TRAFFIC SIGNAL DESIGN FOR SELECTED INTERSECTION POINTS BY VISSIM SOFTWARE

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A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

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DECLARATION

It is hereby declared that this thesis/project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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Dedicated

To

"Our beloved parents"

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ABSTRACT

Application of automatic traffic signaling system is the most time asking demand for our country, especially for the capital, Dhaka. This will save valuable time of travellers as well as money. A total of 7 intersections of 70 signalized intersections in Dhaka City are namely Farmgate signal, Karwan Bazar, Bangla Motor, Kataban Signal, Shahbagh signal, Science Lab signal, and Panthapath signal are designed in this research work. All these roads lead to School, College, University, Hospital, Bank and many public and private workplaces. These roads are manually controlled by the police. Hence faulty traffic control cycle, pro-long the traffic congestions. This work designed the intersections for automatic traffic signaling system for quick and smooth movement of traffic. After designing it was found that, if the intersections are controlled by signaling system, then on an average, more than 90% time is being saved at each road intersection, as compared to manual traffic signaling. It also reduces 60% to 70% vehicle count from queue.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Background and Motivations

In the capital of Bangladesh, the Dhaka city is always over populated. In various studies it is recorded that, though the city has traffics and pedestrians on road, the road monitoring and traffic signaling system is not up to mark. It has been recorded that, 59% of intersections are placed at wrong direction and 27% signals have wrong lighting system. [1]

Dhaka city compelled the rise of increased development without appropriate monitoring within a glimpse of last few decades which resulted in huge urban transport system difficulties. Inadequate transportation system has noticeably affected the physical form and performance of the city. Traffic congestion is now one of the main problems in our daily life. Major causes for this congestion are infrastructure problem, system problem, and human behavior problem etc.[2]

Intersections controls traffic in a safe, orderly and efficient manner. The total road network in Dhaka city spans about 2230 kilometers- including roads, lanes and by-lanes. The road network covered only 8% of city's land area[1].The functional primary road spans only 84.67 Km (DCC). More than 5.2 lac motorized vehicles such as cars, jeeps, microbuses, taxicabs, CNG-run auto-rickshaws, buses, minibuses, trucks and human haulers are registered with the Bangladesh Road Transport Authority (BRTA) in Dhaka till 2009[1].

In Dhaka City, both motorized and non-motorized vehicles occupy the same streets at the same time. Their speed is different and that is why it creates congestion on that,[3].

Specially in Dhaka metropolitan city (DMP), capital of Bangladesh , whose area is 360 km^2 but population is 70,00,940. It is an over crowed city with insufficient roads with respect to the number of vehicle. The consequence of this is traffic jam .In most of the time in day traffic jam is a normal view of Dhaka city. This jam causes unnecessary delay to people, causes accident as drivers drive fast to cross the intersection with one signal. Thus overpopulation & limited roads make the accident.[4].

That's why traffic signaling design and simulation is very important for solves this problem.

1.2 Objectives of work

The main objectives of our research work are

1. Addressing the traffic signaling problem at selected signal point.
2. Signaling time design.
3. Evaluation of signaling time by VISSIM software.

1.3 Organization of the thesis

Chapter 1: Introduction and Objective. This chapter provides the background and motivations of the research. The overall objectives and expected outcomes are also described in this chapter.

Chapter 2: Literature Review. This chapter reviews the related works in the Engineer, E. *et al.* (2015), Sanowar Hossain, M. *et al.* (2017) and Hossain, M. (2004) field with a special focus on Hossain, M. (2004).

Chapter 3: Methodology. This chapter describes the methodology adopted to carry out the research.

Chapter 4: Results and Discussion. This chapter describes the results of reduce traffic signaling time and reduction of vehicle in queue.

Chapter 5: Conclusions and Future Work. This chapter summarizes the conclusions and major contributions of this study and provides recommendations for future studies.

CHAPTER 2

Literature Review

2.1 Introduction

Hossain, 2004 reported from their work that, Metropolitan Traffic Police are neither educated by any organization nor trained or supervised by any expert. From their observation it takes almost 6 to 14 minutes for every busy road to complete a traffic cycle while controlling manually. They analyzed the reasons of disruption of normal traffic operation by Photo analysis and noted numbers of issues including poor road maintenance, unusual and illegal blockage of road and footpath, irregular bus stoppage and passenger loading unloading, water logging and uncontrolled parking. But the major issue was pointed as lack of enforcement. From their report, it can be said that, every busy road intersection is consuming nearly 87% of extra time due to be controlled manually by policeman, than that of a traffic light.[5]

A detailed research work was done for Shahbagh Junction by Sanowar Hossain et al., 2017, for designing optimum signaling system using PTV VISSIM software and estimating the congestion cost. It was investigated and reported that, around forty-six thousand Bangladeshi taka is lost for only one hour of travel time loss.[2]

Engineer et al., 2015 worked on the existing traffic signals and highlighted some deficiencies. They classified the deficiencies in two types, physical and operational. position of signal, poles, cabinet condition, signal light or vision, traffic sign and marking, sight distance at intersection, condition of footpath, median, pedestrian refuse at intersections, pedestrian crossing facilities, pedestrian signal and signal visibility are identified etc. were addressed as physical deficiencies. Moreover, signal timing control system, retiming, signal light condition, signal maintenance, timing control at special events or incidents, signal operation and management and institutional weakness were spotted as operational deficiencies. According to their survey, though there are 70 intersections consist of automatic signaling system, 98% of those are not operated or are violated by city travelers for various above mentioned deficiency aspects.[1]

Another research work was done based on digital image processing on vehicles using color-to-grayscale algorithm to detect the traffic that violate the traffic law. They suggested this automated traffic detection process to be used for all highway intersections for enforcing the laws on the vehicle riders.[6]

Munia, 2019 mentioned in their work that, Bijoy Sharani intersection is controlled by traffic police results in no fixed cycle time. Hence, absolute error was observed from the calibrated data simulation. Though they offered a Diamond Interchange to ensure the smooth movement of vehicle, it does not seem to be realistic as metro-rail is being constructed.[7]

2.2 Summary

Metropolitan Traffic Police take almost 6 to 14 minutes for every busy road to complete a traffic cycle while controlling manually. It was investigated and reported that; around forty-six thousand Bangladeshi taka is lost for only one hour of travel time loss. Every busy road intersection is consuming nearly 87% of extra time due to be controlled manually by policeman, than that of a traffic light. They offered a Diamond Interchange to ensure the smooth movement of vehicle; it does not seem to be realistic as metro-rail is being constructed.

CHAPTER 3

Methodology

3.1 Site Selection

A full road network of seven signaling points were selected for this thesis work. The signaling points are as below

1. Farmgate signal (Farmgate to Karwan Bazar, Farmgate to Khamar Bari, Farmgate to Bijoy Sharoni, Farmgate to Tejturi Bazar)
2. Kawran Bazar signal (Karwan Bazar to Farmgate, Karwan Bazar to Panthapath, Karwan Bazar to Tejgaon Link Rd, Karwan Bazar to Bangla Motor)
3. Bangla Motor Signal (Bangla Motor to Karwan Bazar, Bangla Motor to New Eskaton Road, Bangla Motor to Shahbagh, Bangla Motor to Sonargaon Rd)
4. Shahbagh signal (Shahbagh to Bangla Motor, Shahbagh to TSC, Shahbagh to Shahbag Rd, Shahbagh to M. Bhashani Rd)
5. Panthapath signal (Panthapath to Karwan Bazar, Panthapath to Farmgate, Panthapath to Dhanmondi 32, Panthapath to Science Lab)
6. Science Lab signal (Science Lab to Panthapath, Science Lab to Elephant Rd, science Lab to Mirpur Rd)
7. Kataban signal (Kataban to Shahbagh, Kataban to Nilkhet, Kataban to New Elephant Rd, Kataban to Sonargaon Rd)

It is very important and busy road of Dhaka city. This road is located in the heart of Dhaka city. These road networking serves office, hospitals and clinics including BSMMU and BIRDEM, banking and finance, regular movement of peoples. Also serve the major three institutes of Bangladesh name, Dhaka University (DU), Bangladesh University of Engineering and Technology (BUET) and Dhaka Medical College (DMC). That is why this road network has been chosen for the modified signaling design and to ensure the smooth movement of people. This modified design may save travel time, patients' life, office and working hour and a rapid transaction of our country economy

3.2 Traffic Volume Count

The types of vehicles observed at site of different signaling points were as Privet car, Bike, Ambulance, CNG, Public Bus, Rickshaw, Laguna and Miscellaneous (Ambulance, Cover Van, Institute Vehicle, Delivery Vehicle and Truck). Vehicle counting data was collected at site from January 2022 to April 2022. Peak hours were found observing traffic volume, from 8:00 am to 11:00 am and off-peak hours were from 11:00 am to 4:00 pm in open days. The peak hour again starts at 4:00 pm to 8:00 pm, and it was observed that, from 8:00 pm to 12:00 am are commonly off-peak hour during open days. This scenario is changed during Friday; it was found 10:00 am to 12:00 pm as peak hour and 12:00 pm to 3:00 pm as off-peak hour. The peak hour again starts at 3:00 pm to 8:00 pm, and it was observed that, from 8:00 pm to 12:00 am are commonly off-peak hour during the close days. The vehicles were counted for 30 minutes at each point during peak hours at afternoon, and off-peak hours at night. The vehicle was counted all the seven days long from a week, it was listed separately.[8]

A sample data sheet for vehicle count is shown in Table 3-1.

Table 3-1. Sample Data Sheet of Vehicle Count

Time:		**Date:**	**Day:**	
Signal point	**Serial no.**	**Types of vehicles**	**Talley**	**Nos. of vehicle**
Name Of Intersection	1.	Public bus		
	2.	Private Car		
	3.	Motor bike		
	4	Laguna		
	5	Rickshaw		
	6	CNG		
	7	Miscellaneous		

3.3 AutoCAD Drawing of Map

That was 2D drawings in AutoCAD by measuring the length-width of our selected road junctions on the horizon and location wise with the help of Google Maps. The drawings indicate the traffic lanes and the length and width of each intersection. A fixed scale is used while drawing. Here is a map of all the junctions together in Figure 3-1, and separate drawings of each junction in Figure 3-2 to Figure 3-8.

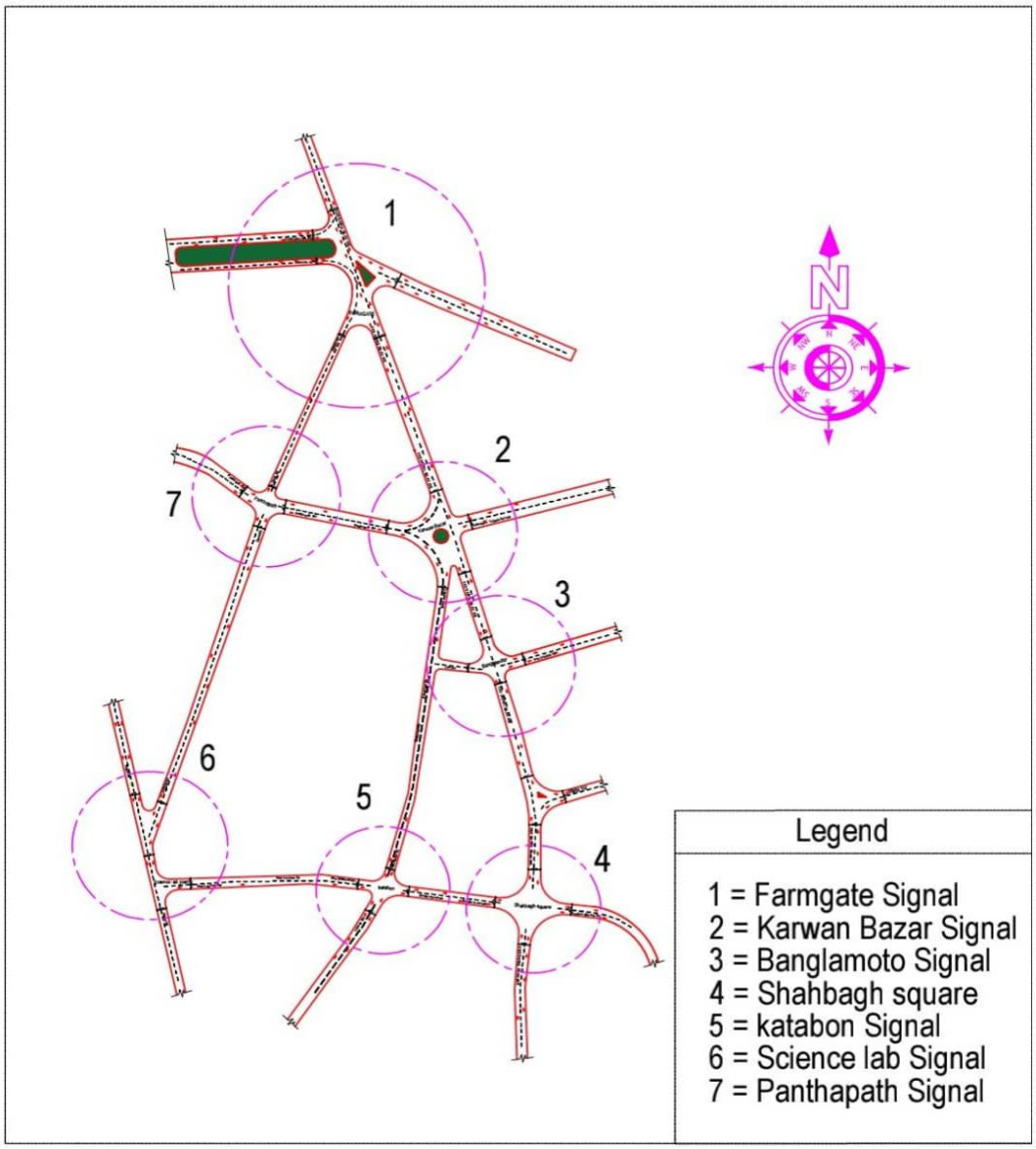


Figure 3-1. Road Networking map of all the selected signals

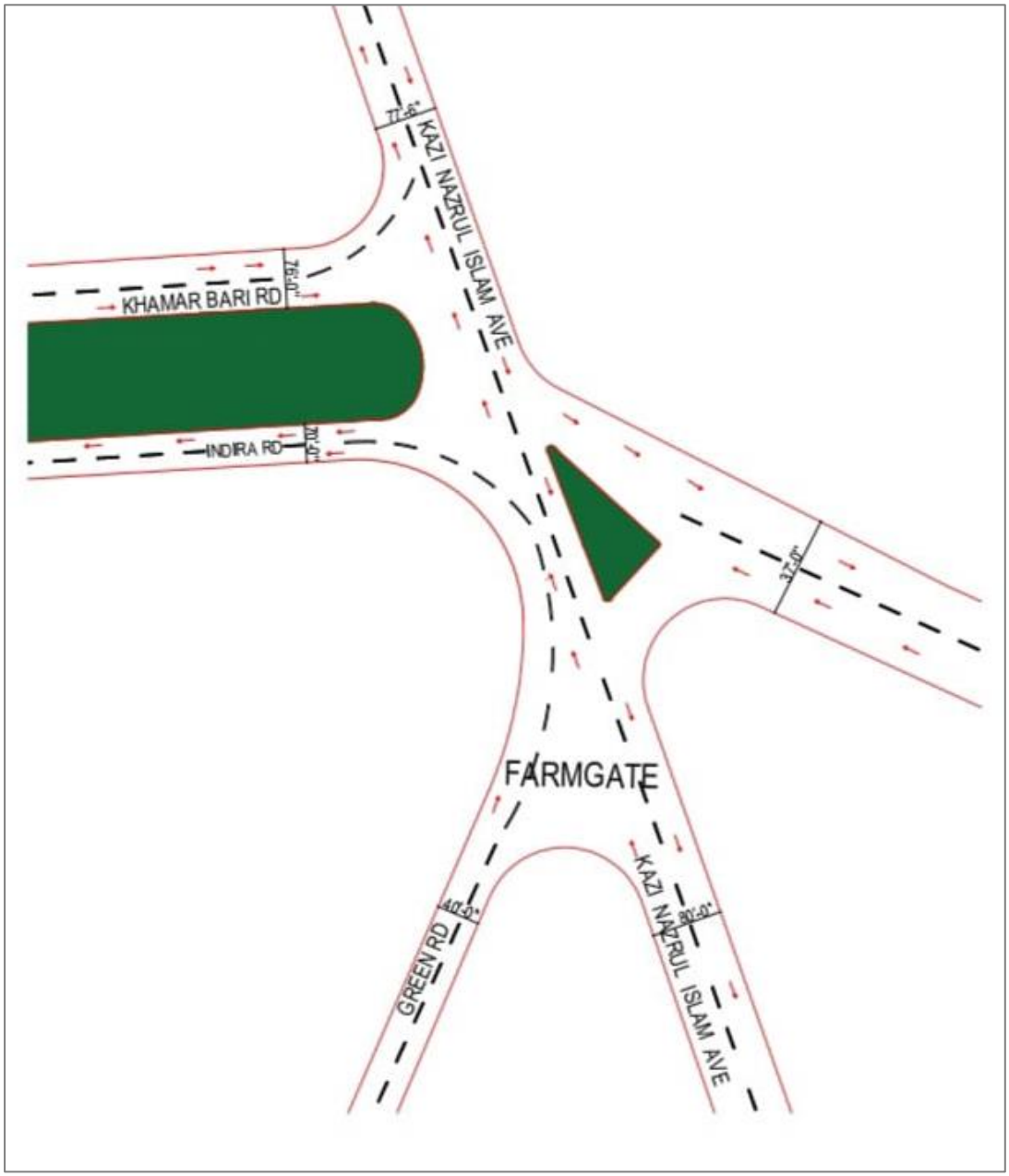


Figure 3-2. Farmgate Intersection

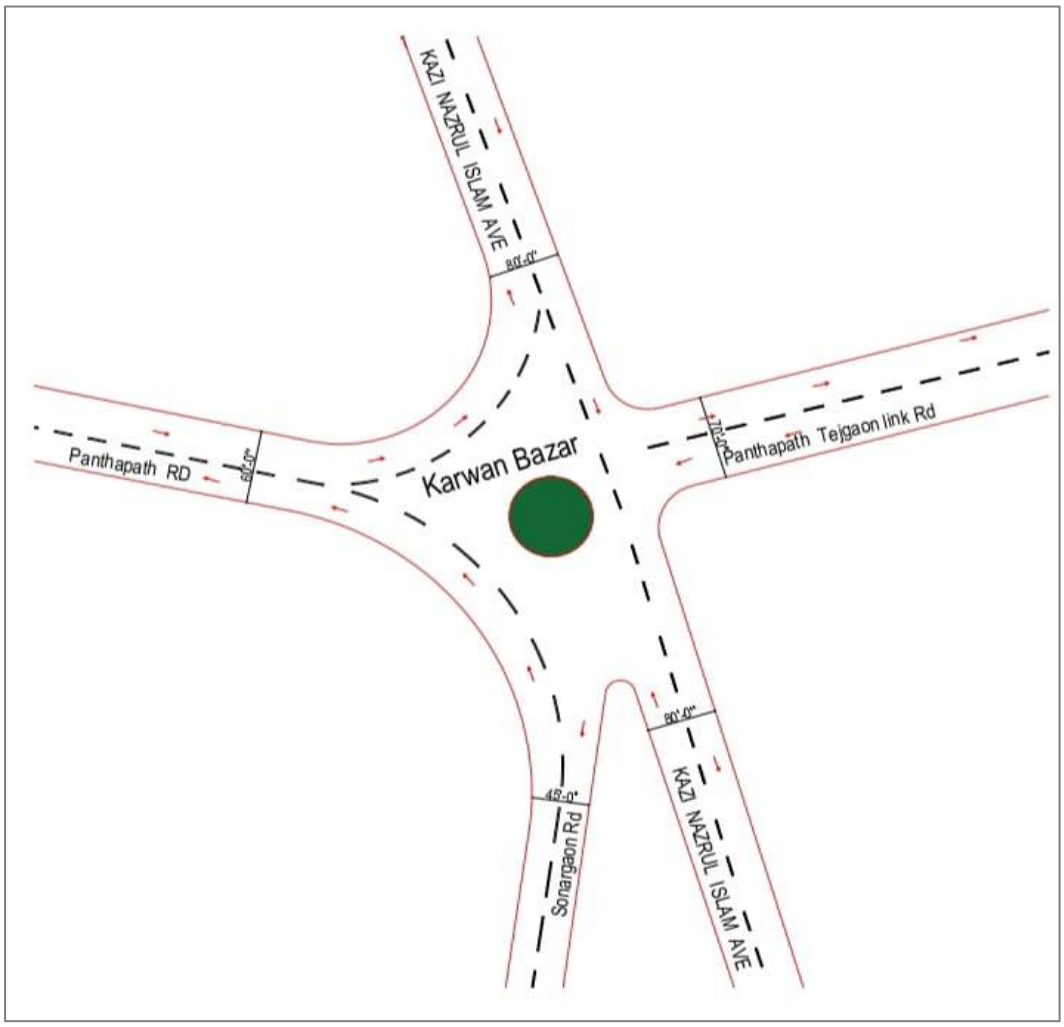


Figure 3-3. Karwan Bazar Intersection

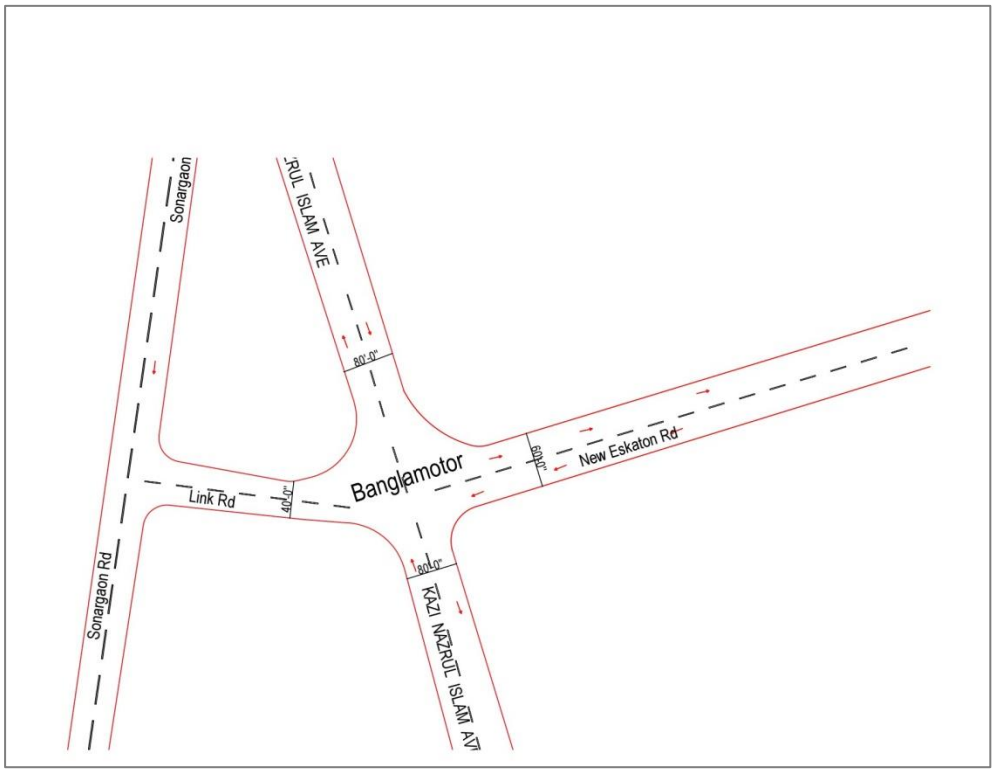


Figure 3-4. Bangla Motor Intersection

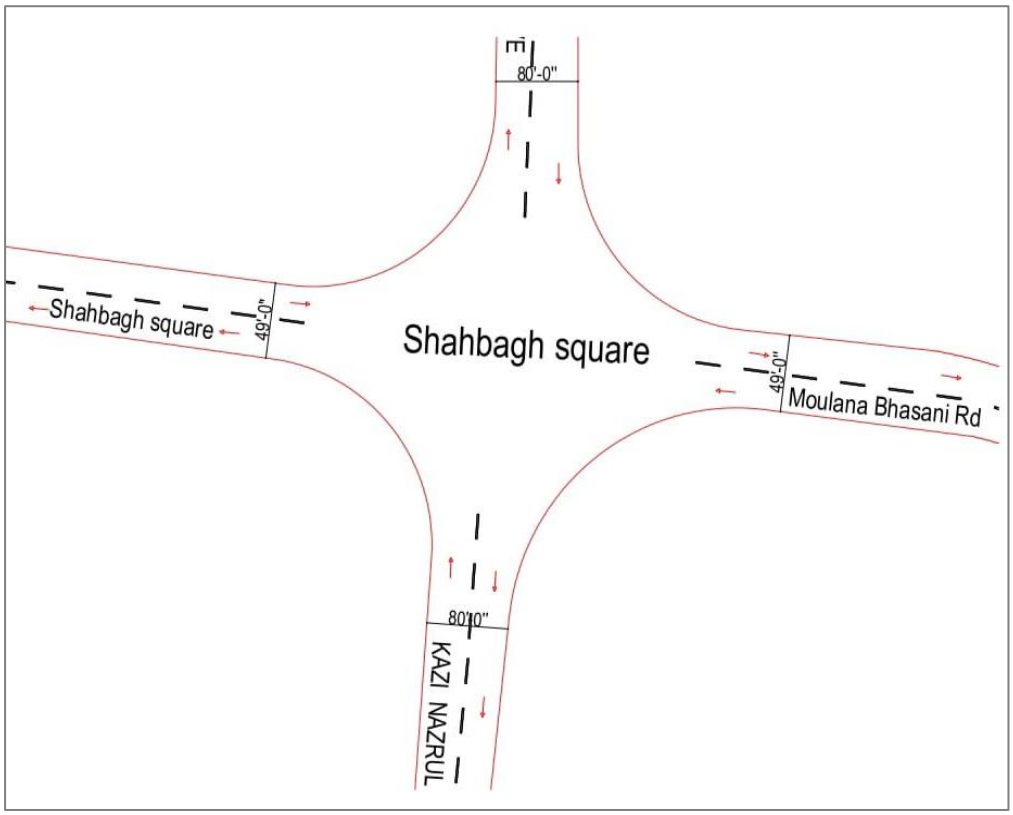


Figure 3-5. Shahbagh Intersection

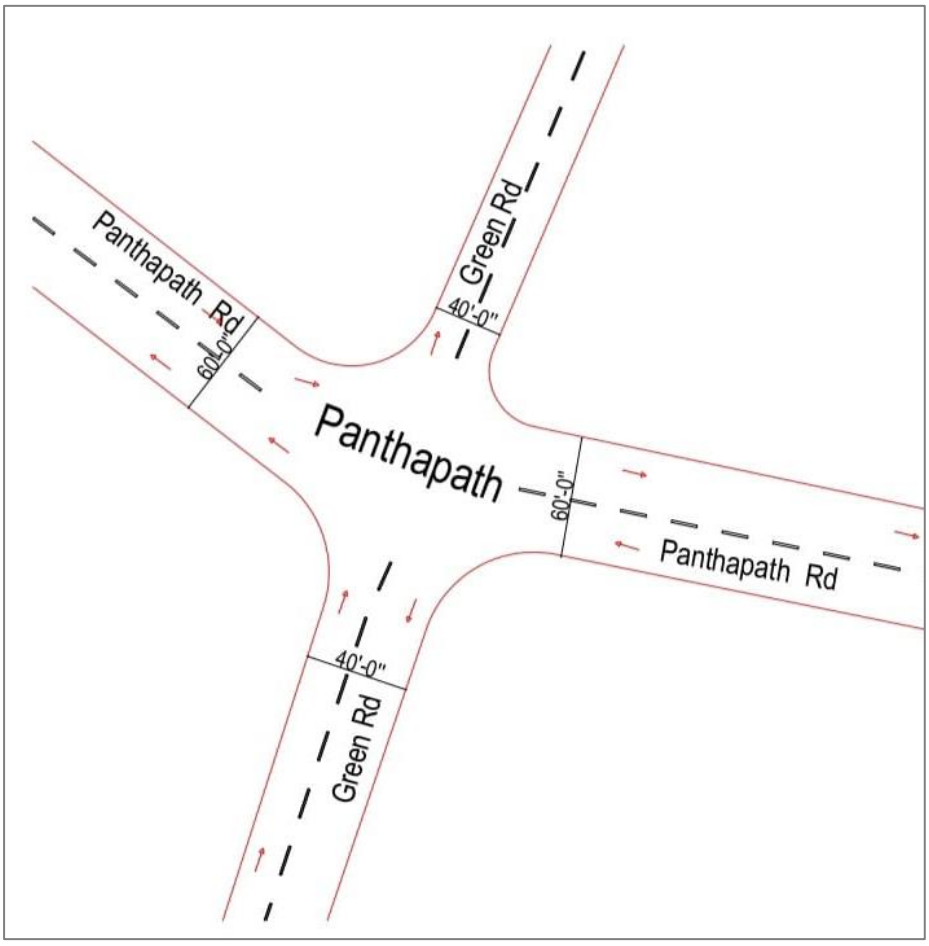


Figure 3-6. Panthapath Intersection Point

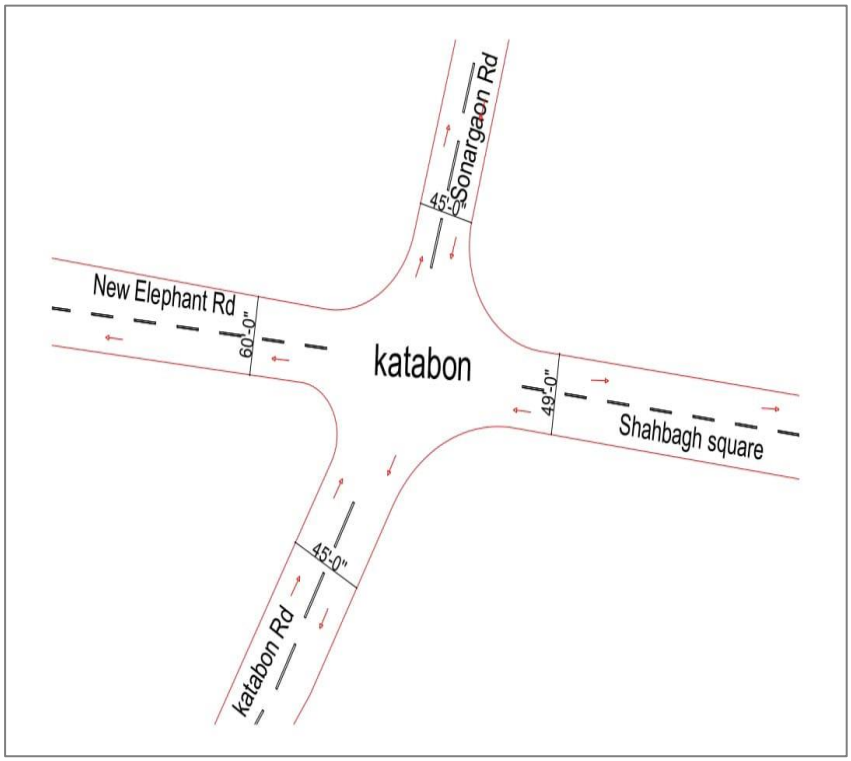


Figure 3-7. Kataban Intersection

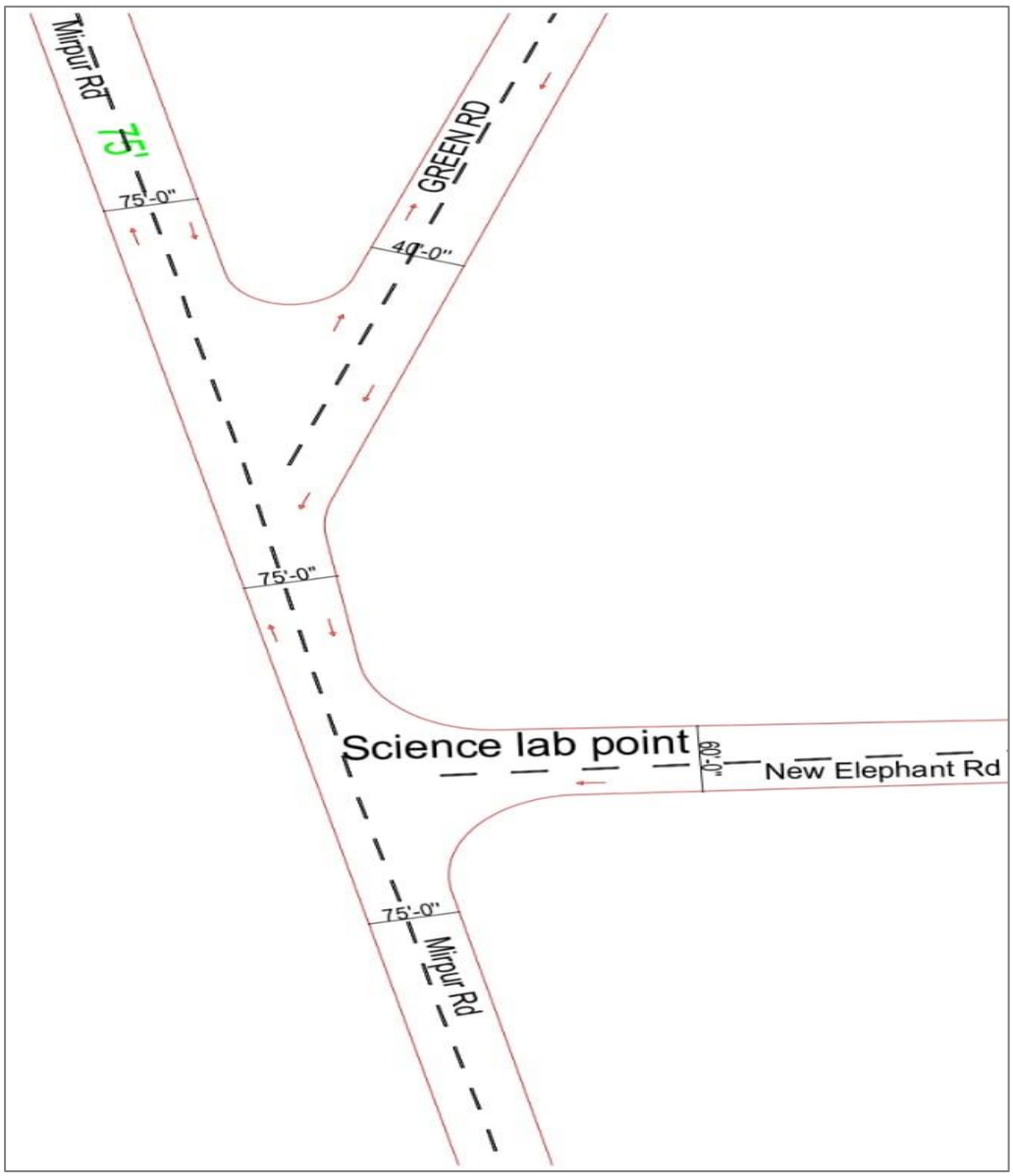


Figure 3-8. Science Lab Intersection

3.4 Manual Signaling Design

The traffic police manually controlling these signals while counting vehicles on our selected roads. This leads to both excessive time consumption and traffic congestion. For this we have done a math calculation with collected traffic volume data.

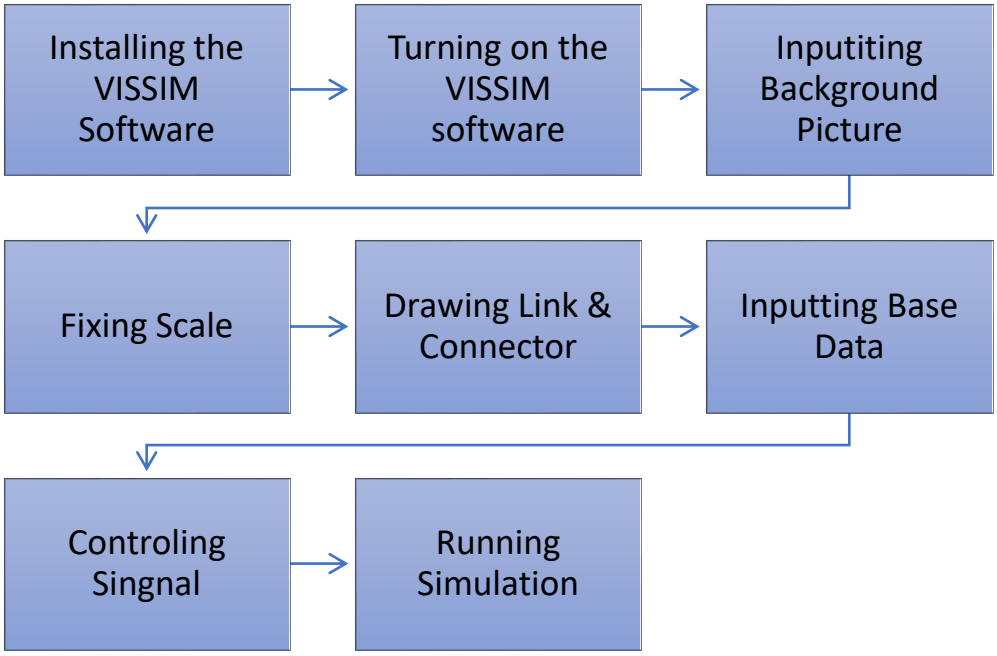
Please see Appendix 1 for detailed Math Calculation of signaling design.

3.5 VISSIM Simulation

VISSIM 2022 (student version) software was for traffic signal simulation.

A flow chart of the methodology of full VISSIM software data input and simulation output is shown in Table 3-2

Table 3-2. VISSIM Software Work Process



A series of figures showing different steps of vissim data input and simulation output is shown in Figure 3-9 to Figure 3-14.

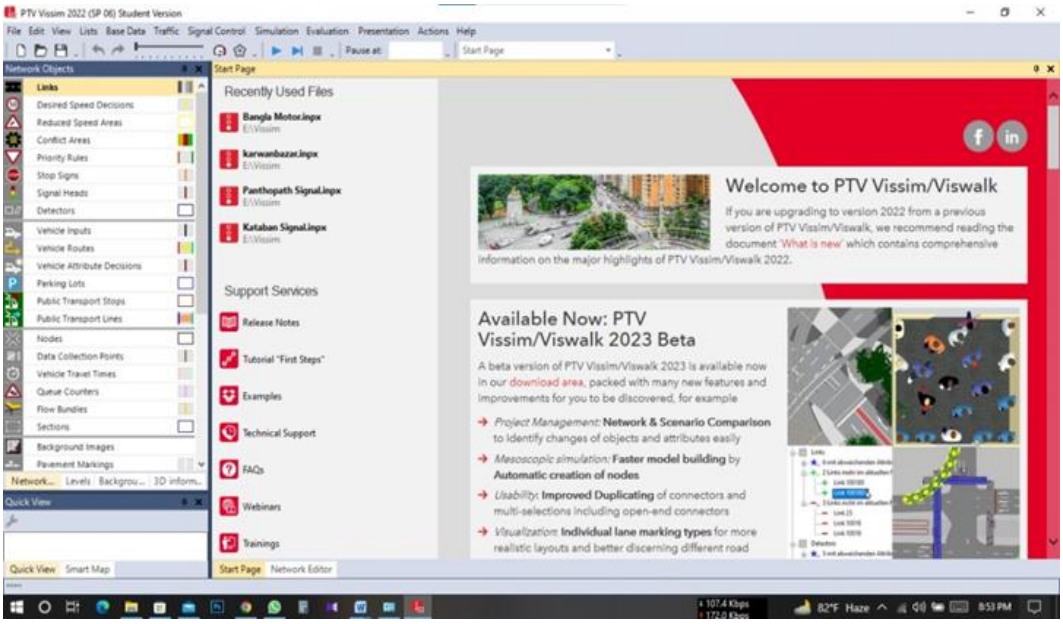


Figure 3-9. Intersection on VISSIM software

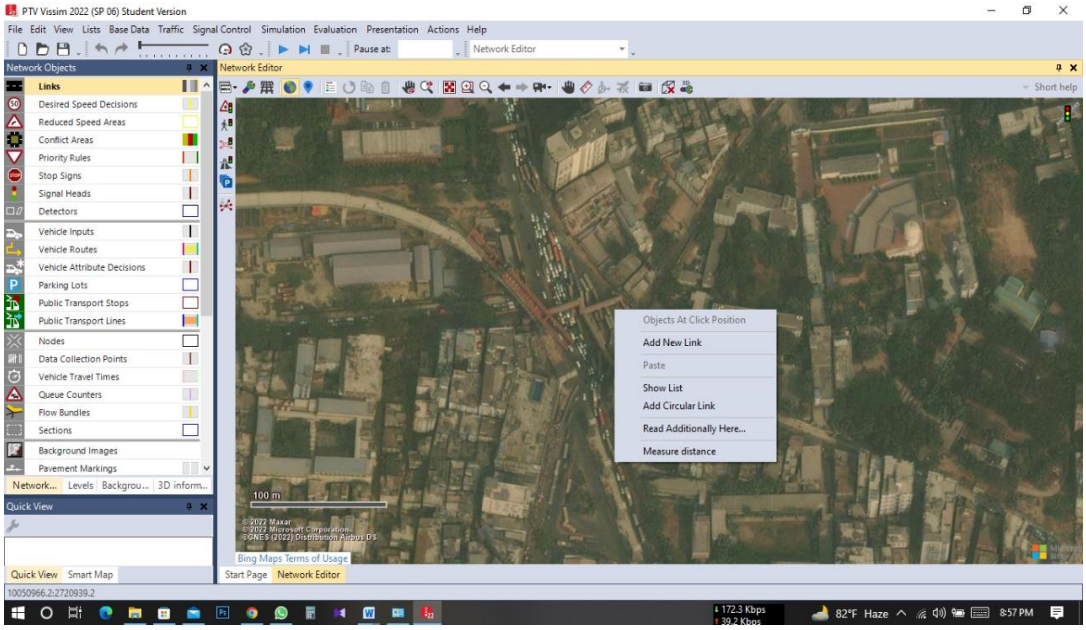


Figure 3-10. Inputting Background Picture & Fixing Scale

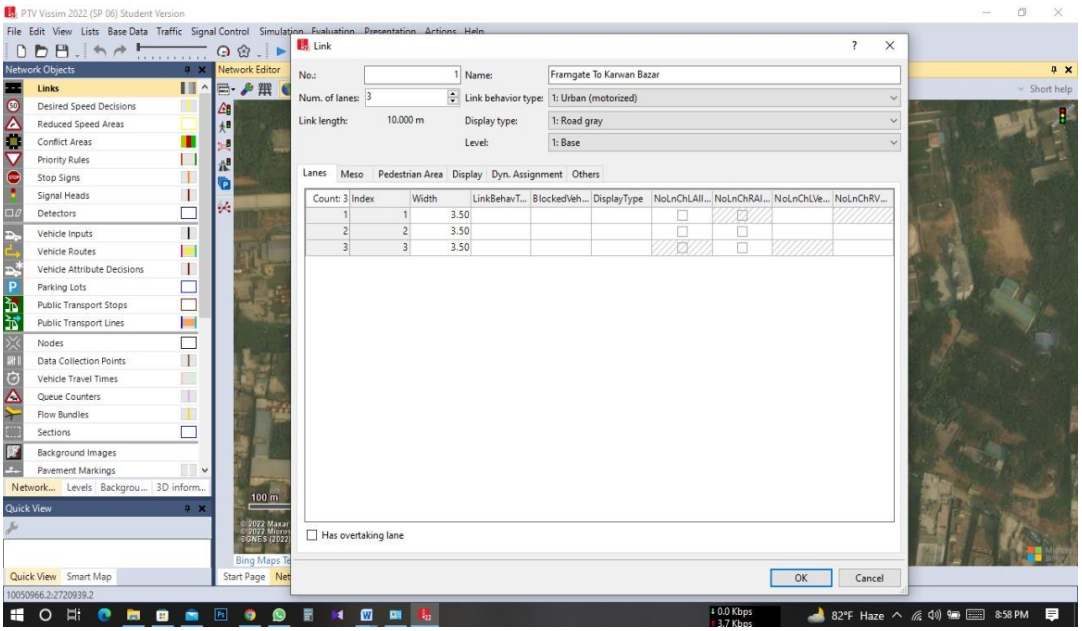


Figure 3-11. Drawing Link & Connector

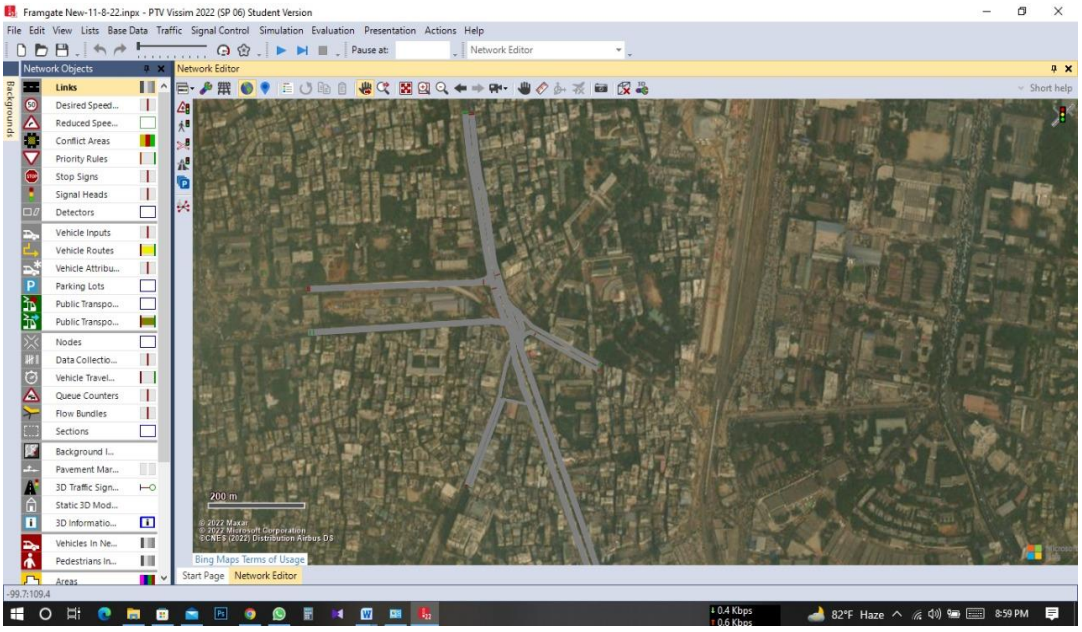


Figure 3-12. Inputting Base data

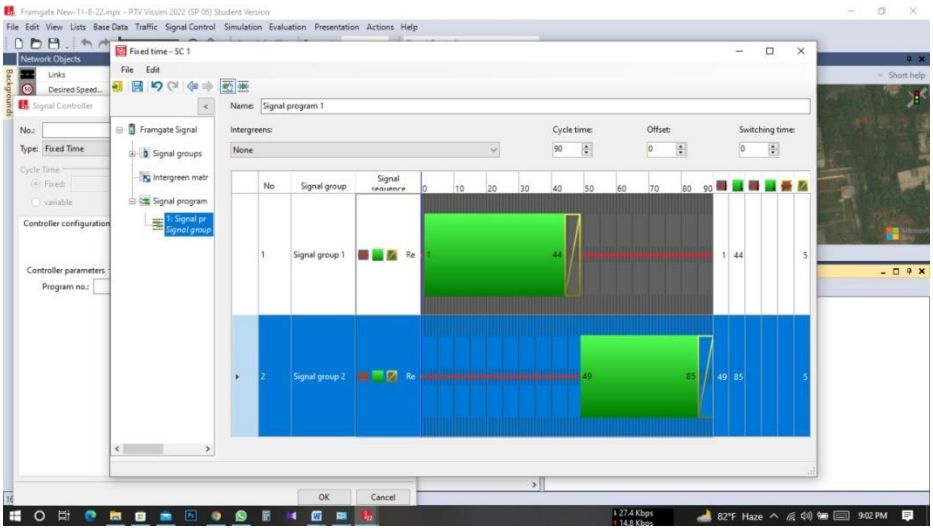


Figure 3-13. Controlling signal time with total cycle time

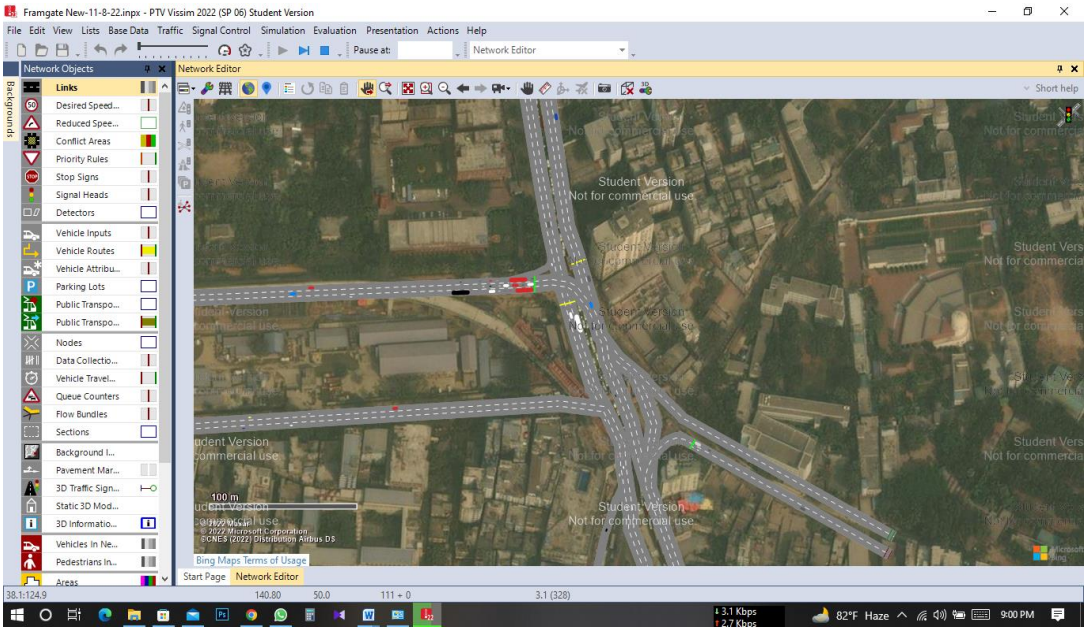


Figure 3-14. Running Simulation

3.6 Summary

At first site selection then traffic volume counting. That was 2D drawings in AutoCAD by measuring the length-width of our selected road junctions on the horizon and location wise with the help of Google Maps. Manual signaling design and VISSIM software data input and simulation output then the result analysis.

CHAPTER 4

Results and Discussion

4.1 Introduction

The types of vehicles observed at site of different signaling points were as Privet car, Bike, Ambulance, CNG, Public Bus, Rickshaw and Laguna. Vehicle counting data was collected at site from January 2022 to April 2022

4.2 Vehicle Counting

Following the table classifying peak hour and off-peak hour.

Table 4-1. Classifying Peak hour and Off Peak hour time

Day	**Time**			
	8:00am To 11:00am	4:00pm To 8:00pm	11:00am To 4:00pm	8:00pm To 12am
Saturday To Thursday	**A**	**B**	**C**	**D**
Day	**Time**			
	10:00am To 12:00pm	3:00pm To 8:00pm	12:00pm To 3:00pm	8:00pm To 12:00am
Friday	**E**	**F**	**G**	**H**
	Peak Hour		**Off-Peak Hour**	

Bellow chart consists of traffic volume study of every intersection.

Figure 4-1. Vehicle counting at site

4.2.1 Location: Farmgate Signal.

It was observed that, majority of vehicles at Farmgate Intersection point was motor cycle and private car. It was nearly 200 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 180 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-2. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Rickshaw	72	98	115	126	112	120	114	118	105	112	108	115	117	122
Laguna	42	48	51	56	38	45	35	48	67	57	39	45	52	61
Privet Car	65	75	80	88	93	87	92	87	91	86	89	87	85	95
Public Bus	40	42	55	70	66	64	65	62	68	67	70	68	72	75
CNG	110	122	105	120	115	112	130	140	135	145	142	162	132	143
Motor Cycle	185	175	162	185	158	180	160	190	140	185	158	168	152	160
Miscellaneous	42	43	48	55	40	42	54	46	54	57	42	82	66	69

Table 4-3. Traffic counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	55	65	67	60	54	80	65	65	60	62	50	58	50	85
Laguna	35	40	31	36	25	35	25	45	67	54	30	45	32	56
Public Bus	43	48	45	50	47	49	49	52	51	55	48	52	47	56
Privet Car	45	65	40	45	43	50	52	50	52	86	49	48	45	95
CNG	77	84	112	125	115	123	108	132	88	95	98	110	86	105
Motor Cycle	85	82	72	85	88	80	90	94	100	115	98	99	92	102
Miscellaneous	30	23	28	15	20	42	24	45	54	57	39	84	76	68

4.2.2 Location: Karwan Bazar Signal

It was observed that, majority of vehicles at Karwan Bazar Intersection point was motor cycle and Rickshaw. It was nearly 200 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 180 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-4. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Rickshaw	68	82	89	92	105	129	117	123	138	134	112	132	114	121
Privet Car	62	66	74	72	85	88	89	92	85	91	92	94	95	86
Public Bus	45	60	60	62	74	78	61	64	68	61	70	65	63	69
CNG	53	55	62	61	73	62	61	70	78	64	79	82	88	90
Motor Cycle	110	147	187	160	185	210	252	260	228	268	215	225	232	178
Miscellaneous	75	56	59	66	77	76	78	68	49	87	48	53	48	57

Table 4-5. Traffic counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	70	75	80	78	85	80	86	75	81	80	90	70	78	85
Public Bus	35	48	50	54	47	53	52	60	41	45	57	42	46	51
CNG	41	45	53	57	43	41	58	51	61	52	49	47	48	58
Privet Car	45	65	50	45	53	60	52	57	58	86	49	48	45	95
Motor Cycle	85	75	62	85	78	80	92	90	102	115	98	68	89	90
Miscellaneous	30	26	28	29	32	42	27	45	54	57	39	84	76	68

4.2.3 Location: Bangla Motor Signal

It was observed that, majority of vehicles at Bangla Motor Intersection point was motor cycle and CNG. It was nearly 280 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 165 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-6. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	102	135	113	104	114	129	167	122	133	138	141	135	148	143
Laguna	45	58	42	37	41	84	35	59	32	46	39	44	36	48
Privet Car	76	83	54	82	95	113	135	125	129	148	145	165	144	139
Motor Cycle	118	147	187	160	185	158	152	160	128	168	185	175	162	178
Public Bus	45	55	65	70	72	75	68	71	70	74	78	76	68	80
CNG	100	110	125	122	145	135	132	123	124	142	125	118	105	140
Miscellaneous	75	56	49	56	67	66	78	66	39	87	38	43	48	47

Table 4-7. Traffic counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	56	66	65	69	64	80	65	65	60	62	50	68	58	85
Laguna	35	40	31	36	27	35	27	45	67	54	30	45	32	56
Privet Car	45	65	40	45	43	50	52	50	52	86	29	48	45	95
Public Bus	45	48	50	57	51	53	58	54	56	54	56	54	59	60
CNG	77	84	112	125	115	123	108	132	88	95	98	110	86	105
Motor Cycle	85	75	62	85	58	80	60	90	40	115	58	68	52	60
Miscellaneous	30	32	28	26	28	42	26	45	54	57	39	84	76	68

4.2.4 Location : Shahbagh signal

It was observed that, majority of vehicles at Shahbagh Intersection point was motor cycle and Rickshaw. It was nearly 195 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 180 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-8. Traffic Counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	102	135	113	104	114	129	167	122	133	138	141	135	148	143
Laguna	25	58	42	37	41	84	35	59	32	46	39	44	36	48
Privet Car	76	83	54	82	95	113	135	125	129	148	145	165	144	139
Motor Cycle	118	147	187	160	185	158	152	160	128	168	185	175	162	178
Public Bus	45	55	65	70	72	75	68	71	70	74	78	76	68	80
CNG	100	110	125	122	145	135	132	123	124	142	125	118	105	140
Miscellaneous	75	56	49	56	67	66	78	66	39	87	38	43	48	47

Table 4-9. Traffic Counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	G	H	C	D	C	D	C	D	C	D	C	D	C	D
Rickshaw	71	74	70	80	84	80	78	85	90	120	65	75	90	95
Laguna	35	40	31	36	25	35	25	45	67	54	30	45	32	56
Public Bus	35	48	50	54	47	53	52	60	41	45	57	42	46	51
CNG	41	45	53	57	43	41	58	51	61	52	49	47	48	58
Privet Car	45	65	50	45	53	60	52	57	58	86	49	48	45	95
Motor Cycle	85	75	62	85	58	80	60	90	40	115	58	68	52	60
Miscellaneous	30	27	28	25	32	42	28	45	54	57	39	64	66	58

4.2.5 Location: Panthapath Intersection Point

It was observed that, majority of vehicles at Panthapath Intersection point was Private Car and Rickshaw. It was nearly 200 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 180 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-10. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Rickshaw	122	165	113	101	124	129	187	123	138	134	142	132	154	141
Laguna	105	158	142	137	141	124	115	129	112	106	109	114	116	118
Privet Car	76	53	54	52	45	43	45	95	29	48	45	65	44	39
CNG	45	52	57	84	82	75	65	54	62	45	56	80	48	52
Motor Cycle	198	167	187	160	185	158	152	160	128	168	185	175	162	178
Miscellaneous	75	56	49	56	67	66	78	66	39	87	38	43	48	47

Table 4-11. Traffic Counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	95	85	58	78	74	80	75	95	80	125	95	75	78	85
Laguna	35	40	31	36	25	35	25	45	67	54	30	45	32	56
Public Bus	35	48	50	54	47	53	52	60	41	45	57	42	46	51
CNG	41	45	53	57	43	41	58	51	61	52	49	47	48	58
Privet Car	45	65	50	45	53	60	52	57	58	86	49	48	45	95
Motor Cycle	85	75	62	85	58	80	60	90	40	115	58	68	52	60
Miscellaneous	30	23	28	25	20	42	24	45	54	57	39	84	76	68

4.2.6 Location : Science lab Intersection Point

It was observed that, majority of vehicles at Science Lab Intersection point was motor cycle and Rickshaw. It was nearly 200 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 180 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-12. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Rickshaw	72	98	115	126	112	120	114	118	105	112	108	115	117	122
Laguna	42	48	51	56	38	45	35	48	67	57	39	45	52	61
Privet Car	45	65	50	55	53	57	52	58	59	86	49	48	65	95
Public Bus	35	40	55	60	56	64	65	62	58	67	70	68	72	75
CNG	110	122	105	120	115	112	130	140	135	145	142	162	132	143
Motor Cycle	155	165	154	162	152	170	160	170	140	185	158	168	152	160
Miscellaneous	42	43	48	55	40	42	54	46	54	57	38	82	66	69

Table 4-13. Traffic counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	55	65	67	60	54	80	65	65	60	62	50	58	50	85
Laguna	35	40	31	36	25	35	25	45	67	54	30	45	32	56
Privet Car	45	65	40	45	43	50	52	50	52	86	29	48	45	95
CNG	77	84	112	125	115	123	108	132	88	95	98	110	86	105
Motor Cycle	85	75	62	85	58	80	60	90	40	115	58	68	52	60
Miscellaneous	30	23	28	22	20	42	24	45	54	57	39	84	76	68

4.2.7 Location: Kataban Intersection Point

It was observed that, majority of vehicles at Kataban Intersection point was motor cycle and Rickshaw. It was nearly 180 nos. per hour during peak hours for all the days long in a week and it reduces to around 150 nos. per hour during off-peak hour. In Friday, motorcycle was found to be higher in count that is about 160 nos. per hour during peak hour. This count goes down to almost 100 nos. per hour for Friday off-peak hour.

Table 4-14. Traffic counting (Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**E**	**F**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Rickshaw	135	138	140	145	141	144	142	150	142	150	145	135	130	133
Laguna	40	45	45	40	41	36	39	56	57	50	37	45	39	42
CNG	148	155	152	165	172	175	170	168	164	170	172	166	165	155
Public Bus	35	42	43	50	52	55	54	61	53	57	56	54	52	50
Privet Car	29	48	75	65	64	54	64	95	52	86	52	50	43	50
Motor Cycle	58	68	85	88	72	85	64	60	68	115	60	90	78	85
Miscellaneous	37	84	30	23	28	16	58	75	54	57	24	45	20	42

Table 4-15. Traffic Counting (Off-Peak Hour)

Traffic Volume														
Unit Veh./Hour	**Friday**		**Saturday**		**Sunday**		**Monday**		**Tuesday**		**Wednesday**		**Thursday**	
Type of Vehicle	**G**	**H**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
Rickshaw	52	65	69	61	64	80	65	65	60	62	50	58	50	85
Laguna	35	40	31	36	35	35	35	45	67	54	31	45	32	56
Privet Car	45	65	40	45	43	50	52	50	52	86	29	48	45	95
CNG	77	84	112	125	115	123	108	132	88	95	98	110	86	105
Motor Cycle	85	75	62	85	58	80	60	90	40	115	58	68	52	60
Public Bus	33	35	32	36	41	42	40	45	44	39	40	45	51	52
Miscellaneous	30	23	28	16	20	42	24	45	54	57	39	84	76	68

4.3 Signaling design and VISSIM simulation

4.3.1 Farmgate signal design

The Intersection point was designed for automatic traffic light signaling in figure 4-2. The designed signal was found to be an 89 second of total cycle length, having 41 sec red signal form Khamar Bari & Tejkuni Para road and 38 sec red light from Bijoy Sharoni & Karwan Bazar road.

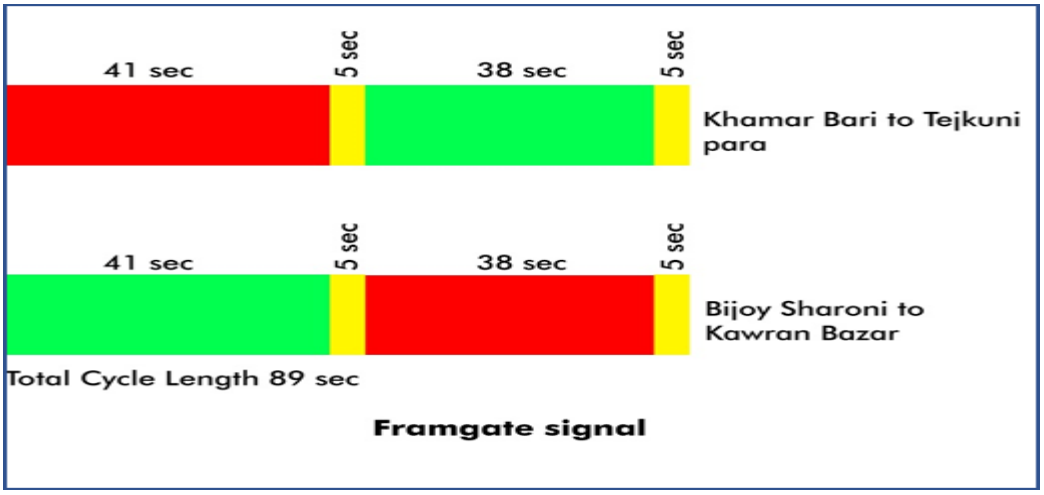


Figure 4-2. Signaling Cycle Length

Figure 4-3. shows the simulation design of Farmgate Intersection. The Intersection point was first simulated for manual signaling of (usually 15-25 mins) and high congestion with almost (nos of vehicle in queue, 60) 60 vehicles in queue was found, showed in figure 4-4. Figure 4-5 shows the simulation of same Intersection point with designed 89 sec signal cycle length from figure 4-2. As a result, a lessen vehicle count of around 10 vehicles in queue was found.

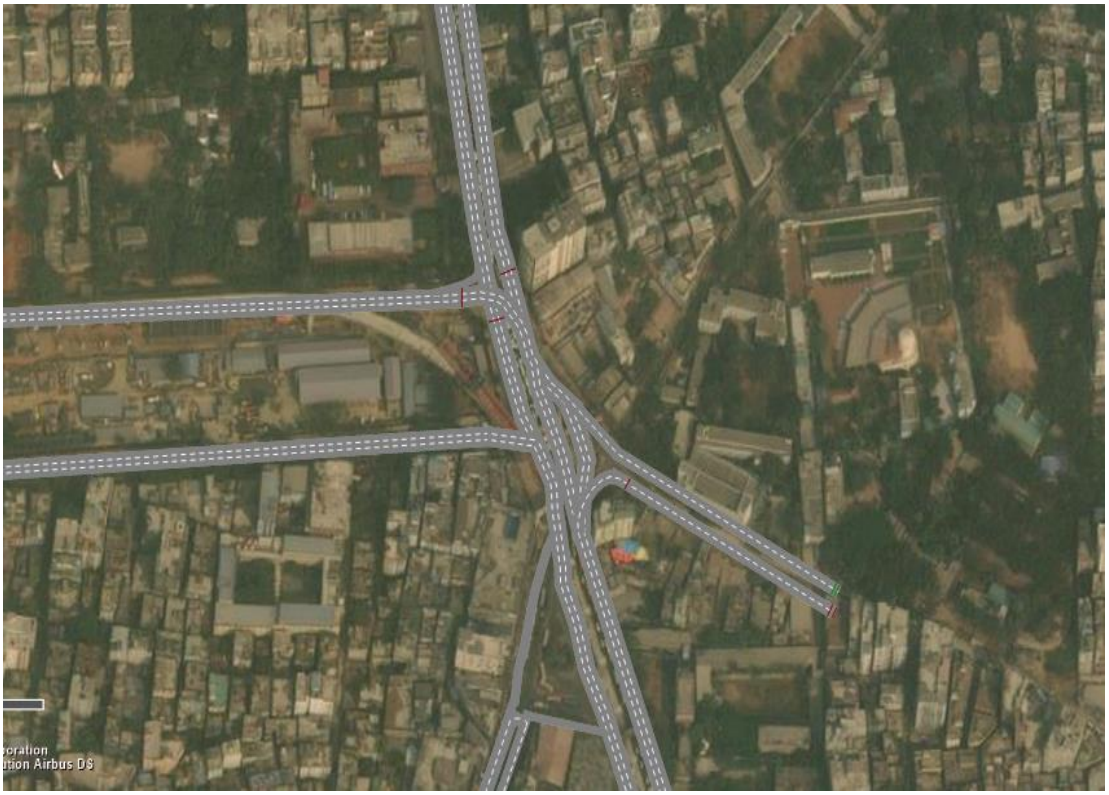


Figure 4-3. Simulation Design of Farmgate Intersection point

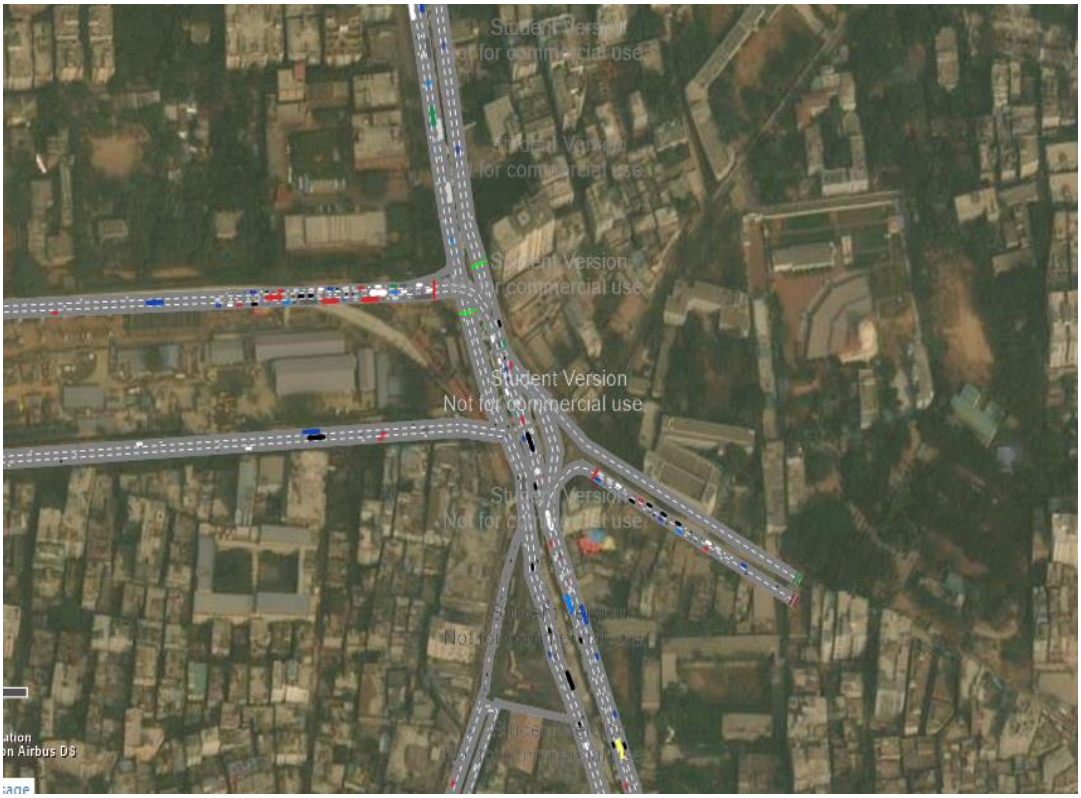


Figure 4-4. Traffic congestion before design

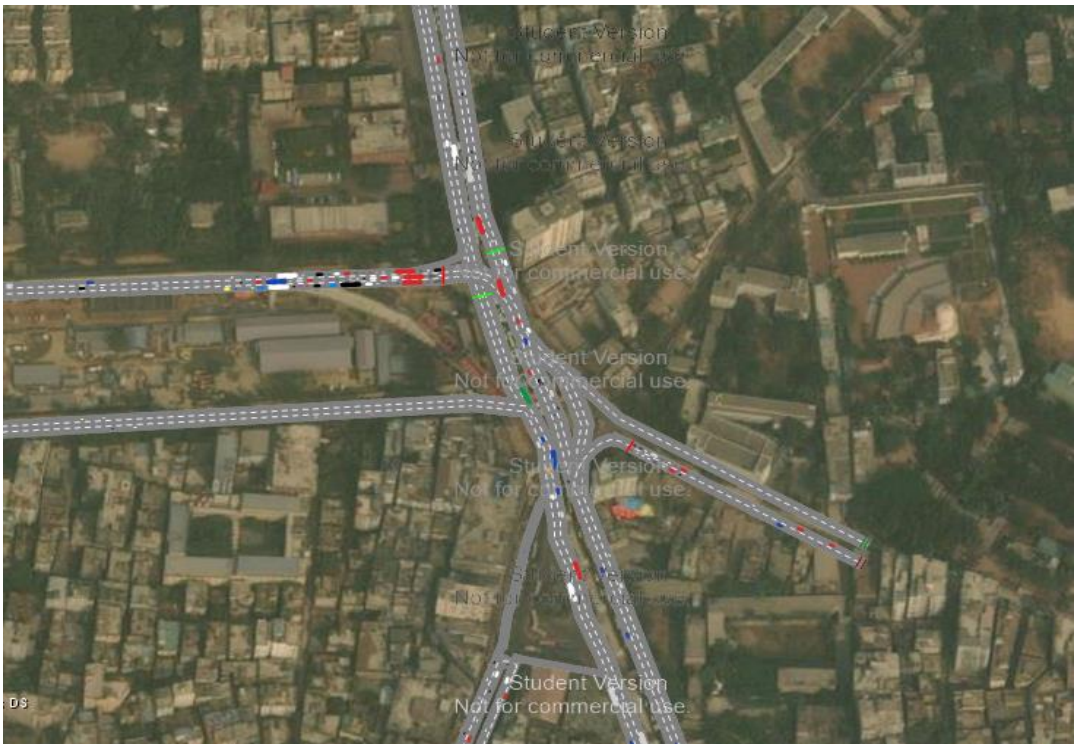


Figure 4-5. Traffic congestion after design

4.3.2 Karwan Bazar signal design

The Intersection point was designed for automatic traffic light signaling in figure 4-6. The designed signal was found to be a 108 second of total cycle length, having 58 sec red signal from Panthapath to Tejgaon Link road and 40 sec red light from Farmgate to Bangla Motor road.

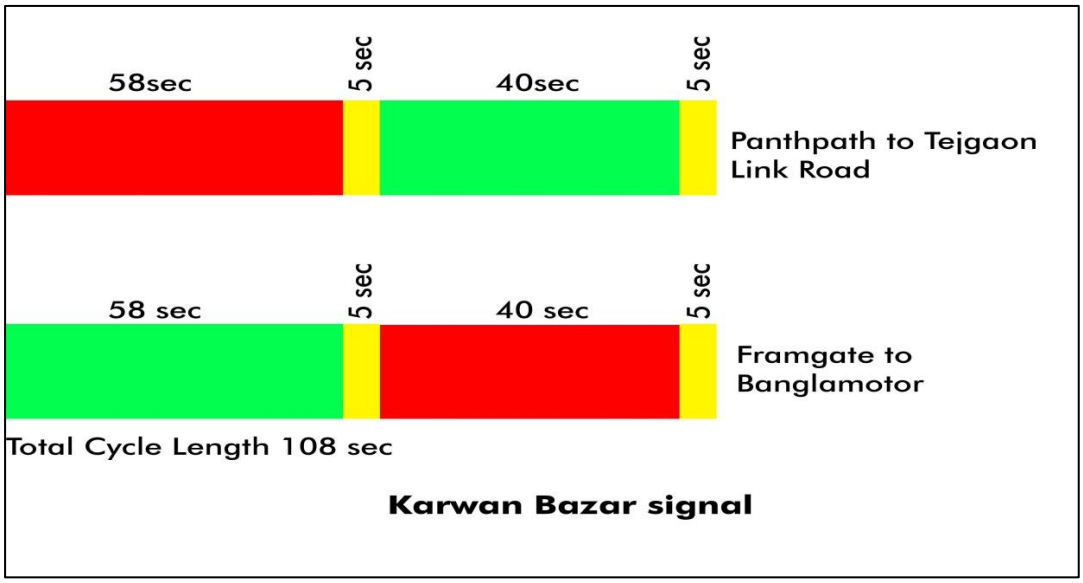


Figure 4-6. Signaling cycle Length

Figure 4-7 shows the simulation design of Karwan Bazar Intersection. The Intersection was first simulated for manual signaling of (usually 20-25 mins) and high congestion with almost 80 vehicles in queue was found, showed in figure 4-8. Figure 4-9 shows the simulation of same Intersection point with designed 108 sec signal cycle length from figure20. As a result, a lessen vehicle count of around 25 vehicles in queue was found.

Figure 4-7. Simulation Design of Karwan Bazar Intersection point

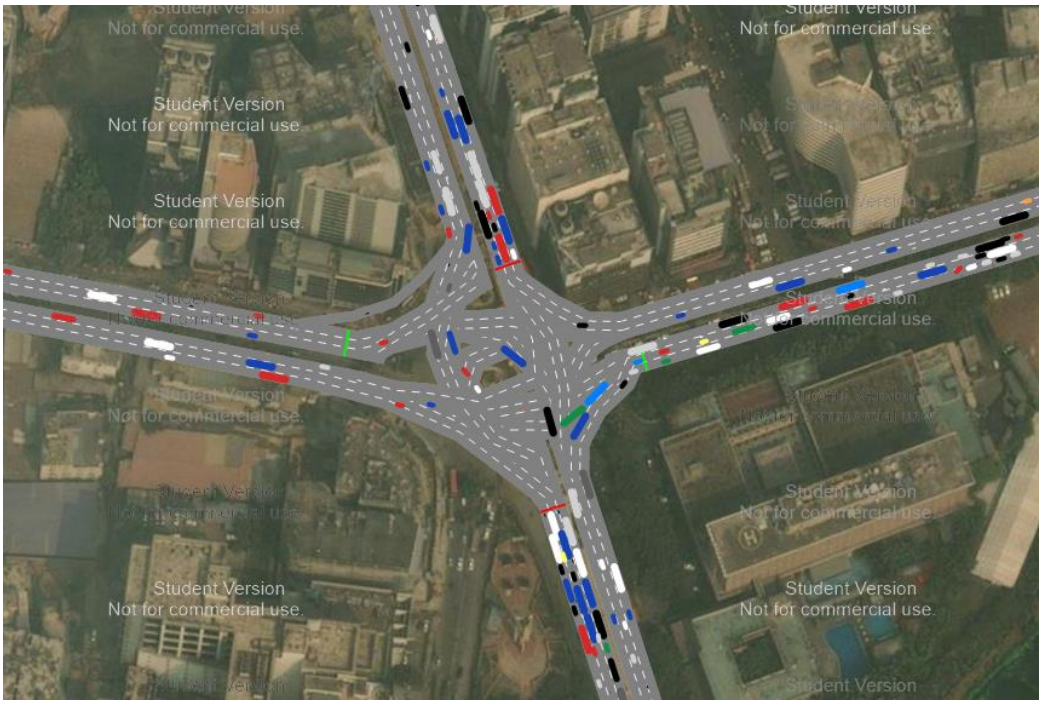


Figure 4-8. Traffic congestion before design

Figure 4-9. Traffic congestion after design

4.3.3 Bangla Motor signal design

The Intersection point was designed for automatic traffic signaling light in figure 4-10. The designed signal was found to be a 78 second of total cycle length, having 37 sec red signal for Link road to New Eskaton road and 31 sec red light for Karwan Bazar to Shahbagh road.

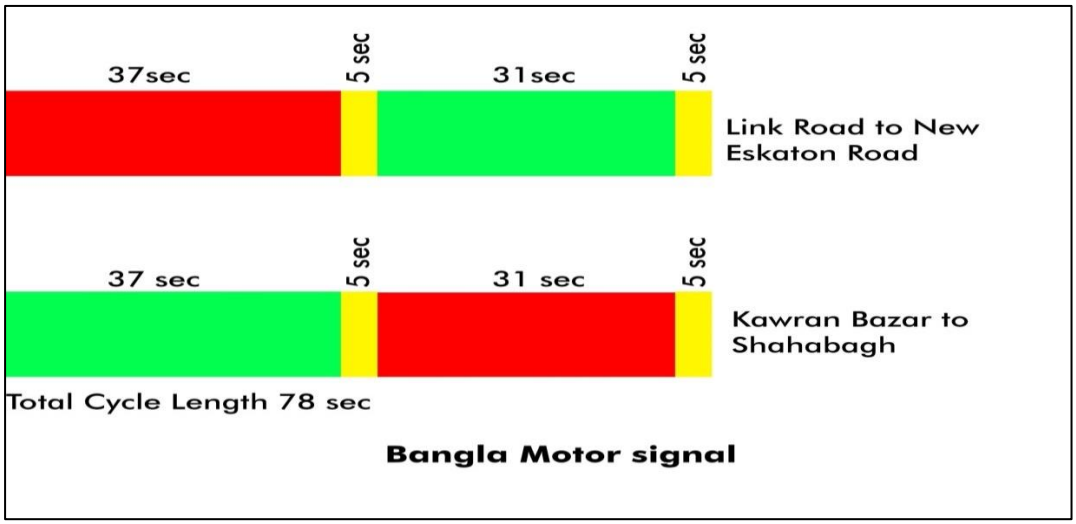


Figure 4-10. Simulation cycle Length

Figure 4-11 shows the simulation design of Bangla Motor Intersection point. The Intersection point was first simulated for manual signaling of (usually 15-20 mins) and high congestion with almost 70 vehicles in queue was found, showed in figure 4-12. Figure 4-13 shows the simulation of same Intersection point with designed 78 sec signal cycle length from figure 4-10. As a result, a lessen vehicle count of around 18 vehicles in queue was found.

Figure 4-11. Simulation Design of Bangla Motor Intersection

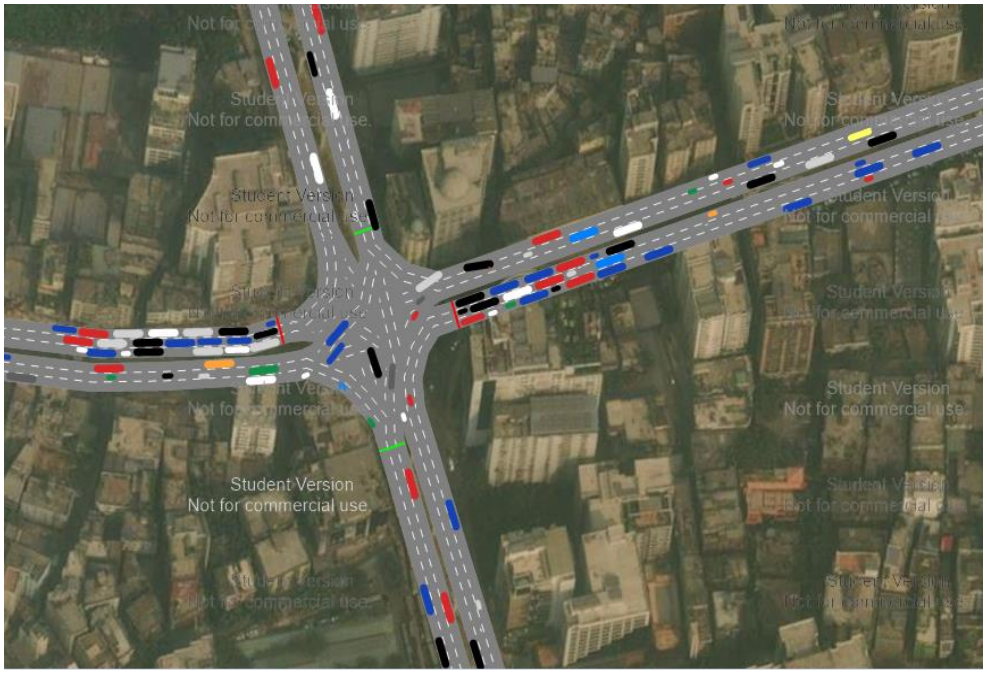


Figure 4-12. Traffic congestion before design

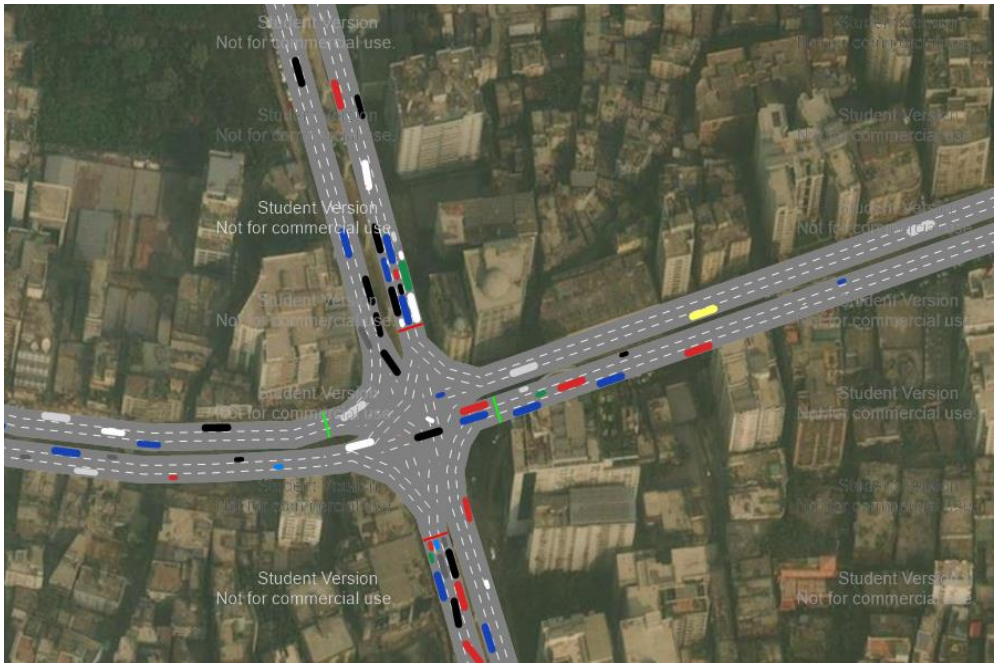


Figure 4-13. Traffic congestion after design

4.3.4 Shahbagh signal design

The Intersection point was designed for automatic signaling light in figure 4-14. The designed signal was found to be a 53 second of total cycle length, having 23 sec red signal for Shahbagh square to M. Bhasani road and 20 sec red light for Bangla Motor to TSC road.

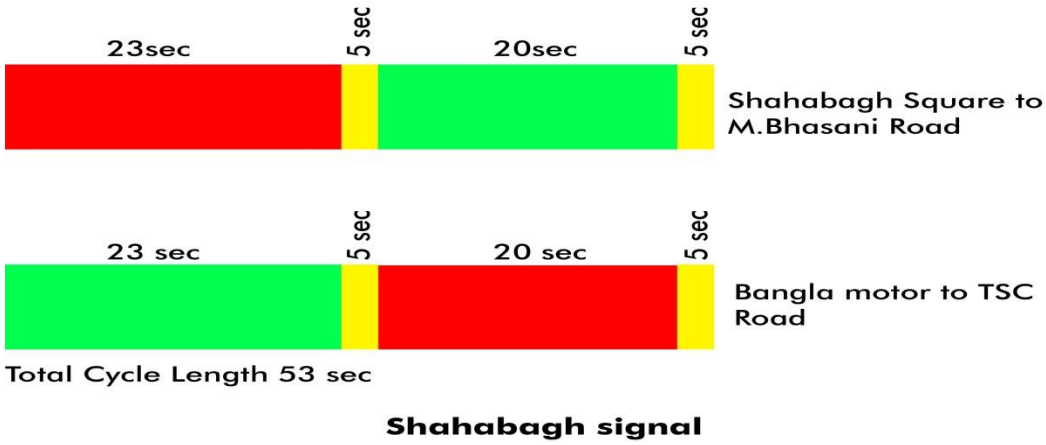


Figure 4-14. Signaling cycle length

Figure 4-15 shows the simulation design of Shahbagh Intersection point. The Intersection point was first simulated for manual signaling of (usually 15-22 mins) and high congestion with almost (nos of vehicle in queue, 75) 75 vehicles in queue was found, showed in figure 1-16. Figure 1-17 shows the simulation of same Intersection point with designed 53 sec signal cycle length from figure 4-14. As a result, a lessen vehicle count of around 20 vehicles in queue was found.

Figure 4-15. Simulation Design of Shahbagh Intersection

Figure 4-16. Traffic congestion before design

Figure 4-17. Traffic congestion after design

4.3.5 Panthapath signal design

The Intersection point was designed for automatic signaling light in figure 4-18. The designed signal was found to be a 87 second of total cycle length, having 49 sec red signal for Farmgate to Green road and 28sec red light for Karwan Bazar to Dhanmondi 32 road.

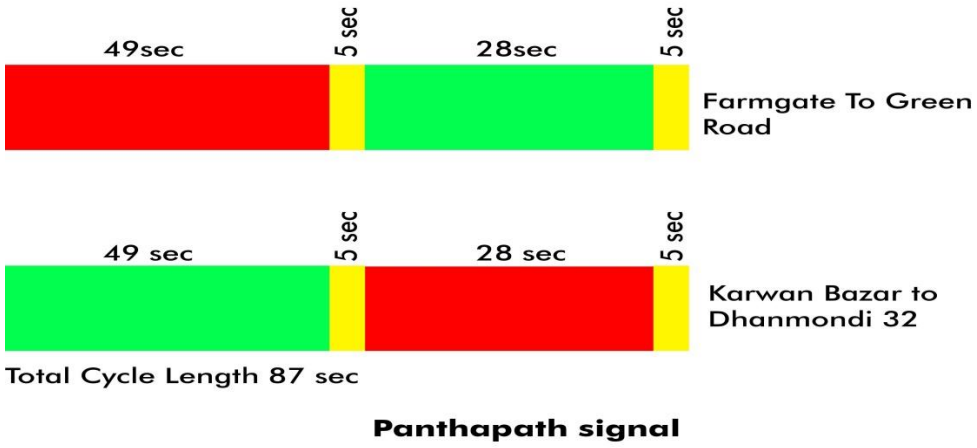


Figure 4-18. Signaling cycle length

Figure 4-19. Shows the simulation design of Panthapath Intersection point. The Intersection point was first simulated for manual signaling of (usually 10-20 mins) and high congestion with almost (nos of vehicle in queue, 70) 70 vehicles in queue was found, showed in figure 4-20. Figure 4-21 shows the simulation of same Intersection point with designed 87 sec signal cycle length from figure 4-17. As a result, a lessen vehicle count of around 16 vehicles in queue was found.

Figure 4-19. Simulation design of Panthapath Intersection

Figure 4-20. Traffic congestion before design

Figure 4-21. Traffic congestion after design

4.3.6 Science Lab signal design

The Intersection point was designed for automatic signaling light in figure 4-22. The designed signal was found to be a 61 second of total cycle length, having 30 sec red signal for Mirpur Road to Green road and 21 sec red light for Mirpur road to Elephant road.

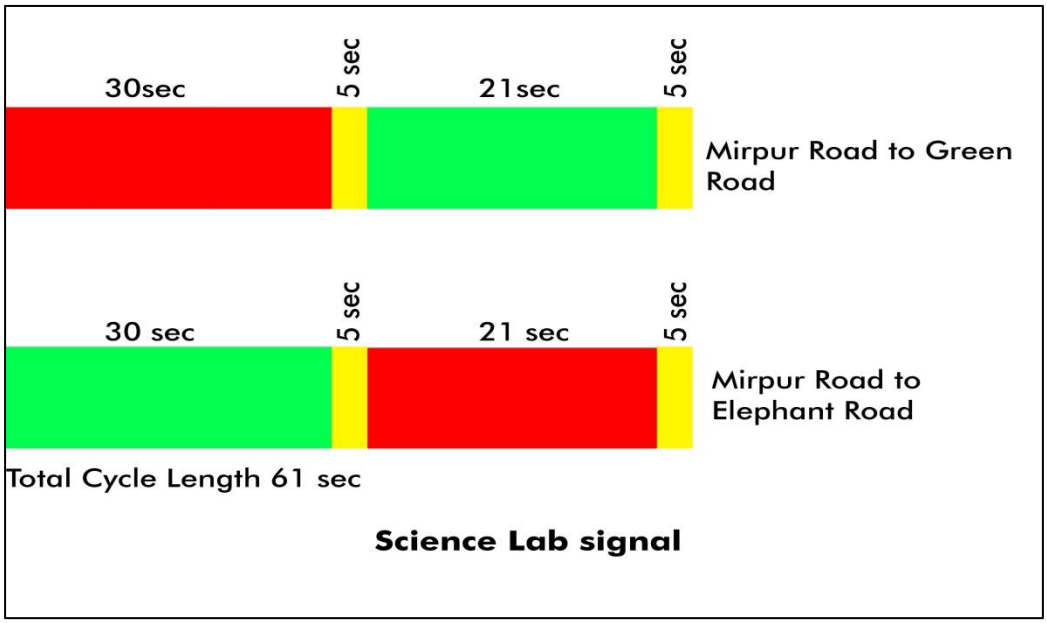


Figure 4-22. Signaling Cycle Length

Figure 4-23 shows the simulation design of Science Lab Intersection point. The Intersection point was first simulated for manual signaling of (usually 12-16 mins) and high congestion with almost (nos of vehicle in queue, 65) 65 vehicles in queue was found, showed in figure 4-24. Figure 4-25 shows the simulation of same Intersection point with designed 61 sec signal cycle length from figure 4-21. As a result, a lessen vehicle count of around 14 vehicles in queue was found.

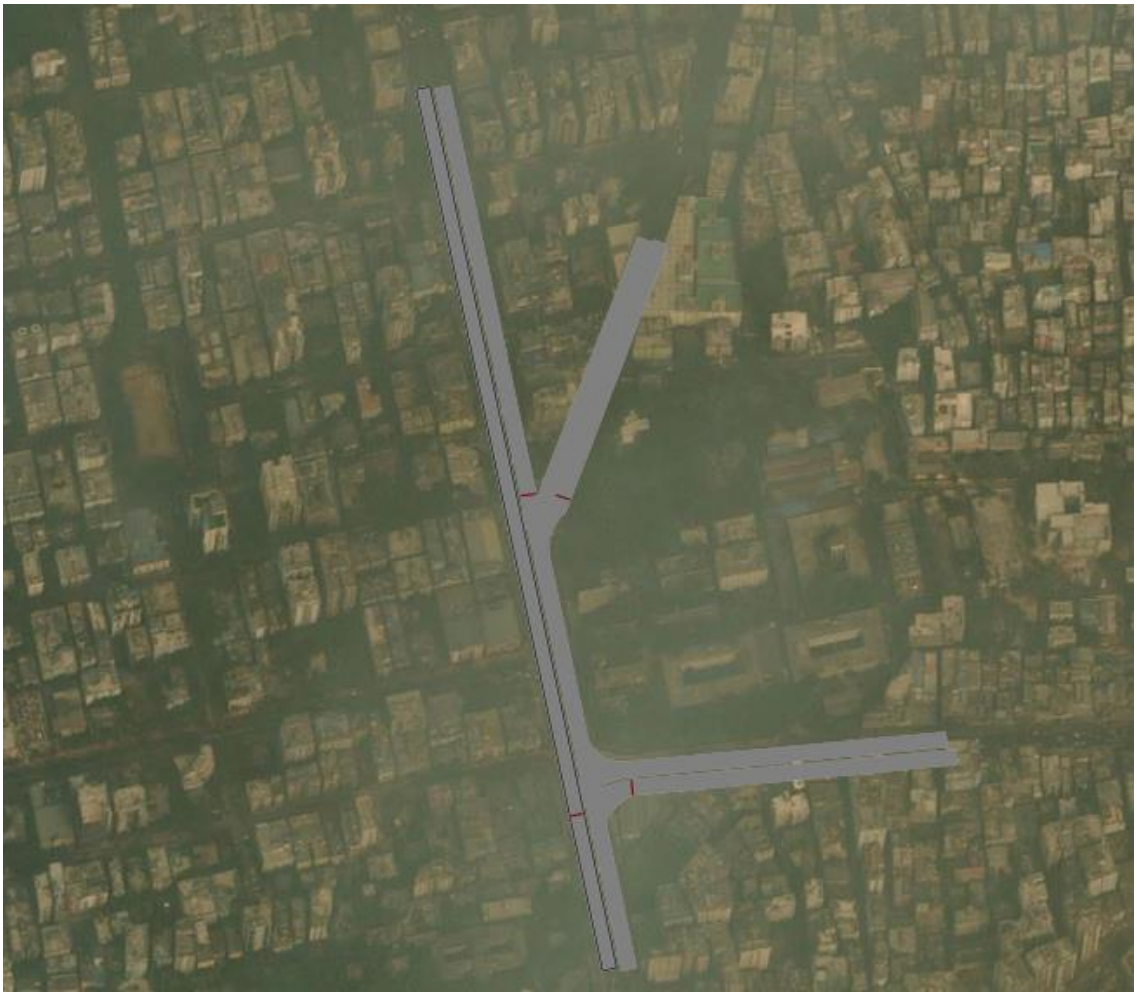


Figure 4-23. Simulation design of Science Lab Intersection point

Figure 4-24. Traffic congestion before design

Figure 4-25. Traffic congestion after design

4.3.7 Kataban signal design

The Intersection point was designed for automatic signaling light in figure 4-26. The designed signal was found to be a 52 second of total cycle length, having 23 sec red signal for Kataban road to Sonargaon road and 19 sec red light for Shahbagh square road to Elephant road.

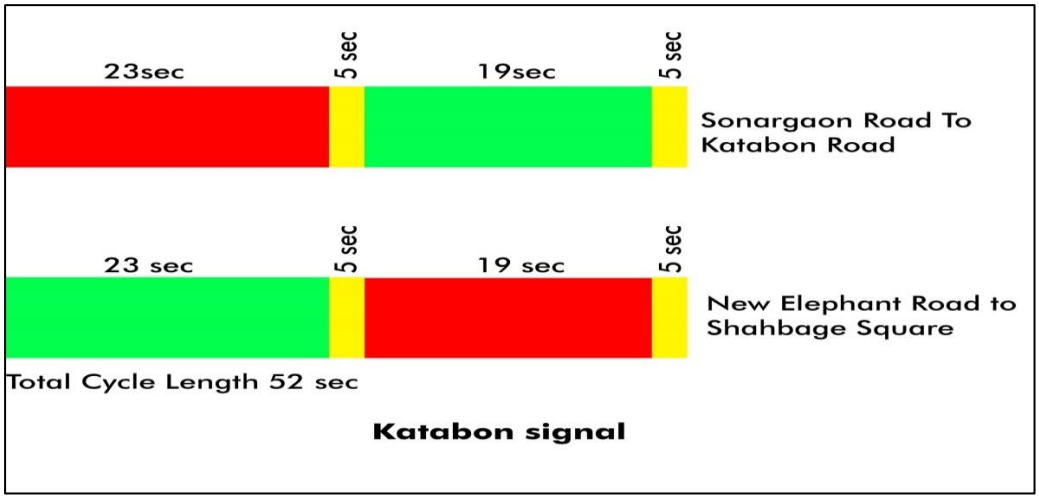


Figure 4-26. Simulation Cycle Length

Figure 4-27 shows the simulation design of Kataban Intersection point. The Intersection point was first simulated for manual signaling of (usually 10-12 mins) and high congestion with almost (nos of vehicle in queue, 50) 50 vehicles in queue was found, showed in figure 4-28. Figure 4-29 shows the simulation of same Intersection point with designed 52 sec signal cycle length from figure 4-26. As a result, a lessen vehicle count of around 12 vehicles in queue was found.

Figure 4-27. Simulation design of Kataban Intersection point

Figure 4-28. Traffic congestion before design

Figure 4-29. traffic congestion after design

4.4 Result Analysis

4.4.1 Signaling cycle length efficiency

To generate the data required for this analysis process, a search algorithm is developed to locate the optimal cycle length based on a time-dependent delay model. Numerical results show that the proposed formulas give a better estimation for optimal cycle length at high intersection flow percentage

Table 4-16. Signaling cycle length efficiency

Name of Intersection point	Signaling time (maximum) by manually controlled traffic	Signaling time by designed cycle length	% Reduction of signaling time
Farmgate	25min=1500sec	89 sec	94%
Karwan Bazar	25min=1500sec	108 sec	92%
Bangla Motor	20min=1200sec	78 sec	93%
Shahbagh	22min= 1320sec	53 sec	95%
Kataban	12min=720sec	52 sec	92%
Science Lab	16min=960sec	61 sec	91%
Panthapath	18min=1080sec	87 sec	90%

4.4.2 Vehicle queue reduction efficiency

Table 4-17. Vehicle queue reduction efficiency

Name of Intersection point	Nos. of vehicle in queue during manual control	Nos. of vehicle in queue during designed cycle length	% Reduction of vehicle in queue
Farmgate	60	10	83%
Karwan Bazar	80	25	68%
Bangla Motor	70	18	74%
Shahbagh	75	20	73%
Kataban	50	12	76%
Science Lab	65	14	78%
Panthapath	70	16	77%

4.5 Summary

The overall review this signaling cycle length efficiency here reduction of signaling time Framgate 94%, Karwan Bazar 92%, Bangla Motor 93%, Shahbagh 95%, Kataban 92% Science Lab 91% and Panthapath 90%. Reduction of vehicle in queue Framgate 83%, Karwan Bazar 68%, Bangla Motor 74%, Shahbagh 73%, Kataban 76% Science Lab 78% and Panthapath 77%.

CHAPTER 5

Conclusions and Future Works

5.1 Conclusions

This thesis work conducted a full fledge signaling design for seven intersections in the center of Dhaka city, the capital of Bangladesh. This signaling design was simulated for its suitability analysis by VISSIM software. The simulation result was analyzed for two points of aspects, firstly percentage of reduction of waiting time, and secondly percentages of reduction of vehicle count in traffic queue. This work was done to ensure the reduction of waiting time not less than 90%. Farmgate intersection was found to be maximum efficient intersection with a highest reduction in waiting time of 95% with a full cycle length of 53 sec. Kawran bazar was found to be the busiest intersection and hence it was needed to provide 108 sec full cycle length with a 92% of reduction of waiting time. This research was compared with the result of Hossain, 2004 which could ensure 87% reduction of waiting time. Hence it can be concluded that, at least more than 3% efficiency was gain in this work than that of Hossain,2004. Moreover Hossain,2004 tried to keep the cycle length fixed at 78 sec for whatever the volume of vehicle be, which affected the vehicle count in queue. This research work concluded with a reduction of vehicle count in queue for the highest with 83% in Farmgate and lowest with 68% in Karwan bazar. It was observed for Shahbagh and Panthapath to have lowest cycle length of 53 sec with almost 93% of reduction in vehicle queue. And as found in Sanowar Hossain *et al.*, 2017 a total of 46 thousand in Bangladeshi taka is wasted for every one hour waiting time at traffic signal this design can help to save a millions of Bangladeshi taka by reducing the waiting time.

5.2 Limitations and Recommendations for Future Works

This is not authorized software. This is the student version (VISSIM 2022). No one has worked with this software in such detail before, so it is difficult to know the details. With this VISSIM software it is not possible to draw roads with a length of

more than 1000 meters. This version it is not possible for traffic simulators to cover all road junctions in one place.

Engr. Et el 2015 fine and legal service against traffic law violators will save time and money at the same time, so regular monitoring system must be studied and developed for confirmation of smooth handling with the design.

5.3 Summary

With this VISSIM software it is not possible to draw roads with a length of more than 1000 meters. This version it is not possible for traffic simulators to cover all road junctions in one place. According to finding, fine and legal service against traffic law violators will save time and money at the same time, so compensation must be ensured. Regular monitoring system must be studied and developed for confirmation of smooth handling with the designed signaling.

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APPENDIX

APPENDIX A

1. Farmgate Signal Calculation

Let Farmgate Signal be “A”

The Road Connecting “A” Signal are

Farmgate to Indira + Khamar bari Road = A1

Farmgate to Karwan bazar Road = A2

Farmgate to Tejturi Bazar Road = A3

Farmgate to Bijoy Sharoni Road = A4

:. A1=A3=130 ft. and A2=A4=140 ft

For both Road Yellow Period Y=5 sec

Based on Pedestrian Walking Speed of =3.936 ft./sec

Pedestrian Clearance time for road A1 and A3 =$\frac{130}{3.936}$ = 33.1 Sec

Pedestrian Clearance time for road A2 and A4 = $\frac{140}{3.936} = 35.60\ Sec$

Adding 7sec for initial walk period minimum

Red light for road A1 & A3 = 33.1+7= 40 sec

And that for road A2 & A4 = 35.6+7=42.6 sec ≈ 43 sec

Minimum green times Based on pedestrian Criteria

Road A1 & A3 = 43-5=38 sec

Road A2 & A4 = 40-5=35 sec

Based on Road width the green time calculated is increased for road A2 & A4 with higher

Road width: $\frac{GA2,A4}{GA1,A3} = \frac{WA2,A4}{WA1,A3}$

Where, GA2, A4 and GA2, A3 are the green timing

For road A2, A4 and A1, A3 and WA2A4

WA1, A4 are the road width

GA1A= 35 sec as calculated above

GA2A4=$\frac{WA2,A4}{WA1,A3} \times GA1, A3 = \frac{140}{130} \times 38$ = 40.92 Sec≈41 Sec

Total Cycle Length

= $G_{(A2,\ A4\ )}$+Y+ $R_{(A1,\ A3)}$ + Y

= 41+5+38+5

=89 sec

2. Karwan Bazar Signal Calculation

The Road Connecting “B” Signal are

Karwan Bazar to Bangla Motor= B4

Karwan Bazar to Tejgaon Link Rd = B5

Karwan Bazar to Farmgate = B6

Karwan Bazar to Panthapath = B7

:. B4=B6=140 ft. and B5=B7=97 ft 34

For Road C8 & C10 Yellow Period YB5, B7=3 sec

For Road C7 & C9 Yellow Period $Y_{B4,\ B6}$=4 sec

For Road C8 & C10 Yellow Period YB5, B7=3 sec

Based on Pedestrian Walking Speed of 3.936 ft./sec

Pedestrian Clearance time for road B4 and B6 = 140/3.936=35.57 sec

Pedestrian Clearance time for road B5 and B7 = 97/3.936=24.65 sec

Adding 7sec for initial walk period minimum

red light for road C7 & C9 = 35.57+7= 42.57 sec and

that for road C8 & C10 = 24.65+7=31.65 sec

Minimum green times Based on pedestrian Criteria

Road C7 & C9 = 31.65-4=27.65 sec

Road C8 & C10= 29.87-3=39.57 sec ≈ 40 sec

Based on Road width the green time Calculated is increased for road C7 & C9 with higher road width: $GB4,6GB5,B7=WB4,B6WB5,B7$

Where, GB4, B6 and GB5, B7 are the green timing for Road B4, B6 and B5, B7 and WB4B6, WB5, B7 are the road width

GB5, B7= 39.57sec as calculated above

GB4, B6=$WB4B6WB5B7\times GB4B6$=140/97×39.57=57.11 $Sec\approx$58 Sec

Total Cycle Length

= GB4, B6+ YB4, B6+ GB5, B7+ YB5, B7

= 58+5+40+5

=108 sec

3. Bangla Motor Signal Calculation

Let Bangla Motor Signal be “C”

The Road Connecting “C” Signal are

Bangla Motor to Link Road = C1

Bangla Motor to Shahbagh = C2

Bangla Motor to New Eskaton Road = C3

Bangla Motor to Karwan Bazar = C4

:. C1=C3=90 ft. and C2 = C4=106 ft.

For both Road Yellow Period Y=5 sec

Based on Pedestrian Walking Speed of 3.936 ft./sec

Pedestrian Clearance time for road C1 and C3 = 90/3.936=22.87 sec

Pedestrian Clearance time for road C2 and C4 = 106/3.936=26.93 sec

Adding 7sec for initial walk period minimum

red light for road C1 & C3 = 22.87+7= 29.87 sec

And that for road C2 & C4 = 26.93+7=33.93 sec ≈ 34 sec

Minimum green times Based on pedestrian Criteria

Road C1 & C3 = 33.93-3=30.93 sec ≈ 31sec

Road C2 & C4 = 29.87-3=26.87 sec

Based on Road width the green time calculated is increased for road A2 & A4 with higher road width: GC2,C4GC1,A3=WC2,C4WC1,C3

Where, GC2, C4 and GC2, C3 are the green timing

For road C2, C4 and C1, C3 and WC2C4

WC1, AC4 are the road width

GC1C= 30.93sec as calculated above

GC2C4=WC2, C4WC1C3×GC1,C3=10690×30.93=36.43 Sec≈37 Sec

Total Cycle Length

= $G_{C2, C4}$ + $G_{C1, C3}$ + Y

= 37+5+31+5

=78 sec

4. Shahbagh signal calculation

Let, Shahbagh Signal be “D”

The Road Connecting “D” Signal are

Shahbagh to TSE Road = D1

Shahbagh to Bangla Motor Road=D2

Shahbagh signal to Shahbagh Square = D3

Shahbagh to M.B.Road = D4

Road width= 65‟‟

Pedestrian speed= 1.2 m/s = 3.936 ft./s

Red light time= 65/3.963+7=23.51~ 25 sec

Red light of D, D1=Y+G of D3D ,D3D4

Y+G of Shahbagh to M.Basani road = 25 sec

Let, Y= 5 sec

G= 25-3 = 22 sec

Red for Shahbagh to M. Basani road= 60/3.936+7= 22.24 sec ~ 23 sec

Y+G of Bangla Motor road to TSC road 23 sec

R= 23 sec

G= 20 sec

Total Cycle Length

$= G_{D2, D4} + G_{D1, D3} + Y$

= 23+5+20+5

=53 sec

Shahbagh to M. Basani road 60‟‟= G 22 sec

1‟‟= 22/60

Karwan bazar to TSC road 65"= 65x22/60 = 23.83 sec ~ 24 sec

Review for extra time 8 sec

Regular traffic speed= 25km/h

= 25 x1000/3600 m/s

= 6.94 m/s

= 6.94 x 3.28 ft./s

= 22.76 ft/s

Traffic of Shahbagh to M.Basani road take = 65/22.76 sec to cross

= 2.8 sec

Traffic of Karwan bazar to TSC road take = 60/ 22.76 = 2.63 sec

5. Science lab signal calculation

Let Science Lab Signal be "E"

The Road Connecting "E" Signal are

Science Lab to Elephant road = E4

Science Lab to Mirpur road =E5

Science Lab to Green road =E6

Road width= 67"

Pedestrain speed= 1.2 m/s = 3.936 ft/s

Red light time= 67/3.963+7=24 sec

Red light of E4, E6=Y+G of E5,

Y+G of Science Lab to Mirpur road = 24 sec

Let, Y= 3 sec

G= 24-3= 21 sec

Red for Science lab to Elephant road= 53/3.936+7= 20.46 sec ~ 21 sec

Y+ G of Science lab to green road =21 sec

Y= 3 sec

G= 18 sec

Science lab to green road 53"= G 21 sec

1“= 21/53

Science lab to green road 67“= 65x21/53 = 26.54 sec ~ 27 sec

Review for extra time 6 sec

Regular traffic speed= 25km/h

= 25 x1000/3600 m/s

= 6.94 m/s

= 6.94x3.28 ft./s

= 22.76 ft./s

Traffic of Science lab to Mirpur road take = 67/22.76 sec to cross

= 2.9 sec

Traffic of Science lab to Elephant road take = 60/ 22.76= 2.63 sec

Traffic signaling cycle

R+Y+G+Y = 1 Cycle

30+5+21+5= 61 sec

6. Panthapath signal calculation

Let, Panthapath Signal be “C”

The Road Connecting “C” Signal are

Panthapath to Karwan Bazar = C7

Panthapath to Farmgate = C8

Panthapath to Dhanmondi 32 = C9

Panthapath to Green Road = C10

C7=88 ft and C9=92 ft. C8=C10=53 ft.

Here, C7 and C9 road are facing each other, so we can go with higher width C9 calculation, For road C7 & C9 yellow period $Y_{C7, C9}$=5 sec

For road C8 & C10 yellow period $Y_{C8, C10}$=5sec

Based on pedestrian walking speed of 3.936ft/sec

Pedestrian clearance time for road C7 and C9 $=\frac{90}{3.936}$

$= 23.37\ sec$

Pedestrian clearance time for road C8 and C10 $=\frac{53}{3.936}= 13.47\ sec$

Adding 7sec for initial walk period

minimum red light for Road C7 & C9 =

23.37+7= 30.37 sec and that for Road C8

& C10 = 13.47+7=20.47 sec Minimum

green times based on pedestrian criteria

Road C7 & C9 = 20.47-4=16.47 sec

Road C8 & C10= 30.37-3=27.7 sec ≈ 28 sec

Based on road width the green time calculated is increased for road C7 & C9 with higher road width: $\frac{GC7,C9}{GC8,10} = \frac{WC7,9}{WC8,10}$

Where, $G_{C7,C9}$ and $G_{C8,\ C10}$ are the green timing for road C7, C9 and C8, C10 and $W_{C7,C9}$,

$W_{C8,\ C10}$ are the road width

$G_{C8,\ C10}$= 28 sec as calculated above

$$= \frac{WC7,9}{WC8,10} \times GC8,C10 = \frac{92}{53} \times 28 \equiv 48.60 Sec \approx 49$$

$G_{B4,\ B6}$ Sec

Total cycle length

$= G_{C7,\ C9} + Y_{C7,\ C9} + G_{C8,\ C10} + Y_{C8,\ C10}$

= 49+5+28+5

=87 sec

7. Kataban signal calculation

Let Kataban Signal be “G”

The Road Connecting “G” Signal are

Kataban to Shahbagh Square Road = G1

Kataban to Sonargaon Road = G2

Kataban to Mirpur Road = G3

Kataban to Kataban Road = G4

:. G1=G3=65 ft. and G2=G4=45 ft.

For both Road Yellow Period Y=5 sec

Based on Pedestrian Walking Speed of =3.936 ft./sec

Pedestrian Clearance time for road G1 and G3 =65/3.936 = 23 Sec

Pedestrian Clearance time for road A2 and A4 = 45/3.936=19Sec

Adding 7sec for initial walk period minimum

Red light for road G1 & G3 = 23+7= 30 sec

And that for road G2 & G4 = 19+7=26 sec

Minimum green times Based on pedestrian Criteria

Road A1 & A3 = 30-5=25 sec

Road A2 & A4 = 26-5=21 sec

Total Cycle Length

= G(G2, G4)+Y+ R(G1, G3) + Y

= 25+5+21+5

=56 sec