENDIX

LIST OF TABLES

Table 2.1	Evaluation of Speed Performance Index on Expressway	7
Table 2.2	Tabulation for Congestion Rule	10
Table 2.3	Road Facility by Respective Service Measure	12
Table 2.4	Traffic Congestion Measures and its Respective Suitability to	13
	Assessment Criteria	
Table 2.5	Urban streets LOS by Street Class	14
Table 2.6	LOS Criteria for Signalized Intersection	14
Table 2.7	LOS Criteria for Non-Signalized intersection	15
Table 2.8	PCU Conversion Factors	19
Table 2.9	Criteria of LOS arterial	20
Table 3.1	Suburban or Urban Arterial Classification	36
Table 3.2	Speed-Traffic Flow Relationships in Urban and Suburban Arterial	37
Table 4.1	Class of Vehicle based on JKR Manual	51
Table 4.2	Tabulation of Weekday Traffic Volume	52
Table 4.3	Tabulation of Weekend Traffic Volume	54
Table 4.4	Traffic Flow at respective junction	56
Table 4.5	Ratio Distribution	57
Table 4.6	Traffic Volume without Irritation from Taman Tas	57
Table 4.7	Cycle Length from Field Survey	59
Table 4.8	Traffic Volume at Intersection by Class	60
Table 4.9	Webster's Optimum Cycle Length	60
Table 4.10	Cases of Traffic Volume	64
Table 4.11	Running Speed by Cases	64
Table 4.12	Adjusted Saturation Flow Rate	66
Table 4.13	LOS Level on Both Cases	68

LIST OF FIGURES

Figure 1.1	Surrounding Area of Study Site	2
Figure 1.2	Jalan Gambang beside Study Area	2
Figure 2.1	Speed Reduction Index	7
Figure 2.2	Cumulative Distribution of Travel time and Reliability Indices	8
Figure 2.3	Membership Functions for Travel Speed Rate	9
Figure 2.4	Membership functions for Very-Low-Speed Rate	10
Figure 2.5	Los with Operation Condition	11
Figure 2.6	Normal Standard Distribution Curve for Travel Speed	18
Figure 3.1	Research Flowchart	24
Figure 3.2	RSU Status Check	26
Figure 3.3	RSU Status not Active	26
Figure 3.4	RSU Battery Tab Check	27
Figure 3.5	RSU Setup Interface	27
Figure 3.6	Location of Rod A and B	28
Figure 3.7	Data Unloading	29
Figure 3.8	Data Reporting	29
Figure 3.9	Data Reporting 2	30
Figure 3.10	Data Reporting 3	30
Figure 3.11	Data Reporting 4	31
Figure 3.12	Data Reporting 5	31
Figure 3.13	Data Reporting 6	32
Figure 3.14	Data Extraction	32
Figure 3.15	Flowchart of MetroCount Device System	33
Figure 3.16	Collecting Physical Data of the Road Segment	34
Figure 3.17	Arterial LOS Methodologies	39
Figure 3.18	New Project with TSS Template	40
Figure 3.19	Imported the Site Image File	40
Figure 3.20	Create Road Intersection	41
Figure 3.21	Modify Road Data	41
Figure 3.22	Insert the Traffic State for Selected Road	42

Figure 3.23	Example Car State with its Respective Turning Percentage for the	42
	Whole Network	
Figure 3.24	Metering to create Traffic Light	43
Figure 3.25	Assign Cycle Length to each segment	43
Figure 3.26	Create Control Plan	44
Figure 3.27	Control Plan Edit	44
Figure 3.28	Master Control Plan Edit	45
Figure 3.29	Include the Data into the Simulation Step	45
Figure 3.30	Simulation Run	46
Figure 3.31	Flowchart of Aimsun Software	47
Figure 4.1	Entries and Exits Road from the Study Area	49
Figure 4.2	Detailed Layout around First Junction	49
Figure 4.3	Detailed Layout around Second Junction	50
Figure 4.4	Detailed Layout around Third Junction	50
Figure 4.5	Variation of Weekday Traffic Volume over Time	53
Figure 4.6	Variation of Weekday Traffic Volume over Time	55
Figure 4.7	Counter Location	56
Figure 4.4	Relationship between Actual Green and Effective Green Time	58
Figure 4.5	Saturation Flow Concept	59
Figure 4.6	Webster's Equation Cycle Length	61
Figure 4.7	85 th Percentile of Free-flow Speed	62
Figure 4.8	Speed-flow Relationship	63
Figure 4.9	Current Traffic Modelling	69
Figure 4.10	Total Delay Time after Simulation	70
Figure 4.11	Queue Patterns of Motor and Bicycle in Simulation	71

LIST OF ABBREVIATIONS

TRB	Transportation Research Board
HCM	Highway Capacity Manual
US HCM	United State Highway Capacity Manual
MHCM	Malaysia Highway Capacity Manual
JKR	Jabatan Kerja Raya
PCU	Passenger Conversion Unit