Estimating Traffic Volume to Identify the Level of Service at Bijoy Sarani Intersection

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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



Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section: 14B

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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 Parents

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ABSTRACT

The increment of vehicles due to the proportional increment of populations and a rapid development of modern society is a major concern in Metropolitan cities in developing countries like Bangladesh. So, it is imperative to monitor traffic volume as well as the quality of transport supply termed as the Level of Service (LOS). The present study is an investigation of the behavior of mixed traffic flow in Dhaka city of Bangladesh. Field Traffic volume survey was carried out to determine the level of service at a signalized Bijoy Sarani intersection in Dhaka North City Corporation (DNCC). Level of service (LOS) was determined by peak hour factor (PHF) method. Nature of traffic flow in Dhaka city is heterogeneous. So, this heterogeneous or mixed traffic are simplified by Passenger car unit (PCU). Then estimated PCU was used to determine LOS. LOS was calculated for both directions of roads. Personal car, Motor bike, CNG and buses are the dominant vehicles in this intersection. According to PHF method, LOS of this intersection is very unstable and worst. Considering and evaluating all the findings it can be recommended that increasing and improving public transport facilities, demotivating private transport should be applied and road width need to be increased to make the traffic flow suitable. Also, incorporation of an effective intelligent traffic signal, implementing traffic rules and regulation should be applied and maintained properly in the worst condition intersection to accelerate the traffic flow in this area.

Keywords: Passenger Car Unit; Level of service; Traffic Volume; peak hour factor; Intersection; Dhaka

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CHAPTER 1
INTRODUCTION

1.1 Introduction:

For the economic development, good transportation system is very important [1-3]. In transportation engineering traffic volume study is a baseline. Engineering operations and management are successfully completed by using it [4]. Traffic volume survey plays a significant role to determine the existing condition and to forecast the future condition of traffic volume [5]. The road traffic in developing countries like Bangladesh is highly heterogeneous comprising of the traffic of different static and dynamic characteristics [6, 7]. Again, Traffic volume data is very important as it is used to estimate capacity of a road and level of service of that given road under the combination of traffic at any hour of a day [8, 9] LOS of a traffic facility defines as a concept used to determine the performance and quality of traffic service to a given flow rate [10]. Levels of service are defined as six categories from A to F category. A represents best operating condition on the other hand F is used to estimate capacity of a road and level of service of that given road under the combination of traffic at any hour of a day [8, 9]. Los of represents the worst [11] In Dhaka city, the increment of traffic volume and congestions are two quickly developing problems. Nowadays, it is common to see traffic congestions at intersections at peak hours in the morning and evening. According to a report, traffic volume is increasing in last few decades and was 19397 in 2015 with annual growth rate 6.1% in this city [12]. This may be due to poor road planning and sub-standard geometric conditions of selected intersections [13]. Intersections become very congested if traffic volumes are high, make inefficiency as a result peoples suffer delay and frustration [14]. A rapid escalation in the number of motor vehicles, greater availability of used vehicles, the relative reduction in prices result traffic congestions [15]. Due to traffic congestion, air pollution, fuel usage, and travel time [16, 17]. Therefore, it is a significant issue to investigate traffic volume and to monitor the quality of transport supply in terms of level of service for major intersections of Dhaka City. Traffic volume count of this study will be helpful for planning, accident analysis [18], design and operation, for roadway of Dhaka city [19] as well as future traffic demand forecasting. To estimate traffic volume at selected intersections, a case study was made at 1 major intersection during morning (9am-10am), Afternoon

(12pm-1pm) and evening (5pm-6pm). To analyze mixed or heterogeneous traffic, a simplification is developed to convert the different types of vehicles into equivalent number of passenger cars named passenger car unit or PCU [6]. Finally estimated PCU values are used to determine LOS on three or four legs divided intersections. Level of service (LOS) was determined by peak hour factor method.

1.2 Objectives

The main objective of this research work was to assess the estimating traffic volume conditions at Bijoy Sarani Intersection. Traffic volume conditions were measured in terms of familiar Level of Service (LOS) criteria.

1.3 Organization of the Thesis

In addition to this introductory chapter, this thesis consists of five different chapters. Chapter 2 summarizes the literatures reviewed in connection of this study. Chapter 3 describes the detailed methodologies used to achieve the study objectives. Chapter 4 presents the results and discussion of the analysis of traffic volume condition. The conclusions and recommendations drawn from this study for future effort are summarized in Chapter 5.

CHAPTER 2

Literature Review

2.1 Introduction

LOS is very effective approach to identify the existing traffic condition of any intersection. Numerous studies have been conducted by different researchers in which they describe the procedure about how to calculate the LOS using various methods.

2.2 Related Works in Foreign Countries

A concept was first developed in 1965 for highway named highway capacity manual (HCM) to define level of service and classify it by a range from A to F for highway [20]. It is very important to analyze the traffic performance for design, maintenance, rehabilitation, and planning of roads. Performance evaluation of traffic in a highway is expressed by a term Level of service. It is a method which can explain traffic conditions for an existing or proposed transportation facility operating based upon current or projected traffic demand [21]. Capacity and level of service are analyzed to get the delay of the analyzed facilities. This Analysis is two types. One is empirical, another is analytical. The empirical model is established on the basis of regression analysis on the other hand the analytical model is based on the gap-acceptance theory [22]. An attempt is made by Ankit N Mahidadiya and Prof. Jayesh Juremalani to estimate passenger Car unit (PCU) in an urban intersection [23]. A study was made in malaysia by jamil et al. using aaSIDRA (full abbreviate of aaSIDRA) intersection version 5.1 software to analyze capacity, level of service at unsignalized intersection. Main purpose was to analyze factors affecting level of service at a junction [24]. Rao et al. followed HCM (highway capacity manual) 2000 to evaluate the capacity, control delay and Level of service of vehicular streams and traffic parameters were abstracted by the videography for 3 uncontrolled intersections in India [25]. Mithun Mohan and Satish Chandra proposed three methods for the estimation of PCU at UI under highly heterogeneous traffic conditions. First one is PCU based on occupancy time, second one is PCU based on potential capacity, and last one is PCU based on queue clearance rate [26].

2.3 Related Works in Bangladesh

Several research programs have been developed in foreign countries, but very limited studies have been made in this selected topic in Bangladesh. A case study like physical feature s survey, delay time survey, parking survey, traffic volume survey was done to find out the condition of traffic and transportation at Central Business Area of Rangpur city [27]. A study was developed by chisty, islam and mishuk to identify the existing level of service of agrabad to CEPZ Road in Chittagong city. To calculate LOS, a traffic survey was carried out to determine traffic volume, capacity, and speed of that existing road [28].

CHAPTER 3

Methodology

3.1 Introduction

The main objective of this research is to identify the LOS of BijaySarani intersections. LOS is related with Modal composition of various transport, Road capacity and Road geometry. Modal composition describes the key operational, commercial advantages and properties of any transport in terms of cost, speed, accessibility, frequency, safety, comfort, etc. In this research to achieve the LOS, traffic volume survey was carried out to count mixed vehicles, geometric feature survey. All traffic data were collected into three phases like morning peak (9-10am), afternoon off peak (12-1pm) and evening peak (5-6pm) and each peak was continued for 1 hours duration (Transport, 2004). Geometric feature survey is needed to identify the existing road capacity. To identify the existing supply and capacity conditions of various intersections road length, width of carriageway, footpath, median, shoulder, number of legs and control system etc. data has been collected by conducting field survey. The calculation of Passenger car unit or PCU is very important to analyze the mixed or heterogeneous traffic and PCU is a simplification which converts the different types of vehicles into equivalent number of passenger cars [26].

3.2 Data Collection Mechanism

We collect our data after group member's discussion. Traffic volume data were collected at each point on weekday for 3 hours with the help of a video camera. Four digital video cameras were used to collect traffic data. Then vehicle types and a Number of the vehicles was counted by slowly playing all recorded videos at the laboratory.

3.3 Description of Study Area

Dhaka is a metropolitan city in Bangladesh and a major urban, commercial and educational Centre of North City Corporation [29]. The study is carried out in Dhaka north City Corporation, located in North East part of Bangladesh. Dhaka North City Corporation consists of 54 wards covering the thanas of Turag, West Uttara west, East Uttara, Uttarkhan, Dakkhin khan, Biman bandar, Khilkhet, Vatara, Badda, Rampura, Hatirjheel, Shilpanchal, Tejgaon, Sher-E-Bangla nagar, Mohammadpur, Adabor, Darussalam, Mirpur, Pallabi, Rupnagar, Shahali, Kafrul,

There are 12 city corporations in Bangladesh and Dhaka is one of the oldest city corporations, which is established in 1610 [29]. In the previous decade Dhaka is called a city of rickshaw but now it is called a city of Busses and cars, Motorcycle, and CNG [2]. In Dhaka city, 62% commercial vehicles transport passenger and carry freight [12]. The nature of all intersections is signalized. Among them, Bijoy Sarani is considered as one of the most busy intersections.

3.4 Road Geometry of Intersections

Bijay Sarani is one of the most busy road intersections in Dhaka city. From Farmgate, in the middle of the old airport, from the Sony Rangs building to the farm house, Rokeya Sarani is connected horizontally. There is a busy road, with a mural at one end and a fighter jet at the other. The Bijoy Sarani to Kazi Nazrul Islam Avenue road has four lanes with two sided footpath and Median. The Bijoy Sarani to Tejgaon Link Road has two lanes with two sided footpath and Median. The Bijoy Sarani to Novo Theatre road has four lanes with two sided footpath and Median. The Bijoy Sarani to Bir Uttam Ziaur Rahman Road has four lanes with two sided footpath and Median. The Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road has two lanes with two sided footpath and Median.

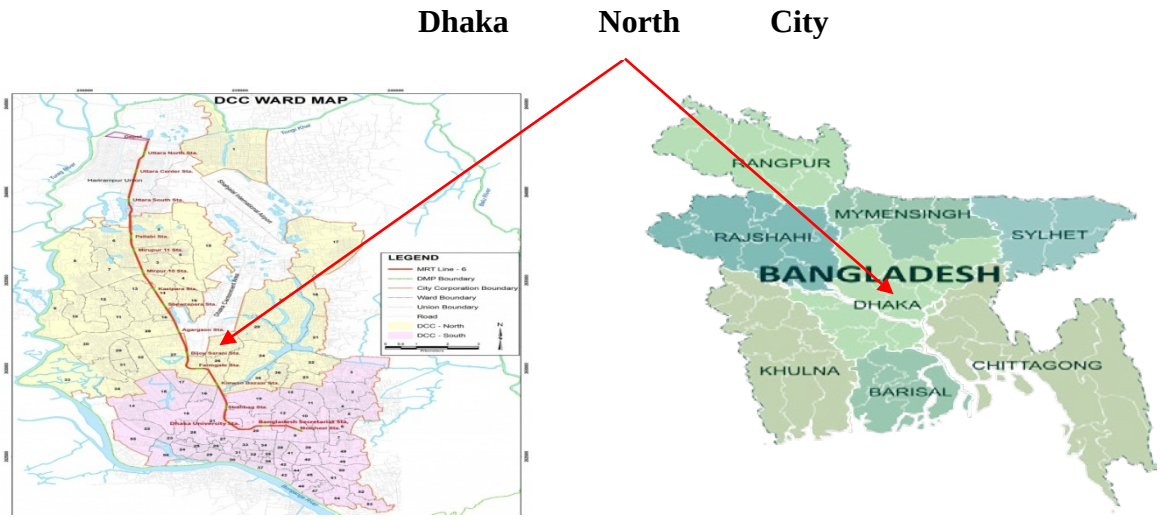


Figure 3-1: Location Map of Study area.

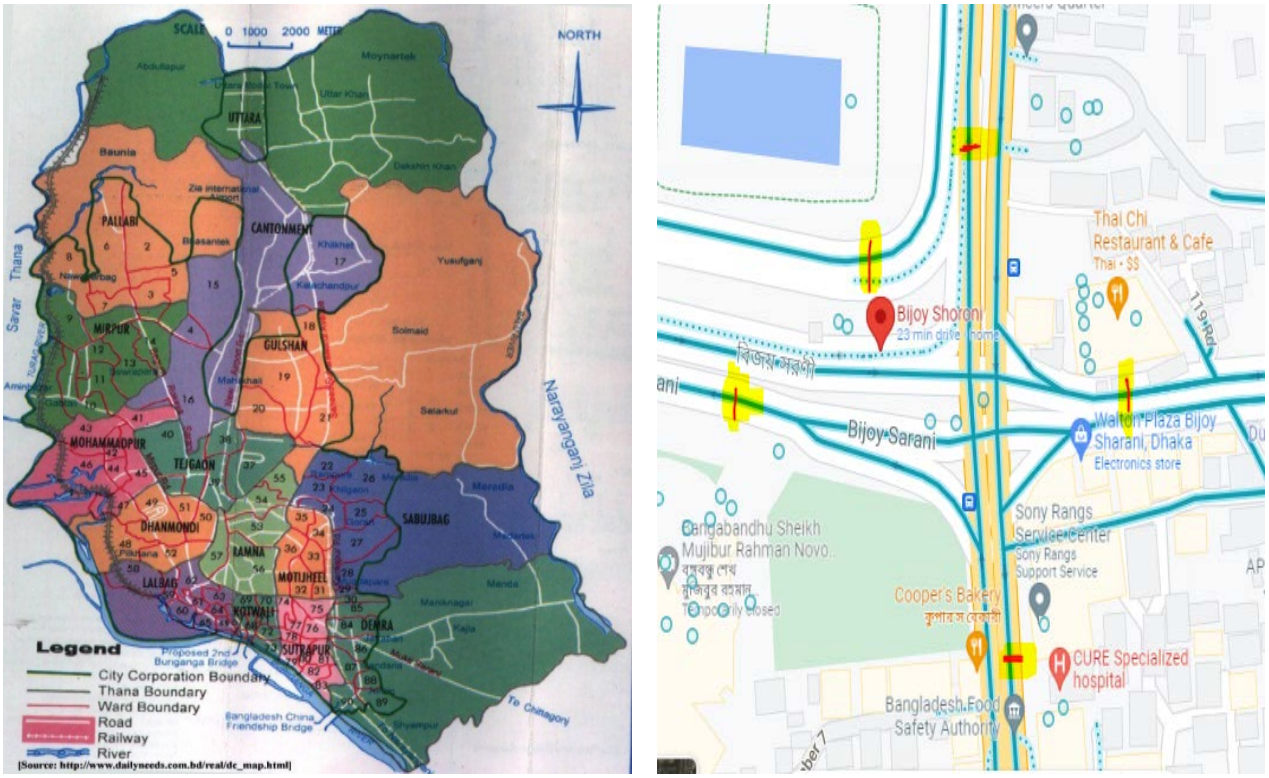


Figure 3-2: Location of Bijoy Sarani Intersection



Figure 3-3: Road Connectivity of Intersection

a) Location of Bijoy Sarani, Dhaka.

b) Road Connectivity of Bijoy Sarani Intersection.

Table 3-1: Road Geometry of One major intersection in DCC area

Point Name	Road Name	Lane Width (ft.)		Median (ft.)	Footpath width (ft.)	
		Right	Left		Right	Left
A	Bijoy Sarani to Kazi Nazrul Islam Avenue	45'-0"	45'-0"	4'-0"	8'-0"	8'-0"
B	Bijoy Sarani to Tejgaon Link Road	22'-0"	22'-0"	2'-0"	5'-0"	5'-0"
C	BijoySarani to Novo Theatre	44'-10"	44'-10"	20'-2"	12'-2"	12'-2"
D	Bijoy Sarani to Bir Uttam Ziaur Rahman Road	44'-0"	44'-0"	4'-0"	7'-6"	7'-6"
E	Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road	23'-8"	23'-8"	1'-8"	3'-6"	3'-6"

3.5 LOS with respect to its Peak Hour Factor

Peak Hour Factor Value	LOS
0.7 or less	A
0.8 or less	B
0.85 or less	C
0.90 or less	D
0.95 or less	E
>1 or less	F

To calculate the LOS, Peak Hour factor (PHF) method is used. Traffic engineers focus on the peak-hour traffic volume in evaluating capacity and other parameters because it represents the most critical time. The analysis of level of service is based on peak rates of flow occurring within the peak hour because substantial short-term fluctuations typically occur during an hour. Common practice is to use a peak 15-minute rate of flow. Flow rates are usually expressed in vehicles per hour, not vehicles per 15 minutes. The relationship between the peak 15-minute flow rate and the full hourly volume is given by the peak-hour factor (PHF) as shown in the following equation (Authority, 2003). Peak-hour factors in urban areas generally range between 0.80 and 0.98. Peak-hour factors over 0.95 are often indicative of high traffic volumes [31]. PHF was evaluated by the following formula [30].

PHF= (hourly volume/4* volume count at highest 15-min)

Table 3-2: PCU factors for Urban road

PCU factors for Urban road	
Vehicle Types	PCU factors
CNg	0.6
Pickup	1.5
Covered van	3
Truck	3
Car	1
Bus	2.5
Bicycle	0.3
Motorcycle	0.5

CHAPTER 4

Results and Discussion

4.1 Introduction

To fulfill the objectives of the study, data analysis has been done on two stages. First, analysis on existing conditions of intersections has been conducted. Secondly, survey data have been conducted to find out the recent traffic performance conditions of these intersections. In mixed traffic condition, modal share is an important factor for assessment of intersection performance.

4.2 Intersection Approach

4.2.1 Bijoy Sarani to Kazi Nazrul Islam Avenue:

Car is the most dominated vehicle about 1110 found in the morning. Rest of the peaks also contain highest amount of car and the number is 705 and 621 at afternoon and evening hour respectively. Motorcycle and busses are maximum in afternoon peak period. The maximum volume of motorcycle is found in the evening period where as maximum CNG volume is found in the morning period. Moderate numbers of vehicles are Covered van, pickup. There is no Truck influence in this lane in the morning peak. Less dominant vehicles are truck, also their effect are less at three peaks. The modal variation is shown in Figure -1.

Table 4-1: Filed survey at Bijoy Sarani to Kazi Nazrul Islam Avenue (Point A) (Actual Vehicle count from field survey).

POINT	A= (Bijoy Sarani to Kazi Nazrul Islam Ave)								Date		25/11/2021	
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Value	Total	60min Value	Total
Morning Peak												
8:00-8:15	78	24	0	0	324	63	42	273	804			
8:15-8:30	27	3	0	0	150	15	18	150	363			
8:30-8:45	54	15	6	0	267	36	57	276	711			
8:45-9:00	81	15	21	0	369	48	72	334	940		2818	

Afternoon peak										
12:00-12:15	24	9	15	3	54	15	48	120	288	
12:15-12:30	78	6	12	0	285	27	24	273	705	
12:30-12:45	105	12	15	0	210	18	54	306	720	
12:45-1:00	99	9	9	0	156	15	24	204	516	2229
Evening Peak										
5:00-5:15	66	9	12	0	123	24	24	192	450	
5:15-5:30	78	21	12	0	207	21	15	252	606	
5:30-5:45	42	9	3	3	156	21	24	192	450	
5:45-6:00	102	24	18	6	135	33	42	243	603	2109

Table 4-2: Bijoy Sarani to Kazi Nazrul Islam Avenue (Point A) (converted Vehicle count by PCU factor).

POINT	A= (Bijoy Sarani to Kazi Nazrul Islam Ave)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	46.8	36	0	0	324	157.5	12.6	136.5	713.4	
8:15-8:30	16.2	4.5	0	0	150	37.5	5.4	75	288.6	
8:30-8:45	32.4	22.5	18	0	267	90	17.1	138	585	
8:45-9:00	48.6	22.5	63	0	369	120	21.6	167	811.7	2398.7

Afternoon peak										
12:00-12:15	14.4	13.5	45	9	54	37.5	14.4	60	247.8	
12:15-12:30	46.8	9	36	0	285	67.5	7.2	136.5	588	
12:30-12:45	63	18	45	0	210	45	16.2	153	550.2	
12:45-1:00	59.4	13.5	27	0	156	37.5	7.2	102	402.6	1788.6
Evening Peak										
5:00-5:15	39.6	13.5	36	0	123	60	7.2	96	375.3	
5:15-5:30	46.8	31.5	36	0	207	52.5	4.5	126	504.3	
5:30-5:45	25.2	13.5	9	9	156	52.5	7.2	96	368.4	
5:45-6:00	61.2	36	54	18	135	82.5	12.6	121.5	520.8	1768.8

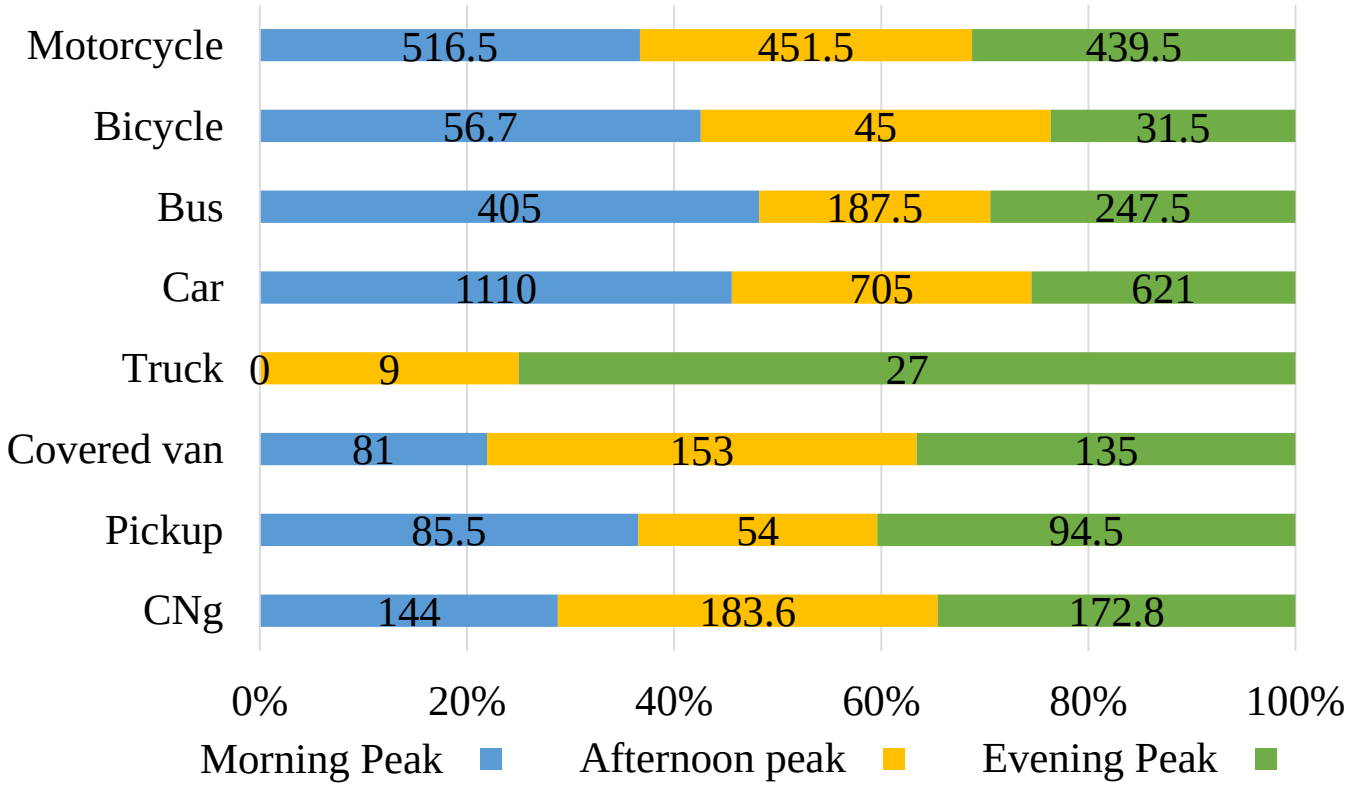


Figure -1: Modal variation of Bijoy Sarani to Kazi Nazrul Islam Avenue

4.2.2 Bijoy Sarani to Tejgaon Link Road:

High concentration of vehicle in Bijoy Sarani to Tejgaon Link Road lane is Car. Amount of such type vehicle is 1782 was found in Morning hour. At evening, morning, afternoon off peaks concentration of covered van, Motorcycle & CNG were maximum Concentration of Bicycle, bus, truck, & pickup is limited, their percentages are about 50%, 32%, 20% and 22% at morning, about 27%, 38%. 40% & 47% at afternoon off peak and rest of the percentage exist at evening respectively. The modal variation is shown in Figure-2.

Table 4-3: Filed survey at Bijoy Sarani to Tejgaon Link Road (Point B) (Actual Vehicle count from field survey).

POINT	B = (Bijoy Sarani to Tejgaon Link Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	150	9	3	0	480	6	24	402	1074	
8:15-8:30	180	18	9	0	270	3	18	486	984	
8:30-8:45	148	21	6	3	537	3	9	988	1715	
8:45-9:00	156	6	12	3	495	6	15	603	1296	5069

Afternoon peak										
12:00-12:15	360	30	48	3	365	3	12	540	1361	
12:15-12:30	270	24	34	6	375	6	9	675	1399	
12:30-12:45	189	21	36	0	321	9	9	465	1050	
12:45-1:00	366	30	45	3	408	6	6	585	1449	5259
Evening Peak										
5:00-5:15	276	12	34	3	363	0	15	336	1039	
5:15-5:30	207	18	42	6	286	9	6	246	820	
5:30-5:45	267	15	30	3	321	3	6	480	1125	
5:45-6:00	156	27	21	0	336	0	3	420	963	3947

Table 4-4: Bijoy Sarani to Tejgaon Link Road (Point B) (converted Vehicle count by PCU factor).

POINT	B = (Bijoy Sarani to Tejgaon Link Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	90	13.5	9	0	480	15	7.2	201	815.7	
8:15-8:30	108	27	27	0	270	7.5	5.4	243	687.9	
8:30-8:45	88.8	31.5	18	9	537	7.5	2.7	494	1188.5	
8:45-9:00	93.6	9	36	9	495	15	4.5	301.5	963.6	3655.7

Afternoon peak										
12:00-12:15	216	45	144	9	365	7.5	3.6	270	1060.1	
12:15-12:30	162	36	102	18	375	15	2.7	337.5	1048.2	
12:30-12:45	113.4	31.5	108	0	321	22.5	2.7	232.5	831.6	
12:45-1:00	219.6	45	135	9	408	15	1.8	292.5	1125.9	4065.8
Evening Peak										
5:00-5:15	165.6	18	102	9	363	0	4.5	168	830.1	
5:15-5:30	124.2	27	126	18	286	22.5	1.8	123	728.5	
5:30-5:45	160.2	22.5	90	9	321	7.5	1.8	240	852	
5:45-6:00	93.6	40.5	63	0	336	0	0.9	210	744	3154.6

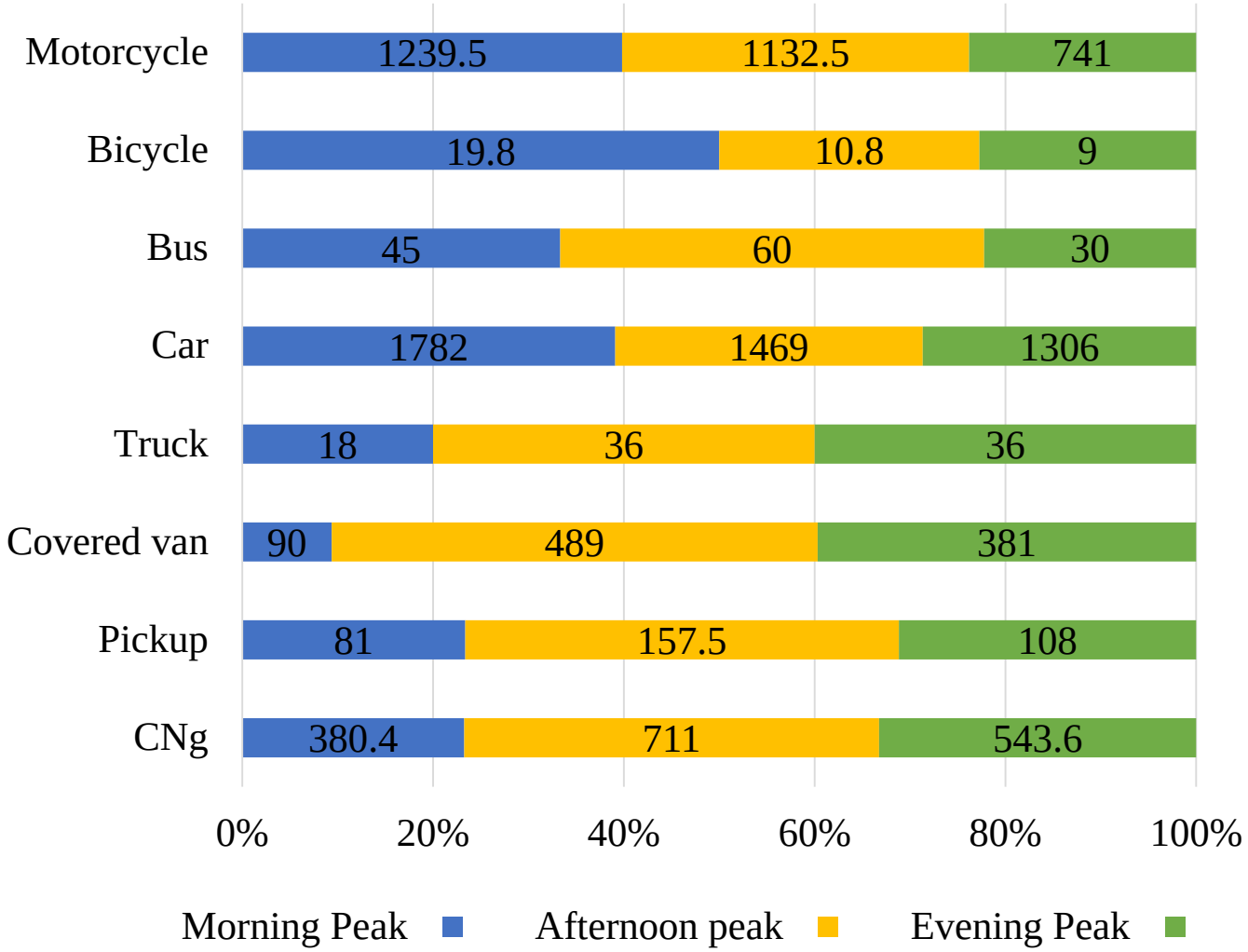


Figure -2: Modal variation of Bijoy Sarani to Tejgaon Link Road.

4.2.3 Bijoy Sarani to Novo Theatre:

In This lane, highest concentration of Car was found and its amount is 1833 and so it is considered as the dominant vehicle morning peak hour. Second dominant vehicles are Motorcycle, CNG, Covered van and their percentage are about 23%, 35%, 32%, at morning, 40%, 27%, 20%, at afternoon off peak and rest of the percentage of vehicles found at evening respectively. Low volume of traffic like Bicycle, Busses, Pickup, was found in this lane. Less dominant vehicles were truck. Shows the modal variation Figure-3

Table 4-5: Filed survey at Bijoy Sarani to Novo Theatre (Point C) (Actual Vehicle count from field survey).

POINT	C= (Bijoy Sarani to Novo Theatre)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	225	33	30	0	606	15	18	360	1287	
8:15-8:30	324	21	27	3	402	15	45	414	1251	
8:30-8:45	312	27	24	0	510	18	27	402	1320	
8:45-9:00	183	9	54	0	315	6	27	522	1116	4974

Afternoon peak										
12:00-12:15	162	18	24	0	345	3	21	705	1278	
12:15-12:30	186	9	27	9	342	15	24	381	993	
12:30-12:45	231	21	9	9	276	9	30	792	1377	
12:45-1:00	237	30	24	0	171	15	18	798	1293	4941
Evening Peak										
5:00-5:15	327	24	39	0	453	18	42	723	1626	
5:15-5:30	309	21	45	0	423	12	33	624	1467	
5:30-5:45	339	36	63	0	474	15	30	648	1605	
5:45-6:00	255	12	33	0	324	9	3	441	1077	5775

Table 4-6: Bijoy Sarani to Novo Theatre (Point C) (converted Vehicle count by PCU factor).

POINT	C= (Bijoy Sarani to Novo Theatre)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	135	49.5	90	0	606	37.5	5.4	180	1103.4	
8:15-8:30	194.4	31.5	81	9	402	37.5	13.5	207	975.9	
8:30-8:45	187.2	40.5	72	0	510	45	8.1	201	1063.8	
8:45-9:00	109.8	13.5	162	0	315	15	8.1	261	884.4	4027.5

Afternoon peak										
12:00-12:15	97.2	27	72	0	345	7.5	6.3	352.5	907.5	
12:15-12:30	111.6	13.5	81	27	342	37.5	7.2	190.5	810.3	
12:30-12:45	138.6	31.5	27	27	276	22.5	9	396	927.6	
12:45-1:00	142.2	45	72	0	171	37.5	5.4	399	872.1	3517.5
Evening Peak										
5:00-5:15	196.2	36	117	0	453	45	12.6	361.5	1221.3	
5:15-5:30	185.4	31.5	135	0	423	30	9.9	312	1126.8	
5:30-5:45	203.4	54	189	0	474	37.5	9	324	1290.9	
5:45-6:00	153	18	99	0	324	22.5	0.9	220.5	837.9	4476.9

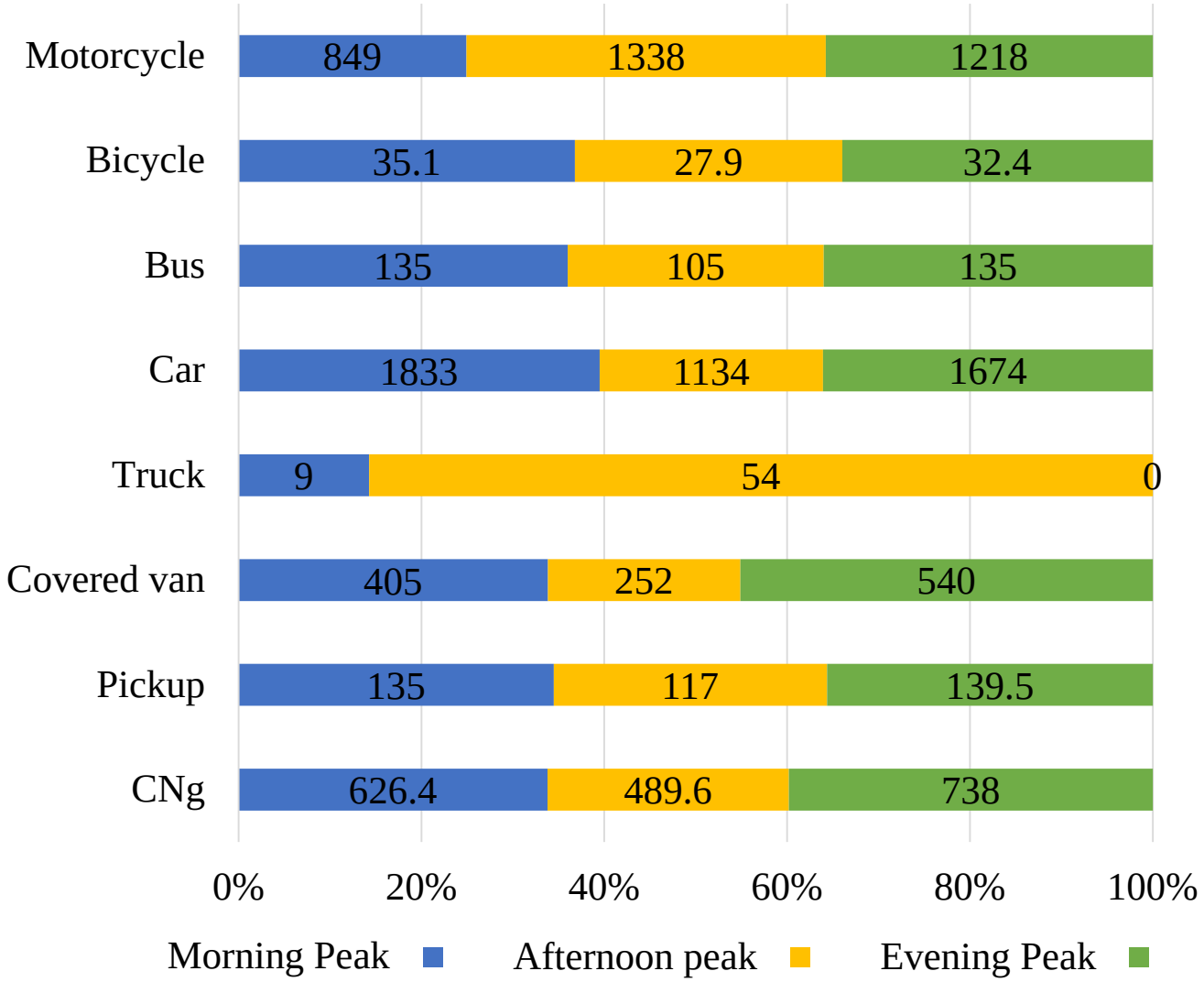


Figure -3: Modal variation of Bijoy Sarani to Novo Theatre.

4.2.4 Bijoy Sarani to Bir Uttam Ziaur Rahman Road:

This lane dominant vehicle is Car (1947). Less influenced vehicles were Bicycle, truck and pickup. Concentration of Motorcycle, Busses, Covered van, CNG about 37%, 43%, 29%, 38%, at morning, 25%, 35%, 36%, 24%, at afternoon and rest of the percentage vehicles were found at evening off peak respectively. Shows the modal variation Figure-4

Table 4-7: Filed survey at Bijoy Sarani to Bir Uttam Ziaur Rahman Road (Point D) (Actual Vehicle count from field survey).

POINT	D = (Bijoy Sarani to Bir Uttam Ziaur Rahman Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	174	9	24	3	1092	42	39	468	1851	
8:15-8:30	162	3	18	0	441	33	24	471	1152	
8:30-8:45	171	9	27	6	759	57	51	438	1518	
8:45-9:00	138	6	33	0	585	30	27	501	1320	5841

Afternoon peak										
12:00-12:15	108	9	21	9	312	51	54	306	870	
12:15-12:30	102	6	24	3	204	24	27	291	681	
12:30-12:45	87	3	33	0	330	21	42	357	873	
12:45-1:00	129	15	54	6	435	15	15	468	1137	3561
Evening Peak										
5:00-5:15	147	24	27	0	468	24	27	501	1218	
5:15-5:30	171	33	45	3	570	27	57	570	1476	
5:30-5:45	174	9	18	6	462	21	51	381	1122	
5:45-6:00	147	15	33	3	447	27	27	396	1095	4911

Table 4-8: Bijoy Sarani to Bir Uttam Ziaur Rahman Road (Point D) (converted Vehicle count by PCU factor).

POINT	D = (Bijoy Sarani to Bir Uttam Ziaur Rahman Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	104.4	13.5	72	9	1092	105	11.7	234	1641.6	
8:15-8:30	97.2	4.5	54	0	441	82.5	7.2	235.5	921.9	
8:30-8:45	102.6	13.5	81	18	759	142.5	15.3	219	1350.9	
8:45-9:00	82.8	9	99	0	585	75	8.1	250.5	1109.4	5023.8

Afternoon peak										
12:00-12:15	64.8	13.5	63	27	312	127.5	16.2	153	777	
12:15-12:30	61.2	9	72	9	204	60	8.1	145.5	568.8	
12:30-12:45	52.2	4.5	99	0	330	52.5	12.6	178.5	729.3	
12:45-1:00	77.4	22.5	162	18	435	37.5	4.5	234	990.9	3066
Evening Peak										
5:00-5:15	88.2	36	81	0	468	60	8.1	250.5	991.8	
5:15-5:30	102.6	49.5	135	9	570	67.5	17.1	285	1235.7	
5:30-5:45	104.4	13.5	54	18	462	52.5	15.3	190.5	910.2	
5:45-6:00	88.2	22.5	99	9	447	67.5	8.1	198	939.3	4077

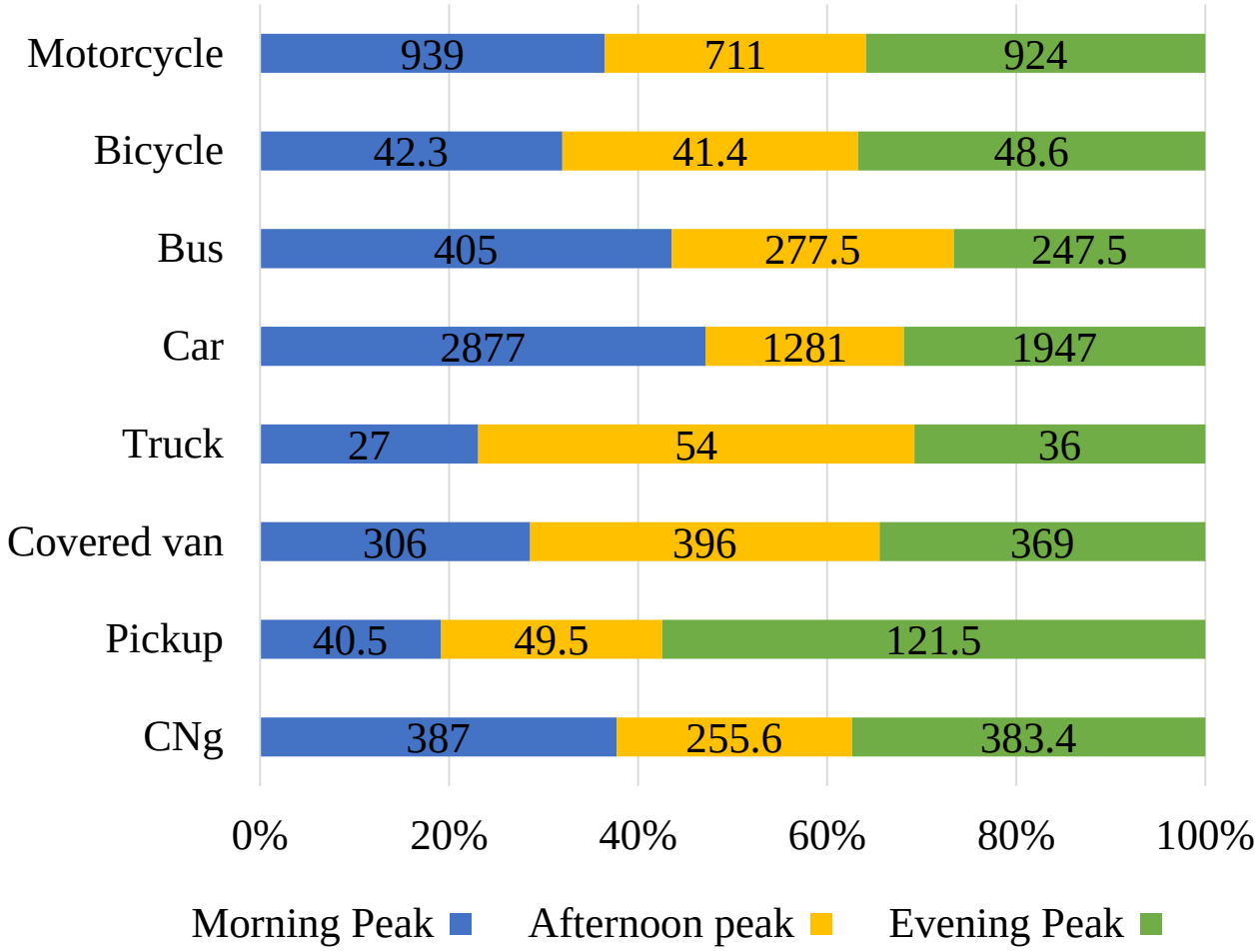


Figure -4: Modal variation of Bijoy Sarani to Bir Uttam Ziaur Rahman Road.

4.2.5 Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road:

Large amount of vehicles is Car found at morning. Concentration, motorcycle, Busses, Covered van, Pickup, CNG, are 48%, 35%, 22%, 20%, 22% at morning, 30%, 20%, 47%, 37%, 40% at afternoon off peak respectively. Low concentration of vehicles is Bicycle, truck Figure- 5

Table 4-9: Filed survey at Bir Uttam Ziaur Rahman to Bir Uttam Major General Azizur Rahman Road (Point E) (Actual Vehicle count from field survey).

POINT	E = (Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	96	15	12	3	393	60	93	417	1089	
8:15-8:30	126	21	24	0	645	27	24	681	1548	
8:30-8:45	147	9	27	9	687	30	33	768	1710	
8:45-9:00	114	27	48	0	477	48	27	492	1233	5580

Afternoon peak										
12:00-12:15	117	24	57	0	258	27	27	339	849	
12:15-12:30	171	27	42	3	309	24	51	282	909	
12:30-12:45	189	18	33	6	258	18	57	246	825	
12:45-1:00	207	36	45	0	441	21	48	267	1065	3648
Evening Peak										
5:00-5:15	228	33	63	3	459	78	63	363	1290	
5:15-5:30	189	54	54	9	396	63	33	369	1167	
5:30-5:45	243	57	39	0	528	33	27	420	1347	
5:45-6:00	258	42	27	6	567	51	54	411	1416	5220

Table 4-10: Bir Uttam Ziaur Rahman to Bir Uttam Major General Azizur Rahman Road (converted Vehicle count by PCU factor).

POINT	E = (Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road)								Date	25/11/2021
Mode	CNG	Pickup	Covered van	Truck	Car	Bus	Bicycle	Motor cycle	15min Total Value	60min Total Value
Morning Peak										
8:00-8:15	57.6	22.5	36	9	393	150	27.9	208.5	904.5	
8:15-8:30	75.6	31.5	72	0	645	67.5	7.2	340.5	1239.3	
8:30-8:45	88.2	13.5	81	27	687	75	9.9	384	1365.6	
8:45-9:00	68.4	40.5	144	0	477	120	8.1	246	1104	4613.4

Afternoon peak										
12:00-12:15	70.2	36	171	0	258	67.5	8.1	169.5	780.3	
12:15-12:30	102.6	40.5	126	9	309	60	15.3	141	803.4	
12:30-12:45	113.4	27	99	18	258	45	17.1	123	700.5	
12:45-1:00	124.2	54	135	0	441	52.5	14.4	133.5	954.6	3238.8
Evening Peak										
5:00-5:15	136.8	49.5	189	9	459	195	18.9	181.5	1238.7	
5:15-5:30	113.4	81	162	27	396	157.5	9.9	184.5	1131.3	
5:30-5:45	145.8	85.5	117	0	528	82.5	8.1	210	1176.9	
5:45-6:00	154.8	63	81	18	567	127.5	16.2	205.5	1233	4779.9

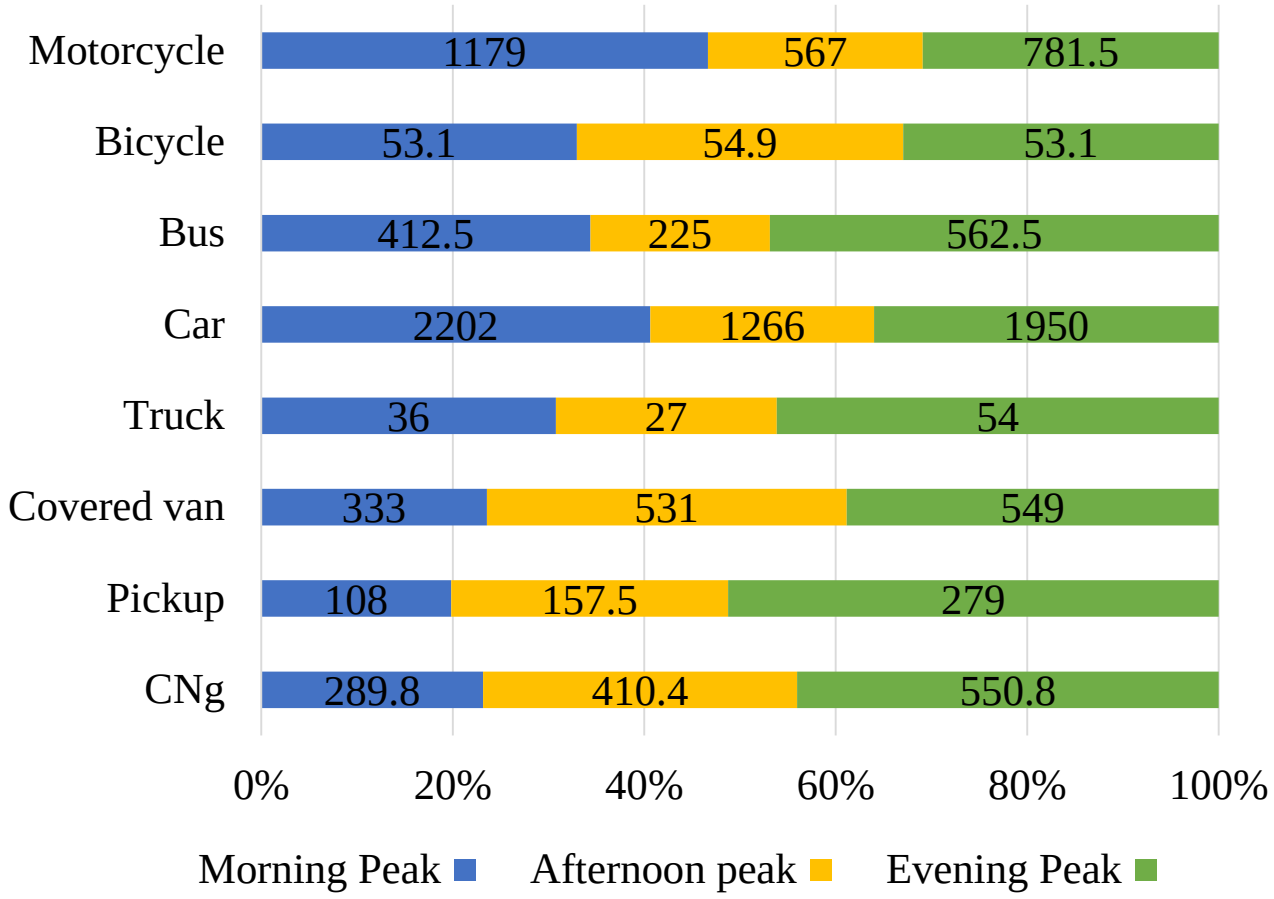
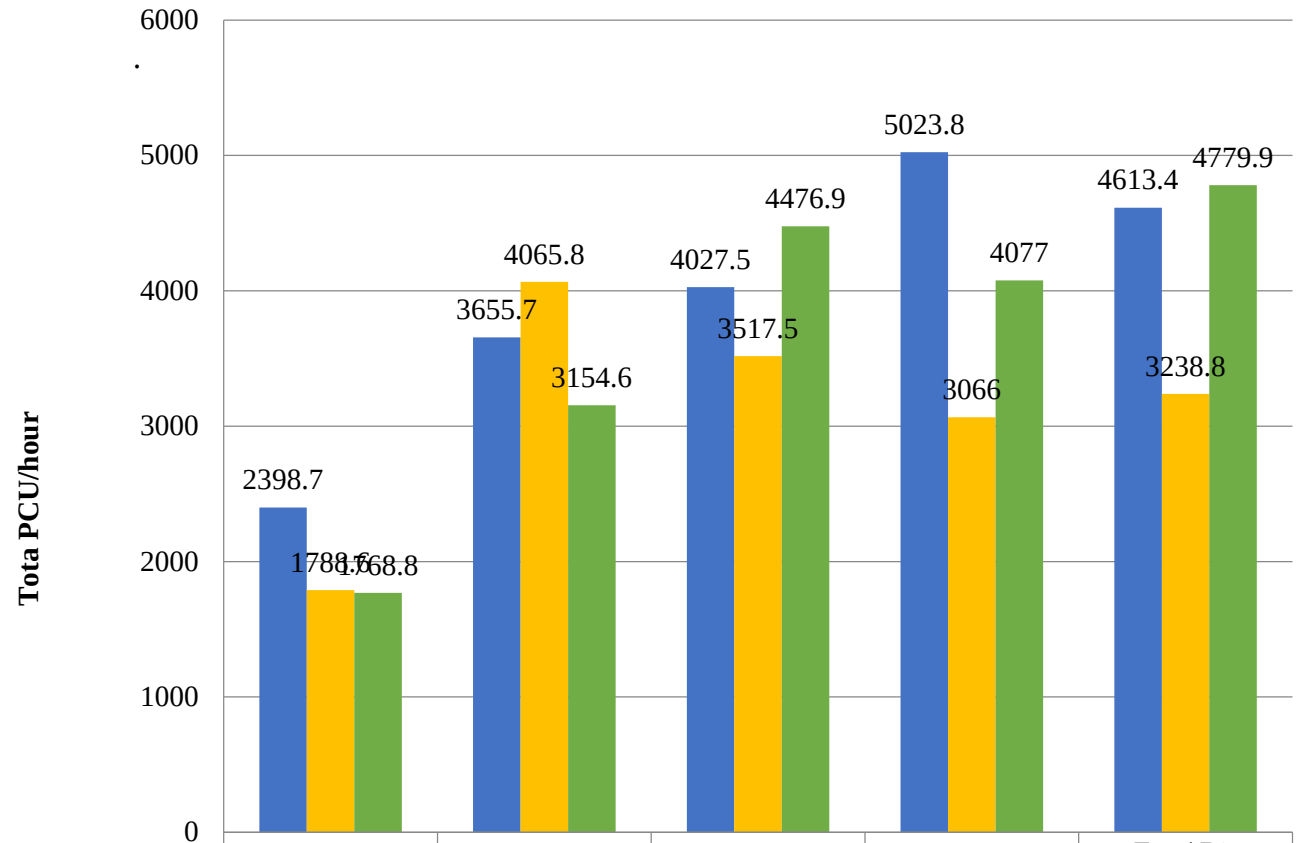


Figure-5: Modal variation of Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road.

4.2.6 Temporal Variation of Five legs of Bijoy Sarani Intersection:

Bijoy Sarani to Bir Uttam Ziaur Rahman Road leg has 5023.80 PCU/hour which contains the highest among the five legs at morning-off peak. Second one is intersection to Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road leg has 4779.90 PCU/hour which contains the highest among at Evening-off peak. and last one is Bijoy Sarani to Novo Theatre leg contain 4515.30 pcu/hour at Evening off peak.4065.80 pcu/hour at afternoon off peak and 2432.30 pcu/hour at morning off peak respectively. Temporal variation of five legs is shown in Figure 9.



	A= (Bijoy Sarani to Kazi Nazrul Islam Ave)	B = (Bijoy Sarani to Tejgaon Link Road)	C= (Bijoy Sarani to Novo Theatre)	D = (Bijoy Sarani to Bir Uttam Ziaur Rahman Road)	E = (Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road)
Morning Peak	2398.7	3655.7	4027.5	5023.8	4613.4
Afternoon peak	1788.6	4065.8	3517.5	3066	3238.8
Evening Peak	1768.8	3154.6	4476.9	4077	4779.9

Figure 9: Temporal variation of five legs.

4.3 Level of Service in Bijoy Sarani Intersection

LOS of Bijoy Sarani to Novo Theatre lane in morning is E category, Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road lane in morning is C category & other lane in morning is B category. Bijoy Sarani to Novo Theatre lane in Afternoon is E category, Bijoy Sarani to Tejgaon Link Road lane in Afternoon is D category, Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road lane in Afternoon C category & others lane in Afternoon B category. Bijoy Sarani to Tejgaon Link Road lane in Evening is E category.

Bijoy Sarani to Novo Theatre lane in evening D category, Bir Uttam Ziaur Rahman Road to BirUttam Major General Azizur Rahman Road lane in evening F category, & Others lane in Evening C category. As we can see that among these three periods lowest lane is D category, Table 4-12. By analyzing one methods level of service of Bijoy Sarani intersection is F which indicates worse condition exist in this intersection.

Table 4-11: Level of service of different lanes of Bijoy Sarani Intersection by Peak Hour Factor

Time	Lane Name	Peak Hour Factor	LOS	Maximum LOS
Morning Peak (9 AM-10 AM)	BijoySarani to Kazi Nazrul Islam Avenue,	0.74	B	F
	Bijoy Sarani to Tejgaon Link Road,	0.76	B	
	Bijoy Sarani to Novo Theatre,	0.91	E	
	Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	0.76	B	
	Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	0.84	C	
Afternoon Off Peak (01 PM- 02PM)	Bijoy Sarani to Kazi Nazrul Islam Avenue,	0.76	B	
	Bijoy Sarani to Tejgaon Link Road,	0.90	D	

	Bijoy Sarani to Novo Theatre,	0.95	E
	Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	0.77	B
	Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	0.85	C
Evening Peak (5PM- 6PM)	Bijoy Sarani to Kazi Nazrul Islam Avenue,	0.85	C
	Bijoy Sarani to Tejgaon Link Road,	0.92	E
	Bijoy Sarani to Novo Theatre,	0.86	D
	Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	0.82	C
	Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	0.96	F

Table 4-12: Level of service of different lanes of Bijoy Sarani Intersection by Peak hour factor method

Lane Name	Volume (PCU/h)	15min highest PCU	PHF	LOS	Maximum LOS
Morning peak					
Bijoy Sarani to Kazi Nazrul Islam Avenue,	2398.7	811.7	0.74	B	E
Bijoy Sarani to Tejgaon Link Road,	3655.7	1188.50	0.77	B	
Bijoy Sarani to Novo Theatre,	4027.5	1103.40	0.91	E	
Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	5023.80	1641.60	0.76	B	
Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	4613.40	1365.60	0.84	C	
Afternoon off peak					
Bijoy Sarani to Kazi Nazrul Islam Avenue,	1788.6	588	0.76	B	E
Bijoy Sarani to Tejgaon Link Road,	4065.80	1125.90	0.90	D	

Bijoy Sarani to Novo Theatre,	3517.5	927.60	0.95	E	
Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	3066	990.90	0.77	B	
Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	3238.80	954.60	0.85	C	
Evening peak					
Bijoy Sarani to Kazi Nazrul Islam Avenue,	1768.8	520.8	0.85	C	F
Bijoy Sarani to Tejgaon Link Road,	3154.6	852.00	0.92	E	
Bijoy Sarani to Novo Theatre,	4476.9	1290.9	0.86	D	
Bijoy Sarani to Bir Uttam Ziaur Rahman Road,	4077	1235.70	0.82	C	
Bir Uttam Ziaur Rahman Road to Bir Uttam Major General AZizur Rahman Road.	4779.90	1238.70	0.96	F	

4.4 Discussion

4.4.1 Causes of Congestion in Intersection:

Bijoy Sarani Intersection plays as one of the main commercial hub of Dhaka city. This is the main reason of rising Car volume in Bijoy Sarani Intersection. Traffic flow in morning peak is higher than other peak hours. This is may be due to Bijoy Sarani Intersection is located near educational and Commercial zone. The factors for Bir Uttom Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road is the land use containing important establishments like BAF Shahin College Dhaka, Prime Minister Office, Birsresh to Shaheed Jahangir Gate, (Dhaka Cantonment Gate,) Govt. Titumir College, Dhaka etc. Most of the VIP movements are done through this intersection and during that movement all the vehicles passing this intersections are forced to stand still.

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4.4.2 Effect of Congestion in intersection:

One of the major disadvantages is outdated and obsolete hand-signalized intersections. This is also known as priority-controlled intersection. It provides no exact indication to the driver's concern when vehicle approaches to enter the intersection [32] Low priority movement on roads cause delay that influence the performance of such type intersection very strongly. As a result, vehicular conflict creates which is responsible for accident and congestion [33]. Level of service F means in an intersection vehicle is forced to move and speed of vehicles are too low [34]. Commercial and educational activities around bijoy sarani intersection attract people so why LOS of bijoy sarani is very low. Again, all the vehicles pass this intersection very slowly. Few lanes contain higher flow rate than their required capacity. If traffic flow equals or becomes less than capacity, collision between vehicles, low mean speed, and frequent unexpected stoppage will occur [35] Congestion occurs due to excess traffic demand and inefficient road operations [36].

CHAPTER 5

Conclusions and Future Works

5.1 Conclusions

The traffic flow behavior in heterogeneous traffic in Dhaka city observed that is absolutely complex. Highest concentration of dominant vehicle (Car & Motorcycle) is found in the morning peak period (9am-10am) at Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road determined by using modal variation. Bijoy Sarani intersection to Bijoy Sarani to Bir Uttam Ziaur Rahman Road leg contain highest amount of PCU/hour at morning hour by using temporal variation. At Bijoy Sarani intersection Car is the dominant vehicle in all lanes. Traffic flow in morning off-peak is higher than other one peak hours in Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road because traffic flow from different two direction mix here. The volume of Bir Uttam Ziaur Rahman Road to Bir Uttam Major General Azizur Rahman Road lane, Bijoy Sarani to Novo Theatre lane at afternoon off peak and Bijoy Sarani to Tejgaon Link Road lane at Evening off peak are higher than their standard capacity. According to Peak Hour Factor Method, LOS of Bijoy Sarani intersection is F category at its highest peak. So, final LOS is F.

5.2 Recommendations

This Based on the study findings, the following recommendations can be put forward to improve the mobility and service quality of signalized intersection as well as other road resembling similar condition:

- A dedicated lane for Bus can be effective to increase this road serviceability.
- The effective width of the carriageway should be increased. This should be free from all encroachment.
- Vehicles of different destinations use this intersection to reach their destination. Grade separation can be a viable solution for external to external traffic movement without disturbing intersection performance.
- Carriageway width should be increased. City Corporation Authority should take necessary steps to improve the condition of this selected intersection.
- The study is done during weekdays. Study during weekends may also be done to perform an comparative analysis.

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