“An assessment on traffic control volume of public transportation system of Khulna city.”

Submitted by:

Md. Zahidul Islam	**ID: 172-47-452**
Ridoy Chandra Sarker	**ID: 172-47-473**
Md. Rahatul Islam	**ID: 172-47-476**
Md. Maksudul Hassan	**ID: 172-47-489**

A thesis submitted to the Department of Civil Engineering, Daffodil International University in partial fulfillment of the requirement for the degree of **Bachelor of Science in Civil Engineering.**

Daffodil International University
102, Shukrabad, Dhanmondi, Dhaka-1207

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The thesis entitled “An assessment on traffic control volume of public transportation system of Khulna city” submitted by Md. Rahatul Islam (172-47-476, Session: Summer 2017); Md. Zahidul Islam (172-47-452, Session: Summer 2017); Ridoy Chandra Sarker (172-47-473, Session: Summer 2017); Md. Maksudul Hassan (172-47-489, Session: Sumer 2017) has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering on September, 2020.

Board of Examiners

Dr. Miah M. Hussainuzzaman
Chairman
Associate Professor and Head
Department of Civil Engineering
Daffodil International University
Daffodil Smart City
Ashulia, Dhaka

Dr. Muhammad Mukhlesur Rahman
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Executive Engineer
Roads and Highways Department

Mohammad Mominul Haque
Member (Internal)
Assistant Professor
Department of Civil Engineering
Daffodil International University
Daffodil Smart City
Ashulia, Dhaka

Mr. Saurav Barua
Member (Internal)
Assistant Professor
Department of Civil Engineering
Daffodil International University
Daffodil Smart City
Ashulia, Dhaka

Khondhaker Al Momin
(Supervisor)
Lecturer
Department of Civil Engineering
Daffodil International University
Daffodil Smart City
Ashulia, Dhaka

Approval

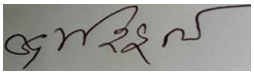
This is to certify that the thesis entitled "**An assessment on traffic control volume of public transportation system of Khulna city**" submitted by **Md. Rahatul Islam** (172-47-476, Session: Summer 2017); **Md. Zahidul Islam** (172-47-452, Session: Summer 2017); **Ridoy Chandra Sarker** (172-47-473, Session: Summer 2017); **Md. Maksudul Hassan** (172-47-489, Session: Sumer 2017) has been accepted as satisfactory in partial fulfillment of the requirement for the degree of **Bachelor of Science in Civil Engineering** on September, 2020.

Khondhaker Al Momin
Lecturer
Department of Civil Engineering
Daffodil International University

Declaration

It is stated that the work "An assessment of traffic volume control of public Transport System of Khulna city." reported in this thesis has been performed under the supervision of **Khondhaker AL Momin** lecturer, Department of Civil Engineering, Daffodil International University. The thesis contains no material previously published or written by another person to the best of my knowledge and belief except where due to reference were made in the thesis itself.

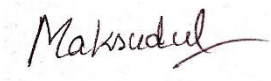
Khondhaker Al Momin
Lecturer
Department of Civil Engineering
Daffodil International University



Md. Zahidul Islam
ID: 172-47-452

Ridoy Chandra Sarker
ID: 172-47-473

Md. Rahatul Islam
ID: 172-47-476



Md. Maksudul Hassan
ID: 172-47-489

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Abstract

This report has been written as “A measurement on traffic control volume of public transport systems of Khulna city”. This paper attempts to gain insights into the traffic control volume and its effect on the public transport system. For this reason a traffic control volume study has been conducted from Dakbangla to Jora-gate Moar of Khulna- city road. In this study, the volume of the road section has been determined through a video analysis method and is represented by the Passenger Car Unit (PCU).

In Traffic Survey and Analysis it is discussed about the congestion points (within 2 km), Control volume Study, ADT, AADT, Rate of Flow, Peak hour factor Flow fluctuation curve study, Directional Distribution, Design hour volume of Dakbangla to Jora-gate direction and Jora-gate to Dakbangla both direction.

Traffic control volume survey was conducted by myself and my fellow classmates on the Dakbangla to Jora-gate road with a view to gaining data and insight about the traffic parameters and conditions in this particular road. Tuesday (30/06/2020) morning was the day we did the survey. We conducted the survey of volume study using a manual counting method. Before starting the final survey, we did a reconnaissance survey for 15 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 control volume study. Then we started the final survey.

Finally, the Level of service (LOS) for this road section is also determined along with the formal and informal parking of the road. Proposals like; reduction of conflicting points, provision of off street parking; would be some potential solutions to increase the efficiency of this section of road.

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Chapter-01

Introduction

1.1 Background

Transport is an important part of Bangladesh's economy. Since the Liberation of the country, the development of infrastructure has progressed rapidly and a number of land, water and air transport modes came into existence. However, significant progress needs to be made for ensuring uniform access to all available transports.

Traffic engineers and planners need information about traffic. They need information to design and manage roads 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 warrants 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 an 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.

It was performed through indirect methods in which vehicle movements were captured by camera and counted by categorizing them. It is a permanent method and so the collected data can be used to monitor and evaluate traffic volumes and trends over a long period of time (Traffic Volume Counts).

1.2 General Objectives of Traffic Volume

1.2.1. Purposes of traffic survey

The main purposes of traffic survey are: Design purposes, Traffic monitoring, Traffic control and volume, Planning purposes, Dynamic Traffic Management Purposes:

1.2.1.1 Design Purposes

- Structural and geometric design of pavements, bridge, and other highway facilities is based on repetition of wheel load on the pavement in its 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.

1.2.1.2 Traffic monitoring

- Automatically authentication of vehicle registration issues, license registration, emission testing, and insurance validity is an application of smart city development.
- Traffic police do these documents checking using license plate checking or verifying documents after stopping the driver which is very annoying for both the drivers and policies.

1.2.2 Traffic control and volume

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 a short count.

Flow fluctuation on different approaches at a junction or different parts of a road network system.

1.2.2.1 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.

1.2.2.2 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

1.2.3. 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

1.3 Other Objectives

- To identify the present condition of the fixed facilities and control systems of Khulna-Jessore Highway.

- To determine the operating characteristics of the public transport system of Khulna-Jessore Highway.
- To evaluate public perception regarding the role and performance of public transportation systems.
- To assess the existing volume condition of the roads and reduce the number of conflict points and also to increase road life by controlling excessive volume of vehicles.
- Carrying out traffic volume studies are designing, improving traffic volume, planning, management etc.

1.4 Main Objectives

To evaluate the reduction of controlling volume of the public transportation system in Khulna city.

Chapter 02

Literature Review

2.1 Introduction

The transport system in Khulna city is now challenged with rapid urbanization, unplanned economic growth, unequal distribution and a rapid growing population, which would be the causes of social, economic and environmental degradation. Sustainable transport may become a key tool for dealing with problems and to provide a better guideline to cope with the future demand. So, it is now essential to assess sustainability of existing transportation systems for Khulna city by choosing a balanced set of parameters reflecting a combination of economic, social and environmental objectives.

The aim of this study is assessing the present condition of the road transport system of Khulna city with its different modes. This study also attempts to find out the existing troubles faced by the people of this city by the present road transport. The study is concerned about the vehicles that run within the city for evaluating its sustainability with respect to environmental, social and economic parameters. The study also develops a strategy for attaining road transport sustainability in Khulna city.

The volume study survey was being conducted from **Dakbangla to Jora-gate** and **Jora-gate to Dakbangla** in both directions on **Khulna-city** road in seven different spots at 1 peak period on weekday and weekend. It was performed through indirect methods in which vehicle movements were captured by camera and counted by categorizing them. It is a permanent method and so the collected data can be used to monitor and evaluate traffic volumes and trends over a long period of time (Traffic Volume Counts). In this study, Passenger Car Unit (PCU) of different vehicles represents the volume across the road sections and Passenger Car Equivalent Unit (PCE) represents the road capacity where Dhaka Urban Transport Study is used as standard but in generally the design capacity of urban arterial roads is 1400 PCU/lane/hour (References). Major finding of this study is determining the Level of service (LOS) of the roads through Volume-Capacity ratio (Boarnet et al., 1998). The objective of this study is to assess the existing volume condition of the roads and reduce the number of conflict points and also to increase road life by controlling excessive volume of vehicles.

2.2 Existing Studies on Volume Count

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

Rahman S.K (2002) performed a study on Vehicular Flow Pattern on Jamuna Multipurpose Bridge Access Road in 2002 during his B.Sc. Engineering project work. That study report has been extensively conferred with during this study. The project used 5 years of daily traffic data as well as 13 weeks of hourly data in the analyses.

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 an increase in the proportion of two-wheelers in traffic streams. 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-wheelers. The capacity of a section with side friction is approximately12 percent lower as compared to a section with no side friction.

(Pothula Sanyasi Naidu, 2015). Since roads have certain width with varying lanes, flow is always defined in terms of width, ADT, termed as average daily traffic, implies the road capacity which is considered as a function of traffic and road geometrics. To express city road capacity the Passenger Car Unit (PCU) or Passenger Car Equivalent (PCE) is used which is termed to be the universally adopted unit for measuring traffic volume or capacity**.**

(Patil, 2015). Case Study on Development of Passenger Car Unit in NAL STOP, PUNE shows that the PCU value of each vehicle is not constant but varies with several factors such as proportion of other classes, level of service and volume to capacity.

(Singh et al. 1991). Level of service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to man oeuvre, traffic interruptions, and comfort and convenience and six LOS which are defined for each type of facility that has analysis procedures available.

(Subhadip Biswas, 2016). Percentage Speed Reduction (PSR) from Free Flow Speed (FFS) can be identified as a performance measure for LOS assessment on urban arterials which has been analyzed from the Case Study on the Assessment of Level of service on Urban Arterials in Kolkata.

A team of observers can record not only traffic volume but also the types of vehicles, turning movements, directions of movements, laden weights of trucks and other such details that cannot be captured by using automatic methods. **(IRC: 9-1972—Traffic census on non-urban roads, New Delhi, 1972).**

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.

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

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 the concept of dynamic PCU was that capacity estimation in a common unit must be the 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.

2.3 Passenger Car Unit

In British practice it is usual to express capacity in terms of "passenger car units". The basic consideration behind this practice is that different types of vehicles offer different degrees of interference to other traffic and it is necessary to bring all types to a common unit. The common unit adopted is Passenger Car Unit (PCU).

The Passenger Car Unit of a vehicle type has been found to depend upon the size and speed of the vehicle, type and kind of road environment (e.g., rural road, urban street, roundabout, traffic signal). They are generally not dependent on the flow and road width.

The PCU equivalents are generally derived from observations, though rough approximations can also be derived by theoretical considerations.

Vehicle Type	PCE
Bus	3.0
Truck	2.0
Auto rickshaw	0.75
Light vehicle	1.0
Motorcycle	0.75
Non-motorized vehicle	0.5

Table 2.3: PCE (Passenger car Equivalent) by vehicle types

2.4 Peak Hour factor

Traffic engineers focus on the peak-hour traffic volume in evaluating capacity and other parameters because it represents the most critical time period. And, as any motorist who travels during the morning or evening rush hours knows, it's the period during which traffic volume is at its highest. The analysis of level of service is based on peak rates of flow occurring within the peak hour because substantial short-term fluctuations typically occur during an hour. Common practice is to use a peak 15-minute rate of flow. Flow rates are usually expressed in vehicles per hour, not vehicles per 15 minutes. The relationship between the peak 15-minute flow rate and the full hourly volume is given by the peak-hour factor (PHF) as shown in the following equation:

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

If 15-minute periods are used, the PHF is computed as:

$$PHF = \frac{V}{4 \times V_{15}}$$

Where,

V = peak-hour volume (vph)

V15 = volume during the peak 15 minutes of flow (vehicle/15 minutes)

2.5 Level of service

The Highway Capacity Manual has introduced the concept of "Level of Service" to denote the level of facility one can derive from a road under different operating characteristics and traffic volumes. The concept of levels of service is defined as a qualitative measure describing the operational conditions within a traffic stream, and their perception by motorists and/or passengers.

The objective of Highway Capacity Manual is to provide a consistent system and techniques for the evaluation of the quality of service on highways and street facilities. HCM presents LOS as an easy-to-understand methodology of analysis and performance measure for single homogenous road segments.

HCM doesn't specify the boundary LOS for congestion state but clearly states that the LOS F is defined as the worst state of flow and represents congested flow. Though there are some reports using other levels of service (D and E) as congested flow, LOS F is generally accepted as a state of traffic flow and hence LOS is the most appropriate congestion indicator.

The following are the factors which might be considered in evaluating the level of service:

- Speed and Travel Time, including the operating speed and overall travel time consumed in travelling over a section of roadway
- Traffic interruptions or restrictions, with due consideration to the number of stops per mile, delays involved and the speed changes necessary to maintain pace in the traffic stream
- Freedom to maneuver to maintain the desired operating speeds
- Driving Comfort and convenience reflecting the roadway and traffic conditions in-so-far as they affect driving comfort and convenience of the driver
- Economy, with due consideration operating cost of the vehicle

It is observed that Shibbari moar to Jora-gate and Boyra College moar to Jora-gate respectively consist of two lanes in both directions. The capacity of each lane is 1400 PCU/hour/lane according to Dhaka Integrated Transport Study, 1994.

There are six types of Level of Service (LOS). They are:

- LOS A- Free flow, with low volumes and high speeds.
- LOS B- Reasonably free flow, but speeds begin to be restricted by traffic conditions.
- LOS C- Stable flow zone, but most drivers restricted in freedom to select their own speed.
- LOS D- Approaching unstable flow, drivers have little freedom to maneuver.
- LOS E- Almost unstable flow, volumes reach near at the capacity of the highway.
- LOS F- Unstable flow may be short stoppages.

Level of service	Speed (Kph)	Volume to capacity Ratio
A	>=80	<=0.6
B	>=40	<=0.7
C	>=30	<=0.8
D	>=25	<=0.9
E	>=15	<=1
F	<15	>1

Source: Traffic Engineering and transport planning, Dr. L R Kadiyali

Table 2.5: Level of service

2.6 Overview

In this Chapter we discussed in brief about previous research on volume study. Those studies ended in figuring out many important findings regarding PCE factors and how this factor is affected. With every year they figured new things from their surveys. When we were investigating in our survey area which is Dakbangla to Jora-gate we tried to keep these findings in mind and also tried to fill the gap in those studies. But due to time restraints and lack of funding we were not able to do much. Despite all that we still managed to conduct a useful data analysis which may contribute to future surveys, this will be discussed in the Data Analysis Chapter.

Chapter 03

Methodology

3.1 Method of traffic volume count

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. Our Traffic Volume Study is continued in Dakbangla to Jora-gate in Khulna City. The location is chosen because of rapid growth of commercial and institutions in the area. This data helps to identify peak hour flow, determine the composition of vehicles on vehicular traffic flow. The way of traffic volume count can be collected by the following methods:-

3.1.1 Manual Counting Method

The most common method of collecting traffic flow data is the manual method, which consists of assigning a person to record traffic as it passes. This method of data collection can be expensive in terms of manpower, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections.
There are two methods of manual counting:

- Direct Method and
- Indirect Method.

3.1.2 Automatic counting method

The detection of vehicular presence and road occupancies has historically been performed primarily on or near the surface of the road. The exploitation of new electromagnetic spectra and wireless communication media in recent years has allowed traffic detection to occur in a non-intrusive fashion, at locations above or to the side of the roadway. Pavement-based traffic detection, currently relatively inexpensive, will be met with fierce competition in the coming years from detectors that are liberated from the road surface.
The most commonly used detector types are:

- Pneumatic tubes
- Inductive loops
- Piezoelectric sensors
- Magnetic loops

3.2 Data Collection Technique and Equipment

There were two ways to count traffic volume.

- By Video recording
- By Manual traffic volume count

Video capturing techniques is preferred over the manual collection (pen and paper method) because:

- It provides a permanent, easily-review record and show the traffic conditions at any time;
- It permits the reading of required parameters in a controlled environment in which plate characters can be closely examined;
- It provides additional information about traffic flow characteristics such as traffic volume and vehicle headway; and
- It can provide a time stamp for accurate determination of arrival times.
- Have better accuracy than manual methods; and
- Able to capture a larger sample of the total number of vehicles.

So, the traffic volume data were counted for this research by using video recording directly. Traffic volumes were analyzed from the video at 1 hour intervals. In addition, other field measurements were done to gather data on the geometrical features of intersection for capacity analysis. These include, number of lanes, lane width, configurations of lanes, grade, width of median, movement policy etc. These measures were done for the intersections whose level of service is going to be determined.

3.3 Counting Period for volume Study

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 purposes, long duration count is conducted.

3.4 Selected counting period for our study

We have counted data for 1 hour per day. And finally we have converted this data into 1 week Calculation.

3.5 Terms related to current study

Before going into the detail of this study, it is important to get familiarized with the terms related to traffic flow characteristics and computation of expansion factors or equations. Therefore, in this section, the important parameters of traffic flow, which are frequently used in this study, are stated in brief.

- **Traffic Volume:** Traffic Volume is defined as the number of vehicles that pass a particular point along a roadway or traffic lane per unit of time. Volume is a measure to quantify the traffic flow and is commonly measured in units of vehicles per hour, vehicles per day and so on.

- **ADT:** ADT stands for Annual Daily Traffic and is defined by the average number of vehicles that pass a particular point during a period greater than one day and less than one year. It is determined by dividing the total number of vehicles within a period by the number of days.

- **AADT:** Average Annual Daily Traffic is represented by the total number of vehicles passing a particular point, averaged over one year data. AADT is a very important factor for geometric design of highways.

- **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.

- **Peak Hour Factor:** The Peak Hour Factor is defined as the ratio of total hourly volume to the maximum rate of flow within the hour.

- **Directional Distribution:** Directional distribution refers to the percentage of traffic flow in one direction during a particular time of day. This factor is particularly important in the case of commuter roads, where maximum flow occurs in one direction in the morning and the other in the evening. This also needs to be considered for efficient geometric design.

- **Design hour volume:** The directional design hour volume (DDHV) is the one-way volume in the predominant direction of travel in the design hour, expressed as a percentage of the two-way DHV. For rural and suburban roads, the directional distribution factor (D) ranges from 55 to 80 percent. A factor of approximately 50 percent is used for urban highways. Keep in mind that the directional distribution can change during the day. For example, traffic volume heading into the central business

district is usually higher than outbound traffic in the morning, but the reverse is true during the afternoon peak hour.

In summary, DDHV = ADT (or AADT)*K*D.

Chapter 04

Study area

4.1 Introduction

Khulna is one of the divisional cities of Bangladesh with a land area of 45.65 km^2. It has a road network of 1231 km (Hossain et al., 2005) here Khulna- city road is about 106.25km (50 - Roads and Railway Division, 2013). For increasing efficiency of this city road and to provide better means to utilize other roads linked to this city road a traffic volume study was necessary. Moreover, a volume study survey can also be helpful in impact analysis of this road and determining the need for a traffic control system. There are three major intersections, Ferry Ghat moar, Jora-gate moar and Shibbari moar.

4.2 Location of study area

Our selected study route was Dakbangla to Jora-gate. The Latitude and Longitude of Dakbangla Moar is **22.8165° N, 89.5626° E** respectively. The Latitude and Longitude of Jora-gate is **22.8292° N, 89.5494° E** respectively.

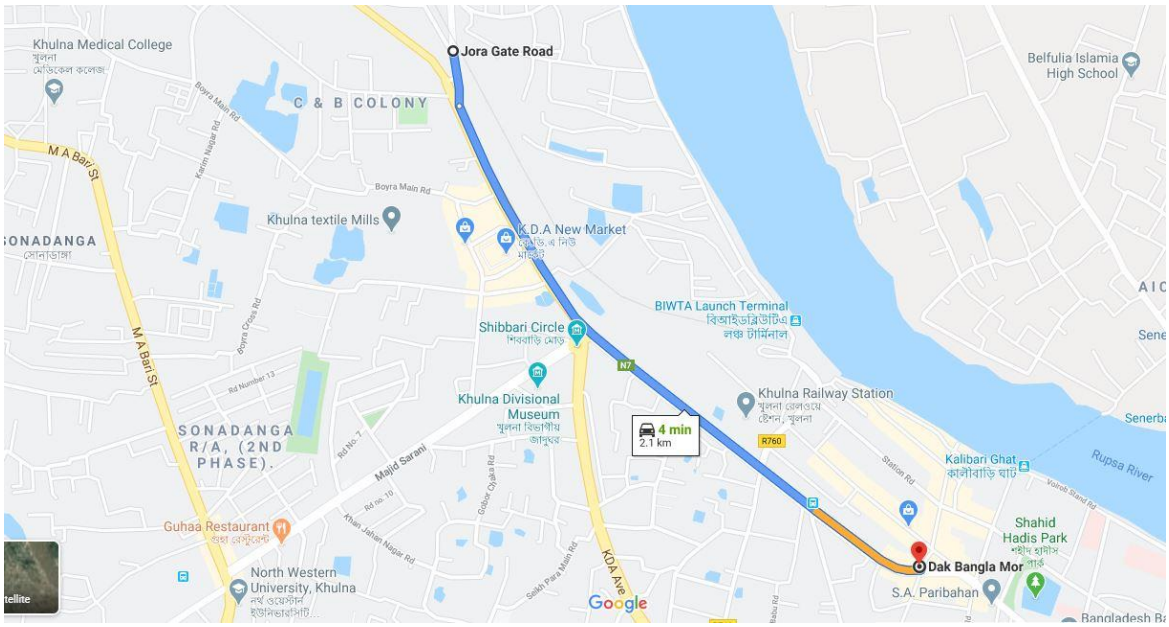


Figure 4.2: Location of study area

4.3 Connectivity of the highway

Our study route is fully connected with Khulna-Jessore Highway. The route connects Khulna city with Jessore. As the route is through the Khulna city the accessibility of people is so high on this highway. The highway is accessible to the local people of Daulatpur, Khalishpur, New market, Moylapota our entire study area falls in the Shibbari area. The Shibbari intersection is near the Sonadanga bus stand. The Jora-gate link falls near Khalishpur area. All kinds of vehicles, motorized, non-motorized, freight have got easy access through this road.

4.4 Composition of traffic

Different kinds of traffic are travelling on the road. The number of public transport is high but private transport is a little amount. Among all private vehicles, motorcycles are most prominent at the study route. The major motorized vehicles are bus, truck, ATUL, CNG, Easy bike, microbus, car, motorcycle, pickup etc. The major non-motorized vehicles van, rickshaw, cycle, pushcart etc. In our study route the traffic circulation flow is given below-

4.5 Control System

In our selected route there is no digital signal system. In Dakbangla there was a manual signal system but in Jora-gate there is no signal system. In our 2 km study route there was no speed breaker. The road marking quality is so good in our study route.

4.6 Observation points

We fixed some suitable observation points for our survey. For volume control survey and spot speed survey, pedestrian flow survey, diverging merging survey we selected some points at Jora-gate, Shibbari and Dakbangla.

For volume control survey two suitable points in Jora-gate and another suitable point in Dakbangla were taken just after the intersection. From that point different types of traffic were counted in two opposite directions.

For diverging merging study and pedestrian flow study four observation points were taken in each intersection. We selected these points beside the four links from where we counted all the vehicles which diverged and merged. Similarly from the same points we observed the pedestrian flow within a distance of 50 m.

Chapter-05

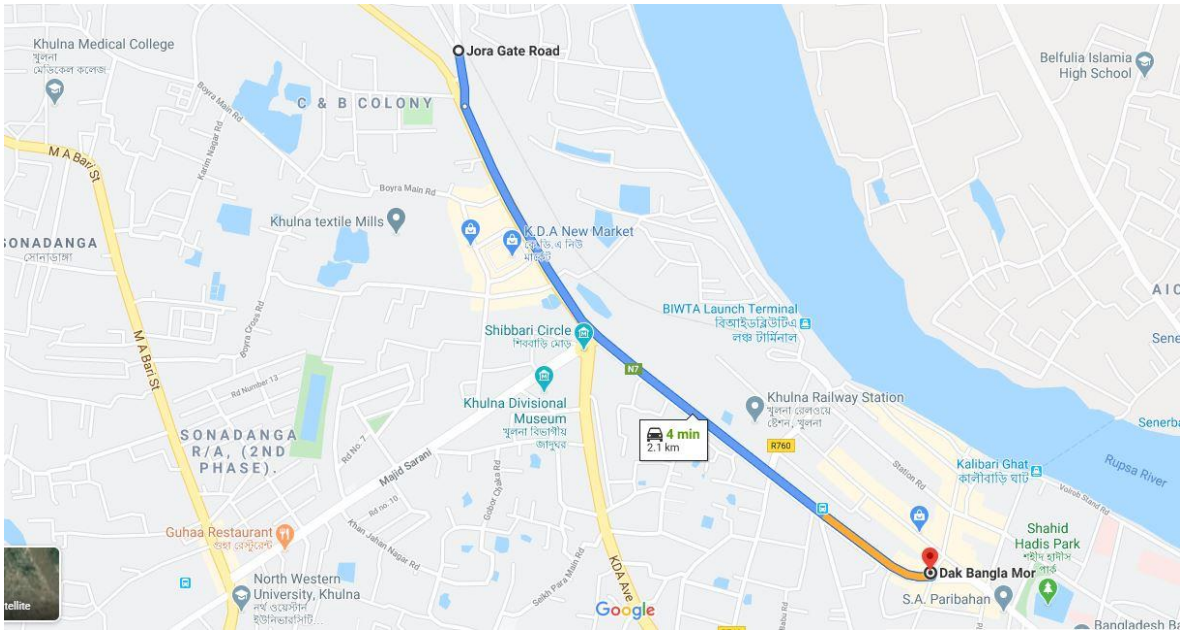
Data collection & Analysis

5.1 Introduction

This chapter illustrates the data collection history, details of survey procedure and presents the collected data in tabular form. The data collected by us is presented in detail, and other groups' data are summarized.

5.2 Location of Data Collection

The survey is done in the link road located between Dakbangla intersections to Jora-gate intersection. Our group was at Jora-gate at the entry point towards Jora-gate to Dakbangla which is shown in the next figure.



(Source: Google map)

Figure 5.2: Survey Location

5.3 Counting Period

Data is collected on **30th June, 2020** to **06 July, 2020**. Short count data is taken over 1 hour volume. Data collection time of different Days are shown in the following table.

Date / Direction	Jora-gate to Dakbangla	Dakbangla to Jora-gate
30-06-2020	09:00 am - 10:00 am	09:00 am - 10:00 am
01-07-2020	10:00 am - 11:00 am	10:00 am - 11:00 am
02-07-2020	11:00 am - 12:00 pm	11:00 am - 12:00 pm
03-07-2020	12:00 pm - 01:00 pm	12:00 pm - 01:00 pm
04-07-2020	01:00 pm - 02:00 pm	01:00 pm - 02:00 pm
05-07-2020	02:00 pm - 03:00 pm	02:00 pm - 03:00 pm
06-07-2020	03:00 pm - 04:00 pm	03:00 pm - 04:00 pm

Table 5.3: Data collection time of different days

5.4 Weather condition

The weather condition was helpful for volume study. The day was very shiny.

5.5 Data Collection Procedure

Whole surveying procedure can be subdivided into three categories:

1) Reconnaissance survey
2) Piloting
3) Final survey

5.5.1 Reconnaissance survey

Purpose of Reconnaissance survey is to eliminate those routes or sites which are impractical or unfeasible and to identify the more promising routes or sites. After reaching the survey location, the reconnaissance survey was done for approximately 10 minutes. During this time, some observations were made to decide how the data collection can be done properly. Firstly, a suitable location was selected about 20m away from the intersection. Then a visual estimation of vehicle composition was done. This helped to decide on how many enumerators is needed to count each class of vehicle. Then five enumerators were assigned to count six types of vehicles and one enumerator was in charge of noticing the time. Another two enumerator was assigned to take photographs

5.5.2 Piloting

After all the decisions were made, piloting was done for another ten minutes to check if there was any sort of problem which was not recognized during the reconnaissance stage.

5.5.3 Final survey

After the above mentioned stages, the final survey started. Enumerators recorded data at a 10 minutes interval in their tally sheet for 60 minutes. Then the data were assembled for further calculations.

5.6 Collected data

The collected data is shown in the following tables.

5.6.1 Vehicle classification

Vehicles were classified as follows

1	Bus (B)	All types of bus
2	Truck (T)	All types of truck
3	Auto Rickshaw (AR)	Easy-bike, Mahindra, CNG
4	Light Vehicle	Pickup, Micro, Private car, Ambulance, Jeep, Pajero, Utility vehicles.
5	Motor-cycle	All types of motor-cycle
6	Non-Motor Vehicles (NMV)	Rickshaw, Bi-cycle, Van, Thela Gari

Table-5.6.1: Vehicle classification

Volume data were recorded for seven days according to the above table.

5.6.2 Data collection

Data collected for day 1 according to vehicle composition as mentioned in 5.6.1 are presented below:

Day-01 (30-06-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	0	0	1	1	0	1	3	1	0	2	1	0	0	4	7
Truck	7	8	8	4	5	5	37	4	5	4	7	6	3	29	66
Auto Rickshaw	122	116	134	118	116	131	737	158	134	137	140	137	152	858	1595
Light Vehicle	86	62	73	85	78	70	454	63	46	54	76	54	67	360	814
Motor cycle	99	121	176	135	111	148	790	93	99	152	134	107	133	718	1508
Non-Motorized Vehicle	98	104	128	110	103	105	648	80	89	98	96	94	89	546	1194
Total	412	411	520	453	413	460	2669	399	373	447	454	398	444	2515	5184
Total number of vehicles =															

Table 5.6.2: Vehicle Composition (Nos.) of (Day-01)

5.6.3 Summary of collected data by Day-2 to Day-7

Day-02 (01-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	0	1	0	0	0	0	1	0	0	0	0	2	0	2	3
Truck	6	3	4	2	1	3	19	8	6	4	7	4	2	31	50
Auto Rickshaw	175	180	160	122	155	164	956	115	122	98	125	133	102	695	1651
Light Vehicle	21	22	18	16	11	21	109	14	8	7	8	8	7	52	161
Motor cycle	84	88	90	42	46	65	415	84	73	55	42	66	58	378	793
Non-Motorized Vehicle	54	42	48	32	62	32	270	54	37	27	22	31	22	193	463
Total	340	336	320	214	275	285	1770	275	246	191	204	244	191	1351	3121
Total number of vehicles =															

Table-5.6.3 (a): Vehicle composition (Nos.) of (Day-02)

Day-03 (02-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	1	0	1	0	2	1	5	2	0	0	0	1	2	5	10
Truck	4	2	5	4	3	4	22	5	2	5	3	2	4	21	43
Auto Rickshaw	162	180	173	190	185	169	1059	194	153	157	163	158	174	999	2058
Light Vehicle	58	52	51	48	59	39	307	38	31	35	67	50	64	285	592
Motor cycle	173	187	185	197	186	178	1106	87	94	128	134	104	119	666	1772
Non-Motorized Vehicle	67	72	69	82	67	72	429	63	74	68	82	85	73	445	874
Total	465	493	484	521	502	463	2928	389	354	393	449	400	436	2421	5349
Total number of vehicles =															

Table-5.6.3 (b): Vehicle composition (No.) of (Day 03)

Day-04 (03-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck	4	6	4	3	5	2	24	5	6	3	2	3	1	20	44
Auto Rickshaw	83	86	76	67	89	55	456	89	62	72	65	88	72	448	904
Light Vehicle	10	14	21	14	11	16	86	13	16	14	12	11	16	82	168
Motor cycle	69	53	61	46	55	41	325	48	66	67	65	55	65	366	691
Non-Motorized Vehicle	22	25	21	22	18	21	129	21	34	31	23	32	23	164	293
Total	188	184	183	152	178	135	1020	176	184	187	167	189	177	1080	2100
Total number of vehicles =															

Table-5.6.3 (c): Vehicle composition (No.) of (Day-04)

Day-05 (04-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	0	2	1	0	0	0	3	2	0	0	2	1	0	5	8
Truck	4	5	3	4	4	3	23	5	4	4	3	5	2	23	46
Auto Rickshaw	122	112	103	117	125	94	673	102	95	104	91	112	108	612	1285
Light Vehicle	28	24	27	21	35	31	166	22	26	33	31	28	34	174	340
Motor cycle	90	79	87	85	98	93	532	107	112	117	124	115	140	715	1247
Non-Motorized Vehicle	53	60	66	57	62	64	362	105	98	113	127	121	128	692	1054
Total	297	282	287	284	324	285	1759	343	335	371	378	382	412	2221	3980
Total number of vehicles =															

Table-5.6.3 (d): Vehicle composition (No.) of (Day 05)

Day-06 (05-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	1	0	2	0	1	0	4	0	1	2	0	0	0	3	7
Truck	5	4	3	6	4	5	27	4	2	5	5	3	5	24	51
Auto Rickshaw	161	138	145	158	141	129	872	116	128	132	118	123	137	754	1626
Light Vehicle	47	42	33	29	34	41	226	32	28	34	41	29	33	197	423
Motor cycle	112	108	114	127	131	128	720	117	121	127	142	135	130	772	1492
Non-Motorized Vehicle	85	98	111	92	89	105	580	102	98	117	132	105	113	667	1247
Total	411	390	408	412	400	408	2429	371	378	417	438	395	418	2417	4846
Total number of vehicles =															

Table-5.6.3 (e): Vehicle composition (No.) of (Day 06)

Day-07 (06-07-2020)															
Vehicle Composition															
Vehicle Types	**Jora-gate to Dakbangla (Minutes Interval)**							**Dakbangla to Jora-gate (Minutes Interval)**							**Total**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	**(0-10)**	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**	**Total**	
Bus	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
Truck	0	4	2	1	3	4	14	9	0	3	2	3	2	19	33
Auto Rickshaw	170	153	157	141	176	145	942	180	188	166	155	165	143	997	1939
Light Vehicle	23	42	41	41	60	31	238	28	36	35	31	34	24	188	426
Motor cycle	135	151	167	120	138	108	819	173	149	160	161	163	155	961	1780
Non-Motorized Vehicle	110	100	99	122	94	106	631	80	151	119	143	115	132	740	1371
Total	438	450	466	425	472	394	2645	470	524	483	492	480	456	2905	5550
Total number of vehicles =															

Table-5.6.3 (f): Vehicle composition (No.) of (Day 07)

5.7 Data Analysis

5.7.1 Vehicle composition in the traffic system

Vehicles counted by day-01 are presented below according to their percentage in traffic stream in a pie chart. These are formed according to section 5.6.2 where a detailed data table is presented.

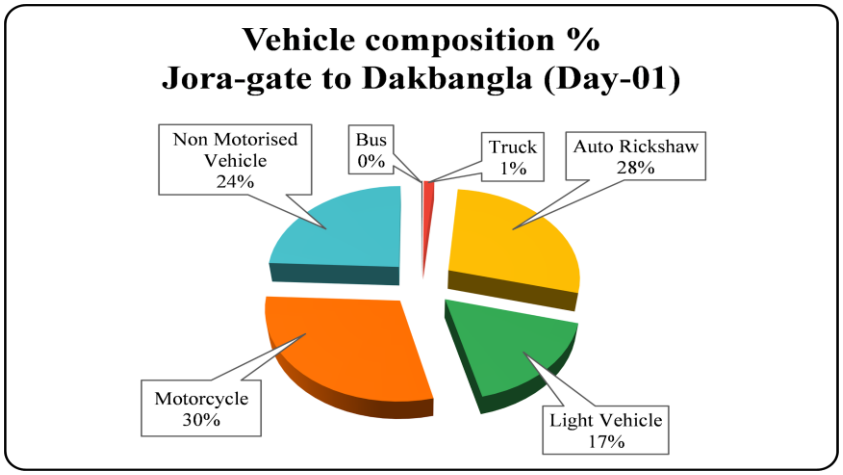


Figure-5.7.1 (i): Pie chart showing vehicle composition % of (Day-01) of Jora-gate to Dakbangla direction

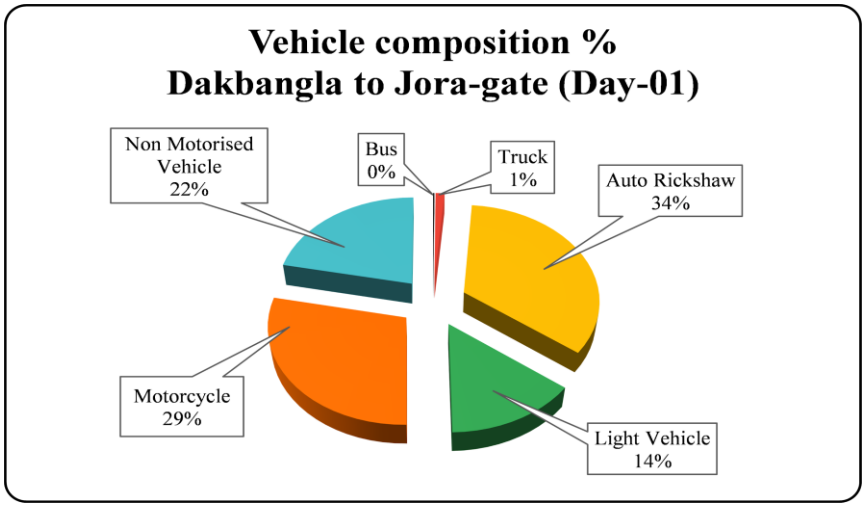


Figure-5.7.1 (ii): Pie chart showing vehicle composition % of (Day-01) of Dakbangla to Jora-gate direction

The following bar diagram shows the vehicle composition according to the number of vehicles.

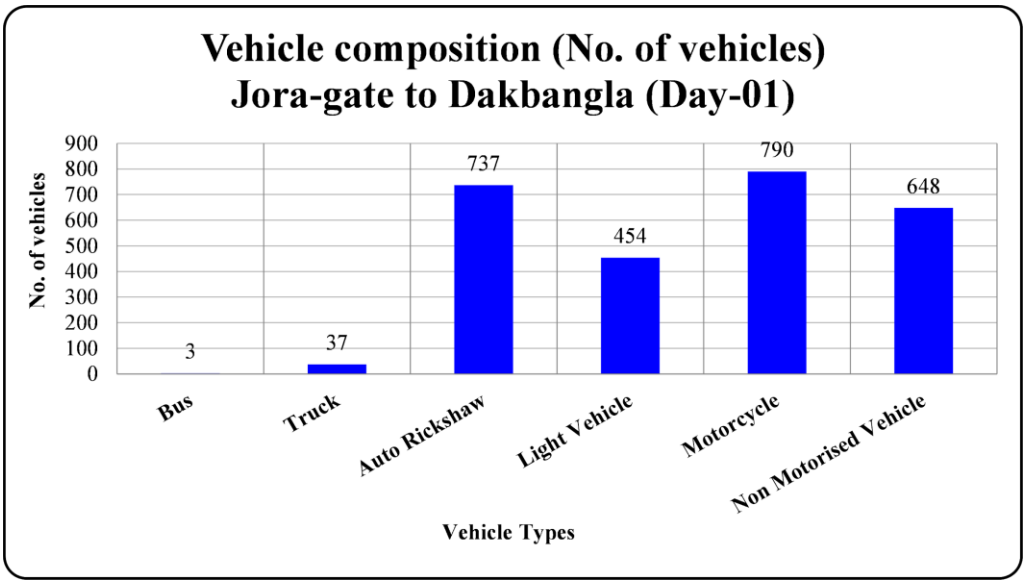


Figure-5.7.1 (iii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-01) of Jora-gate to Dakbangla direction

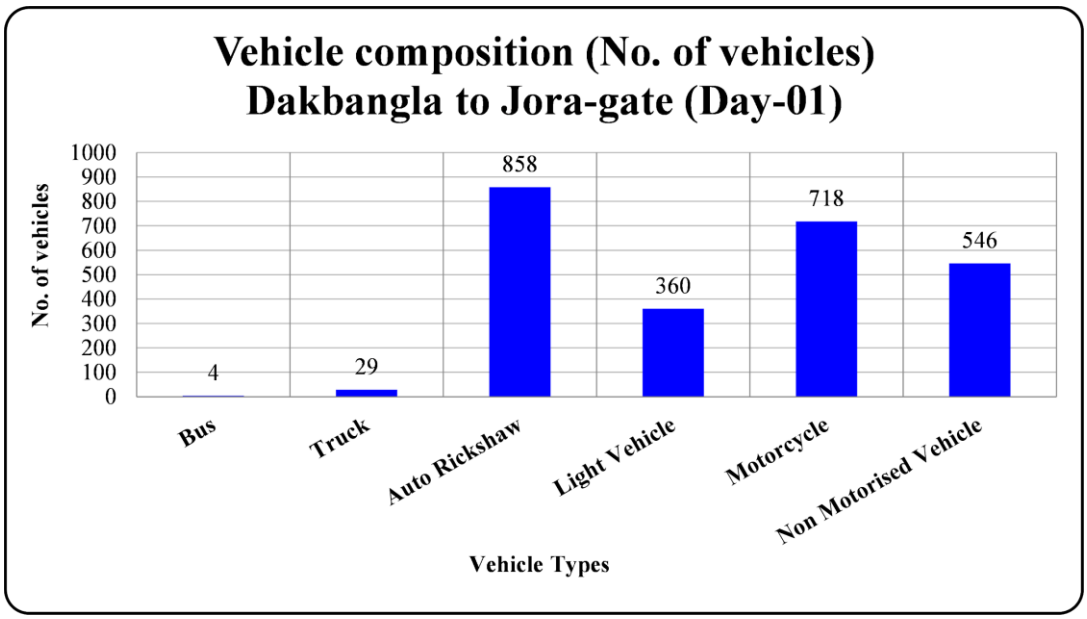


Figure-5.7.1 (iv): Bar diagram showing vehicle composition (No. of vehicles) of (Day-01) of Dakbangla to Jora-gate direction

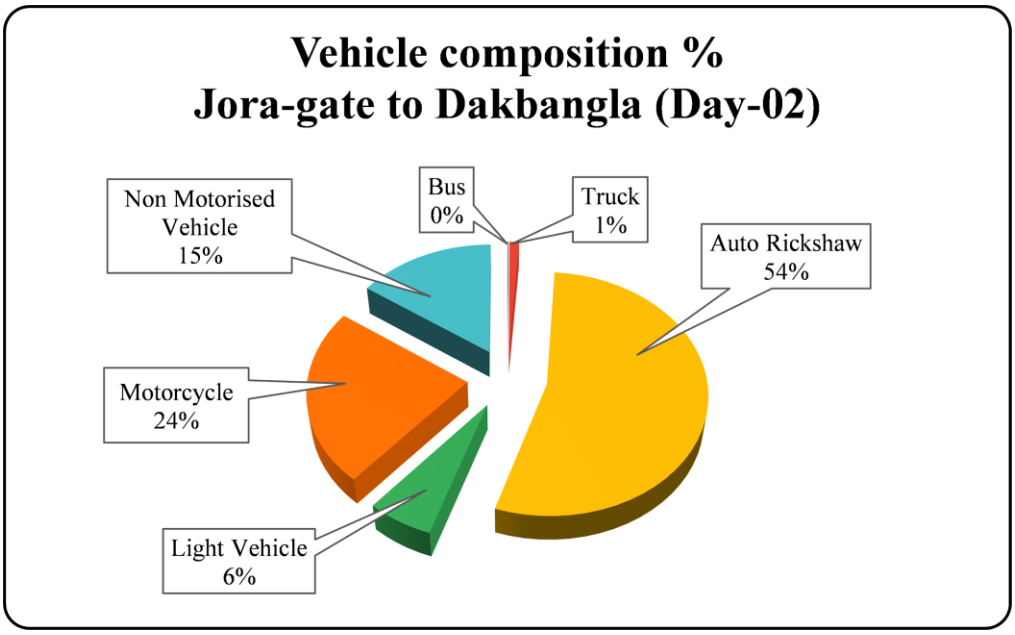


Figure-5.7.1 (v): Pie chart showing vehicle composition % of (Day-02) of Jora-gate to Dakbangla direction

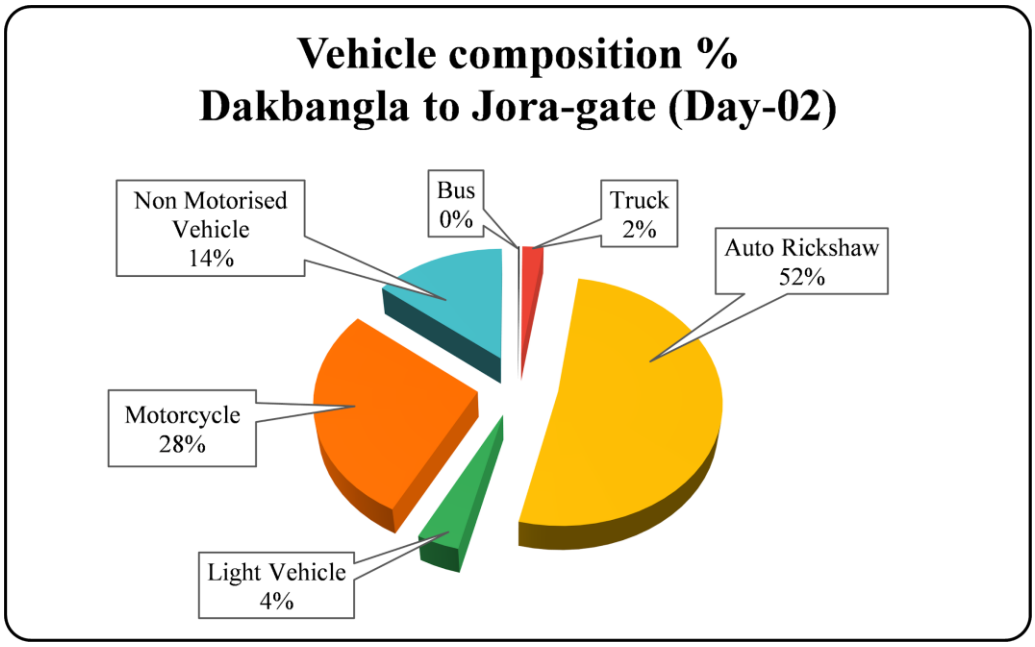


Figure-5.7.1 (vi): Pie chart showing vehicle composition % of (Day-02) of Dakbangla to Jora-gate direction

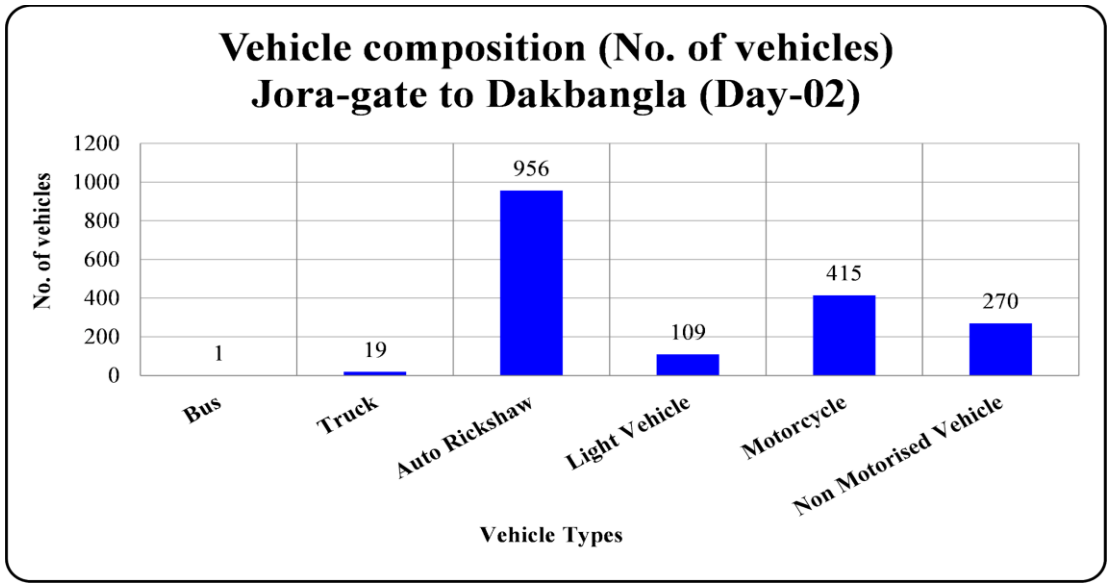


Figure-5.7.1 (vii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-02) of Jora-gate to Dakbangla direction

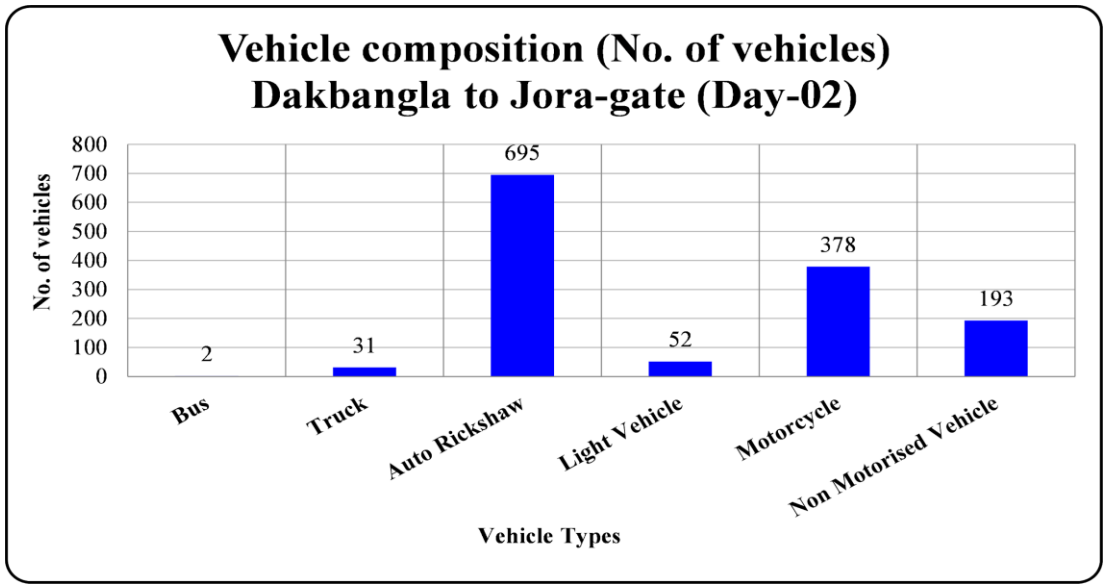


Figure-5.7.1 (viii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-02) of Dakbangla to Jora-gate direction

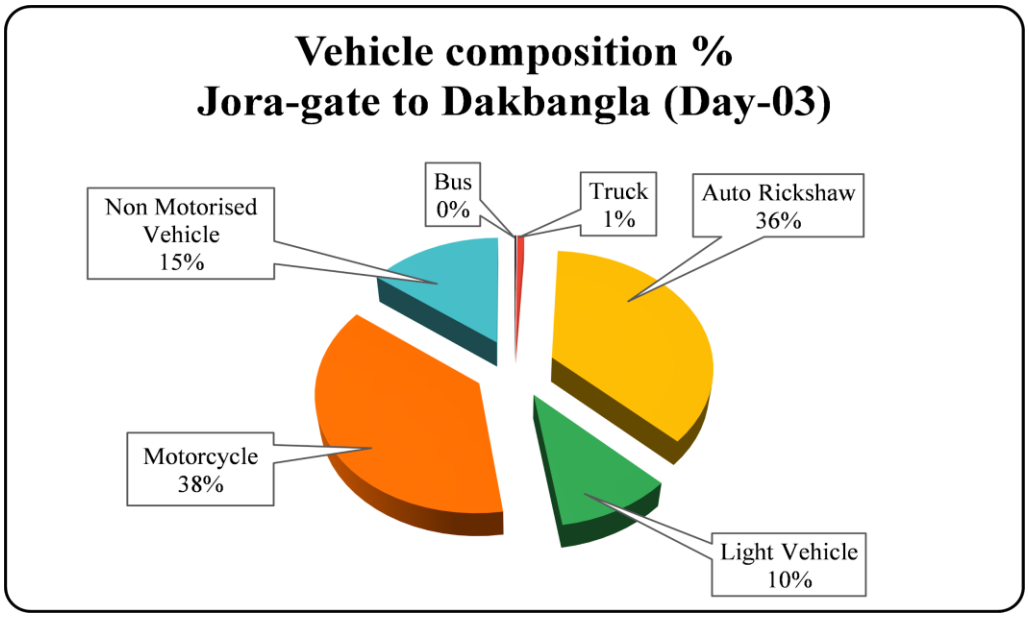


Figure-5.7.1 (ix): Pie chart showing vehicle composition % of (Day-03) of Jora-gate to Dakbangla direction

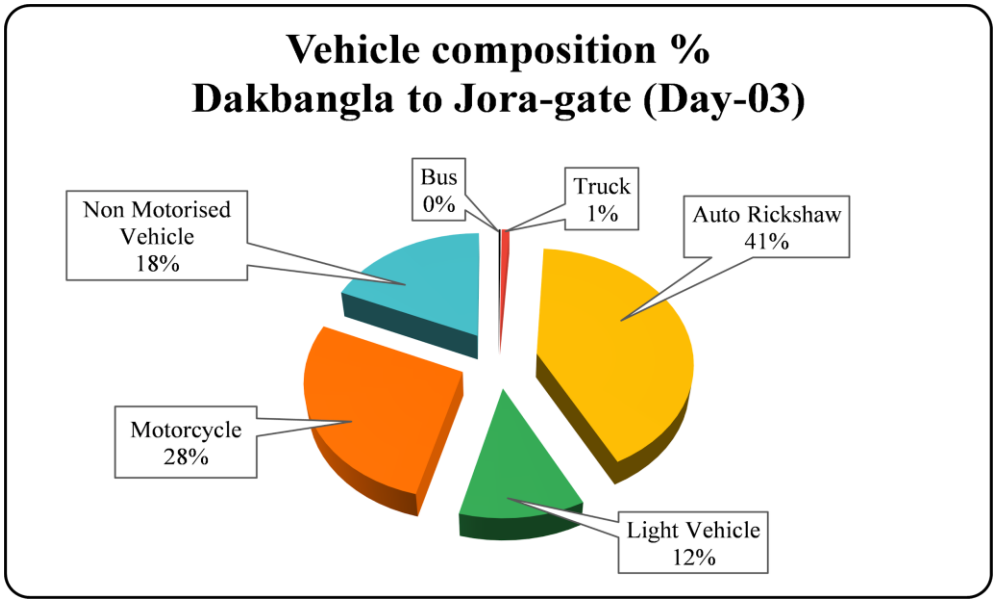


Figure-5.7.1 (x): Pie chart showing vehicle composition % of (Day-03) of Dakbangla to Jora-gate direction

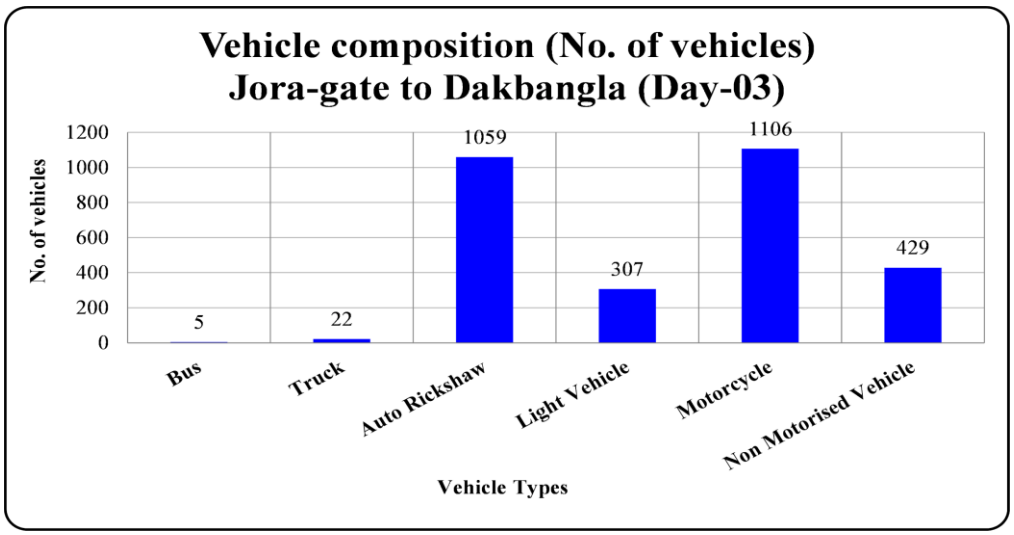


Figure-5.7.1 (xi): Bar diagram showing vehicle composition (No. of vehicles) of (Day-03) of Jora-gate to Dakbangla direction

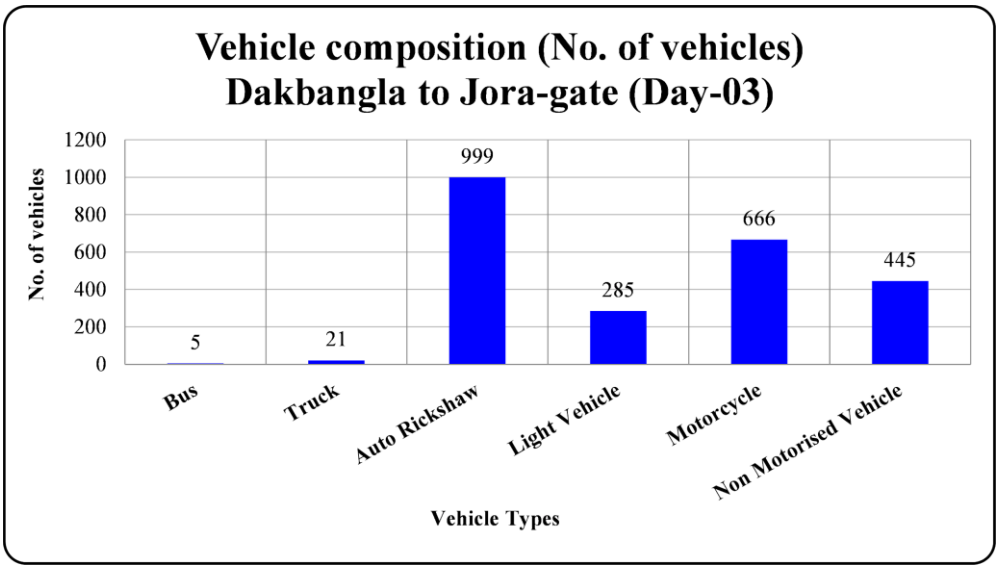


Figure-5.7.1 (xii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-03) of Dakbangla to Jora-gate direction

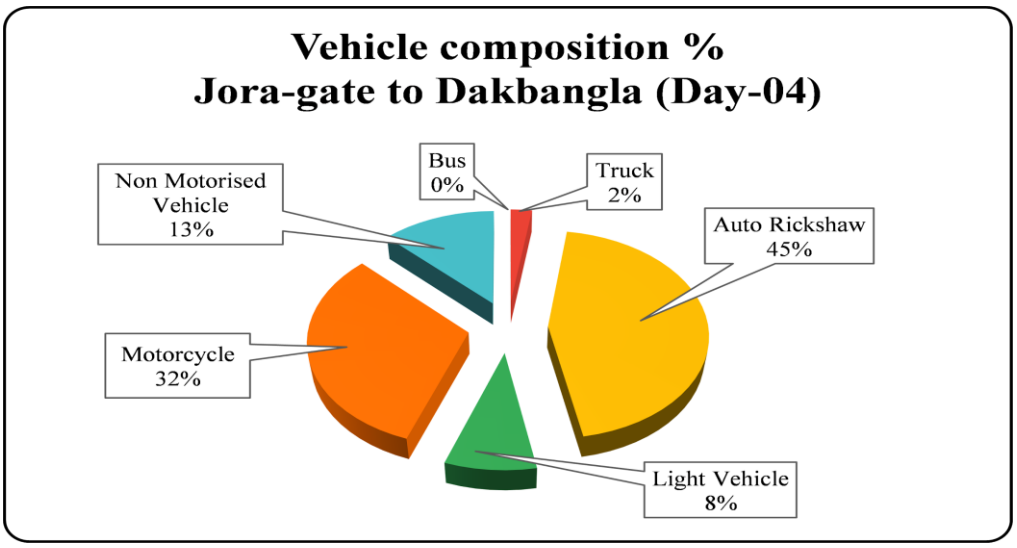


Figure-5.7.1 (xiii): Pie chart showing vehicle composition % of (Day-04) of Jora-gate to Dakbangla direction

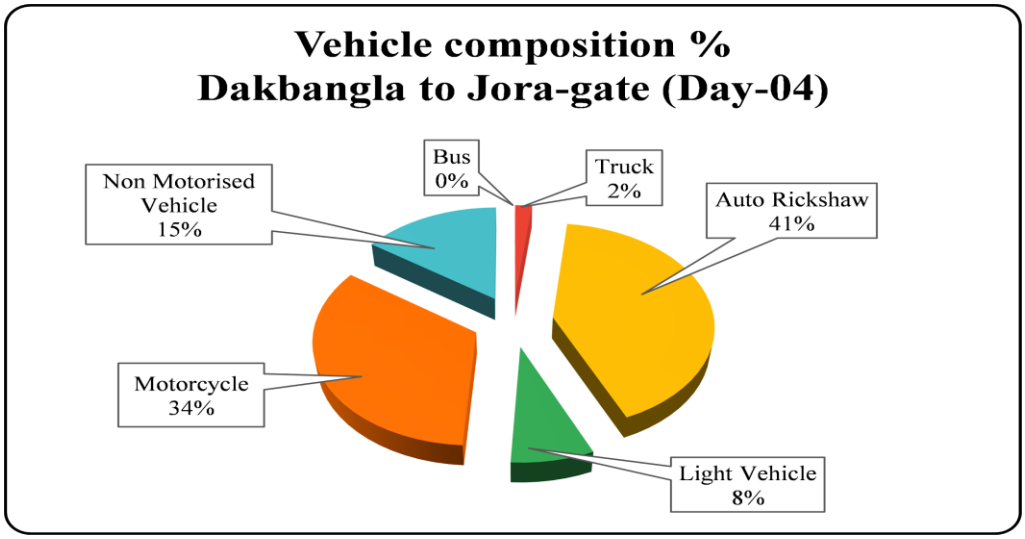


Figure-5.7.1 (xiv): Pie chart showing vehicle composition % of (Day-04) of Dakbangla to Jora-gate direction

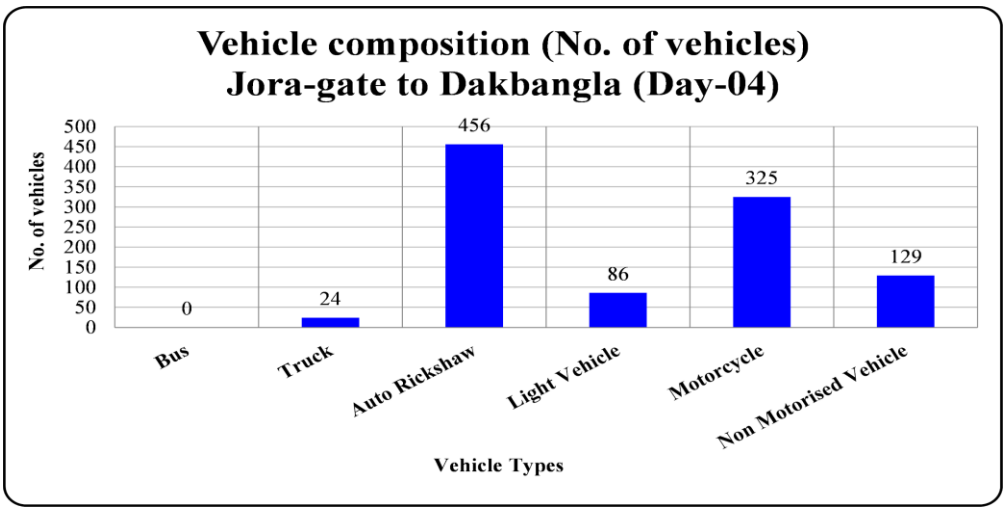


Figure-5.7.1 (xv): Bar diagram showing vehicle composition (No. of vehicles) of (Day-04) of Jora-gate to Dakbangla direction

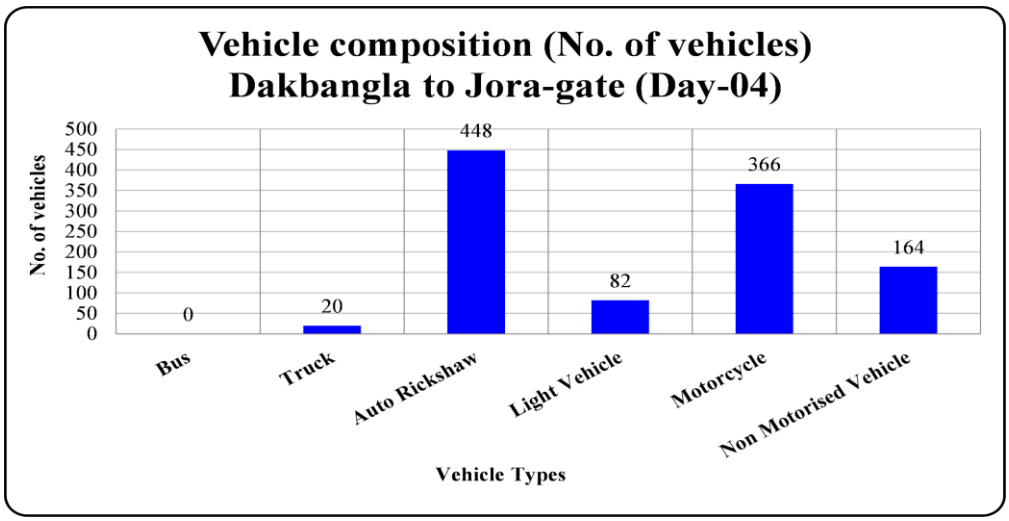


Figure-5.7.1 (xvi): Bar diagram showing vehicle composition (No. of vehicles) of (Day-04) of Dakbangla to Jora-gate direction

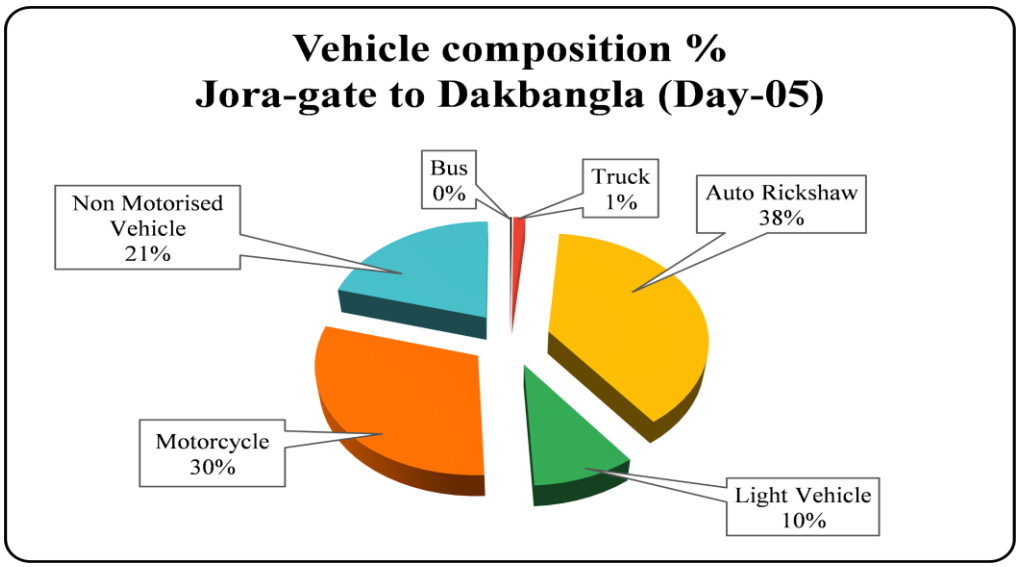


Figure-5.7.1 (xvii): Pie chart showing vehicle composition % of (Day-05) of Jora-gate to Dakbangla direction

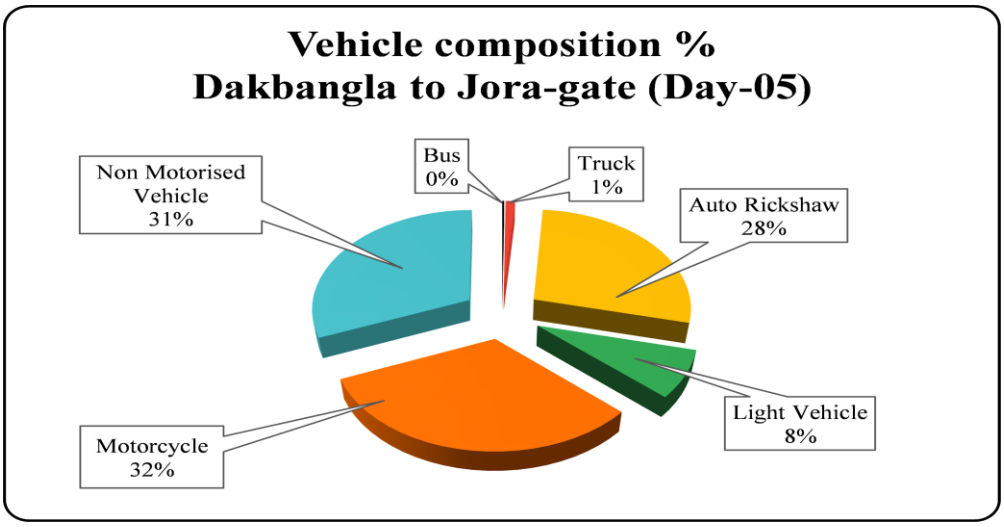


Figure-5.7.1 (xviii): Pie chart showing vehicle composition % of (Day-05) of Dakbangla to Jora-gate direction

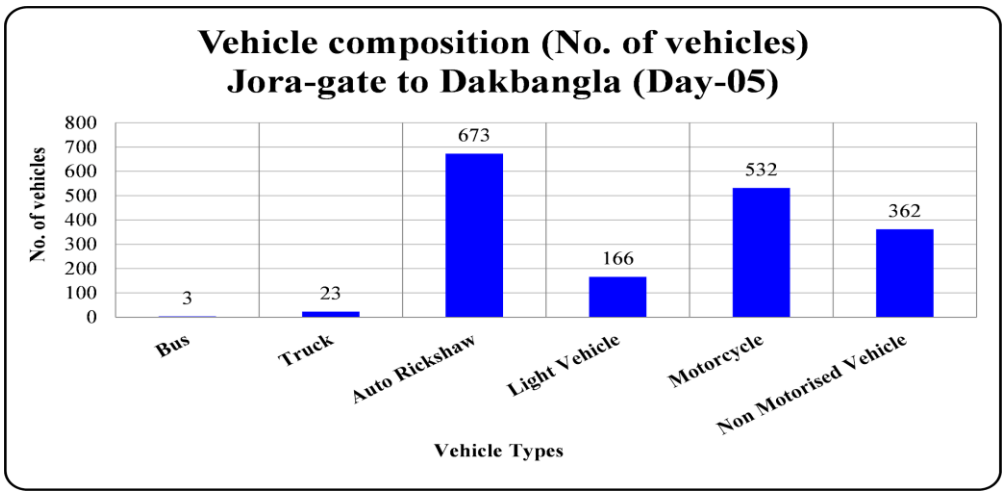


Figure-5.7.1 (xix): Bar diagram showing vehicle composition (No. of vehicles) of (Day-05) of Jora-gate to Dakbangla direction

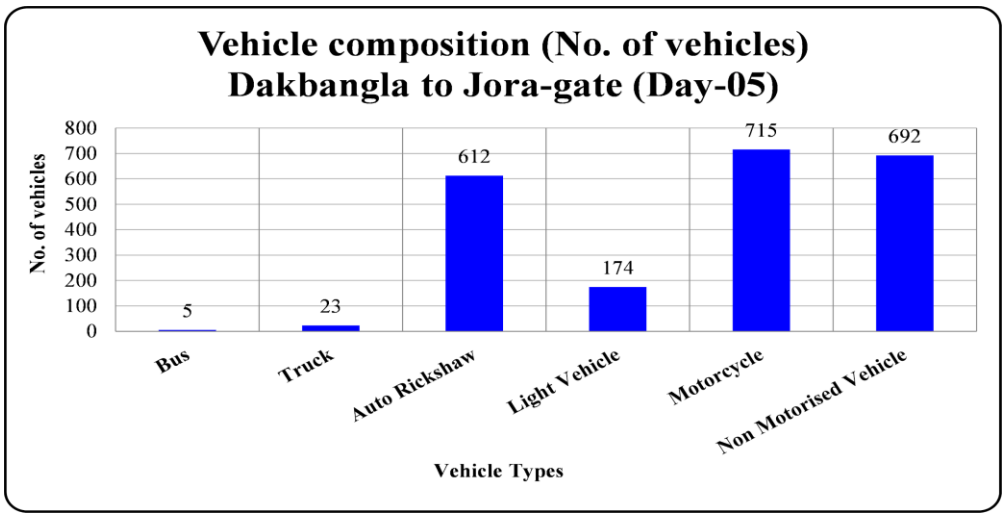


Figure-5.7.1 (xx): Bar diagram showing vehicle composition (No. of vehicles) of (Day-05) of Dakbangla to Jora-gate direction

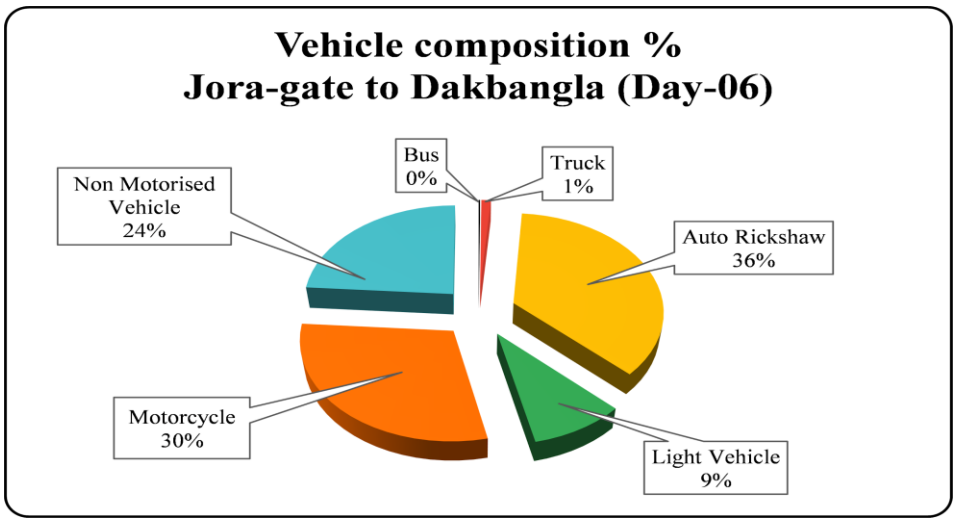


Figure-5.7.1 (xxi): Pie chart showing vehicle composition % of (Day-06) of Jora-gate to Dakbangla direction

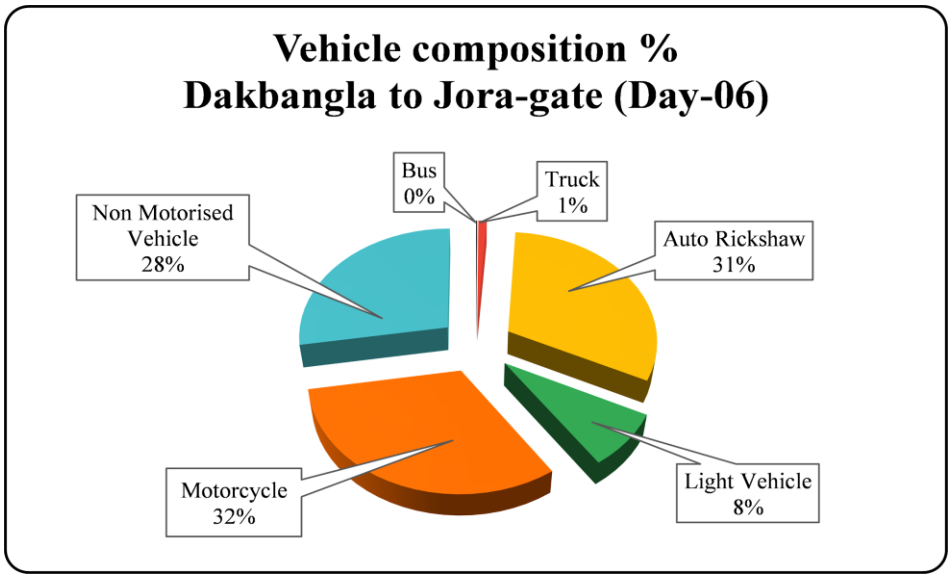


Figure-5.7.1 (xxii): Pie chart showing vehicle composition % of (Day-06) of Dakbangla to Jora-gate direction

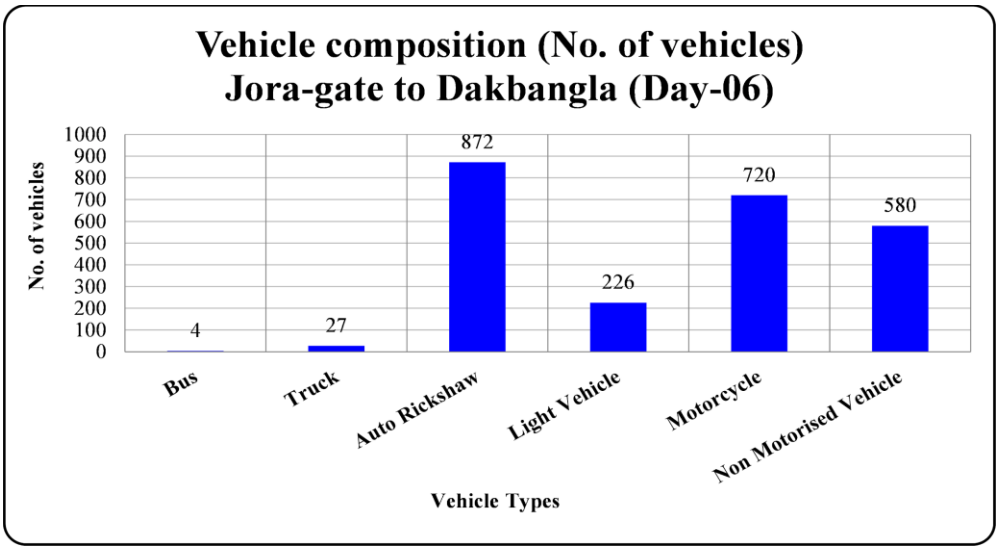


Figure-5.7.1 (xiii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-06) of Jora-gate to Dakbangla direction

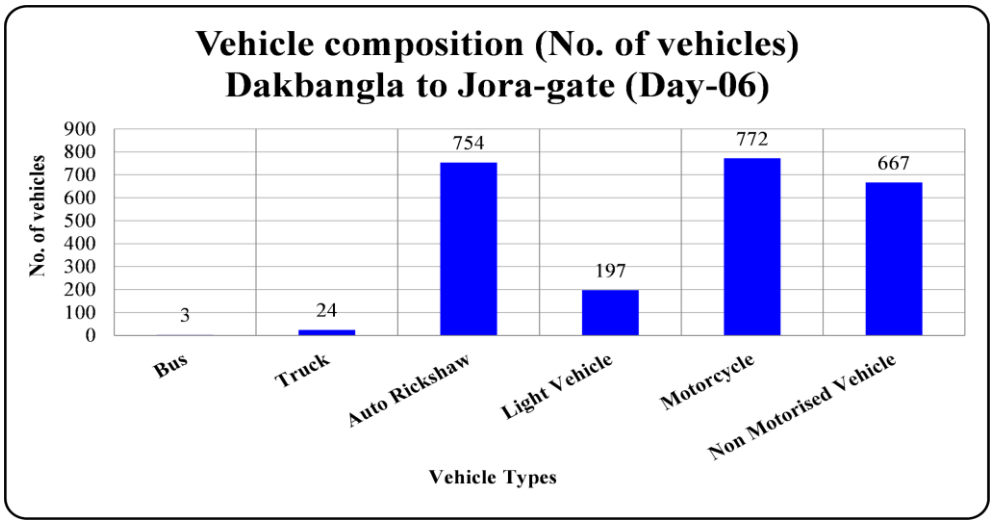


Figure-5.7.1 (xxiv): Bar diagram showing vehicle composition (No. of vehicles) of (Day-01) of Dakbangla to Jora-gate direction

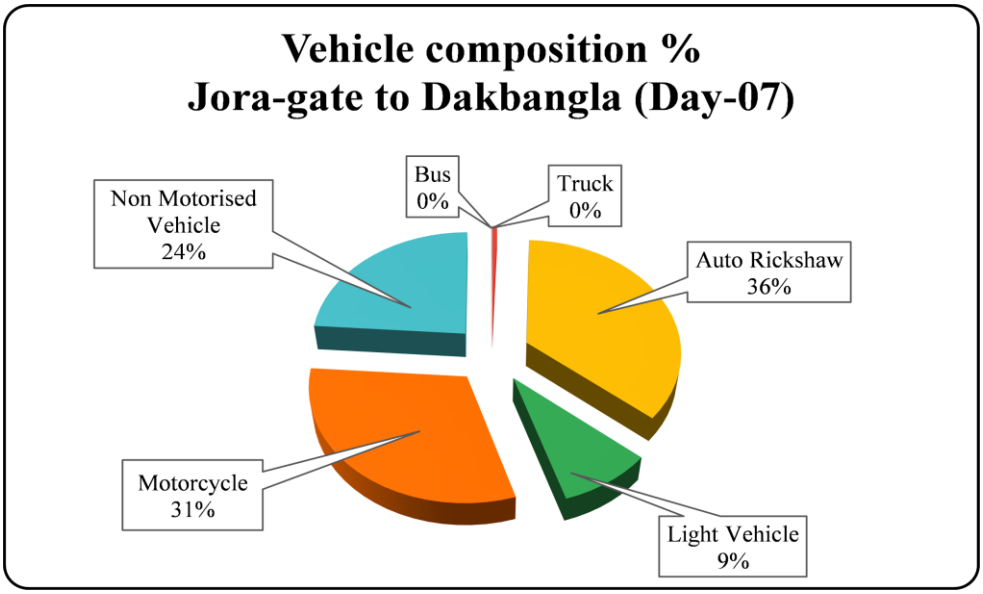


Figure-5.7.1 (xv): Pie chart showing vehicle composition % of (Day-07) of Jora-gate to Dakbangla direction

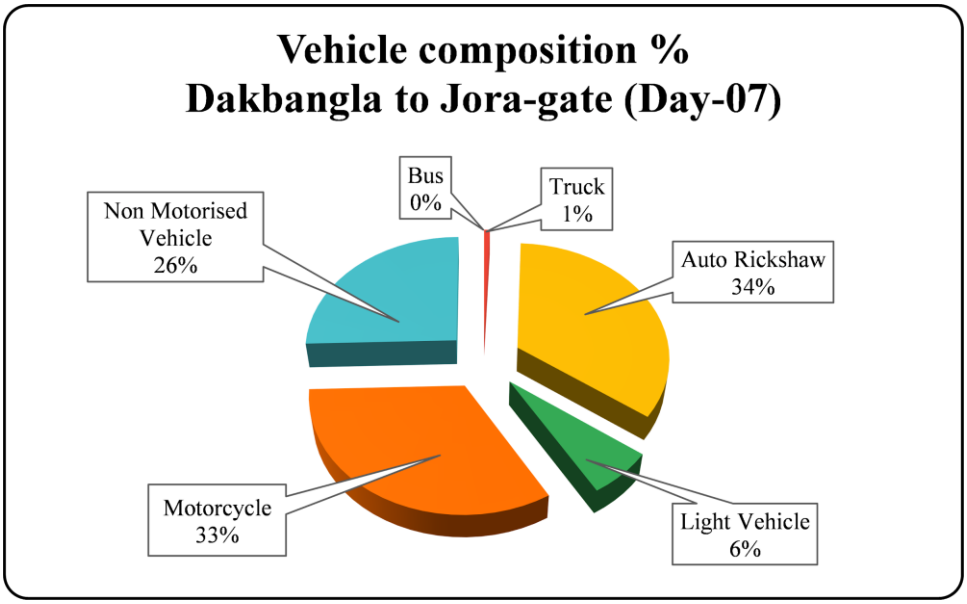


Figure-5.7.1 (xvi): Pie chart showing vehicle composition % of (Day-07) of Dakbangla to Jora-gate direction

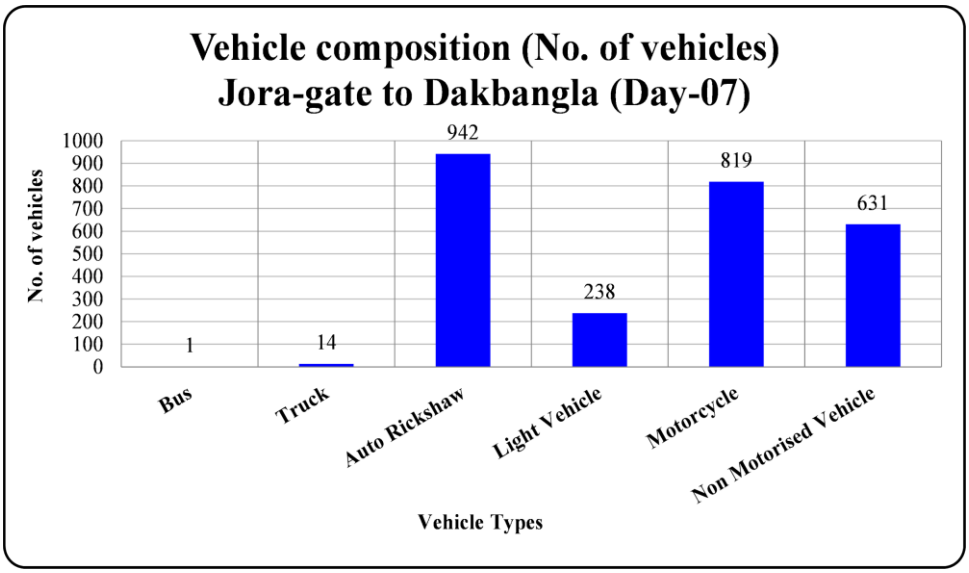


Figure-5.7.1 (xvii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-07) of Jora-gate to Dakbangla direction

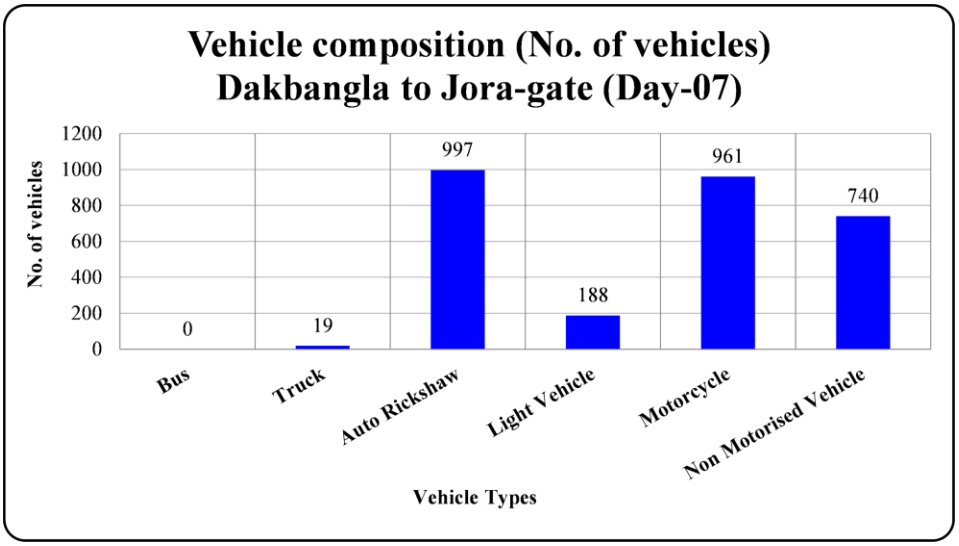


Figure-5.7.1 (xviii): Bar diagram showing vehicle composition (No. of vehicles) of (Day-07) of Dakbangla to Jora-gate direction

5.7.2 Service flow rate

For service flow rate, number of vehicles counted by day-01 in **Jora-gate to Dakbangla** direction are multiplied by respective passenger car equivalent (PCU) units. PCU units are taken according to **"Geometric Design Standards RHD, version 4, Table 2.4".**

Jora-gate to Dakbangla (Day-01)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	1	1	0	1	3	3
Truck	7	8	8	4	5	5	37	2
Auto Rickshaw	122	116	134	118	116	131	737	0.75
Light Vehicle	86	62	73	85	78	70	454	1
Motor-cycle	99	121	176	135	111	148	790	0.75
Non-Motorized Vehicle	98	104	128	110	103	105	648	0.5
Total No. of Vehicles	412	411	520	453	413	460	2669	-----
Total PCU	314.75	307.75	388.5	340.75	309.75	344.75	2006.25	-----

Table-5.7.2 (a): Service flow rate of day-01 of Jora-gate to Dakbangla direction

Dakbangla to Jora-gate (Day-01)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	1	0	2	1	0	0	4	3
Truck	4	5	4	7	6	3	29	2
Auto Rickshaw	158	134	137	140	137	152	858	0.75
Light Vehicle	63	46	54	76	54	67	360	1
Motor-cycle	93	99	152	134	107	133	718	0.75
Non-Motorized Vehicle	80	89	98	96	94	89	546	0.5
Total No. of Vehicles	399	373	447	454	398	444	2515	-----
Total PCU	302.25	275.25	333.75	346.5	296	331.25	1885	-----

Table-5.7.2 (b): Service flow rate of day-01 of Dakbangla to Jora-gate direction

5.7.3 Summary of Service flow rate of all groups (PCU)

Service flow rate in Jora-gate to Dakbangla direction is presented below:

Jora-gate to Dakbangla direction							
Types of vehicle	**Day-01**	**Day-02**	**Day-03**	**Day-04**	**Day-05**	**Day-06**	**Day-07**
Bus	9	3	15	0	9	12	3
Truck	74	38	44	48	46	54	28
Auto Rickshaw	552.75	717	794.25	342	504.75	654	706.5
Light Vehicle	454	109	307	86	166	226	238
Motor-cycle	592.5	311.25	829.5	243.75	399	540	614.25
Non-motorized Vehicle	324	135	214.5	64.5	181	290	315.5
Total	**2006.25**	**1313.25**	**2204.25**	**784.25**	**1305.75**	**1776**	**1905.25**

Table-5.7.3 (a): Summary of service flow rate (Jora-gate to Dakbangla)

Service flow rate in Dakbangla to Jora-gate direction is presented below:

Dakbangla to Jora-gate direction							
Types of vehicle	**Day-01**	**Day-02**	**Day-03**	**Day-04**	**Day-05**	**Day-06**	**Day-07**
Bus	12	6	15	0	15	9	0
Truck	58	62	42	40	46	48	38
Auto Rickshaw	643.5	521.25	749.25	336	459	565.5	747.75
Light Vehicle	360	52	285	82	174	197	188
Motor-cycle	538.5	283.5	499.5	274.5	536.25	579	720.75
Non-motorized Vehicle	273	96.5	222.5	82	346	333.5	370
Total	**1885**	**1021.25**	**1813.25**	**814.5**	**1576.25**	**1732**	**2064.5**

Table-5.7.3 (b): Summary of service flow rate (Dakbangla to Jora-gate)

5.7.4 Directional Distribution

From the previous sub-section (5.7.3), service flow rate is found for each direction. The ratio of these two values gives the idea about directional distribution.

Directional Distribution					
Time	**Direction**	**Day**	**Service Flow Rate (PCU/hr.)**	**Total**	**Directional Distribution %**
9:00 am - 10:00 am (30-06-2020)	**Jota-gate to Dakbangla**	**Tuesday**	**2006.25**	**3891.25**	**51.56**
	Dakbangla to Jora-gate		**1885**		**48.44**
10:00 am - 11:00 am (01-07-2020)	**Jota-gate to Dakbangla**	**Wednesday**	**1313.25**	**2334.5**	**56.25**
	Dakbangla to Jora-gate		**1021.25**		**43.75**
11:00 am - 12:00 pm (02-07-2020)	**Jota-gate to Dakbangla**	**Thursday**	**2204.25**	**4017.5**	**54.87**
	Dakbangla to Jora-gate		**1813.25**		**45.13**
12:00 pm - 1:00 pm (03-07-2020)	**Jota-gate to Dakbangla**	**Friday**	**784.25**	**1598.75**	**49.05**
	Dakbangla to Jora-gate		**814.5**		**50.95**
1:00 pm - 2:00 pm (04-07-2020)	**Jota-gate to Dakbangla**	**Saturday**	**1305.75**	**2882**	**45.31**
	Dakbangla to Jora-gate		**1576.25**		**54.69**
2:00 pm - 3:00 pm (05-07-2020)	**Jota-gate to Dakbangla**	**Sunday**	**1776**	**3508**	**50.63**
	Dakbangla to Jora-gate		**1732**		**49.37**
3:00 pm - 7:00 pm (06-07-2020)	**Jota-gate to Dakbangla**	**Monday**	**1905.25**	**3969.75**	**47.99**
	Dakbangla to Jora-gate		**2064.5**		**52.01**

Table 5.7.4: Directional distribution

5.7.5 Peak Hour Factor

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:

Day 03 has the highest flow rate which is 2204.25 PCU/hour. For Jora-gate to Dakbangla direction and Day 07 has the highest flow rate which is 2064.5 PCU/hour. For Dakbangla to Jora-gate direction.
Using details data of Day 03 (Appendix B, table: 05) and Day 07 (Appendix B, table: 14) and PCU factors as used in section 5.3.1, PCU values with 10 minutes interval are shown in tabular form as follows:

Jora-gate to Dakbangla (Day-03)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	1	0	1	0	2	1	5	3
Truck	4	2	5	4	3	4	22	2
Auto Rickshaw	162	180	173	190	185	169	1059	0.75
Light Vehicle	58	52	51	48	59	39	307	1
Motor-cycle	173	187	185	197	186	178	1106	0.75
Non-Motorized Vehicle	67	72	69	82	67	72	429	0.5
Total No. of Vehicles	465	493	484	521	502	463	2928	-----
Total PCU	353.75	367.25	367	387.25	382.75	346.25	2204.25	-----

Table 5.7.5 (a): Data for PHF Determination (Jora-gate to Dakbangla Direction)

$$PHF = \frac{2204.5}{4 \times \{(367.25 + 387.25 + 346.25)/2\}} = 1.009$$

Dakbangla to Jora-gate (Day-07)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	0	0	0	3
Truck	9	0	3	2	3	2	19	2
Auto Rickshaw	180	188	166	155	165	143	997	0.75
Light Vehicle	28	36	35	31	34	24	188	1
Motor-cycle	173	149	160	161	163	155	961	0.75
Non-motorized Vehicle	80	151	119	143	115	132	740	0.5
Total No. of Vehicles	470	524	483	492	480	456	2905	-----
Total PCU	350.75	364.25	345	343.5	343.5	317.5	2064.5	-----

Table 5.7.5 (b): Data for PHF Determination (Dakbangla to Jora-gate Direction)

$$PHF = \frac{2064.5}{4 \times \{(364.25 + 343.5 + 317.5)/2\}} = 1.007$$

Observation:

1. PHF measures traffic demand fluctuations within the peak hour. It generally varies in between less than 1 to greater than 1. Our value agrees with it.
2. 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.

5.7.6 Estimate ADT & AADT

Details calculation of ADT and AADT are given below.
Details chart of this factor given in the appendix A.
Here,

MEF = 0.948 for June (Appendix A: Table 1)
DEF = 7.727 for Tuesday (Appendix A: Table 2)
HEF = 18.80 (Time 9:00 am - 10:00 am) (Appendix A: Table 3)

Day 01 (30-06-2020)

Estimated 24 hour volume for Tuesday (Jora-gate to Dakbangla), using HEF
$= 2006.25 \times 18.80$
$= \mathbf{37717.5}$ **PCU**

From 24 hour volume for Tuesday estimated volume for the week using DEF,
Total 7 days volume
$= 37717.5 \times 7.727$
$= 291443.12$ **PCU**

Average 24 hours volume (on average daily traffic, ADT)
$= 291443.12 \div 7$
$= 41634.73$ **PCU**

Since the data were collected in June, using the MEF for June, obtained AADT is
$AADT = 41634.73 \times 0.984$
$= 39469.73$ **PCU**

Now,
Estimated 24 hour volume for Tuesday (Dakbangla to Jora-gate), using HEF
$= 1885 \times 18.80$
$= 35438$ **PCU**

From 24 hour volume for Tuesday estimated volume for the week using DEF,
Total 7 days volume
$= 35438 \times 7.727$
$= 273829.43$ **PCU**

Average 24 hours volume (on average daily traffic, ADT)
$= 273829.43/7$
$= 39118.49$ **PCU**

Since the data were collected in June, using the MEF for June, obtained AADT is
AADT $= 39118.49 \times 0.948$
$= 37084.33$ **PCU**

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 6.582 for Wednesday (Appendix A: Table 2)
HEF = 17.11 (Time 10:00 am - 11:00 am) (Appendix A: Table 3)

Day 02 (01-07-2020)

Estimated 24 hour volume for Wednesday (Jora-gate to Dakbangla), using HEF
$= 1313.25 \times 17.11$
$= \mathbf{22469.7}$ **PCU**

From 24 hour volume for Wednesday estimated volume for the week using DEF,
Total 7 days volume
$= 22469.7 \times 6.582$
$= 147895.61$ **PCU**

Average 24 hours volume (on average daily traffic, ADT)
$= 147895.61 \div 7$
$= 21127.94$ **PCU**

Since the data were collected in July, using the MEF for June, obtained AADT is
AADT $= 21127.94 \times 0.578$
$= 1221.95$ **PCU**

Now,
Estimated 24 hour volume for Tuesday (Dakbangla to Jora-gate), using HEF
$= 1021.25 \times 17.11$
$= 17473.6$ **PCU**

From 24 hour volume for Tuesday estimated volume for the week using DEF,
Total 7 days volume
$= 17473.6 \times 6.582$
$= 115011.15$**PCU**

Average 24 hours volume (on average daily traffic, ADT)
$= 115011.15 \div 7$
$= \mathbf{16430.16\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
$AADT = 16430.16 \times 0.582$
$= \mathbf{9496.64\ PCU}$

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 7.012 for Thursday (Appendix A: Table 2)
HEF = 18.52 (Time 11:00 am - 12:00 pm) (Appendix A: Table 3)

Day 03 (02-07-2020)

Estimated 24 hour volume for Thursday (Jora-gate to Dakbangla), using HEF
$= 2204.25 \times 18.52$
$= \mathbf{40822.7\ PCU}$

From 24 hour volume for Thursday estimated volume for the week using DEF,
Total 7 days volume
$= 40822.7 \times 7.012$
$= \mathbf{286248.84\ PCU}$

Average 24 hours volume (on Average Daily Traffic, ADT)
$= 286248.84 \div 7$
$= \mathbf{40892.69\ PCU}$

Since the data were collected in July, using the MEF for July, obtained AADT is
$AADT = 40892.69 \times 0.578$
$= \mathbf{23635.98\ PCU}$

Now,
Estimated 24 hour volume for Thursday (Dakbangla to Jora-gate), using HEF
$= 1813.25 \times 18.52$
$= \mathbf{33581.4\ PCU}$

From 24 hour volume for Tuesday estimated volume for the week using DEF,
Total 7 days volume
$= 33581.4 \times 7.012$
$= \mathbf{235472.71\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 235472.71 \div 7$
$= \mathbf{33638.96\ PCU}$

Since the data were collected in July, using the MEF for July, obtained AADT is
$AADT = 33638.96 \times 0.582$
$= \mathbf{19443.32\ \ PCU}$

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 7.727 for Friday (Appendix A: Table 2)
HEF = 18.80 (Time 12:00 am - 1:00 pm) (Appendix A: Table 3)

Day 04 (03-07-2020)

Estimated 24 hour volume for Friday (Jora-gate to Dakbangla), using HEF
$= \textit{784.25} \times \textit{18.71}$
$= \textit{14673.3}$ **PCU**

From 24 hour volume for Friday estimated volume for the week using DEF,
Total 7 days volume
$= 14673.3 \times 5.724$
$= \mathbf{83990.07\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 83990.07 \div 7$
$= \mathbf{11998.58\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
$AADT = 11998.58 \times 0.582$
$= \mathbf{6935.18\ PCU}$

Now,
Estimated 24 hour volume for Friday (Dakbangla to Jora-gate), using HEF
$= 814.5 \times 18.71$
$= \mathbf{15239.3\ PCU}$

From 24 hour volume for Friday estimated volume for the week using DEF,
Total 7 days volume
$= 15239.3 \times 5.724$
$= \mathbf{87229.72\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 87229.72 \div 7$
$= \mathbf{12461.39\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
AADT $= 12461.39 \times 0.578$
$= \mathbf{7202.68\ PCU}$

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 6.51 for Friday (Appendix A: Table 2)
HEF = 16.71 (Time 1:00 pm - 2:00 pm) (Appendix A: Table 3)

Day 05 (04-07-2020)

Estimated 24 hour volume for Saturday (Jora-gate to Dakbangla), using HEF
$= 1305.75 \times 16.71$
$= 21819.1$ **PCU**

From 24 hour volume for Saturday estimated volume for the week using DEF,
Total 7 days volume
$= 21819.1 \times 6.51$
$= \mathbf{142042.23\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 142042.23 \div 7$
$= \mathbf{20291.75\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
AADT $= 20291.75 \times 0.582$
$= \mathbf{11728.63\ PCU}$

Now,
Estimated 24 hour volume for Saturday (Dakbangla to Jora-gate), using HEF
$= 1576.25 \times 16.71$
$= \mathbf{26339.1\ PCU}$

From 24 hour volume for Saturday estimated volume for the week using DEF,
Total 7 days volume
$= 26339.1 \times 6.51$
$= \mathbf{171467.79\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 171467.79 \div 7$
$= \mathbf{24495.40\ PCU}$

Since the data were collected in July, using the MEF for July, obtained AADT is
AADT $= 24495.40 \times 0.578$
$= \mathbf{14158.34\ PCU}$

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 9.515 for Sunday (Appendix A: Table 2)
HEF = 14.84 (Time 2:00 pm - 3:00 pm) (Appendix A: Table 3)

Day 06 (05-07-2020)

Estimated 24 hour volume for Sunday (Jora-gate to Dakbangla), using HEF
$= 1776 \times 14.84$
$= \mathbf{26355.8\ PCU}$

From 24 hour volume for Sunday estimated volume for the week using DEF,
Total 7 days volume
$= 26355.8 \times 9.515$
$= \mathbf{250775.82\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 250775.82 \div 7$
$= \mathbf{35825.12\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
$AADT = 35825.12 \times 0.582$
$= \mathbf{20706.92\ PCU}$

Now,
Estimated 24 hour volume for Sunday (Dakbangla to Jora-gate), using HEF
$= 1732 \times 14.84$
$= \mathbf{25702.9\ PCU}$

From 24 hour volume for Sunday estimated volume for the week using DEF,
Total 7 days volume
$= 25702.9 \times 9.515$
$= \mathbf{244562.90\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 244562.90 \div 7$
$= \mathbf{34937.56\ PCU}$

Since the data were collected in July, using the MEF for July, obtained AADT is
$AADT = 34937.56 \times 0.578$
$= 20193.91$ **PCU**

Here,
MEF = 0.578 for July (Appendix A: Table 1)
DEF = 7.012 for Sunday (Appendix A: Table 2)
HEF = 14.77 (Time 3:00 pm - 4:00 pm) (Appendix A: Table 3)

Day 07 (06-07-2020)

Estimated 24 hour volume for Monday (Jora-gate to Dakbangla), using HEF
$= 1905.25 \times 14.77$
$= 28140.5$ **PCU**

From 24 hour volume for Monday estimated volume for the week using DEF,
Total 7 days volume
$= 28140.5 \times 7.012$
$= \mathbf{197321.48\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 197321.48 \div 7$
$= \mathbf{28188.78\ PCU}$

Since the data were collected in July, using the MEF for June, obtained AADT is
AADT$= 28188.78 \times 0.582$
$= \mathbf{16293.12\ PCU}$

Now,
Estimated 24 hour volume for Monday (Dakbangla to Jora-gate), using HEF
$= 2064.5 \times 14.77$
$= \mathbf{30492.7\ PCU}$

From 24 hour volume for Monday estimated volume for the week using DEF,
Total 7 days volume
$= 30492.7 \times 7.012$
$= \mathbf{213814.57\ PCU}$

Average 24 hours volume (on average daily traffic, ADT)
$= 213814.57 \div 7$
$= \mathbf{30544.94\ PCU}$

Since the data were collected in July, using the MEF for July, obtained AADT is
AADT $= 30544.94 \times 0.578$
$= \mathbf{17654.97\ PCU}$

Details of ADT & AADT				
Time	**Direction**	**Day**	**ADT (PCU)**	**AADT (PCU)**
09 a.m. - 10 a.m.	**Jota-gate to Dakbangla**	Tuesday	41634.73	39469.73
	Dakbangla to Jora-gate		39118.49	37084.33
10 a.m. - 11 a.m.	**Jota-gate to Dakbangla**	Wednesday	21127.94	1221.95
	Dakbangla to Jora-gate		16430.16	9496.64
11 a.m. - 12 p.m.	**Jota-gate to Dakbangla**	Thursday	40892.69	23635.98
	Dakbangla to Jora-gate		33638.96	19443.32
12 p.m. - 01 p.m.	**Jota-gate to Dakbangla**	Friday	11998.58	6935.18
	Dakbangla to Jora-gate		12461.39	7202.68
01 a.m. - 02 a.m.	**Jota-gate to Dakbangla**	Saturday	20291.75	11728.63
	Dakbangla to Jora-gate		24495.40	14158.34
02 p.m. - 03 p.m.	**Jota-gate to Dakbangla**	Sunday	35825.12	20706.92
	Dakbangla to Jora-gate		34937.56	20193.91
03 p.m. - 04 p.m.	**Jota-gate to Dakbangla**	Monday	28188.78	16293.12
	Dakbangla to Jora-gate		30544.94	17654.97

Table 5.7.6: Details of ADT & AADT

5.7.7 Flow Fluctuation Curve

Jora-gate to Dakbangla							
Time	**Service Flow Rate (PCU/hr.)**	**HEF**	**Estimated 24 hour volume (PCU)**	**DEF**	**Estimated volume for the week (PCU/7days)**	**ADT (PCU/day)**	**(% ADT)**
09:00 am - 10:00 am	2006.25	18.8	37717.5	7.727	291443.12	41634.73	20.82
10:00 am - 11:00 am	1313.25	17.11	22469.7075	6.582	147895.61	21127.94	10.57
11:00 am - 12:00 am	2204.25	18.52	40822.71	7.012	286248.84	40892.69	20.45
12:00 pm - 01:00 pm	784.25	18.71	14673.3175	5.724	83990.07	11998.58	6.00
01:00 pm - 02:00 pm	1305.75	16.71	21819.0825	6.51	142042.23	20291.75	10.15
02:00 pm - 03:00 pm	1776	14.84	26355.84	9.515	250775.82	35825.12	17.92
03:00 pm - 04:00 pm	1905.25	14.77	28140.5425	7.012	197321.48	28188.78	14.10
					Total ADT =	**199959.60**	

Table 5.7.7 (a): Calculation of ADT & %ADT of Jora-gate to Dakbangla direction

Dakbangla to Jora-gate							
Time	**Service Flow Rate (PCU/hr.)**	**HEF**	**Estimated 24 hour volume (PCU)**	**DEF**	**Estimated volume for the week (PCU/7days)**	**ADT (PCU/day)**	**(% ADT)**
09:00 am - 10:00 am	1885	18.8	35438	7.727	273829.43	39118.49	20.41
10:00 am - 11:00 am	1021.25	17.11	17473.5875	6.582	115011.15	16430.16	8.57
11:00 am - 12:00 am	1813.25	18.52	33581.39	7.012	235472.71	33638.96	17.55
12:00 pm - 01:00 pm	814.5	18.71	15239.295	5.724	87229.72	12461.39	6.50
01:00 pm - 02:00 pm	1576.25	16.71	26339.1375	6.51	171467.79	24495.40	12.78
02:00 pm - 03:00 pm	1732	14.84	25702.88	9.515	244562.90	34937.56	18.23
03:00 pm - 04:00 pm	2064.5	14.77	30492.665	7.012	213814.57	30544.94	15.94
					Total ADT =	**191626.90**	

Table 5.7.7 (b): Calculation of ADT & %ADT of Dakbangla to Jora-gate direction

Using the values of above tables, flow fluctuation curve is drawn below:

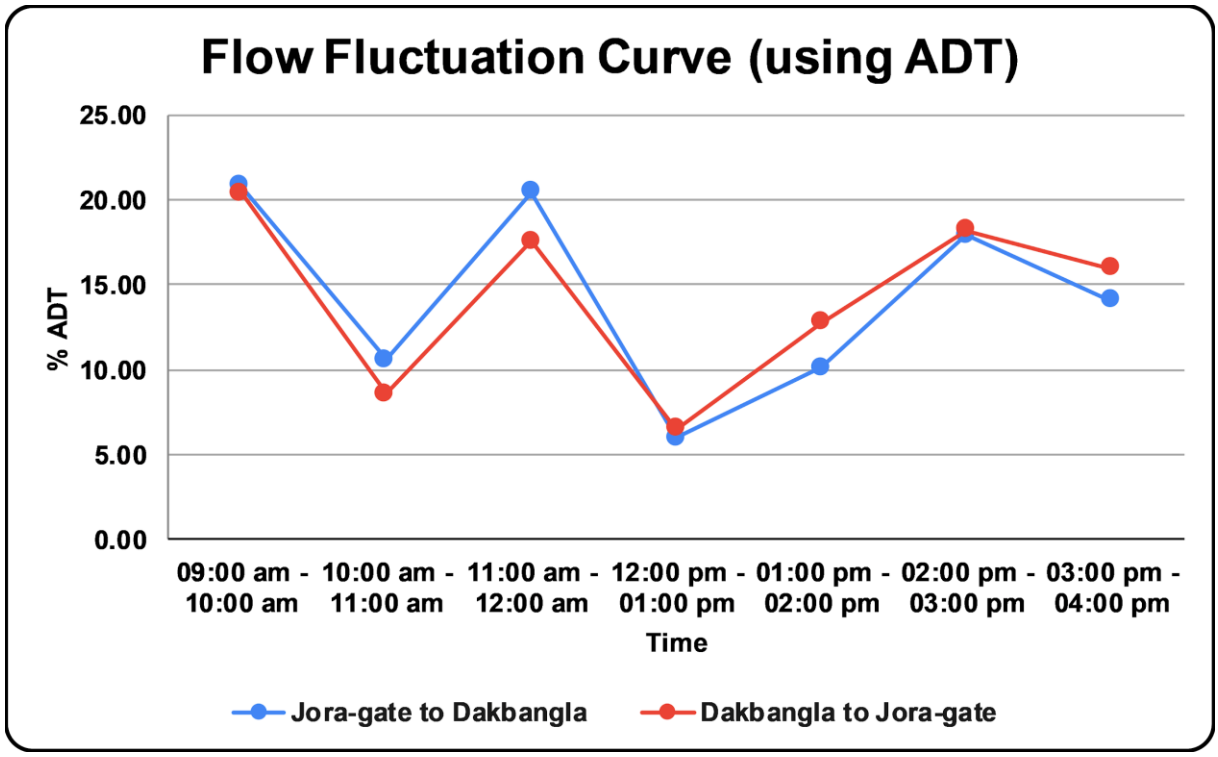


Figure5.7.7: Flow fluctuation curve

Chapter 06

Conclusion & Recommendations

6.1 Introduction

Efficient circulation of road networks is one of the key elements in future growth and prosperity of a city. The existing road transport in Khulna city is now pronounced as air and sound pollution, traffic congestion and traffic fatalities. The overall road transport system of Khulna city is not socially and economically satisfactory. The private transports (motorcycle and private car/jeep) are used by only higher income groups. But due to the high cost of traveling this group is not satisfied with this to travel within the city. The auto-rickshaw service is available for short and long trips in the city but the accidental frequency by auto-rickshaw is high and its unauthorized parking tendency throughout the city causes higher levels of traffic congestion. Among all the vehicles running in this city the cheaper transport mode is public bus service. Lower and lower moderate income groups mostly use this service. But unavailability of city bus service in all routes, more passengers than sitting capabilities of bus, insufficient sitting facilities for women and lack of adequate quality service, this city service is not comfortable to the moderate to high-income groups. In Khulna city, among the all modes of motorized transport the auto rickshaw is mostly air and noise polluting and during travel with this mode the passengers suffer from some health problems due to high noise level. Motorcycles and private cars also cause high levels of air and noise pollution but the city bus service is less polluting than all other modes. The larger segment of the city dwellers belongs to low-income groups. Bus, as a cheaper means of road transport, is needed to allow mobility of low-income people. Buses with quality service may induce comparatively higher income groups as well to travel by bus instead of using private transports, thus reducing traffic volume of roads.

6.2 Discussion on vehicle composition

Motorcycle vehicles consist of more than the pie chart (29.6%), Auto-Rickshaw (Mahindra-Easy-bike) takes 27.6% and Non-motorized vehicles 24.3%, Light vehicles 17.0%.

6.3 Level of service

- The LOS (Level of Service) is B.
- The road was constructed to serve as a main road of the city.
- Main road should have a LOS B.

6.4 Discussion on Directional distribution

50.63% of traffic flow was from Jora-gate to Dakbangla direction. And 49.37% of traffic was flowing from Dakbangla to Jora-gate direction. Directional distribution was found nearly equal on both sides of the road. So it can be said that the geometric design of the road is adequate for present traffic.

6.5 Discussion on flow fluctuation

From the flow fluctuation curve, it is seen that the vehicle movement is nearly uniform in that road. % of ADT is higher for **Jora-gate to Dakbangla** and **Dakbangla to Jora-gate** both direction at 09.00 AM-10.00 AM

6.6 Recommendation

- Zebra Crossing is required for the safety of Pedestrians.
- Non-motorized Vehicles should not be allowed.
- Amount of public transport should be increased.
- Separate lane is required for non-motorized vehicles. (e.g.: Rickshaw, Bicycle, Paddle Van)
- Speed Breaker is needed urgent on the intersection of Shibbari moar in order to reduce accidents
- Signal should be visualized properly
- The amount of road signs were insufficient. Proper instruction details should be clearly visible.
- For the convenience of both drivers and pedestrians the road signs should be newly established at necessary intervals.

6.7 Limitation

- Collected data may not be always accurate.
- Short count was taken (1 hour).
- All criteria regarding Data collection may not always be fulfilled.
- Some errors may have occurred when calculating Journey speed and vehicle speed.
- Observation points may not be always in a suitable location.
- Insolent surveyors
- Suitable time for conducting surveys may not be always maintained.
- Now a day's automatic counting method based on CCTV/Video image processing is reliable and popular. But due to resource constraint it was not possible.
- Enumerators
- Expansion factors used for the calculation of ADT were developed for a rural primary road.

6.8 Recommendation for future work

For more reliable data automatic data collection processes should be used. Different and new methods of volume study can be used instead of manual survey so that more precise understanding can be gained from the results. Funding should be increased. And safety measurement should be increased.

6.9 Conclusion

In Traffic Survey and Analysis it is discussed about the congestion points (within 2 km), Control volume Study, ADT, AADT, Rate of Flow, Peak hour factor Flow fluctuation curve study, Directional Distribution, Design hour volume of Dakbangla to Jora-gate direction and Jora-gate to Dakbangla both direction.

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Appendix-A

Table 1: Monthly Expansion Factors for a rural primary road

Month	MEF	Month	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
Saturday	6.51
Sunday	9.515
Monday	7.012
Tuesday	7.727
Wednesday	6.582
Thursday	7.012
Friday	5.724

Table 3: Hourly Expansion Factors for a rural primary road

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

Appendix-B

Table 01: PCU calculation of Jora-gate to Dakbangla direction (Day 01)

Jora-gate to Dakbangla (Day-01)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	1	1	0	1	3	3
Truck	7	8	8	4	5	5	37	2
Auto Rickshaw	122	116	134	118	116	131	737	0.75
Light Vehicle	86	62	73	85	78	70	454	1
Motor-cycle	99	121	176	135	111	148	790	0.75
Non-motorized Vehicle	98	104	128	110	103	105	648	0.5
Total No. of Vehicles	412	411	520	453	413	460	2669	-----
Total PCU	314.75	307.75	388.5	340.75	309.75	344.75	2006.25	-----

Table 02: PCU calculation of Dakbangla to Jora-gate direction (Day 01)

Dakbangla to Jora-gate (Day-01)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	1	0	2	1	0	0	4	3
Truck	4	5	4	7	6	3	29	2
Auto Rickshaw	158	134	137	140	137	152	858	0.75
Light Vehicle	63	46	54	76	54	67	360	1
Motor-cycle	93	99	152	134	107	133	718	0.75
Non-motorized Vehicle	80	89	98	96	94	89	546	0.5
Total No. of Vehicles	399	373	447	454	398	444	2515	-----
Total PCU	302.25	275.25	333.75	346.5	296	331.25	1885	-----

Table 03: PCU calculation of Jora-gate to Dakbangla direction (Day 02)

Jora-gate to Dakbangla (Day-02)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	1	0	0	0	0	1	3
Truck	6	3	4	2	1	3	19	2
Auto Rickshaw	175	180	160	122	155	164	956	0.75
Light Vehicle	21	22	18	16	11	21	109	1
Motor-cycle	84	88	90	42	46	65	415	0.75
Non-motorized Vehicle	54	42	48	32	62	32	270	0.5
Total No. of Vehicles	340	336	320	214	275	285	1770	-----
Total PCU	254.25	253	237.5	159	194.75	214.75	1313.25	-----

Table 04: PCU calculation of Dakbangla to Jora-gate direction (Day 02)

Dakbangla to Jora-gate (Day-02)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	2	0	2	3
Truck	8	6	4	7	4	2	31	2
Auto Rickshaw	115	122	98	125	133	102	695	0.75
Light Vehicle	14	8	7	8	8	7	52	1
Motor-cycle	84	73	55	42	66	58	378	0.75
Non-motorized Vehicle	54	37	27	22	31	22	193	0.5
Total No. of Vehicles	275	246	191	204	244	191	1351	-----
Total PCU	206.25	184.75	143.25	158.25	186.75	142	1021.25	-----

Table 05: PCU calculation of Jora-gate to Dakbangla direction (Day 03)

Jora-gate to Dakbangla (Day-03)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	1	0	1	0	2	1	5	3
Truck	4	2	5	4	3	4	22	2
Auto Rickshaw	162	180	173	190	185	169	1059	0.75
Light Vehicle	58	52	51	48	59	39	307	1
Motor-cycle	173	187	185	197	186	178	1106	0.75
Non-motorized Vehicle	67	72	69	82	67	72	429	0.5
Total No. of Vehicles	465	493	484	521	502	463	2928	-----
Total PCU	353.75	367.25	367	387.25	382.75	346.25	2204.25	-----

Table 06: PCU calculation of Dakbangla to Jora-gate direction (Day 03)

Dakbangla to Jora-gate (Day-03)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	2	0	0	0	1	2	5	3
Truck	5	2	5	3	2	4	21	2
Auto Rickshaw	194	153	157	163	158	174	999	0.75
Light Vehicle	38	31	35	67	50	64	285	1
Motor-cycle	87	94	128	134	104	119	666	0.75
Non-motorized Vehicle	63	74	68	82	85	73	445	0.5
Total No. of Vehicles	389	354	393	449	400	436	2421	-----
Total PCU	296.25	257.25	292.75	336.75	296	334.25	1813.25	-----

Table 07: PCU calculation of Jora-gate to Dakbangla direction (Day 04)

Jora-gate to Dakbangla (Day-04)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	0	0	0	3
Truck	4	6	4	3	5	2	24	2
Auto Rickshaw	83	86	76	67	89	55	456	0.75
Light Vehicle	10	14	21	14	11	16	86	1
Motor-cycle	69	53	61	46	55	41	325	0.75
Non-motorized Vehicle	22	25	21	22	18	21	129	0.5
Total No. of Vehicles	188	184	183	152	178	135	1020	-----
Total PCU	143	142.75	142.25	115.75	138	102.5	784.25	-----

Table 08: PCU calculation of Dakbangla to Jora-gate direction (Day 04)

Dakbangla to Jora-gate (Day-04)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	0	0	0	3
Truck	5	6	3	2	3	1	20	2
Auto Rickshaw	89	62	72	65	88	72	448	0.75
Light Vehicle	13	16	14	12	11	16	82	1
Motor-cycle	48	66	67	65	55	65	366	0.75
Non-motorized Vehicle	21	34	31	23	32	23	164	0.5
Total No. of Vehicles	176	184	187	167	189	177	1080	-----
Total PCU	136.25	141	139.75	125	140.25	132.25	814.5	-----

Table 09: PCU calculation of Jora-gate to Dakbangla direction (Day 05)

Jora-gate to Dakbangla (Day-05)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	2	1	0	0	0	3	3
Truck	4	5	3	4	4	3	23	2
Auto Rickshaw	122	112	103	117	125	94	673	0.75
Light Vehicle	28	24	27	21	35	31	166	1
Motor-cycle	90	79	87	85	98	93	532	0.75
Non-motorized Vehicle	53	60	66	57	62	64	362	0.5
Total No. of Vehicles	297	282	287	284	324	285	1759	-----
Total PCU	221.5	213.25	211.5	209	241.25	209.25	1305.75	-----

Table 10: PCU calculation of Dakbangla to Jora-gate direction (Day 05)

Dakbangla to Jora-gate (Day-05)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	2	0	0	2	1	0	5	3
Truck	5	4	4	3	5	2	23	2
Auto Rickshaw	102	95	104	91	112	108	612	0.75
Light Vehicle	22	26	33	31	28	34	174	1
Motor-cycle	107	112	117	124	115	140	715	0.75
Non-motorized Vehicle	105	98	113	127	121	128	692	0.5
Total No. of Vehicles	343	335	371	378	382	412	2221	-----
Total PCU	247.25	238.25	263.25	267.75	271.75	288	1576.25	-----

Table 11: PCU calculation of Jora-gate to Dakbangla direction (Day 06)

Jora-gate to Dakbangla (Day-06)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	1	0	2	0	1	0	4	3
Truck	5	4	3	6	4	5	27	2
Auto Rickshaw	161	138	145	158	141	129	872	0.75
Light Vehicle	47	42	33	29	34	41	226	1
Motor-cycle	112	108	114	127	131	128	720	0.75
Non-motorized Vehicle	85	98	111	92	89	105	580	0.5
Total No. of Vehicles	411	390	408	412	400	408	2429	-----
Total PCU	307.25	283.5	294.75	300.75	293.5	296.25	1776	-----

Table 12: PCU calculation of Dakbangla to Jora-gate direction (Day 06)

Dakbangla to Jora-gate (Day-06)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	1	2	0	0	0	3	3
Truck	4	2	5	5	3	5	24	2
Auto Rickshaw	116	128	132	118	123	137	754	0.75
Light Vehicle	32	28	34	41	29	33	197	1
Motor-cycle	117	121	127	142	135	130	772	0.75
Non-motorized Vehicle	102	98	117	132	105	113	667	0.5
Total No. of Vehicles	371	378	417	438	395	418	2417	-----
Total PCU	265.75	270.75	302.75	312	281	299.75	1732	-----

Table 13: PCU calculation of Jora-gate to Dakbangla direction (Day 07)

Jora-gate to Dakbangla (Day-07)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	1	0	1	3
Truck	0	4	2	1	3	4	14	2
Auto Rickshaw	170	153	157	141	176	145	942	0.75
Light Vehicle	23	42	41	41	60	31	238	1
Motor-cycle	135	151	167	120	138	108	819	0.75
Non-motorized Vehicle	110	100	99	122	94	106	631	0.5
Total No. of Vehicles	438	450	466	425	472	394	2645	-----
Total PCU	306.75	328	337.5	299.75	351.5	281.75	1905.25	-----

Table 14: PCU calculation of Dakbangla to Jora-gate direction (Day 07)

Dakbangla to Jora-gate (Day-07)								
Types of vehicle	**Minutes (Interval)**						**Total**	**PCU Factor**
	(0-10)	**(11-20)**	**(21-30)**	**(31-40)**	**(41-50)**	**(51-60)**		
Bus	0	0	0	0	0	0	0	3
Truck	9	0	3	2	3	2	19	2
Auto Rickshaw	180	188	166	155	165	143	997	0.75
Light Vehicle	28	36	35	31	34	24	188	1
Motor-cycle	173	149	160	161	163	155	961	0.75
Non-motorized Vehicle	80	151	119	143	115	132	740	0.5
Total No. of Vehicles	470	524	483	492	480	456	2905	-----
Total PCU	350.75	364.25	345	343.5	343.5	317.5	2064.5	-----