COMPARISON OF LEVEL OF SERVICE OF MIRPUR-10 CIRCLE TRAFFIC SIGNAL DURING PEAK HOUR AND OFF PEAK HOUR USING HIGHWAY CAPACITY MANUAL

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

Section: 16F+16D

Summer -2022

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Spring-2022

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DECLARATION

We hereby declare that this report is our own work and effort and that it has not been submitted anywhere for any award. All the contents provided here is totally based on our own labor dedicated for the completion of the data collection of Level of Service study of the road lying near to our university.

Where other sources of information have been used, they have been acknowledged and the sources of information's have been provided in the reference section.

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Dedicated

to

“Our Parents”

ACKNOWLEDGEMENTS

All praises belongs to Almighty Allah, the most merciful, the most beneficent and the most kind for giving us the opportunity, courage and enough energy to carry out and complete the entire thesis work.

We are grateful and deeply indebted to our guide Angila Tabassum, Assistant Professor of the Department of Civil Engineering, Sonargaon University, Dhaka. We have the great privilege and honor to express our whole hearted indebtedness to her for kindly placing at our disposal all the facilities available in the department for her guidance, supervision, inspiring encouragement, constructive criticism and help in carrying out this thesis.

We like to express gratitude to all faculty members of Department of Civil Engineering, Sonargaon University, Dhaka for their constant help and sincere cooperation during the entire study period.

It remained incomplete if we do not express whole hearted thanks and gratitude our parents for sharing our pain and pleasure. We are very much grateful to them who always assisted and helped throughout our study at Sonargaon University. We consider it a privilege to have studied with such dignified people. Co-operation and assistance of all the officers and stuffs of the Sonargaon University are acknowledged.

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. 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 major un-signalized intersections in Dhaka City Corporation. Level of service was determined by volume capacity ratio and peak hour factor method. Nature of traffic flow in Dhaka city is heavy. So, this heavy traffic are simplified by Passenger car unit. Then estimated passenger car unit was used to determine level of service. It was calculated for both directions of roads. bus, car, microbus, CNG and motorcycles are the dominant vehicles in Mirpur-10 intersection. According to peak hour factor method and V/C ratio method, level of service of Mirpur intersection is very unstable and heavy. It can be recommended that restriction for vehicle movement in daytime should be applied in Mirpur-10 intersection and width of Mirpur-10 to Pallabi and Mirpur-1 to Dhaka cantonment area road need to be increased to make the traffic flow suitable. Also, incorporation of an effective traffic signal, traffic rules and regulation should be applied and maintained properly in the worst condition intersection to accelerate the traffic flow in Dhaka City Corporation area.

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CHAPTER 1

INTRODUCTION

1.1 Back ground and Motivations

Roads and highways are important asset, on which the nation moves. They carry about 65% of freight and 85% of passenger traffic in Bangladesh. It is estimated that the road traffic has been growing at 7-10% per annum. Among all types of roads, highways that connect various parts of the country are considered to be more important. Roads and highways are considered to be a major infrastructure that impacts on the economic landscape and prosperity of a country. Besides, providing mobility to people, they provide much needed infrastructure for the movement of goods and services so that the supply of them meets with demand points.

Traffic volume survey plays a significant role to determine the existing condition and to future condition of traffic volume. The road traffic in developing countries like Bangladesh are highly heterogeneous comprising of the traffic of different static and dynamic characteristics. Again, traffic volume data is very important as it is used to estimate capacity of a road and level of service of the given road under the combination of traffic at any hour of a day.

In Dhaka city, the increment of traffic volume and congestion are two quickly developing problems. Nowadays, it is common to see traffic congestion 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 8.1% in this city. This may be due to Poor road planning and sub-standard geometric conditions of selected intersections. Intersections become very congested if traffic volume are high, make inefficiency as a result peoples suffer delay and frustration. A rapid escalation in the number of motor vehicles, greater availability of used vehicles, the relative reduction in prices result traffic congestion. Due to traffic congestion, air pollution, fuel usage, and travel time. 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 Corporation (DCC). Traffic volume count of this study will be helpful for planning, accident analysis, design and operation, for roadway of Dhaka city as well as future traffic demand forecasting. To estimate traffic volume at selected intersections, a case study was made at 4 major intersections during morning (8am-10am), noon(12pm-2pm) and evening (4pm-6pm).To analyze mixed or heterogeneous traffic, a simplification is developed by (add authors name) to convert the different types of vehicles into equivalent number of passenger cars named Passenger car unit or PCU. Finally estimated PCU value are used to determine LOS on three or four legs divided intersections. Level of service (LOS) was determined by volume capacity ratio and peak hour factor method. (Abdulla Al Kayf, 2018)

The main purposes of traffic survey are: traffic monitoring, traffic control and management, traffic enforcement, traffic forecasting, model calibration and validating etc.

Level of Service determination of any intersection requires precise collection of different data such as: traffic speed, traffic volume, lane details etc.

Traffic speed: Speed is an important transportation consideration because it relates to safety, time, comfort, convenience, and economics. Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed Percentiles, which are useful in making many speed-related decisions. Spot speed data have a number of safety applications, including the following:

1. Determining existing traffic operations and evaluation of traffic control devices

    a. Evaluating and determining proper speed limits

    b. Determining the 50^{th} and 85^{th} speed percentiles

    c. Evaluating and determining proper advisory speeds

    d. Establishing the limits of no-passing zones

    e. Determining the proper placements of traffic control signs and markings

    f. Setting appropriate traffic signal timing

2. Establishing road way design elements

    a Evaluating and determining proper intersection sight distance

    b Evaluating and determining proper passing sight distance

    c Evaluating and determining proper stopping sight distance

3. Assessing road way safety questions

    a Evaluating and verifying speed in problems

    b Assessing speed as a contributor to vehicle crashes

    c Investigating input from the public or other officials

4. Monitoring traffic speed trends by systematic ongoing speed studies

    a Measuring effectiveness of traffic control devices or traffic programs, including signs and Markings, traffic operational changes, and speed enforcement programs.

Traffic Volume: The purposes of carrying out traffic volume count are to determine existing traffic volume on a specific road or intersection. This helps in designing, improving traffic system, planning, management etc.

Lane details: This data includes the existing number of lanes, working lane width, existing curb size etc. This helps to redesign, improve, plan traffic network.

1.2 Objectives of this study

- To determine existing traffic volume and speed during peak hour and off peak hour.
- To check the fluctuation of Level of Service during peak hour and off peak hour.

1.3 Outline of Report

The report has been documented in the following manner. The first chapter gives the primary understanding of the problem statement and objectives of the study. The second chapter has been devoted to review of earlier studies to set the guidelines for the present work. The criteria for site selection, method of data collection and theory on traffic volume while the methods we adopted in our data collection system have been discussed in chapter three. Analysis and discussion of results are given in fourthchapter. The specific conclusions drawn from this study and recommendations for further work are given in the fifth chapter

1.4 Planning Purposes:

Accurate information on the amount of traffic on the roads is vital for the planning of both road maintenance and improvement policies. Traffic volume network analysis helps in deciding/planning if there is need for:

- Improvement
- Expansion in terms of construction missing links, by-pass, alternative road etc.

CHAPTER 2

Literature Review

2.1 Introduction

Level of service 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 level of service using various methods.

The level of service has helped in determining various factors that can help us in deciding well that what can be the possible causes of the accidents. Also, it has helped us recognize those highways which are deadly. It helps to fight the problem of congestion and the hazards it can lead to. (Abdulla et. al., 2018)

2.2 Traffic Volume Study

The term traffic volume study can be term as traffic flow survey or simply the traffic survey. It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time. Traffic data are needed in research, planning, designing and regulation phases of traffic engineering and are also used in established priorities and schedules of traffic improvements. The traffic engineer must acquire general knowledge of traffic volume characteristics in order to measure and understand the magnitude, composition, and time and route distribution of volume for each area under his jurisdiction.

Definition of the free flow speed ranges of urban street classes and speed limits of LOS categories using Hierarchical Agglomerative Clustering and data collected by GPS handheld receiver in Indian context (Bhuyan and Rao, 2011).For developing countries, it has shown the effect of different types of vehicles on congestion trough congestion model (Maitra et. al., 2004). The established model can be used as a tool for formulating traffic management measures for urban roads (Basu et.al., 2006). The model passenger car equivalency for urban mid-block using stream speed as measure of equivalence. In this study a neural network approach was explored to capture the effects of traffic volume and its composition level on the stream speed tried to determine the travel pattern along a particular route of Tokyo metropolitan area (Cao et. al., 2003). Utilized Fuzzy set in order to find the uncertainty associated with the LOS categories (Kikucha and

Chakroborty, 2007). Six frameworks were proposed by the authors in order to determine the uncertainty associated under each LOS category. It was found the LOS criteria of walkways proposed by HCM 2000 are not suitable for China. The authors have taken user perception into consideration for classification of LOS at urban rail transit passages and found the limit for LOS standards suitable for China is lower than that suggested by HCM 2000. It has been studied about the LOS of a signalized intersection taking user perception into account. The author found that it is best to differentiate LOS into six categories as described in HCM but proposed a new six LOS by merging existing LOS A and B and splitting existing LOS F into two categories (Pecheux et. al., 2000). Developed methodology to define levelof service of urban roads taking into account users' perceptions (Pattnaik and Ramesh Kumar, 1996). It has noted down that the HCM (2000) methodologies have not been based upon user perception surveys (Kittelson and roess, 2001). The Methodologies have resulted from a combination of consulting studies, research, debates and discussions of the highway capacity and quality of service committee (Pecheux et. al., 2000). In July 2001, at the midyear meeting of the HCQS committee, a motion was passed that stated "the committee recognizes that there are significant issues with the current LOS structure and encourages investigations to address these issues". It presented standardized methods that allow a differentiated evaluation of saturation of flow (LOS F) conditions beyond static considerations of traffic conditions in German highway capacity manual. According to Indian roads congress (IRC, 1990) , for an urban roads, the LOS are strongly affected by factors such as heterogeneity of traffic, speed regulations, frequency of intersections, presence of bus stops, on-street parking, road side commercial activities and pedestrian volumes etc.

2.3 Parts of traffic studies

Traffic studies include:

- Inventory of road traffic physical features
- Traffic stream characteristics - volume, speed, density, occupancy studies etc.
- Capacity studies of streets and intersections
- System usage studies- Travel time and delay, O-D survey
- Travel demand- home interview survey
- Road users cost- Value of travel time, vehicle operating cost
- Parking supply & demand studies
- Mass transit performance and usage studies
- Traffic accidents studies
- Environmental impact studies of transport (Hossain,2018)

2.4 Scope of Traffic Volume Studies:

The traffic volume count study is carried out to get following useful information:

- Magnitudes, classifications and the time and directional split of vehicular flows. Magnitude is represented by volume of traffic. Vehicles are classified into some predefined classes based on vehicle size and capacity. In a two way road, vehicles moving towards two directions are counted separately to get the proportion. Time and directional split is useful to identify tidal flow.

- Proportions of vehicles in traffic stream. Proportion of vehicles indicates whether public or private transport dominates the traffic system. It also indicates the choice of road users.

- Hourly, daily, yearly and seasonal variation of vehicular flows. These variations are needed to establish expansion factors for future use. Using expansion factors, AADT can be calculated from short count.

- Flow fluctuation on different approaches at a junction or different parts of a road network system. (Hossain, 2018)

2.5 Level of Service

Level of Service is a part and frequently used term and concept of transportation planning in urban planning. A transport planner finds it useful for number of surveys. It helps in planning for existing and upcoming projects. The level of service in transportation has a big impact on how long your trip will take. Level of service (LOS) is a critical part of transport planning. The objective of LOS is to ensure that all travelers can reach their destinations on time, with the minimum level of discomfort and inconvenience. A level of service is a way to objectively measure the performance of transport systems. In most cases, it measures how well a system delivers a certain level of service. (Anon., 2020)

Table 2. 1: Level of Service by V/C ratio

LOS Level	**V/C ratio**	**Description**	**Control delay per vehicle for signalized intersections (S/veh)**
A	≤0.60	Highest driver comfort; free flowing	≤10
B	0.60-0.70	High degree of driver comfort; little delay	>10-20
C	C 0.70-0.80	Acceptable level of driver comfort; some delay	>20-35
D	0.80-0.90	Some driver frustration; moderate delay	>35-55
E	0.90-1.00	High level of driver frustration; high levels of delay	>55-80
F	>1	Highest level of driver frustration; excessive delays	>80

- **A** is considered as the best quality of traffic where the driver can enjoy his drive with better flow and speed of their own choice. While level F stands for worst quality of traffic. A stands for free flow where the motorist has the ability to move between the lanes. There is a high level of physical and psychological comfort to the drivers.

- **B** stands for reasonable free flow where the speed of vehicles is maintained flexibility for moving between the lanes within the traffic is slightly limited. There is a high level of physical and psychological comfort to the drivers.

- **C** stands for stable flow or near free flow. The mobility of changing lanes Require driver's attention and is noticeably limited compared to other. Experienced drivers are comfortable. The minor occurrence may not have a great effect but service will show noticeable effects and there is a chance of
  traffic delays.

- **D** signifies proceed towards the unstable flow. Speed decreases as the number of vehicles slightly increase. Freedom for changing the lanes within the traffic stream is quite limited and the drivers level of comfort decreases. Minor occurrence on the roads can create delays for the others. This is usually found common on urban streets during the time of peak hours.

- **E** is unstable Flow because of the lesser or unusable gaps, the flow becomes irregular and the speed can increase or decrease. The traffic rarely reaches appropriate limit or suggested limit. Speed is nearby or above 50 ml/h. Shockwave is created when there is change is lane or merging of traffic. Any accidents may cause a noticeable delay. Level of comfort ability in this flow7 becomes poor for the driver. In urban areas usually, we face this problem because of the road congestion which cannot be changed.

- **F** leads to a breakdown of the flow. The time for traveling is not predicted, usually, it takes more than its capacity. A Highway may face Level of Service during its busy hours with C some days and F at other days or once in a week.(Anon., 2020) (S.M. Mim, 2020)

2.6 Highway Capacity

Highway capacity is associated with traffic volume and traffic density. Traffic volume is the number of vehicles passing a given point on a roadway during a specified time period. This is usually expressed as vehicles per hour.

2.7 Importance of the Concept of Highway Capacity

- The capacity of a highway should be adequate to serve the needs of the projected traffic.
- The class of highway, lane width, number of lanes and intersections are dependent on capacity.
- Improvements on geometric elements, traffic control devices and traffic management measures can be effectively planned based on the studies of highway capacity.

2.8 Methods of Cluster Analysis:

Cluster analysis divides the data into conceptually meaningful groups of objects that share common characteristics. The meaningful groups are the goal, and then the clusters should capture the natural structure of the data. Clusters are the potential classes rather than it also useful for data summarization and automatically finding classes. Various clustering methods have been applied in speed data for creating the meaningful groups. There are four types of clustering algorithm have been applied for this research work. Such as: - Ad a boost algorithm, Genetic programming, Maximum likelihood method and Expectation-Maximization Method. These four algorithms are useful for classification of urban streets and LOS categories.

2.9 Summary:

From the literature review, it was found that; the LOS is not passable defined for heterogeneous traffic flow with different operational features in Indian context. GPS was found to be accurate technique for collecting speed data. Delineating LOS is essentially classification problem. Clustering analysis is the worthiest proficiency to solve the classification problem. The next chapter gives the detail idea about study area and data collection technique.

The adequacy of the existing highway network for the existing traffic volume can be assessed by capacity studies; transportation planning can be done effectively using this information.

CHAPTER 3

Methodology

3.1 Introduction

The methodology in a research paper, thesis paper or dissertation is the section in which the actions done to investigate and research a problem and the rationale for the specific processes and techniques used within the research to identify, collect and analyze information that helps you understand the problem is described.

3.2 Methodology Over view

Location: A field survey is conducted at the Mirpur-10 Circle Signal. We stood by the side of the road and different vehicles were counted by different persons. We selected one enumerator among us who was in charge of time. She commanded us when to jump from current time step we were working to next time step.

Date: Data for volume study was collected on 15th June 2022. It was Wednesday.
Time: Time of data collection for volume study was from 9:00 to 9:15 am and 1:00 to 1:15 pm.
Weather Condition: It was initially a sunny day and the temperature was 33℃
Observation: Classified Vehicle Counts.
Method: Direct Manual Method.
Duration: 15 minutes (Short Count)
Equipment: Stopwatch, Tally sheet, Pencil, video camera etc.
Number of Enumerators: Six.

Fig: 3.1 Our survey location map

Fig: 3.2 Study area of north point

Fig: 3.3 Study area of south point

Fig: 3.4 Study area of east point

Fig: 3.5 Study area of west point

3.3 Summary

At first the data collection methodology was discussed at the university and then the data was collected for 1 Hours (Peak Hour) & 1 Hours (Off Peak Hour) from the above mentioned road during a regular day which was then converted to one hour data set. Peak hour was 9:00 to 10.00 AM and off peak hour was 1:00 to 2:00 PM. From this survey the number of vehicles, vehicles speeds, vehicles spacing etc were obtained. After the collection of data, all these data were converted in terms of PCU (Passenger Car Unit) by multiplying it with its corresponding PCU factor.

CHAPTER 4

Results and Discussion

4.1 Introduction

This chapter presents the findings of the research. The discussion on the results can be presented in this chapter also. The discussion of results can also be presented in a separate chapter. If the findings are distinct enough, the results can be presented in more than one chapter also. The results should be organized as per the specific aims mentioned in Chapter.

4.1.1 Peak Hour Level Service Determination (9 am-10 am)

4.1.1.1 North Bound

Table 4.1: North bound peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	69	276	3
Car	205	820	1
Microbus	48	192	3
Pickup	19	76	3
CNG	146	584	0.75
Motorcycle	365	1460	0.75
	Total	3408	

Volume capacity ratio calculation:

Total Volume (PCU) = 3408

Average center to center spacing of vehicle,

$$S = 0.278\ vt + \frac{v2}{254\mu} + L$$

$$= 0.278*18*3.5 + \frac{(18)^2}{254*0.4} + 3$$

$$= 21.79$$

$$\text{Capacity} = \frac{1000\ v}{s}$$

$$= \frac{1000*18}{21.79}$$

$$= 826.06$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{3408}{826.06}$$

$$= 4.13$$

Here,

Average vehicle speed V = 18km/hr

Reaction Time t = 3.5s

Average length of vehicle L = 3m

Co-efficient of friction μ = 0.4

4.1.1.2 South Bound

Table 4.2: South bound peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	86	344	3
Car	247	988	1
Microbus	103	412	3
Pickup	16	64	3
CNG	153	612	0.75
Motorcycle	396	1584	0.75
	Total	4004	

Volume capacity ratio calculation:

Total Volume (PCU) =4004

Average center to center spacing of vehicle,

$$S = 0.278vt + \frac{V^2}{254\mu} + L$$

$$= 0.278*17*3 + \frac{(17)^2}{254*0.4} + 3$$

$$= 22.38$$

Here

Average vehicle speed V = 17km/hr

Reaction Time t = 3.5s

Average length of vehicle L= 3m

Co-efficient of friction μ = 0.4

$$\text{Capacity} = \frac{1000}{s}$$

$$= \frac{1000*18}{22.38}$$

$$= 759.60$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{4004}{759.60}$$

$$= 5.27$$

4.1.1.3 East Bound

Table 4.3: East bound peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	64	256	3
Car	216	864	1
Micro bus	93	372	3
Pickup	29	116	3
CNG	142	568	0.75
Motorcycle	406	1624	0.75
	Total	3800	

Volume capacity ratio calculation:

Total Volume (PCU) =3800

Average center to center spacing of vehicle,

$S = 0.278vt + \frac{v^2}{254\mu} + L$

Here,

Average vehicle speed V = 15km/hr

Reaction Time t = 3.5s

Average length of vehicle L = 3m

Co-efficient of friction μ = 0.4

$= 0.278*15*3.5 + \frac{(15)^2}{254*0.4} + 3$

$= 19.80$

$\text{Capacity} = \frac{1000\,v}{s}$

$= \frac{1000*15}{19.80}$

$= 757.57$

$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$

$= \frac{3800}{757.57}$

$= 5.02$

4.1.1.4 West Bound

Table 4.4: West bound peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	77	308	3
Car	296	1184	1
Micro bus	102	408	3
Pickup	23	92	3
CNG	158	632	0.75
Motorcycle	409	1636	0.75
	Total	4260	

Volume capacity ratio calculation:

Total Volume (PCU) = 4260

Average center to center spacing of vehicle,

$$S = 0.278vt + \frac{v^2}{254\mu} + L$$

$$= 0.278*16*3.5 + \frac{(16)^2}{254*0.4} + 4$$

$$= 21.08$$

$$\text{Capacity} = \frac{1000v}{s}$$

$$= \frac{1000*16}{21.08}$$

$$= 759.01$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{4260}{759.01}$$

$$= 5.61$$

Here,
Average vehicle speed V = 16km/hr

Reaction Time t = 3.5s

Average length of vehicle L = 4m

Co-efficient of friction μ = 0.4

4.1.2 OFF peak hour (1pm-2pm)

4.1.2.1 North Bound

Table 4.5: North bound off peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	34	136	3
Car	96	384	1
Microbus	26	104	3
Pickup	26	104	3
CNG	129	516	0.75
Motorcycle	347	1388	0.75
	Total	2632	

Volume capacity ratio calculation:

Total Volume (PCU) = 2632

Average center to center spacing of vehicle,

$$S = 0.278vt + \frac{v^2}{254\mu} + L$$

$$= 0.278*20*3.5 + \frac{(20)^2}{254*0.4} + 3$$

$$= 26.39$$

$$\text{Capacity} = \frac{1000v}{s}$$

$$= \frac{1000*20}{26.39}$$

$$= 757.86$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{2632}{757.86}$$

$$= 3.47$$

Here,

Average vehicle speed V= 20km/hr

Reaction Time t = 3.5s

Average length of vehicle L = 3m

Co-efficient of friction μ = 0.4

4.1.2.2 South Bound

Table 4.6: South bound off peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	58	232	3
Car	109	436	1
Micro bus	56	224	3
Pickup	15	60	3
CNG	108	432	0.75
Motorcycle	328	1312	0.75
	Total	2696	

Volume capacity ratio calculation:

Total Volume (PCU) =2696

Average center to center spacing of vehicle,

$$S=0.278vt+\frac{v^2}{254\mu}+L$$

$$=0.278*18*3.5+\frac{(18)^2}{254*0.4}+3$$

$$= 23.70$$

$$\text{Capacity} = \frac{1000v}{s}$$

$$= \frac{1000*18}{23.70}$$

$$=759.49$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{2696}{759.49}$$

$$= 3.54$$

Here,
Average vehicle speed V = 18km/hr
Reaction Time t = 3.5s
Average length of vehicle L= 3m
Co-efficient of friction μ = 0.4

4.1.2.3 East Bound

Table 4.7: East bound off peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	42	168	3
Car	138	552	1
Micro bus	39	156	3
Pickup	23	92	3
CNG	96	384	0.75
Motorcycle	298	1192	0.75
	Total	2544	

Volume capacity ratio calculation:

Total Volume (PCU) = 2544

Average center to center spacing of vehicle,

$$S=0.278vt+\frac{v^2}{254\mu}+L$$

$$=0.278*17*3.5+\frac{(17)^2}{254*0.4}+3$$

$$= 22.38$$

$$\text{Capacity} = \frac{1000v}{s}$$

$$=\frac{1000*17}{22.38}$$

$$= 759.60$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{2544}{759.60}$$

$$= 3.35$$

Here,

Average vehicle speed V = 17km/hr

Reaction Time t = 3.5s

Average length of vehicle L =3m

Co-efficient of friction μ =0.4

4.1.2.4 West Bound

Table 4.8: West bound off peak hour vehicle

Vehicle	Veh/15 min	Veh/hr	PCU Factors
Bus	37	148	3
Car	162	648	1
Microbus	62	248	3
Pickup	19	76	3
CNG	131	524	0.75
Motorcycle	309	1236	0.75
	Total	2880	

Volume capacity ratio calculation:

Total Volume (PCU)= 2880

Average center to center spacing of vehicle,

$$S = 0.278vt + \frac{V2}{254\mu} + L$$

Here,

Average vehicle speed V= 19km/hr

Reaction Time t = 3.5s

Average length of vehicle L = 3m

Co-efficient of friction $\mu = 0.4$

$$= 0.278*19*3.5 + \frac{(19)^2}{254*0.4} + 3$$

$$= 25.04$$

$$\text{Capacity} = \frac{1000v}{s}$$

$$= \frac{1000*19}{25.04}$$

$$= 758.78$$

$$\text{Volume Capacity Ratio (V/C)} = \frac{\text{Volume}}{\text{Capacity}}$$

$$= \frac{2280}{758.78}$$

$$= 3.79$$

- Clear of each bound is F > 1.00. The values of each result fall under F category.

4.2 Summary

From the analysis we can see that the existing roadway condition is not suitable for free flow of traffic. The level of service is not that good and this will cause discomfort to the passengers. The peak hour condition is mostly due to surge of traffic on that area. This is due to the bigger traffic volume on the East-West road. Due to which passengers are facing various problems.Passengers are unable to reach their destination on time due to excess traffic. Many people stand for hours without getting a bus seat, which leads to various accidents. As a result both passengers and drivers are affected.

CHAPTER 5

Conclusion and Recommendations

5.1 Conclusions

The ultimate goal of this research was to analyze the Level of service of the Mirpur-10 circle traffic signal during peak hour and off peak hour. The letter "F" represents that the Level of service in this intersection is not ideal. The road will have traffic jam and cause driver frustration and time waste. This congestion problem is nearly a reflection of the existing traffic operating condition of the city. Though in the off peak hours the traffic conditions improves slightly and becomes F type but that's not enough for smooth traffic maneuver. Between the two traffic ways the North-South roadway performs slightly better than the East-West roadway. This is due to heavy traffic volume in the East-West roadway and narrowing of the road way due to illegal parking of vehicles.

5.2 Limitations and Recommendations for Future Works

Level of Service of an existing roadway is an important part of traffic studies is necessary for planning and management. Further studies are required to get thorough knowledge on the roadway condition. Uses of advanced scientific methods and technologies regarding traffic studies are required to get more precise data. Traffic volume should be reduced by introducing better public transportation facilities. Furthermore, this research recommends proper planning, designing of a road networking by analyzing the current roadway capacity and future demand. Local Government Authority, Roads and Highways Department should take proper management initiatives to improve the existing roadway condition.

5.3 Limitation Points of View

- Un-skilled enumerators.
- The manual method of counting is unreliable.
- Due to resource constraints, automatic method was not applied. Short-term (30minute) data collection due to time constraints.
- The actual volume was not found.

5.4 Scope for Further Study

- There are some shortcomings in the study. If these shortcomings can be overcome, more reliable and valuable data can be obtained. These shortcomings are described below-
- This volume study was practiced by un-skilled enumerators, which may lead to some errors in the data collection process.
- Data collected by manual method of counting, which is unreliable and irreversible, more representatives and reliable data could be obtained if automatic data collection method were followed.
- Data were collected for the short-term (30 minutes), which was not representative of the flow characteristics of the road. If continuous data were collected, that would be much more representative than this short count of traffic volume.

5.5 Overview

This traffic volume survey was taking place with limited resources and equipment. As the main purpose of this survey is to know the process of traffic volume count, this limitation can be overlooked .There are some recommendations based on the study that took place. They are as follows-

- The manual count method required trained enumerators, which was not available in this case.
- For more reliable data, an automatic data collection process should be used.
- Data were collected for 30 minutes by each group, which may not represent the hourly fluctuation of traffic, so for more allegorical data, one-hour data should be taken.
- More public transport facilities should be provided to support the need of inhabitants living in the residential area near the road.
- NMV should be prohibited on this road which will help to increase the Level of Service and Travel Speed.
- This road mainly served the purpose of collector road. Collector roads should be designed for a level of service F or better.

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