DEVELOPMENT OF CAPACITY MODEL FOR ARTERIAL ROAD UNDER HETEROGENEOUS TRAFFIC CONDITION –A CASE STUDY OF RAJKOT CITY

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CERTIFICATE

It is certified that the work contained in this dissertation thesis entitled '***DEVELOPMENT OF CAPACITY MODEL FOR ARTERIAL ROAD UNDER HETEROGENEOUS TRAFFIC CONDITION-A CASE STUDY OF RAJKOT CITY*** ' submitted by **VALA MILAP VINODRAY**, **210041005** studying at Civil Engineering Department, Faculty of Engineering & Technology, for the award of M.Tech (Civil Engineering-Transportation) is absolutely based on his own work carried out under my supervision and that this thesis has not been submitted elsewhere for any degree.

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It is certified that the work contained in this dissertation thesis entitled '***DEVELOPMENT OF CAPACITY MODEL FOR ARTERIAL ROAD UNDER HETEROGENEOUS TRAFFIC CONDITION-A CASE STUDY OF RAJKOT CITY***'submitted by **VALA MILAP VINODRAY**, **210041005** studying at Civil Engineering Department, Faculty of Engineering & Technology for partial fulfillment of M.Tech degree to be awarded by ATMIYA University, has accepted article entitle '***DEVELOPMENT OF CAPACITY MODEL FOR ARTERIAL ROAD UNDER HETEROGENEOUS TRAFFIC CONDITION-A CASE STUDY OF RAJKOT CITY'*** for publication by the **INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS[E-ISSN 2348-1269, P-ISSN 2349-5138]**

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1) ____

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Dedicated to,

For every success of my life, for
Being worm and caring, great
Enthusiasm, Inspiration, Support &
Love is Heart of my Achievement
Thank You.

My Mom, Dad &
My beloved Friends

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Place: Atmiya University, Rajkot - Milap V. Vala

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ABSTRACT

DEVELOPMENT OF CAPACITY MODEL FOR ARTERIAL ROAD UNDER HETEROGENEOUS TRAFFIC CONDITION- A CASE STUDY OF RAJKOT CITY

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Due to the fast expansion in income and automobile ownership among urban residents, traffic on urban highways is escalating. The issues brought on by the increased traffic have likewise gotten greater and more complicated. India's city streets in general transport heterogeneous traffic, which consists of a variety of vehicles including cars, buses, trucks, motorcycles, light-duty trucks, auto rickshaws, pedal bicycles, hand-drawn carts, animal-drawn carts, and more. The urban diverse traffic flow is impacted by these vehicles' various speeds, sizes, load carrying capacity, and passenger capacities, among other factors. Non-uniform carriageway width over the length of the road is typical, particularly in developing nations. The difference in roadway width also causes the traffic stream speed to experience higher levels of congestion throughout the link's length. The most significant component that directly influences the behaviour of the traffic stream is the traffic mix. Since the majority of the traffic is made up of the same sorts of vehicles, homogenous traffic does not experience sudden changes in its features. In contrast, heterogeneous traffic consists of a mix of several vehicle kinds, including cars, trucks, buses, LCVs, two- and three-wheelers, bicycles, and others. These vehicles vary in terms of their size, form, power, ability to transport a load, and speed. Because of this, the properties of the traffic stream for heterogeneous traffic vary remarkably. When there are the most two-wheelers in the traffic composition, the speed and flow values are greater. Due to the fact that two-wheelers take up less space than cars, buses, and trucks, this is the case. Additionally, the needed distance for a standstill is quite short since two-wheelers can be stopped much more quickly than buses. When two-wheelers are operated on urban streets, speed is also increased.

Keywords: Heterogeneous traffic, Speed-flow, Vehicle Composition, Capacity

Chapter 1

Introduction

1.1 General

Urbanization is growing. Additional roads and highways are developed in an effort to balance roadway capacity and demand at the same time as traffic volumes and travel lengths continue to rise, and the new roadway facilities fill up quickly when they are finished. This is due to improved transportation technology and a growing economy. Traffic jams and safety issues have a negative influence on our cities' economies, environments, and general quality of life.

Increased population growth urban streets experience a tremendous growth in traffic. The issues associated with increased traffic also becoming more and more complicated. India's metropolitan highways often handle a variety of traffic that is diverse in nature of numerous vehicles, including trucks, buses, and cars Motorbikes, light-duty trucks, auto rickshaws, bicycles, hand- and animal-drawn carts, etc. The urban diverse traffic flow is impacted by these vehicles' various speeds, sizes, load carrying capacity, and passenger capacities, among other factors. When there is a significant speed gap between several vehicle classifications in mixed traffic, the issue is magnified. With little possibilities to overtake, it significantly raises the needed number of overtakes. forecasting and In the design, planning, operation, and layout of road network segments, capacity information is essential. Lane width, gradient, and style of shoulder are all elements on the road that affect a multi-lane road's capacity.

The primary goals of the analysis and modelling for road linkages were to create speed-flow correlations for various road types and to investigate how geometric traffic and environmental factors affected these relationships. Environment and activities along the road play a significant part in slowing down traffic in metropolitan areas. Numerous activities on the side of the road might drastically slow down traffic.

The examination and evaluation of the road transport system and its constituent parts can benefit greatly from the use of computer simulation models. Additionally, these models are highly helpful in the development of queuing analysis, shock wave analysis, automobile following theory, and traffic stream models. Only when it has been shown that analytical procedures are ineffective should simulation models be taken into consideration.

1.2 Important of capacity in Highway Transportation

1. Only when capacity is matched to expected traffic requirements can a highway facility be designed. The roadway type, number of lanes, lane width, junctions, and weaving portions are all determined by capacity.
2. The sufficiency or deficit of existing roadway networks may be determined by comparing current traffic volumes to their capacity. This evaluation can help with transport planning research.
3. By considering capacity studies, improvements and adjustments in geometric characteristics, junction features, traffic control devices, and traffic management strategies may be planned efficiently.

1.3 Factor affecting Capacity

Following main two categories which affecting the capacity

1) Roadway Factors
2) Traffic Factors

Roadway factors pertain to restrictive physical features of road such as lane width, lateral clearance shoulders, auxiliary lanes, surface conditions, alignment and grade.

Lane width: - A lane width of 3.65m is considered as the defined ideal and the capacities of lanes narrower than this as given by the Highway capacity manual.

Lateral clearance:-Lateral obstructions such as retaining walls, abutments, signposts, light poles and parked cars, located closer than 1.83m from the edge of a traffic lane reduce the capacity.

Shoulders:-Shoulders of adequate width are necessary for maintaining traffic continuously. The Highway capacity Manual reckons that for lanes less than 3.65m wide, paved shoulders of 1.2 m or more width increase the effective width of the adjacent traffic lanes by 0.3m

Surface condition:-A deteriorated and poorly maintained pavement adversely affects level of service but the Highway Capacity Manual states that adequate data are not available to develop suitable adjustment factors to reflect the effect of surface condition on capacity.

Alignment:- The factors under alignment that affect capacity are the sharpness of curves and the percentage of road length with sub-standard overtaking sight distance.

Grades:-. Grades adversely affect the speed of vehicles, especially trucks, and thus influence the capacity.

1.4 Problem statement

The traffic on urban highways is gradually increasing as the city's economy and vehicle ownership develop. The non-uniform carriageway width over the length of the road, which reduces vehicle speed. The majority of traffic flow in urban area is heterogeneous traffic flow. Different vehicle sizes and speeds on the same lane reduce vehicle speed and have an impact on capacity.

1.5 Objective of study

1. Develop Speed flow relationship for selected road widths.
2. Study the impact of traffic composition on road capacity.
3. Develop regression models for road capacity.

1.6 Scope of study

1. Analyze traffic data collected on selected road widths.
2. To find out effect of speed, vehicle composition on road capacity
3. Validation with observed data.

1.7 Summary

1. This chapter is the first one.
2. The current chapter provides an overview of the issues that regular traffic encounters, which highlights the necessity of studying traffic flow using advanced techniques.

Chapter 2

Literature Review

2.1 General

A review of these studies, particularly in the heterogeneous traffic flow model , is presented below. The review is more about the use of microscopic data in different traffic flow models .

Urban traffic is increasing rapidly. Problems such as increased traffic and related problems also became more difficult. Most of the bad traffic seen on the urban roads of India is cars, buses, carts, motorcycles, trucks, auto rickshaws, pedal bikes, hand drawn wheelbarrows, animal pulling carts etc. Different sizes of cars, dimensions, load capacity or passenger capacity etc. Traffic patterns can be divided into two groups: microscopic and macroscopic.

The micro model explains the concept of individual tools and how they interact with each other. Vehicle tracking is also a microscopic model that tries to explain the movement of vehicles in a row in vehicle , and the transmission model is suitable for situations where vehicle will have to pass through the gap, such as overlapping traffic in signal less traffic. Junction .The macroscopic model describes the relationship between flow rate and density

The computer simulation model can play an important role in the analysis and evaluation of the Pole Conveyor System and its products. Additionally, model is useful for traffic models, vehicle fit theory, shock analysis and analysis.

2.2 Overview of literature

Debraj Pal et al. [2019] Impact of Pcu Estimation Methodology on Capacity of Two-Lane Rural Roads in India: A Case Study. In this study, the results of the PCU estimation method for determining the road capacity of two rural roads are shown. The case study roads are considered Kolkata-Basanti Highway and Howrah-Antha Highway. Both are part of two national highways near Kolkata and Howrah. Three PCU estimation methods were used to determine the PCU values of vehicles traveling along the road sections of the study, i.e. Static PCU values from IRC 64 (1990), dynamic PCU concept from Chandra and Sinha (2001) and methods introduced in Indo-HCM (2017).The PCU value is determined by the dynamic PCU concept depending on the characteristics of the vehicle and the area in which it is located (Table 3 and Table 4). The PCU value was determined by the method introduced in Indo-HCM, considering both dynamics and percent. These PCU values were used to establish the velocity-average relationship for the two methods using Greenshield's linear model (Figs. 2 to 10). Finally, different PCU values are obtained from different PCU cost estimation methods and capacity estimation of the two highways. The Kolkata-Basanti route was found to be less efficient using static PCU values, while no such difference was observed for the Howrah-Amta route.The way Howrah-Amta uses the PCU is different, as both wheels have a static PCU of 0.5 but the dynamic PCU values and the PCU values reported by Indo-HCM are lower (see Table 4 and Table 6). Not according to Trends seen on Kolkata-Basanti highway. The baseline capacity for Kolkata-Basanti Highway and Howrah-Amtar Highway is linearly related to operating speed and is 2875 PCU/hour and 2636 PCU/hour, respectively. The estimated capacity of the Kolkata-Basanti road is lower than the capacity at baseline, while the difference between the estimated capacity of the Howrah-Amta road is not significant. This difference is due to the majority of three-wheeled trucks (approximately 20% of all traffic) traveling on this highway (see Figure 5) (highest: 1 vs 1.2 tons), with an average speed of 28 km/h (58% of the speed of other vehicles in traffic). The potential value estimated using the static PCU value is reported because for 3-wheeled vehicles, the static PCU value is considered equal to the light commercial vehicle value of 1.5 (see Table 1).In the other two ways of estimating PCU value, wagons have more PCU value, which makes the capacity estimation more and compared to the capacity at base conditions. On the other hand, the buses are not on Howrah-Amta Road. Thus, the potential predicted by the Greenshield linear model is not different from that predicted under baseline conditions. Given that the percentage of 2-wheelers on Howran-Amta Road is more than 50%, this affects the ability to estimate the cost of the PCU prepared by Indo-HCM. Therefore, it is clear from this study that the dynamic PCU concept and the guidelines in Indo-HCM (2017) give more real results in terms of predictive ability, unlike the old PCU values.The development of this concept is a significant development in the engineering industry. Further modification of these elements can open up another dimension in this case, taking into account the daily effects and the effect of weather on PCU values to provide better results**.**

Chintan Advani et al. [2019] Performance Evaluation of Urban Trunk Networks Using Wi-Fi Sensors in Heterogeneous Traffic Conditions. This study provided important insights into the use of Wi-Fi-based sensors in network research to construct O-D matrices at multiple links and improve data density.This study demonstrates that the new ITS-based Wi-Fi technique is useful for evaluating complex networks without compromising results. It is clear that the quality of the results is greatly affected by the placement of the sensors. This article introduces a method of constructing an O-D matrix by comparing a device's MAC ID with time similarity when in multiple calls. For convenience, the first term is taken into account when comparing IDs between two sites. The development of path-based O-D matrices here was followed by the development of algorithms for data cleaning and filtering in R software.Path-based O-D matrices can be used to predict traffic links by providing traffic results from some detail. However, in order for network connectivity to be predicted, it is necessary to reduce the main matrix to form the traffic-based O-D matrix, which must be fast on many links. A review of the literature determined that some criteria were used to determine link efficiency based on general criteria that consider route distance and average speed. Therefore, this study tries to eliminate this misconception by determining the distribution of the travel times of the vehicles on a part of the road during the study period, as a result, the journey time can be determined. Also, to determine the accuracy of this phenomenon, the classification followed by race cars was validated with the help of simple assembly software that runs 60 different models to determine the best fit.The software shows that Burr and GEV are the most suitable models for most connections. When the confidence intervals for these distributions are examined, it is seen that the model accepts all of them. Therefore, after adopting this model, the mailbox box was also created to determine if a link presents illegal information so that the travel time with traffic can be changed. Finally, this leads to the second matrix from traffic that can only be extended to the link. Finally, try to identify the model that can be used to predict the intersection by analyzing the correlation coefficient that will be useful for later use.The linear model was evaluated according to the positive results of the first tests. Based on further research, new methods with higher accuracy and precise prediction methods can be developed and will review many obsolete applications**.**

Jay Mistry et al. [2021] analyzed traffic flow under non-uniform traffic of a multi-leg intersection: a case study in India, In this study, a simulation-based operation evaluates the effectiveness of traffic control to reduce delays and improve traffic flow. For this, Kamrej junction in Surat, which is one of the largest junctions along NH-48, was chosen.Vehicle data (volume data and velocity details) were collected and used to build microscopic simulation models. Wiedemann-74 vehicle adaptation parameters, such as vehicle adaptation behavior, distance and lane change, were also evaluated to be heterogeneous (weak lane keeping). Within the scope of preliminary data collection of Kamrej junction, tape measure was used to measure road geometry such as line markings, lane widths, medians, sidewalks, and two roads and main access points. Traffic data was collected for 24 hours as part of the initial review. (06:00 - 06:00) Check from the perspective of the intersection using the photo gallery.Three cameras were placed in two locations to separate traffic from all directions and mixed traffic, including at turns. The 24-hour visible intersection is 137747 PCU. Combined traffic volume at Kamrej junction is 9584 PCU/hour, and it is observed between 09:30 and 10:30 at the junction, when the traffic is heavy in the morning, with two wheels at the most (2W), which makes up 68% of it. all vehicles. This was followed by automobiles with 21%, tricycles with 6%, buses, light commercial vehicles (light commercial vehicles) and heavy commercial vehicles (heavy commercial vehicles) with 2%, 2% and 1%, respectively. Speed data was also collected using an uphill radar gun on each route. Speed measurements were recorded for each route at a distance of 50 meters from the intersection.Delay patterns can also be collected from the video by specifying a length of approximately 140 m for each path. Table 1 shows the 85th percentile speed (km/h) of different roads. Traffic accident registration record within 500 meters radius from Kamrej junction 5 years ago, 5 traffic accidents occurred in the last 5 years, 5 people died. Seven serious injuries were also recorded. According to the Indian government's Ministry of Road Transport and Highways (MORTH), the black spot is a nearly 500m long road where five fatalities and serious injuries have occurred in the past three years.For this reason, our education intersection is also a black spot for accidents. The model was then evaluated and validated using volume and travel time as key variables and MAPE was found to be less than 15%, indicating that the model can be used for further analysis. For the working intersection, according to the estimated delay value, it has been determined that all approach intersections operate according to LOS F. Our traffic management system is planned with four-stage signal control. The effectiveness of this strategy is justified by reducing the latency.It was found that 35-40% of the total volume was left empty for each path. Therefore, free traffic is necessary to improve traffic and reduce delays. The baseline LOS is generally F, but using the GI-3 model, significant improvement in LOS C has been observed, all according to national guidelines called Indo-HCM (CRRI India, 2017). Among the traffic management plans, including geometric improvements, the GI-3 is the biggest improvements, i.e., (given the development of the central island + white left wing + expansion of options + 4-level signal control) was found to be a more satisfying option than doing nothing.

Eva Kvasnovska et al. [2022] used microsimulation for the capacity and emissions evaluation of the new bridge design, In this paper, three microsimulation alternatives (baseline TDI, DDI and MUDI) were developed and not only evaluated for potential performance. but also compared to all other peak hours during operation in terms of Emissions. The results show that the Unconventional Replacement Alternative Design (UAID) of DDI and MUDI provides a better performance capability for poor Level of Service (LOS) E compared to the current state of TDI. Main path (SA, NA) in DDI improves capacity from LOS to E to C and even B assessment in case of MUDI. The main road maintains the same LOS for DDI, while the other roads East (EA) and West road (WA) are reduced by one level in case of MUDI.Total emissions calculated from microsimulation results for selected elements (NOx, NO2, CO, benzene, PM10 and PM2.5) provide a better consideration for DDI selection. Emissions have been reduced by 30% on average compared to the current situation, and total emissions by 31.8% on average compared to the MUDI alternative. Based on the overall analysis of our small-scale test, DDI is a better and balanced alternative to the current state of TDI in terms of performance and emissions Geometric design has an impact on speed and vehicle length, thus creating traffic flow. It uses MUDI Data for the road, but also increases fuel consumption, resulting in more emissions compared to DDI alternatives. The proposed analysis is for peak uptime, the MUDI and DDI alternatives currently still show lower emissions compared to TDI, but it will be interesting to see daily emissions tests for traffic.As left-turning vehicles still have to take a longer route, MUDI alternatives can offer higher emissions, especially for less loaded vehicles. According to Ahn et al. (2009) Varhelyi (2002) or Mandavilli et al. (2008), replacing signalized intersections with roundabouts or non-signaled intersections results in increased emissions, resulting in a significant increase in fuel consumption while waiting for vehicle emissions. , and drivers keep their engines running at a red light. However, this is not in our case of overpass layout as we are trying to use the existing model to create another way that will affect the existing development more or less.This study demonstrates real problems in developed cities and provides a compelling survey of the emissions and potential of other types of transitions not currently available in the Czech Republic. It offers a new way in which restructuring proposals are analyzed not only in terms of efficiency but also in terms of emissions. This work demonstrates a new method for miniaturization using modern PTV Vissim software and emission generation using MEFA 13. Based on the results of the study, we can conclude that MUDI and DDI are good solutions for difficult roads in Czech cities. Still, more research focusing on driving behavior and its effects is needed before it can be applied in the Czech Republic.This study shows that the UAID type gives good results in terms of capacity and emissions performance and can solve delays and queues in the middle of big cities. Peak hour traffic and emissions estimates are currently analyzed in this study, but it will be interesting to see capacity and emissions estimates for traffic changes on a daily basis. Also, a cost-benefit analysis would be a good addition to the overall evaluation of the proposal.

D.N.D. Jayaratne et al.[2019] In this study estimated capacity and the factors affecting the capacity were examined by reviewing the data and the data flow was collected by the researchers. Speed data was collected by the new method of Google traffic data. This is considered a simple method and uses data that can be used in future research. A preliminary review was conducted to verify the applicability of the approach proposed by the HCM 2010 guidelines to local conditions. However, it was determined that the speed observed on the local roads was well below the speed specified by the guide.Therefore, it is understood that the HCM guidelines cannot be applied to different traffic conditions in Sri Lanka. The average maximum speed of the 25 observed routes is 42 km/h with a standard deviation of 10.5 km/h. The combination of vehicles found in the study was based on criteria, with most vehicles being motorcycles and tricycles. While 50% of the vehicles in traffic are motorcycles and tricycles, only 28% of the vehicles in traffic are passengers.Given the potential benefits of the first principle, many benefits have been found. A Greenshields linear model was used to calculate the potential. Values between 2399 pcu/h and 1346 pcu/h were found. While the average capacity value of is 1922 pcu/h, the 85th percentile capacity value is 2246 pcu/h. When these results are compared to those found in the literature, including HCM guidelines, the capacity ranges from 2200-1900 pcu/h.But the main difference is that the speed capacity is very low in comparison. In conclusion, this study covers the basis of predictive capacity in heterogeneous ambulances in developing countries. More work is needed to understand the impact of different tools and geometric parameters**.**

Niraj Trivedi et al. [2014] Development of Heterogeneous Traffic Capacity Models in Urban Areas, Accelerated Urbanization Improvement of Transportation Technology and Economic Development, Driving and stability capability with the construction of many roads and highways in a balanced traffic. As demand increases, new places fill up quickly.Traffic and safety are important issues affecting the economy, environment and quality of life in our cities. More problems arise in mixed situations where the difference between different vehicles is significant. It leads to many difficulties that are necessary in situations where time is limited. Forecasting and understanding capabilities are essential for the design, planning, operation and installation of road networks. Roads that affect the capacity of multi-lane roads include lane width, slope, and shoulder type Analysis and modeling of road connections often establishes a relationship between different roads and learns the effects of traffic and the environment. .Road conditions and recreation play an important role in reducing urban pollution. Various roadside activities can reduce speed. Computer simulation models can play an important role in the analysis and evaluation of transportation systems and products. Additionally, these models are useful for traffic modeling, traffic simulation, shock detection and queue analysis. Simulation models should only be considered when analytical methods are found to be unsuitable.Compare the model results with the capabilities announced by IRC. The calculated potential was found to be higher than the theoretical potential. These conclusions were made due to changes in the behavior of the vehicle, not changes in the PCU. The model was created using the regression method. Model recognized and welcomed by the measuring system.It provides 100 fair production models and theoretical results. The capacity values estimated by different researchers vary due to changes in road and traffic conditions. The formula for estimating PCU should be based on variables that reflect the combination of characteristics that have a full impact on the vehicle type on road service quality. Two-wheeled vehicles generate more traffic than other vehicles. 60% of two wheels found.It uses less space, reducing latency and therefore increasing capacity.

Shubhash Chand et al. [2016], Development of Saturation Flow Models of Heterogeneous Traffic Signal Intersections, In this study, a suitable method has been developed to calculate the PCU and saturation flow according to the current traffic flow. This study clearly shows that the PCU value should be estimated based on studies in the intersection area, because in most cases it will be very different compared to the PCU value in IRC: SP-41. Generally, the change in water flow can be explained by the removal time of the PCU estimate, but sometimes, the change in water flow during different saturated green parameters can be made in the same way.This can be attributed to the difference between different vehicles at different green times of the red light. Therefore, this article attempts to explain the importance of PCU value and reveals from the limited research above that PCU value is useful for geometric conditions such as packaging, packaging and general path for advertising. Results from this study are as follows: Dynamic PCU values are negatively correlated with flow rate for all vehicle classes except light commercial vehicle and automobile/bus PCU. PCU values for cars, two-wheelers, and three-wheelers were found to decrease with increasing speed when the green light was on (Table 5). As traffic speed increased, small vehicles such as two-wheelers and three-wheelers tended to squeeze themselves into empty spaces.Due to this phenomenon, heavy vehicles do not have freedom of movement and there will be differences between large vehicles. This will result in higher PCU rates for LCVs and trucks/buses as speed increases. In the Dynamic PCU, two wheel percentages were found to decrease lane flow, while the heavy vehicle ratio increased lane flow. In fact, PCU power flow is directly related to the combination of competition in the path to the green signal stage (Table 6). It is clear from this analysis that the percentage of both wheels is greater during saturation than the difference between the narrow one, which increases the saturation flow rate.It ranges from 0.15 to 0.21, from 0.61 to 0.96 for tricycles, and from 1 for trucks.33 - 1.57, Light Commercial Vehicle 1.45 - 2.00 and car/bus Light Commercial Vehicle 3.24 - 4.96. Meanwhile, the PCU displays 1.0, 0.5, 0.8, 1 for cars, two-wheelers, three-wheelers, light commercial vehicles and trucks.5 and 2.3 per IRC: SP-41. IRC: Estimated significant changes in PCU compared to results reported in SP-41 were observed for two-wheeled vehicles and trucks/buses.

Kwame Kwaka osei et al. [2021], Guidance options to improve loop capacity and latency through micro simulation: Ghana artery case study This study shows what can be achieved by introducing loop through micro simulation results. Based on the results of this study, the following conclusions can be drawn: The capacity of the two research areas in is limited and cannot meet the needs of traffic. Therefore, they are crowded and are characterized by long delays and long queues, especially in the morning rush. The proposed roundabout is a good improvement that can reduce congestion at roundabouts. The direction loop operates at a higher capacity and has less delay than a single lane. While there is a slight increase in capacity (approximately 5%) at the Ejisu survey junction, delays and delays on the highway have been reduced to the competitive aspect ratio for a circular route. One limitation of the proposed scheme is that the high volume of left-turning traffic at the intersection blocks the lane. Therefore, it is necessary to provide the appropriate length for left-hand traffic. In addition, due to the limited memory length of the left turners, it is best to model the signal as a left-turning 4-phase signal to avoid blocking the lane due to the high demand for the left lane. The results of this study are based on the volume and behavior of traffic at certain intersections. Therefore, the results cannot be generalized. As this study is part of an ongoing study, further research will evaluate the potential impact on capacity and latency of removing high left traffic from the Road Right Turn U-turn (RTUT) control strategy, particularly in Ejisu. In addition, the intersection will be modeled as pedestrian-phase 4-phase signaling. Future research may also explore strategies for different needs levels, behaviors, and different storage times**.**

Linh Thanh Trinh et al. [2021] Analysis of Microscopic Characteristics of Motorcycle Roundabouts in Mixed Traffic Conditions: Example of Vietnam Mixed traffic has received more research due to its prevalence in developing countries. In this study, a study has been carried out that contributes to the understanding of the combination of circulation cycles. The traffic situation in Vietnam (mixed motorcycle) and the characteristics of the traffic cycle are analyzed. Regarding the first program, the two main factors that indicate the combination are the business requirements and the availability of small cars. Vehicles lacking any of these elements cannot be described as a combination. Vietnam was chosen as a case study due to two factors. The national sport differs in that motorcycles (90%) dominate, but it is a hybrid sport. The traffic mix understanding in Vietnam presented here supports our understanding of traffic in other mixed countries. The second part supports the microscopic features of the motorcycle. Acceleration, deceleration, rotation speed, key clearing, spatial tracking, trajectory, etc. analyzed in detail. The results revealed three unique microscopic features of the motorcycle. First, motorcycles frequently change speed and direction while riding. This study builds on previous research, including quantitative analysis. Secondly, the movement of the motorcycle is limited by its speed. The relationship between angular momentum and velocity can be expressed as an equation and applied directly to microscopic simulations. Third, the damage done to the motorcycle in the case study was only 1.25 seconds. Fourth, keep the area around the motorcycle clean. This finding mirrors previous findings about the middle of the blocks and provides a better understanding of cyclists' psychology on cycling. The results of this study can be used for model development and measurement using simulation software. Despite this contribution, this study has some limitations. First, it is limited to one training center. Differences in geometric patterns such as inscribed diameter, central island, and branches should be expanded in future research. IN addition, the characteristics of different types of vehicles should be taken into account. Also, the security zone here is focused on single vehicles only. The effect of cross flow on the motorcycle at the scene of the accident should be evaluated. Finally, the characteristics of the car and other vehicles traveling along the lane are not taken into account. The interaction between motorcycles and other vehicles along the lane should be considered in future research**.**

Nikhil G. Raval et al. [2017] Developing a Road Capacity Assessment Model for Heterogeneous Traffic Conditions in Urban Areas in Half of Ahmedabad City. Regression models were also developed to determine the 4-lane divided (in both directions) road widths, the observed differences between different vehicles, and the average distance between vehicles in Ahmedabad, Gujarat, India. The estimation of the city's capacity is important for transportation planning. Determining capacity is critical to reducing congestion and delays on inner city roads. The following are the main results of this study The relationship between competitive speed for selected segments has been established. The given capacity was also found to be higher than the value recommended by the IRC: 106-1990 Model 1 and Model 2 were designed to estimate urban capacity, including road width, traffic combination and average speed. The statistical significance of the independent variables in the construct was analyzed using the 't' test. When the facts are analyzed, it can be considered that the width of the road, the combination of the two wheels and the vehicle affect the capacity due to the high speed and mobility. The model developed in this study addresses the dense heterogeneous traffic on both main and secondary main roads in the city of Ahmedabad. It has been determined that each vehicle type is different in terms of the size, speed and road width of the city road, and therefore

the capacity is different in each selected region. In the study area of Ahmedabad, India, the mix of two-wheeled vehicles and cars ranges from 53% to 65% and 23% to 30%, respectively. Due to the different characteristics of each vehicle group, it has been observed that the mix of two-wheeled vehicles, cars, sedans and buses affects the capacity of urban roads. The Model Urban Road Capacity Estimate is designed for movement of selected roads only. The same could be extended to two-way traffic on city streets. The model created by can be tested on the roads in various parts of the city with similar features. Develop generic models of 2-lane, 4-lane and 6-lane urban roads to estimate capacity.

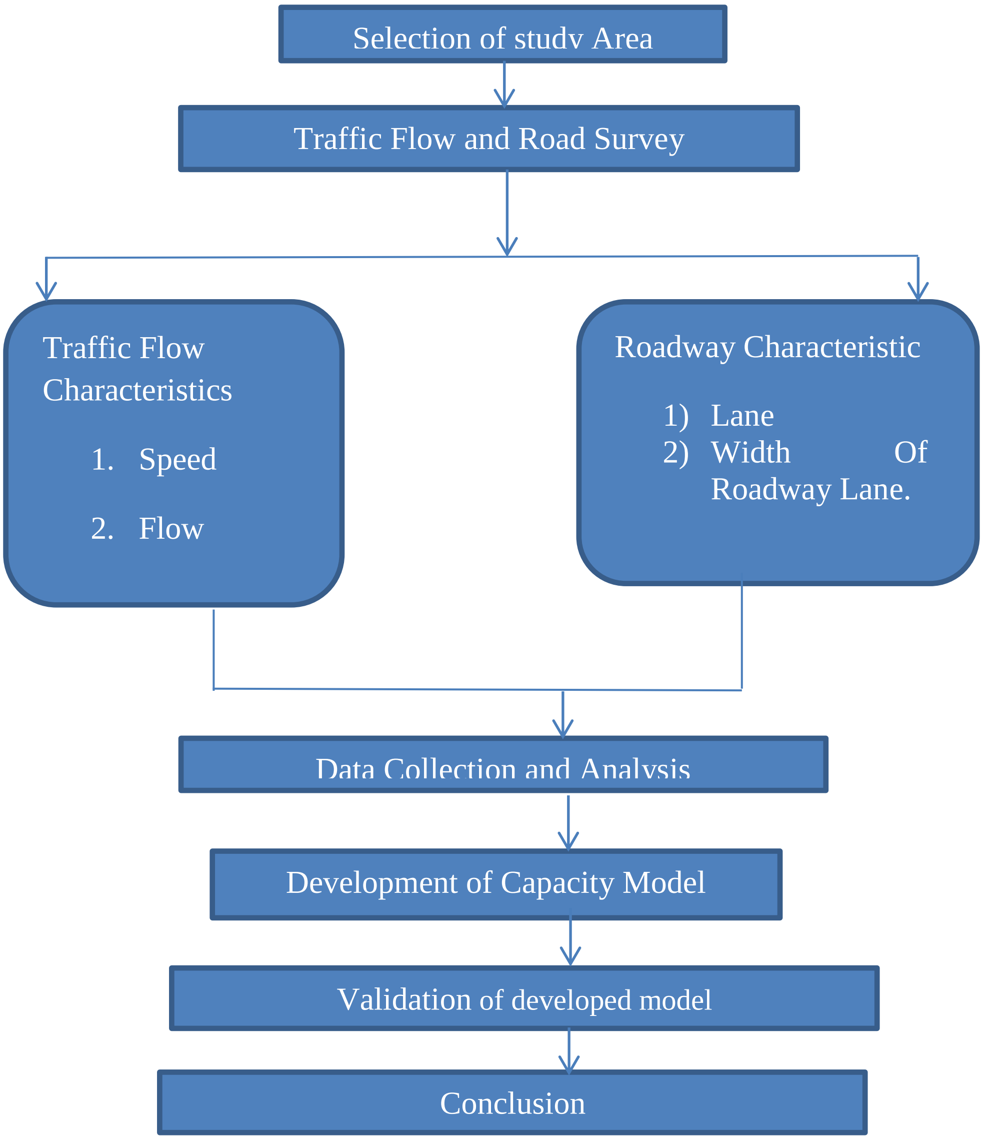
2.3 Summary

The chapter discusses the capacity model study. The chapter explains how capacity may be used to represent any physical phenomena whose components can be considered as discrete.

Chapter 3

Methodology

3.1 Methodology chart



3.2 Selection of study area

The research is being conducted on an important traffic corridor in Rajkot. The Mid block portion of road has been chosen for this investigation. The traffic survey was conducted on Arterial road for that university route, Rajkot was chosen for the survey.

3.3 Traffic Field Study and Surveys

1. Traffic flow and CVC count
2. Traffic stream speed at operating traffic volume
3. Composition of traffic and
4. Width of the road section

3.3.1 Traffic flow characteristics:

Heterogeneous nature of traffic which include different vehicles like Two-wheelers, Three wheelers, cars Auto Rickshaws, light commercial vehicles, buses, trucks, animal drawn vehicles etc. the speed as well as the size of these vehicles are different so the speed of deferent vehicles is to be measured. speed can be measured by different ways like,

- Stop watch method
- Pressure contact tube method
- Radar meter method
- By Speed gun
- Time lapse photography method
- Videography method.

In this study speed measured by stop watch method and other variable find by Videography .Two point mark on the urban traffic stream on selected location the length of the road is taken 20m to 30m in between is known as mid-block section of the road the video will be played the time taken by different vehicles to cross 30m distance will be measured in seconds. After completing the traffic survey the video is to played reputed when all the measure the speed of deferent vehicles as discussed earlier the disadvantage of this method is that it is too tedious and tie consuming however the results are accurate and reliable by this method another important traffic flow characteristics is the flow which is measured in vehicles per hour this is also possible by videography method if we play the video again and again we can count the total numbers of different vehicles.

3.3.2 Roadway Characteristics

- No. of lane
- Width of lane
- Lateral clearance
- Surface of the pavement

3.4 Summary

This chapter describes the methodology and research areas of the work. This chapter gives brief description of the characteristics of the core track, as well as research and investigation into the field of exercise. The following chapters include data collection, data collection methods, and classified volumes. Number of surveys for study areas.

Chapter 4

Data Collection and Study Area

4.1 General

In this section, the study area, data collection is discussed. The urban road in the city of R ajkot is chosen as a case study.

4.2 Overall Transportation Scenario

Rajkot traffic is characterized by the presence and composition of intercity travel. The city is now dealing with a number of transportation issues, including traffic congestion, parking challenges, limited road width, and increased usage of personalized transportation. Method of transportation, long delays at signalized intersections, an increase in the number of intermediate passenger transport vehicles, traffic accidents, and insufficient mass transit services.

4.3 Data Collection

The following data is required for execution.

- Traffic Flow (q) and CVC count,
- Traffic stream speed at operating traffic volume (qs)
- Composition of traffic and
- Width of the road section.

In this study, video and manual methods were adopted for traffic data collection and flow measurement. At the Rajkot City site, video cameras were placed over composite walls and buildings along selected sites. The video camera was placed at a high angle to the left. Continuous imaging was performed for 2 hours in the morning and evening. After collecting the data at the Ministry of Transportation's artificial intelligence laboratory, it was secretly analyzed to calculate the volume and measure the speed.

4.4 Method of Data Collection

Roads were selected in such a way that different traffic data sets were used.Videographic techniques were used to collect traffic information, and the road section considered in this study was operating in a mixed traffic situation. The different types of vehicles that can be found on site are listed below along with the codes used in the following table.

- Two wheeler (2W)
- Three wheeler (3W)
- Four wheeler e.g., car, van, jeep, etc. (car)
- Bus, Truck, etc. (Bus)
- Cycle
- Slow Moving Vehicle (Non-Motorized) (SMV)

The types of vehicles found in the field are categorically categorized according to the available information and the type of flow configuration of the different vehicles. for a group. For example, some large vehicles such as buses, trucks are put into a group. Likewise, cars, jeeps, vans, etc.assigned to the same group. I can watch secret Chinese cars at 5 minute intervals. Flow counter is aggregated at 5-minute intervals and varies by hourly PCU capacity (PCU/h) of . The conversion of variance and sufficient data depends on the length of the maximum hourly flow account. Flow rates and hourly flow data of are plotted at 5-minute intervals.The velocities used in the Free Flow model represent the free flow rate of the stream. The free velocity of the stream was estimated after observing the maximum observed velocity of different vehicle types during the unconscious period. The maximum speed seen depends on the car type. The speed limit for the model is , using (1) of all vehicle types currently in flow and (2) the maximum speed found based on the speed of the traffic flow (). Availability of different tools in information and flow is divided into groups. For example, sometimes buses, trucks, etc. Like all major vehicles. people were divided into groups. Similarly, jeeps, vans, etc. grouped together. Hidden I was able to see the number of cars in 5 minutes at a time. Flow counter is aggregated at 5-minute intervals and varies by hourly PCU capacity (PCU/h) of .The conversion of variance and sufficient data depends on the length of the maximum hourly flow account. Flow rates and hourly flow data of are plotted at 5-minute intervals. The velocities used in the Free Flow model represent the free flow rate of the stream. independence The maximum is found after observing the estimated flow. Different types of fast cars in off-season.Find the fastest depending on the type of car.

4.5 Study of Speed-Flow

For the case study, just one road section was studied. Videography was used to collect data on these roads. The data was subsequently analyzed in a transportation laboratory, and the speed and volume per five-minute time period were calculated. using the road, the speed-flow and traffic composition have been generated using 5 minute time interval data. The road segments are given below.

- University road[from Indira circle to university]
- University road [from university to Indira circle]

4.6 Classified Volume survey

In classified volume count, one hour of videography is performed to determine vehicle flow on the designated stretch, which is subsequently converted to PCU/hr and the road width is 7.6m.

[SUNDAY 26/2/23] TIME 9:30 AM TO 10:30 AM

Table 4.1 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	92	53	13	0	0	1	164	1968	148.4	1781
10	96	55	15	0	1	1	178	2136	158.8	1906
15	102	63	19	1	1	2	203	2436	181.9	2183
20	122	65	22	0	2	0	231	2772	203.3	2440
25	157	77	23	1	1	1	285	3420	244.75	2937
30	175	60	24	2	0	2	293	3516	244.45	2933
35	188	79	25	1	2	3	333	3996	276.2	3314
40	177	76	22	1	1	2	319	3828	257.15	3086
45	168	72	19	0	1	1	306	3672	237.8	2854
50	157	71	17	1	0	0	296	3552	224.9	2699
55	164	66	20	0	1	2	308	3696	231.2	2774
60	158	63	19	2	1	1	304	3648	225.7	2708

[SUNDAY 26/2/23] TIME 10:30 AM TO 11:30 AM

Table 4.2 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	88	45	15	0	1	2	156	1872	143.2	1718
10	98	42	10	1	2	3	166	1992	141.7	1700
15	83	46	17	1	1	0	163	1956	145.85	1750
20	97	51	20	0	2	1	191	2292	166.95	2003
25	122	59	24	1	0	0	231	2772	200.7	2408
30	153	75	21	2	2	1	284	3408	239.35	2872
35	175	72	23	1	0	3	309	3708	252.65	3032
40	178	82	18	0	1	1	320	3840	253.3	3040
45	182	85	20	2	0	2	336	4032	266.7	3200
50	162	74	22	1	2	1	312	3744	244.9	2939
55	158	70	18	1	0	0	302	3624	226.7	2720
60	166	68	23	0	1	2	320	3840	240.7	2888

[SUNDAY 26/2/23] TIME 5:30 PM TO 6:30 PM

Table 4.3 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	78	63	26	2	2	3	179	2148	181.9	2183
10	83	60	23	1	1	1	179	2148	172.25	2067
15	80	71	24	0	0	2	192	2304	179.8	2158
20	92	70	20	1	1	0	204	2448	182.6	2191
25	133	74	24	0	2	1	259	3108	224.95	2699
30	138	81	22	1	1	2	275	3300	232.9	2795
35	140	84	21	2	0	0	282	3384	235.4	2825
40	173	76	23	1	1	1	315	3780	255.75	3069
45	177	85	24	1	2	1	335	4020	271.15	3254
50	174	84	26	0	1	2	337	4044	268.7	3224

55	172	86	23	2	1	1	340	4080	267.2	3206
60	169	82	22	1	3	0	337	4044	259.15	3110

[SUNDAY 26/2/23] TIME 6:30 PM TO 7:30 PM

Table 4.4 C.V.C. for Indira to University

Time	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	83	47	22	1	1	1	160	1920	157.25	1887
10	78	48	20	2	2	0	160	1920	153.7	1844
15	88	50	21	1	1	1	177	2124	162	1944
20	94	52	31	1	0	2	200	2400	187.5	2250
25	131	58	23	0	2	1	240	2880	205.45	2465
30	138	53	27	2	0	3	253	3036	216.1	2593
35	142	73	30	1	1	1	283	3396	243.5	2922
40	152	80	22	0	1	0	295	3540	239.4	2873
45	128	68	29	1	1	1	273	3276	226	2712
50	158	73	24	1	2	2	310	3720	245.3	2944
55	163	78	23	0	1	1	321	3852	248.05	2977
60	172	84	29	1	2	0	348	4176	276	3312

[SUNDAY 26/2/23] TIME 9:30 AM TO 10:30 AM

Table 4.5 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	85	66	22	1	1	1	181	2172	177.75	2133
10	81	60	21	0	0	2	174	2088	163.55	1963
15	90	64	20	1	1	1	192	2304	175.5	2106
20	88	58	24	2	2	2	196	2352	180	2160
25	119	67	23	0	1	0	235	2820	203.65	2444
30	125	77	30	1	2	1	266	3192	236.15	2834

35	131	79	27	1	0	1	274	3288	233.85	2806
40	136	72	25	0	1	2	276	3312	226.2	2714
45	126	73	27	1	2	1	275	3300	226.9	2723
50	147	78	20	0	1	0	296	3552	229.65	2756
55	158	79	23	2	1	1	319	3828	249.7	2996
60	164	77	21	1	3	2	328	3936	249.2	2990

[SUNDAY 26/2/23] TIME 10:30 AM TO 11:30 AM

Table 4.6 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	86	46	20	3	2	2	164	1968	160.7	1928
10	88	53	23	2	2	3	181	2172	173.4	2081
15	93	57	22	1	1	2	191	2292	175.15	2102
20	90	66	25	0	1	1	203	2436	185.3	2224
25	120	77	30	4	0	4	260	3120	237.4	2849
30	131	72	29	3	2	3	270	3240	238.85	2866
35	142	80	32	2	0	0	291	3492	254.9	3059
40	145	78	28	0	1	1	293	3516	244.55	2935
45	150	84	35	0	1	0	315	3780	267.9	3215
50	155	81	30	2	2	1	321	3852	264.85	3178
55	166	78	35	1	0	1	336	4032	275.1	3301
60	161	75	33	1	1	1	332	3984	265.75	3189

[SUNDAY 26/2/23] TIME 5:30 PM TO 6:30 PM

Table 4.7 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	86	47	10	0	1	1	150	1800	133.3	1600
10	92	45	12	1	0	0	160	1920	140.2	1682
15	90	55	11	2	1	2	176	2112	151.1	1813

20	88	51	14	0	2	1	176	2112	148.2	1778
25	134	66	20	1	0	1	247	2964	209.1	2509
30	157	77	21	1	2	2	290	3480	242.55	2911
35	160	71	23	1	1	0	291	3492	240.6	2887
40	167	75	22	1	1	0	306	3672	247.85	2974
45	171	74	20	0	0	1	311	3732	242.65	2912
50	169	77	24	2	2	1	325	3900	259.35	3112
55	166	69	18	0	0	2	310	3720	230.3	2764
60	172	72	22	1	1	0	328	3936	248.6	2983

[SUNDAY 26/2/23] TIME 6:30 PM TO 7:30 PM

Table 4.8 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	88	46	12	1	1	1	154	1848	140	1680
10	95	48	15	0	0	0	168	2016	149.25	1791
15	90	42	17	0	1	0	165	1980	144.9	1739
20	94	56	20	2	3	1	196	2352	175.5	2106
25	136	51	23	1	1	1	238	2856	203	2436
30	155	66	22	0	0	0	273	3276	226.25	2715
35	164	72	21	1	2	1	296	3552	242.4	2909
40	173	68	24	2	1	0	308	3696	251.55	3019
45	180	60	18	1	1	1	306	3672	235	2820
50	166	71	12	1	0	1	301	3612	222.1	2665
55	168	64	19	0	1	0	307	3684	229.4	2753
60	156	68	20	2	1	2	309	3708	231.6	2779

[THRUSDAY 23/2/23] TIME 9:30 AM TO 10:30 AM

Table 4.9 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	109	55	23	1	1	1	195	2340	186.75	2241
10	121	49	22	0	0	0	202	2424	183.75	2205
15	132	57	29	1	2	1	237	2844	219.4	2633
20	147	50	20	2	1	2	242	2904	206.85	2482
25	168	50	22	1	1	1	268	3216	224	2688
30	173	55	25	2	2	1	288	3456	242.35	2908
35	167	51	21	1	1	0	276	3312	221.85	2662
40	161	54	23	0	1	1	280	3360	222.55	2671
45	176	51	25	2	0	0	299	3588	237.4	2849
50	173	58	19	1	0	1	302	3624	228.35	2740
55	180	52	21	0	1	2	311	3732	231.2	2774
60	159	56	22	1	2	1	301	3612	224.6	2696

[THRUSDAY 23/2/23] TIME 10:30 AM TO 11:30 AM

Table 4.10 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	90	41	25	1	0	1	163	1956	161.1	1933
10	105	42	22	0	1	2	182	2184	166.95	2003
15	124	38	20	1	1	0	199	2388	174.6	2095
20	133	44	21	2	1	1	222	2664	191.95	2303
25	146	37	25	1	2	3	239	2868	202.7	2432
30	166	36	32	1	1	1	267	3204	228.5	2742
35	138	38	22	0	2	2	237	2844	189.1	2269
40	141	29	25	1	1	1	238	2856	188.75	2265
45	164	31	20	1	0	1	262	3144	196.6	2359

50	171	30	21	0	2	0	274	3288	203.05	2437
55	165	33	26	1	1	0	281	3372	212.35	2548
60	159	40	30	0	2	1	292	3504	222.45	2669

[THRUSDAY 23/2/23] TIME 5:30 PM TO 6:30 PM

Table 4.11 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	112	41	21	1	1	1	182	2184	171	2052
10	126	40	25	0	2	0	203	2436	187.3	2248
15	135	44	28	1	1	2	226	2712	205.65	2468
20	118	53	18	2	0	3	214	2568	183.1	2197
25	130	59	24	0	2	2	242	2904	208.1	2497
30	142	54	27	1	1	1	256	3072	218.5	2622
35	155	45	20	0	0	0	255	3060	201.25	2415
40	160	57	24	1	3	1	286	3432	231.8	2782
45	158	39	23	1	1	2	269	3228	207.9	2495
50	141	42	29	2	2	1	267	3204	213.35	2560
55	165	50	30	1	2	2	305	3660	239.55	2875
60	146	49	28	0	1	2	286	3432	216.7	2600

[THRUSDAY 23/2/23] TIME 6:30 PM TO 7:30 PM

Table 4.12 C.V.C. for Indira to University

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	107	42	25	1	1	0	181	2172	175.85	2110
10	115	46	27	0	0	1	199	2388	186.65	2240
15	136	54	30	1	2	2	240	2880	221.8	2662
20	145	52	24	2	1	1	245	2940	214.95	2579

25	151	56	31	1	2	0	266	3192	236.25	2835
30	138	60	45	0	1	1	275	3300	255.3	3064
35	160	55	38	1	1	3	293	3516	255.8	3070
40	168	59	34	1	3	2	307	3684	260.2	3122
45	155	59	36	0	1	1	297	3564	249.05	2989
50	169	52	33	1	2	3	310	3720	250.95	3011
55	179	43	30	1	2	1	311	3732	242.65	2912
60	175	45	27	2	1	2	312	3744	236.85	2842

[THRUSDAY 23/2/23] TIME 9:30 AM TO 10:30 AM

Table 4.13 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	110	37	25	1	1	1	180	2160	173.5	2082
10	125	38	33	2	2	0	210	2520	204.95	2459
15	135	47	35	1	1	1	235	2820	222.25	2667
20	149	50	31	0	2	1	253	3036	226.95	2723
25	138	52	29	1	2	2	249	2988	219.3	2632
30	141	55	37	2	1	1	267	3204	240.95	2891
35	149	54	34	1	0	0	273	3276	235.95	2831
40	150	49	28	0	1	0	268	3216	218.9	2627
45	135	58	25	1	1	1	266	3192	213.25	2559
50	156	55	32	2	1	1	297	3564	242.2	2906
55	160	39	29	1	2	1	287	3444	222.4	2669
60	171	42	27	2	0	2	304	3648	229.4	2753

[THRUSDAY 23/2/23]   TIME 10:30 AM TO 11:30 AM

Table 4.14 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	119	34	23	1	1	1	184	2208	173.25	2079
10	134	39	31	1	0	0	215	2580	203.7	2444
15	141	42	28	2	1	0	229	2748	209.55	2515
20	148	46	24	1	2	1	242	2904	210.4	2525
25	150	51	34	0	1	3	264	3168	234.1	2809
30	138	49	36	0	3	2	258	3096	229.5	2754
35	126	50	29	1	2	1	244	2928	207.9	2495
40	159	56	25	0	1	1	282	3384	227.05	2725
45	168	53	31	1	2	3	303	3636	247.2	2966
50	170	46	34	2	1	2	305	3660	248.1	2977
55	155	55	28	1	1	4	299	3588	232.45	2789
60	171	52	30	0	2	1	316	3792	243.45	2921

[THRUSDAY 23/2/23]   TIME 5:30 PM TO 6:30 PM

Table 4.15 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	98	49	20	1	1	1	175	2100	166.5	1998
10	104	44	18	0	4	0	180	2160	163.6	1963
15	116	55	17	1	1	1	206	2472	180	2160
20	122	52	24	2	2	2	224	2688	199.5	2394
25	138	59	19	0	1	1	243	2916	202.3	2428
30	160	60	20	0	0	0	270	3240	220	2640
35	166	51	25	1	1	2	281	3372	229.9	2759
40	175	54	31	1	2	0	303	3636	252.25	3027
45	182	48	33	0	3	1	312	3744	255.1	3061
50	170	44	35	2	2	1	304	3648	249.1	2989
55	165	53	29	1	2	2	307	3684	240.5	2887

									5	
60	169	48	28	0	0	0	305	3660	230.75	2769

[THRUSDAY 23/2/23] TIME 6:30 PM TO 7:30 PM

Table 4.16 C.V.C. for University to Indira

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle/ 5 min	Vehicle/ hr	Pcu/ 5 min	Pcu/hr
5	105	40	23	1	2	3	179	2148	170.95	2051
10	107	41	19	1	1	1	180	2160	163.25	1959
15	113	51	20	0	1	1	201	2412	177.55	2131
20	122	54	32	1	0	0	229	2748	211.7	2540
25	133	50	25	2	2	2	239	2868	207.75	2493
30	128	43	26	1	1	1	230	2760	195	2340
35	135	59	31	0	0	2	262	3144	223.05	2677
40	139	61	27	1	1	0	269	3228	222.85	2674
45	129	58	30	1	2	1	266	3192	220.15	2642
50	126	55	24	0	1	1	257	3084	199.3	2392
55	140	47	29	1	0	2	274	3288	213	2556
60	151	45	23	2	1	2	284	3408	210.85	2530

4.6.1 Peak hour calculation

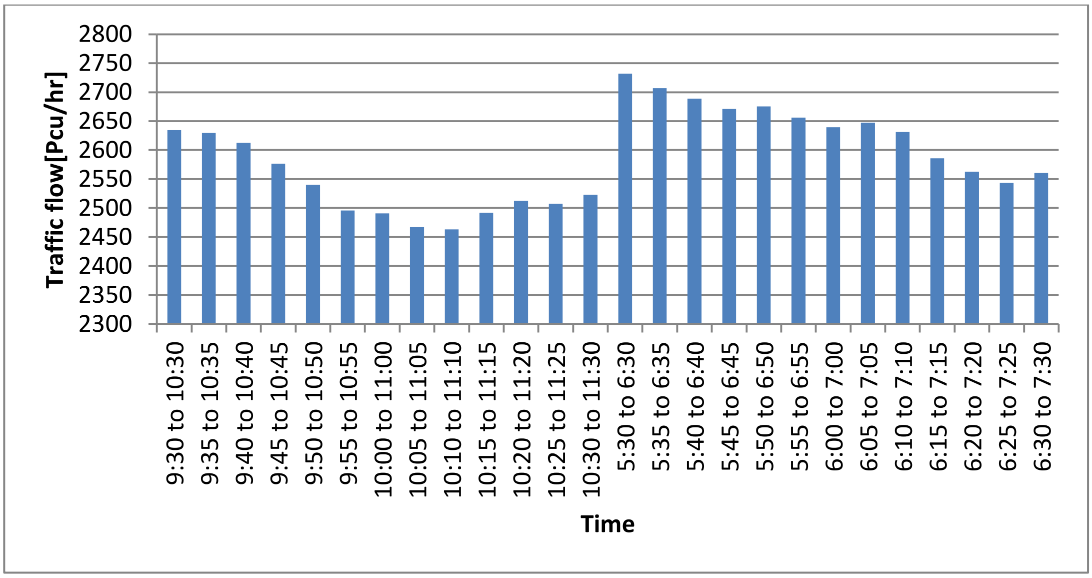


Figure 4.1 Peak hour calculation of Indira to University

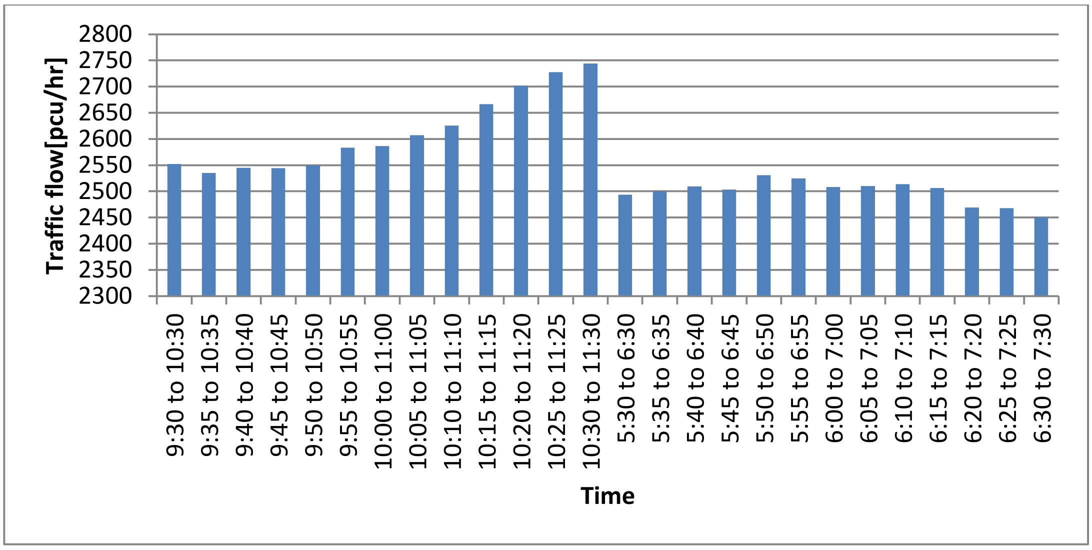


Fig.4.2 Peak hour calculation of University to Indira

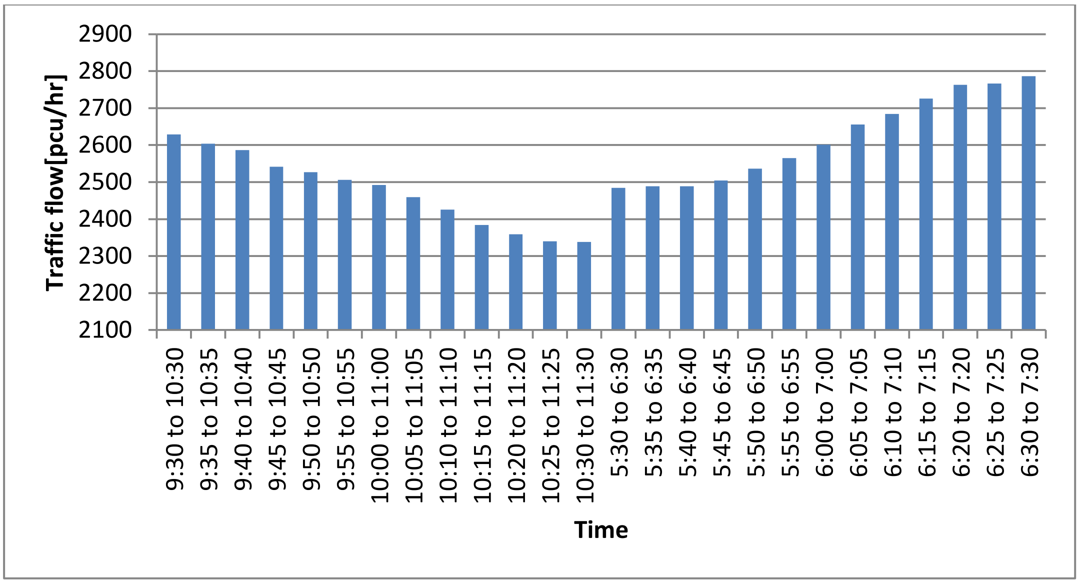


Figure 4.3 Peak hour calculation of Indira to University

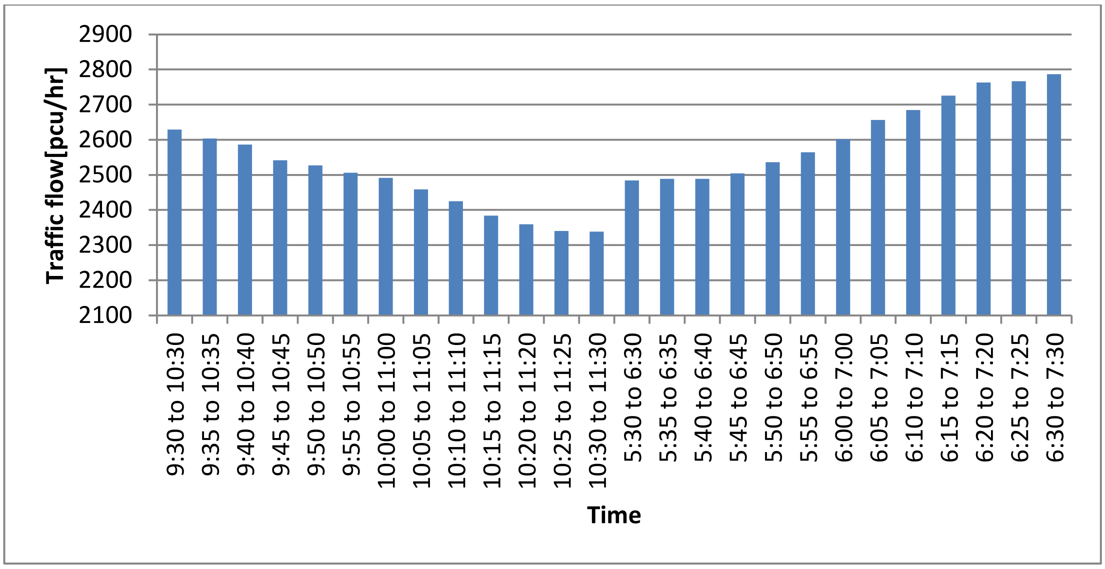


Figure 4.4 Peak hour calculation of University to India

4.7 Summary

The chapter contains the different survey data of selected stretches. The classified volume has bine carried at different stiches out for collection. The collected data are given in tabular form. The analysis of collected data is described in next chapter.

Chapter 5

DATA ANALYSIS

5.1 General

The existence and composition of the traffic network reflects the traffic situation in Rajkot . The city has to deal with many traffic problems such as congestion, parking problem, ins ufficient road width, increased traffic congestion, delays at intersections, increased traffic between passengers, traffic jams and inadequate public transport.

5.2 Vehicle Composition

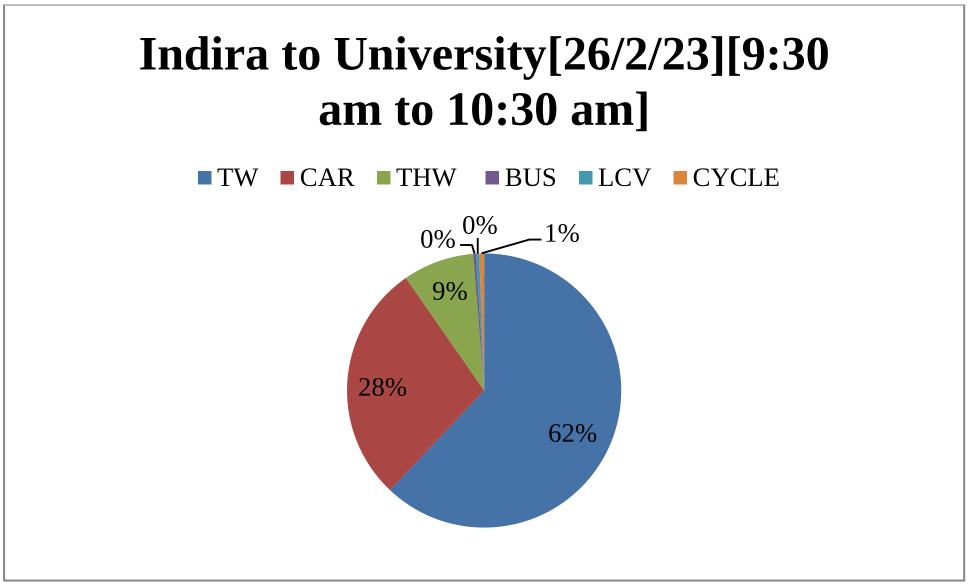


Fig.5.1 Vehicular Traffic Composition on Indira to University

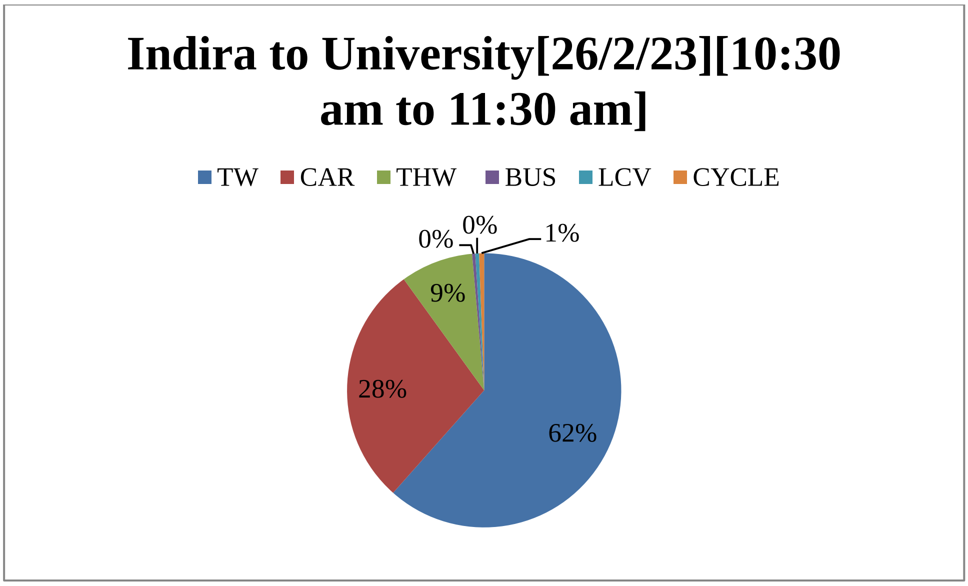


Fig.5.2 Vehicular Traffic Composition on Indira to University

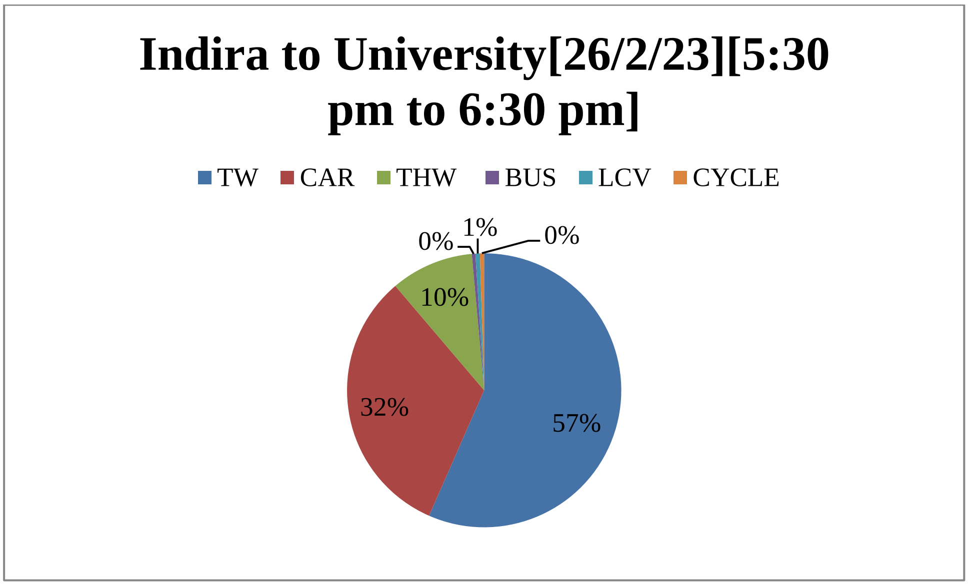


Fig.5.3 Vehicular Traffic Composition on Indira to University

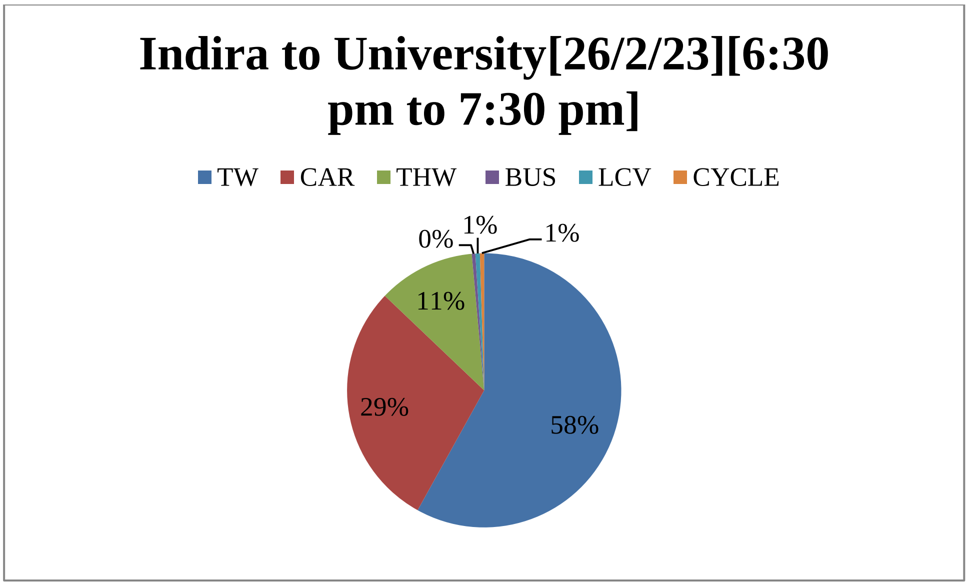


Fig.5.4 Vehicular Traffic Composition on Indira to University

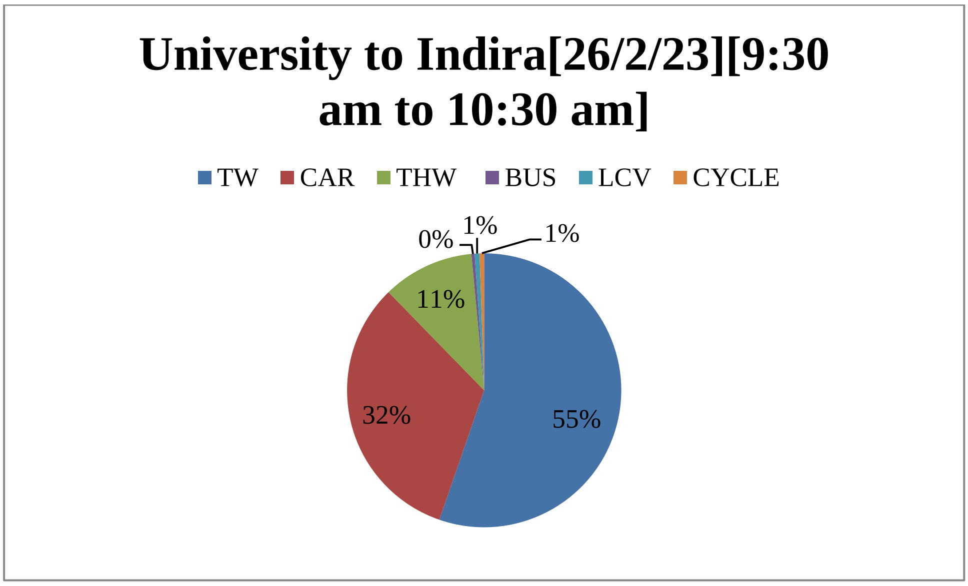


Fig.5.5 Vehicular Traffic Composition on University to Indira

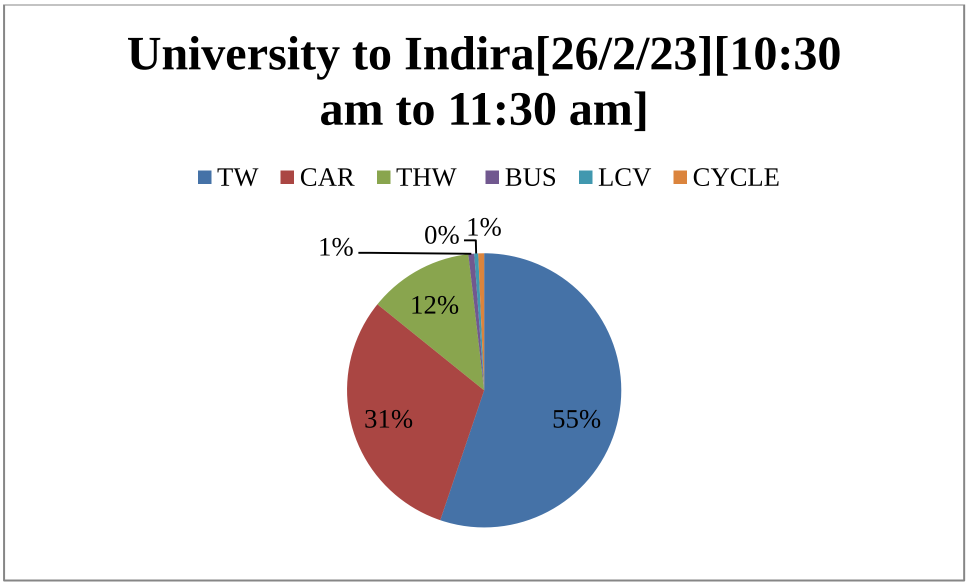


Fig.5.6 Vehicular Traffic Composition on University to Indira

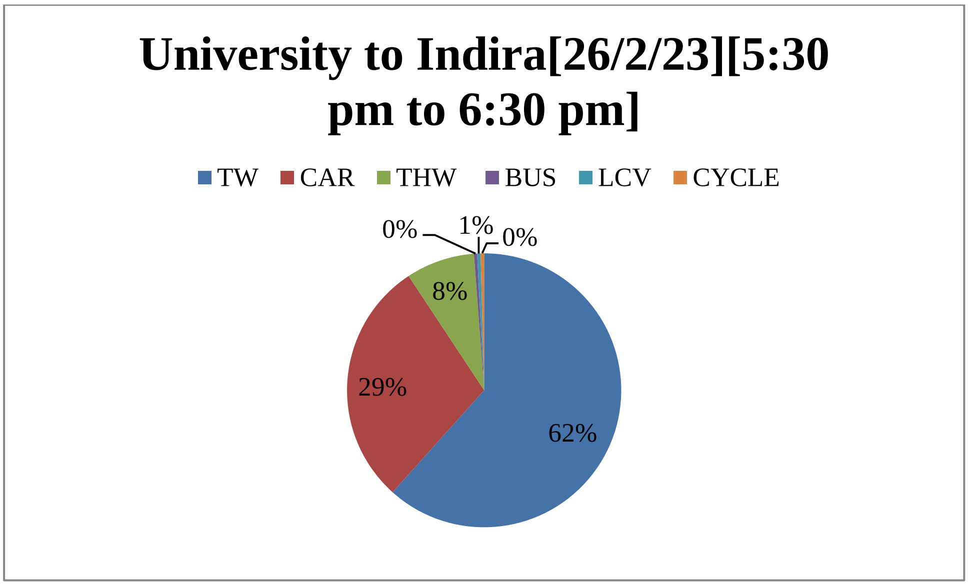


Fig.5.7 Vehicular Traffic Composition on University to Indira

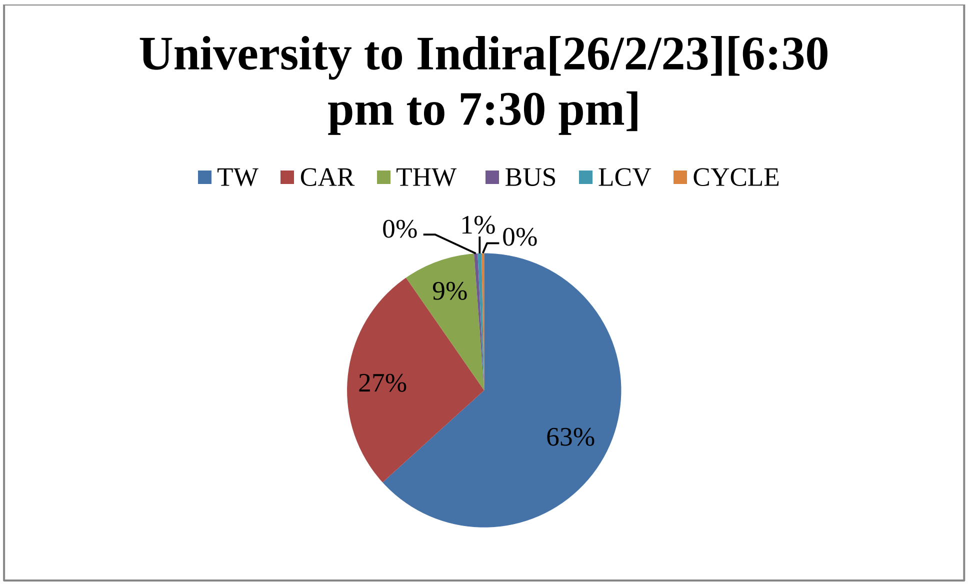


Fig.5.8 Vehicular Traffic Composition on University to Indira

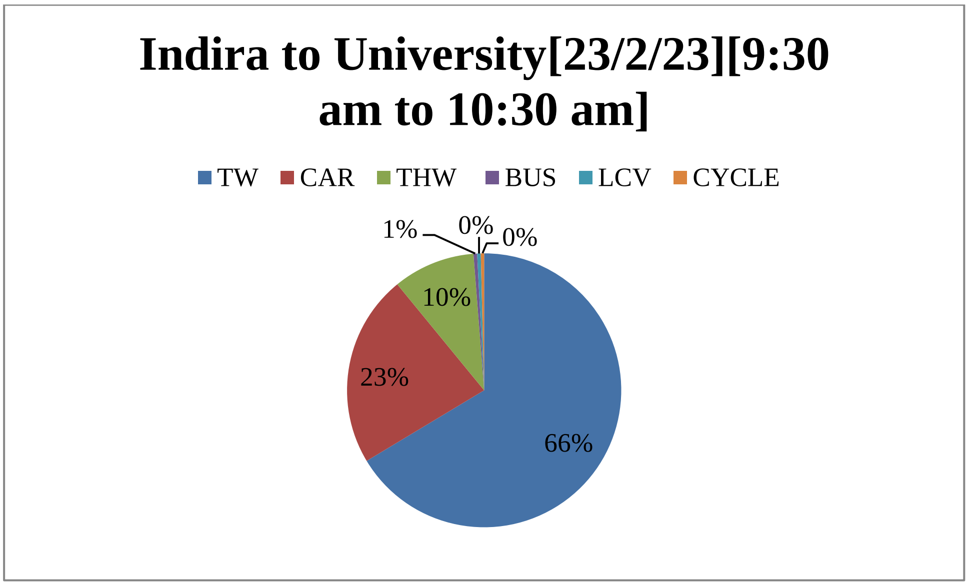


Fig.5.9 Vehicular Traffic Composition on Indira to University

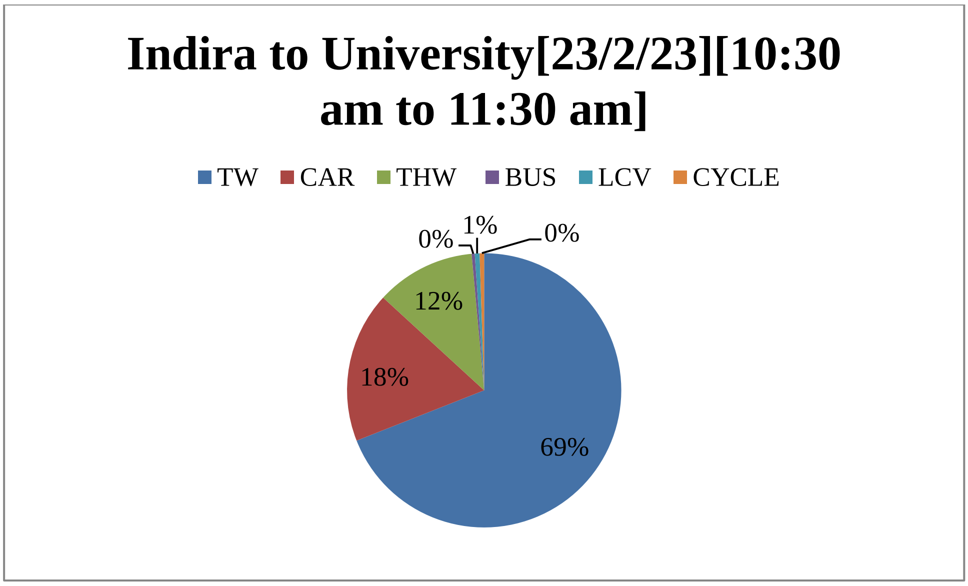


Fig.5.10 Vehicular Traffic Composition on Indira to University

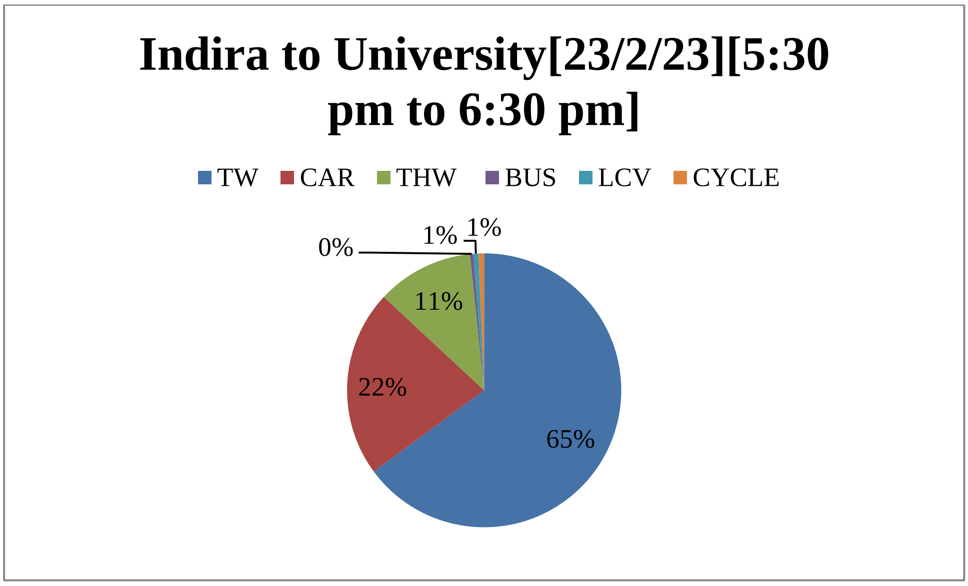


Fig.5.11 Vehicular Traffic Composition on Indira to University

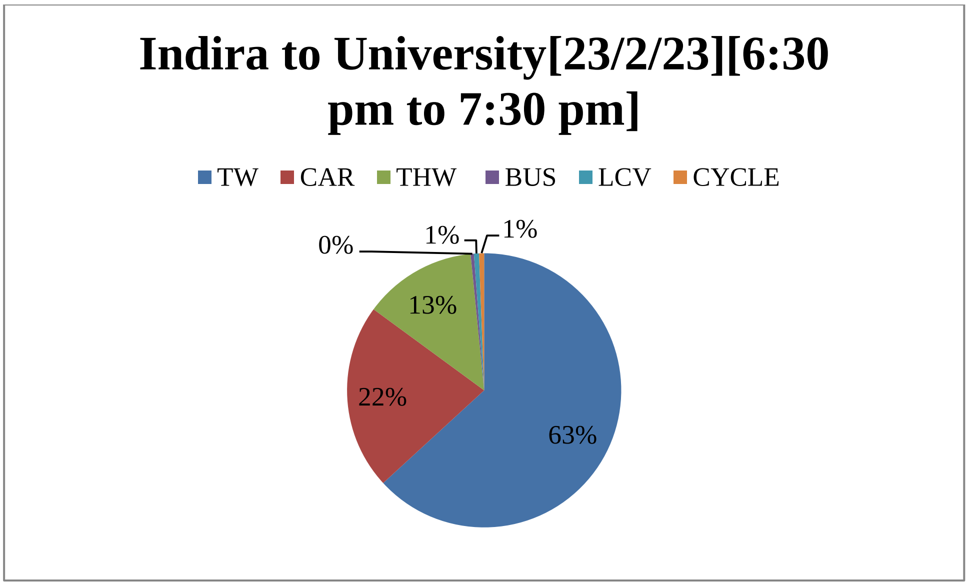


Fig.5.12 Vehicular Traffic Composition on Indira to University

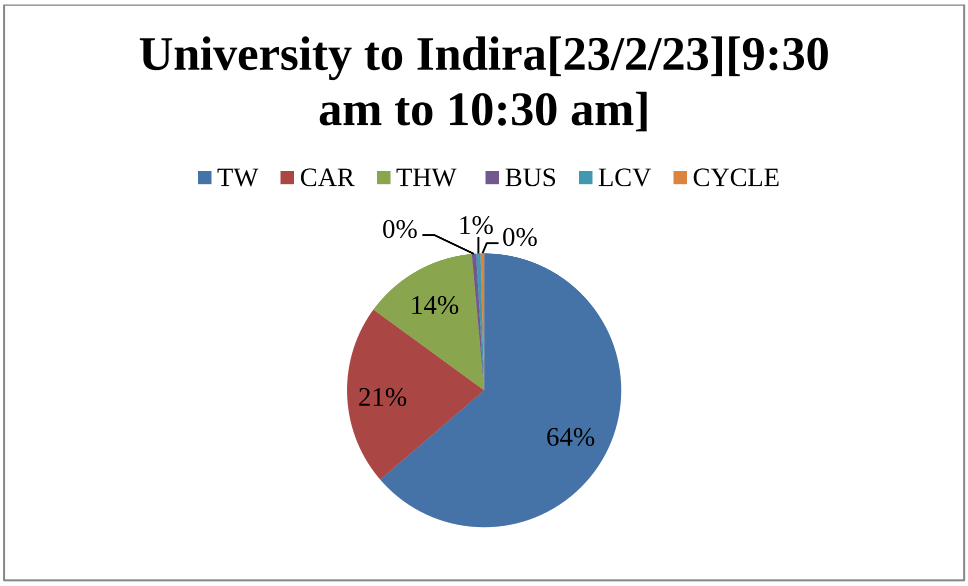


Fig.5.13 Vehicular Traffic Composition on University to Indira

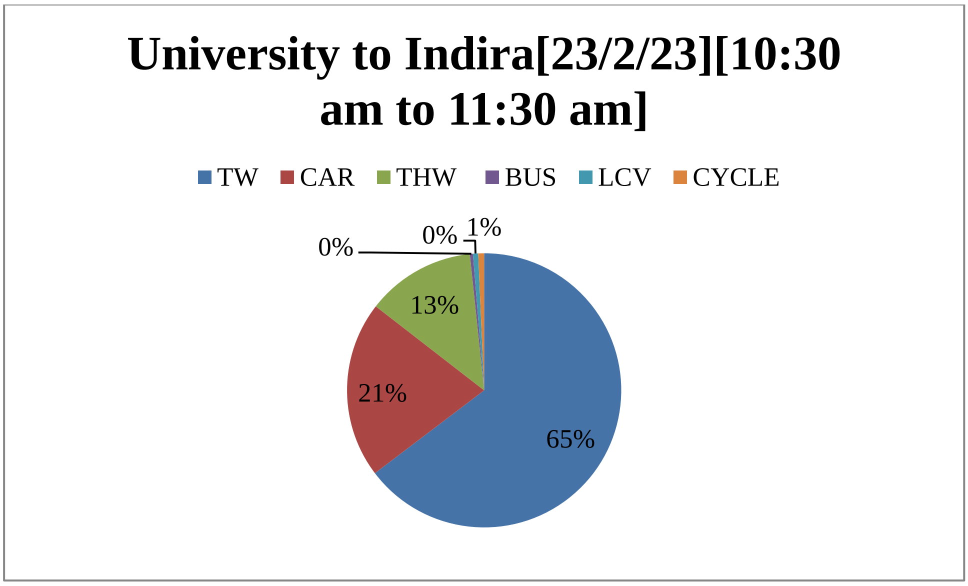


Fig.5.14 Vehicular Traffic Composition on University to Indira

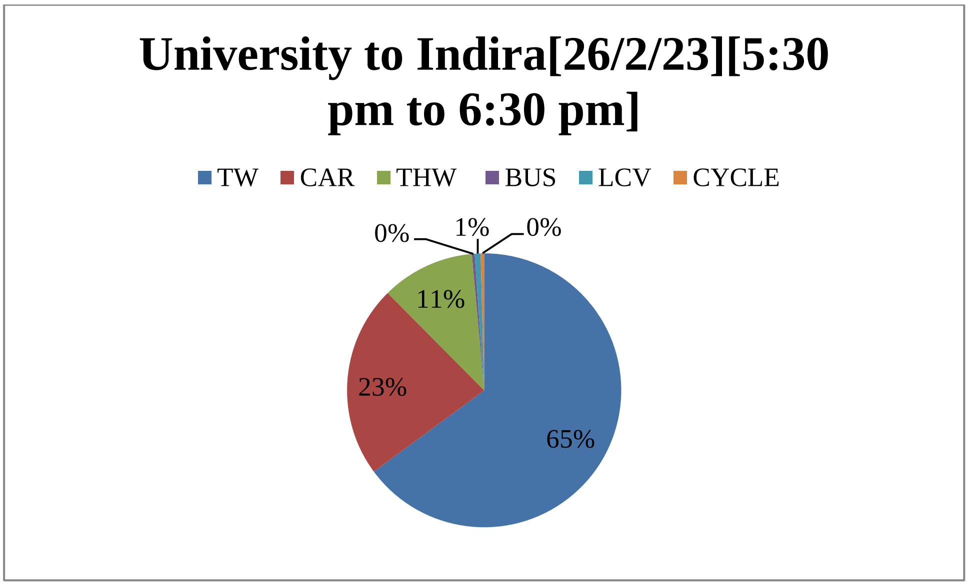


Fig.5.15 Vehicular Traffic Composition on University to Indira

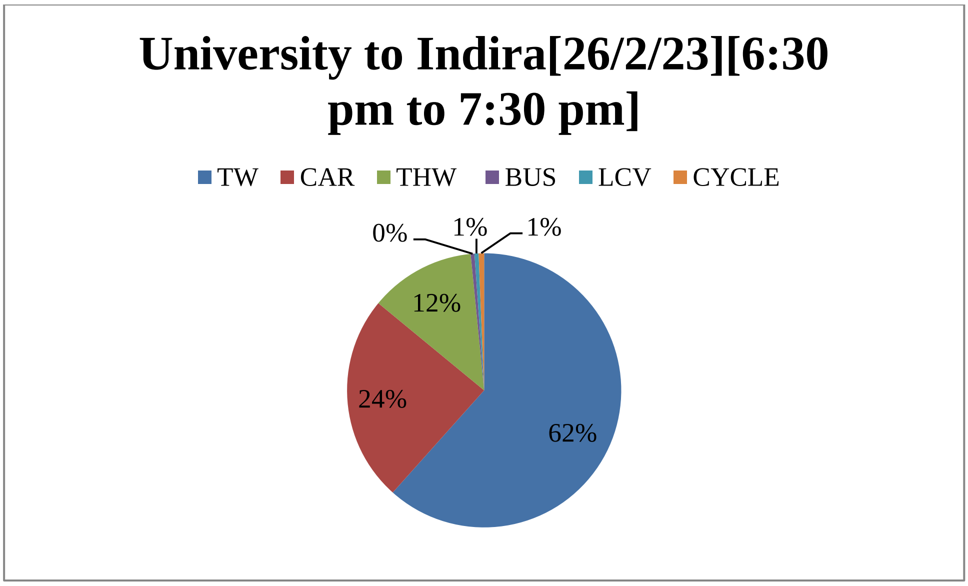


Fig.5.16 Vehicular Traffic Composition on University to Indira

5.3 Speed flow relationship:

In speed flow graph peak hour of traffic is selected for university to Indira and Indira to university.

Table 5.1 Traffic flow-speed data for Indira to University

Sr No.	Traffic flow	speed
1	2100	31.48
2	2240	31.29
3	2662	31.5
4	2579	31.06
5	2835	31.81
6	3064	31.87
7	3070	31.75
8	3122	27.89
9	2989	27.4
10	3011	26.71
11	2932	25.52
12	2842	24.46

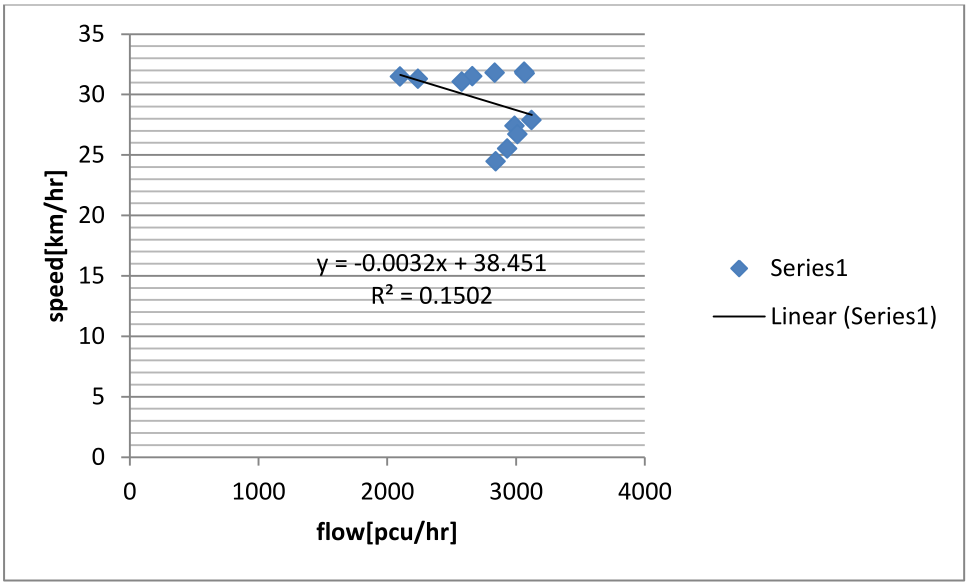


Fig. 5.17 Speed-Flow relationship [Indira to University]

The Figure shows the relation between flow and speed. The capacity of an approach is 3122 PCU/hour.

Table 5.2 Traffic flow-speed data for University to Indira

Sr No.	Traffic flow	speed
1	1600	27.7
2	1682	27.19
3	1813	28.4
4	1778	24.05
5	2509	25.6
6	2911	26.6
7	2887	24.8
8	2974	23.07
9	2912	23.39
10	3102	25.79
11	2764	25.65
12	2983	29.75

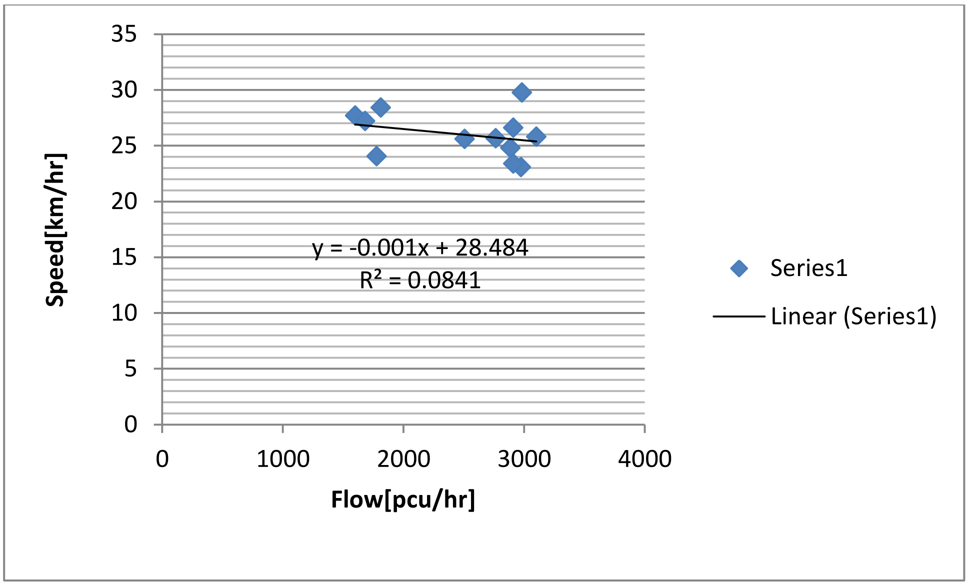


Fig. 5.18 Speed-Flow relationship [University to Indira]

The Figure shows the relation between flow and speed. The capacity of an approach is 3102 PCU/hour.

5.4 Summary

This chapter described vehicle growth and traffic mix for selected segments. This chapter includes the speed flow relationship for selected length. The next chapter is about the creation of a capacity model.

Chapter 6

Development of Capacity Model

6.1 Development of Capacity Model

Following Model is developed for estimation of capacity for heterogeneous traffic flow for Indian condition using regression analysis.

6.2 Capacity Model

Capacity= -75.94+9.52X1+11.26X2+23.68X3+18.19X4+17.08X5+3.32X6+1.91X7

X1= Percentage of Two wheeler in traffic composition

X2= Percentage of Car in traffic composition

X3= Percentage of Three wheeler in traffic composition

X4= Percentage of Bus wheeler in traffic composition

X5= Percentage of Lcv wheeler in traffic composition

X6= Percentage of Cycle in traffic composition

X7= Traffic stream speed

6.3 Satistical Validation (T-test)

For statistical validation, t test is carried out. The calculations of t test are as describedbelow.

Table-6.1 t-Statistical validation of the model based on Observed and Mathematical Model

Sr No.	Average Traffic stream capacity [Observed]	Average Traffic stream capacity[Model]	Difference Deviation	Square Deviation
1	2100	2103.47	3.47	12.0409
2	2240	2239.74	0.26	0.0676
3	2662	2656.92	5.08	25.8064

4	2579	2574.94	4.06	16.4836
5	2835	2839.87	4.87	23.7169
6	3064	3060.85	3.15	9.9225
7	3070	3072.84	2.84	8.0656
8	3122	3122.78	0.78	0.6084
9	2989	2989.75	0.75	0.5625
10	3011	3013.76	2.76	7.6176
11	2932	2927.6	4.4	19.36
12	2842	2843.41	1.41	1.9881
	33446	**33445.93**	**33.83**	**126.2401**

d_{mean} = mean of observed difference;

= (∑ difference of deviation)/ no. of samples

= 33.83/12

=2.81

Now, t statistics of observed speeds,

$$t_o = \frac{\text{mean of observed difference}}{\sqrt{k-1}}$$

k = number of data setk = 12

Sd = the standard deviation

$$Sd^2 = \frac{\text{square deviation}}{(k-1)}$$

Sd^2 = <u>126.2401</u>

(12-1)

$Sd^2 = 11.47$

Therefore Sd=3.38

$t_o=2.81/3.38\sqrt{12}$

$t_o=2.87$

Statistical Validation:

Model

- R^2 =0 .99
- T observed = 2.87
- T critical= 2.07

It is seen that the value of t-statistics calculated (t_o) is nearly equal to the corresponding table value. This implies that the Mathematical Model Capacity fairly represent the observed Capacity

Chapter 7

Conclusions

7.1 General

The study's goal is to determine the impact of capacity on traffic flow behaviour. Data such as categorized volume counts, Traffic stream speed are gathered in this study. In the current study, it was discovered that Develop a Capacity Model is best suited to diverse traffic circumstances on urban road sections in the study region.

7.2 Conclusion

- The Capacity Model is extremely useful for estimating future traffic, traffic planning and design, testing different alternatives, and assessing traffic management strategies.
- This urban routes include of vehicles such as cars,buses,tw,thw,lcv,cycles etc.
- There are more two-wheelers in the study region.
- In this study investigated that maximum flow is generated at Indira circle to university as compared to university to Indira circle.
- Regression methods are used to create the models.
- The models are created with variables such traffic composition, and Speed.
- PCU calculation must be based on variables that indicate the combination of factors that contribute to the overall effect of the type of vehicle on the quality of service provided by the route.
- Composition of Traffic A two-wheeler is more expensive than other modes of transportation. More than 60% of two-wheelers are noticed. It decreases latency since less space is filled, and so capacity rises.

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Books

11. IRC 106-1990 " Guide lines for capacity of Urban roads in Plain Areas"

ANNEXURE 1

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ABSTRACT
Development of capacity model for Arterial road under heterogeneous Traffic condition- A Case Study of Rajkot city
Submitted By MILAP VINODRAY VALA M.Tech Scholar, Civil Engineering Department AU Rajkot
Guided by Asharaf Mathakiya Assistant Professor, Civil Engineering Department AU Rajkot
Due to the fast expansion in income and automobile ownership among urban residents, traffic on urban highways is escalating. The issues brought on by the increased traffic have likewise gotten greater and more complicated. India's city streets in general transport heterogeneous traffic, which consists of a variety

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of vehicles including cars, buses, trucks, motorcycles, light-duty trucks, auto rickshaws, pedal bicycles, hand-drawn carts, animal-drawn carts,

ANNEXURE 2

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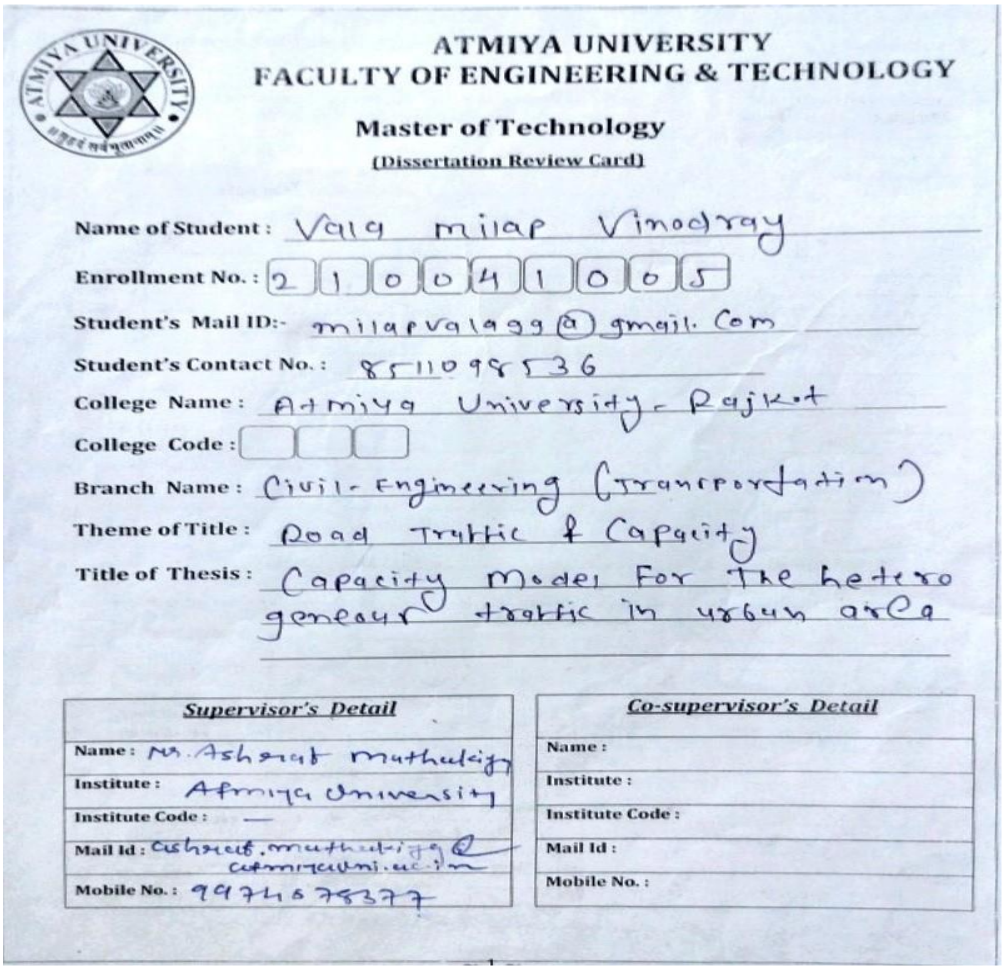

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Institute :	Atmiya	AU
Institute Code :	-	-
Mobile No. :	7874800084	9974079377
Sign :		

Particulars	*Internal Guide Details*	
	Expert 1	**Expert 2**
Name :	Mr. Asharaf Muthukiya	
Institute :	AU	
Institute Code :	-	
Mobile No. :	9974079377	
Sign :		

Enrollment No. of Student : 2 1 0 0 4 1 0 0 5

❖ **Comments of Dissertation Phase-1 (** DP - 1 **)** **(Semester 3)**

Exam Date : ___/___/___

Title : Capacity model for the hetero-geneous traffic in urban area.

1. Appropriateness of title with proposal. (Yes/ No) ________
2. Whether the selected theme is appropriate according to the title ? (Yes / No) ________
3. Justify rational of proposed research. (Yes/ No) ________
4. Clarity of objectives. (Yes/ No) ________

Suggested title

Development of capacity model for Arterial road under heterogeneous traffic condition - A case study of Rajkot city

20/12/2022

~ 3 ~

Enrollment No. of Student : 2 1 0 0 4 1 0 0 5

Exam Date : 20 / 12 / 22

Sr. No.	Comments given by External Examiners (DP-I) : (Please write specific comments)	Modification done based on Comments
	Title change	done
	Reframe scope and objective	
	Add standard Papers in literature review	
	Indetify study Area quickly	
	Literature summary missing	
	Research Gap Identification	
		(Internal Guide Sign.)

- Approved ☐
- Approved with suggested recommended changes ☑
- Not Approved ☐

Please tick on any on.
If approved/approved with suggession then put marks ≥ 50 %.

➢ **Details of External Examiners :**

Particulars	Full Name	University / College Name & Code	Mobile No.	Sign.
Expert 1	Ravindra r. solanki	Marwadi uni	9687200929	
Expert 2				

Enrollment No. of Student : 2 1 0 0 4 1 0 0 5

❖ Comments of Mid Sem Review ( ) (Semester 4)

Exam Date : 25 / 3 / 2023

Sr. No.	**Comments given by External Examiners :** i) The appropriateness of the major highlights of work done; State here itself if work can be approved with some additional changes. ii) Main reasons for approving the work. iii) Main reasons if work is not approved.	**Modification done based on Comments**
1.	modify methodology chart.	done
2.	References should be arranged alphabetically	
3.	do proper formatting as per University guideline	
4.	Completion of work within due time frame.	
		Internal Guide Sign.

- *Approved* ☐
- *Approved with suggested recommended changes* ☑
- *Not Approved* ☐

Please tick on any on. If approved/approved with suggession then put marks ≥ 50 %.

➢ ***Details of External Examiners :***

Particulars	*Full Name*	*University / College Name & Code*	*Mobile No.*	*Sign.*
Expert 1	JAY KIRIT KALARIA	MARWADI UNIVERSITY	9879470378	
Expert 2				

Enrollment No. of Student : ☐☐☐☐☐☐☐☐☐

❖ **Comments of DP-II Review (   )** **(Semester 4)**

Exam Date : ____/____/________

Sr. No.	**Comments given by External Examiners :** i) Main reasons for approving the work. ii) Main reasons if work is not approved.	**Modification done based on Comments**

- *Approved* ☐
- *Not Approved* ☐

Please tick on any one.

If approved then put marks ≥ 50 %.

➢ ***Details of External Examiners :***

Particulars	***Full Name***	***University / College Name & Code***	***Mobile No.***	***Sign.***
Expert 1				
Expert 2				

ANNEXURE 4

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.2)	LCV (1.4)	CYCLE (0.4)	Vehicle / 5 min	Vehicle/hr	Pcu / 5 min	Pcu/hr