

**ESTIMATION OF DYNAMIC PCUS
UNDER HETEROGENEOUS TRAFFIC
CONDITION ON URBAN ROAD: A CASE
STUDY OF RAJKOT CITY**

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It is certified that the work contained in this dissertation thesis entitled “ **ESTIMATION OF DYNAMIC PCUS UNDER HETEROGENEOUS TRAFFIC CONDITION ON URBAN ROAD: A CASE STUDY OF RAJKOT CITY** ” submitted by **Miss. BARAD AMI DINESHBHAI, 190041002** studying at Civil Engineering Department, Faculty of Engineering & Technology, for the award of M.Tech in Transportation Engineering is absolutely based on her own work carried out under my supervision and that this work/thesis has not been submitted elsewhere for any degree/diploma.

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Dedicated to,

*For every success of my life, for
being worm and caring, Great
Enthusiasm, Inspiration, Support &
Love are Heart of my Achievement.*

Thank you.

*My Mom, Dad &
My beloved Friends*

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Place: Atmiya University, Rajkot

- Ami D. Barad

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“Estimation of Dynamic PCUs under heterogeneous traffic condition on Urban road: A case study of Rajkot city”

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ABSTRACT

This study presents the concept of “Dynamic Passenger Car Unit (DPCU)” for the urban local roads under heterogeneous traffic condition, and it reflects that the Passenger Car Unit (PCU) is not a static factor as assumed. The parameter considered for the estimation of the DPCU are (1) average speed of vehicle (2) projected rectangular area of vehicle (3) length of vehicle. The traffic data was collected at the mid-block section as of the following roads: (1) Nana mava road (2) Raiya road. Both roads having same geometric condition. The mid-block section was kept of 30m and traffic data was collected. The roads are two lane divided roads and having different traffic composition. The mid-block section was such selected that it was free from parked vehicles, bus stop, effects of the intersection, curvatures etc. The DPCU was obtained by following two methods: (1) Homogenization coefficient method (2) Chandra’s method. The traffic data was collected using videography method for in morning 8:00am to 12:00pm and in evening 4:00pm to 8:00pm was concluded for the roads by the study of traffic volume. The peak hour traffic was used to calculate the DOCU values and efforts were made to suggest the best reliable DPCU value.

Keywords: Heterogeneous traffic, Dynamic PCU.

CHAPTER 1

INTRODUCTION

1.1 General:

One of the fundamental measures of traffic on a road system is the volume of traffic using the road in a given interval of time. It is also termed as flow and it is expressed in vehicles per hour or vehicles per day. When the traffic is composed of a number of types of vehicles, it is the normal practice to convert the flow into equivalent passenger car unit (PCUs), by using certain equivalency factor. The flow is then expressed as PCUs per hour or PCUs per day.

A knowledge of the vehicular volume using a road network is important for understanding the efficiency at which the system work at present and the general quality of service offered to the road users. Knowing the flow characteristics one can easily determine whether a particular section of the road is handling traffic much above or below its capacity. If the traffic is heavy, the road suffers from congestion with consequent loss in journey speed. Lower speeds cause economic loss to the community due to time lost by the occupants of the vehicles and the higher operational cost of the vehicles. Congestion also leads to traffic hazards. Volume counts are, therefore, indicators of the need to improve the transport facilities and are an invaluable tool in the hands of a transport planner. They enable him to draw up schemes for improvement of roads based on a system of relative priorities and to allocate the scare economic resources most advantageously.

The traffic using a road is composed of a variety of vehicles ranging from the simple pedal cycles to the motor car and the heavy commercial vehicles. Each type having an influence on the performance of the road in its own way, a simple volume count, without classifying the vehicles into distinct types when doing the volume counting.

The ultimate aim of travel is to transport men and goods. The number of people involved in travel is an important measure in transportation planning. When it is desired to find out the number of people travelling in vehicles, an estimate of the average occupancy becomes necessary.

1.2 Problem identification:

- In static PCU, consider the length of vehicles. Depending on the PCU value of passenger car, we assume PCU for all the vehicles with respect to length only.
- For calculating the dynamic PCU, considering the dynamic characteristics like speed of vehicles, length of vehicles, rectangular area of vehicles etc.

1.3 Need for the study:

1. Traffic in India, is highly heterogeneous, comprising different types of vehicles with widely varying static and dynamic characteristics.
2. Mixing of various classes of vehicles along a road without their physical segregation creates various complex problem.
3. Each class of vehicles in the traffic stream cannot be considered as equivalent to any other vehicles class as there are considerable differences in the vehicular and flow characteristics of each vehicle class.

1.4 Objective of study:

1. To determine dynamic PCU values for varying traffic composition at urban road in the Rajkot city by Homogenization coefficient method and Chandra's method.
2. To compare DPCU value of different two stretches of Rajkot city by both methods.
3. To compare the DPCU value, while taking passenger car as a standard car (up to 1400cc) and Big car (more than 1400cc).

1.5 Scope of study:

1. From various factor influencing of PCU value we have considered average speed and traffic volume.
2. Study is limited to Rajkot urban road only.

CHAPTER 2

INTRODUCTION TO PCU & DPCU

2.1 General:

Traffic flow is generally heterogeneous in nature. However, the degree of heterogeneity varies with the context. For example, it is usually more for developing nations. Due to this heterogeneity, traffic studies often become critical. Passenger Car Unit (PCU) is a commonly used approach to convert the heterogeneous traffic volume into its equivalent homogeneous.

2.2 Passenger Car Unit (PCU):

“It is common practice to consider the passenger car as the standard vehicle unit to convert the other vehicle classes and this unit is called passenger car unit or PCU.”

The PCU may be considered as a measure of the relative space requirement of a vehicle class compare to that of a passenger car under a specified set of roadway, traffic and other conditions.

The PCU value of a vehicle class may be considered as the ratio of a roadway where there are passenger cars only to the capacity of the same roadway when there are vehicles of that class only.

Estimation of PCU is important for each vehicle category present in the traffic stream to design and analyse the performance of different traffic facilities and to manage the regulation and control of traffic.

PCU of a vehicle category largely varies depending upon the type of road facility. For example, a set of PCU recommended for urban road is not applicable to determine the homogeneous equivalent of traffic volume at freeway, signalized and unsignalized intersection, roundabout or any other road facility.

2.2.1 Factors affecting PCU value:

The PCU values of different vehicle classes depends upon following factors:

1. Dimensions of vehicle such as width and length.
2. Dynamic characteristics of vehicles such as power, speed, acceleration and breaking.
3. Transverse and longitudinal gaps or clearance between moving vehicles which depends upon the speeds, driver characteristics and the vehicle classes at the adjoining spaces.
4. Traffic stream characteristics such as composition of different vehicle classes, mean speed and speed distribution of the mixed traffic stream and volume to capacity ratio.
5. Roadway characteristics such as road geometrics including gradient and curves, access controls, rural or urban road, presence of intersections and the type of intersection.
6. Regulation and control of traffic such as speed limit, one-way traffic, presence of different traffic control devices etc.

2.2.2 PCU value for vehicles:

The equivalent PCUs of different vehicle categories do not remain constant under all circumstances. Rather, these are a function of the physical dimensions and operational speeds of respective vehicle classes. In urban situations, the speed differential amongst different vehicle classes is generally low, and such as the PCU factors are predominantly a function of the physical dimensions of the various vehicles. Nonetheless, the relative PCU of a particular vehicle type will be affected to a certain extent by increase in its proportion in the total traffic. Considering all these factors, the conversation factors as shown in table are recommended for adoption.

Vehicle Type	Equivalent PCU Factors	
	% composition of Vehicles type in traffic stream	
	5%	10%and above
<u>Fast vehicles:</u>		

Two wheelers motor cycle or scooter etc.	0.5	0.75
Passenger car, pick-up van	1.0	1.0
Auto-rickshaw	1.2	2.0
Light commercial vehicle	1.4	2.0
Truck or Bus	2.2	3.7
Agricultural Tractor Trailer	4.0	5.0
<u>Slow vehicles:</u>		
Cycle	0.4	0.5
Cycle rickshaw	1.5	2.0
Tonga (Horse drawn vehicle)	1.5	2.0
Hand cart	2.0	3.0

Table 2.1 Recommended PCU factors for various types of vehicles on urban road

2.3 Dynamic Passenger Car Unit (DPCU):

“Dynamic Passenger Car Unit can be co-related with projected rectangular area of car and vehicle category as well as with saturation flow rate, speed, headway, travel time.”

In Indian 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”. The interaction between moving vehicles in a traffic stream is highly complex and is influenced by a number of roadway and traffic factors. The accurate estimation of the magnitude of vehicular interaction for different roadway and traffic condition is the prerequisite for better operation and management of roadway facilities in their prevailing conditions.

In most of the developing countries including India, the prevailing traffic is heterogeneous in nature. It comprises of a wide range of vehicle category which are different from each other in terms of static and dynamic behaviour. Passenger Car Unit is a commonly used approach to convert the heterogeneous traffic volume into its equivalent homogeneous.

2.4 Definitions and Terminology:

Flow (or volume): It is the number of vehicles that pass through a given point on a road during a designated time interval. Since road have a certain width and the required number of lanes is accommodated within the available width, flow is always expressed in relation to the given width i.e. per lane or per direction etc. The time unit selected is one hour.

Passenger Car Unit (PCU): It is the amount of interaction (or impedance) caused by the vehicle to a traffic stream with respect to a standard passenger car.it is used to convert a heterogeneous traffic stream into a homogeneous equivalent to express flow and density in a common unit.

Peak Hour Flow: Peak rates of flow are related to hourly volumes with peak hour factor. This factor is defined as the ratio of total hourly volume to the peak rate of flow within the hour.

Shoulder type: A shoulder is a portion of the road contiguous with the carriage and is intended for accommodating of stopped vehicles, emergency used and providing lateral structure support to the road. Shoulders can be of two types:

- ✓ **Paved Shoulder:** They are constructed with the similar material as that of the main carriage width ranging from 1.5 to 2.0m.
- ✓ **Unpaved Shoulder:** they are constructed with well compacted earth, also called earthen shoulders, or materials like turf, stabilized soil, gravel, brick paving etc. In the case of multilane interurban highways, given the fact that they cater to high speed traffic, paved shoulder (1.5 to 2.0m) are invariably provided on the outer side of the carriageways and it is supplemented with unpaved shoulder of suitable width ranging from 1.0 to 1.5m.

Shoulder Width: The width of the shoulder should be adequate for providing working space around a stopped vehicle. For multilane interurban highways, generally 1.5 to 2.0m wide paved shoulder are provided. They are supplemented with unpaved shoulders in open areas. As shoulders can act as auxiliary lanes in Indian condition, especially to accommodate slow moving vehicles and even motorized two wheelers, they are expected to increase the capacity of the road section. In addition, wider shoulder provides a sense of security to the driver and hence they can drive with more freedom. Therefore, width of shoulders is expected to affect both capacity and LOS.

Speed: It is the rate of motion of individual vehicles or of traffic stream. It is measured in meter per second (m/s) or kilometre per hour (km/hr). The types of speed measurements used in traffic engineering are Space Mean Speed and Time Mean Speed.

- ✓ **Space Mean Speed (SMS):** It is the mean speed of vehicles at any instant if time over a certain length of the road. It is the average speed based on average travel time of vehicles to traverse a known segment of a roadway.
- ✓ **Time Mean Speed (TMS):** it is the mean speed of vehicles observed at a point on the road over a period.

Traffic Flow or Traffic Volume: the amount of a traffic on a road is generally measured as either traffic volume or traffic flow. Traffic volume is the total number of vehicles that pass over a given point or section of a roadway in a given interval of time. Traffic volume can thus be given for annual, daily, hourly, or sub-hourly periods.

CHAPTER 3

LITERATURE REVIEW

3.1 General:

A review of literature is important in any research work. In this aspect the studies carried out on estimation of Dynamic PCUs as well as relevant information pertaining to the how to find equivalency factor under heterogeneous traffic condition on urban road.

3.2 Literature review:

A literature is a text written by Expert on current issues related to field is contributes on the basis of current knowledge including substantive finding, as well as theoretical and methodological contributions to a particular topic. Also, a literature review can be interpreted as a review of an abstract accomplishment.

3.3 Research work:

A. MAHER, S. CHANDRA, S. VELMURUGAN (2014)

“Passenger Car Units at different Levels of Service for capacity analysis of multilane interurban highways in India.”

Passenger car units (PCU) of different types of vehicles are required to convert a mixed traffic stream into a homogeneous equivalent, and thereby to express the mixed traffic flow in terms of equivalent number of passenger cars. Earlier studies have reported that PCU for a vehicle is dynamic in nature and changes with traffic volume and proportional share of a vehicle type in the traffic stream. The present study provides PCU values for different types of vehicles typically found on interurban multilane highways in India at different levels of service (LOS). Traffic simulation model VISSIM is used to generate the traffic flow and speed data for conditions that are difficult to obtain from field

observations. Important VISSIM parameters are first calibrated to reflect mixed traffic flow behaviour and then the software is used to draw the speed-volume relationships for cars and one of the remaining four categories of vehicles in the traffic stream. The proportion of second category of the vehicle was also varied to observe its effects on PCU values. Finally, PCU values are suggested for different type of vehicles at different LOS and for different traffic composition on four-lane and six-lane divided highways.

Conclusion:

- They have studied on two section of interurban highways, one with four lane and other with six lane divided roadway.
- Traffic volume and speed data were collected for 6 hours during morning peak hours, non-peak hours and in evening hours by using video recording methods.
- They were used VISSIM model to know the effect of traffic composition on capacity and develop speed – flow curve for different combination of traffic composition
- The result obtained from study were value of PCU decrease with decrease in level of services from A to E.
- Capacity of four lanes and six lane divided highway was estimated as 4950 PCU/h and 6700 PCU/h in each direction of traffic movement.

GAURANG JOSHI, DINESH VAGADIA (2013)

“Dynamic Vehicle Equivalent Factors for characterisation of mixed traffic for multilane metropolitan arterials in India.”

Traffic volume which is key input for road system design is represented in terms of standard passenger car unit. IRC: 106-1990; Guidelines for Capacity of Urban Roads in Plain Area, recommends two sets of PCU values based on “5%” and “10% and more” composition of various vehicle types in total traffic volume. It is also established that the vehicle type with major proportion in the traffic stream dominates behaviour of other vehicles and therefore conversion of mixed traffic with predominance of two wheelers in to passenger cars is also questionable. In the present paper, Dynamic Vehicle Equivalent Factors (DVEF) namely Dynamic Car Unit (DCU) and Dynamic Two-wheeler Unit (DTU) are derived using modified homogenization coefficient approach based on comprehensive field traffic data collected by video graphic technique on mid-block road sections of multilane arterials in seven metropolitan cities of India. A simple method to derive traffic volume in DCU/DTU for different traffic composition and traffic volume for a standard 10.5 m wide three lane arterial road is discussed in the present study. Significance of DVEF and its variation with influencing parameters in mixed traffic is also discussed in this paper.

Conclusion:

- In this paper Dynamic vehicles equivalent factors (DVEF) called as Dynamic car unit and Dynamic Two wheeler unit (DTU) were derived by using homogenization coefficient approach.
- Traffic data collected on seven cities of India, luck now, Kanpur, Jaipur, Patna, Surat, Pune and Thiruvananthapuram.
- Traffic volume counted manually for 1 min time interval and spot speed calculated by using stop watch.
- Mathematically, DVEF considering ‘x’ reference vehicles are the ratio of speed to area of vehicles.
- This study was based on real world observations and result may not exactly match simulation results.
- Driver behaviour and local condition lead to higher deviation in result. Effect of driver behaviour reduce with increase in traffic flow.

MEGHA BHATT, PRIYESH PATEL (2017)

“Determination of Dynamic PCU in Ahmedabad city.”

Due to rapid growth in population and vehicle ownership, there is tremendous traffic congestion on signalized intersections of urban corridors. If signalized intersections coming frequently on the corridor without coordination, then the vehicular delay is enormous during peak hours. Signal cycle timings are generally depending on arrival rate and saturation flow rates of approaches. For the mixed traffic conditions, vehicles are converted into Passenger Car unit (PCU) to estimate the flow values. PCU values of different types of vehicles are varying with composition of vehicles, time, situation, location and their interaction. Static PCU values suggested by Indian Roads Congress (IRC) for the signalized intersection is generally overestimate the saturation flow rate. Dynamic PCU value for mid- block section in the Indian traffic scenario has been found by the several researchers, but very few researchers have attempted to find the dynamic PCU on the signalized intersections. Dynamic PCU can be co-related with projected area of car and vehicle category as well as with departure flow rate (saturation flow rate), speed, headway, travel-time etc. The actual travel time to cross the signalized intersection includes most of the factors like acceleration, deceleration, manoeuvrability etc.

Conclusion:

In this paper, classify difference between static PCU value and dynamic PCU value. Data is collected with the help of videography at decided intersection during peak hours. They concluded that-

1. Mix and composite traffic observed during study.
2. At all intersection it is found that composite of two wheelers is quit high (60%-70%).
3. Three wheelers composite varies between (11%-19%).
4. Car composite varies between (14%-25%).
5. Light Commercial Vehicle composite varies between (0%-1%).
6. Bus composite varies between (0%-2%).
7. Non-motorized composite varies between (0%-2%).
8. Maximum vehicle are observed at Swastik Char Rasta intersection.
9. The proportion of 2W, 3W and Car is more as compared to LCV, Bus/Truck and NM.

**PREMA SOMANATHAN PRAVEEN, VENKATACHALAM THAMIZH
ARASAN (2013)**

“Influence of traffic mix on PCU value of vehicles under heterogeneous traffic conditions.”

Study of the basic traffic flow characteristics like traffic volume is the pre-requisites for the effective planning, design, operation and management of roadway systems. Traffic in developing countries like India is heterogeneous in nature consisting of vehicles of different categories with widely varying dimensional and operational characteristics. The moving vehicles of heterogeneous traffic occupy any convenient lateral position on the road without any lane discipline, based on the availability of space. The interaction between moving vehicles under such traffic condition is highly complex in nature, which can be represented in terms of the amount of impedance caused to flow of traffic by a vehicle type in comparison with that of Standard vehicle (passenger car). Passenger Car Unit (PCU) can be an appropriate measure to represent the relative impedance caused by a vehicle in heterogeneous traffic. This paper is concerned with the application micro-simulation technique to derive equivalency values (PCU Factors) on a purely homogeneous (cars-only) traffic stream as well as on a heterogeneous traffic stream for different categories of road vehicles over a wide range of traffic flow and compositions on four-lane divided urban roads in India. The PCU values obtained for the different types of vehicles, for a wide range of traffic volume and composition, indicate that the PCU values of a vehicle type significantly changes with change in traffic volume and composition.

Conclusion:

- They were collected data on divided urban road in India to find out the influence of change in traffic volume and composition and volume on PCU of the vehicles
- They were used HETEROSIM software to determine the PCU value.
- It was found that, at low volume levels, the PCU value of vehicles increase with increase in traffic volume, whereas under higher volume condition, the PCU value decrease with increase in traffic volume, for any given composition.
- It was found that the effect of traffic composition on PCU values is higher at lower value and the effect of traffic composition on PCU value decrease with increase in the composition of subject vehicles.

PATEL BINDIYA, MAYURSINH JADEJA, MONICABA VALA (2016)

“Determination of Dynamic PCUs of different types of passenger vehicles on urban road: A case study of Rajkot city.”

This study represents a concept of "dynamic passenger car unit' ('DPCU'), appropriate for the heterogeneous traffic on Indian roads, and shows that the PCU factor for a vehicle type is not a static factor as it is usually assumed. Various relationships will be developed between speed-flow, classified volume of vehicles and Average speed. PCU values of different types of vehicles By using three different methods of estimating PCU, PCU value of different category of vehicles should be found. This PCU factor is the ratio of the projected rectangular area of the vehicle type to the speed of the vehicle type, with respect to car. Factors influencing PCU value are is determined on Rajkot Urban Road by different methods and suggest the reliable method.

Conclusion:

- They studied urban road of Rajkot city & collect traffic flow data and average speed of all vehicles through videography technique at one minute interval on two road (kalawad road, 150ft. Ring road) for the duration ranging from 6 hours covering the morning and evening period.
- DPCU is calculated by Homogenization co-efficient method and Chandra's method.
- They concluded that Homogenization Coefficient Method gives higher PCU values for smaller vehicles as 2W, 3W compared to Chandra's Method.
- Chandra's Method gives higher PCU values for larger vehicles as Bus, LCV, Truck, MAV compared to homogenization coefficient method.

ER. SUMIT RANA, ER. ANIL KHARB (2016)

“Development of Passenger Car Units (PCU), case study of Ghantaghar chowk, Karnal district of Haryana.”

The increasing of traffic volume at our intersection has been arise a problem like road accidents, conflicts and congestions. These problems can solve by providing an efficient traffic signal control at the intersection for continuous and efficient movement of vehicles through the intersection. According to traffic signal, signal timing is most important which is used to decide green time of the traffic light shall be provided at an intersection and how long the pedestrian walk signal should be provided. Traffic volume studies are to be made to determine the number, movement and classification of vehicles at the given location. These data is used identify normal flow of the road; determine the influence of heavy vehicles or pedestrians on vehicular traffic volume. The length of the sampling period depends on the type of count being taken. According to manual count with 15-minute intervals could be used to obtain the traffic volume data. The collected data is converted into PCU units. Webster’s method is a rational approach for signal design. The design is simple and is totally based on formulae’s laid down by Webster. In this method, the total cycle of the signal is determined which forms a total least delay occurring at signal.

Conclusion:

- They collected speed measurement data, time headway measurement, width and lateral clearance in Karnal, Ghantaghar chowk, Haryana.
- Speed of different classes of vehicle was measured using the speed gun software in a smart phone.
- They concluded that almost all classes of vehicles commonly found in Karnal city, India. The PCU value of each vehicle is not a constant but varies with several factors such as proportion of other classes, level of service, volume to capacity. The speeds of individual vehicles in the queue need not to be precisely equal, but may vary slightly from vehicle to vehicle and similarly the time headway of individual vehicles in the queue. In this study, the average value of speed and time headway is taken.

YASH R. DASANI, MONICABA VALA, BINDIYA PATEL

“Estimation of dynamic Equivalency Factor under heterogeneous traffic condition on urban arterial road: A case study of Porbandar city.”

This paper presents the concept of “Dynamic Equivalency Factor” (DEF) for the urban arterial roads under heterogeneous traffic condition, and it reflects that the PCU (Passenger Car Unit) is not a static factor as assumed. The parameters considered for the estimation of DEF are (1) average speed of the vehicle, (2) traffic composition, (3) time headway, and (4) roadway width. The traffic data was collected from three urban roads of Porbandar City, and it was collected at the mid-block section as of the following roads: (1) M.G Road, (2) S.V.P Road and (3) Chhaya Road. The mid-block section was kept of 30 M and traffic data was collected. The following road selected varies in road widths as two lanes divided and two lanes undivided and having different traffic composition. The sections were such selected that it was free from parked vehicles, bus stop, effects of the intersection, curvatures, etc. The DEF was obtained by the following methods (1) multiple regression method, (2) headway method, (3) Chandra’s method and (4) homogenization coefficient method. The traffic data was collected using videography technique for morning 8 a.m.–8 p.m. from which the morning peak hours 8:30–11:30 and evening peak hours 5–8 was concluded for the roads by the study of traffic volume. The peak hour traffic was used to calculate the DEF values and efforts were made to suggest the best realizable DEF value.

Conclusion:

- Headway method gives higher DEF values for truck, bus and MAV and lower DEF values for 2W and 3W than IRC standards.
- Homogenization coefficient method gives DEF values for all classes of the vehicle nearly the same with a little amount of variation to IRC PCU values.
- Chandra’s method gives lower DEF values for 2W and 3W and higher DEF values for LCV, bus, truck, MAV than IRC standards.
- Chandra’s method can be suggested as the best reliable method as it considers the projected area of vehicle rather than only longitudinal length used in homogenization coefficient method.
- The Headway method yield much higher values of DEF is it is directly dependent on time headway of vehicles.

CHAPTER 4

STUDY AREA AND METHODOLOGY

4.1 General:

Study area is most important part of the project and it gives the effectiveness of the research area. Methodology for study depends on different parameters like vehicle speed, vehicle types, road width, traffic composition, etc. This all data is collected by counting number of vehicles at particular location by using Classified Volume Count and average speed to determine Dynamic PCU for heterogeneous traffic.

4.2 Study area:

Rajkot is the 4th largest city in Gujarat and 28th largest city in India with population more than 2.0 million as per survey in 2021. It is the capital of Saurashtra region. It is located at 22.3° N and 70.78° E and is spread in the area of 104.9km² and located 138m above mean sea level. Climatic condition of Rajkot is generally semi-arid and average low temperature lies between 20°C to 22°C and average high temperature is 40°C.

Rajkot is a head quarter of Rajkot district and the city is connected with other parts of the country by Rail, Air and Roads. They are mainly two railway stations, one at Junction Plot area and another at Bhaktinagar area. Also there are major roads and NH-8A links Kandla, NH-8B links Porbandar and state capital Gandhinagar. Then, state highways connect Rajkot to other important towns of the region like Jamnagar, Surendranagar, Porbandar, Junagadh, Veraval, Bhavnagar, Amreli, Bhuj, Kandla, Ahmedabad, Baroda etc. The city is also served by an aerodrome and linked by air with Vadodara, Bhuj, Bombay, Delhi and Ahmedabad.

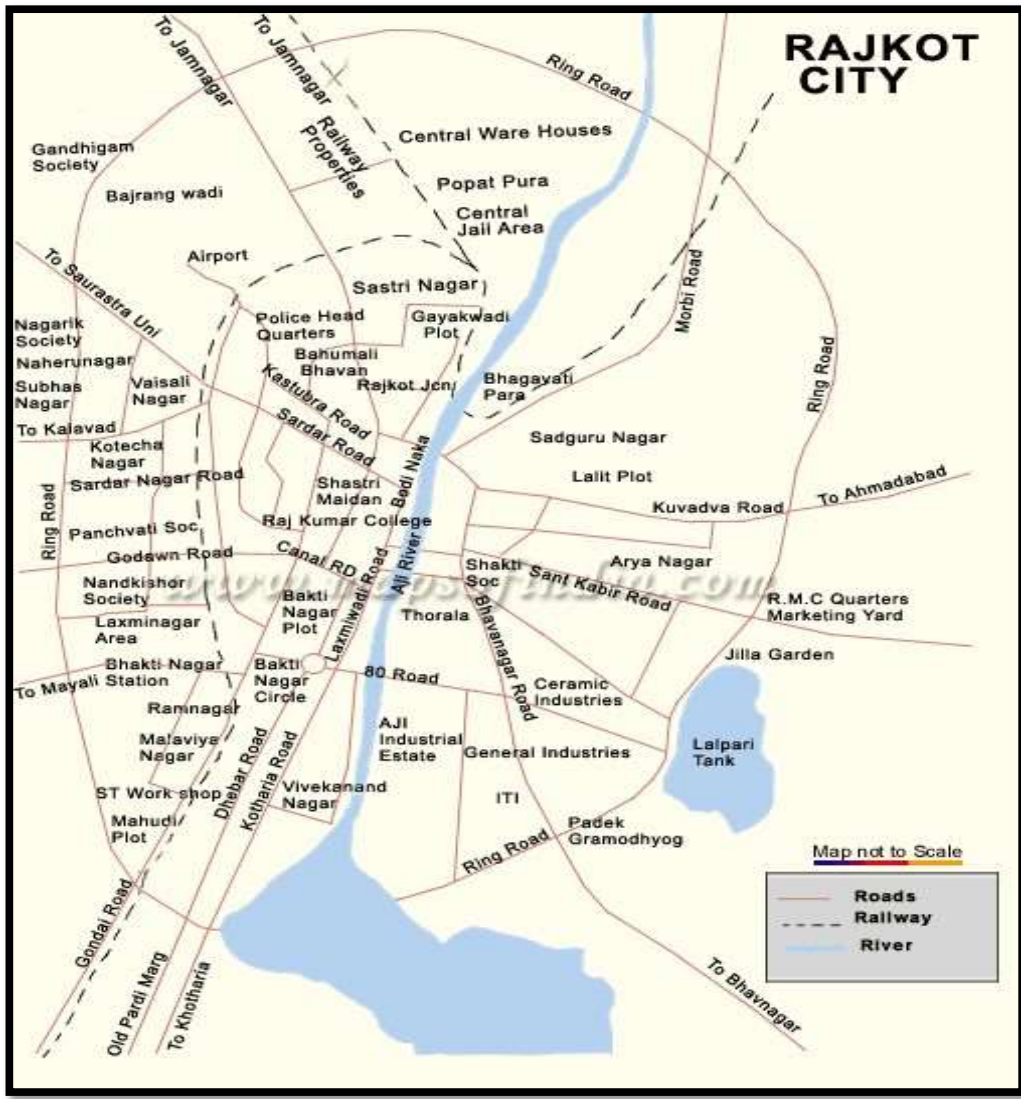


Figure 4.1 Map of Rajkot city

4.3 Study area characteristics:

Following are two stretches of Rajkot city where traffic is heterogeneous.

1. Nana mava road
2. Raiya road

Both stretch have same geometric condition like, type of carriageway, carriageway width, shoulder width, type of shoulder, median width etc.

Both are two lane divided roads.

On the road, 30m straight mid-block section selected and it should be free from effect of intersection, curvature, bus stop or any other side friction.

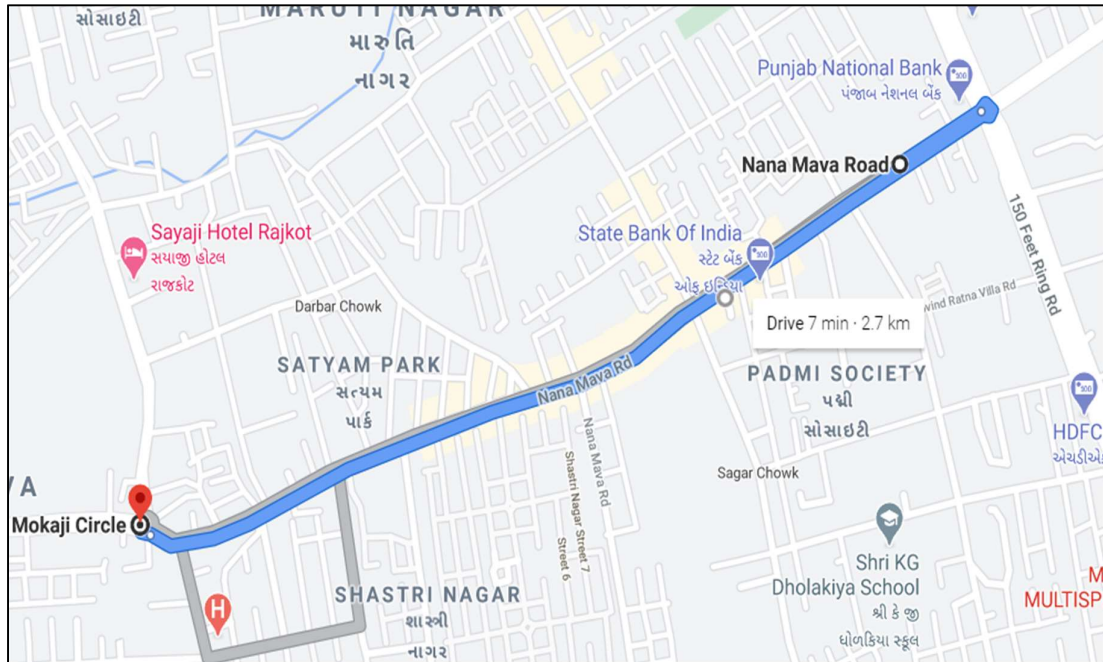


Figure 4.2 Map of Nana mava road

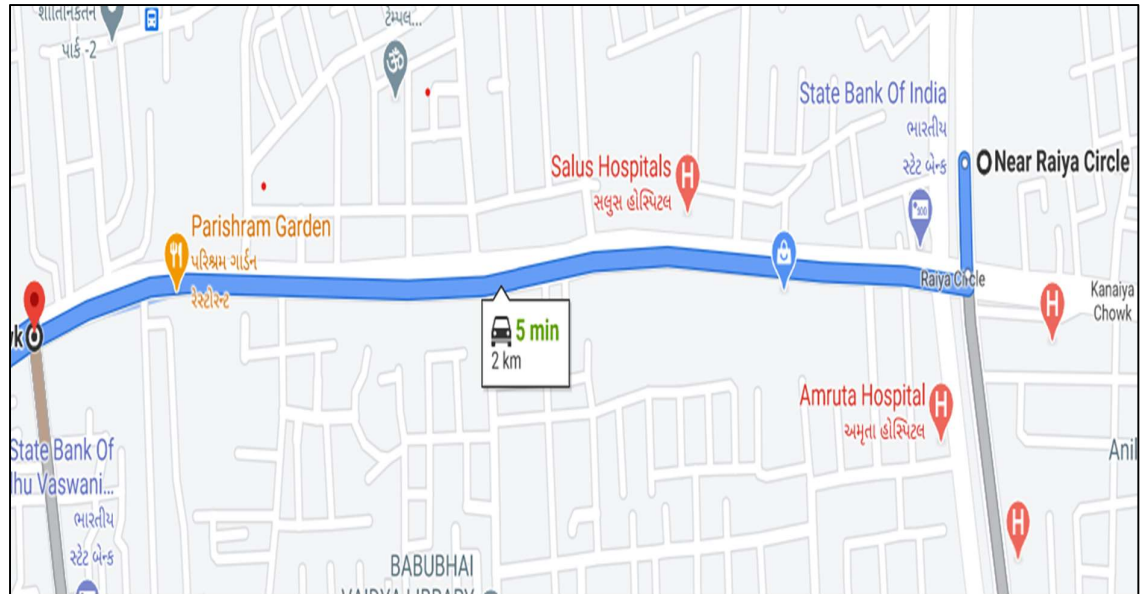


Figure 4.3 Map of Raiya road

4.4 Proposed methodology flow chart:

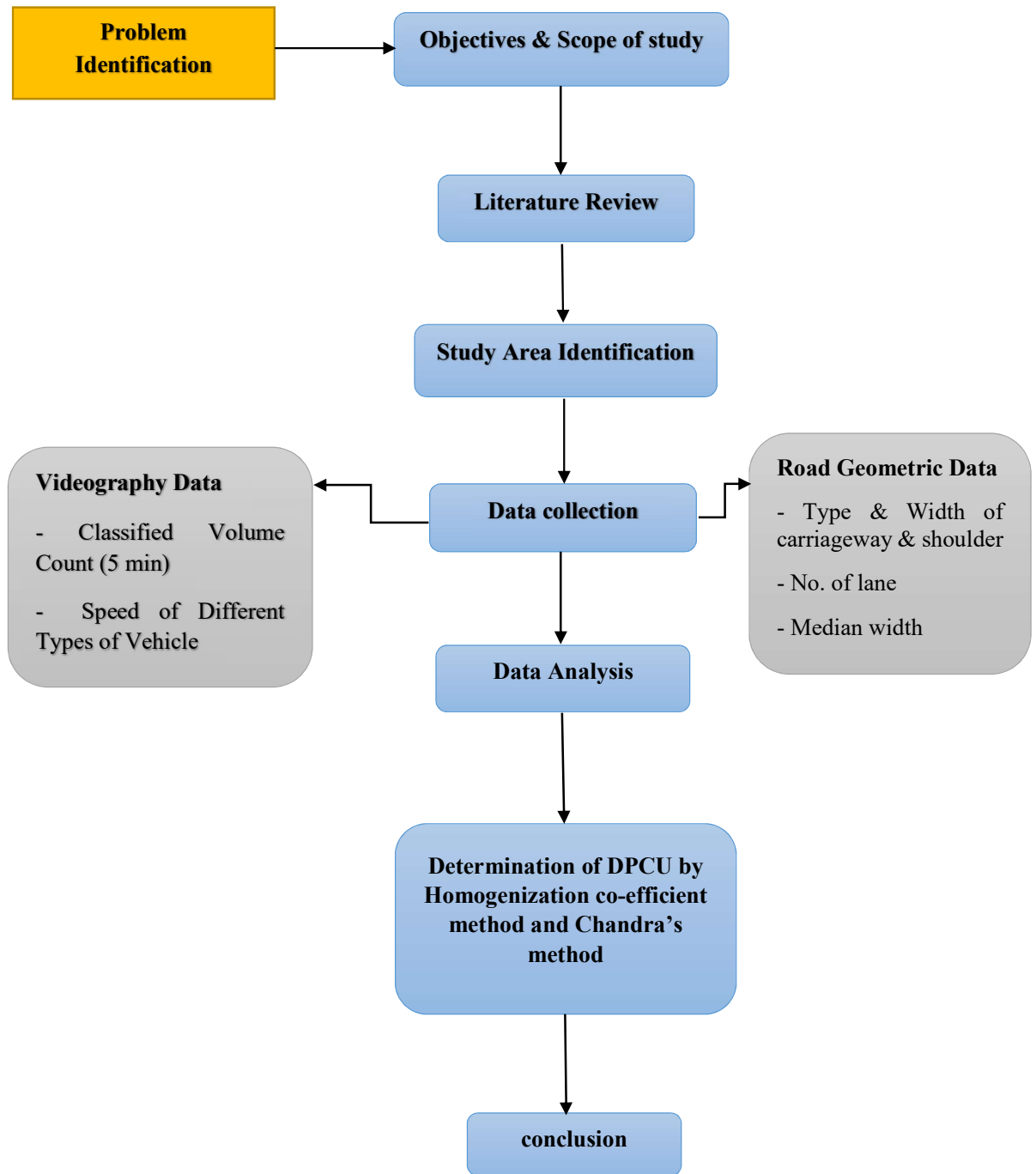


Figure 4.4 Flow chart of proposed methodology

4.5 Methods used for Data Collection:

4.5.1 Classified Volume Count:

To achieve the objectives of this thesis, field observation and data collection is required to measure the average speed and vehicle volume at different approach configuration containing traffic flows of varied compositions. Data should be collected at two stretches for classified volume count at 30m mid-block section.

Number of traffic lane, type and width of carriageway, type and width of shoulder etc. geometric data collection are considered in this study. Depending on the prevailing roadway condition videography method were used for collection of traffic data for this study. Placing the video camera at the suitable location to cover the traffic movement on selected stretch or road. Traffic data was collected in morning 8:00am to 12:00pm and in evening 4:00pm to 8:00pm using videography method. Traffic counts were aggregated for 5-minute interval.

4.5.2 Space Mean speed:

To determine the space mean speed of vehicle, we have a stretch of 30m, with the help of video, we can see how much time takes for a vehicle to go through this stretch and from that we can find the average speed of the vehicle. For example, it takes 2.3 second for a single vehicle to pass 30m stretch, then average speed of that vehicles:

$$\text{Speed} = \text{distance} / \text{time}$$

$$= 30 / 2.3$$

$$= 13.04 \text{ m/s}$$

Therefore, speed of that vehicle is 13.04 m/s.

4.6 Methods used for estimation of DPCU:

The Dynamic Passenger Car Unit (DPCU) of vehicles are determine by different methods viz.

1. Homogenization Co-efficient method
2. Chandra's method
3. Headway method
4. Multiple regression method

But I have worked on two methods: (i) Homogenization co-efficient method and (ii) Chandra's method

Above stated two methods take into account physical dimensions of vehicles for estimation of Dynamic Passenger Car Unit.

Vehicle type	Length (m)	Width (m)	Projected area (sq. m)
Two wheeler	1.87	0.64	1.20
Three wheeler	3.20	1.40	4.48
Standard car	3.72	1.44	5.36
Big car	4.58	1.77	8.11
Bus	10.10	2.43	24.54
LCV	6.10	2.10	12.81
2/3 axle truck	7.50	2.35	17.63
MAT	12.10	2.44	29.52
Tractor	7.40	2.20	16.28
Cycle	1.90	0.45	0.86

Table 4.1 Vehicle types and their dimension (given indo HCM-2017, T-1.3)

4.6.1 Homogenization coefficient method:

This method is adopted by developed countries where homogeneous traffic conditions persists and lane discipline is followed.

The PCU value is determined by,

$$PCU = L_i/V_i \div L_c/V_c$$

Where,

L = length of vehicle

V = speed of vehicle

i = vehicle type

c = car

4.6.2 Chandra's method:

This method is modification of homogenization coefficient method in which the length of vehicle is considered for the PCU calculation while in here the length of vehicle is replaced by the projected rectangular area of the vehicle.

The PCU value is determined by using following equation:

$$PCU = V_c/V_i \div A_c/A_i$$

Where,

V = speed of vehicle

A = area of vehicle

i = vehicle type

c = car

4.7 Summary:

This chapter includes study area characteristics and overview about the study stretch. In this module traffic flow and importance of heterogeneous traffic condition of this case study is discuss. Then flow chart of proposed methodology is shown through which whole objectives of thesis will complete. Various methodology and various surveys is discussing in this chapter. Method for data collection is also stated in this chapter.

CHAPTER 5

DATA COLLECTION AND ANALYSIS

5.1 General:

Data collection and analysis process is most important part of the thesis to accomplish the objectives with proper effectiveness. For estimation of Dynamic PCU required length of vehicle, area of vehicle and average speed of vehicle to get the accurate outcome. Data collection of various survey is done with representing each of relation with other. Data analysis portion is give the idea about the traffic pattern, composition, space mean speed etc. at different two stretches.

5.2 Road Geometry:

Roadway geometry include the following details of the existing facilities,

- ✓ No. of carriageway
- ✓ Carriageway width
- ✓ Type of shoulder
- ✓ Shoulder width
- ✓ Type of pavement
- ✓ Median width

	Nana mava road	Raiya road
Type of carriageway	Two lane divided	Two lane divided
Carriageway width	6.60m	6.60m
Type of shoulder	Paved	Paved
Shoulder width	2m	2m
Type of pavement	R.C.C.	R.C.C.
Median width	0.50m	0.50m

Table 5.1 Road geometric data

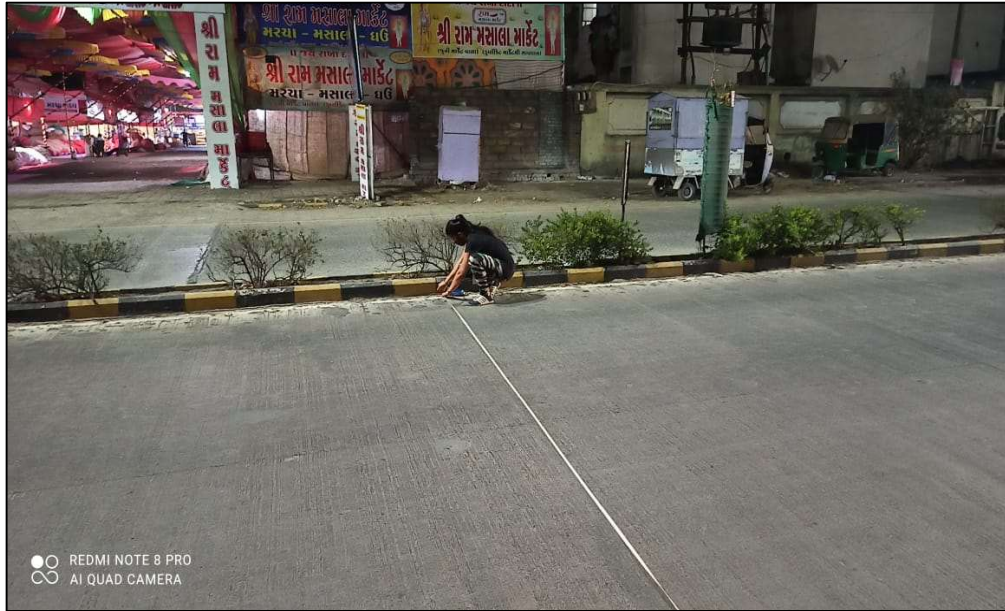


Figure 5.1 To measure width of carriageway

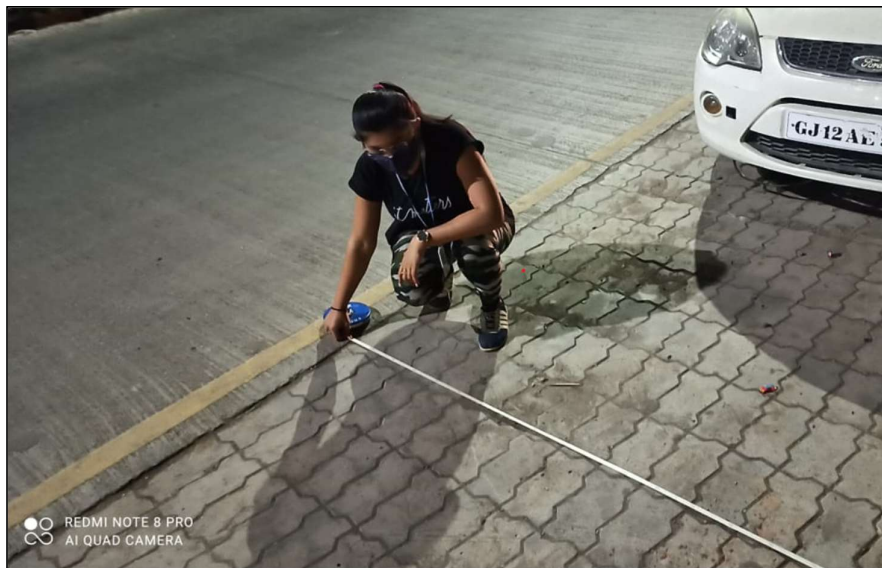


Figure 5.2 To measure shoulder width

5.3 Classified volume count data:

Nana mava road:

Time: 8:00am to 12:00pm, Date: 02/04/2021, Friday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-9:00am	2316	449	350	49	3	39	14	3	23	115
9:00-10:00am	3187	524	387	93	2	73	8	0	14	106
10:00-11:00am	3175	582	430	78	2	66	4	0	6	73
11:00-12:00pm	2916	566	364	59	2	54	9	3	4	38

Table 5.2 Vehicle Composition at Nana mava road (Morning, Friday)

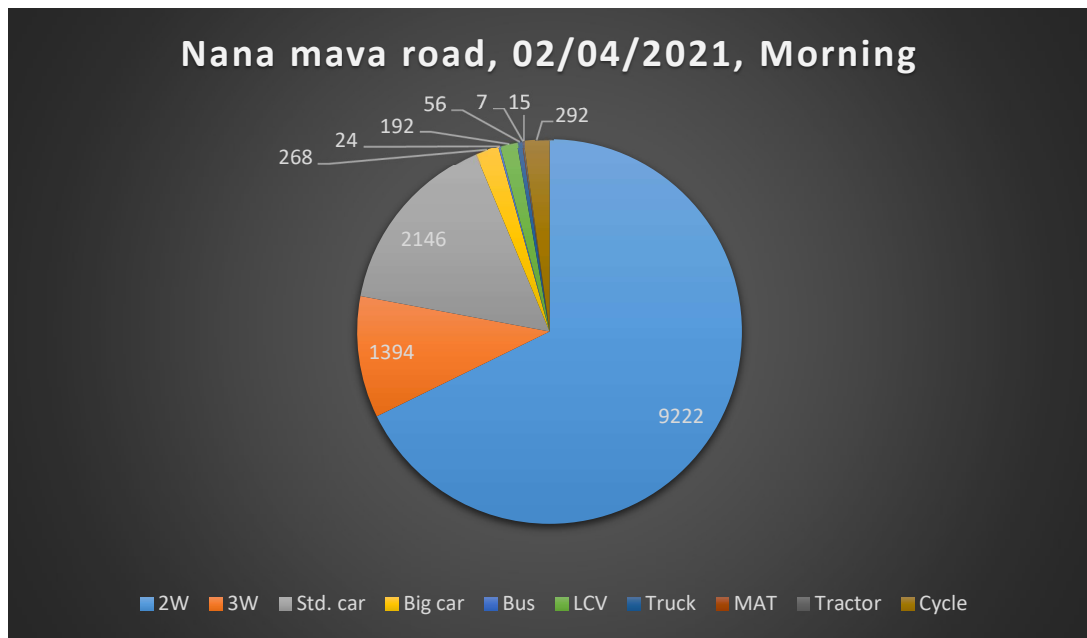


Figure 5.3 Vehicle Composition at Nana mava road (Morning, Friday)

Nana mava road:

Time: 4:00pm to 8:00pm, Date:02/04/2021, Friday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-5:00pm	2096	375	366	61	3	39	7	0	8	48
5:00-6:00pm	2718	524	365	71	0	41	1	2	2	54
6:00-7:00pm	3883	573	437	74	2	43	2	0	2	134
7:00-8:00pm	4291	558	489	75	5	23	2	0	1	145

Table 5.3 Vehicle Composition at Nana mava road (Evening, Friday)

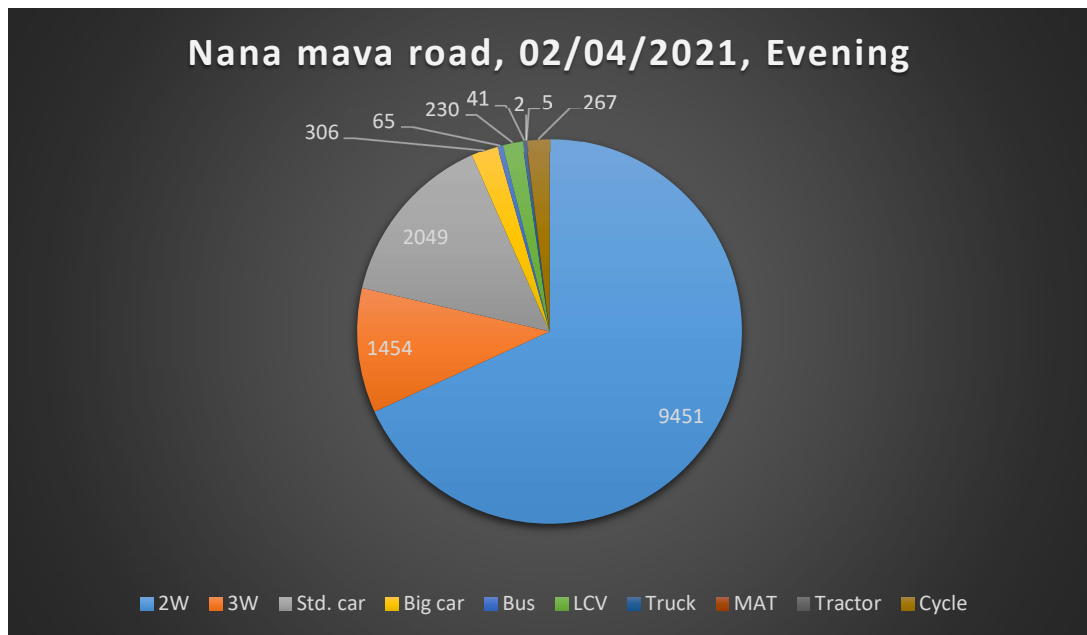


Figure 5.4 Vehicle Composition at Nana mava road (Evening, Friday)

Nana mava road:

Time: 8:00am to 12:00pm, Date: 03/04/2021, Saturday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-9:00am	2260	324	576	37	15	42	15	2	5	130
9:00-10:00am	2478	397	545	77	2	44	8	2	5	71
10:00-11:00am	2434	366	596	72	3	46	22	1	6	49
11:00-12:00pm	2271	390	519	67	2	63	23	0	5	45

Table 5.4 Vehicle Composition at Nana mava road (Morning, Saturday)

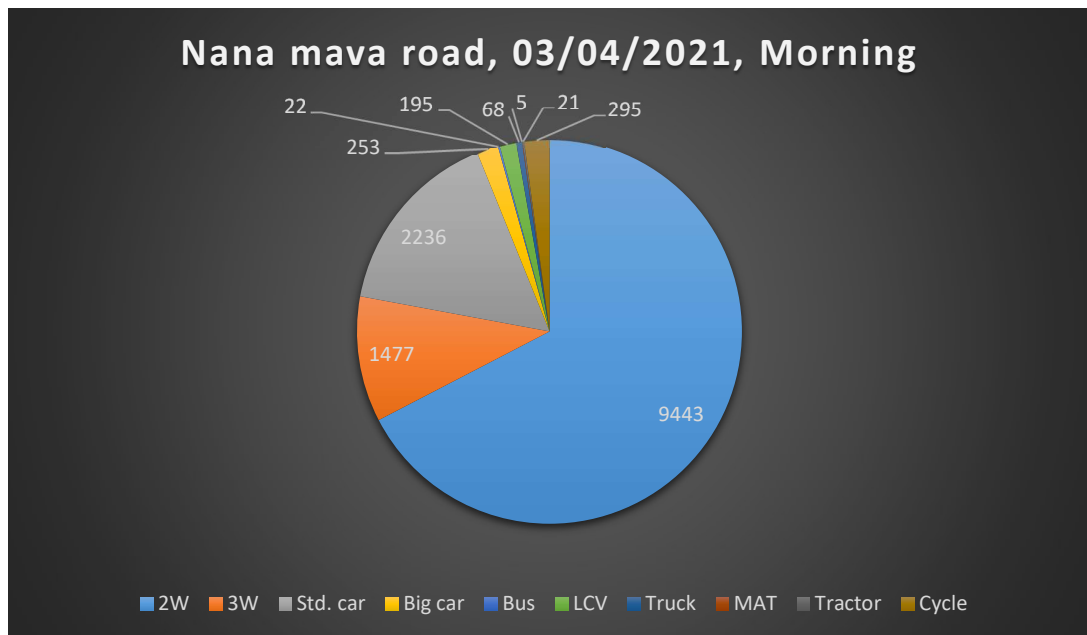


Figure 5.5 Vehicle Composition at Nana mava road (Morning, Saturday)

Nana mava road:

Time: 4:00pm to 8:00pm, Date: 03/04/2021, Saturday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-5:00pm	1686	319	505	67	9	76	15	0	4	42
5:00-6:00pm	2193	360	534	53	12	63	19	0	5	53
6:00-7:00pm	2683	376	581	63	16	52	18	0	1	110
7:00-8:00pm	2768	384	591	64	28	38	7	0	1	107

Table 5.5 Vehicle Composition at Nana mava road (Evening, Saturday)

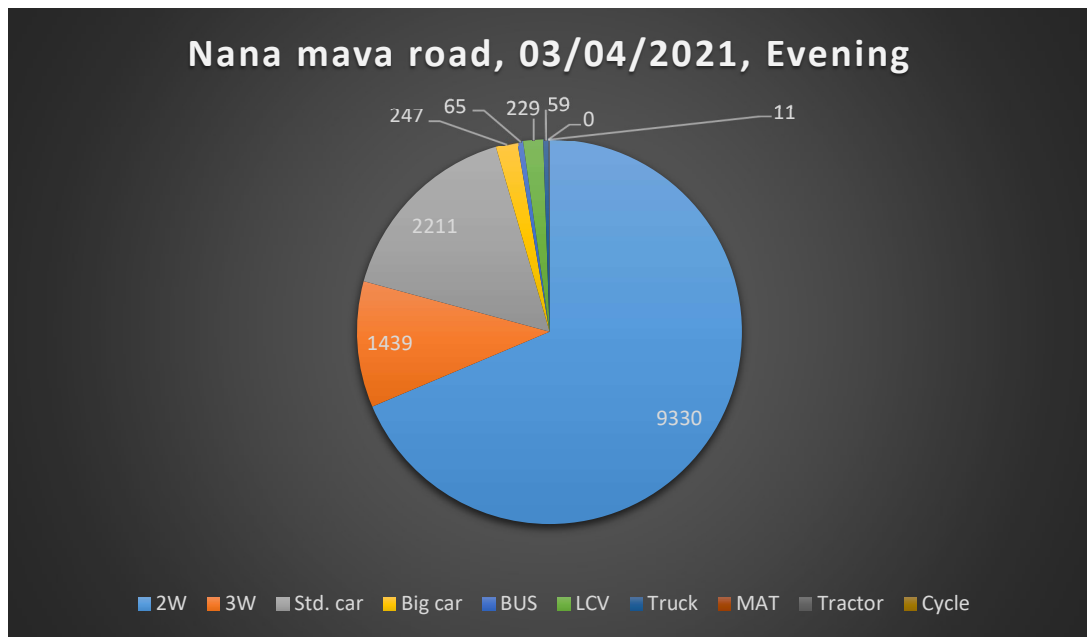


Figure 5.6 Vehicle Composition at Nana mava road (Evening, Saturday)

Raiya road:

Time: 8:00am to 12:00pm, Date: 05/04/2021, Monday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-9:00am	2316	449	350	49	3	39	14	3	23	115
9:00-10:00am	3187	524	387	93	2	73	8	0	14	106
10:00-11:00am	3175	582	430	78	2	66	4	0	6	73
11:00-12:00pm	2916	566	364	59	2	54	9	3	4	38

Table 5.6 Vehicle Composition at Raiya road (Morning, Monday)

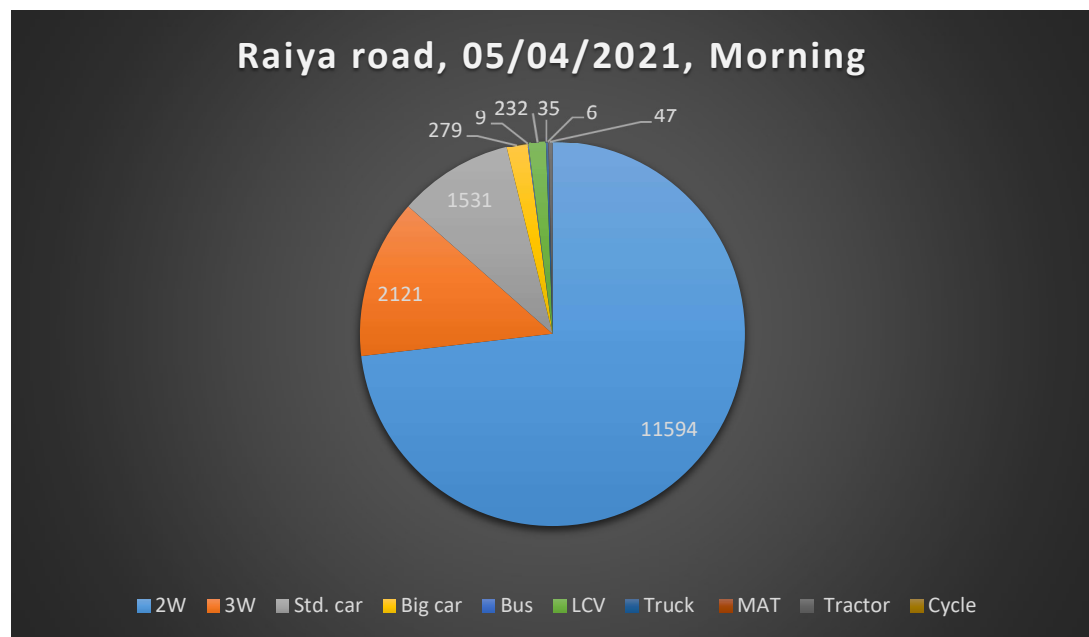


Figure 5.7 Vehicle Composition at Raiya road (Morning, Monday)

Raiya road:

Time: 4:00pm to 8:00pm, Date: 05/04/2021, Monday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-5:00pm	2096	375	366	61	3	39	7	0	8	48
5:00-6:00pm	2718	524	365	71	0	41	1	2	2	54
6:00-7:00pm	3883	573	437	74	2	43	2	0	2	134
7:00-8:00pm	4291	558	489	75	5	23	2	0	1	145

Table 5.7 Vehicle Composition at Raiya road (Evening, Monday)

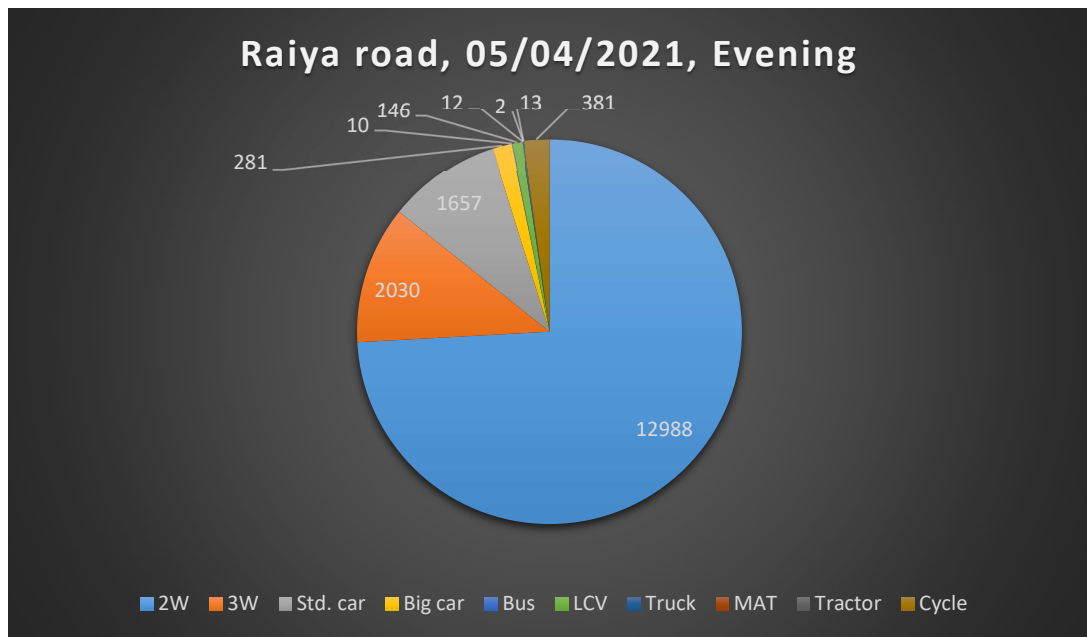


Figure 5.8 Vehicle Composition at Raiya road (Evening, Monday)

Raiya road:

Time: 8:00am to 12:00pm, Date: 08/04/2021, Thursday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-9:00am	2288	445	380	43	2	37	8	0	3	141
9:00-10:00am	3242	536	446	56	2	47	8	2	9	105
10:00-11:00am	3078	576	472	105	2	81	5	0	2	40
11:00-12:00pm	2677	524	392	87	0	55	2	0	3	40

Table 5.8 Vehicle Composition at Raiya road (Morning, Thursday)

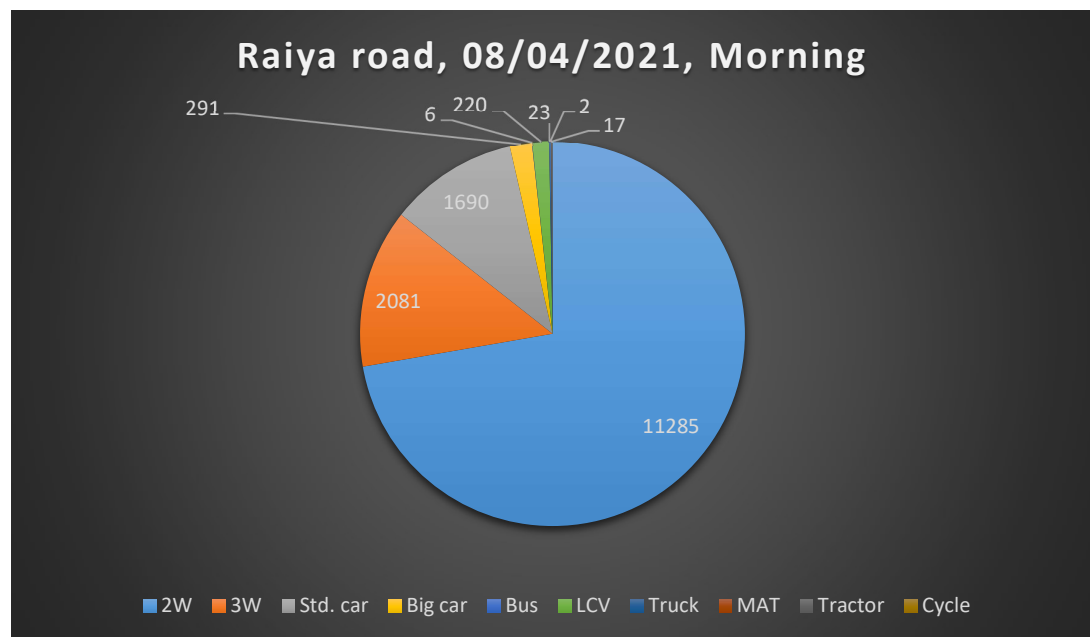


Figure 5.9 Vehicle Composition at Raiya road (Morning, Thursday)

Raiya road:

Time: 4:00pm to 7:00pm, Date: 08/04/2021, Thursday

Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-5:00pm	2230	486	399	54	3	37	3	1	6	51
5:00-6:00pm	2638	527	416	86	1	48	1	0	4	86
6:00-7:00pm	3636	512	521	100	0	44	2	0	1	79

Table 5.9 Vehicle Composition at Raiya road (Evening, Monday)

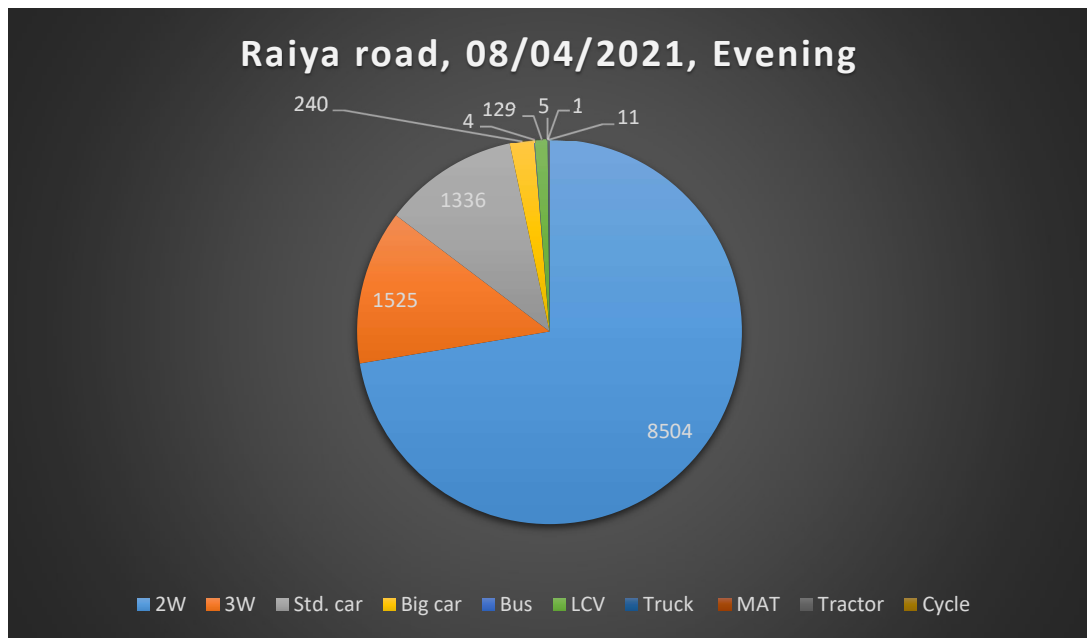


Figure 5.10 Vehicle Composition at Raiya road (Evening, Monday)



Figure 5.11 Picture of data collection

5.4 Summary:

In this chapter data analysis is presented in terms of pie chart and table for the Classified Volume Count data analysis and space mean speed analysis. This chapter is most important part of the research because the estimation of Dynamic PCUs is based on this data analysis.

CHAPTER 6

RESULT

6.1 General:

After data collection and data analysis, to find out the value of Dynamic Passenger Car Unit for all the vehicle like, two wheelers, three wheelers, standard car (up to 1400cc), big car (more than 1400cc), bus, light commercial vehicle (up to 9 tonne), two or three axle truck (up to 25.2 tonne), multi axle truck, tractor and cycle. Usually we use standard car as a passenger car to find out the dynamic PCU of vehicles. But here Dynamic PCU value of vehicles is also found by taking the big car as a passenger car.

6.2 Result:

DPCU at Nana mava road:

Types of vehicle	DPCU value			
	Homogenization co-efficient method		Chandra's method	
	P.C.=Std. car	P.C.= Big car	P.C.= Std. car	P.C.= Big car
2W	0.450034	0.448104	0.200430	0.162391
3W	0.904757	0.902890	0.879100	0.713851
Std. car up to 1400cc	1	1.008199	1	0.820376
Big car >1400cc	1.019202	1	1.252546	1
Bus	2.686789	2.630518	4.530695	3.609434
LCV	2.016143	2.002990	2.938454	2.375382
2/3 axle truck	2.477350	2.482630	4.041630	3.295700
MAT	6.799765	4.672713	9.809877	8.059504
Tractor	2.727724	2.781339	3.828185	3.297310
Cycle	1.030290	1.027885	0.323655	0.262744

Table 6.1 DPCU value at Nana mava road

DPCU at Raiya road:

Types of vehicle	DPCU value			
	Homogenization co-efficient method		Chandra's method	
	P.C.=Std. car	P.C.= Big car	P.C.= Std. car	P.C.= Big car
2W	0.454002	0.441540	0.202198	0.160013
3W	0.912338	0.889095	0.886466	0.702945
Std. car up to 1400cc	1	0.987189	1	0.803280
Big car >1400cc	1.039089	1	1.276987	1
Bus	3.206050	2.994162	5.406319	4.108381
LCV	1.996235	1.953585	2.908761	2.316841
2/3 axle truck	2.545991	2.462918	4.153613	3.270282
MAT	6.754043	6.631932	11.435969	9.137253
Tractor	3.658581	3.537181	5.586162	4.394652
Cycle	1.129110	1.102427	0.354698	0.281799

Table 6.2 DPCU value at Raiya road

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Conclusion:

Following are the important conclusions that are drawn from the present study.

1. Homogenization coefficient method gives higher DPCU values for smaller vehicles as two wheelers, three wheelers, cycle compared to Chandra's method.
2. Chandra's method gives higher DPCU values for larger vehicles as bus, LCV, truck, tractor, MAT compared to Homogenization co-efficient method.
3. While using passenger car as a big car, it gives lower DPCU values for almost all the vehicles compared to standard car.
4. Chandra's method can be suggested as the best reliable method as it considers the projected area of vehicles whereas only longitudinal length used in Homogenization co-efficient method.

7.2 Future scope:

- ✓ Estimation of Dynamic Passenger Car Unit (DPCU) values is very important for traffic capacity analysis and other relevant applications such as level of service (LOS) measures, determination of saturation flow rate, signal design and coordination, and development of traffic flow models.
- ✓ The accuracy of PCU values is highly significant in traffic flow analysis.

CHAPTER 8

REFERENCES

8.1 Journal article:

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2. GAURANG JOSHI & DINESH VAGADIA “Dynamic Vehicle Equivalent Factors for characterisation of mixed traffic for multilane metropolitan arterials in INDIA” journal of Indian Road Congress, volume 74-2, July-September 2013.
3. MEGHA BHATT, PRIYESH PATEL “Determination of Dynamic PCU in Ahmedabad city” IJARIE-ISSN(O)-2395-4396 Vol-3 Issue-2, 2017.
4. PREMA SOMANATHAN PRAVEEN, VENLATAVHALAM THAMIZH ARASAN “Influence of traffic mix on PCU value of vehicles under heterogeneous traffic conditions” International Journal for Traffic and Transport Engineering, 2013, 3(3):302-330.
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6. ER. SUMIT RANA, ER. ANIL KHARB, “Development of Passenger Car Units (PCU), case study of Ghantaghar chowk, Karnal District of Haryana” International Journal of Latest Research in Engineering & Computing (IJLREC) Volume4, Issue 5, Page no. 25-29, September-October 2016.
7. YASH R. DASANI, MONICABA VALA, BINDIYA PATEL “Estimation of Dynamic Equivalency Factor under heterogeneous traffic condition on urban arterial road: A case study of Porbandar city”.

8.2 IRC code:

- ✓ IRC 106-1990 Guideline for capacity of urban road in plain area.
- ✓ Indo-.HCM: 2017.

ANNEXURE 1

Classified Volume Count data sheet

NANA MAVA ROAD										
Time: 8:00am to 12:00pm, Date:02/04/2021, Friday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-8:05	186	27	33	9	1	2	0	0	0	7
8:05-8:10	266	25	46	8	1	6	2	0	0	11
8:10-8:15	166	17	42	3	4	6	1	0	3	6
8:15-8:20	198	21	37	6	0	2	1	0	0	14
8:20-8:25	192	15	34	2	2	1	1	0	0	13
8:25-8:30	164	17	39	7	3	3	4	0	0	7
8:30-8:35	119	18	54	8	2	1	1	0	2	8
8:35-8:40	191	23	45	9	0	1	1	0	1	7
8:40-8:45	222	20	43	7	0	3	2	0	0	10
8:45-8:50	195	29	49	6	0	0	0	0	0	12
8:50-8:55	201	15	48	6	1	2	1	0	0	8
8:55-9:00	243	27	52	5	0	3	0	0	0	8
9:00-9:05	220	31	50	2	0	3	0	0	0	9
9:05-9:10	204	26	49	8	1	5	3	0	0	13
9:10-9:15	232	24	59	5	1	3	2	1	0	14
9:15-9:20	200	31	62	5	0	6	3	0	0	12
9:20-9:25	195	25	55	3	1	4	2	0	0	6
9:25-9:30	214	25	58	4	0	2	3	0	0	7
9:30-9:35	206	31	40	4	0	4	2	0	0	6
9:35-9:40	219	27	56	2	0	5	0	0	0	4
9:40-9:45	200	35	58	1	1	5	2	1	0	5

9:45-9:50	194	36	42	2	0	7	0	0	0	6
9:50-9:55	201	25	43	4	0	6	0	0	0	3
9:55-10:00	201	41	28	10	1	6	1	0	0	13
10:00-10:05	220	28	36	6	0	3	1	1	0	9
10:05-10:10	209	29	34	7	0	6	0	0	0	5
10:10-10:15	197	28	63	6	0	7	1	0	0	4
10:15-10:20	204	46	50	8	1	2	2	0	0	8
10:20-10:25	206	39	33	4	0	5	0	1	0	7
10:25-10:30	187	29	48	12	0	4	2	0	0	4
10:30-10:35	164	40	35	4	0	3	3	0	1	1
10:35-10:40	204	40	39	6	0	6	1	1	1	2
10:40-10:45	179	40	57	6	0	4	0	0	0	3
10:45-10:50	200	31	46	6	1	4	0	0	1	1
10:50-10:55	178	47	38	6	0	5	2	0	1	2
10:55-11:00	165	38	40	9	0	5	0	0	1	4
11:00-11:05	185	31	42	3	0	5	1	1	0	5
11:05-11:10	175	36	47	5	1	3	1	0	0	4
11:10-11:15	186	34	42	6	0	9	2	0	1	1
11:15-11:20	178	25	49	5	0	2	2	0	0	3
11:20-11:25	194	25	46	7	0	4	3	0	1	3
11:25-11:30	155	33	40	3	0	5	1	0	0	0
11:30-11:35	186	39	41	4	0	8	0	0	1	4
11:35-11:40	173	29	35	4	1	7	0	1	1	5
11:40-11:45	178	22	56	7	0	3	1	0	0	2
11:45-11:50	148	23	39	7	1	1	1	0	0	1
11:50-11:55	159	26	36	5	0	2	0	0	0	3
11:55-12:00	163	25	32	6	0	3	0	0	0	2
TOTAL	9222	1394	2146	268	24	192	56	7	15	292

NANA MAVA ROAD										
Time: 4:00pm to 8:00pm, Date:02/04/2021, Friday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-4:05	127	16	42	3	0	6	0	0	0	1
4:05-4:10	126	31	41	5	1	6	1	0	0	3
4:10-4:15	132	26	30	9	2	1	4	1	0	3
4:15-4:20	141	18	42	4	2	1	4	1	0	3
4:20-4:25	149	25	40	3	0	7	4	0	0	2
4:25-4:30	145	42	39	6	1	4	1	0	0	4
4:30-4:35	145	28	26	8	0	3	0	0	0	4
4:35-4:40	187	30	33	6	0	5	1	0	0	7
4:40-4:45	168	25	31	6	1	7	3	0	0	5
4:45-4:50	145	20	57	9	1	7	0	0	0	4
4:50-4:55	156	25	44	5	0	2	0	0	0	1
4:55-5:00	160	34	40	9	1	6	3	0	0	3
5:00-5:05	141	29	42	6	1	5	0	0	0	2
5:05-5:10	163	32	45	8	0	7	0	0	0	1
5:10-5:15	179	33	41	8	1	6	3	0	0	2
5:15-5:20	198	43	39	6	2	6	3	0	0	6
5:20-5:25	178	43	49	8	2	6	0	0	0	2
5:25-5:30	189	28	31	6	2	1	1	0	0	5
5:30-5:35	178	24	49	5	1	8	0	0	0	5
5:35-5:40	219	36	29	10	3	7	2	0	0	4
5:40-5:45	186	36	40	7	0	2	0	0	0	2
5:45-5:50	181	32	34	6	0	4	0	0	0	4
5:50-5:55	213	45	39	4	0	5	2	0	0	5
5:55-6:00	200	43	59	5	1	9	0	1	0	5
6:00-6:05	204	27	42	4	1	4	1	0	0	10

6:05-6:10	206	32	47	8	2	7	0	0	0	8
6:10-6:15	209	29	49	7	1	10	0	0	1	7
6:15-6:20	211	21	54	6	1	9	0	0	0	13
6:20-6:25	214	33	35	6	0	7	0	0	0	5
6:25-6:30	215	41	35	8	1	8	0	0	0	7
6:30-6:35	205	29	38	12	2	3	1	0	1	3
6:35-6:40	211	31	32	8	2	6	0	0	0	10
6:40-6:45	207	26	43	5	1	2	0	0	0	14
6:45-6:50	225	30	41	3	1	6	0	0	0	6
6:50-6:55	212	41	39	15	1	7	2	0	0	7
6:55-7:00	245	22	42	4	3	2	0	0	0	8
7:00-7:05	234	27	46	7	0	4	0	0	1	8
7:05-7:10	232	41	45	5	4	2	0	0	0	4
7:10-7:15	249	23	51	6	5	3	2	0	0	6
7:15-7:20	221	29	38	6	2	6	1	0	0	8
7:20-7:25	240	32	54	6	3	7	0	0	0	8
7:25-7:30	263	38	39	5	2	2	1	0	2	8
7:30-7:35	231	23	51	6	2	2	0	0	0	6
7:35-7:40	237	28	63	8	4	0	0	0	0	7
7:40-7:45	264	25	55	8	3	1	2	0	0	9
7:45-7:50	241	32	65	3	0	2	0	0	0	10
7:50-7:55	231	33	51	5	1	1	0	0	0	4
7:55-8:00	238	17	42	3	1	4	1	0	0	8
TOTAL	9451	1454	2049	306	65	230	41	2	5	267

NANA MAVA ROAD										
Time: 8:00am to 12:00pm, Date:03/04/2021, Saturday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-8:05	167	20	49	4	2	6	1	0	1	11
8:05-8:10	176	24	39	1	1	3	1	0	0	7
8:10-8:15	181	14	42	2	2	3	0	1	1	8
8:15-8:20	178	30	40	3	3	5	4	0	0	15
8:20-8:25	190	18	48	2	1	1	0	0	0	15
8:25-8:30	175	24	50	4	2	2	2	0	2	10
8:30-8:35	225	29	49	2	3	3	0	1	1	10
8:35-8:40	194	32	39	2	1	3	2	0	0	10
8:40-8:45	194	36	57	3	0	5	1	0	0	9
8:45-8:50	194	32	57	3	0	5	0	0	0	11
8:50-8:55	191	31	56	7	0	3	1	0	0	16
8:55-9:00	195	34	50	4	0	3	3	0	0	8
9:00-9:05	203	26	46	4	0	2	1	0	0	7
9:05-9:10	217	33	45	7	1	2	3	0	2	8
9:10-9:15	215	41	50	6	0	6	1	1	0	14
9:15-9:20	185	31	46	7	0	9	1	1	2	6
9:20-9:25	224	41	42	4	0	3	1	0	1	5
9:25-9:30	190	36	40	5	1	3	0	0	0	8
9:30-9:35	200	33	52	8	0	3	0	0	0	2
9:35-9:40	219	41	49	5	0	1	0	0	0	6
9:40-9:45	203	24	44	8	0	2	0	0	0	2
9:45-9:50	211	31	43	10	0	4	0	0	0	6
9:50-9:55	203	27	42	7	0	5	1	0	0	3
9:55-10:00	208	33	46	6	0	4	0	0	0	4
10:00-10:05	210	31	52	9	0	4	1	0	0	6

10:05-10:10	191	32	55	4	1	4	2	0	0	3
10:10-10:15	195	37	50	4	0	2	1	0	1	7
10:15-10:20	192	33	53	8	0	2	2	0	1	5
10:20-10:25	208	37	51	4	1	2	0	0	1	3
10:25-10:30	212	21	42	7	0	6	2	1	0	2
10:30-10:35	216	33	43	5	0	1	3	0	0	4
10:35-10:40	212	29	58	7	0	6	0	0	0	4
10:40-10:45	214	24	42	7	0	6	2	0	1	3
10:45-10:50	197	32	52	6	0	2	3	0	1	4
10:50-10:55	179	30	47	4	0	7	3	0	0	2
10:55-11:00	208	27	51	7	1	4	3	0	1	6
11:00-11:05	182	37	47	5	0	4	2	0	0	3
11:05-11:10	191	39	41	6	0	5	1	0	1	3
11:10-11:15	189	25	42	9	0	6	1	0	1	5
11:15-11:20	198	44	44	4	0	4	1	0	0	3
11:20-11:25	187	26	36	7	1	8	1	0	1	2
11:25-11:30	184	27	39	5	0	9	2	0	0	5
11:30-11:35	178	39	46	2	0	4	0	0	0	4
11:35-11:40	214	31	43	3	0	4	3	0	1	3
11:40-11:45	166	33	53	9	0	5	2	0	0	8
11:45-11:50	185	25	41	9	0	5	5	0	0	2
11:50-11:55	204	33	48	3	1	5	3	0	1	4
11:55-12:00	193	31	39	5	0	4	2	0	0	3
TOTAL	9443	1477	2236	253	22	195	68	5	21	295

NANA MAVA ROAD										
Time: 4:00pm to 8:00pm, Date:03/04/2021, Saturday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-4:05	134	24	40	9	1	5	1	0	0	1
4:05-4:10	125	19	46	5	1	10	1	0	1	2
4:10-4:15	113	27	54	5	0	7	1	0	0	4
4:15-4:20	141	22	48	6	1	7	1	0	0	3
4:20-4:25	128	24	38	3	2	4	2	0	0	5
4:25-4:30	147	31	48	4	1	9	3	0	0	5
4:30-4:35	139	18	33	5	1	3	2	0	0	5
4:35-4:40	136	28	36	7	0	2	1	0	1	4
4:40-4:45	158	32	38	6	0	8	2	0	1	4
4:45-4:50	141	30	44	6	1	9	1	0	1	3
4:50-4:55	154	31	32	6	0	4	0	0	0	2
4:55-5:00	170	33	48	5	1	8	0	0	0	4
5:00-5:05	159	20	40	9	0	5	1	0	1	0
5:05-5:10	175	31	33	7	1	8	1	0	0	6
5:10-5:15	151	25	52	6	2	3	4	0	1	7
5:15-5:20	169	25	39	5	1	8	2	0	0	1
5:20-5:25	188	28	46	2	2	3	1	0	2	6
5:25-5:30	169	23	40	3	2	5	2	0	0	3
5:30-5:35	218	34	44	4	1	4	1	0	0	1
5:35-5:40	182	35	56	3	0	3	1	0	0	3
5:40-5:45	205	44	51	3	2	5	0	0	0	9
5:45-5:50	167	23	42	2	1	5	2	0	0	2
5:50-5:55	217	37	40	5	0	5	3	0	1	5
5:55-6:00	193	35	51	4	0	9	1	0	0	10
6:00-6:05	210	34	50	0	2	5	1	0	0	6

6:05-6:10	204	29	45	8	1	6	3	0	0	17
6:10-6:15	223	41	55	7	1	6	0	0	0	7
6:15-6:20	235	32	58	6	0	6	1	0	1	9
6:20-6:25	209	35	28	4	2	2	1	0	0	11
6:25-6:30	214	29	39	11	1	5	0	0	0	4
6:30-6:35	223	31	54	5	2	2	2	0	0	10
6:35-6:40	250	30	41	6	3	2	3	0	0	9
6:40-6:45	238	37	54	2	1	8	3	0	0	7
6:45-6:50	224	25	58	4	0	3	2	0	0	12
6:50-6:55	225	28	48	4	2	3	2	0	0	11
6:55-7:00	228	25	51	6	1	4	0	0	0	7
7:00-7:05	220	28	53	7	7	3	1	0	0	7
7:05-7:10	228	23	45	9	0	2	0	0	0	14
7:10-7:15	227	27	51	4	1	3	2	0	0	5
7:15-7:20	229	33	53	6	4	5	1	0	0	14
7:20-7:25	244	29	42	4	5	2	1	0	0	8
7:25-7:30	260	21	48	5	1	3	0	0	0	8
7:30-7:35	238	31	50	4	5	4	1	0	0	8
7:35-7:40	239	47	52	6	1	3	0	0	1	6
7:40-7:45	210	26	49	6	1	2	0	0	0	11
7:45-7:50	228	43	46	4	0	5	0	0	0	5
7:50-7:55	226	39	50	2	1	4	0	0	0	7
7:55-8:00	219	37	52	7	2	2	1	0	0	14
TOTAL	9330	1439	2211	247	65	229	59	0	11	312

RAIYA ROAD										
Time: 8:00am to 12:00pm, Date:05/04/2021, Monday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-8:05	169	32	34	4	0	3	3	2	1	5
8:05-8:10	173	36	32	3	0	3	0	0	2	8
8:10-8:15	159	41	32	2	0	2	1	0	1	12
8:15-8:20	186	36	30	3	1	3	1	0	0	10
8:20-8:25	181	32	29	5	0	2	0	0	4	19
8:25-8:30	184	43	27	4	0	3	2	0	3	8
8:30-8:35	182	44	21	3	0	3	2	0	4	8
8:35-8:40	193	37	22	2	0	5	2	1	4	7
8:40-8:45	218	33	27	3	1	3	0	0	0	7
8:45-8:50	197	35	32	6	1	4	0	0	2	13
8:50-8:55	246	47	33	7	0	2	1	0	0	6
8:55-9:00	228	33	31	7	0	6	2	0	2	12
9:00-9:05	251	49	31	8	1	2	1	0	2	8
9:05-9:10	273	32	30	8	0	7	1	0	1	9
9:10-9:15	265	40	29	9	0	6	1	0	3	10
9:15-9:20	265	47	30	7	1	5	0	0	2	14
9:20-9:25	235	48	28	8	0	7	2	0	3	11
9:25-9:30	241	44	34	8	0	4	0	0	0	10
9:30-9:35	277	37	37	6	0	6	1	0	1	9
9:35-9:40	252	39	36	8	0	7	0	0	0	8
9:40-9:45	285	37	38	9	0	6	0	0	0	8
9:45-9:50	279	52	33	8	0	9	1	0	1	3
9:50-9:55	281	49	31	9	0	8	0	0	0	9
9:55-10:00	283	50	30	5	0	6	1	0	1	7
10:00-10:05	265	52	32	4	0	5	0	0	0	4

10:05-10:10	269	44	39	7	0	7	0	0	0	7
10:10-10:15	274	43	38	6	0	4	0	0	0	7
10:15-10:20	281	63	40	4	0	1	0	0	0	6
10:20-10:25	280	58	44	9	0	2	0	0	0	9
10:25-10:30	289	50	32	7	0	5	0	0	0	8
10:30-10:35	312	42	35	8	1	6	2	0	2	4
10:35-10:40	256	50	33	4	0	7	0	0	0	11
10:40-10:45	232	58	36	5	0	8	0	0	1	4
10:45-10:50	245	43	35	9	0	9	0	0	0	7
10:50-10:55	240	39	34	7	1	7	2	0	3	2
10:55-11:00	232	40	32	8	0	5	0	0	0	4
11:00-11:05	272	44	29	9	1	4	2	0	0	4
11:05-11:10	257	49	28	7	0	5	0	0	0	2
11:10-11:15	226	50	22	8	0	4	0	1	0	2
11:15-11:20	247	52	30	8	0	5	0	0	0	3
11:20-11:25	246	41	33	4	1	2	2	0	2	5
11:25-11:30	250	39	32	1	0	3	0	0	0	1
11:30-11:35	235	56	35	3	0	6	0	0	0	2
11:35-11:40	239	54	29	5	0	3	0	0	0	3
11:40-11:45	222	57	31	4	0	8	3	0	2	3
11:45-11:50	242	40	32	3	0	6	0	0	0	2
11:50-11:55	236	42	33	5	0	5	1	2	0	5
11:55-12:00	244	42	30	2	0	3	1	0	0	6
TOTAL	1159	212	1531	279	9	232	35	6	47	332
L	4	1								

RAIYA ROAD										
Time: 4:00pm to 8:00pm, Date:05/04/2021, Monday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-4:05	136	31	36	1	0	5	0	0	0	2
4:05-4:10	164	27	33	4	1	3	2	0	3	2
4:10-4:15	169	28	30	3	0	2	0	0	0	3
4:15-4:20	172	26	33	5	1	1	2	0	3	7
4:20-4:25	178	28	32	4	0	1	0	0	0	5
4:25-4:30	181	29	31	6	0	3	1	0	0	4
4:30-4:35	185	34	32	8	0	3	1	0	1	6
4:35-4:40	176	30	30	7	1	2	0	0	0	2
4:40-4:45	182	33	29	5	0	3	1	0	1	5
4:45-4:50	173	37	24	6	0	5	0	0	0	5
4:50-4:55	189	38	27	5	0	4	0	0	0	3
4:55-5:00	191	34	29	7	0	7	0	0	0	4
5:00-5:05	204	37	34	8	0	5	0	0	2	4
5:05-5:10	217	39	35	8	0	6	0	0	0	7
5:10-5:15	209	40	37	6	0	1	0	0	0	6
5:15-5:20	229	41	31	6	0	2	0	0	0	5
5:20-5:25	230	45	32	5	0	3	0	1	0	4
5:25-5:30	228	39	29	7	0	4	0	0	0	5
5:30-5:35	233	35	27	6	0	5	1	1	0	5
5:35-5:40	233	44	22	6	0	5	0	0	0	1
5:40-5:45	228	48	24	6	0	4	0	0	0	4
5:45-5:50	220	45	29	4	0	1	0	0	0	5
5:50-5:55	237	52	33	5	0	2	0	0	0	2
5:55-6:00	250	59	32	4	0	3	0	0	0	6

6:00-6:05	264	51	35	5	0	4	0	0	0	2
6:05-6:10	285	54	34	7	0	5	0	0	0	4
6:10-6:15	294	52	33	4	1	4	1	0	1	5
6:15-6:20	304	53	29	5	0	1	0	0	0	7
6:20-6:25	317	49	37	6	0	1	0	0	0	9
6:25-6:30	324	51	38	5	1	2	0	0	0	13
6:30-6:35	334	48	37	5	0	4	0	0	0	12
6:35-6:40	322	39	38	7	0	3	0	0	0	19
6:40-6:45	355	37	39	6	0	4	0	0	0	17
6:45-6:50	363	46	36	7	0	6	1	0	1	14
6:50-6:55	359	46	42	8	0	5	0	0	0	19
6:55-7:00	362	47	39	9	0	4	0	0	0	13
7:00-7:05	353	55	36	8	1	1	0	0	0	14
7:05-7:10	367	45	34	7	0	2	0	0	0	13
7:10-7:15	369	52	33	6	0	0	0	0	0	12
7:15-7:20	356	41	32	4	0	1	0	0	0	11
7:20-7:25	371	47	35	5	1	0	0	0	1	7
7:25-7:30	359	46	39	7	0	4	0	0	0	9
7:30-7:35	373	42	48	9	0	2	0	0	0	10
7:35-7:40	335	45	49	10	0	3	1	0	0	16
7:40-7:45	342	49	52	6	0	3	0	0	0	12
7:45-7:50	349	49	50	6	3	2	1	0	0	14
7:50-7:55	354	43	47	5	0	2	0	0	0	15
7:55-8:00	363	44	34	2	0	3	0	0	0	12
TOTAL	1298	203	1657	281	10	146	12	2	13	381
L	8	0								

RAIYA ROAD										
Time: 8:00am to 12:00pm, Date:08/04/2021, Thursday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
8:00-8:05	151	36	32	5	0	3	1	0	0	9
8:05-8:10	158	25	33	3	0	3	0	0	0	10
8:10-8:15	167	37	33	2	0	1	0	0	0	9
8:15-8:20	187	28	31	4	0	2	1	0	2	9
8:20-8:25	187	36	30	4	0	3	1	0	0	9
8:25-8:30	189	39	32	2	1	4	0	0	0	10
8:30-8:35	190	37	34	3	0	5	0	0	0	12
8:35-8:40	189	39	33	4	0	2	1	0	1	17
8:40-8:45	192	39	32	7	1	3	0	0	0	11
8:45-8:50	213	40	30	3	0	2	2	0	0	12
8:50-8:55	236	46	29	2	0	4	2	0	0	16
8:55-9:00	229	43	31	4	0	5	0	0	0	17
9:00-9:05	240	42	35	5	0	7	0	0	0	15
9:05-9:10	249	43	36	6	1	6	2	1	1	13
9:10-9:15	256	42	34	7	0	5	0	0	0	9
9:15-9:20	259	42	35	2	0	2	1	0	1	12
9:20-9:25	267	44	37	5	0	1	0	0	0	10
9:25-9:30	289	45	39	4	0	3	0	0	0	7
9:30-9:35	299	46	40	3	0	2	1	0	5	5
9:35-9:40	291	47	42	3	0	4	0	0	0	7
9:40-9:45	305	41	39	4	1	3	1	1	1	12
9:45-9:50	276	48	36	4	0	1	0	0	0	10
9:50-9:55	255	49	38	7	0	6	3	0	1	2

9:55-10:00	256	47	35	6	0	7	0	0	0	3
10:00-10:05	260	50	34	7	0	9	0	0	0	7
10:05-10:10	262	49	38	9	1	8	0	0	1	6
10:10-10:15	257	44	40	10	0	7	2	0	0	5
10:15-10:20	254	52	41	11	0	6	0	0	0	2
10:20-10:25	255	50	41	12	0	3	0	0	0	3
10:25-10:30	256	54	43	9	1	5	1	0	1	2
10:30-10:35	254	50	37	10	0	7	0	0	0	3
10:35-10:40	263	49	45	8	0	6	0	0	0	2
10:40-10:45	254	47	40	8	0	4	1	0	0	3
10:45-10:50	253	46	39	9	0	9	0	0	0	2
10:50-10:55	257	43	37	7	0	10	1	0	0	2
10:55-11:00	253	42	37	5	0	7	0	0	0	3
11:00-11:05	250	42	33	4	0	8	0	0	0	2
11:05-11:10	252	40	38	9	0	10	0	0	0	4
11:10-11:15	227	40	33	9	0	4	0	0	0	4
11:15-11:20	225	41	35	8	0	3	0	0	0	2
11:20-11:25	239	43	32	7	0	1	0	0	0	3
11:25-11:30	219	42	34	10	0	2	2	0	2	5
11:30-11:35	217	44	30	9	0	3	0	0	0	4
11:35-11:40	215	45	28	7	0	2	0	0	0	6
11:40-11:45	210	47	27	6	0	7	0	0	0	5
11:45-11:50	202	48	33	6	0	6	0	0	1	5
11:50-11:55	209	47	34	5	0	5	0	0	0	0
11:55-12:00	212	45	35	7	0	4	0	0	0	0
TOTAL	1128	208	1690	291	6	220	23	2	17	326
L	5	1								

RAIYA ROAD										
Time: 4:00pm to 8:00pm, Date:08/04/2021, Thursday										
Time	2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
4:00-4:05	168	29	34	2	1	5	0	1	3	4
4:05-4:10	173	28	35	2	0	2	0	0	0	5
4:10-4:15	174	32	36	4	0	4	0	0	0	4
4:15-4:20	178	31	31	3	1	1	1	0	1	3
4:20-4:25	179	35	35	7	0	3	0	0	0	2
4:25-4:30	189	45	32	6	0	3	0	0	0	7
4:30-4:35	190	47	29	4	0	5	0	0	0	6
4:35-4:40	192	50	27	5	0	2	0	0	0	2
4:40-4:45	193	49	33	2	1	3	0	0	1	5
4:45-4:50	200	48	35	3	0	4	0	0	0	6
4:50-4:55	196	47	34	8	0	3	0	0	0	4
4:55-5:00	198	45	38	8	0	2	1	0	1	3
5:00-5:05	193	46	36	7	0	4	0	0	0	4
5:05-5:10	184	44	37	9	0	4	0	0	0	5
5:10-5:15	196	43	33	7	1	7	0	0	0	6
5:15-5:20	187	42	32	6	0	6	0	0	0	7
5:20-5:25	193	45	31	5	0	5	0	0	0	7
5:25-5:30	212	39	29	9	0	6	1	0	3	7
5:30-5:35	220	44	30	9	0	3	0	0	0	8
5:35-5:40	225	46	34	8	0	2	0	0	0	9
5:40-5:45	238	47	35	7	0	5	0	0	1	10
5:45-5:50	247	48	35	6	0	2	0	0	0	12
5:50-5:55	265	42	39	7	0	3	0	0	0	5
5:55-6:00	278	41	45	6	0	1	0	0	0	6

6:00-6:05	270	44	42	8	0	4	0	0	0	4
6:05-6:10	273	47	40	10	0	3	0	0	0	6
6:10-6:15	277	46	41	6	0	2	0	0	0	7
6:15-6:20	282	43	42	8	0	5	0	0	0	6
6:20-6:25	289	42	43	12	0	6	0	0	0	6
6:25-6:30	297	38	44	11	0	6	2	0	1	7
6:30-6:35	299	39	46	7	0	2	0	0	0	5
6:35-6:40	301	42	48	9	0	2	0	0	0	7
6:40-6:45	312	44	47	10	0	3	0	0	0	8
6:45-6:50	325	40	42	7	0	4	0	0	0	9
6:50-6:55	346	45	41	2	0	2	0	0	0	7
6:55-7:00	365	42	45	10	0	5	0	0	0	7
TOTAL	8504	1525	1336	240	4	129	5	1	11	216

ANNEXURE 2

Space Mean Speed sample sheet (m/s)

NANA MAVA ROAD									
Time: 8:00am to 12:00pm, Date:02/04/2021, Friday									
2W	3W	Std. car up to 1400cc	Big car >1400cc	Bus	LCV up to 9tonne	Truck up to 25.2tonne	MAT	Tractor	Cycle
11.03	9.01	10.13	8.64	9.62	8.8				4.85
8.12	9.56	9.71	9.26	8.02	8.64	7.59			4
10.46	9.87	10.64	12.16	8.09	8.76	7.1		6.56	4.65
9.56	9.72	8.5	10.7		7.58	8.1			3.68
10.51	8.98	9.4	11.63	7.26	8	8.67			3.96
10.06	9.93	5.52	11.09	8.76	8.21	6.76			4.01
10.36	10.06	8.31	11.67	7.45	6.93	7.09		6.77	4.02
13.2	7.49	9.66	9.96		6.12	8.25		7.41	4.14
11.03	7.11	9.27	11.7		7.82	5.67			5
11.17	7.77	9.15	12.96						4.1
11.07	8.86	8.29	9.15	9.01	5.96	6.62			4.21
8.28	8.29	8.96	9.87		6.88				4.87
7.93	7.54	9.22	9.2		6.62				4
9.72	7.81	9.53	8.39	8.33	6.95	6			4.69
9.87	8.19	7.07	8.46	7.06	6.91	5.93	4.09		4.54
8.24	8.63	10.01	8.3		6.06	5.67			4.51
10.43	6.79	7.67	12.05	7	6.59	6.67			4.3
10.45	7.28	5.52	10.16		6.13	6.79			3
10.53	7.29	7.32	13		8.56	7			3.75
9.71	7.76	8.22	11.63		7.64				4.96
10.17	8.91	9.33	12.01	9.32	7.62	7.22	4.01		5.2
8.28	8.66	10.64	11.57		7.96				4
7.39	7.54	8.31	9.38		5.61				4.52
8.23	8.19	9.65	10.78	8.14	6.18	7.98			3.96
7.39	8.76	9.36	11.69		7.92	8.08	3.98		4.74
8.23	7.88	8.46	9.67		5.9				4.85
10.54	7.76	8	11		8.35	8.03			4.3
10.56	8.53	7.49	8	7.16	7.26	6.26			4.15
9.31	6.11	7.38	8.02		5.36		3.63		3.87
10.69	8.81	7	10.4		5.05	7.44			3.99
9.88	8.86	7.56	10.57		7.34	7.2		6.59	3
7.82	7.59	8.31	10.86		7.65	6.42	5.1	7.98	3.33
8.69	7.96	8.55	10.1		6.96				3.56
8.65	8.58	7.45	11.01	7.95	6.45			6.58	4
9.61	9.56	7	11		6.87	6.51		6.74	3.91
8.67	8.35	8.01	11.23		5.87	6.96		7	5.36
7.38	6.89	8.44	11.06		5.41	5.85	4.26		5.85

8.88	8	8.56	11.6	8.05	7.04	5.31			5.64
9.05	9.04	8.47	11.8		6.6	7.81		6.85	5
9.07	7.44	8	11.87		7.81	6.2			3.87
9	8.56	9.05	10.65		5.56	6.47		5.89	4.47
8.49	8.95	8.4	10.87		8.3	6.45			
8.11	7.49	7.41	11.45		7			6.62	3.42
8	7.89	7.7	10.41	8.41	7.4		4.64	6.74	3.63
8	7	7.31	10.38		7.21	5			4.6
7.56	7	8.56	11.87	7.69	6.45	5			4
8.53	8.04	9.63	11.95		6.89				4.21
8.69	8.45	9.81	12.01		6				4.12

ANNEXURE 3

PAPER PUBLICATION CERTIFICATE

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Authored by
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From
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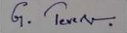
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6.1
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ANNEXURE 4

Review Card



ATMIYA UNIVERSITY FACULTY OF ENGINEERING & TECHNOLOGY

Master of Technology

(Dissertation Review Card)

Name of Student : Bunad Ami Dineshbhai

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College Name : Atmiya University

College Code :

Branch Name : Civil Engineering [Trans.]

Theme of Title : Traffic Engineering

Title of Thesis : Estimation of Dynamic PCUs
under heterogeneous traffic condition
on urban road : A case study of Rajkot city.

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<u>Co-supervisor's Detail</u>
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Institute :
Institute Code :
Mail Id :
Mobile No. :

Enrollment No. of Student : 190041002

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

Exam Date : 09/02/2021

Title : Estimation of Dynamic PGUs under heterogeneous traffic condition on urban road : A case study of Rajkot city.

-
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) _____

ANNEXURE 5

Plagiarism certificate




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