A Comparison of Traffic Volume Study between Panthapath and Russel Square junction before and after the lockdown due to COVID-19 in Dhaka city.

Submitted By

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

SONARGAON UNIVERSITY

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DECLARATION

We thereby declare that the research reported in this thesis has been performed by us and this thesis work or any part of it has not been submitted else where for any other purpose except when due reference is made in the text of the thesis.

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CERTIFICATION

This is to certify that the thesis paper on “TRAFFIC VOLUME STUDY” is done by **Faysal Ahmmed, Md. Atiqur Rahman, Forkan Uddin Asik, Azharul Islam Rafi , Suraiya Sultana Bithi & Shah Alam** for partial fulfillment of the requirement of the degree of Bachelor of Science (B.Sc) in Civil Engineering.

This thesis has been carried out under my guidance and is record of the successful work.

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ACKNOWLEDGEMENT

First of all, we like to show our highest gratitude to the Almighty Allah for his mercy, blessing and guidance while we were preparing our thesis. This study was not possible without the help of our honorable teacher Md. **Redowan Rashid** who helped us a lot by giving sufficient time for discussions and continuous suggestions and guidance for the preparation of this Thesis. We express our heartiest thanks to the head of the department and others faculty members of the Department of Civil Engineering, who helped us by providing their important suggestions. We are also grateful to all our teachers of the University for their co-operation and dedicated teaching for the achievement of the degree of B.Sc in Civil Engineering. We are very much grateful to them who always assisted and helped throughout our study at Sonargaon University. We consider it a privilege to have studied with such dignified people. Co-operation and assistance of all the officers and stuffs of the Sonargaon University are acknowledged.

ABSTRACT

Traffic engineering uses 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 before and after COVID-19 traffic flow are **volume, speed** and **density**. To investigate the impact of lockdown during the COVID-19, we conducted a traffic volume study in the same road at two different times (Before and after lockdown) in Dhaka city. This study specifically aims to assess the change of traffic volume with respect to travel behavior, traffic characteristics and socio-demographic characteristics with the change of control policies for the COVID-19.

The current work studies traffic characteristics this COVID-19 situation 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 Panthapath to Russel Square junction in 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. 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.

In the case of COVID-19, the “stay-at-home” order and implications of social distancing measures, which aim to “flatten the curve” of the spread and in turn, have significantly changed people’s travel behavior in different ways. However, the data we found did not serve the overall purpose of the stay-at-home theory. Before lockdown the Hourly PCU of Panthapath to Russel Square junction was 1739 whereas at present in the lockdown we got Hourly PCU 1728.72. So level of Service (LOS) of this junction remains “F” like before. So, the lockdown had no effect on this Panthapath to Russel Square junction.

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List of Abbreviations

ADT - Average Daily Traffic

AADT - Annual Average Daily Traffic

DEF - Daily Expansion Factor

HEF - Hourly Expansion Factor

MEF - Monthly Expansion Factor

LOS - Level of Service

PHF - Peak Hour Factor

PCE – Passenger Car Equivalent

PCU – Passenger Car Unit

CHAPTER 1

INTRODUCTION

1.1 : General

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

Traffic volume studies are conducted to determine the number, movements and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded. For example, an intersection count may be conducted during the peak flow period. If so, manual count with 25-minute intervals could be used to obtain the traffic volume data.

The information on traffic volume is an important input required for planning, analysis, design and operation of roadway systems. Highway capacity values and speed flow relationships used for planning, design and operation of highways, in most of the developed countries, pertain to fairly homogeneous traffic conditions comprising vehicles of more or less uniform static and dynamic characteristics. But the traffic scenario in developing countries like Bangladesh differs significantly from the conditions of developed countries in many respects. In Bangladesh road traffic, the heterogeneity is of high degree with vehicles of widely varying static and dynamic characteristics. Under this condition, it becomes difficult to make the vehicles to follow traffic lanes. Consequently, the vehicles tend to choose any

advantageous lateral position on the road based on space availability. Under the said traffic conditions expressing traffic volume as number of vehicles passing a given section of road per unit time will be inappropriate and some other suitable base needs to be adopted for the purpose. The problem of measuring 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 PCU is the universally adopted unit of measurement of traffic volume, derived by taking the passenger car as the 'standard vehicle'.

1.2 : Necessity of Traffic Volume Study

Traffic engineers and planners need 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. Traffic engineers 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.

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

- Increase the efficiency and life of roads
- Reduces traffic volume at a particular road
- Provide better means for development of infrastructures

- ❖ Provide better means to utilize other roads in case of special events in the city
- ❖ Provide estimates at no vehicles against no of persons.

Traffic volume data are needed in research, planning, designing and regulation phases of traffic engineering and are also used in established priorities and schedules of traffic improvements. The traffic engineer must acquire 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/her jurisdiction.

1.3: General Objectives of Traffic Volume Study

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

1.3.1 Design purposes:

- 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 side-walks, pedestrian crossing etc.

1.3.2 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.

1.3.3 Planning Purposes:

- Accurate information on the amount of traffic on the roads is vital for the planning of both road maintenance and improvement policies.
- Traffic volume network analysis helps in deciding/planning if there is need for
    - Improvement
    - Expansion in terms of construction missing links, by-pass, alternative road etc.

1.3.4 Dynamic Traffic Management Purposes:

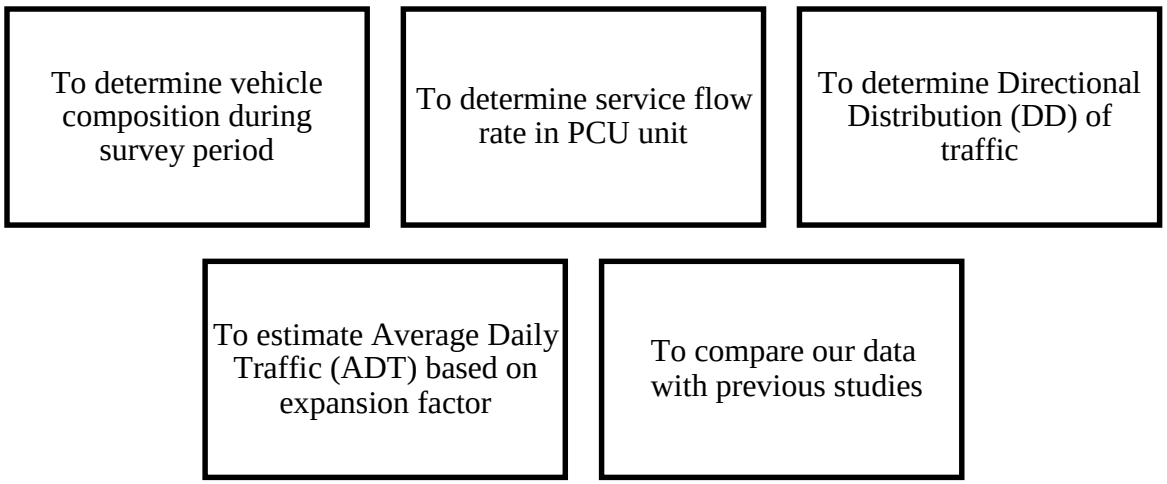
Up to date and continuous flow/congestion information is essential for optimizing-

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

1.3.5 Other Purposes:

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

1.4 : Specific Objectives of our Traffic Volume Study

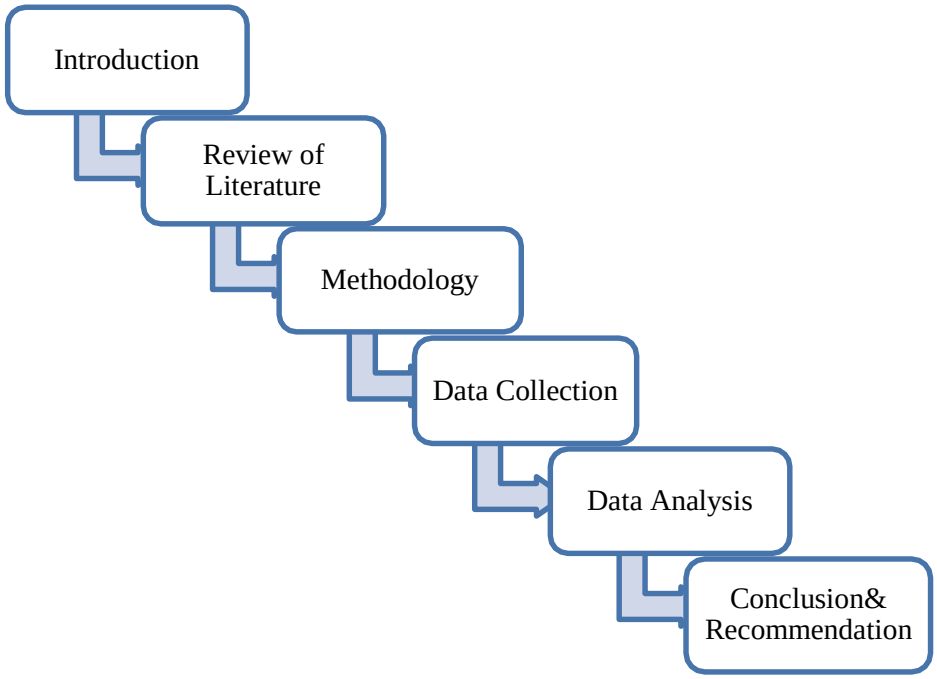


1.5 : Scopes of Traffic Volume Study

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

1.6 : Steps of Organizing the Report



CHAPTER 2

REVIEW OF LITERATURE

2.1 : General

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.

2.2 : Definitions

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

Rate of flow: The equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a time interval less than 1hr. usually 25 min.

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

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

PCU/PCE: PCE means passenger car equivalent to express various types and characteristics vehicles to a common type usually the passenger car. One car is considered to one unit.

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

The common applications are:

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

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

This is useful for:

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

Average Weekday Traffic (AWT): The average 24-hr weekday volume at a given location over a defined time period less than one year. A common application is to measure an AWT for each month of the year.

Average Annual Weekday Traffic (AAWT): The average 24-hr volume occurring on weekdays over a full 365-day year, estimated as number of vehicles passing a site on weekdays in a year divided by the number of weekdays (usually 260, considering 5-day week).

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

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

It is useful for:

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

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

Interrupted flow: Flow at stop and go situation.

Uninterrupted flow: When the flow is smooth.

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

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

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

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

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

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

Peak flow: Flow at peak periods

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

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

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

2.3 : Previous Traffic Volume Studies

Jie Zhang, et. al. 2021 has been investigating the impact of COVID-19 on the number of people involved in crashes accounting for the intensity of different control measures using Negative Binomial (NB) method. Based on a comprehensive dataset of people involved in crashes aggregated in New York City during January 1, 2020 to May 24, 2020, people involved in crashes with respect to travel behavior, traffic characteristics and socio-demographic characteristics are found. The results show that the average person miles traveled on the main traffic mode per person per day, percentage of work trip have positive effect on person involved in crashes. On the contrary, unemployment rate and inflation rate have negative effects on person involved in crashes. Interestingly, different level of control policies during COVID-19 outbreak are closely associated with safety awareness, driving and travel behavior, and thus has an indirect influence on the frequency of crashes. Comparing to other three control policies including emergence declare, limits on mass gatherings, and ban on all nonessential gathering, the negative relationship between stay-at-home policy implemented in New York City from March 20, 2020 and the number of people involved crashes is found in our study.

According to Scott A. Parr. August 2020, the COVID-19 pandemic resulted in significant social and economic impacts throughout the world. In addition to the health consequences, the impacts on travel behavior have also been sudden and wide ranging. This study describes the drastic changes in human behavior using the analysis of highway volume data as a representation of personal activity and interaction. Same-day traffic volumes for 2019 and 2020 across Florida were analyzed to identify spatial and temporal changes in behavior resulting from the disease or fear of it and statewide directives to limit person-to-person interaction. Compared to similar days in 2019, overall statewide traffic volume dropped by 47.5%. Although decreases were evident across the state, there were also differences between rural and urban areas and between highways and arterials both in terms of the timing and extent. The data and analyses help to demonstrate the early impacts of the pandemic and may be useful for operational and strategic planning of recovery efforts and for dealing with future pandemics.

Coronavirus disease 2019 (COVID-19) has impacted and is still disturbing all sectors across the world, including transportation. Due to the pandemic, people around the world were forced to quarantine and telework, and vehicle circulation only occurred when strictly necessary. In fact, the analysis of road traffic data collected during the current pandemic crisis depicts striking effects of the pandemic on the transportation sector, that is, city movement registered record low values.

Due to the pandemic, people around the world were forced to quarantine and telework, and vehicle circulation only occurred when strictly necessary. In fact, the analysis of road traffic data collected during the current pandemic crisis depicts striking effects of the pandemic on the transportation sector, that is, city movement registered record low values. The world's most congested cities registered an average 5-7% city movement during their respective most critical month of the lockdown.

The current global health disaster serves as an opportunity to evaluate which aspects of modern life are essential, and which are needed to change or improve so that we can look to achieve more sustainable societies and improve our quality of life. The pandemic showed how today the transportation sector faces several new challenges, namely: (1) public transportation needs to have a limit regarding the number of users in order to accomplish social distancing; (2) the use of private vehicles circulating daily tends to increase; and (3) teleworking decreases the need to commute and the use of public transportation and private vehicles.

Italy's monthly traffic volume during the morning rush hour was 30 percent below the previous year's level in December 2020. Traffic volume had decreased significantly in March and April, when Italy started ordering people to stay home to limit the spread of the coronavirus pandemic.

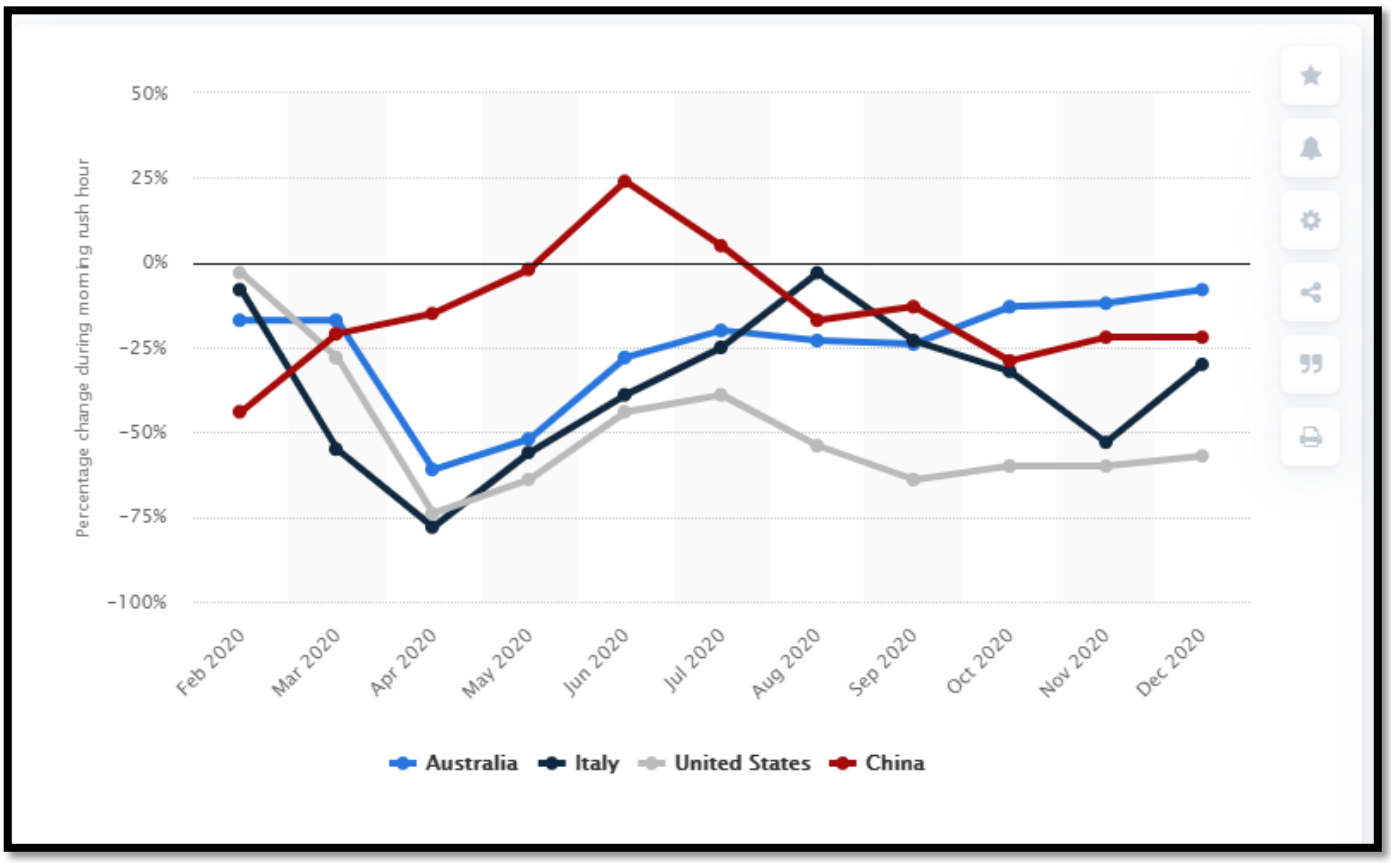


Fig 2.0: Traffic reduction in selected countries amid coronavirus crisis 2020 (i.Wagner, Jun 4, 2021)

COVID-19 Traffic Volume Trends

https://www.ite.org/about-ite/covid-19-resources/covid-19-traffic-volume-trends/

Calgary, Alberta, Canada

Dates of Counts: March 2 – May 31, 2020

Volume Trend (approximate): Weekday segment volumes reduced 54%.

Link: City of Calgary COVID-19 Travel Trends; Mobility Trends in May 2020

Description: A multi-modal review of travel trends in Calgary due to COVID-19. Transit ridership, taxi/ridesharing trips, and passenger car volumes have decreased. Heavy Truck volume has remained consistent with pre-pandemic conditions. Pedestrians and Bikes continue to use the pathway system for recreation. Additional link added to show data through May 31, 2020 for City of Calgary. To provide some context, some business in Calgary started re-opening the second week of May, and restaurants and hair saloon were able to open up May 25. We are now seeing increases for all modes of travel and slight increases in congestion / decreases in speed during the rush hours.

Los Angeles/Ventura Counties, CA

Dates of Counts: December 1, 2019 – March 31, 2020

Volume Trend (approximate): Total VMT reduced by 30 to 40%

Link: VMT Count Summary

Description: These are the daily VMT trends for last 4 months courtesy of Caltrans PeMS.
In the last two weeks of March, since "shelter in place" orders were issued March 16, 2020, there has been about a 30% decrease in weekday VMT on freeways in the San Francisco Bay Area and Los Angeles County. Weekend VMT on urban freeways has dropped about 40%. After the initial large drop in the first 48 hours after the orders took effect, there has been continuing, but moderate decreases in VMT. Delays in both the Bay Area and Los Angeles have dropped roughly 80%.

San Francisco Bay Area, CA

Dates of Counts: December 1, 2019 – March 31, 2020

Volume Trend (approximate): Total VMT reduced by 30 to 40%

Link: VMT Count Summary

Description: These are the daily VMT trends for last 4 months courtesy of Caltrans PeMS. In the last two weeks of March, since "shelter in place" orders were issued March 16, 2020, there has been about a 30% decrease in weekday VMT on freeways in the San Francisco Bay Area and Los Angeles County. Weekend VMT on urban freeways has dropped about 40%. After the initial large drop in the first 48 hours after the orders took effect, there has been continuing, but moderate decreases in VMT. Delays in both the Bay Area and Los Angeles have dropped roughly 80%.

Fort Collins, CO

Dates of Counts: March 1 – April 7, 2020

Volume Trend (approximate): Volume reductions from 45% to 55%

Link: Volume Count Summary

Description: In Fort Collins, aggregated counts from system detectors located around the City are presented relative to when the various State orders were put in place. Travel reductions of 45% - 55%

are being demonstrated under "stay at home" orders. Context was also provided for the type of traffic volumes relative to other typical days. Christmas Day traffic represents a 66% reduction in travel compared to a typical weekday here.

Loveland, CO

Dates of Counts: March 10 – April 5, 2019 and March 10 – April 5, 2020

Volume Trend (approximate): Percentages not noted.

Link: Count Summary

Description: Compared 2019 vs. 2020 volumes in three locations. Volumes have stabilized and it doesn't appear that volumes have started to tick back up. All of the patterns appear to be holding, just at a lower level than before.

Florida State

Dates of Counts: March 10 – April 7, 2020

Volume Trend (approximate): State traffic volumes reduced 30 to 50%

Link: https://www.fdot.gov/statistics/trafficdata/default.shtm

Description: Florida Department of Transportation has developed a dashboard on traffic volume (and truck) variations related to the COVID-19 restrictions and also provided a summary report.

Cape Corel, FL

Dates of Counts: Feb 2 – April 4, 2019 and Feb 2, 2020 – April 4 2020

Volume Trend (approximate): Total volume reductions up to 60%

Link: Count Summary

Description: Compared day-to-day volumes from last year to this year at a few count stations.

Manatee County, FL

Date of Counts: February 10 to April 16, 2020 (compared to same time period in 2019)

Volume Trend (approximate): 30% to 40% reduction in volume compared to 2019

Link: File 1 and File 2

Description: The first file provides a comparison of the regular weekday traffic from 2019 to 2020. The second compares weekly change in traffic before and after the declaration of local curfew (during the curfew hours).

Lake County, IL

Dates of Counts: February 25 – April 8, 2020

Volume Trend (approximate): Total volumes are down 37% - 48%

Link: Traffic volumes Feb 25-27, 2020 & March 3-5, 2020 (Pre-COVID-19); March 18-19, 2020 & March 24-25, 2020 & March 31-April 1, 2020; April 7-8, 2020, April 14-15, 2020 & April 21-22

Description: See executive summary on each count summary for a week by week description. Each description also has a statement on how the week is trending.

Iowa State

Dates of Counts: March 13 – April 14, 2020

Volume Trend (approximate): State traffic volumes reduced approximately 40%

Link: https://iowadot.gov/maps/Data/AUTOMATIC-TRAFFIC-RECORDER-REPORTS

Description: This report contains traffic data collected from over 120 Continuous Count Sites in Iowa State that report how traffic trends have changed since Friday March 13, 2020. The data is being collected daily and compared to the same time period in 2019. They also show traffic truck/freight traffic demonstrating a slight increase, but trending back to normal.

Overland Park, KS

Dates of Counts: March 1 – April 19, 2020

Volume Trend (approximate): Local Road Volume reductions up to 65%

Link: Volume Count Summary

Description: Traffic volume has remained steady between March 25th and April 19th at approximately 50-60% below normal.

Amherst, MA

Dates of Counts: Pre-Covid, 4/15/17; Covid, 3/24/20, 4:30-5:30 PM weekday turning movements

Volume Trend (approximate): Volumes 38.4% of Pre-COVID-19 volumes

Link: Volume Count Summary

Description: Governor issued an order to close non-essential businesses the prior day, 3/23/20. The intersection is proximate to two grocery stores (which were open) and is a major access route to UMASS Amherst (which had sent students home).

Oregon State

Dates of Counts: March 5 – April 7, 2020

Volume Trend (approximate): Not provided.

Link: Moving Average Volumes

Description: 7-day moving average of detector actuations, averaged over 170 traffic signals across Oregon.

Portland, OR

Dates of Counts: December 30, 2019 – March 5, 2020

Volume Trend (approximate): Volume reductions up to 50%

Link: Volume Count Summary

Description: Portland's data is from system detectors at this point and we're using this opportunity to invest more time in the Automated Traffic Signal Performance Measures (ATSPM) system for the City. Portland has finally seen a leveling off of weekday data, so perhaps all of the Stay Home messages have done all they can and we're down to just "essential" traffic.

State College, PA

Dates of Counts: February 10 – April 9, 2020

Volume Trend (approximate): Collector traffic volume reduced approximately 60%

Link: Traffic Volumes on Select Collector

Description: Analysis of 60 days of traffic volumes on an urban collector in State College, PA.

Chattanooga, TN

Dates of Counts: February 18 – April 2, 2020

Volume Trend (approximate): Intersection volume reductions from 10% to 45%

Link: Average 24-Hour Intersection Volume per Week

Description: The City of Chattanooga's Department of Transportation has been tracking the weekly data at 12 specific locations in the city. The first 8 represent downtown core and the remaining 4 are a representation of other key locations in town.

Salt Lake City, UT

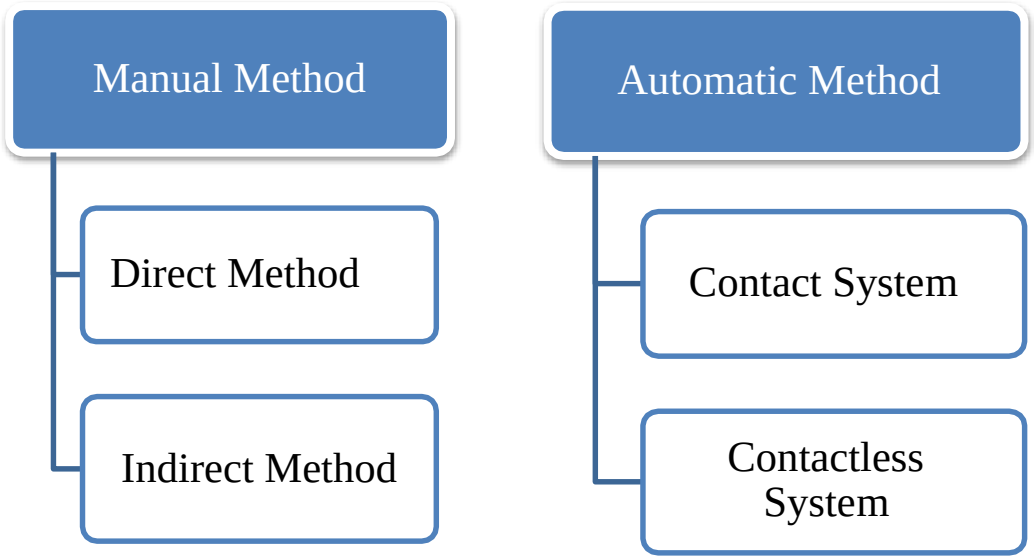
Dates of Counts: Feb 18 – March 5, 2020

Volume Trend (approximate): Intersection volumes reduced by up to 50% to 75% of normal

Link: Intersection Count Summary

Description: Graph includes data from Tues-Thurs using raw data from ATSPMs. On the right side of the graph in the spreadsheet, there is a track of a timeline of events (e.g. when the governor signed an emergency declaration; when schools shut down; earthquake; county stay home order, etc). Over the last few weeks, intersection volumes are about 50% to 75% of normal. Here is s a link intersection data https://docs.google.com/spreadsheets/d/1JSDm902zNYIJG446dscO43noi3UDQai0oAu0WUFmMI/edit?usp=sharing and freeway data: https://docs.google.com/spreadsheets/d/1qPfHnEu9ZQPOIf5BE1IR2wp9wFZd8SsvbXm-i2dyww/edit#gid=971711753

2.4: Counting Methods



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

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

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

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

2.4.1 : Manual Counting Method

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

Manual Count Recording Methods:

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

Tally Sheets:

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

Fig 2.1: Tally Sheet Fig

2.2: Mechanical counter

Mechanical Counting Boards:

Mechanical count boards consist of counters mounted on a board that record each direction of travel. Common counts include pedestrian, bicycle, vehicle classification, and traffic volume counts. Typical counters are push button devices with three to five registers. Each button represents a different stratification of type of vehicle or pedestrian being counted. The limited number of buttons on the counter can restrict the number of classifications that can be counted on a given board. A watch or a stopwatch is also necessary with this method to measure the desired count interval.

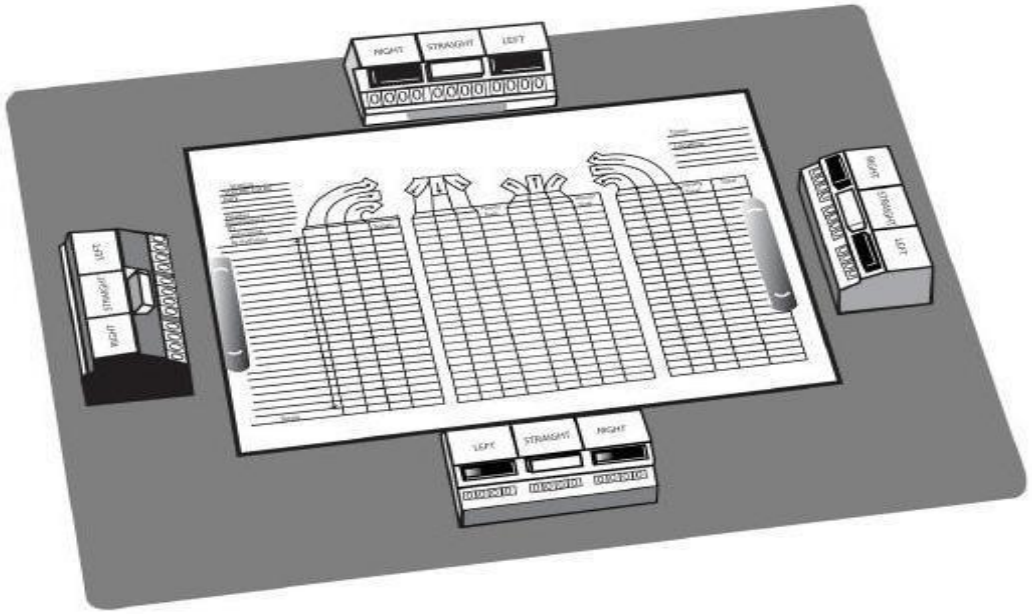


Fig 2.3: Mechanical Counting Board

Electronic Counting Boards:

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

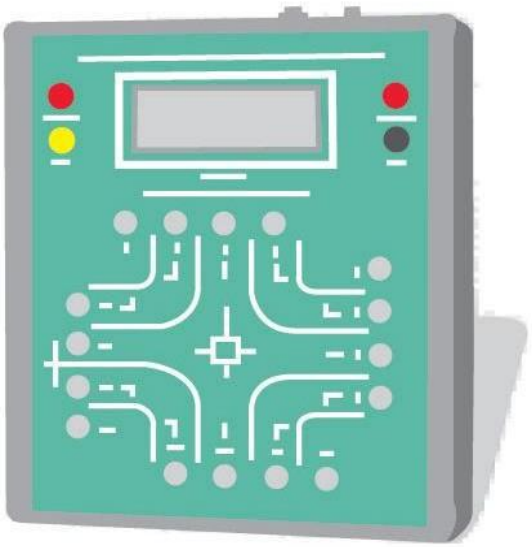


Fig 2.4: Electronic Counting Board

A manual count study includes three key steps:

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

Perform Necessary Office Preparations

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

Select Proper Observer Location

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

Label Data Forms and Record Observations

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

Fig 2.5: Signal Mounted Video Camera for Traffic Volume Count

- **Direct Method:** Data is counted by using 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.

❖ **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 transcript 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.

2.4.2 : Automatic Counting Method

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

Automatic Count Recording Methods:

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

Portable Counters:

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

Permanent Counters:

Permanent counters are used when long-term counts are to be conducted. The counts could be performed every day for a year or more. The data collected may be used to monitor and evaluate traffic volumes and trends over a long period of time. Permanent counters are not a cost-effective option in most situations. Few jurisdictions have access to this equipment.

Videotape:

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

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

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

Perform Necessary Office Preparations

During office preparations, coordinate all data collection activities with appropriate state and local officials, including transportation, traffic, and law enforcement agencies. For example, you may coordinate with state or local officials in obtaining traffic control for the deployment and recovery of

equipment. The field team must be briefed on the data collection process to ensure that all observers are collecting the same data type. The team should assemble and inspect all tools, supplies, and equipment. Each piece of equipment should be tested.

Deploy and Calibrate Data Collection Equipment

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

Check Data and Retrieve Equipment

When the data collection period has ended, the recorded data are checked for accuracy. Crews recover data collection equipment by reversing the process they used to deploy it.

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

- **Bending plate**: a weight pad attached to a metal plate embedded in the road to measure axel weight and speed. It is an expensive device and requires alteration to the road bed.

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

The major non-intrusive methods include:

- **Manual observation**: a very traditional method involving placing observers at specific locations to record vehicle or pedestrian movements. At its simplest, observers use tally sheets to record, but numbers, on the other hand there are mechanical and electronic counting boards available that the observer can punch in each time an event is observed. It can record traffic numbers, type and directions of travel. Manual counts give rise to safety concerns, either from the traffic itself or the neighborhoods where the counts are being undertaken.
- **Passive and active infra-red**: a sensor detecting the presence, speed and type of vehicles by measuring infra-red energy radiating from the detection area. Typically the devices are mounted overhead on a bridge or pylon. The major limitation is the performance during inclement weather, and limited lane coverage.
- **Passive magnetic**: magnetic sensors that count vehicle numbers, speed, and type are placed under or on top of the roadbed. In operating conditions the sensors have difficulty differentiating between closely spaced vehicles.

- **Microwave- Doppler/ Radar**: mounted overhead the devices record moving vehicles and speed. With the exception of radar, devices they have difficulty in detecting closely spaced vehicles and do not detect stationary vehicles. They are not affected by weather.
- **Ultrasonic and passive acoustic**: devices that sound waves or sound energy to detect vehicles. Those using ultrasound are placed overhead to record vehicle presence but can be affected by temperature and turbulence; the acoustic devices are placed alongside the road and can detect numbers and vehicle type.

Fig 2.6: Pneumatic tube technology is used to collect vehicle classification data **(Contact System)**

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

- **Advantages:** This method is suitable for long duration or 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 format. 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.

2.5: Overview

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

CHAPTER 3

METHODOLOGY

3.1 : General

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

3.2 : Survey Zone

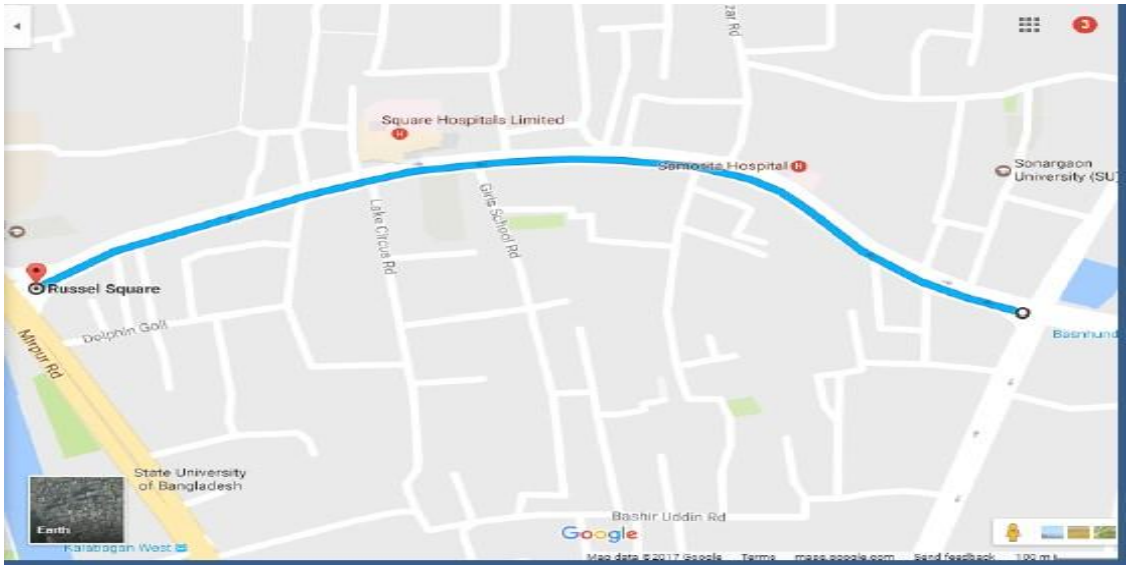


Fig 3.1: Survey Road

3.3 : Reconnaissance Survey

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

- The number of private car is predominant in this road; second most available vehicle along this road is motorcycle.
- One foot over bridge in this road which is used by Square Hospital
- There are number of commercial building, shop, office building is situated on both side of the road
- There are two hospital, Square and BRB Hospital, is situated alongside the road, which is a major attraction of traffic and emergency vehicle
- A large number of private vehicle type traffic is generated from this area

On the basis of all information a model classified traffic volume survey data sheet was developed for pilot survey.

3.4 : Pilot Survey

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

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

3.5 : Counting Method

Amongst the two methods of traffic counting (Manual and Automatic), Manual traffic count has been selected. Required materials for automatic traffic count cannot be obtained from SU. Again, available automatic traffic counting machines were not fully functional. Considering the circumstance, the manual method of traffic count was the best possible option. But because of the lockdown, we were having trouble spontaneously counting cars, so we recorded the video on our mobile phones, and then came home and tiled the vehicles, counting them separately, and then writing them on the table.

3.6 : Overview

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

CHAPTER 4

DATA COLLECTION

4.1 General

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

4.2 Date

Data for volume study were collected on 14 to 20 April, 2021. It was Wednesday to Tuesday. It was total 7 working day's.

4.3 Duration

Duration of data collection was 25 minutes, which was took place from 05:00 pm to 05:25 pm.

4.4 Weather Condition

It was a hot sunny day. Sky was clear. At the time of data collection there was smooth breeze flowing by.

4.5 Location

Location: Location of the traffic volume study was selected to be from Panathapath to Russel Square. Vehicles from Panathapath to Russel Square and from Russel Square to Panthapath were counted.

4.6 Observation

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

4.7 Method

The survey was conducted by direct count with manual method. But because of the lockdown, we were having trouble spontaneously counting cars, so we recorded the video on our mobile phones, and then came home and tiled the vehicles, counting them separately, and then writing them on the table.

4.8 Equipment

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

4.9 Number of Enumerator

There were 3 enumerators in group. Every enumerator was appointed to count one or more than one category of vehicle.

CHAPTER 5

DATA ANALYSIS

5.1 General

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

5.2 Traffic Volume Count Data

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

Table 5.1: Traffic Volume Count Data

Day-1

Site & Location : Panthapath to Russel square

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

Data : 14.04.2021 (Wednesday) Lockdown

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	0	1	1	1	0	0	0
5--10	0	0	1	2	0	0	0
10--15	0	0	2	1	0	0	0
15-20	0	0	1	2	0	0	0
20-25	0	0	1	2	0	0	0
Total	**0**	**1**	**6**	**8**	**0**	**0**	**0**

Day- 2

Site & Location : Panthapath to Russel square

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

Data : 15.04.2021 (Thursday) lockdown

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	1	14	62	27	39	54	1
5--10	1	18	67	29	28	46	3
10--15	1	14	70	32	24	51	1
15-20	2	13	65	21	22	42	1
20-25	0	8	41	18	16	35	3
Total	**5**	**67**	**305**	**127**	**129**	**228**	**9**

Day- 3

Site & Location : Panthapath to Russel square

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

Data : 16.04.2021 (Friday) Lockdown

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Hot and Sunny day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	0	22	31	26	43	40	5
5--10	0	20	28	24	38	46	3
10--15	1	16	35	27	41	38	1
15-20	0	18	38	22	35	32	4
20-25	0	13	34	25	33	41	8
Total	**1**	**89**	**166**	**124**	**190**	**197**	**21**

Day- 4

Site & Location : Panthapath to Russel square

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

Data : 17.04.2021 (Saturday) Lockdawn

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	1	45	108	25	61	96	12
5--10	1	50	67	18	46	83	8
10--15	1	26	42	13	32	46	5
15-20		35	23	10	13	21	5
20-25	1	14	27	6	11	11	5
Total	**4**	**170**	**267**	**72**	**163**	**257**	**35**

Day- 5

Site & Location : Panthapath to Russel square

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

Data : 18.04.2021 (Sunday) Lockdown

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	0	20	15	9	18	14	3
5--10	1	19	31	17	14	16	9
10--15	1	12	9	19	12	41	9
15-20	0	22	20	4	23	10	7
20-25	1	17	23	16	29	17	4
Total	**3**	**90**	**98**	**65**	**96**	**98**	**32**

Day- 6

Site & Location : Panthapath to Russel square

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

Data : 19.04.2021 (Monday) Lockdown

Time : 5.00 Pm- 5.25 Pm

Duration : 25minute

Weather Condition: Sky is clear.

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	1	7	43	9	29	22	15
5--10	0	22	37	6	33	27	9
10--15	2	43	34	39	42	31	3
15-20	2	19	17	20	18	30	16
20-25	0	33	59	19	29	13	11
Total	**5**	**124**	**190**	**93**	**151**	**123**	**54**

Day- 7

Site & Location : Panthapath to Russel square

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

Data : 20.04.2021 (Tuesday)

Time : 5.00 Pm- 5.25Pm

Duration : 25minute

Weather Condition: Hot & Humid day

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	**Cng**	**Car**	**Jeep/ Microbus/ Ambulance**	**Motorcycle**	**Nmv**	**Utility**
0-5	0	38	71	26	40	30	15
5--10	0	40	37	24	33	38	9
10--15	1	24	75	39	51	50	20
15-20	0	26	13	20	18	30	16
20-25	0	50	85	19	39	24	1
Total	**1**	**178**	**281**	**128**	**181**	**172**	**61**

Avg.7 Days

Data Collection Table

Cycle (min)	Number of Vehicles						
	Bus	Cng	Car	Jeep/ Microbus/ Ambulance	Motorcycle	Nmv	Utility
0-5	3	147	331	123	230	256	51
5--10	3	169	268	120	192	256	41
10--15	7	135	267	170	202	257	39
15-20	4	133	177	99	129	165	49
20-25	2	135	270	105	157	141	32
Avg.	**3.8**	**143.8**	**262.6**	**123.4**	**182**	**215**	**42.4**

Vehicle Classification	Observation in 25 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	**3.8**	**9.12**	**0.39**	**3**	**27.36**
Cng (C)	**143.8**	**345.12**	**14.78**	**0.5**	**172.56**
Car (LV)	**262.6**	**630.24**	**26.99**	**1**	**630.24**
Jeep/ Microbus/ Ambulance	**123.4**	**296.16**	**12.68**	**1.5**	**444.24**
Motorcycle (MC)	**182**	**436.8**	**18.71**	**0.1**	**43.68**
NMV	**215**	**516**	**22.10**	**0.5**	**258**
Utility	**42.4**	**101.76**	**4.36**	**1.5**	**152.64**
Total =	**973**	**2335.20**	**100**		**1728.72**

Previous Data Table (below):

Vehicle Classification	Observation in 25 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	3	7	0.323	3.0	21
Cng (C)	157	377	16.90	0.5	188.5
Car (LV)	287	689	30.89	1	689
Jeep/ Microbus/ Ambulance	107	257	11.52	1.5	385.5
Motorcycle (MC)	158	379	16.99	0.1	37.9
NMV	152	365	16.37	0.5	182.5
Utility	65	156	6.99	1.5	234
Total =	929	2230	100		1739

5.3 Vehicle Composition

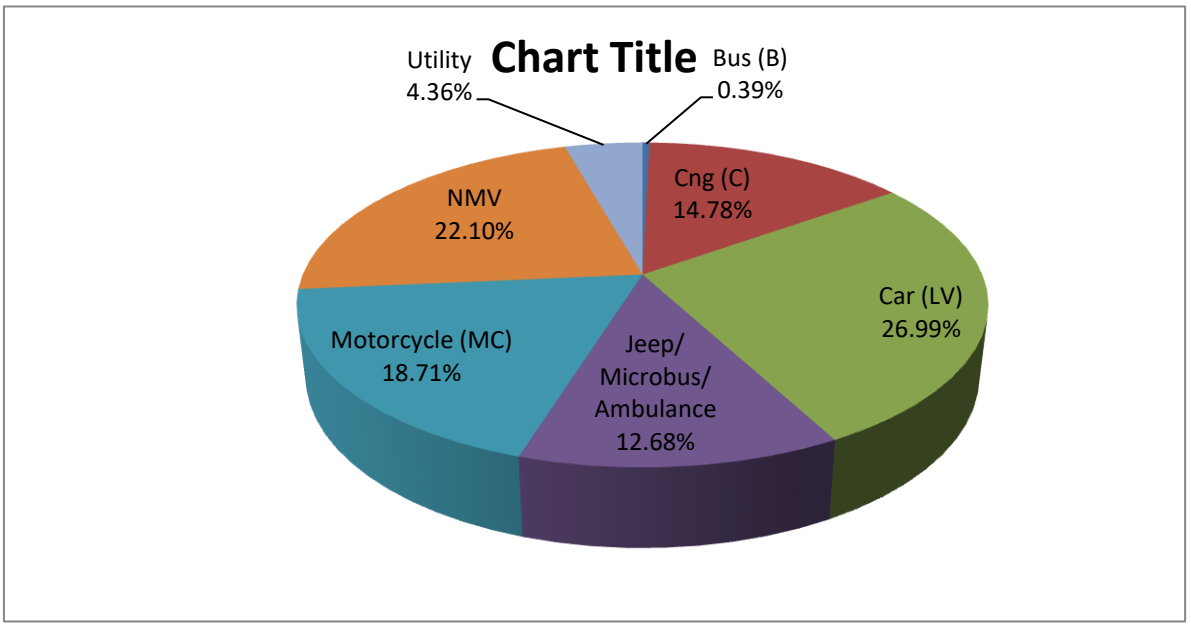


Figure 5.1 Vehicle Composition of Traffic Stream during our study

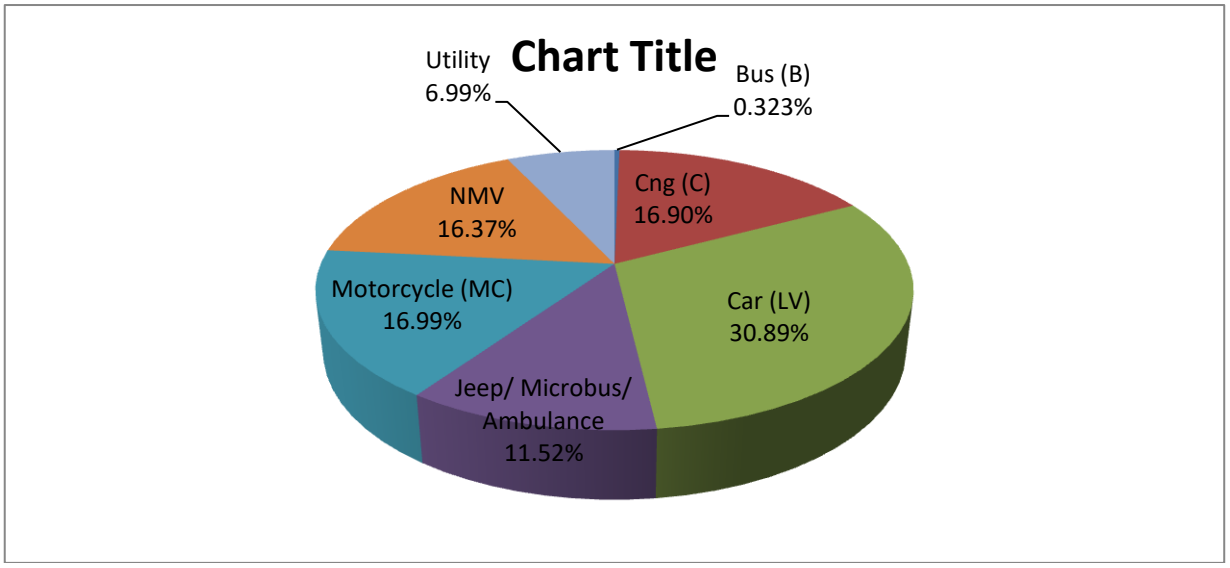


Figure 5.1.1 Vehicle Composition of Traffic Stream before lockdown

5.4 Service Flow Rate and Level of Service (LOS)

Service Flow Rate is the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a given period under prevailing roadway, traffic, and control conditions while maintaining a designated level of service. The service flow rates generally are based on a 25-minute period. Typically, the hourly service flow rate is defined as four times the peak 25-minute volume. Service flow rate is the traffic parameter most commonly used in capacity and level-of-service (LOS) evaluations. Knowledge of highway capacity and LOS is essential to properly fit a planned highway or street to the requirements of traffic demand.

LOS Criteria:

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

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

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

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

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

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

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

Table 5.2: Service Flow Rate

Vehicle Classification	**Observation in 25min**	**PCU**	Converted **Number**	**Hourly PCU**
Bus (B)	3.8	3.0	11.4	27.36
Cng (C)	143.8	0.5	71.9	172.56
Car (LV)	262.6	1	262.6	630.24
Jeep/Microbus/ Ambulance	123.4	1.5	185.1	444.24
Motorcycle (MC)	182	0.1	18.2	43.68
NMV	215	0.5	107.5	258
Utility	42.4	1.5	63.6	152.64
Total =	973		720.3	1728.72

Service Flow Rate (05:00 pm – 06:00 pm) = 1728.72 PCU/hr From calculation it is found that the service flow rate of this corridor at 05:00pm to 06:00 pm was 1728.72 PCU/hr. Again, level of service of a road can be determined from service flow rate. Level of service of a road can be classified according to service flow rate as below.

Table 5.3: Service Flow Rate

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

According to this table the level of service of the road was ‘F’ at 05:00 pm-06:00 pm in Sunday.

5.5 Directional Distribution

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

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

Table 5.4: Directional Distribution

Direction	**Time**	**Average PCU/hr**	**Directional Distribution**
Panthapath to Russel Square	5:00PM-6:00PM	1728.72	56%
Russel Square to Panthapath	5:00PM-6:00PM	1358.28	44%

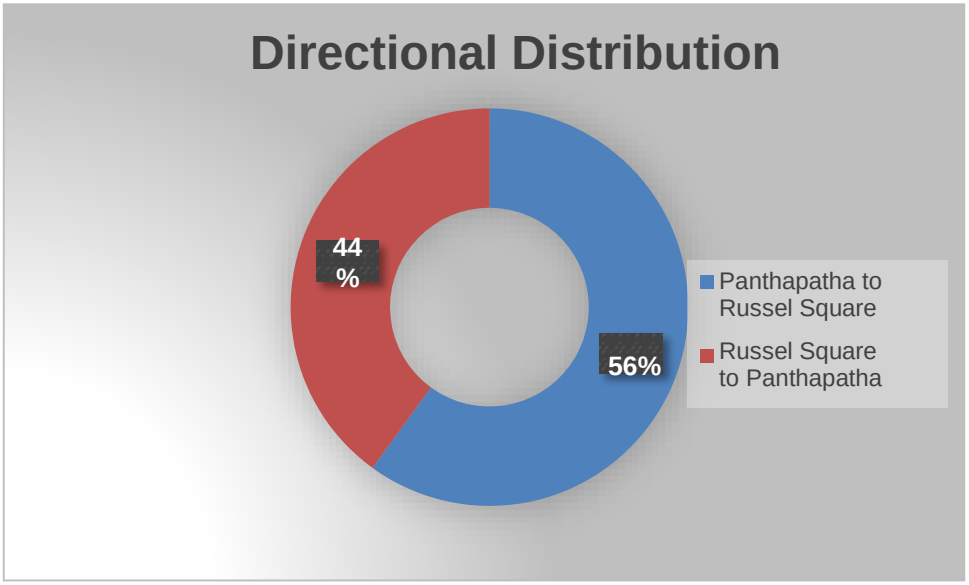


Fig 5.2: Directional Distribution

5.6 Overview

This section of report presents the analysis based on collected data, which leads to make some comparison with previous data. When we compare our data collection table with the traffic volume data before the lockdown, we see that Hourly PCU for bus was 21 before the lockdown. However, during the lockdown we found it was 27.36. For CNG Hourly PCU was 188.5 in previous data whereas in our study it was 172.56. For Car Hourly PCU was 689 and we found 630.24 in our study. For Jeep/microbus/ Ambulance 385.5 was the value of Hourly PCU before the lockdown while we found 444.24 during the lockdown. For MC Hourly PCU was 37.9 and we achieved 43.68 while counting the traffic volume. For utility Hourly PCU decreased from 234 to 152.64.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 General

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

6.2 Discussion on Vehicle Composition

In our study, light vehicle was the predominant in the corridor among the vehicle counted. 26.99% percent of vehicles are of this category which is similar to the previous data that was counted 30.89%. We found that second most frequent vehicle category NMV that counts 22.10% whereas MC and CNG were second most frequent before the lockdown counting 16.99% and 16.90% of total vehicles. During this lockdown CNG vehicle counted 14.78%. Again, third most frequent vehicle category was Motorcycle, which consist 18.71% percent of total vehicle and before the lockdown NMV were the third most frequent having 16.37% of total vehicles. Only 0.39 percent was bus in our study while in previous data it was .323% of total vehicles. 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. It can be assumed that, more people were travelling by bus from distance places. Scarcity of public transport in this area gives rise to the dependency on NMV.

6.3 Discussion on Directional Distribution

56 percent of traffic flow was towards Panthapath which indicates tidal flow towards East-West. It was morning rush hour. So flow was higher towards the city center. 44 percent of traffic was flowing towards West-East. If another vehicle count was done in evening rush hour, opposite scenario might be seen.

6.4 Discussion on Flow Fluctuation

To draw flow fluctuation curve, it was assumed that volume for three continuous hours were counted, although all vehicles were counted within one hour. Each group counted vehicles for 25 minutes in each direction. Flow rates were calculated from that short count data and plotted. The flow fluctuation curve shows a peak at 05:00 pm-06:00 pm.

6.5 Recommendations

There are some recommendations based on the study took place. They are as follows-

- Manual count method required trained enumerators, which was not available in this case.
- For more reliable data automatic data collection process should be used.
- Data were collected for 25 minutes by each group, which may not represent the hourly fluctuation of traffic, so for more allegorical data one hour data should be taken.
- More public transport facility should be provided to support the need of inhabitants living the residential area near the road.
- NMV should be prohibited in this road which will help to increase the Level of Service and Travel Speed.
- This road mainly served the purpose of collector road. Collector roads should be designed for a level of service F or better.

6.6 Scope for Further Study

There are some shortcomings in the study. If these shortcomings can be overcome, more reliable and valuable data can be obtained. These shortcomings are described below-

- This volume study was practiced by un-skilled enumerators, which may lead to some error in data collection process.
- Data collected by manual method of counting, which is unreliable and irreversible, more representatives and reliable data could be obtained if automatic data collection method were followed.
- Data were collected for short-term (25 minute), which was not representative to the flow characteristics of the road. If 7 days continuous data were collected, that would me much more representative than this short count of traffic volume.

6.7 Overview

This traffic volume survey was took place with limited resource and equipment. As the main purpose of this survey is to know the process of traffic volume count, so this limitation can be overlooked.This paper investigates the effect of human mobility and control policies including emergency declarations, bans on gatherings of certain sizes, school closures, restrictions on businesses, and stay-at-home or shelter-in-place of residence orders on the number of persons involved in crashes in Dhaka City during COVID-19 pandemic. Dhaka City was chosen as the site for our case study, since the city suffered from the first wave of COVID-19 spread during March and April and has a high volume of traffic. Meanwhile, a significant amount of data could be generated from the mobile device to collect residents' trip

information. These factors combined to outline a vivid picture of how this pandemic has impacted person involved. Due to the COVID-19, the number of vehicles remain almost same for the following reasons:

- All office (government, semi-government and non-government organization) and courts were open during the lockdown.
- Covid-19 Emergency services were on.
- This street has several important hospitals (Lab-Aid, Samaritan, BRB Hospital) and pharmacies, people have taken treatment from here during the COVID-19 period.
- The area has residential areas and many factories.
- The factory had a plethora of cargo vehicles because Ramadan and Eid were ahead.
- All kinds of markets and shopping malls were open.
- Fear of the Covid-19 among people was less than before, so they went out with cars in search of livelihood.
- The drivers were low-income and had no choice but to go out on a daily basis.
- Many people start running ride sharing rickshaw vans etc. to earn alternative income as money have lost their jobs.
- The month of Ramadan has already fallen, and we know that the traffic is light at this time of year.
- Authority covid-19 was as strict on vehicles as during the first wave.There was a slight flexibility during the next wave so there was normal traffic pressure.

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…The End…