A Traffic Volume Study Between Khamarbari and Aarong Junction in Dhaka City

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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: (10C+10D)

Semester - Fall-2021

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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

Volume study is an essential measure to determine the service of a road and study the need for any change to the current transportation system. Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. In the absence of effective planning and traffic management of the city, the current road infrastructure cannot cater to the future needs of the city.

The current work studies traffic characteristics in the city of Dhaka at one selected priority junction. Volume survey was conducted by myself and my fellow groupmates on the Khamarbari and Aarong junction with a view to gaining data and insight about the traffic parameters and conditions in this road. We collected seven days data for the survey and conducted the survey of volume study using manual counting method. Before starting the final survey, we did a reconnaissance survey for 10 minutes for identifying a suitable location. We also conducted piloting for five minutes for the purpose to find out any problems that were related to the volume study. Then we started the final survey.

This study analyzes the data to form an idea about vehicle composition in the traffic stream, service flow rate, directional distribution, estimation of ADT and AADT. Finally, the results from this report would be helpful for better understanding the roadway capacity, demand and overall conditions of that route and can be used for any future project or expansion of this road.

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LIST OF ABBREVIATIONS

ADT - Average Daily Traffic

AADT - Annual Average Daily Traffic

DEF - Daily Expansion Factor

HEF - Hourly Expansion Factor

MEF - Monthly Expansion Factor

LOS - Level of Service

PHF - Peak Hour Factor

PCE – Passenger Car Equivalent

PCU – Passenger Car Unit

CHAPTER 1

INTRODUCTION

1.1: General

The term traffic volume study can be termed as traffic flow survey or simply the traffic survey. It is defined as the procedures to determine mainly the volume of traffic moving on the road of a particular section during a particular time.

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded. For example, an intersection count may be conducted during the peak flow period. If so, a manual count with 30-minute intervals could be used to obtain the traffic volume data.

The information on traffic volume is an important input required for the planning, analysis, design, and operation of roadway systems. Highway capacity values and speed flow relationships used for planning, design, and operation of highways, in most of the developed countries, about fairly homogeneous traffic conditions comprising vehicles of more or less uniform static and dynamic characteristics. But the traffic scenario in developing countries like Bangladesh differs significantly from the conditions of developed countries in many respects. In Bangladesh road traffic, the heterogeneity is of a high degree with vehicles of widely varying static and dynamic characteristics. Under this condition, it becomes difficult to make the vehicles follow traffic lanes. Consequently, the vehicles tend to choose any advantageous lateral position on the road based on space availability. Under the said traffic conditions expressing traffic volume as the number of vehicles passing a given section of road per unit time will be

inappropriate and some other suitable base needs to be adopted for the purpose. The problem of measuring the volume of such heterogeneous traffic has been addressed by converting the different types of vehicles into equivalent passenger cars and expressing the volume in terms of Passenger Car Units (PCU) per hour. The PCU is the universally adopted unit of measurement of traffic volume, derived by taking the passenger car as the 'standard vehicle'.

1.2: Necessity of Traffic Volume Study

Traffic engineers and planners need traffic information. They need the information to design and manage road and traffic systems. They use the information for planning and designing traffic facilities, selecting geometric standards, economic analysis, and determination of priorities. They use this to justify warrant of traffic control devices such as signs, traffic signals, pavement markings, school, and pedestrian crossings. Traffic engineers also use this information to study the effectiveness of introduced schemes, diagnose given situations, find appropriate solutions, forecast the effects of projected strategies, calibrate, and validate traffic models. The transportation system is dynamic. Traffic information must be regularly updated to keep pace with the ever-changing transportation system. Data must be collected and analyzed systematically to get representative information. Traffic surveys are the means of obtaining traffic information. This is a systematic way of collecting data to be used for various traffic engineering purposes.

Traffic volume studies are needed to engineers and planners for these specific reasons

- Increase the efficiency and life of roads
- Reduces traffic volume at a particular road
- Provide better means for the development of infrastructures
- Provide better means to utilize other roads in case of special events in the city
- Provide estimates at no vehicles against no of persons.

Traffic volume 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 a general knowledge of traffic volume

characteristics to measure and understand the magnitude, composition, and time and route distribution of volume for each area under his/her jurisdiction.

1.3: General Objectives of Traffic Volume Study

The objectives of carrying out traffic volume count are designing, improving traffic system, planning, management etc.

1.3.1 Design purposes:

- The structural and geometric design of pavements, bridges, and other highway facilities. Structural design is based on the repetition of wheel load on the pavement in the entire design life. AADT is needed with traffic growth rate to compute design wheel repetition. The geometric design is based on peak hour volume to avoid congestion.
- Intersection design includes minimum turning path, channelization, flaring, traffic control devices viz. traffic signs, markings, signals based on approach volume, and turning proportions.
- Pedestrian volume study is useful for designing sidewalks, pedestrian crossings, etc.

1.3.2: Improvement purposes:

- To allocate a limited maintenance budget rationally, it is important to know the traffic volume carried by a particular roadway section to decide the importance of the road and fix its relative priority.
- To improve the roadway operating condition, it is important to know the traffic volume.
- To examine the existing operating/service condition of a roadway section.
- To check the need (warrant) traffic control devices.
- To determine the type of improvement measure, need to be taken.
- To measure the effectiveness of a traffic control measure.

1.3.3: 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 a need for
    - Improvement
    - Expansion in terms of construction missing links, by-pass, alternative road, etc.

1.3.4 Dynamic Traffic Management Purposes:

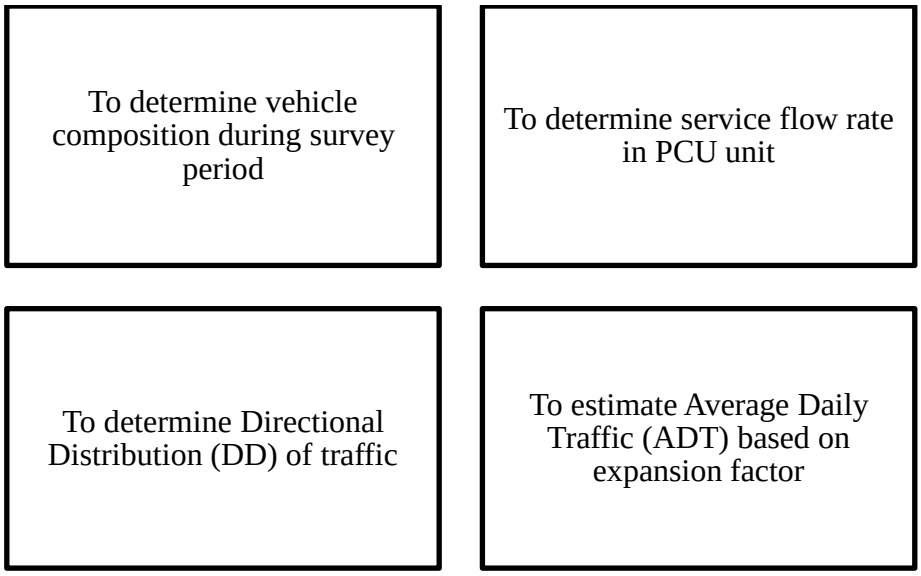
Up to date and continuous flow/congestion information is essential for optimizing-

- Traffic signal design and thereby improving junction performance.
- Network productivity by providing information to the road user.

1.3.5 Other Purposes:

- Estimation of highway usage
- Measurement of current demand of a facility
- Estimation of trends
- Economic feasibility evaluation.

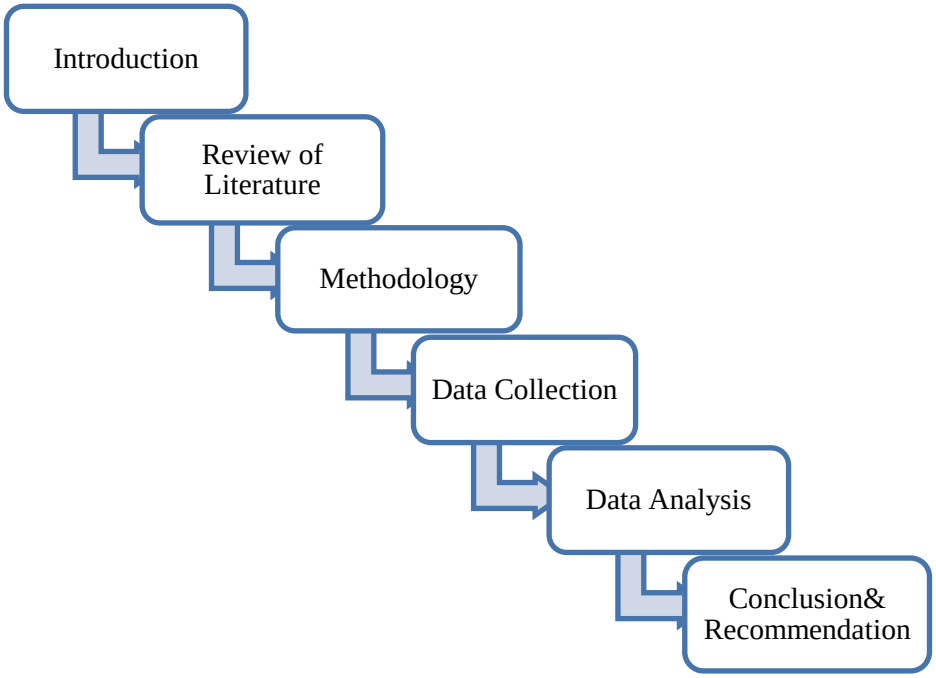
1.4: Specific Objectives of Traffic Volume Study



1.5: Scopes of Traffic Volume Study

- 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 are 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.

1.6: Steps of Organizing the Report



CHAPTER 2

REVIEW OF LITERATURE

2.1: General

The transportation system is dynamic. Traffic information must be regularly updated to keep pace with the ever-changing transportation system. Data must be collected and analyzed systematically to get representative information.

2.2: Definitions

Volume/flow: The total number of vehicles that pass over a given point or section of a lane or roadway during a given time interval. It is the actual number of vehicles observed or predicted to pass a point during a given interval.

Rate of flow: The equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a time interval less than 1hr. uusually30 min.

Demand: Demand is a measure of the number of vehicles (or passengers, or persons) waiting for service in the given period. Demand is frequently higher than actual volumes where congestion exists. Some trips divert to alternative routes and other trips are simply not made. In case of uncongested conditions, demand would be equal to volume.

Capacity: Capacity is the maximum number that can reasonably be expected to be served in the given period. Capacity should be precisely defined as the flow rate for the period immediately preceding the formation of queues. Once the queue is formed it will become queue discharge rate. This is more important than the stable-flow value.

PCU/PCE: PCE means passenger car equivalent to express various types and characteristics vehicles to a common type usually the passenger car. One car is considered to be one unit (**Ahmed et al., 2005**).

ADT: Average daily traffic or ADT, and sometimes also mean daily traffic, is the average number of vehicles two-way passing a specific point in 24 hours, normally measured throughout a year. ADT is the standard measurement for vehicle traffic load on a section of road and the basis for most decisions regarding transport planning, or to the environmental hazards of pollution related to road transport. Road authorities have norms based on ADT, with decisions to expand road capacity at given thresholds.
The common applications are:

- Planning of highway activities
- Measurement of current demand
- Evaluation of existing traffic flow

AADT: Annual average daily traffic, abbreviated AADT, is a measure used primarily in transportation planning and transportation engineering. It is the total volume of vehicle traffic on a highway or road for a year divided by 365 days. AADT is a useful and simple measurement of how busy the road is. It is also sometimes reported as Average Annual Daily Traffic.
This is useful for:

- Estimation of highway user revenues
- Accident rates per 1000 vehicle-km
- Traffic volume trends
- Economic feasibility
- Development of the hierarchical system of facilities
- Improvement and maintenance programs.

Average Weekday Traffic (AWT): The average 24-hr weekday volume at a given location over a defined time of less than one year. A common application is to measure an AWT for each month of the year.
Average Annual Weekday Traffic (AAWT): The average 24-hr volume occurring on weekdays over a full 365-day year, estimated as the number of vehicles passing a site on weekdays in a year divided by the number of weekdays (usually 260, considering 5-day week).

Expansion Factor: Hourly, Daily and Monthly Expansion factors can be determined using data obtained at continuous count station.

Peak Hour Volume (PHV): Maximum number of vehicles that pass a point on a highway during 60 consecutive minutes.

It is useful for:

- Functional classification of highways
- Design of geometric characteristics
- Capacity analysis
- Traffic operational plans
- Parking regulations

Design Hourly Volume: It is the economic hourly flow of the future year, which is used for designing geometric features roadways. It is chosen in such a way that during the design period it should not be exceeded too often or too much.

Interrupted flow: Flow at stop and goes situation.

Uninterrupted flow: When the flow is smooth.

Saturation flow: The maximum hourly rate of an approach at a signalized junction.

Service flow rate: The maximum hourly rate of a roadway section during a given period under prevailing roadway conditions.

Free flow: When drivers face no restriction in driving and can maintain their desired speeds.

Forced flow: When Lane changing opportunity decreases with increasing traffic volume and drivers are forced to follow slow leaders.

Stable/ Steady flow: When demands are well below the roadway capacity and the average rate of flow remains almost constant with time.

Unstable flow: When demand is at or near or exceeds the roadway capacity and the average rate of flow fluctuates largely with time.

Peak flow: Flow at peak periods

Off-peak flow: Flow at off-peak/lean periods.

Contraflow: For repair works; an arrangement on a large road by which traffic going in both directions uses only one side of the road. For bus priority, a special arrangement on a one-way street by which only bus is allowed to go in the opposite direction.

Tidal flow: When traffic flows in both directions exhibit unbalanced characteristics at peak periods viz. morning rush at in-bound lanes due to commuter traffic and in the evening the same is true for the outbound lanes.

2.3: Previous Traffic Volume Studies

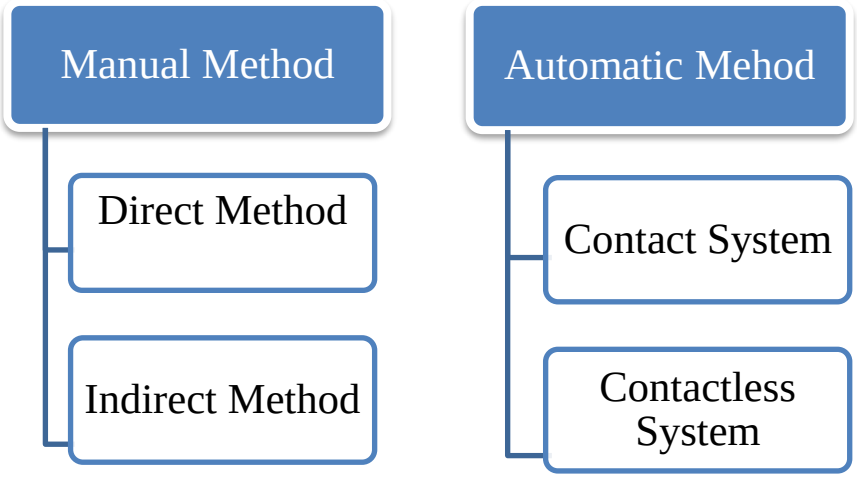
Satya Narayana (2012) studied the effect of traffic volume, its composition, and stream speed on passenger car equivalents. The method proposed by Chandra is used for developing the PCU factors and found that for two-axle trucks PCU values are found to increase with an increase in the compositional share of respective vehicle types in the traffic stream. The PCU of two-wheelers practically remains unaffected by its compositional share in the traffic stream. A compositional share of 2W at different locations was observed in the range of 31.69% to 34.23% whereas an increase in PCU values is 1.1% only and it may be attributed due to high maneuverability. In slow-moving traffic PCU values of bullock carts are increasing with the decrease in the compositional share in the stream.

Lum K.M, Fan H.S.L, Lam (1998) observed traffic volume and travel time data at several arterial roads in Singapore to analyze the speed-flow relationships for radial and ring arterial roads. The general speed-flow model incorporating "minimum delay per intersection" and "frequency of intersections per kilometer", as model parameters, reflects better speed-flow characteristics of traffic on arterial roads.

Chandra S, Kumar V, and Sikdar (1995) made a comprehensive study on the capacity of urban roads. It was emphasized that PCU values for vehicle type are dynamic and depend on all factors affecting the behavior of the vehicle in the traffic

stream. Data collected at various mid-block sections of Delhi were used to study the dynamic nature of PCU for a vehicle type. They observed that the PCU for a vehicle type decreases with an increase in its proportion in the traffic stream.

2.4: Counting Methods



Two methods are available for conducting traffic volume counts (1) manual and (2) automatic. Manual counts are typically used to gather data for the determination of vehicle classification, turning movements, the direction of travel, pedestrian movements, or vehicle occupancy. Automatic counts are typically used to gather data for the determination of vehicle hourly patterns, daily or seasonal variations and growth trends, or annual traffic estimates.

The selection of the study method should be determined using the count period. The count period should be representative of the time of day, day of the month, and month of the year for the study area. For example, counts at a summer resort would not be taken in January. The count period should avoid a special event or compromising weather conditions (Sharma 1994). Count periods may range from 5 minutes to 1 year.

Typical count periods are 15 minutes or 2 hours for peak periods, 4 hours for morning and afternoon peaks, 6 hours for the morning, midday, and afternoon peaks, and 12 hours for daytime periods (Robertson 1994). For example, if you were conducting a 2-hour peak period count, eight 15-minute counts would be required (**Currin, 2001**).

The study methods for short duration counts are described in this chapter in order from least expensive (manual) to most expensive (automatic), assuming the user is starting with no equipment.

2.4.1: Manual Counting Method

Most applications of manual counts require small samples of data at any given location. Manual counts are sometimes used when the effort and expense of automated equipment are not justified. Manual counts are necessary when automatic equipment is not available. Manual counts are typically used for periods of less than a day. Normal intervals for a manual count are 5, 10, or 30 minutes.

Manual Count Recording Methods:

Manual counts are recorded using one of three methods: tally sheets, mechanical counting boards, or electronic counting boards.

Tally Sheets:

Recording data onto tally sheets is the simplest means of conducting manual counts. The data can be recorded with a tick mark on a pre-prepared field form. A watch or stopwatch is necessary to measure the desired count interval.

Fig 2.1: Tally Sheet

Fig 2.2: Mechanical counter

Mechanical Counting Boards:

Mechanical count boards consist of counters mounted on a board that records each direction of travel. Common counts include pedestrian, bicycle, vehicle classification, and traffic volume counts. Typical counters are push-button devices with three to five registers. Each button represents a different stratification of the type of vehicle or

pedestrian being counted. The limited number of buttons on the counter can restrict the number of classifications that can be counted on a given board. A watch or a stopwatch is also necessary with this method to measure the desired count interval.

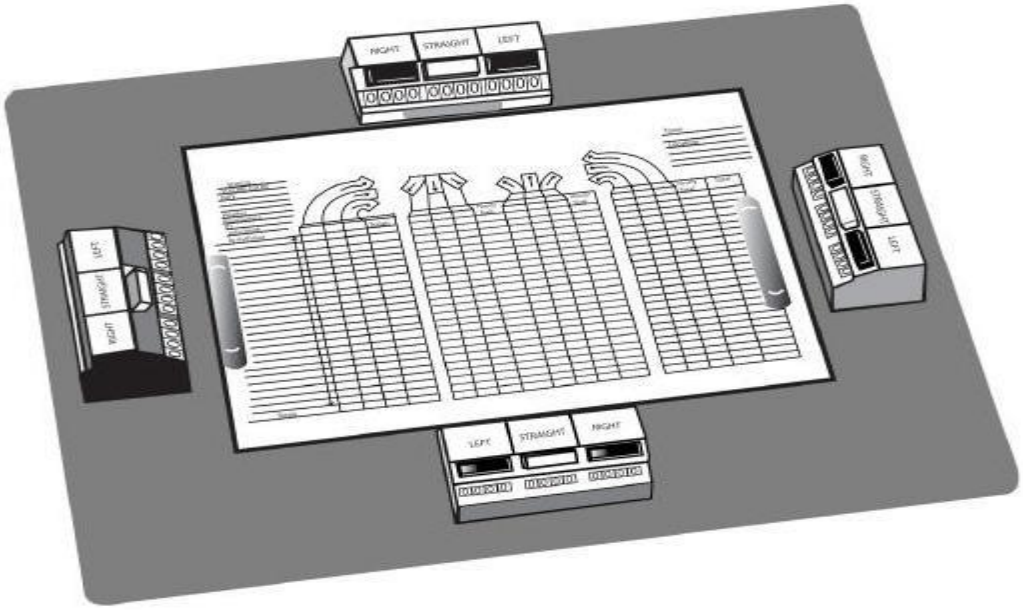


Fig 2.3: Mechanical Counting Board

Electronic Counting Boards:

Electronic counting boards are battery-operated, hand-held devices used in collecting traffic count data. They are similar to mechanical counting boards, but with some important differences. Electronic counting boards are lighter, more compact, and easier to handle. They have an internal clock that automatically separates the data by time interval. Special functions include automatic data reduction and summary. The data can also be downloaded to a computer, which saves time.

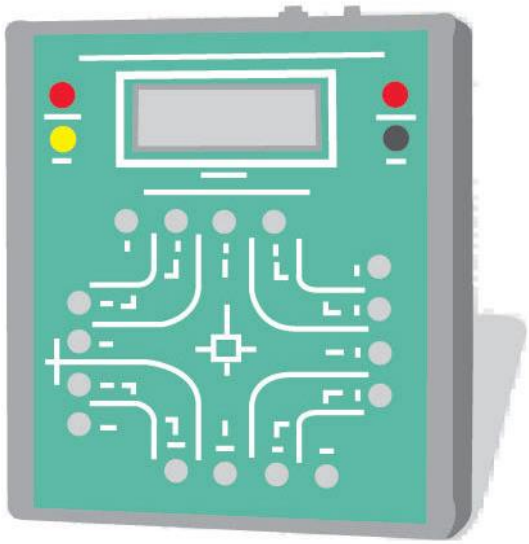


Fig 2.4: Electronic Counting Board

A manual count study includes three key steps:

1. Perform necessary office preparations.
2. Select proper observer location.
3. Label data sheets and record observations.

Perform Necessary Office Preparations

Office preparations start with a review of the purpose of the manual count. This type of information will help determine the type of equipment to use, the field procedures to follow, and the number of observers required. For example, an intersection with multiple approach lanes may require electronic counting boards and multiple observers.

Select Proper Observer Location

Observers must be positioned where they have a clear view of the traffic. Observers should be positioned away from the edge of the roadway. If observers are positioned above ground level and clear of obstructions, they usually have the best vantage point. Visual contact must be maintained if there are multiple observers at a site. If views are unobstructed, observers may count from inside a vehicle.

Label Data Forms and Record Observations

Manual counts may produce a large number of data forms; therefore, the data forms

should be carefully labeled and organized. On each tally sheet (a blank tally sheet is provided in Appendix B), the observer should record the location, time and date of observation, and weather conditions. Follow the data recording methods discussed earlier.

Fig 2.5: Signal Mounted Video Camera for Traffic Volume Count

- **Direct Method:** Data is counted by using a hand tally and manual counters/enumerators.
- **Advantages:** By this method traffic volume as well as vehicle classification and turning proportions can be obtained. Data can be used immediately after collection.
- **Disadvantages:** This method is not practicable for a long-duration count and when the flow is high. Error is common especially when the volume is high. The count cannot be cross-checked. The count cannot be done in bad weather.

- **Indirect Method:** In this method, data is collected using a video camera. Video is captured for a long time and data is collected later by rewinding.
  - **Advantages:** Besides traffic volume, several traffic parameters can be obtained from the recorded film. Data can be cross-checked, and quality can be ensured. This method is applicable when the volume is high. It is suitable for non-lane-based traffic operations.
  - **Disadvantages:** A suitable elevated place is required for filming operation. Data cannot be used immediately after collection. Data must be manually transcript from the recorded film. This process is time-consuming and tedious. Because of the limitation of the capacity of film, it is not suitable for long-duration counts. The quality of video recorded on film is dependent on the intensity of light and this method is not suitable on overcast days.

2.4.2: Automatic Counting Method

The automatic count method provides a means for gathering large amounts of traffic data. Automatic counts are usually taken in 1-hour intervals every 24 hours. The counts may extend for a week, month, or year. When the counts are recorded for each 24-hour time, the peak flow period can be identified.

Automatic Count Recording Methods:

Automatic counts are recorded using one of three methods: portable counters, permanent counters, and videotape.

Portable Counters:

Portable counting is a form of manual observation. Portable counters serve the same purpose as manual counts but with automatic counting equipment. The period of data collection using this method is usually longer than when using manual counts. The portable counter method is mainly used for 24-hour counts. Pneumatic road tubes are used to conduct this method of automatic counts.

Permanent Counters:

Permanent counters are used when long-term counts are to be conducted. The counts could be performed every day for a year or more. The data collected may be used to

monitor and evaluate traffic volumes and trends over a long period. Permanent counters are not a cost-effective option in most situations. Few jurisdictions have access to this equipment.

Videotape:

Observers can record count data by videotaping traffic. Traffic volumes can be counted by viewing videotapes recorded with a camera at a collection site. A digital clock in the video image can prove useful in noting time intervals. Videotaping is not a cost-effective option in most situations. Few small jurisdictions have access to this equipment.

An automatic count study includes three key steps (Robertson 1994):

1. Perform necessary office preparations.
2. Deploy and calibrate data collection equipment.
3. Check data and retrieve equipment.

Perform Necessary Office Preparations

During office preparations, coordinate all data collection activities with appropriate state and local officials, including transportation, traffic, and law enforcement agencies. For example, you may coordinate with state or local officials in obtaining traffic control for the deployment and recovery of equipment. The field team must be briefed on the data collection process to ensure that all observers are collecting the same data type. The team should assemble and inspect all tools, supplies, and equipment. Each piece of equipment should be tested.

Deploy and Calibrate Data Collection Equipment

The portable counter method using pneumatic road tubes is described here since the other methods are not cost-effective for jurisdictions in most automatic count study situations. The road tubes are prepared on the roadside to minimize the time each traffic lane is closed. Workers then place the road tubes across the lanes. The location of the tubes should be outside the influence of other factors such as an intersection, major access points, etc. Traffic control should be provided to protect the crew. After placing, the crew should make sure that the tubes are functioning properly. Finally, the crew can secure the road tubes to the pavement. To avoid theft, the recorder may also be secured.

Check Data and Retrieve Equipment

When the data collection period has ended, the recorded data are checked for accuracy. Crews recover data collection equipment by reversing the process they used to deploy it. Again, this automatic traffic count can be further classified as **intrusive** and **non-intrusive** methods. The former includes counting systems that involve placing sensors in or on the roadbed, the latter involves remote observational techniques. In general, the intrusive methods are used most widely because of their relative ease of use and because they have been employed for decades. The only widely used non-intrusive method is manual counting, which enjoys wide application because of its ease. Intrusive methods, however, have evolved little over the last decade, but in the US, with federal transport policy emphasis on IT solutions to traffic management, progress is being made in the development of non-intrusive methods. The major intrusive methods include:

- **Bending plate**: a weight pad attached to a metal plate embedded in the road to measure axel weight and speed. It is an expensive device and requires alteration to the roadbed.
- **Pneumatic road tube**: a rubber tube that is placed across the lanes that use pressure changes to record the number of axle movements in a counter placed on the side of the road. The drawback is that it has limited lane coverage, may become displaced, and can be dislodged by snowplows.
- **Piezo-electric sensor**: a device that is placed in a groove cut into the roadbed of the lane(s) being counted. This electronic counter can be used to measure weight and speed. Cutting into the roadbed can affect the integrity of the roadbed and decrease the life of the pavement.
- **Inductive loop**: a wire embedded in the road in a square formation that creates a magnetic field that relays the information to a counting device at the side of the road. This has a generally short life expectancy because it can be damaged by heavy vehicles and is also prone to installation errors.

The major non-intrusive methods include:

- **Manual observation**: a very traditional method involving placing observers at specific locations to record vehicle or pedestrian movements. At its simplest, observers use tally sheets to record, but numbers, on the other hand, there are mechanical and electronic counting boards available that the observer can punch

in each time an event is observed. It can record traffic numbers, types, and directions of travel. Manual counts give rise to safety concerns, either from the traffic itself or the neighborhoods where the counts are being undertaken.

- **Passive and active infra-red**: a sensor detecting the presence, speed, and type of vehicles by measuring infra-red energy radiating from the detection area. Typically, the devices are mounted overhead on a bridge or pylon. The major limitation is the performance during inclement weather and limited lane coverage.
- **Passive magnetic**: magnetic sensors that count vehicle numbers, speed, and type are placed under or on top of the roadbed. In operating conditions, the sensors have difficulty differentiating between closely spaced vehicles.
- **Microwave- Doppler/ Radar**: mounted overhead the devices record moving vehicles and speed. Except for radar, devices they have difficulty in detecting closely spaced vehicles and do not detect stationary vehicles. They are not affected by the weather.
- **Ultrasonic and passive acoustic**: devices that sound waves or sound energy to detect vehicles. Those using ultrasound are placed overhead to record vehicle presence but can be affected by temperature and turbulence; the acoustic devices are placed alongside the road and can detect numbers and vehicle type.

Fig 2.6: Pneumatic tube technology is used to collect vehicle classification data

(Contact System)

Fig 2.7: Using radar technologies, Smart Sensor HD devices have the capability of detecting vehicles **(Contactless System).**

- **Advantages:** This method is suitable for long duration or the continuous count. It is used as a permanent counting station. It does not need manpower and is free from human error. Data is obtained in a usable format. It is less expensive as manpower is not needed. The count is not affected by bad weather conditions.
- **Disadvantages:** It requires strict lane discipline. Non-motorized vehicles are hard to detect by this method. Detailed classification of the vehicle is not possible. Accuracy is less than the manual method. Installation cost is high.

2.5: Overview

Providing all required knowledge, information and materials regarding traffic volume study, a team of people can be appointed to carry out volume survey by following proper method.

CHAPTER 3

METHODOLOGY

3.1: General

Traffic surveys and studies are an integral component of a comprehensive Traffic and Transportation Study. Appreciation of existing traffic and travel characteristics is extremely important for developing comprehensive traffic and transportation plan. Moreover, the traffic survey data, apart from helping in understanding the existing traffic and transportation situation along with its problems and constraints, would help in the development, calibration, and validation of the travel demand forecasting models. To achieve these goals number of traffic surveys must be set out in Khamarbari Road Segment between Khamarbari and Aarong. But before the final survey a reconnaissance and piloting survey has been executed to familiarize with the jobs and to find any problem that may occur in vehicle counting in the final survey.

3.2: Survey Zone

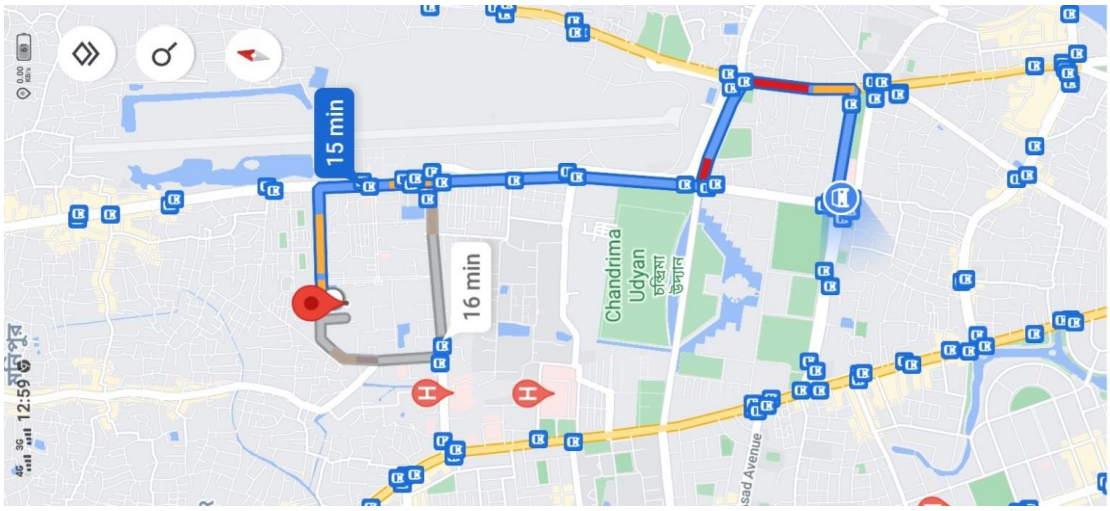


Fig 3.1: Survey Road

3.3: Reconnaissance Survey

A walkover reconnaissance and route alignment survey were first carried out. This is essentially carried out to verify the physical features on the ground which may not be visible on the map due to developments that might have taken place after the preparation of the map**.** Based on the reconnaissance survey, some Traffic Analysis Zone (TAZs) for taking survey data has been identified. Again, observing the pattern of the vehicle along the road, the enumerators are assigned to count the specific vehicle for traffic volume study. Some bottleneck points were identified in the reconnaissance survey. And causes of bottlenecks were also identified. The pedestrian facility along the road was also observed in this survey.

- The number of private cars is predominant on this road; the second most available vehicle along this road is the motorcycle.
- One playground name is T&T playground.
- There are several commercial buildings, shop, Nam Bhaban office building is situated on one side of the road
- There are two schools, Rajdhani high school, and Dhanmondi Government boys' high school, which is situated alongside the road, which is a major attraction of traffic and emergency vehicle
- Many private vehicles type traffic is generated from this area

Based on all information a model classified traffic volume survey data sheet was developed for the pilot survey.

3.4: Pilot Survey

In the light of the results of the reconnaissance survey, a pilot survey was set out. A pilot survey is a “pre-survey” of the final survey. A pilot survey helped to work out some of the procedural bugs even though it is not likely to add anything new or important to the main survey. Here are some outcomes from the pilot survey:

- It permitted preliminary testing of the method of a survey that leads to testing a more precise method in the main survey. It leads to changing some processes, dropping some, and developing a new process for volume count and speed study.
- It provided the enumerators with ideas, approaches, and clues that have not been foreseen in the reconnaissance survey. Such as- place selected for counting traffic volume in the reconnaissance survey did not provide a clear view of the road, which raise the need of selecting a new place for traffic count. TAZs identified in the pilot survey provide a clearer view than before and decrease the chance of error.
- It permitted a thorough check of the planned survey procedures, giving a chance to evaluate their usefulness for the data. This helped to make needed alterations in the data collecting methods, and therefore, analyze data in the main survey more efficiently.
- It greatly reduced the number of unanticipated problems.
- The experience gathered from the pilot survey would help a lot during the final survey.

3.5: Counting Method

Amongst the two methods of traffic counting (Manual and Automatic), Manual traffic count has been selected. Required materials for automatic traffic count cannot be

obtained from SU. Again, available automatic traffic counting machines were not fully functional. Considering the circumstance, the manual method of traffic count was the best possible option.

3.6: Overview

Following a systematic method of collecting workable data can be collected. A well-defined and disciplined method of survey leads to reliable data for further planning, designing, and decision-making process.

CHAPTER 4

DATA COLLECTION

4.1 General

Following the method described before data were collected. To accomplish a smooth process of data collection, wholesome knowledge regarding the survey area is required, which will be described below along with the process of data collection.

4.2 Date

Data for the volume study were collected from 15 to 21 October 2021.

4.3 Duration: The duration of data collection was 30 minutes, which took place from 04:00 pm to 04:30 pm.

4.4 Weather Condition: It was a hot sunny day. The sky was clear. At the time of data collection, there was a smooth breeze flowing by.

4.5 Location

Location: The location of the traffic volume study was selected to be from Khamarbari to Aarong. Vehicles from Khamarbari to Aarong and from Aarong to Khamarbari were counted.

4.6 Observation

The main goal of observation was classified vehicle counts. As the vehicles were classified in different categories, they were counted throughout the counting period.

4.7 Method

The survey was conducted by direct count with a manual method.

4.8 Equipment

For recording data, a tabulated sheet was prepared by enumerators beforehand, which come in handy in recording classified vehicle count. A stopwatch was used to follow the time of data collection.

4.9 Number of Enumerator

There were 5 enumerators in the group. Every enumerator was appointed to count one or more than one category of vehicle.

Site picture

CHAPTER 5

DATA ANALYSIS

5.1 General

Data were collected following the procedure described before and collected data were analyzed afterward.

5.2 Traffic Volume Count Data

Data collected by following the specific process of data collection are presented below:

Table 5.1: Traffic Volume Count Data

Site & Location: Khamarbari to Aarong

Day-1

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 15.10.2021 (Friday) Weekend

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	CNG	Car	Jeep/ Microbus/ Ambulance	Motorcycle	NMV	Utility
0-5	5	07	12	10	10	15	2
5—10	3	16	15	8	13	21	0
10—15	6	19	12	8	18	23	7
15-20	10	21	08	15	05	35	4
20-25	5	13	18	6	12	28	3
25-30	4	10	5	7	6	12	4
Total	**33**	**86**	**70**	**54**	**64**	**134**	**20**

Day-2

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 16.10.2021 (Saturday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	2	18	16	6	21	25	3
5—10	5	15	23	8	23	23	11
10--15	4	12	21	7	24	21	13
15-20	7	19	22	8	10	45	5
20-25	5	21	09	6	13	11	14
25-30	4	12	10	11	10	20	6
Total	**27**	**97**	**91**	**46**	**101**	**145**	**52**

Day-3

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 17.10.2021 (Sunday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot and Sunny day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	0	8	2	1	22	33	12
5—10	5	9	10	5	21	21	1
10—15	3	7	5	0	17	25	3
15-20	4	12	11	0	19	40	6
20-25	8	15	13	6	12	35	7
25-30	5	6	10	5	11	20	5
Total	**25**	**57**	**51**	**17**	**102**	**174**	**34**

Day-4

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 18.10.2021 (Monday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	3	11	21	8	13	32	18
5--10	8	22	25	5	17	23	17
10--15	11	07	8	7	19	19	13
15-20	2	9	12	12	20	21	18
20-25	5	13	18	15	05	25	14
25-30	7	10	15	7	10	16	10
Total	**36**	**72**	**99**	**54**	**84**	**136**	**90**

Day-5

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 19.10.2021 (Tuesday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	**Number of Vehicles**						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	5	12	31	9	21	35	4
5--10	9	15	23	4	27	23	5
10--15	5	13	20	9	9	22	7
15-20	7	12	08	8	11	08	9
20-25	8	08	15	13	13	15	12
25-30	5	08	14	5	12	9	7
Total	**39**	**68**	**111**	**48**	**93**	**112**	**44**

Day-6

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 20.10.2021 (Wednesday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	2	12	20	8	8	30	5
5--10	5	3	23	11	9	33	0
10--15	10	12	17	13	11	19	2
15-20	13	15	13	15	8	18	8
20-25	15	20	15	11	12	12	7
25-30	7	10	11	09	05	10	5
Total	**52**	**72**	**99**	**67**	**53**	**122**	**27**

Day-7

Site & Location: Khamarbari to Aarong

Observation: One directional (E to W) classified Vehicle count.

Data: 21.10.2021 (Thursday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cyle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	3	12	12	2	2	20	10
5--10	8	17	14	8	21	21	10
10--15	13	19	14	11	13	17	5
15-20	15	09	8	15	14	13	2
20-25	3	11	12	5	10	09	3
25-30	5	10	07	4	5	07	6
Total	**47**	**78**	**66**	**45**	**65**	**87**	**36**

Avg. 7 Days

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	3	11	16	6	14	27	8
5-10	6	14	17	7	19	24	6
10-15	6	13	14	8	16	21	7
15-20	8	14	12	10	12	26	7
20-25	7	14	14	9	11	19	9
25-30	5	09	24	7	8	13	6
Total	**35**	**75**	**97**	**47**	**80**	**130**	**43**

Vehicle Classification	Observation in 30 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	35	70	6.90	3.0	210
CNG (C)	75	150	14.79	0.5	75
Car (LV)	97	194	19.13	01	194
Jeep/ Microbus/ Ambulance	47	94	9.27	1.5	114
Motorcycle (MC)	80	160	15.78	0.75	120
NMV	130	260	25.64	0.5	130
Utility	43	86	8.48	01	86
Total =	507	1014	100	--	929

Site & Location: Aarong to Khamarbari

Day-1

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 15.10.2021 (Friday) Weekend

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	7	10	10	9	8	14	5
5--10	5	12	14	11	15	11	3
10--15	4	21	11	6	12	18	6
15-20	7	13	10	9	6	21	5
20-25	5	12	15	7	13	15	7
25-30	3	8	6	9	10	10	7
Total	**31**	**76**	**66**	**51**	**64**	**89**	**33**

Day-2

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 16.10.2021 (Saturday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	5	21	13	10	25	9	6
5--10	3	14	12	11	21	12	10
10--15	10	8	18	6	17	10	7
15-20	9	15	23	4	9	23	2
20-25	7	12	11	5	15	10	19
25-30	5	15	5	7	10	12	7
Total	**39**	**85**	**82**	**43**	**97**	**76**	**51**

Day-3

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 17.10.2021 (Sunday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot and Sunny day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	7	7	10	3	10	9	5
5—10	6	10	7	7	12	11	2
10—15	4	12	3	2	2	5	4
15-20	5	7	12	3	7	7	7
20-25	6	11	9	9	9	11	5
25-30	6	9	11	7	4	10	5
Total	**34**	**56**	**52**	**31**	**44**	**53**	**28**

Day-4

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 18.10.2021 (Monday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	4	9	10	5	9	18	10
5--10	5	12	13	7	12	12	20
10--15	6	8	9	9	15	17	11
15-20	3	5	13	10	18	18	9
20-25	6	12	12	14	3	13	12
25-30	4	11	10	13	6	13	12
Total	**28**	**57**	**67**	**58**	**63**	**91**	**74**

Day-5

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 19.10.2021 (Tuesday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	3	11	25	10	15	19	5
5—10	7	16	21	5	18	18	3
10—15	6	14	15	9	7	21	9
15-20	5	6	7	9	12	7	10
20-25	5	10	5	6	7	9	12
25-30	7	3	5	6	9	11	10
Total	**33**	**60**	**78**	**45**	**68**	**85**	**49**

Day-6

Site & Location: Aarong to Khamarbari

Observation: One directional (W to E) classified Vehicle count.

Data: 20.10.2021 (Wednesday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	4	11	19	5	5	18	3
5--10	7	5	21	9	10	15	6
10--15	8	10	15	14	9	14	5
15-20	12	11	11	12	7	13	9
20-25	10	13	10	9	5	11	5
25-30	12	5	7	9	10	8	3
Total	**53**	**55**	**83**	**58**	**46**	**79**	**31**

Day-7

Site & Location: Aarong to Khamarbari.

Observation: One directional (W to E) classified Vehicle count.

Data: 21.10.2021 (Thursday)

Time: 4.00 Pm- 4.30 Pm

Duration: 30 minutes

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	5	11	9	3	10	13	9
5--10	7	13	13	5	9	12	2
10--15	9	12	11	7	11	8	7
15-20	11	11	13	9	8	9	4
20-25	4	10	9	10	9	7	5
25-30	5	9	10	10	12	3	10
Total	**41**	**66**	**65**	**44**	**59**	**52**	**37**

Avg. 7 Days

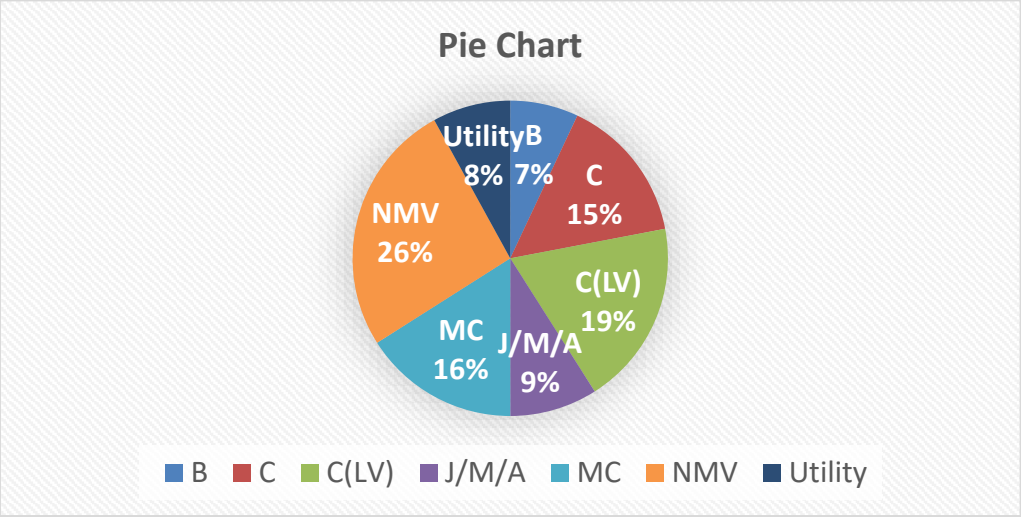
Cycle (min)	Number of Vehicles						
	Bus	**CNG**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**NMV**	**Utility**
0-5	5	11	14	6	12	14	6
5--10	6	12	14	8	14	13	7
10--15	7	12	12	8	10	13	7
15-20	7	10	13	8	10	14	7
20-25	6	11	10	9	9	11	9
25-30	6	9	8	9	9	10	8
Total	**37**	**65**	**71**	**48**	**64**	**75**	**44**

Vehicle Classification	Observation in 30 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	37	74	9.16	03	222
CNG (C)	65	130	16	0.5	65
Car (LV)	71	142	17.57	01	142
Jeep/ Microbus/ Ambulance	48	96	11.88	1.5	144
Motorcycle (MC)	64	128	15.84	0.75	96
NMV	75	150	18.56	0.5	75
Utility	44	88	10.89	01	88
Total =	404	808	100	-	832

5.3 Vehicle Composition

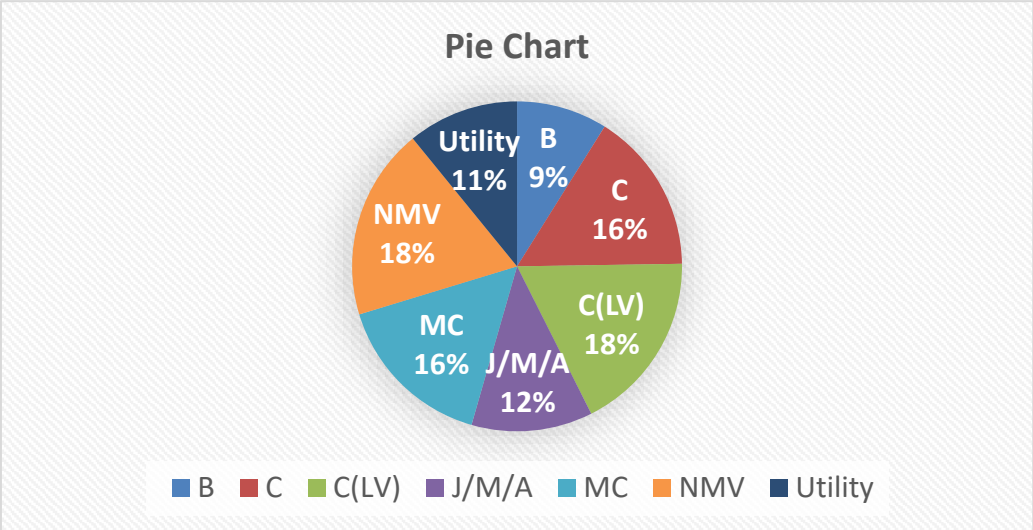
Site & Location: Khamarbari to Aarong

Non-Motor vehicle was predominant in the corridor among the vehicle count. 25.64% percent of vehicles are of this category. Again, the second most frequent vehicle category was Light vehicle, which consists of 19.13% percent of the total vehicle.



Site & Location: Aarong to Khamarbari

Non-Motor vehicle was the predominant in the corridor among the vehicle counted. 18.56% percent of vehicles are of this category. Again, second most frequent vehicle category was the Light vehicle, which consists of 17.57% percent of the total vehicle.



5.4 Service Flow Rate and Level of Service (LOS)

Service Flow Rate is the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a given period under prevailing roadway, traffic, and control conditions while maintaining a designated level of service. The service flow rates generally are based on 30 minutes. Typically, the hourly service flow rate is defined as four times the peak 30-minute volume. Service flow rate is the traffic parameter most used in capacity and level-of-service (LOS) evaluations. Knowledge of highway capacity and LOS is essential to properly fit a planned highway or street to the requirements of traffic demand.

LOS Criteria:

Level of Service (LOS) is a qualitative measure used to relate to the quality of motor vehicle traffic service. LOS is used to analyze roadways and intersections by categorizing traffic flow and assigning quality levels of traffic based on performance measures like vehicle speed, density, congestion, etc (**Chandra and Prasad, 2004**).

LOS-A: Represents Free-flow condition; freedom to select travel speed; side-friction or interaction is very low; level of comfort and convenience is excellent

LOS-B: Represents a zone of stable flow; reasonable freedom to select travel speed; Side- friction starts affecting and level of comfort and convenience is relatively lower

LOS-C: Also, a zone of stable flow; selection of speed is affected by others; Side-friction significantly affects the drivers, and level of comfort and convenience declines noticeably

LOS-D: Represents the limit of stable flow; freedom to select travel speed is severely affected; Side-friction severely affects the drivers and level of comfort and convenience is poor.

LOS-E: Represents close to the capacity level; average speeds are low but uniform; Side- friction causes forced maneuvers and level of comfort and convenience is extremely poor and driver frustration is high.

LOS-F: Represents zone of forced or breakdown flow; queue formation takes place (stop-and-go waves); delays results.

Passenger Car Equivalent (PCE) is a metric used in Transportation Engineering, to assess traffic-flow rate on a highway. A Passenger Car Equivalent is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car.

Table 5.2: Service Flow Rate

Site & Location: Khamarbari to Aarong

Vehicle Classification	**Observation in 30 min**	**PCU**	Converted **Number**	**Hourly PCU**
Bus (B)	35	3.0	105	210
CNG (c)	75	0.5	37.5	75
Car (LV)	97	01	97	194
Jeep/microbus/ ambulance	47	1.5	70.5	114
Motorcycle (MC)	80	0.75	60	120
NMV	130	0.5	65	130
Utility	43	01	43	86
Total =	507		478	929

Traffic Flow (04:00 pm - 04:30 pm) =478 PCU

Service Flow Rate (04:00 pm – 04:30 pm) = 929 PCU/hr. from calculation it is found that the service flow rate of this corridor from 04:00 pm to 04:30 pm was 929 PCU/hr. Again, the level of service of a road can be determined from the service flow rate. The level of service of a road can be classified according to service flow rate as below.

LOS	**Service Flow Rate (PCU/hr.)**
A	<600
B	600-700
C	700-900
D	900-1200
E	1200-1400
F	>1400

Table 5.3: Level of Service vs. Service Flow Rate

According to this table, the level of service of the road was ‘D’ from 04:00 pm-04:30 pm.

Site & Location: Aarong to Khamarbari

Vehicle Classification	Observation in 30 min	PCU	Converted Number	Hourly PCU
Bus (B)	37	3.0	111	222
CNG (C)	65	0.5	32.5	65
Car (LV)	71	01	71	142
Jeep/Microbus/ Ambulance	48	1.5	72	144
Motorcycle (MC)	64	0.75	48	96
NMV	75	0.5	37.5	75
Utility	44	01	44	88
Total =	404		416	832

Traffic Flow (04:00 pm - 04:30 pm) =416 PCU

Service Flow Rate (04:00 pm – 04:30 pm) = 832 PCU/hr. from calculation it is found that the service flow rate of this corridor from 04:00 pm to 04:30 pm was 832 PCU/hr. Again, the level of service of a road can be determined from the service flow rate. The level of service of a road can be classified according to the service flow rate as below.

LOS	Service Flow Rate (PCU/hr.)
A	<600
B	600-700
C	700-900
D	900-1200
E	1200-1400
F	>1400

Table 5.4: Level of Service vs. Service Flow Rate

According to this table, the level of service of the road was ‘C’ from 04:00 pm-04:30 pm.

5.5 Directional Distribution

The directional distribution is defined as the percentage of heavier volume over the total highway volume. This directional distribution is relevant only when designing or analyzing highways with two or more lanes in one direction. Directional distributions are used for capacity analysis, signal timing, justifying traffic control, etc.

The directional distribution can be calculated from the data obtained as below:

Direction	Time	PCU/hr.	Average PCU/hr.	Directional Distribution
Khamarbari to Aarong	4:00PM-4:30PM	929	929	53%
Aarong to Khamarbari	4:00PM-4:30PM	832	832	47%

Table 5.4: Directional Distribution

5.6 Peak Hour Factor (PHF)

The peak hour factor (PHF) is the hourly volume during the maximum-volume hour of the day divided by the peak 15-minute flow rate within the peak hour.

Details calculation is shown below:

Site & Location: Khamarbari to Aarong

Vehicle Type	PCU	Interval (Minutes)					
		0-5	**5-10**	**10-15**	**15-20**	**20-25**	**25-30**
Bus (B)	03	9	18	18	24	21	15
CNG (C)	0.5	5.5	7	6.5	7	7	4.5
Car (LV)	01	16	17	14	12	14	24
Jeep/ Microbus/ Ambulance	1.5	9	10.5	12	15	13.5	10.5
Motorcycle (MC)	0.75	10.5	14.25	12	9	8.25	6
NMV	0.5	13.5	12	10.5	13	9.5	6.5
Utility	01	8	6	7	7	9	6
Total PCU=	-	71.5	84.75	80	87	82.25	72.5

Table: Data for PHF determination

$$PHF = \frac{\text{Hourly Volume}}{\text{Peak rate of flow within the hour}}$$

$$PHF = \frac{929}{4(84.75+87+82.25)}$$

PHF= 0.91437

Observation:

- PHF measures traffic demand fluctuations within the peak hour. It generally varies in between 0.85 to 0.95. Our value agrees with it.
- From short count data, the actual (design) flow rate can be calculated by dividing the peak hour volume by the PHF, or by multiplying the peak 15 minutes' volume by four.

Vehicle Type	PCU	Interval (Minutes)					
		0-5	**5-10**	**10-15**	**15-20**	**20-25**	**25-30**
Bus (B)	03	15	18	21	21	18	18
CNG (C)	0.5	5.5	6	6	5	5.5	4.5
Car (LV)	01	14	14	12	13	10	8
Jeep/ Microbus/ Ambulance	1.5	9	12	12	12	13.5	13.5
Motorcycle (MC)	0.75	9	10.5	7.5	7.5	6.75	6.75
NMV	0.5	7	6.5	6.5	7	5.5	5
Utility	01	6	7	7	7	9	8
Total PCU=	-	65.5	74	72	72.5	68.25	63.75

Table: Data for PHF determination

Site & Location: Aarong to Khamarbari

$$PHF = \frac{\text{Hourly Volume}}{\text{Peak rate of flow within the hour}}$$

$$PHF = \frac{832}{4(74+72.5+68.25)}$$

PHF= 0.96857

Observation:

- PHF measures traffic demand fluctuations within the peak hour. It generally varies in between 0.85 to 0.95. Our value does not agree with it.
- From short count data, the actual (design) flow rate can be calculated by dividing the peak hour volume by the PHF, or by multiplying the peak 15 minutes' volume by four.

5.7 Estimate ADT and AADT

Site & Location: Khamarbari to Aarong

Details calculation of ADT and AADT are given below. Expansion factors used here are known as Mohib's JMB Factors.

Here

MEF=0.948 for October

DEF=5.724 for Friday

HEF= 12.85 (Time: 4.00 PM-4.30 PM)

Estimated 24 hours' volume for Friday (Khamarbari to Aarong) using HEF.

=929×12.85

=11937.65 PCU

=11938 PCU

From 24 hours' volume for Friday estimated volume for the week using DEF, total 7 days' volume.

=11938×5.724

=68333.11 PCU

=68333 PCU

Average 24 hours' volume (on average daily traffic, ADT)

=68333÷7

=9761.85 PCU

=9762 PCU (Khamarbari to Aarong)

Since the data were collected in October, using the MEF for May, obtained AADT is

AADT=9762×0.948

=9254.38 PCU**=9254 PCU**

Site & Location: Aarong to Khamarbari

Details calculation of ADT and AADT are given below. Expansion factors used here are known as Mohib's JMB Factors.

Here

MEF=0.948 for October

DEF=5.724 for Friday

HEF= 12.85 (Time: 4.00 PM-4.30 PM)

Estimated 24 hours' volume for Friday (Aarong to Khamarbari) using HEF.

=832×12.85

=10691.2 PCU

=10691 PCU

From 24 hours' volume for Friday estimated volume for the week using DEF, total 7 days' volume.

=10691×5.724

=61195.28 PCU

=61195 PCU

Average 24 hours' volume (on average daily traffic, ADT)

=61195÷7

=8742.14 PCU

=8742 PCU (Aarong to Khamarbari)

Since the data were collected in October, using the MEF for May, obtained AADT is

AADT=8742×0.948

=8287.42 PCU **=8287 PCU**

5.8 Overview

In our study, we see that the hourly PCU for buses from Khamarbari to Aarong was 210. However, for Aarong to Khamarbari direction, we found the value for the bus was 222. For CNG hourly PCU was 75 for Aarong to Khamarbari whereas in our study it was 65 for Khamarbari to Aarong.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 General

This report presented all possible analyses by the data collected from the field survey. Now it's time to discuss the results obtained from the analysis and their significance

6.2 Discussion on Vehicle Composition

Vehicle composition shows that 19.13 percent of total traffic was light vehicles. Only 6.90 percent were on the bus. The reason for a high proportion of light vehicles is the proximity of the location to the residential area of high-income group people. The light vehicles were not highly occupied. But buses were almost fully occupied. It can be assumed that more people were traveling by bus from distant places. About 25.64 percent of total vehicles were NMV. The scarcity of public transport in this area gives rise to the dependency on NMV.

6.3 Discussion on Directional Distribution

53% percent of traffic flow was towards Khamarbari which indicates tidal flow towards East-West. It was morning rush hour. So, the flow was higher towards the city center. 47% of traffic was flowing towards West-East. If another vehicle count was done in the evening rush hour, the opposite scenario might be seen.

6.4 Recommendations

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.

6.5 Limitations

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

6.6 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.

6.7 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.

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APPENDIX

Table 1: Monthly Expansion Factors for a Rural Primary Road

Month of Year	MEF	Month of Year	MEF
January	**1.756**	**July**	**0.578**
February	**1.976**	**August**	**0.521**
March	**1.635**	**September**	**0.632**
April	**1.482**	**October**	**0.948**
May	**1.395**	**November**	**1.186**
June	**0.948**	**December**	**1.355**

Table 2: Daily Expansion Factors for a Rural Primary Road

Days of Week	DEF
Sunday	**9.515**
Monday	**7.012**
Tuesday	**7.727**
Wednesday	**6.582**
Thursday	**7.012**
Friday	**5.724**
Saturday	**6.51**

Table 3: Hourly Expansion Factors for a Rural Primary Road

Hour	HEF	Hour	HEF
6:00- 7:00 a.m.	**42.01**	**6:00- 7:00 p.m.**	**16.6**
7:00- 8:00 a.m.	**28.99**	**7:00- 8:00 p.m.**	**17.5**
8:00- 9:00 a.m.	**22.05**	**8:00- 9:00 p.m.**	**20.4**
9:00- 10:00 a.m.	**18.8**	**9:00- 10:00 p.m.**	**25.3**
10:00- 11:00 a.m.	**17.11**	**10:00- 11:00 p.m.**	**31.2**
11:00- 12:00 p.m.	**18.52**	**11:00- 12:00 a.m.**	**34.2**
12:00- 1:00 p.m.	**18.71**	**12:00- 1:00 a.m.**	**51.2**
1:00- 2:00 p.m.	**16.71**	**1:00- 2:00 a.m.**	**82.3**
2:00- 3:00 p.m.	**14.84**	**2:00- 3:00 a.m.**	**124**
3:00- 4:00 p.m.	**14.77**	**3:00- 4:00 a.m.**	**137**
4:00- 5:00 p.m.	**12.85**	**4:00- 5:00 a.m.**	**144**
5:00- 6:00 p.m.	**13.85**	**5:00- 6:00 a.m.**	**90.2**