DEVELOPMENT OF TRAFFIC SIGNAL MODEL FOR AN INTERSECTION

BY

CHOO LI RONG

Being a Project Report submitted to
INTI INTERNATIONAL UNIVERSITY
as a requirement for
DIPLOMA IN CIVIL ENGINEERING
(Semester: JANUARY 2015)

Faculty of Science, Technology, Engineering and Mathematics
INTI INTERNATIONAL UNIVERSITY

Supervisor: MR SUDESH NAIR BASKARA
(April 2015)

Acknowledgement

The first person I would like to thank is my supervisor, Mr.Sudesh. I am new to this project topic and I have to work on it from the very start. The first thing that I did when I got the title is going to meet my supervisor and discussed about it. Mr.Sudesh asked me to go to the library to borrow some of the books which are related to my project title. Furthermore, he guided me and gave me advices while I was working on my reports. He explained to me in a very detailed manner when I did not understand the new formulas and questions that I had found and I really appreciate it.

Second, I would like to say thanks to my family members since they gave me encouragement when I was desperate and fed up in doing my reports. Their imperceptibly support made me put more effort into my project. Besides that, they also gave me some ideas on how I should design my traffic signal.

Thirdly, I must say thanks to my dearest friends who had really helped me a lot. Different peoples have different opinions and ideas. With this, I was able to get some ideas from my friends which were really useful in my project. Furthermore, my friends accompanied me to buy the materials which I needed in my traffic signal modelling.

Last but not least, I would like to thank the INTI University because INTI provided me a place, which is the library to increase my knowledge for my project. I was able to obtain more information from the books in the library and I also surfed the internet to get the information which I needed.

I declare that this project is entirely my own work except where due references are made

CHOO LI RONG

10 April 2015

Abstract

The main purpose of this project is to design a new traffic signal for an intersection. According to the data and the research I collected in front of INTI University, I realized that traffic jam will occur during the peak hour which are 1200-1300 and 1800-1900. Due to the traffic problems, I have decided to design a new traffic signal to avoid traffic jam from happening in front of INTI University so that it would be more convenient for the road users, where the new intersection point will be designed exactly in front of the new INTI football field. This is done to reduce accident occurrence, providing safety to road users.

The traffic signal design had been designed according to my researches, data collected on site (in front of INTI University), calculation and results. Besides that, the traffic timing is also based on my calculation to function, so that lesser traffic jam will happen in front of INTI University. Base on the calculation, we know that 1200-1300 and 1800-1900 has peak flow rate compare to 0800-0900 and 1500-1600.When it is peak hour, q will be 408veh/h and 444veh/h and normal time q will be 132veh/h and 180veh/h, the higher the q, the more serious of traffic jam.The signal timing estimated to be 100 seconds for whole cycle.

According to my final result, my study has met my purpose which is provide shortcut or detour of road user movement from Jalan Persiaran Perdana(roundabout shown in Figure 4) to the INTI for faster access and lesser travelling time. Besides, it also improve the flow at intersection and no more traffic jam will occur in front of INTI University.

Content

List of Tables

List of Figures

1.0 Introduction

Traffic light can be considered as something common and popular in Malaysia. As we know that, traffic lights play an important role in our country. Traffic lights is also known as traffic signals, traffic lamps, signal lights and etc. Traffic lights alternate the right ways to road users by displaying lights of a standard colour which are green, red and yellow. Green light allows traffic to proceed in the direction denoted, yellow light provides warning that the signal will be changing from green to red and red signal stops any traffic from proceeding.

Traffic light prevent accidents from happening although there are still some collisions happening at signal intersections. In addition to that, they also allow road users to get to a certain place within their time schedule and keep peoples safety when they are crossing the railroad since pre-emptions are built into the system so that when a train is coming, it turns the traffic lights green for the desired direction. Traffic signals also allow the pedestrians to cross the road safely and without backing up traffic when there is a walk or do not walk sign. Traffic lights nowadays have pre-emptions where they will turn the traffic light green for an emergency vehicle which is sensed by a rapid light movement detector. This makes everything a lot safer and keeps things moving faster. Traffic signals in bigger cities can help you get on the on-ramp faster and safer too.

Traffic lights is a common belief, often from drivers that are stuck in queues, that they are installed at a junction with little consideration for the flow of traffic or dominant turning movements. Whilst this may be the case for some ill-conceived installations or portable traffic signals at roadwork, there is, however, a lot of thought and preparation that goes into the traffic signal design process for new signal controlled junctions.

Due to the research above, I have design a new traffic signal for an intersection point located in front of the new INTI football field which is Figure 1. The main purpose for the design is to reduce the traffic jam happen in front of INTI University.

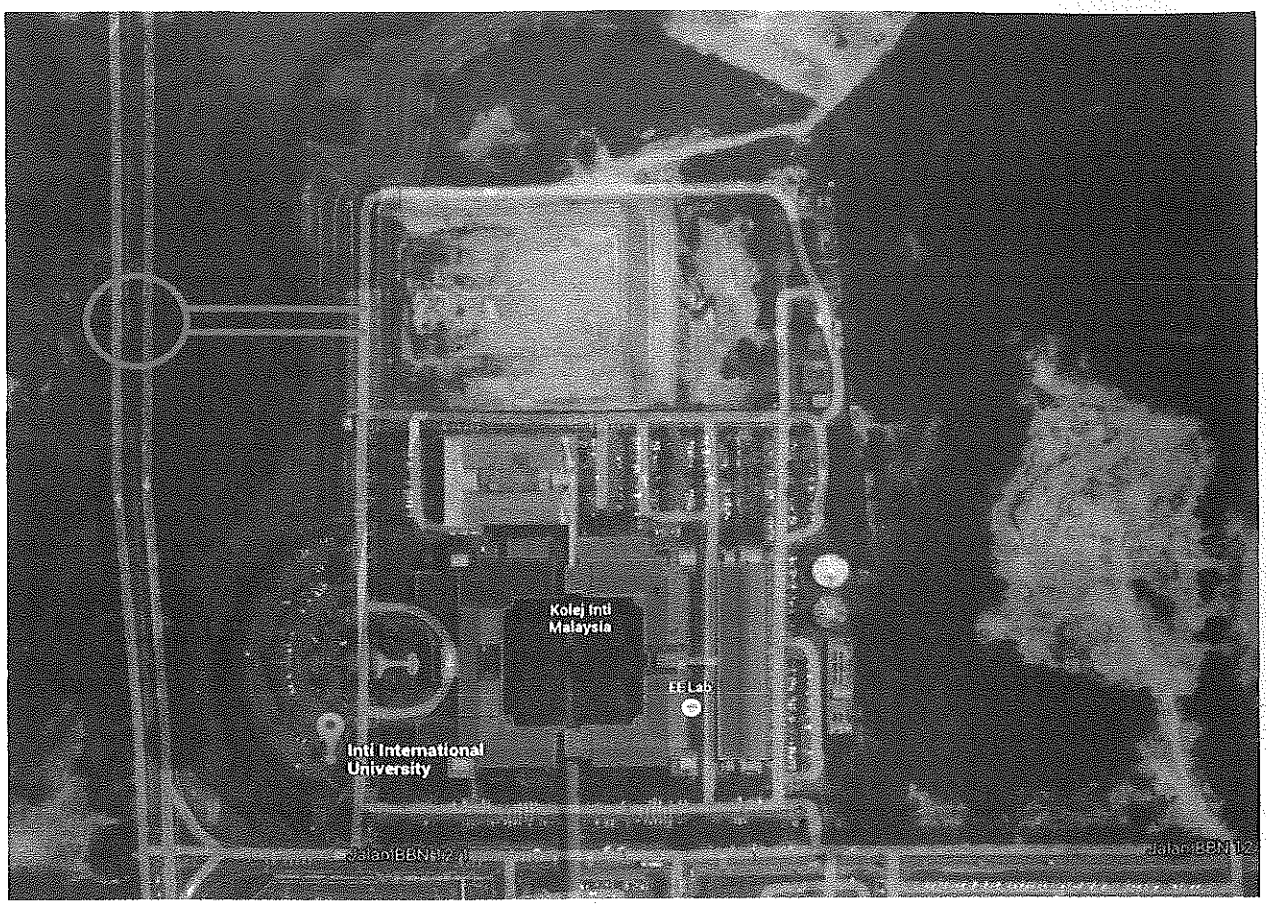
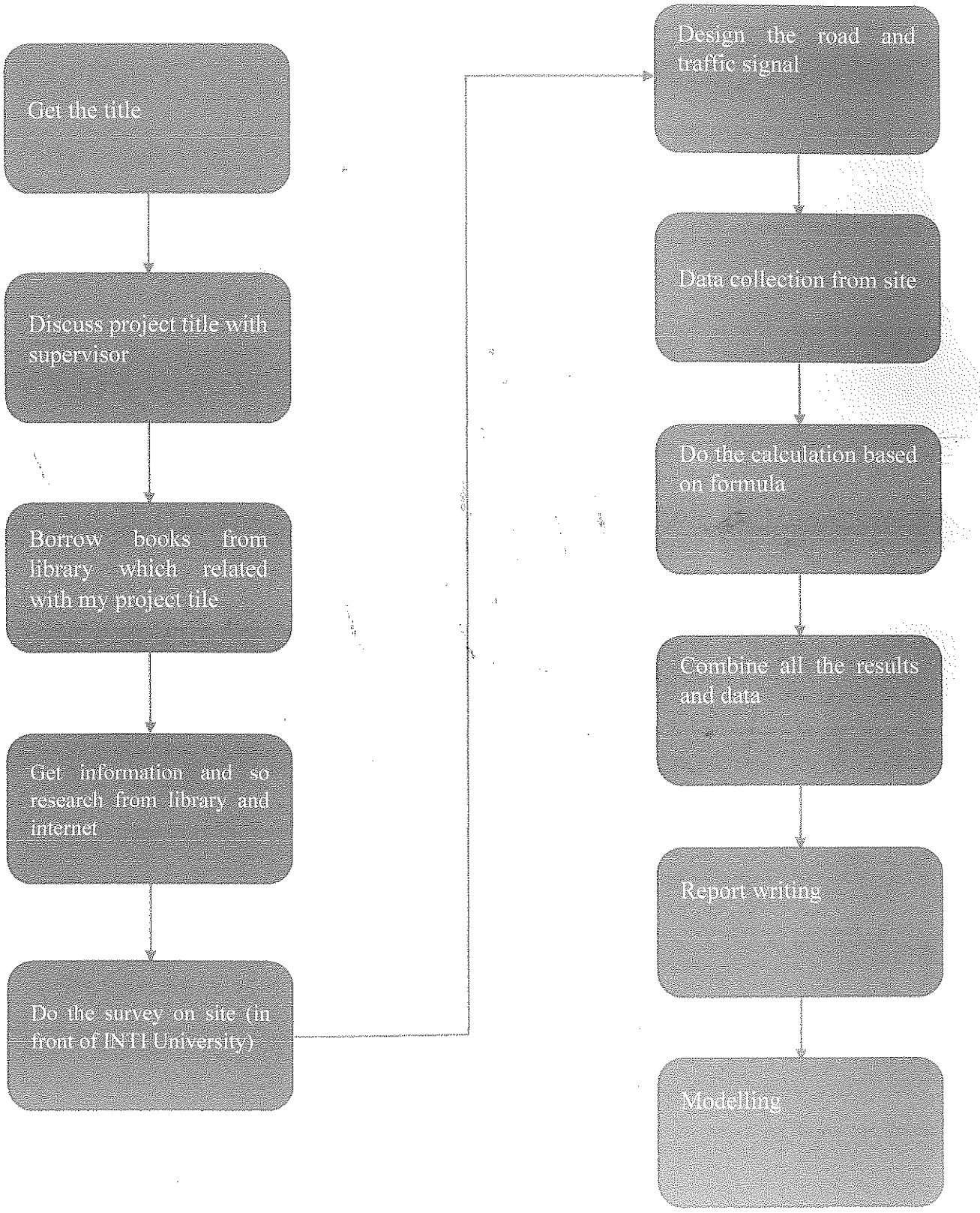

Kolej Inti
Malaysia
EE Lab
Inti International
University
Jalan BBN 12/1
Jalan BBN 12

Figure 1

2.0 Methodology



3.0 Results

Table 1

Time	Number of Vehicles	Time	Number of Vehicles
0900-0905	10	1200-1205	21
0905-0910	11	1205-1210	35
0910-0915	14	1210-1215	40
0915-0920	9	1215-1220	23
0920-0925	8	1220-1225	24
0925-0930	10	1225-1230	26
0930-0935	11	1230-1235	25
0935-0940	8	1235-1240	45
0940-0945	12	1240-1245	47
0945-0950	16	1245-1250	44
0950-0955	12	1250-1255	38
0955-1000	11	1255-1300	40
AVERAGE	11	AVERAGE	34
q(veh/h)	132	q(veh/h)	408

Table 2

Time	Number of Vehicles	Time	Number of Vehicles
1500-1505	20	1800-1805	38
1505-1510	18	1805-1810	32
1510-1515	12	1810-1815	30
1515-1520	11	1815-1820	35
1520-1525	19	1820-1825	35
1525-1530	18	1825-1830	36
1530-1535	12	1830-1835	35
1535-1540	18	1835-1840	39
1540-1545	13	1840-1845	37
1545-1550	14	1845-1850	41
1550-1555	12	1850-1855	42
1555-1600	13	1855-1900	44
AVERAGE	15	AVERAGE	37
q(veh/h)	180	q(veh/h)	444

3.1 Formulae

1. Car Flow Rate

$$q = \frac{n \times 3600}{T} \; veh/h$$

- n = number of vehicles passing a point in the roadway in T sec
- q = the equivalent hourly flow

2. Cycle Length

$$C_O = \frac{1.5L+5}{1-\sum_{i=1}^{\#phases} \frac{C_i}{s}}$$

- C_o= optimal cycle length
- s = saturation flow
- L = lost time [lost time = yellow(3seconds) + red(3seconds)]
- C_i = critical volume for phase i

3. Signal Timing Calculation

Y=Q/S

- Q=Vehicles Per Hour(V)
- S= Saturation Flow (Normally 2 lanes=3600)

4. Total time lost, L $= (I_1 - a + l_1) + (I_2 - a + l_2) + (I_3 - a + l_3)$

5. Cycle time, C_o $= (1.5\ L + 5) / (1\text{-}Y)$

6. Effective green time $g_1 = (y_1/Y)\ (C_o - L)$

7. Actual green time, $k_1 = g_1 + l_1 - a$

3.2 Explanation

Table 1 and Table 2 show the results of the number of vehicles passed by the intersection point in front of INTI University in 5 minutes. Other than that, Figure 2 shows the plan view of the intersection point in front of INTI University. Next, Table 3 shows that vehicles from a road turning into another road according to Figure 2(Example: from West turn to South). Figure 3 will show the cycle time for every traffic light.

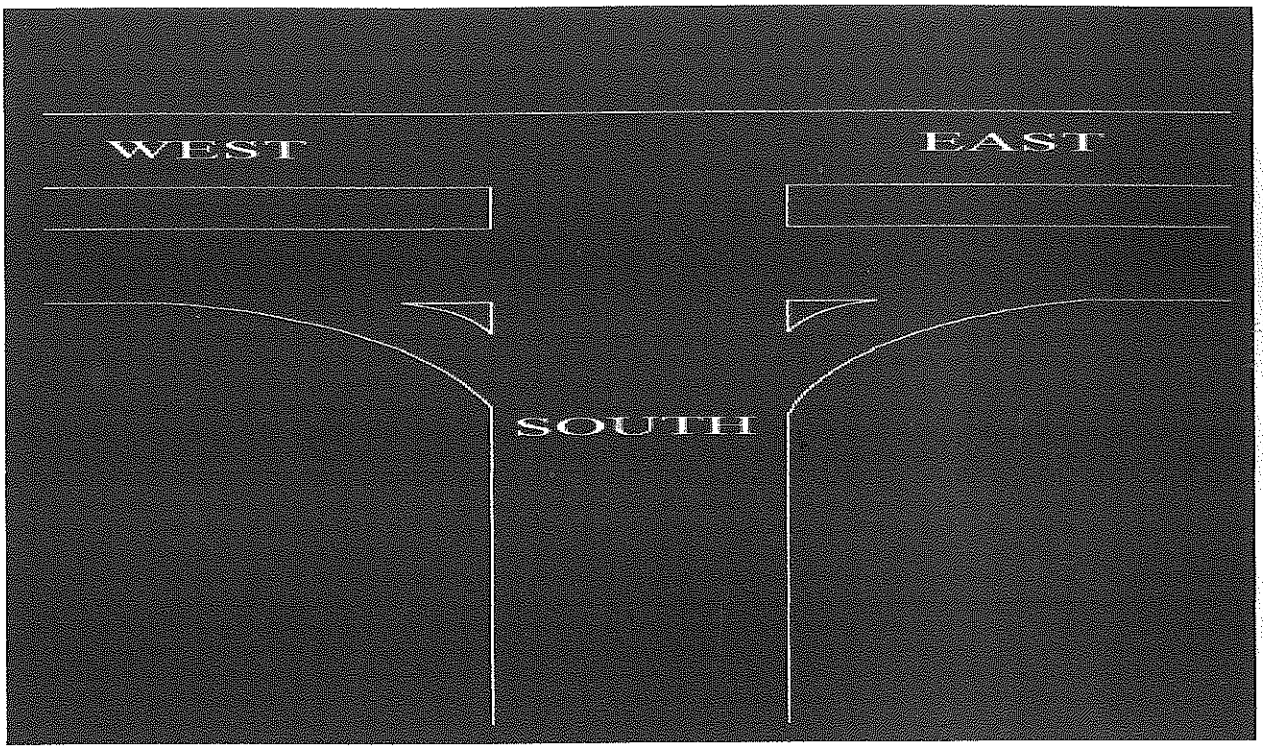


Figure 2

Table 3

From	West	West	East	East	South	South
To	South	East	South	West	West	East
VPH/hr	900	650	500	750	800	650
Lane Width	3.5 m	3.5 m	3.5 m	3.5 m	3.5 m	3.5 m

3.3 Calculation

Example

Base on Table 1, Formula 1= $q = \frac{n \times 3600}{T} veh/h$

$$q = \frac{11 \times 3600}{300} veh/h$$

$$= 132\ veh/h$$

Formula 2=$c_o = \frac{1.5L+5}{1-\sum_{i=1}^{\#phases} \frac{C_i}{s}}$

$$c_o = \frac{1.5(3+3)+5}{1-(\frac{820}{1800}+\frac{508}{1800})}$$

$$c_o = 51s$$

Base on Figure 2 and Table 3, Formula 3= Y=Q/S

Table 4

From	West	West	East	East	South	South
To	South	East	South	West	West	East
Q(V/hr)	900	650	500	750	800	650
Lane Width	3.5 m	3.5 m	3.5 m	3.5 m	3.5 m	3.5 m
S	3600	3600	3600	3600	3600	3600
Y=Q/S	0.250	0.181	0.139	0.208	0.222	0.181
Y max	0.250		0.208		0.222	

Total Y=0.181+0.208+0.222

=0.661

Assume:

Time between green (I) = 4 seconds

Lost time (l) = 6 seconds

Yellow time (a) = 3 seconds

Total time lost, L $= (I_1 - a + l_1) + (I_2 - a + l_2) + (I_3 - a + l_3)$

$= (4 - 3 + 6) + (4 - 3 + 6) + (4 - 3 + 6)$

= 21 sec

Cycle time, C_o $= (1.5\ L + 5) / (1-Y)$

$= (1.5 \times 21 + 5) / (1 - 0.661)$

= 107.67 sec (approx. to 108sec)

For West

Effective green time $g_1 = (y_1/Y)\ (C_o - L)$

$= (0.250/0.661)\ (108-21)$

=33sec

Actual green time, $k_1 = g_1 + l_1 - a$

=24+6-3

=36sec