Study on Traffic Volume Mirpur-1 to Science Lab 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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Section: (Section: 13B)

Semester - (Summer-2021)

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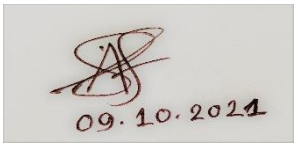
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"Our Parents
&
Respectable Supervisor"

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ABSTRACT

Traffic engineering used engineering methods and techniques to achieve the safe and time efficient movement of people and goods on roadways. The safe and time efficient movement of the people and goods is dependent on Traffic flow, which is directly connected to the traffic characteristics. The three main parameters of a traffic flow are volume, speed and density. In the absence of effective planning and traffic management of the city, the current road infrastructure cannot cater the future needs of the city. Pedestrian and vehicle volumes have increased significantly in the last decade due to the change of the economics of the middle-class families. The current work studies traffic characteristics in the city of Dhaka at one selected priority junction. In this work emphasis was given on traffic volume and the analysis was carried out through primary traffic flow surveys at Science Lab to Mirpur Section-1in Dhaka city. Traffic flow is studied by manual methods. For better understanding of the present status of traffic flow at the junction, traffic survey is conducted. Calculation of Passenger Car Units (PCU's) for different vehicle types was provided by our respected course co-coordinators of the course CE400. With the help of the data collection, an attempt had been made to understand the traffic patterns during different time periods. Traffic control at that junction is also dependent on the traffic flow characteristics. Hence the results from the present study are helpful in controlling the traffic at the intersection and also in suggesting some of the remedial measures to improve the traffic safety in the region. Remedial measures such as widening the road, changing 4-lane to 6-lane or by providing more public transport can be recommended based on the outcomes of the work.

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CHAPTER 1
INTRODUCTION

1.1 Background and Motivations

Traffic Volume:

Traffic Volume is defined as the number of vehicles crossing of road per unite time at any sleeted period.

Methods Available for traffic count:

1. Manual Methods
2. Combination of manual and mechanical methods
3. Automatic devices
4. Moving observer method
5. Photographic method

Types of vehicles volume count:

1. Short term counts, say, for one hour or two hour.
2. Counts for a full day
3. Counts for a full week
4. Continuous count

This quote describes almost everything about the importance of transportation. Transportation is carrying civilization to a brighter future. Now a day's transportation is one of the most burning issues in every territory of the world. Every country is approaching differently according to their needs and solving their transportations problems within their capabilities. In designing buildings we need to determine loads coming to the structure to calculate reinforcement to be provided for safe functioning of the structure. Here in transportation volume serves the same purpose. For planning, designing and operation of transportation system the first and foremost requirement is volume. Volume is simply the

number of vehicles passing a section of a roadway. Expressing traffic volume as number of vehicles passing a given section of road or traffic lane per unit time will be inappropriate when several types of vehicles with widely varying static and dynamic characteristics are comprised in the traffic. The problem of measuring 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 Unit (PCU) per hour. The interaction between moving vehicles under such heterogeneous traffic condition is highly complex. Again volume is not constant. It increases with time. So a continuous method of calculating volume is a matter of great importance for smooth functioning of transportation system. If volume data is not found on a continuous basis then the transportation system may fail and the economy of the country may face a great difficulty.

1.2 OBJECTIVES

- To measure traffic volumes and note other related traffic characteristics (e.g. flow composition, flow fluctuations etc.).
- To determine hourly volume in terms of passengers car equivalents (PCE).
- To determine vehicle composition in traffic stream.

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 fourth chapter. The specific conclusions drawn from this study and recommendations for further work are given in the fifth chapter.

1.4 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.

1.5. a. Design purposes:

Structural and geometric design of pavements, bridge, and other highway facilities. Structural design is based on repetition of wheel load on the pavement in entire design life. AADT is needed with traffic growth rate to compute design wheel repetition. Geometric design is based on peak hour volume to avoid congestion.

Intersection design including 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 crossing etc,

1.5 b. Improvement purposes:

To allocate limited maintenance budget rationally, it is important to know the traffic volume carried by a particular roadway section in order to decide the importance of the road and fixing its relative priority.

In order 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

1.5 c. 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

1.5 d. 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

1.5.e. Other Purposes:

- Estimation of highway usage
- Measurement of current demand of a facility
- Estimation of trends
- Economic feasibility evaluation
- Computation of accident rates- accidents/1 00m vehicle-miles

CHAPTER 2

Literature Review

The main problem in developing the analytical speed-flow relationship is heterogeneity of traffic stream. The vehicles in the mix produce different impedance due to their varied static and dynamic characteristics. Hence simply adding the number of vehicles does not give the authentic speed flow relationship. For this reason, the vehicles are normally presented in terms of standard type of vehicle using certain conversion factors. Generally, passenger car is adopted as standard vehicle and this factor is known as passenger car unit (PCU). Many researchers have developed methods to estimate PCU for a vehicle type. The interesting point to note is that each of these studies has resulted into different PCU values for the same type of vehicle. There exists large variation in PCU values being adopted in different parts of the world.

2.1 Traffic Survey

Traffic engineers and planners need information about traffic. They need information to design and manage road and traffic system. 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. The also use this information to study the effectiveness of introduced schemes, diagnosing given situations and finding appropriate solutions, forecasting the effects of projected strategies, calibrating and validating traffic models.

Transportation system is a dynamic system. Information about traffic must be regularly updated to keep pace with ever-changing transportation system. Data must be collected and analyzed systematically to get representative information.

Traffic surveys are the means of obtaining **information** about traffic. This is a systematic way of collecting data to be used for various traffic engineering purposes.

2.2 Main purposes of traffic survey:

The main purposes of traffic survey are: traffic monitoring, traffic control and management, traffic enforcement, traffic forecasting, model calibration and validating 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
- Axle load survey
- Mass transit performance and usage studies
- Traffic accidents studies
- Environmental impact studies of transport

2.4 Traffic Volume Study

Traffic data are needed in research, planning, designing and regulation phases of traffic engineering and are also used in establishing 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.

2.5 Definitions:

2,5 a. 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 is called volume. It is the actual number of vehicle observed or predicted to passing a point during a given interval.

2.5 b. 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. usually 15 min.

2.5 c. Average Daily Traffic (ADT):

The average 24-hr volume at a given location over a defined time period less than one year. The common application is to measure an ADT for each month of the year. Others are:

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

2.5 d. Average Annual Daily Traffic (AADT)

Average Annual Daily Traffic (AADT); The average 24-hr volume at a given location over a **full** 365 days year, estimated as the number of vehicles passing a site in a year divided by 365 days (366 in leap year).

This is useful for:

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

In 1992, AASHTO released the AASHTO Guidelines for Traffic Data Programs, which identified a way to produce an AADT without seasonal or day-of-week biases by creating an "average of averages." For every month and day-of-week, a Monthly Average Day of Week (MADW) is calculated (84 per year). Each day-of-week's MADW is then calculated across months to calculate an Annual Average Day of Week (AADW) (7 per year). Finally, the

AADWs are averaged to calculate an AADT. The United States Federal Highway Administration (FHWA) has adopted this method as the preferred method in the [FHWA Traffic Monitoring Guide].

AASHTO Guidelines for Traffic Data Programs. American Association of State Highway and Transportation Officials. 1992.

2.6 Types of Volume Counts

Different types of traffic counts are carried out, depending on the anticipated use of the data to be collected. These different types will now be briefly discussed below:

2.6 a. Cordon Counts

When information is required on vehicle accumulation within an area such as the

central business district (CBD) of a city, particularly during a specific time, a cordon count is undertaken. The area for which the data are required is cordoned off by an imaginary closed loop; the area enclosed within this loop is defined as the *cordon area.* Figure 1.1 shows such an area where the CBD of a city is enclosed by the imaginary loop ABCDA. The intersection of each street crossing the cordon line *is* taken as a count station; volume counts of vehicles and/or persons entering and leaving the cordon area are taken. The information obtained from such a count is useful for planning parking facilities, updating and evaluating traffic operational techniques, and making long-range plans for freeway and arterial street systems.

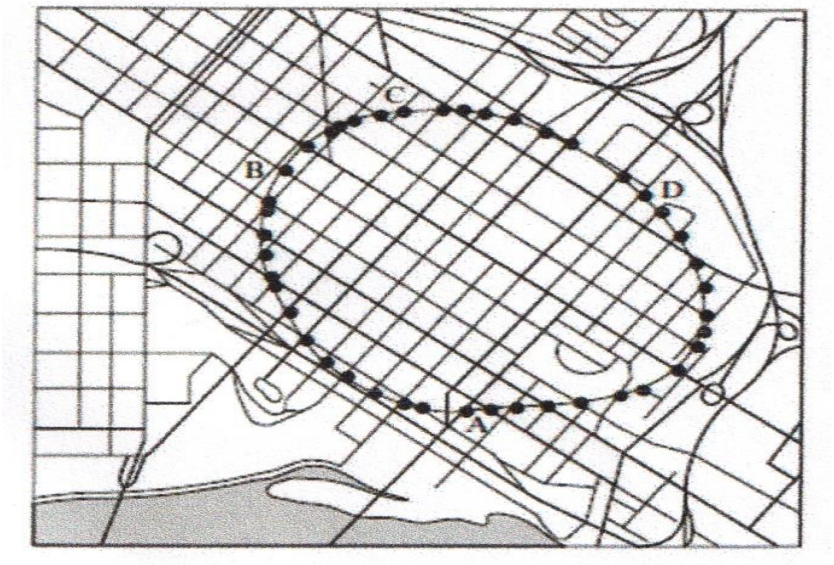


Fig.2.1 Example of Station Locations for a Cordon Count (Traffic Highway Engineering)

2.6 b. Screen Line Counts

In screen line counts, the study area is divided into large sections by running imaginary lines, known as screen lines, across it. In some cases, natural and manmade barriers, such as rivers or railway tracks, are used as screen lines. Traffic counts are then taken at each point where a road crosses the screen line. It is usual for the screen lines to be designed or chosen such that they are not crossed more than once by the same street. Collection of data at these screen-line stations at regular intervals facilitates the detection of variations in the traffic volume and traffic flow direction due to changes in the land-use pattern of the area.

2.6 c. Intersection Counts

intersection counts are taken to determine vehicle classifications, through movements, and turning movements at intersections. These data are used mainly in determining phase lengths and cycle times for signalized intersections, in the design of channelization at intersections, and in the general design of improvements to intersections.

2.6 d. Pedestrian Volume Counts

Volume counts of pedestrians are made at locations such as subway stations, midblock, and crosswalks. The counts are usually taken at these locations when the evaluation of existing or proposed pedestrian facilities is to be undertaken. Such facilities may include pedestrian overpasses or underpasses. Pedestrian counts can be made using the TDC-12 electronic manual counter described earlier and shown in Figure 1.2. The locations at which pedestrian counts are taken also include intersections, along sidewalks, and mid-block crossings. These counts can be used for crash analysis, capacity analysis, and determining minimum signal timings at signalized intersections.

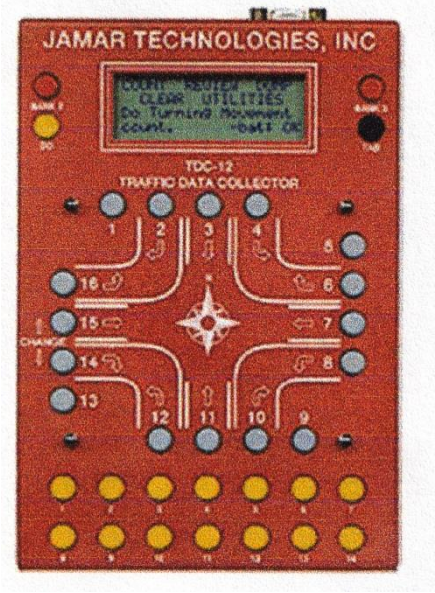


Fig2.2 TDC-12 electronic manual counter

2.6 e. Periodic Volume Counts

In order to obtain certain traffic volume data, such as AADT, it is necessary to obtain data continuously. However, it is not feasible to collect continuous data on all roads because of the cost involved. To make reasonable estimates of annual traffic volume characteristics on an area-wide basis, different types of periodic counts, with count durations ranging from 15 minutes to continuous, are conducted; the data from these different periodic counts are used to determine values that are men employed in the estimation of annual traffic characteristics. The periodic counts usually conducted are:

- Continuous
- Control
- Coverage counts.

2.6 e. i) Continuous Counts.

These counts are taken continuously using mechanical or electronic counters showed in Figure 1.3. Stations at which continuous counts are taken as permanent count stations. Tn selecting permanent count stations, the highways within the study area must first be properly classified. Each class should consist of highway links with similar traffic patterns and characteristics. A highway link is defined for traffic count purposes as a homogeneous section that has the same traffic characteristics, such as AADT and daily, weekly, and seasonal variations in traffic volumes at each point. Broad classification systems for major roads may include freeways, expressways, and major arterials. For minor roads, classifications may include residential, commercial, and industrial streets.

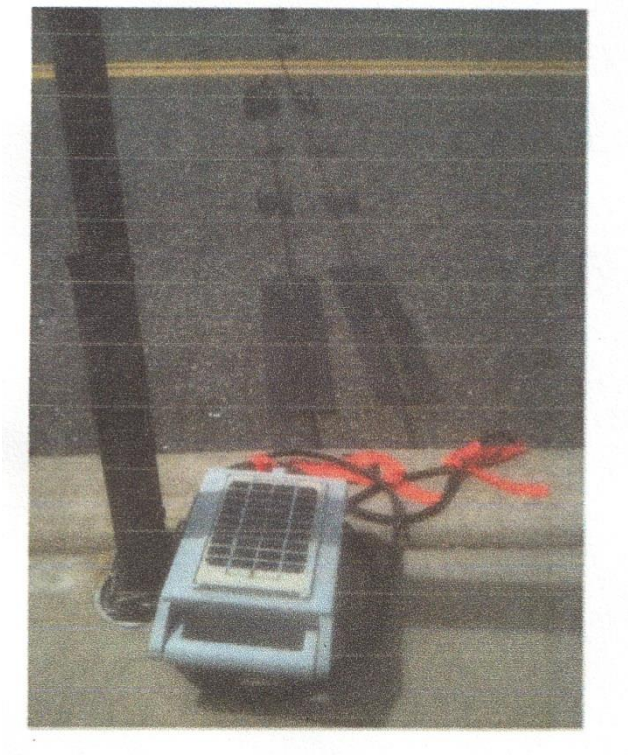


Fig 2.3 Continuous counting device

2.6 e. ii) Control Counts.

These counts are taken at stations known as control-count stations, which are strategically located so that representative samples of traffic volume can be taken on each type of highway or street in an area-wide traffic counting program. The data obtained from control counts are used to determine seasonal and monthly variations of traffic characteristics so that expansion factors can be determined. These expansion factors are used to determine year-round average values from short counts

2.7 Expansion Factors

Hourly, daily, and monthly expansion factors can be determined using data obtained at continuous count stations (Described in section 1.8. e.).

2.7 a. Hourly expansion factors

(HEFs) are determined by the formula:

$$\text{HEF} = \frac{\text{Total volume for 24 hour period}}{\text{volume for parttculer hour}}$$

These factors are used to expand counts of durations shorter than 24 hour to 24-hour volumes by multiplying the hourly volume for each hour during the count period by the HEF for that hour and finding the mean of these products

2.7 b. Daily expansion factors (DEFs) are computed as

$$\text{DEF} = \frac{\text{Aerage total volume for week}}{\text{Average volume for particular day}}$$

These factors are used to determine weekly volumes from counts of 24-hour duration by multiplying the 24-hour volume by the DBF.

2.7 c. Monthly expansion factors (MEFs) are computed as

$$MEF = \frac{AADT}{ADT\ for\ particuler\ month}$$

The AADT for a given year may be obtained from the ADT for a given month by multiplying this volume by the MEF.

2.8 **Reconnaissance survey**

2.8 a. Purpose

The main objective of reconnaissance survey is of examine the general character of he area for the purpose of determining the most feasible routes, or routes, for further more detailed **investigations.** Data collected should be adequate to examine the feasibility of all the different routes in question, as also to furnish the Engineer-in-charge with approximate estimates of quantities of costs, so as to enable him to decide on the most suitable alternative or alternatives.

The survey should also help in determining any deviations necessary in the basic geometric standards to be adopted for the highway facility.

2.8 b. Survey Method

The reconnaissance survey may be conducted in the following sequence

- Study of topographical survey sheets, agricultural, soil, geological and meteorological maps, and aerial photographs, if available.
- Aerial reconnaissance (where necessary and feasible)
- Ground reconnaissance (including another round of aerial reconnaissance for inaccessible and difficult stretches, where called for).

2.8 c. Photogrammetry support to highway engineering:

Photogrammetry technology is also useful to the highway engineer in many ways. Large scale maps on scales of 1:2,000 to 1:25,000 can be very precisely produced through photogrammetric process. The contouring can also be produce, the common intervals depending on the height of the camera. Very minute and precise measurements amounting to sub-mere accuracy can be obtained. In other words, profile (with height values) and cross-sections across highway center-line can be extracted from optical model.

2.8 d. Satellite remote sensing:

This technique is used with the help of satellites. At present, it gives resolution of the order of 6 meters. Photographic products of imagery are available from National Remote Sensing Agency, Hyderabad on scales of 1:12,500, 1:25,000 and 1:50,000. Digital products are also available in floppy cartridges and tapes. The cartridge/tape can be digitally processed in the computer and the image on the monitor can be interpreted with the possibility of enhancement of quality through manipulation of image processing software. Major advantages of satellite imagery is its repeatability as orbiting satellites visit the same spot on earth every few weeks. Thus, the latest information regarding the physical features (like, the extent of a town or urban area, etc.) can be obtained to update on available map. The information on natural resources namely, geology, geomorphoiogy, land use, soil status (waterlogging, erosion, etc.), drainage, forest extent, etc. as available may be most useful input for the planners of highway alignment.

2.8 e. Smaif format aerial photography (SFAP):

In case of large projects with mapping as one of the main objectives conventional aerial photography in traditional format (23 cm x 23 cm) may also be useful. There are at least there known agencies India for such aerial photography, namely he National Remote Sensing Agency (NRSA), Hyderabad, Air Survey Company, Calcutta and the India Air Force. All aerial photography work requires clearance from the Ministry of Defense. The major advantages of SFAP are:- Very large scale true color photography can be done in scales up to

1:1,000 to 1:2,000 (up to scales of 1:10,000). Acquisition plan alongside highways can be suitably made in scale of 1:4,000. Monitoring of urban areas, villages and environment along the corridor are possible at comparatively lower cost than ground surveys.

2.8 f. Aerial Reconnaissance

An aerial reconnaissance will provide a bird's eye view of eh alignments under consideration along with the surrounding area. It will help to identify factors which call for rejection or modification of any of the alignment. Final decision about the alignments to be studied in detail on the ground could be taken on the basis of the aerial reconnaissance.



Fig2.4: Aerial Reconnaissance

2.8 g. Ground Reconnaissance

The various alternative routes located as a result of the map study are further examined in the field by ground reconnaissance. As such, this part of the survey is an important link in the chain of activities leading to selection of the final route.

General reconnaissance consists of general examination of the ground walking or riding along the probable route and collecting all available information necessary for evaluating the same, hi the case of hill sections, it may sometime be advantageous to start the reconnaissance from the obligatory point situated close to the top. If an area is inaccessible for the purposes of ground reconnaissance, recourse may have to aerial reconnaissance to clear the doubts.

While carrying out ground reconnaissance, it is advisable to leave reference pegs to facilitate further survey operations.

2.8 h. Instruments for reconnaissance survey

instruments generally used during ground reconnaissance include compass, Abney level/Altimeter, Pedometer, Aneroid barometer, Clinometers, Ghat trace, etc. Walkie-talkie sets, mobile phone and pagers are useful for communication, particularly in difficult terrain. Use of the instruments mentioned above to obtain ground slopes, maximum gradients, elevation of critical summits or stream crossing, and location of obligatory points, serve as a check on the maps being used. In difficult hilly and forest terrain assistance of new technology, like Global Position System (GPS) or Differential GPS (DGPS) may also be taken where the magnitude and importance of the work justify their provision. GPS is a comparatively new technology which utilizes the satellites orbiting around the earth. A minimum of four satellites are needed to indicate the coordinates (X, Y, Z) on the ground at any time of day and night with accuracy of a few centimeters, two geo-receivers are sued and this mode of using two GPS is known as differential GPS (DGPS).

2.9 METHODS FOR VOLUME SURVEY

There are two major methods of counting vehicle for volume survey. They are-

- Manual Counting Method and
- Automatic counting method.

2.9. a. Manual Counting Method

In this method, vehicles are counted manually. There are two methods of manual counting:

- Direct Method and

- Indirect Method.

2.9.a. i)Direct Method:

Data is counted by using 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 long duration count and when flow is high. Error is common especially when volume is high. Count cannot be cross checked. Count cannot be done in bad weather.

1.9.a. ii)Indirect Method.

In this method, data is collected using video camera. Video is captured for long time and data is collected later by rewinding.

- Advantages: Besides traffic volume, several traffic parameters can be obtained from recorded film. Data can be cross checked and quality can be ensured. This method is applicable when volume is high. It is suitable for non-lane based traffic operation.

- Disadvantages: A suitable elevated place is required for filming operation. Data cannot be used immediately after collection. Data must be manually transcripted of recorded film. This process is time consuming and tedious. Because of limitation of capacity of film, it is not suitable for long duration counts. Quality of video recorded on film is dependent on intensity of light and this method is not suitable in overcast days.

2.9.b. Automatic counting method:

In this method, vehicles are counted automatically without any human involvement. There are two techniques of automatic counting: a) Contact system based on pneumatic, mechanical, magnetic or piezo-electric method and b) Contactless system based on electrical/optical, ultrasound/infrared radar, micro wave, CCTV/video image processing method etc.

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

2.10. Counting periods:

Vehicles can be counted for any duration. Duration of count depends on the objective of data collection. For traffic control and management or operational studies short duration count at peak period is conducted. For planning and design purpose, long duration count is conducted. For our study purpose we collected volume data for 15 minutes, spot speed data for 30 minutes and travel speed data for 30 minutes. In total we spent 1 hour 15 minutes for collecting data

Determination of Number of Count Stations

The minimum sample size depends on the precision level desired. The commonly used precision level for volume counts is *95-5*. When the sample size is less than 30 and the selection of counting stations is random, a distribution known as the student's *t* distribution may be used to determine the sample size for each class of highway links. The student's *t* distribution is unbounded (with a mean of zero) and has a variance that depends on the scale parameter, commonly referred to as the degrees of freedom (v).The degrees of freedom (v) is a function of the sample size; v *N* I for the student's *t*

distribution. The variance of the student's *t* distribution is, which indicates

approaches infinity, the variance approaches 1.

Assuming that the sampling locations are randomly selected, the minimum sample number is given as

$$n = \frac{(t)^2 x (s)^2}{NxNi(d)^2}$$

where,

n = minimum number of count locations required

t = value of the student's *t* distribution with (1 - a/2) confidence level *(N-l* degrees

of freedom) *N* = total number of links (population) from which a sample is to be selected

a = significance level

S- estimate of the spatial standard deviation of the link volumes *d* = allowable range of error

2.11 Previous works

The present study is essentially about the importance of traffic volume in traffic engineering of urban and suburban road links, in particular the literature on effect of traffic volume, speed-flow relationships, passenger car equivalents, peak hour factor, flow variations and traffic capacity and level of serviceability (LOS).

Van Aerde (1995) presented a generic **speed-flow-density** relationship, which was successfully applied and calibrated for both freeways and arterials in both the micro and the macro domains. The model is a single regime model, but appears to be able to describe both congested and un- congested traffic conditions. The model described by Van Aerde, however, is flexible enough to allow **speeds at capacity to be set in excess of Greenshields value of half the free-flow speed** and to allow **jam density to be specified,** hi other words, the Greenshields model can be described as being a special case of the more general Van Aerde model. Various curves for a freeway in Twin Cities, USA is shown in Figure 2.2.

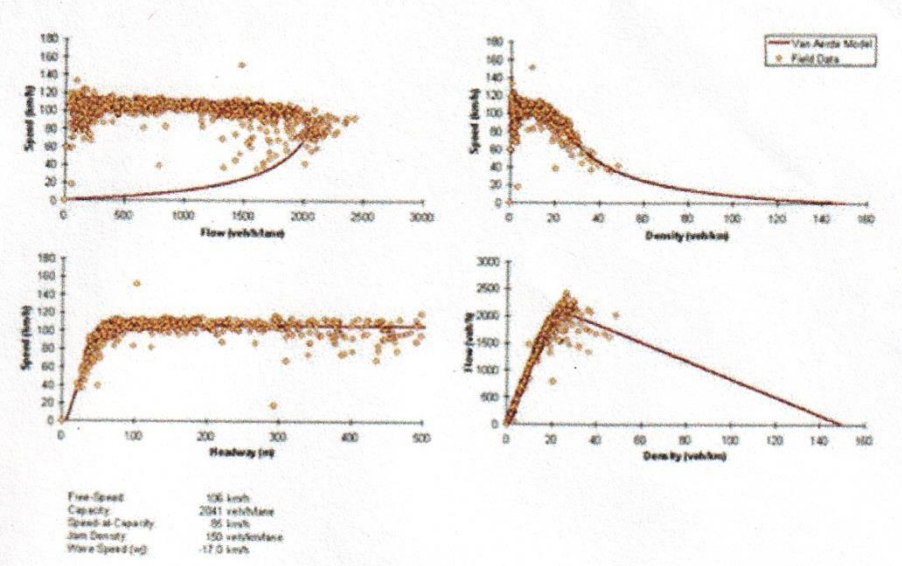


Figure 2.5 Van Curves to Freeway Data (Twin Cities, USA) **(van Aerde, 1995)**

Satyanarayana (2012) studied the effect of traffic volume, its composition and stream speed on passenger car equivalents . 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 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. Compositional share of 2W at different locations were observed in the range of 31.69% to 34.23% whereas increase in PCU values are 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 decreasing in the compositional share in the stream.

V.T Hamizh Arasan and Krishnamurthy (2008) provided an insight into the complexity of the vehicular interaction in heterogeneous traffic. The PCU estimates, made through microscopic of simulation, for the different types of vehicles of heterogeneous traffic, for a wide range traffic volume and roadway conditions indicate that the PCU value of a vehicle significantly changes with change in traffic volume and width of roadway.

Ahmed Al-Kaisy (2005) found that the HCM suggested PCU factors for heavy vehicles is applicable only under free-flow conditions and hence, attempted to derive

passenger ear equivalents for heavy vehicles during congestion. It is found from the review of the literature that several studies on estimation of PCU values of vehicles in heterogeneous traffic have been conducted.

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

Maitra (1999) proposed 10 levels of services with 9 in a stable flow zone (conventional LOS A to E region) and one representing the unstable flow (presently LOS F), as a means of quantifying congestion on urban roads. They estimated capacity values of study locations on urban roads as 3,500 and 4,500 PCU per how for road widths of 7.0 and 10.3 m respectively in one direction.

Marwah and Bhuvanesh (2000) suggested level of service classification for urban heterogeneous traffic. They considered journey speed of cars, journey speed of motorised two wheelers, concentration, and road occupancy to define LOS.

Chandra.S and Prasad N.V (2004) found that the PCU factors calculated at different sections of urban roads vary substantially across the sections. Capacity varies with physical and traffic conditions and traffic composition. Capacity of a multilane divided urban road increases linearly with increase in the proportion of two-wheelers in traffic stream. It is estimated that capacity of an urban road section increases by approximately 9 percent for every 10 percent increase in the proportion of 2-wheeler. The capacity of a section with side friction is approximately 12 percent lower as compared to a section with no side friction.

Central Road Research Institute (CRRI), (1988) New Delhi to determine the PCU value for different types of vehicles comprises of linear regression of the speed of cars with volume of different categories of vehicles. The method suggests collection of large amount of data on speed of cars under traffic volume and composition and fitting multiple linear regression equations.

Ramanayya (1988) developed a computer simulation model relating average speeds of the traffic stream, the traffic volume and composition of traffic stream. The model

could recognize eight different categories of vehicles in the stream and it could be run for any combination of slow and fast moving vehicles. Traffic stream models, relating speed of vehicle type with flow and percentage of slow moving vehicles, were developed for each vehicle type. The models, so derived are given in the following equations.

Year - 101.42 - 21.48 log Q - 30.38P
Vbus = 95.12 - 20.75 log Q - 30.39P
Vtruck =92.8 - 21.81 log Q - 19.61P
Vauto =85.0 - 18.35 log Q - 30.02P
Vmotorcycle =85.9- 16.7 log Q - 23.41P
Where,
V= average speed (km/hr),
Q- average traffic flow (veh/hr),
P= percentage of slow moving vehicles in the traffic stream.

The above relationships indicate that proportion of slow moving vehicles has negative effect on speed of a vehicle type. Using the above relationships, design vehicle units (DVU) were derived in terms of western passenger car and these are given in Table

the corresponding value for bus. Also, the design vehicle unit for scooter is more than that for auto rickshaw. The physical size of auto is 3 times more than the projected rectangular area of a scooter and therefore, more DVUs for the latter seems to be misleading.

Tanaboriboon and Aryai (1990) studied the effect of vehicle size on capacity of multilane highway in Thailand. All vehicles moving on the road were classified in to three major categories; small, medium and large. Headway was observed for different combinations of leading and trailing vehicles and the basic capacity was determined by considering the reciprocal of the average minimum time headway adopted by small vehicle. Medium sized vehicles were not found to have affected the lane capacity in any way, but the presence of large vehicle, had an adverse impact on the traffic stream. The average headway was found to have increased with an increase in the percentage of large vehicles in stream. This in turn, led to reduction in capacity of the traffic lane.

Chandra S, Kumar V and Sikdar (1995) made a comprehensive study on capacity of urban roads. It was emphasized that PCU values for vehicle type is dynamic in nature and depends on all factors affecting the behavior of vehicle in the traffic stream. Data collected at various 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 increase in its own proportion in the traffic stream.

Parker (1996) observed that knowledge of traffic composition plays an important role in determining capacity. It was found that the percentage of heavy goods vehicles (HGVs) within traffic stream has a major effect on capacity due to length, limited maneuverability, lower desired speed and engine power to weight ratio. As the presence of HGVs in the traffic stream increases, the capacity reduces in term of **throughout** of vehicle per hour.

Chandra and Sikdar (2000) observed that PCU for a vehicle type is mainly controlled by homogeneity/ heterogeneity of the traffic stream, which in turn, depend upon the relative proportion of different types of vehicle. The basic philosophy involved in the development of concept of dynamic PCU was that capacity estimation in a common unit must be same irrespective of stream composition under given physical and control conditions. They developed a computer program to evaluate PCU for a vehicle type of urban roads.

Golias (2003) examined the influence of taxi behavior on urban traffic conditions. Using computer simulation and the Taxi Equivalence Factor (TEF), a concept similar to the passenger cat equivalents for heavy vehicles, the impacts of taxi traffic on the capacity, and delays at urban road sections is quantified. The taxi equivalence factor is based either on capacity or on delay. Simulated and field data were used to derive TEF and sensitivity analysis is carried out in relation to a variety of traffic parameters. The findings suggest that the most important factor influencing the TEF related to traffic conditions is the number of traffic lanes. In particular, increase in vehicle travel time increases for one lane roadways in the presence of taxis may exceed those corresponding for two lane road by up to about 40%. An increase in the v/c ratio from 0.8 to 1.0 causes increases in the delay-based TEF values that may reach up to about 90%, The TEF decreases again, indicating that as the system becomes saturated, the effect of taxis on traffic decreases.

Basil D, Maitra S.K (2006) studied the effect of traffic volume and its composition on Passenger Car Equivalency (PCE). Taking the stream speed as Measure of Equivalence (MOE), a methodology is demonstrated for the estimation of PCE. The reduction in stream speed caused by marginal increment in traffic volume by a vehicle type is compared with that of caused by an old technology car, which is taken as the reference vehicle for the estimation of PCE. The study reveals that PCE is affected by traffic volume and its composition. For all vehicle types, PCE values are found to increase with an increase in traffic volume, but the effect is predominant for heavy vehicles. The PCE of two wheelers practically remains unaffected by its compositional share in the traffic stream.

Arkatkar (2011) studied the effect of variation of traffic volume, road width, magnitude of upgrade and its length on PCU value, by using traffic-flow simulation model HETEROSIM. Field data collected on traffic flow characteristics are used in calibration and validation of the simulation model. The validated simulation model is then used to derive PCU values for different types of vehicles and it indicate that the model is capable of replicating the heterogeneous traffic flow on mid-block sections of intercity roads, for different roadway conditions, to a satisfactory extent.

Andrew P, Tarko and Rafaell (2005) investigated the variability of PHF over time and across locations. The day-to-day variability of PHF was found to be as strong as tile site-to-site variability. This finding prompts for estimating the PHF based on multiple field measurements or, where measurements are not possible, for using a model that return s the average value of PHF. This paper presents such a model, which links PHF with hourly volume, population, and time of day, and demonstrates that a large portion of the variability in the sample of observations can either be explained with the model or be attributed to the day-to -day fluctuation.

The Highway Capacity Manual advises that in the absence of field measurements, reasonable approximations for the PHF may be made as follows: 0.95 for congested conditions, 0.92 for urban areas, and 0.88 for rural areas. General guidelines for determining future peak hour factors can be found in the Development Review Guidelines, and are summarized as follows: 0.85 for Minor Street inflows and outflows, 0.90 for Minor Arterials, 0.95 for Major Streets, unless better information is available.

CHAPTER 3
Methodology

- **Selection of Study Area**
- **Data Collection**
- **Data Analysis**
- **Result of the Study**
- **Conclusion and Recommendation**

Location: Location of the spot for traffic volume survey was chosen to be **Mirpur Section-1.** To **Science Lab**

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 26 and 27 May 2021. It was Wednesday and Thursday and it was a weekday.

Time: Time of data collection for volume study was different for different groups however for group the time was from 10:00 am to 4:00 pm

Weather Condition: It was initially a sunny day but afterwards it became cloudy.

Observation: Classified Vehicle Counts.

Method: Direct Manual Method.

Duration: 1 HOUR

Equipment: Stop watch, Tally sheet. Clip board, video camera etc. (A blank tally sheet is provided in the appendix)

Number of Enumerators: Six

Methodology of reconnaissance survey

Before going for the actual work we have conducted a reconnaissance survey on the previous day of actual work. Due to lack of instruments we could not adopt any of the methods described in section 2.9. We just visited the spot of study and divided the whole road length into five equal sections. And then we have selected the reference points where we collected volume data. And on the day of operation we went directly to the spot and collected volume data. But if we could conduct the actual reconnaissance work then we would have good understanding of the whole formation of the study zone.

STUDY AREA

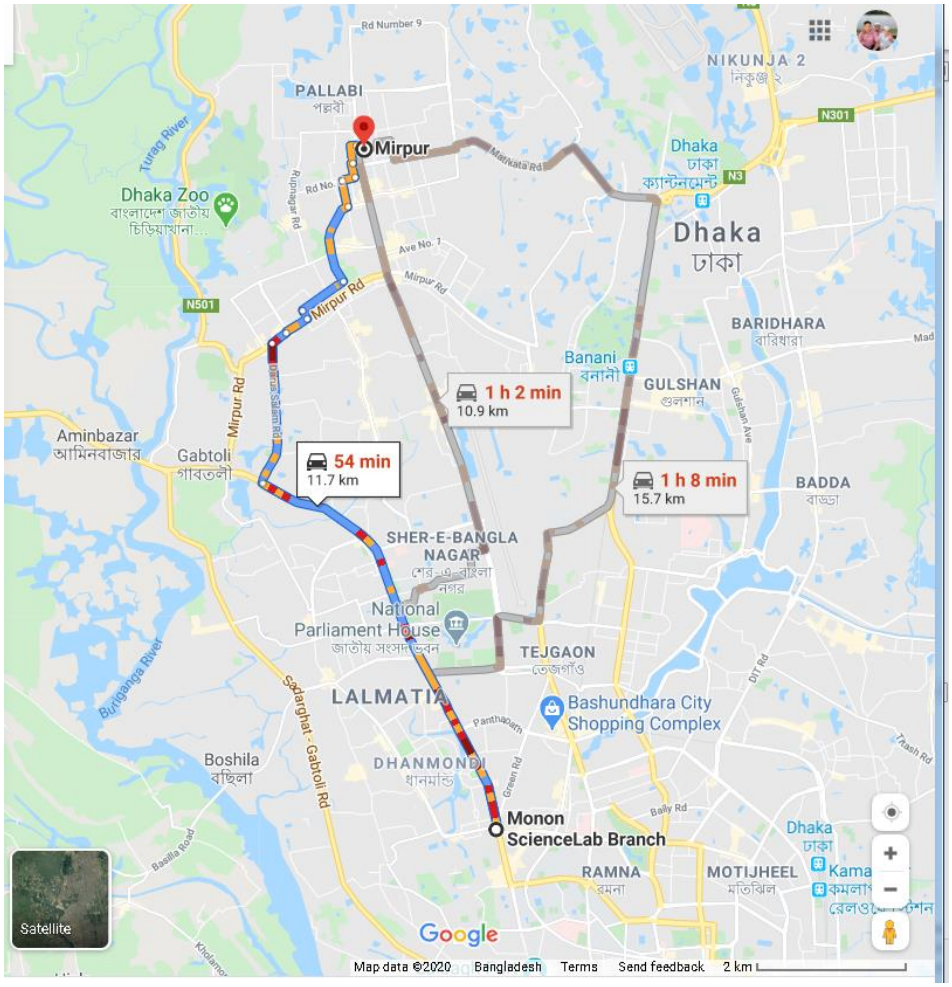


Fig: 3.1 Study Area on Google Map (**Mirpur -1 to Science lab)**

CHAPTER 4

Results and Discussion

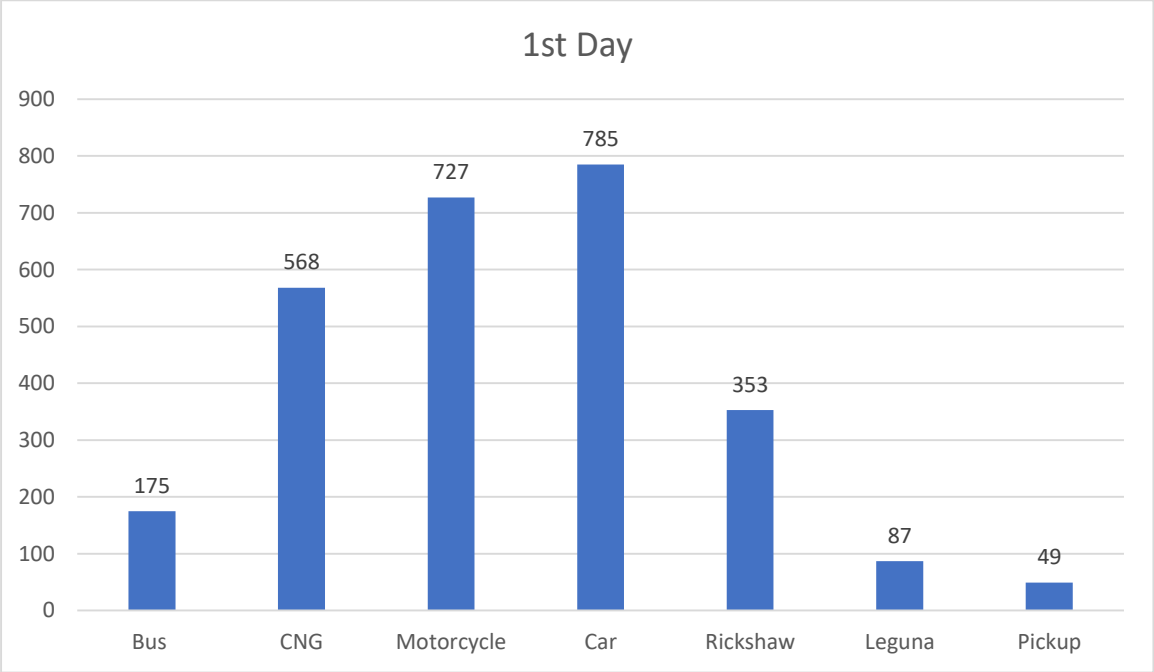


Fig 4.0: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (10.00 AM-11.00 AM)

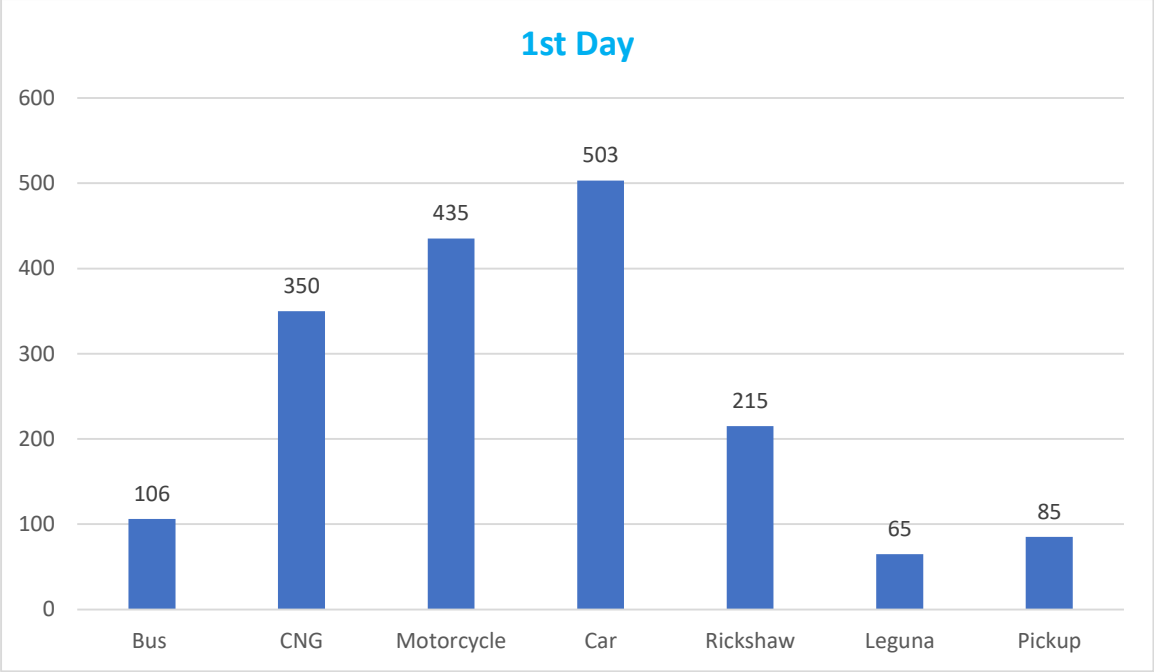


Fig 4.1: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (11.00 AM-12.00 PM)

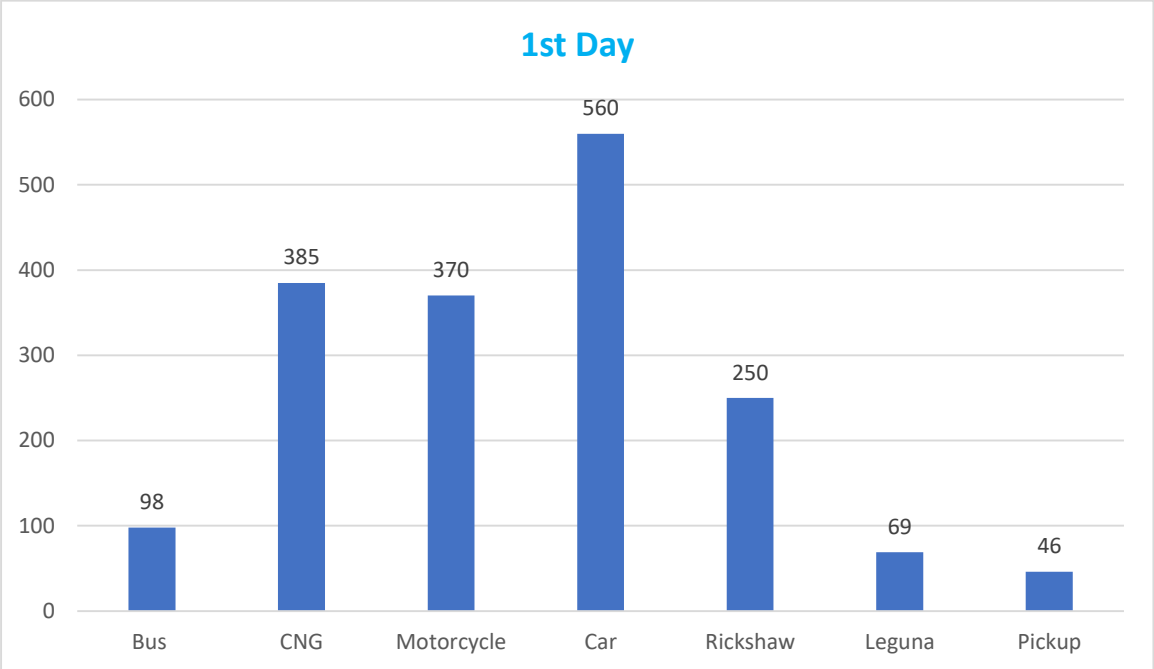


Fig 4.2: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (12.00 PM-1.00 PM)

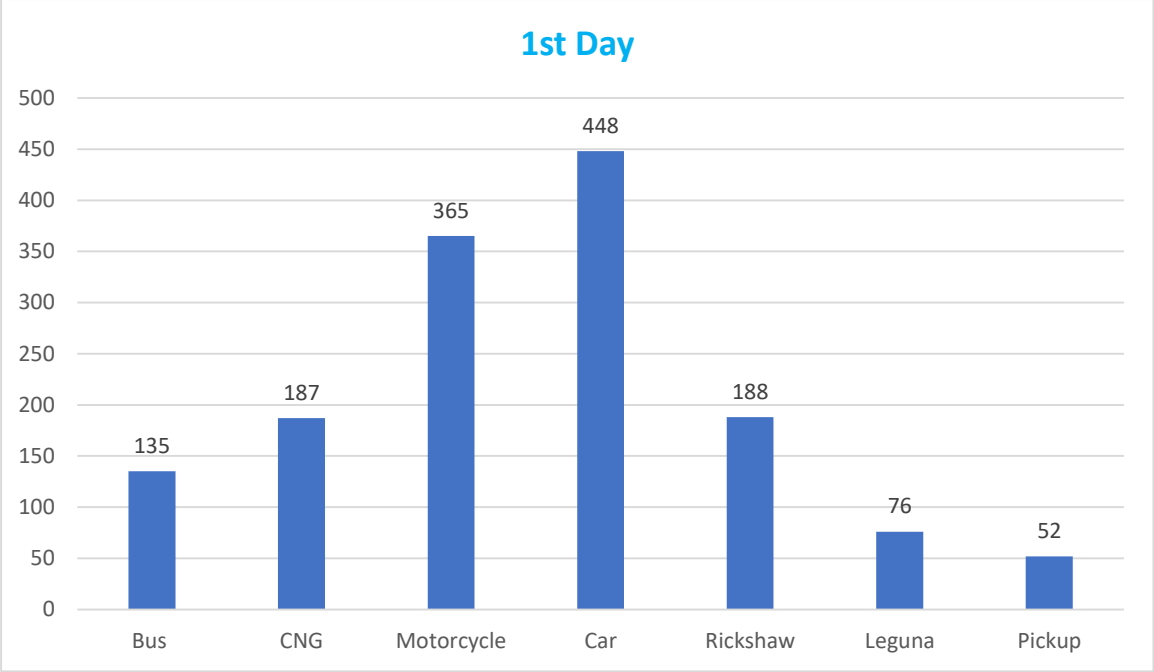


Fig 4.3: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (1.00 PM-2.00 PM)

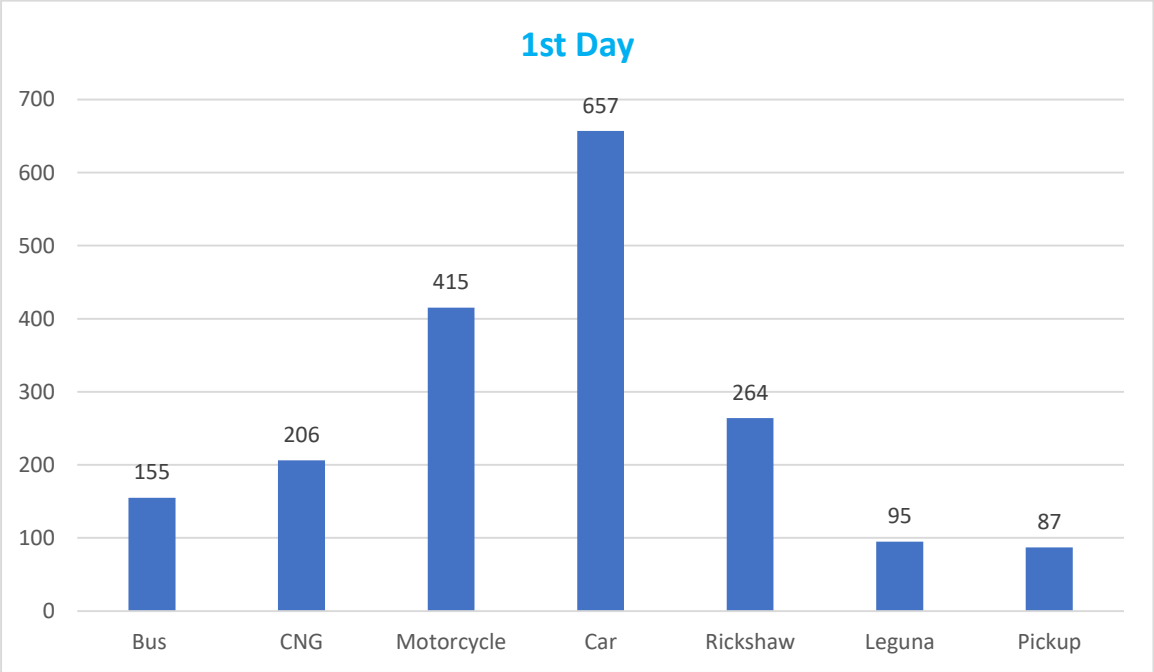


Fig 4.4: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (2.00 PM-3.00 PM)

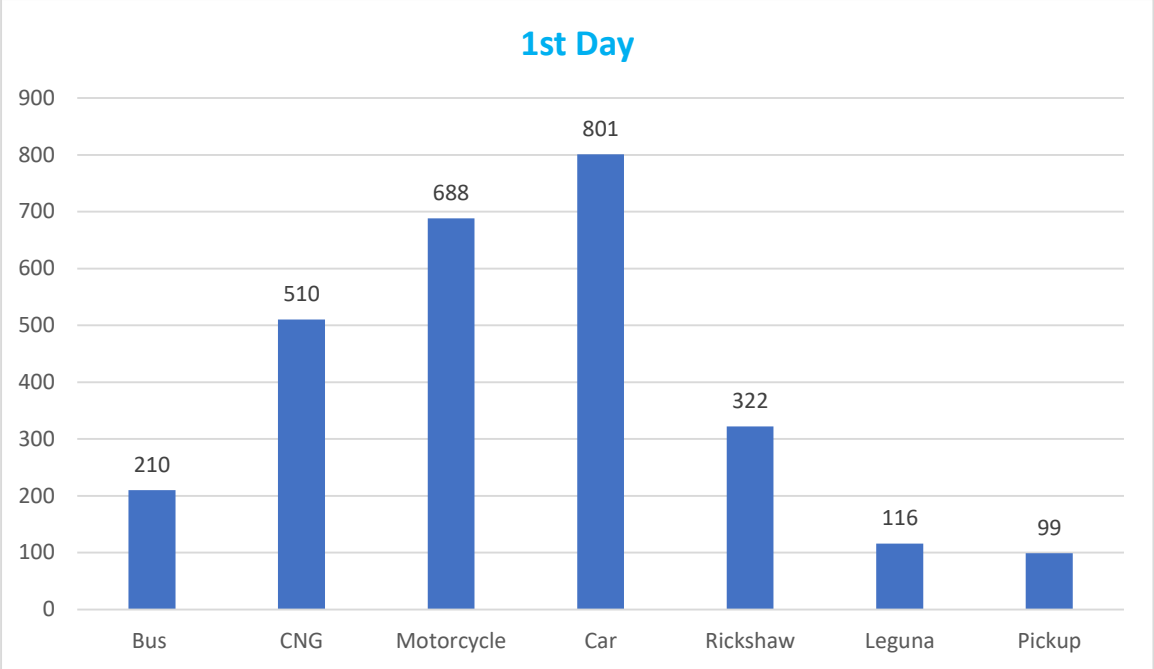


Fig 4.5: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (3.00 PM-4.00 PM)

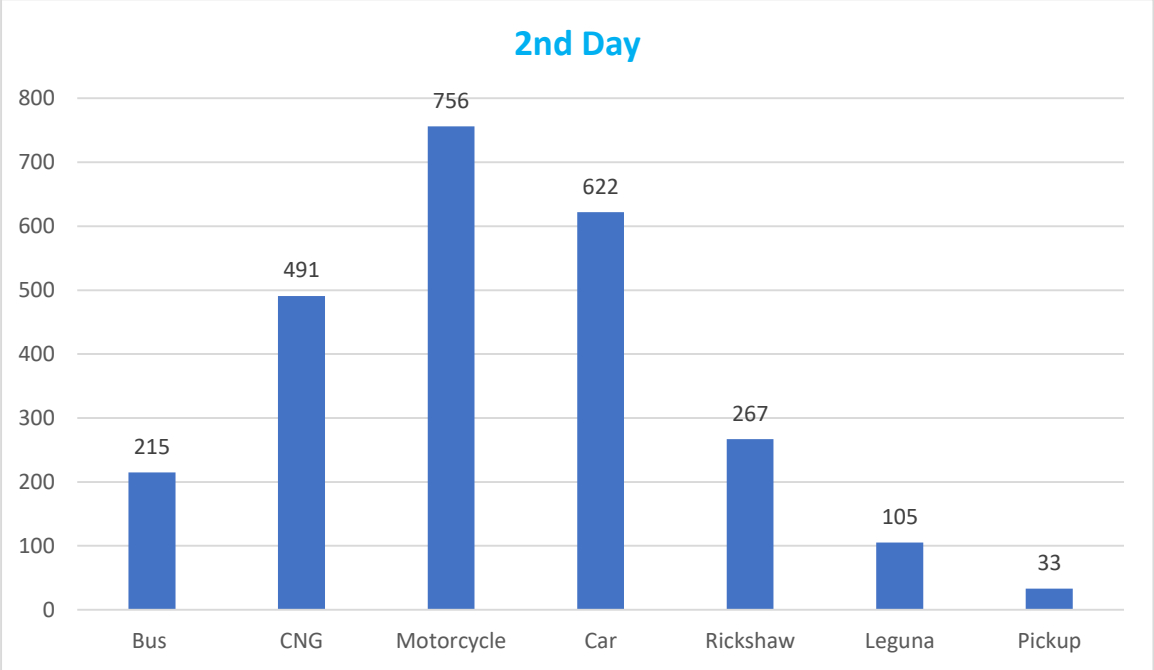


Fig 4.6: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (10.00 AM-11.00 AM)

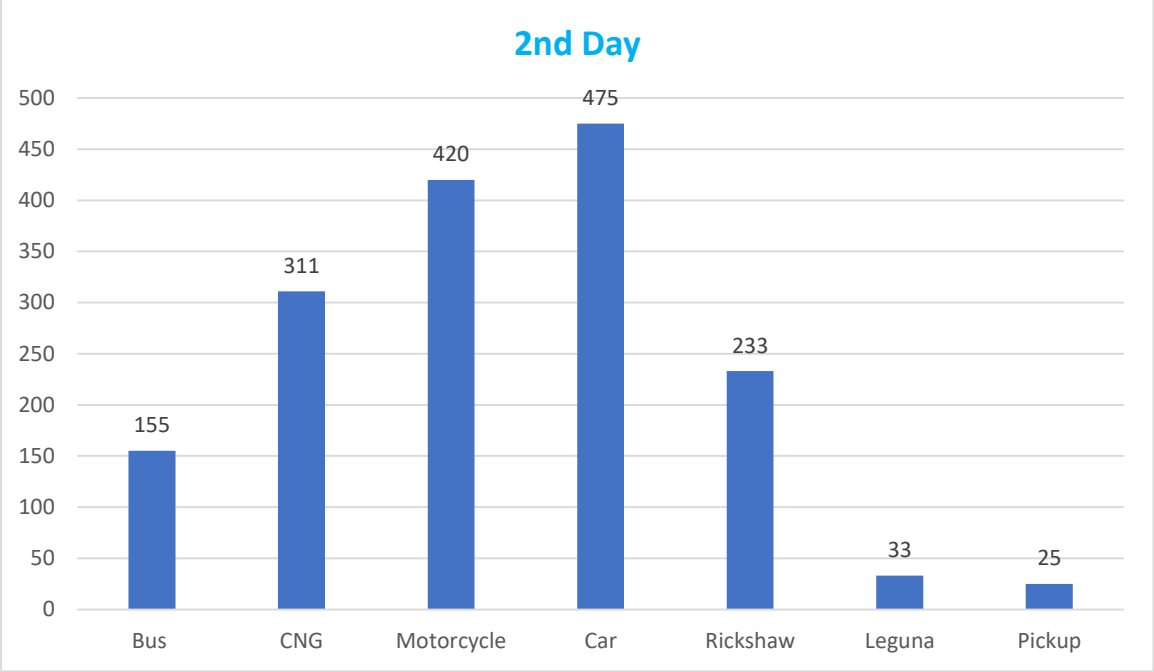


Fig 4.7: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (11.00 AM-12.00 PM)

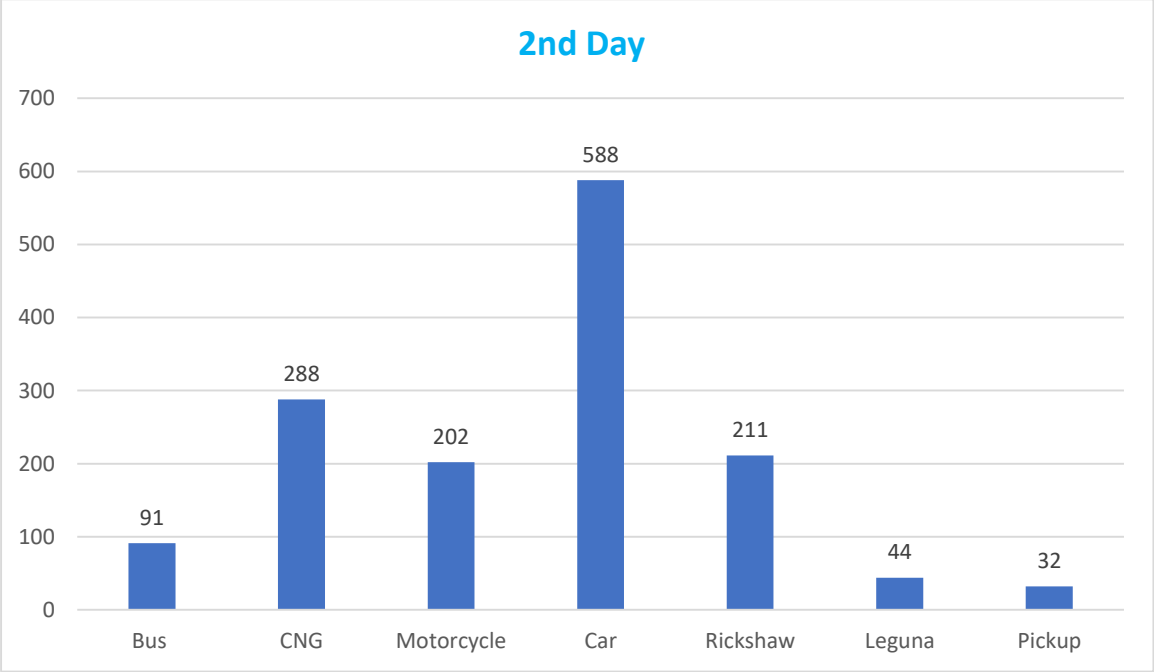


Fig 4.8: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time(12.00PM-1.00PM)

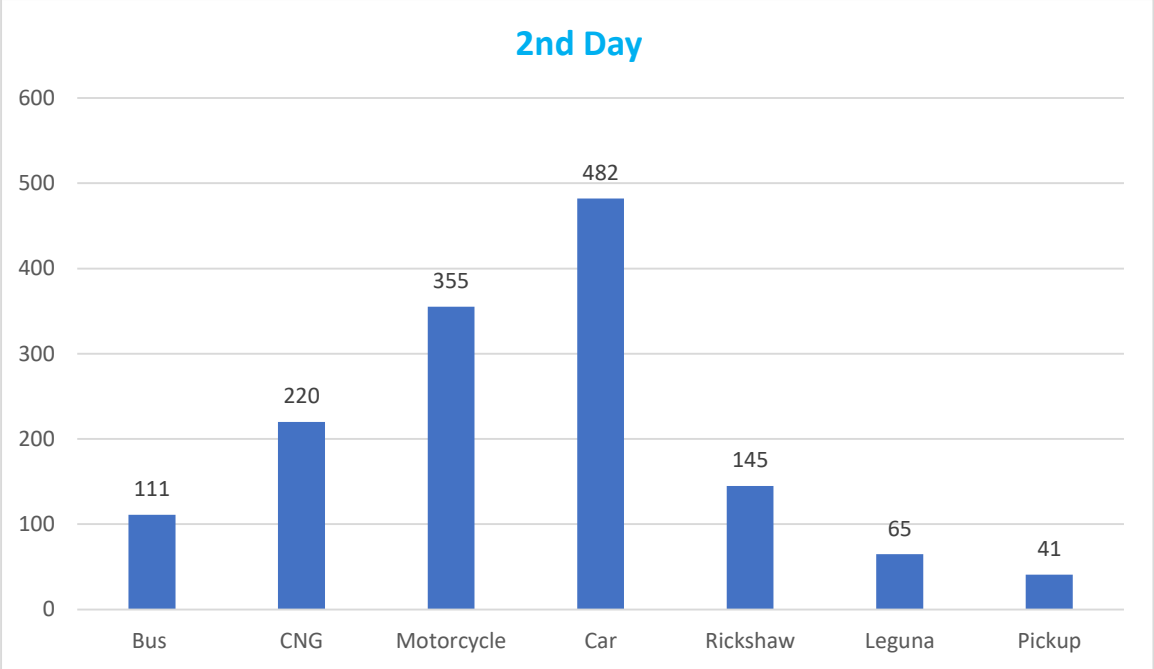


Fig 4.9: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (1.00 PM-2.00 PM)

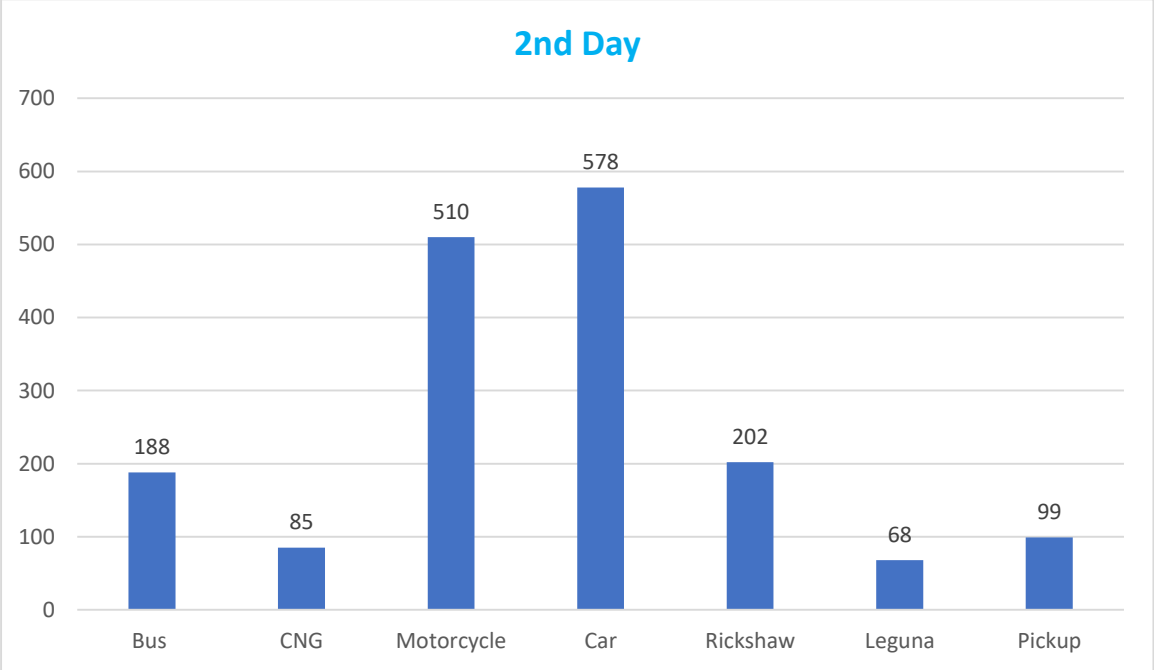


Fig 4.10: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (2.00 PM-3.00 PM)

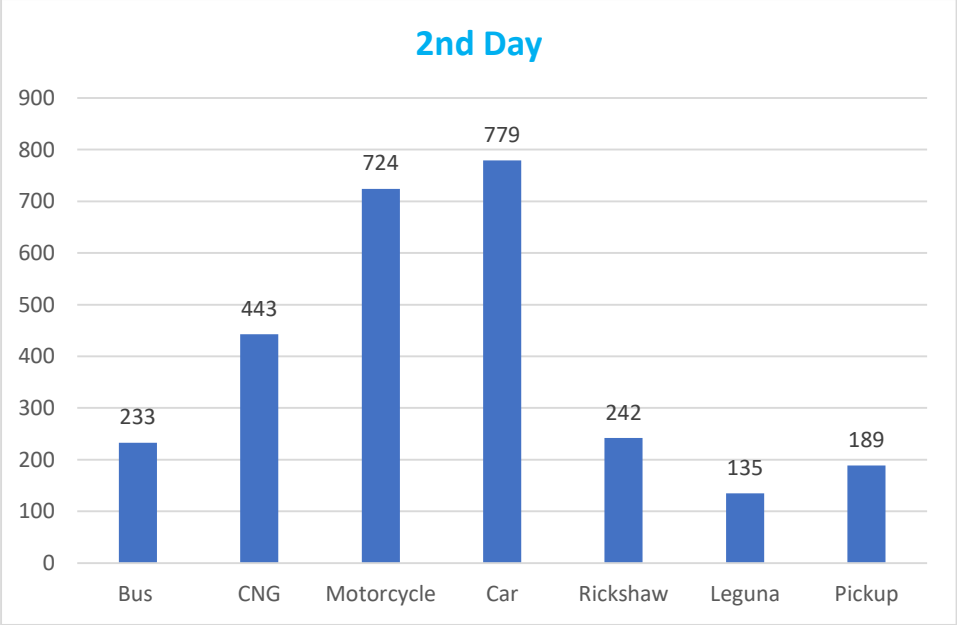


Fig 4.11: Traffic Count at Science Lab, # Science Lab to Mirpur Road Time (3.00 PM-4.00 PM)

1st Working Day (26.05.2021) (10.00 AM-4.00 PM)			
Vehicle Type	**Total Number of Vehicle per day**	**PEC Value (IRC)**	**(Passenger Car Unit) PCU/hr.**
Bus	879	3.5	1538
CNG	2206	0.8	882
Motorcycle	3000	0.5	750
Car	3754	1	1877
Rickshaw	1592	0.8	637
Laguna	508	0.8	203
Pickup	418	3.5	732

Table 4.12: PCU/hr. calculation Science Lab to Mirpur-01

2nd Working Day (27.05.2021) (10.00 AM-4.00 PM)			
Vehicle Type	**Total Number of Vehicle per day**	**PEC Value (IRC)**	**(Passenger Car Unit) PCU/hr.**
Bus	993	3.5	1738
CNG	1838	0.8	735
Motorcycle	2967	0.5	742
Car	3524	1	1762
Rickshaw	1300	0.8	520
Laguna	450	0.8	180
Pickup	419	3.5	733

Table 4.13: PCU/hr. calculation Science Lab to Mirpur-01

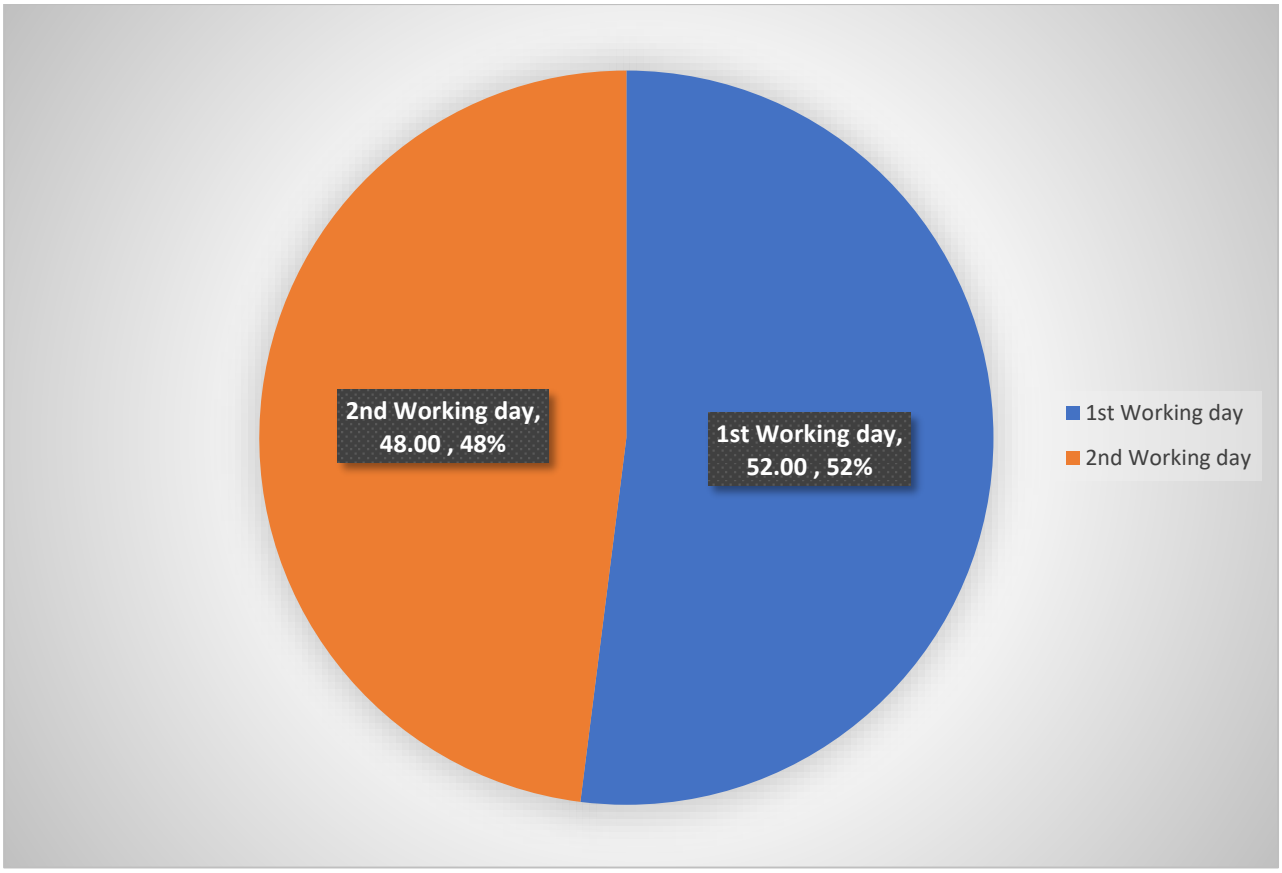


Fig 4.14: Direction Distribution (On Working Day).

RESULT

1. Traffic Composition is shown in Chart.

2. Average Daily Traffic **(ADT):** 11924 PCU.

3. Directional Distribution **(DD):**

1st Working Day

Science Lab to Mirpur- 01 (52%)

2nd Working Day

Science Lab to Mirpur- 01 (48%)

CHAPTER 5
Conclusions and Future Works

The following conclusions are drawn from present study.

5.1. Discussion on vehicle composition:

Vehicle composition shows that most of the vehicles in the traffic stream were light vehicles. Only twenty seven percent (27%) was buses. The reason for high proportion of light vehicle is the proximity of the location to residential area of high-income group people. The light vehicles were not highly occupied. But buses were almost fully occupied and people were travelling by standing due to lack of seat in them. It can be assumed that, more people were travelling by bus though their occurrences were low. We were settled on a suggestion that if the number of busses could be increased then the traffic system would become more efficient. Again we saw that the busses were very much old and some of them did not have smooth front glasses. So a huge modification is recommended in the public transportation system.

5.2. Discussion on directional distribution:

48 percent of traffic flow was towards flyover which indicates tidal flow towards Mirpr-1. It was morning rush hour. So, flow was higher towards the city center. Only 52 percent of traffic was flowing towards Technical. If another vehicle count was done in evening rush hour, opposite scenario would have been seen.

5.3. Discussion on flow fluctuation:

To draw flow fluctuation curve, it was assumed that volume for five continuous hotu-s were counted, although all vehicles were counted within one hour and fifteen minutes. Each

group counted vehicles for 15 minutes. Flow rate was calculated from that short count data and plotted. The average flow fluctuation curve shows two peaks at 10:00-11:00 hrs and 12:00-13:00hrs.

5. 4 Recommendations

1. Optimum vehicle composition of a traffic flow consists of 40% public transport or BUS while there was only 27% public transport in our study road.

2. The buses we observed on the road were too much old that they could not maneuver easily although the maneuverability of buses is originally low. So replacing these old buses with new ones is highly recommended.

3. Bicycle should have specific lanes of their own which typically is placed beside the footpath/shoulder. But there was not any specific lane in the road we studied. So it is recommended mat a lane system should be introduced to increase efficiency of the road at the same time there should be a bicycle specific lane.

4. NMT or electrical low speed vehicles should not be permitted in this type of arterial road. Although they typically travel on the left lane but they create a drag force which slows down the high speed vehicles which creates congestion.

4. There were some large container trucks observed on the road. Congestion can be slightly avoided if these vehicles were allowed only at off peak hours

5.5 Limitations

1. The Study based on manual count that is irreversible.
2. The number of team members was less. If it was more, it gives more accurate result.
3. We counted vehicles at peak period, for one hour duration. If it becomes more, give more accurate result.

5.6 Recommendations for future work

1, The present study is focused mainly on traffic volume only. Speed-flow studies are useful to evaluate the more parameters. There is a scope on speed flow studies on urban road links for future work.

2. Sensor can be used to count Traffic.

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APPENDIX

Traffic Volume Some Solation Example:

1. Flyover Bridge



Advantage

1.Provides for two-phase signals with short cycle lengths, significantly reducing delay.

2. Operate fast, efficient, economic, comfortable, modern and reliable road transport system in the country.

3. Help develop road transport system in the private sector.

4. Play essential role as the controlling outfit for better and quality service within government fare and freight structure in road transport sector in the country.

5. Development of transport facilities like Mass Rapid Play strategic interventional role for sustaining better and disciplined road transport system in the country. To reduce the travel time.



Disadvantage

1. Construction of flyover causes loss of lands

2.The significant damage of infrastructure of private and public property.

3. There is evidence that health hazards may potentially occurred.

4. There are also a number of impacts on environment.

5.Noise and air pollution increased on the adjacent areas.

6.Accident increased on the adjacent areas.

7.Traffic congestion increased on the surrounding areas.

2. Cable Bus



Advantage

1. Reliable, Fail-Safe Power. For over five decades, Cable Bus has demonstrated its superior reliability in the power generation, mining, petrochemical, paper, heavy industrial and commercial industries.

2. Cost-Effective & Energy Efficient.

3. Flexible & Versatile.

4. Easy to Install.

Disadvantages:

1. if the main cable fails or gets damaged the whole network will fail.
2. as more workstations are connected the performance of the network will become slower because of data collisions.
3. every workstation on the network "sees" all of the data on the network – this is a security risk.

4. Underpasses

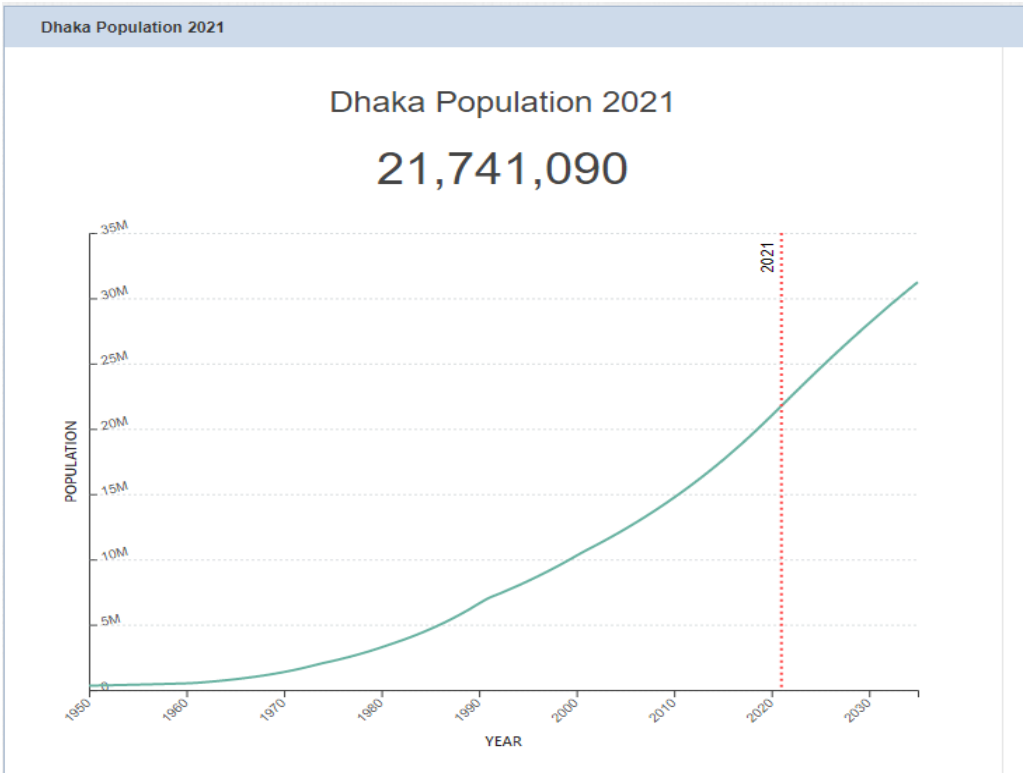


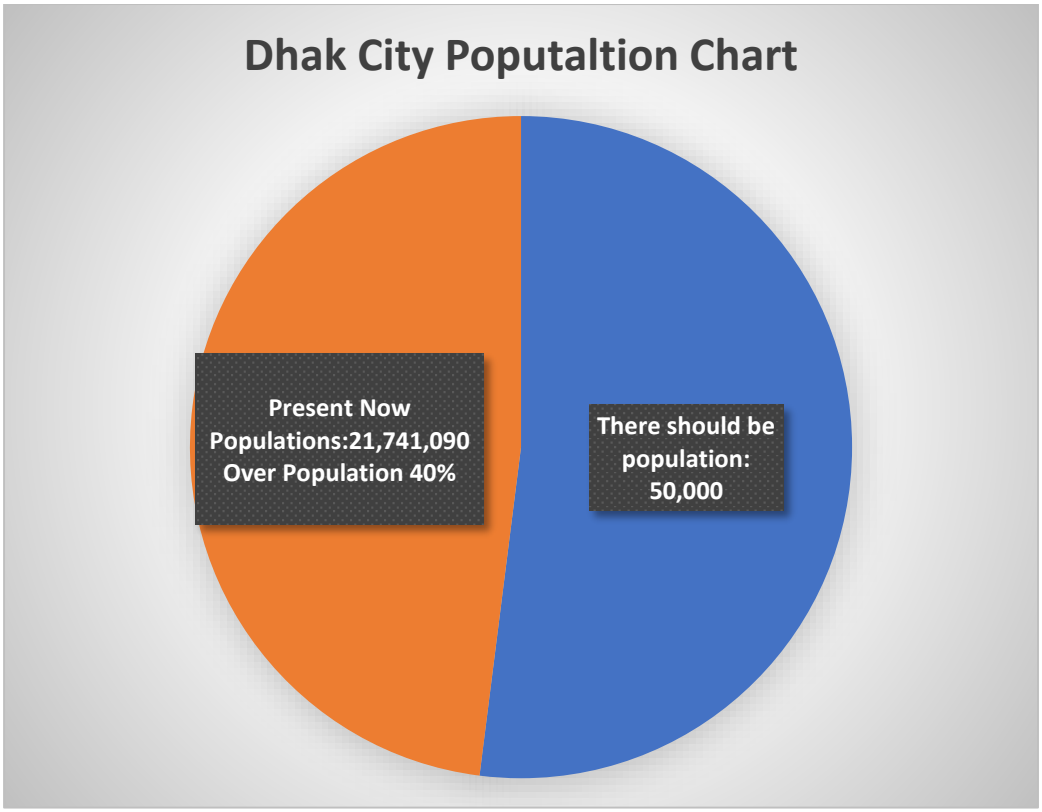
Advantage

- There are no interactions with motor traffic,
- at all - no chance of people being hit attempting to
- cross the road instead of waiting for a green signal to cross,
- for instance. Underpasses are more direct.
- They can run under roads in the exact direction they are required.

Disadvantages

- underpasses are susceptible to flooding and can become unusable
- if not routinely maintained. Reduced pedestrian/vehicular conflict.
- Can help to reduce fatal and serious injuries involving pedestrians and bicyclists.





To minimize the traffic problem in this city we can take following measures:

1.Offices, hospitals, school –colleges, garments etc. can be decentralized from Dhaka city.

2.In that way we can distribute the crowd to the other part of the city

3.and so reduce the traffic problem.

4.For our daily-to-daily life it should be very peaceful and we can save more times that we spend in road due to traffic.

5.Considering the above measures should be taken immediately.

THANK YOU