VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELGAVI – 590 018, Karnataka

Project Report On

"UPGRADATION OF HIGHWAY SYSTEMS USING MODERN TECHNIQUES"

Submitted to partial fulfilment of the requirement for award of VIII Semester

B.E in Civil Engineering

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DEPARTMENT OF CIVIL ENGINEERING

SAHYADRI COLLEGE OF ENGINEERING & MANAGEMENT

ADYAR, MANGALURU – 575 007

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ADYAR, MANGALURU – 575 007

(Affiliated to Visvesvaraya Technological University, Belgaum)

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

This is to certify that the Project Report entitled **"UPGRADATION OF HIGHWAY SYSTEMS USING MODERN TECHNIQUES"** is submitted in partial fulfillment for the requirement of VIII semester B.E in Civil Engineering during the year 2020-21 and is a result of bonafide work carried out by

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DECLARATION

We hereby declare that the entire work embodied in this Project Report titled **"UPGRADATION OF HIGHWAY SYSTEMS USING MODERN TECHNIQUES"** has been carried out by us at Sahyadri College of Engineering and Management, Mangaluru under the supervision of **MR. MANOHAR K** for Bachelor of Engineering in Civil Engineering. This report has not been submitted to this or any other University for the award of any other degree. We affirm that no portion of our work is plagiarized. In the event of a complaint of plagiarism, we shall be fully responsible. We understand that our supervisor may not be in position to verify that this work is not plagiarized.

Place: Mangalore

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ABSTRACT

The demand on our overburdened highway system is increasing every day. As traffic congestion multiplies the effects of individual variations in driving performance “as determined by physical abilities, knowledge, experience and, indeed, personality.” We lose control over our plans and schedules; we rush because we're late; we cause accidents and create ill will through recklessness and bad temper. This, in turn, makes the highway system even more sluggish, unpredictable, and nonresponsive to driver needs.A solution is waiting in the wings. The Automated Highway System (AHS) program, stepped up in response to the mandate of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) to "develop an automated highway and vehicle prototype from which future fully automated intelligent vehicle-highway systems can be developed," will provide the vision and technology to make highway driving efficient, safe, and predictable. In an automated highway system, analyzing the existing roads for the provision of better solution or to check for feasibility of the current road design by developing an application.

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Chapter 1

INTRODUCTION

A better road network plays a very important role in the development of the country in many ways such as economy etc. From the last few years, the traffic in the cities as well as on the highways is continuously increasing thus the rate of accidents is increasing. The Government is continuously working on the development of roads for the safety of people.

Ideally, the development of a major road system is an orderly, continuous process. The process follows several steps: assessing road needs and transport options; planning a system to meet those needs; designing an economically, socially, and environmentally acceptable set of roads, and providing for future extensions and reconstruction. Sometimes, situations like road congestion and exceeding the limit of maximum traffic capacity of a road can arise and this system can also take decisions automatically accordingly. Vehicles can never cross the speed limit under this system.

This project involves the development of an application that takes into account the traffic flow and outputs the relevant road design which is economical and safe. The account of traffic flow may be manual or real-time using external sources. The main aim of this project is to analyze the existing roads and either provide a better solution or to check for the feasibility of the current road design.

1.1 STUDY AREA

Nanthoor is a locality in the city of Mangalore, Karnataka, India. It is one of the busiest junctions in Mangalore. It is the junction of two national highways. Karnataka's longest national highway (NH 169) starts from Nanthoor Junction. This important junction, which is an intersection for the three major highways of Mangalore – NH 17, NH 48 and NH 13, is in total disarray causing hardship, inconvenience and total chaos to the motorists and general public.

FIG 1.1 LOCATION ON MAPS

FIG 1.2 STUDY AREA OF LOCATION

This junction assumes significance mainly because all the three Highways passing through Mangalore hit Nanthoor junction. Apart from traffic emanating from the Highways there is also the traffic that comes from the city making it a four-way-traffic junction. Vehicles come from Pumpwell, Kulshekar-Kaikamba, Nanthoor polytechnic and from Hampankatta-Kankanady through Shivbagh intersect through this junction. There is an incomplete triangle at the junction from the road approaching from Pumpwell, which is causing inconvenience and confusion to the drivers especially newcomers. Earlier, traffic from Pumpwell used to go straight on this road on NH 17. Recently IRKON has done a circle (incomplete) at the mouth of the junction and traffic from Pumpwell is directed through the circle. Just a few steps ahead there is a triangle which is in total mess. This triangle bifurcate the road coming from Shivbagh and the road coming the Junction from Nanthoor-Polytechnic towards the junction.

IRCON which is by known for its incompetence and inferior quality of work has left the space in between these two roads undone causing uneven space and creating confusion.

1.2 STUDY ON TRAFFIC VOLUME

The term traffic volume study can be termed as traffic flow survey or simply the traffic survey. It is defined as the procedure to determine mainly the volume of traffic moving on the roads at a particular section during a particular time. Traffic volume (flow) is variable. It is of great importance to the traffic engineer. It is essentially the quantity of movement per unit of time at a specified location.

The number of vehicles crossing a section of road per unit time at any selected period is called traffic volume and the study of traffic volume is known as a traffic volume study. The unit of traffic volume is vehicles per hour or vehicles per day.

1.2.1 IMPORTANCE OF TRAFFIC VOLUME STUDY

Traffic survey is very important to be performed because it can:

- Increase the efficiency and life of roads
- Reduces traffic volume at a particular section
- Provide better means for the development of infrastructures
- Provide better means to utilize other roads in case of special events in the city
- Provide an estimate of no vehicles against the of persons

1.2.2 THE FOLLOWING STUDIES ARE CARRIED OUT IN THE TRAFFIC VOLUME STUDY

- Classification of traffic, i.e. buses, trucks, cars, auto-rickshaws, cycles, bullock carts, pedestrians, etc.
- Number of vehicles in each class.
- The direction of each class of traffic flow is also noted.
- At intersections, the traffic flow in each direction of flow including turning movements is recorded.
- The peak traffic period is also noted.

1.2.3 TYPES OF VOLUME COUNTS

Hourly traffic volumes and average daily volumes are those commonly used in the planning, design, and operation of highway facilities. Traffic demands in the vehicle per

hour per lane are of great significance in dealing with practical traffic problems.

1. Peak Hour Volume (PHV) or Peak Hour Flow (PHF)

The highest hourly volume in a day is called peak hour volume. It is the maximum number of vehicles that pass a point on a highway for one hour. There is one peak in the morning and another in the evening referred to as 'morning peak hour' and 'evening peak hour'.

2. Average Annual Daily Traffic (AADT)

It is the average 24 hours volume count collected every day in the year.

3. Average Daily Traffic (ADT)

The total volume during a certain number of days, divided by that number of days is called average daily traffic.

4. Classified volumes

Classified traffic volume count gives a better understanding of the types of vehicles that uses the road and can be used for a number of other purposes apart from the transportation surveys.

5. Short counts less than an hour

This mainly Analyse maximum rates of flow and, variation within the peak hour.

6. Cordon count volumes

This count will be based on the collected information regarding the trips done by pedestrians and personal cars, in addition to other public transportation modes such as trucks, buses, trains, monorail, and bikes. Personal data regarding the movements made by an individual in-vehicle, by the path, and by public transportation are recorded, by collecting the vehicle type along with passenger information in every vehicle.

7. Pedestrian volumes

The pedestrian count is a simple, relatively inexpensive way to measure the volume and direction of pedestrian traffic in the CBD through time and by location. As such, it provides quantitative data to evaluate the need for and effectiveness of various pedestrian planning measures at particular places in the downtown area.

8. Turning movement's counts

Turning Movement Count or most popularly known as Intersection count is to count pedestrians, cycles, or vehicles that are moving towards an intersection. The main purpose is to gather vehicle data to determine the traffic flow in that direction.

1.2.4 METHODS OF TRAFFIC VOLUME STUDY

Counting of traffic volume study

The traffic volume study counts may be done by mechanical counters or manually.

a) Mechanical Counters (Automatic Counters)

These may be either fixed (Permanent) type or portable type. The mechanical counter can automatically record the total number of vehicles crossing a section of the road in the desired period. The working may be by the effect of impulses or stimuli caused by traffic movements on a pneumatic hose placed across the roadway. This method is employed in cases where the manual count method is not feasible. Various instruments are available for the automatic count, which have their own merits and demerits. Some of the widely used instruments are pneumatic tubes, inductive loops, weigh-in-motion Sensors, micro-millimeter wave Radar detectors, and video cameras. Both types of count can be classified or unclassified. Classified traffic volume count gives a better understanding of the types of vehicles that uses the road and can be used for a number of other purposes apart from the transportation surveys. Unclassified traffic volume count is done where sufficient manpower is not available or the budget for the survey is low. This type of volume count does not give a piece of good information about the road.

Some of the widely used instruments are

i) Pneumatic tubes – These are tubes placed on the top of road surfaces at locations where traffic counting is required. As vehicles pass over the tube, the resulting compression sends a burst of air to an air switch.

ii) Inductive loops – Inductive loop detector consists of embedded turned wire. It includes an oscillator, and a cable, which allows signals to pass from the loop to the traffic counting device. Inductive loops are cheap, almost maintenance-free, and are currently the most widely used equipment for vehicle counting and detection

iii) Weigh-in-Motion Sensor types – A variety of traffic sensors and loops are used to count, weigh and classify vehicles while in motion, and these are collectively known as Weigh In Motion (WIM) sensor systems.

iv) Micro-millimeter wave Radar detectors – Radar detectors actively emit radioactive signals at frequencies ranging from the ultra-high frequencies (UHF) of 100 MHz, to 100 GHz, and can register vehicular presence and speed and can be used to determine vehicular volumes and classifications in both traffic directions.

v) Video Camera – Video image processing system utilizes machine vision technology to detect vehicles and capture details about individual vehicles when necessary. The system

is useful for traffic counting and gives a +/- 3% tolerance, and is not appropriate for vehicular speed and their classification.

b) Manual Counts

The most common method of collecting traffic volume data is the manual method of traffic volume count, which involves a group of people recording a number of vehicles passing, on a predetermined location, using tally marks in inventories. Raw data from those inventories are then organized for compilation and analysis. This method of data collection can be expensive in terms of manpower, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections also in the case where automatic methods cannot be used due to lack of infrastructure, necessary authorization, etc.

c) Duration and Interval of Traffic Counts

In order to predict traffic flow volumes that can be expected on the road network during specific periods, knowledge of the fact is required that traffic volumes change considerably at each point in time. There are three important cyclical variations:

- **Hourly pattern:** the way traffic flow characteristic varies throughout the day and night;
- **Daily Pattern:** The day-to-day variation throughout the week.

Monthly and yearly Pattern: The season-to-season variation throughout the year.

When analyzing the traffic one must also be aware of the directional distribution of traffic and the manner in which its composition varies as it is important to deal with the tidal flow.

- Hourly patterns – Typical hourly patterns of traffic flow, particularly in urban areas, generally show a number of distinguishable peaks. The peak in the morning followed by a lean flow until another peak in the middle of the afternoon, after which there may be a new peak in the late evening. The peak in the morning is often more sharp by reaching the peak over a short duration and immediately dropping to its lowest point. The afternoon peak on the other hand is characterized by a generally wider peak. The peak is reached and dispersed over a longer period than the morning peak.
- Daily patterns – The traffic volume generally varies throughout the week. The traffic during the working days (Monday to Friday) may not vary substantially, but the traffic volume during the weekend is likely to differ from the working days on a different type of roads and in different directions.

1.3 OBJECTIVES

To introduce new road design for safe and fast flow of traffic.

- To analyze and adapt new road techniques for existing road designs.
- To create a real-time Application that automatically predicts the type of traffic system.
- To design a highway that would reduce traffic congestion.
- To rupture the travel time and to develop an easy, short, and economic transportation system.
- To compare the economics of the pavements.
- To introduce new traffic systems for the movement of people, goods, and services, and to meet the growing population and traffic of a city.
- To minimize the time for analysis of road designs for engineers and carry out necessary projects quickly.
- To find substitutions for the current road systems.
- Traffic volume study is accepted as a true measure of the relative importance of roads and in deciding the priority to improvement and expansions.
- Traffic volume study is used in planning, traffic operation, and control of existing facilities.
- Used in planning and designing the new facilities.
- For the analysis of traffic patterns and trends.
- Classified volume study is useful in ‘structural design of pavements, in geometric design, and in computing roadway capacity.
- For planning sidewalks, crosswalks, subways, etc.
- Turning movement study used in the design of intersections in planning signal timings, etc.
- To know the various types of the vehicle using the road.

1.4 SCOPE OF TRAFFIC VOLUME STUDIES

The study of traffic volume at a particular location is necessary to create the following scopes

- Flow fluctuation on different approaches at a junction or different parts of a road network system.
- Magnitudes, classifications and the time and directional split of vehicular flows. Magnitude is represented by volume of traffic. Vehicles are classified into some

predefined classes based on vehicle size and capacity. In a two-way road, vehicles moving towards two directions are counted separately to get the proportion. Time and directional split is useful to identify tidal flow.

- Proportions of vehicles in traffic stream. Proportion of vehicles indicates whether public or private transport dominates the traffic system. It also indicates the choice of road users.
- Hourly, daily, yearly and seasonal variation of vehicular flows. These variations are needed to establish expansion factors for future use. Using expansion factors, AADT can be calculated from short count.
- Effectiveness of a traffic control measure
- To check existing, operating service condition of a roadway section
- Planning traffic operation and control of existing facility
- To design intersection, signal timings, channelization
- Structural design of pavements, geometric design and road way capacity.

1.4 METHODOLOGY

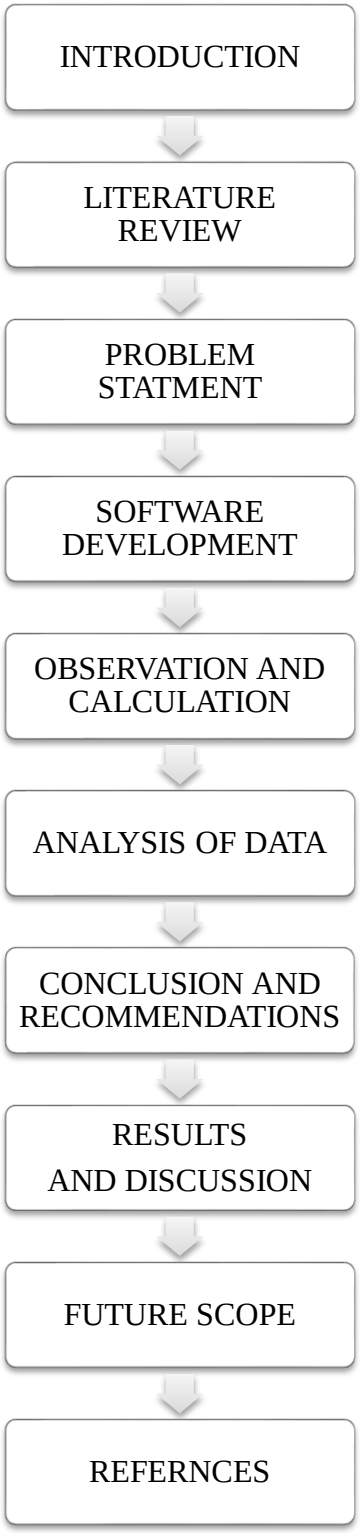

FIG 1.3 FLOW CHART OF METHODOLOGY

Chapter 2

LITERATURE REVIEW

[1] Teron Nguyen (2019) says that in the recent decade, the development of smart technologies, Internet of things and inexpensive on board sensors and other methods to evaluate road surface conditions. Nowadays various techniques and systems have been developed to measure road profiles. And also to detect road irregularity for multiple purposes such as expedient maintenance of pavements.

[2] Jojo France-Mensah (2017) this paper reports on a case study of the use of visualization of geospatial data that is distributed across data sets and requires integration over time and space to aid decision makers. Many State Highway Agencies (SHAs) in the United States, organized along the traditional way i.e., planning, design, construction, maintenance, and operations. This paper documents the benefits associated with visualization and integration of projects data in a GIS to address planning challenges facing a typical highway agency.

[3] Raimondo Schettini (2005) says that advanced video surveillance systems are a huge collection of hardware and software functionality including data acquisition, communication, data storage and data processing. Image processing algorithms play a major role in the fulfilment of the systems functional requirements. Paper presents an innovative software approach to the condition of time critical, safe, robust and conFIGurable monitoring systems.

[4] Logan Jansen (2000) this paper reviews Heavy traffic including congestion can be observed all over the world. Since space for new roads is limited it is necessary to improve the exploitation of the existing network. Intersection is the key to improve urban traffic capacity. Signal timing optimization is one of the most direct and effective traffic control methods. Reasonable traffic signal timing ensures good travel speed, comfort, safety, and environmental protection.

A comparison case study has been presented that combines different aspects of specification problems from the traffic control system domain.

Domain modelling has been identified as an important candidate for the integration with software specification techniques.

[5] Eduardo Graells-Garrido (2018) this paper reviews that the Cities are growing at a fast rate, and transportation networks need to adapt accordingly. To design, plan, and manage transportation networks, domain experts need data that reflect how people move from one place to another, at what times, for what purpose, and in what mode(s) of transportation. However, traditional data collection methods are not cost-effective or timely.

In this paper we presented an interdisciplinary approach to infer the distribution of mode of transportation usage for commuting. The approach follows the conventions and parameters of the area of application, Transportation, and uses tools and methods from Data Science applied to a non-traditional data source: billing records from mobile phone networks.

[6] Hai Dinh (2017) this paper reviews that Traffic data collection is very important in transportation applications to assess performance, improve safety and design roads. Before modern powerful computing systems were economically available, traffic engineers or human operators were traditionally deployed in the field for manual traffic data collection.In this paper, the authors proposed a system for automated traffic data collection for roundabouts. The developed system consists of a tracking module and a data mining module. The tracking module has three major processing steps of camera calibration, vehicle segmentation and vehicle tracking.

[7] McCluskey (2006) this journal shows new ideas and approaches to the ideas of designing road transportation support systems based on the influence of autonomic computing systems. It also provides the ongoing research and studies by top leading groups in Europe carried out by leading scientists and traffic engineers. It highlights the importance and need of autonomous road transport systems to areas of “Smart city” and “Intelligent Transportation”.

The work on Autonomic Road Transport Support (ARTS) aims in meeting the challenges from Intelligent Transport Systems (ITS) by fusing the data, experiments and results from the 30 years of study done manually, Artificial Intelligence (AI), Image processing and several other algorithms developed by data scientists. It starts with the visions, opportunities and challenges, then presents the use and application of ARTS technology benefiting and encouraging for a smart, economical and safe road system.

[8] Petros (Ed.) (1997) The United States had managed to construct and develop one of the biggest and efficient road systems in the world. But in the years, due to increased traffic, the current systems were also found to be not sufficient and economical. This made the researchers feel the need to develop more efficient systems using advanced technologies.

Advanced systems can be used to automate some of the basic elements of the system like decision making tasks in order to eliminate sluggish, unpredictable and nonresponsive behaviors that have negative effects on the transportation efficiency. The Intelligent Vehicle-Highway Systems (IVHS) or as recently termed Intelligent Transportation Systems (ITS) programs around the world aim to improve the efficiency of the existing traffic systems. The main areas of this field are:

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Vehicle Control Systems (AVCS)
- Commercial Vehicle Operations (CVO)

Chapter 3

DATA COLLECTION

3.1 GENERAL

The traffic volume study plays an important role to help the engineers for designing unsignalized intersections, improvement of the traffic junctions, signal designing procedures and also for the designing of vehicular storage lane system. In this study, the aim is to do the improvement of Nanthoor junction by analyzing its traffic volume count leads to capacity analysis.

The data to be collected for the study is very essential to do the analysis of traffic as well as to understand the current condition and behaviour of traffic. The collection of the data regarding traffic volume count for this study has been done by manual method. It requires the record of traffic vehicular count on the recording sheets. The count was done to know about the various vehicles entering the proposed junction from all the three legs. The vehiculartraffic included cars, buses, trucks; two-wheeler motorized vehicles, light commercial vehicles as well as tractors. The numbers of cars were found to be highest in number entering into the junction. The heavy multi-axle trucks‟ vehicular traffic has been found to be very less. The cyclists are almost negligible in the area. It has been found that people prefer both public as well as private transport to go to various places. The traffic count was done in order to know about the peak hours flow after converting the normal flow in Passenger Car Units (PCU‟s).

3.2 TRAFFIC VOLUME COUNTS

The aim to conduct traffic vehicular counting is determination of total number of roadwayvehicles, their movements as well as their classification based on type, size. With the help of this data, it is possible to know about the effect of large heavy vehicles on the overall traffic. Also, it is quite helpful to know how pedestrians‟ population affect the overall traffic. Thisdata is also helpful for the improvement of any traffic junction. The method to be selected forstudy is determined by the period for which counting will be done. For a given study area, the period of counting is the representative for the time of a day, days of a month or months of a particular year.

There are two types of methods which are used for conducting traffic count:

(1) Manual method

(2) Automatic method

3.2.1 MANUAL COUNT STUDY

The study of manual traffic count is used in order to collect data for determining the classification of vehicle, travelling direction, volume. It consists of three main steps. These are as follows

1) Performing necessary preparations.

2) Selection of location.

3) Record Observations.

These steps can be further explained as follows

- **Performing Necessary Preparations**

The preparation starts while reviewing the exact purpose of counting. This information helps to determine the procedure to follow on field, numbers of observers needed such as to do the study at any intersection with multiple lanes will require various number of observers.

- **Selection of Location**

The location to be selected should be accessible for all the observers. The observers should stand at the place from where they will be having the clear vision of the on-going vehicular traffic. It is suggested that the observer should stand at a position which should be somewhat away at certain distance from the edge of road. If possible, the observers should be positioned at a place which is cleared of all obstructions. If two or more observers are present at site then all of them must have visualised contact with each other.

- **Record Observations**

It is essential to organize the data record carefully as the traffic counts could have a number of data forms and various sheets. On each record sheet or tally sheet, it is required by the observer to mention the selected location, the date on which observation has been taken as 19 well as the time of recording observations. Along with this, the weather condition of the selected is also required to be mentioned on the record sheet.

3.2.2 MANUAL COLLECTION AND CALCULATION OF DATA

Formulas

The observations of the volume count survey were done by manual counts. Figure shows the plan view of road junction and location of surveyor in the road junction at nanthoor junction. Observations were to be taken in the junction for every 15 minutes intervals in the peak hour morning 07:30 to 09:30 for fifteen days. The maximum of the fifteen days survey data was taken but we added a single survey.

TABLE 3.1 SHOWS THE TRAFFIC VOLUME SURVEY

TRAFFIC VOLUME SURVEY									
INTERSECTION: Nanthoor junction						Shift: Morning	Date: 01-04-2021		
Time	No. of fast moving vehicles						No: of slow moving vehicles.		
	Buses	Trucks and delivery vans, lorry	Container trailers	Car, jeep,Vans.	Auto Rickshaw	Motor Cycle,scooter Mopeds	Cycles	Cycle rickshaw	BD/HD Carts
7:30-7:45	36	2	1	30	22	195	8	0	0
7:45 - 8:00	30	8	3	26	28	160	7	0	0
8:00 - 8:15	34	6	2	36	47	233	10	0	0
8:15 - 8:30	25	8	2	37	44	218	15	0	0
8:30 - 8:45	35	14	5	57	65	293	17	0	0
8:45 - 9:00	26	16	2	49	47	234	9	0	0
9:00 - 9:15	30	14	3	55	51	298	5	0	0
9:15 - 9:30	36	21	3	57	53	282	0	0	0

a. Peak Hour: An hour whose PCU is higher is taken as peak hour of the existing road junction. By this way, 08:30 to 09:30 is taken as peak hour. The vehicle travelled on the peak hour is shown below on table 2.

TABLE 3.2 THE VEHICLE TRAVELLED ON THE PEAK HOUR

Peak hour	Buss e	Trucks and deliver y vans, lorry	Containe r trailers	Car, jeep, Vans .	Auto Rickshaw	Motorcycle, scooter Mopeds	Cycle	Cycle ricksha w	BD/H D Carts
Total	125	65	13	218	216	1107	31	0	0

b. Peak Hour Factor:

The peak hour factor is used in HCM capacity and level of service analysis to account for the variation in traffic volumes during the peak hour. The peak hour factor is computed and its conclusion is obtained.

TABLE 3.3 PCU RATES

Vehicle Type	Pcu
Car	1.0
Motorcycle	0.5
Bicycle	0.2
Lcv	2.2
Truck, Bus, Containers	3.5
3 - Wheeler	0.8

It measures the relationship between the peaks 15 minutes of Traffic compared to total vehicle volume over the entire peak hour. It is the Ratio of total hourly Traffic volume against the busiest 15 minute interval Peak Hour Factor = Peak volume/ (4 times of the Maximum of 15 minutes Value).

TABLE 3.4 FLOW IN PCU FOR NANTHOOR JUNCTION

Time Interval	Flow In Pcu
07:30 To 07:45	225

07:45 To 08:00	273
08:00 To 08:15	339
08:15 To 08:30	307
08:30 To 08:45	448
08:45 To 09:00	394
09:00 To 09:15	410
09:15 To 09:30	450
TOTAL PEAK VOLUME (08:30 To 09:30)	**1702**

$$\textbf{Peak Hour Factor} = \frac{\textbf{PEAK VOLUME}}{\textbf{4 times of the Maximum of 15 minutes Value}}$$

$$= \frac{1702}{4 \times 450}$$

$$= 0.945$$

c. Volume / Capacity Ratio

The Volume-to-Capacity ratio (V/C) measures the level of congestion on a roadway by dividing the volume (VPD) of traffic (existing or future) by the capacity of the roadway.

The capacity of the road junction is taken from the table of Traffic engineering and transport planning by L.R. Kadiyali.

Based on the volume/capacity ratio, the junction is classified under a level of service.

TABLE 3.5 LEVEL OF SERVICE CHART

Volume /Capacity ratio	Level of service(LOS)	Performance
0.0-0.2	"A"	Excellent
0.2-0.4	"B"	Very Good
0.4-0.6	"C"	Good
0.6-0.8	"D"	Fair
0.8-1.0	"E"	Poor
>1	"F"	Very Poor

For Nanthoor junction:

Volume of the junction = 1702

Capacity of the junction = 1000

V/C ratio = 1702/1000 = 1.7

Therefore, the junction falls under the LEVEL OF SERVICE “F”

Chapter 4

SOFTWARE DEVELOPMENT

4.1 STAGES

1. Pre - SDLC Stage

To understand the traffic characteristics and traffic flow, pedestrian characteristics, and vehicle characteristics. To study the existing structures and their economical value. Gather all the information and data required for the analysis.

2. SDLC Stage

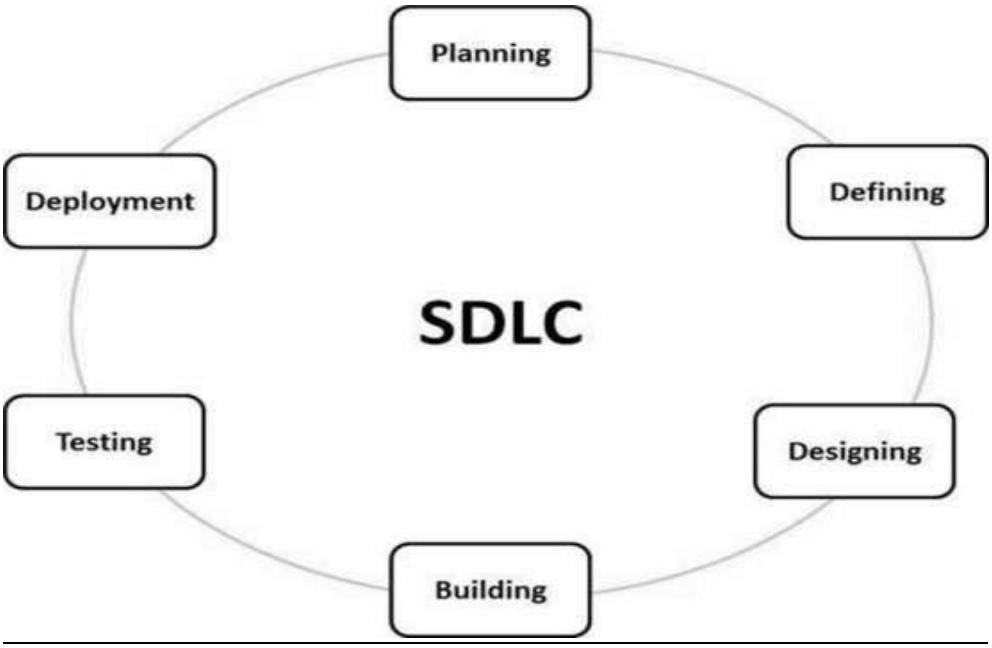

FIG 4.1 SDLC WORKING CHART

A. Planning and Requirement Analysis

- Software Development Life Cycle (SDLC) is a process used by the software industry to design, develop and test high-quality software.
- Requirement analysis is the most fundamental stage in SDLC.
- The information is then used to plan the basic project approach and to conduct product feasibility studies in the economical, operational, and technical areas.
- Planning for the quality assurance requirements and identification of the risks associated is also done in the planning stage.

B. Requirements specification

The next step is to clearly define and document the product requirements and get them approved by the customer or the market analysts done through SRS (Software Requirement Specification).

C. Designing the Product Architecture

Based on the requirements specified in SRS, more than one design approach for the product architecture is proposed and documented in a DDS - (Design Document Specification).

D. Building or Developing the Product

In the last stage of SDLC, the actual development starts and the product is built and programming code is generated as per DDS during this stage.

E. Testing the Product

The testing activities are mostly involved in all the stages of SDLC. This stage refers to the testing of the stage of the product where defects are reported, tracked, fixed and retested until it reaches its SRS standards.

F. Deployment in the Market and Maintenance

Once the product is tested and ready to be deployed it is released formally in the appropriate market (UAT- User acceptance testing).

3. Post - SDLC Stage

To test the software application by comparing manual data which has been calculated.

Upgradation of the software application according to the necessary requirements.

4.2 DEVELOPMENT OF SOFTWARE

1. Embedded Google maps

Google Maps has a "Share or embed map" feature that provides users with the map's HTML code so that they can insert it into their website's code.

You can embed a map view image, a street view image, or even specific directions for a route.

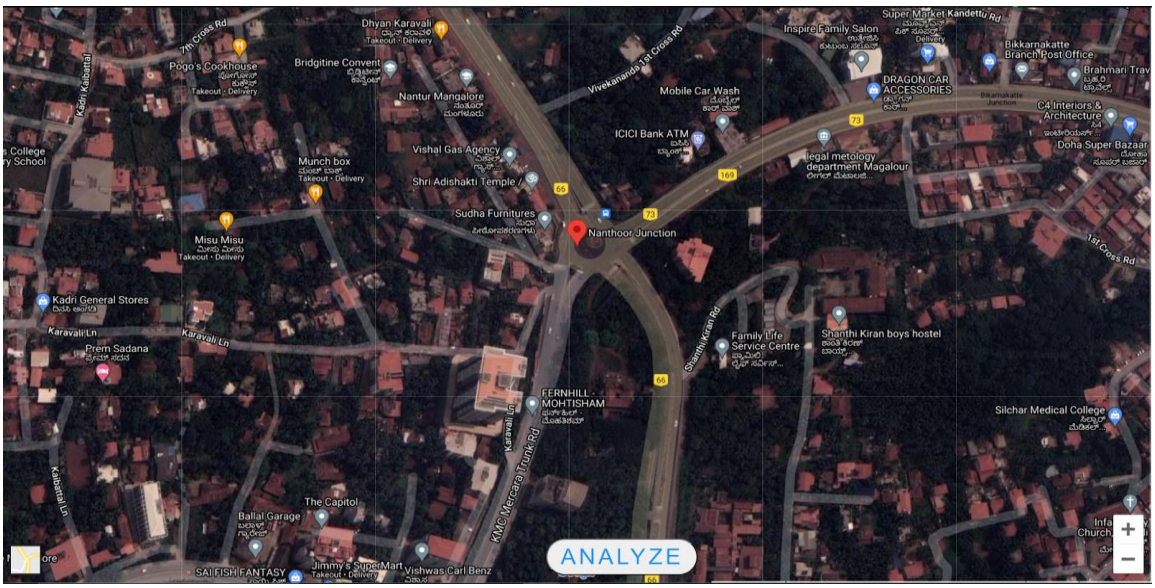

FIG 4.2 LOCATION MAP FROM WEBPAGE

index.html | analyze.html | report.html

```
<!DOCTYPE html>
<html>
<head>
    <title>index</title>
    <link rel="stylesheet" type="text/css" href="style.css">
    <link href='https://fonts.googleapis.com/css?family=Lato' rel='stylesheet'>
</head>
<body>
    <style >
        *{
            margin: 0;
            padding: 0;
            box-sizing:border box;
        }
    </style>

    <section>
        <iframe src="https://www.google.com/maps/embed?pb=!1m18!1m12!1m3!1d2377.6810662878315!2d74.86276565814744!3d12.883934912410806!2m3!1f0!
        2f0!3f0!3m2!1i1024!2i768!4f13.1!3m3!1m2!1s0x3ba35a234331c627%3A0x5177e0a4ec3c823b!2sNanthoor%20Junction%2C%20Edapally%20-%20Panvel%20
        Hwy%2C%20Kadri%2C%20Mangalore%2C%20Karnataka%20575004!5e1!3m2!1sen!2sin!4v16236609326951!5m2!1sen!2sin" width="100%" height="940px"
        style="border:0;" allowfullscreen></iframe>
    </section>

    <a href="analyze.html">
        <button class ="btn">Analyze</button>
    </a>

</body>
</html>
```

FIG 4.3 CODING USED FOR DEVELOPING THE SOFTWARE

2. Language used

HTML: HTML is the standard markup language for Web pages. HTML tags are used to determine how to display the document.

Basic Syntax:

<html>

<head>

<title>Page title</title>

</head>

<body>

<h1>This is a heading</h1>

```
<p>This is a paragraph.</p>
<p>This is another paragraph.</p>
</body>
</html>
```

3. In Analyzation page we create a table with values already entered.

Table syntax:

```
<table style="width:100%">
  <tr>
    <th>HEADER 1</th>
    <th>HEADER 2</th>
    <th>HEADER 3</th>
  </tr>
  <tr>
    <td>ROW 1 VALUE 1</td>
    <td>ROW 1 VALUE 2</td>
    <td>ROW 1 VALUE 3</td>
  </tr>
  <tr>
    <td>ROW 2 VALUE 1</td>
    <td>ROW 2 VALUE 2</td>
    <td>ROW 2 VALUE 3</td>
  </tr>
</table>
```

```
<!DOCTYPE html>
<html>
<head>

  <link rel="stylesheet" type="text/css" href="style.css">
<link rel="preconnect" href="https://fonts.gstatic.com">
<link href="https://fonts.googleapis.com/css2?family=Big+Shoulders+Stencil+Display&display=swap" rel="stylesheet">

   <!-- <script type="text/javascript" src="https://www.gstatic.com/charts/loader.js"></script>
    <script type="text/javascript">
      google.charts.load('current', {'packages':['corechart']});
      google.charts.setOnLoadCallback(drawChart);

      function drawChart() {

        var data = google.visualization.arrayToDataTable([
          ['Task', 'Hours per Day'],
          ['Buses',     10],
          ['Truck & Delivery Vans,Lorry', 2],
          ['Container Traliers',  2],
          ['Car,Jeep,Vans', 2],
           ['AutoRickshaw',    7],
            ['MotorCycle,Scooter,Mopels',1],
            ['Cycles',2],
            ['CycleRickshaw', 1],
             ['BD/HD carts', 1]
         ]);

        var options = {
          title: 'Peak Hour',
          width:'800',
          height:'800',
        };

        var chart = new google.visualization.PieChart(document.getElementById('piechart'));

        chart.draw(data, options);
      }
    </script>
-->
</head>
<body >
```

FIG 4.4 CODING USED FOR ANALYSING BUTTON

The following are the observation were to be taken in the junction for every 15 minutes intervals:-

TRAFFIC VOLUME SURVEY

Intersection:Nanthoor Junction

Time	No.of fast moving vehicls						No of slow moving vehicls		
	Buses	Trucks and Delivery Vans, Lorry	Containers Traliers	Car, Vans, Jeep	Auto Rickshaw	MoterCycle, Scooter, Mopeds	Cycles	Cycle Rickshaw	BD/HD Carts
07:30 to 07:45	36	2	1	30	22	195	8	0	0
07:45 to 08:00	30	8	3	26	28	160	7	0	0
08:00 to 08:15	34	6	2	36	47	233	10	0	0
08:15 to 08:30	25	8	2	37	44	218	15	0	0
08:30 to 08:45	35	14	5	57	65	293	17	0	0
08:45 to 09:00	26	16	2	49	47	234	9	0	0
09:00 to 09:15	30	14	3	55	51	298	5	0	0
09:15 to 09:30	36	21	3	57	53	282	0	0	0

▶ Click here to calculate the Peak Hour

▶ Click here to calculate the Peak hour factor

▶ Click here to calculate Volume/Capacity Ratio

FIG 4.5 TABULAR COLUMN OF TRAFFIC VOLUME SURVEY

4. Calculation

Peak hour value is extracted from the table and volume capacity ratio is calculated.

Summary and details tag are used.

Syntax:

<details>

```
<summary>Title</summary>
<p>Related Data</p>
</details>
```

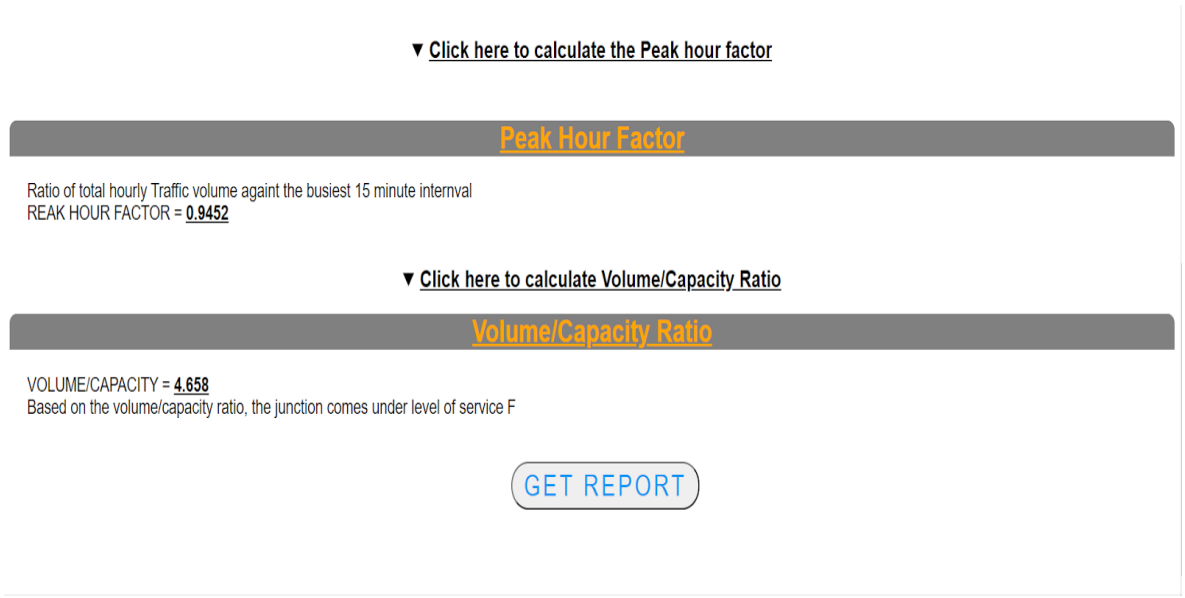

FIG 4.6 CALCULATION UPDATEDS OF TRAFFIC VOLUME SURVEY

Peak hour factor & Volume-capacity ratio calculator is highlighted when mouse is hovered on it for emphasis.

```
Syntax:<style type="text/css">
   .hoverable:hover {
      background-color: yellow;
   }
</style>
```

5.Pie chart is used to diplay calculated data graphically.

Javaxcript:JavaScript (JS) is a lightweight, interpreted, or just-in-time compiled programming language with first-class functions

syntax for creating a piechart:

```
<script type="text/javascript">
// Load google charts
google.charts.load('current', {'packages':['corechart']});
google.charts.setOnLoadCallback(drawChart);
```

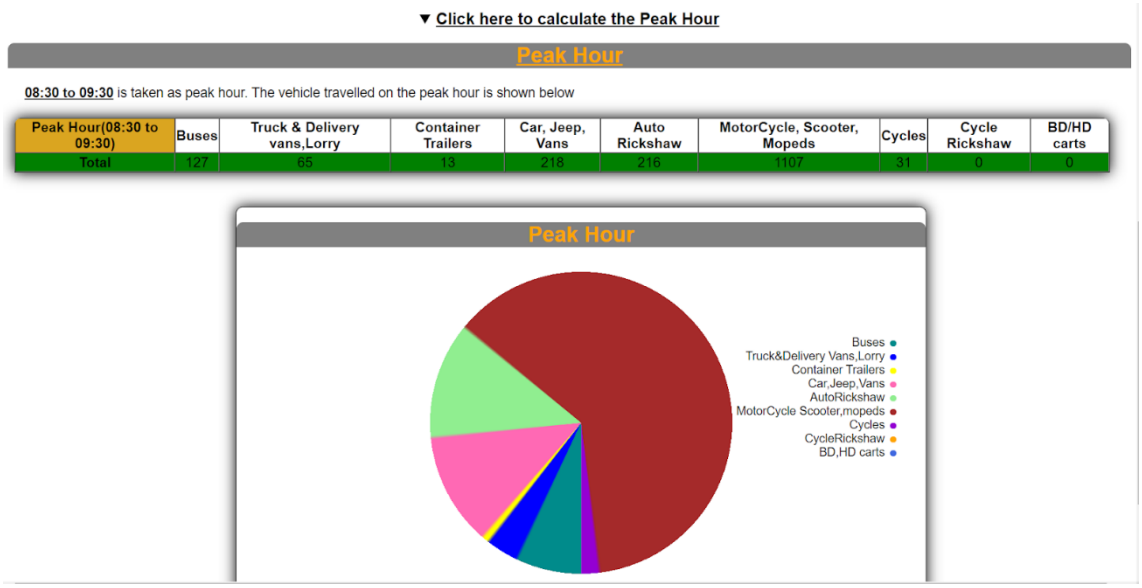

FIG 4.7 PIE CHAT REPRESENTATION OF TRAFFIC VOLUME SURVEY IN A WEBPAGE

6.HREF or REL tag is used to link to web pages.

syntax:link text

```
index.html | analyze.html | report.html

<!DOCTYPE html>
<html>
<head>
    <link rel="stylesheet" type="text/css" href="style.css">

<link rel="preconnect" href="https://fonts.gstatic.com">
<link href="https://fonts.googleapis.com/css2?family=Alegreya&display=swap" rel="stylesheet">
    <title></title>
</head>
<body>
        <style type="text/css">
        font-family: 'Alegreya', serif;
        p{
            font-size: 25px;
            text-align: :justify ;
            line-height: 10%;
        }
        h1{
            color: orange;
            text-align: center;
            background-color: grey;

        }
        #try
        {
            line-height: 1.3;
        }
        #message{
            text-align: center;
        }
         </style>


<h1>RESULT AND DISCUSSION</h1>
<p id="try">PCU value for junction Traffic flow is computed by using the Traffic Volume Count survey data. The peak hour is 08:30 am to 09:30
am which is obtained by survey. The peak volume per hour is computed, that is taken from hourly peak hours. The peak hour factor is calculated
as 0.9452. Then the volume/capacity ratio is found to be 4.658. Based on this value, the level of service of this junction is computed.</p>
```

FIG 4.8 CODING

7. Button

Button is used to link to REPORT page.The report page include result,conclusion and suggestions.

index.html | analyze.html | report.html

```
<!DOCTYPE html>
<html>
<head>
    <link rel="stylesheet" type="text/css" href="style.css">

<link rel="preconnect" href="https://fonts.gstatic.com">
<link href="https://fonts.googleapis.com/css2?family=Alegreya&display=swap" rel="stylesheet">
    <title></title>
</head>
<body>
        <style type="text/css">
        font-family: 'Alegreya', serif;
        p{
            font-size: 25px;
            text-align: :justify ;
            line-height: 10%;
        }
        h1{
            color: orange;
            text-align: center;
            background-color: grey;

        }
        #try
        {
            line-height: 1.3;
        }
        #message{
            text-align: center;
        }
         </style>


<h1>RESULT AND DISCUSSION</h1>
<p id="try">PCU value for junction Traffic flow is computed by using the Traffic Volume Count survey data. The peak hour is 08:30 am to 09:30 am which is obtained by survey. The peak volume per hour is computed, that is taken from hourly peak hours. The peak hour factor is calculated as 0.9452. Then the volume/capacity ratio is found to be 4.658. Based on this value, the level of service of this junction is computed.</p>
```

FIG 4.9 CODING FOR REPORT

8. Cascading Style Sheets (CSS)

CSS is a style sheet language used for describing the presentation of a document written in a markup language such as HTML [1] CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts.

This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, and enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file which reduces complexity and repetition in the structural content as well as enabling the .css file to be cached to improve the page load speed between the pages that share the file and its formatting.

For pie chart radial-gradient tag is used.

syntax:

```
#grad {
  background-image: radial-gradient(red, green, blue);
}
```

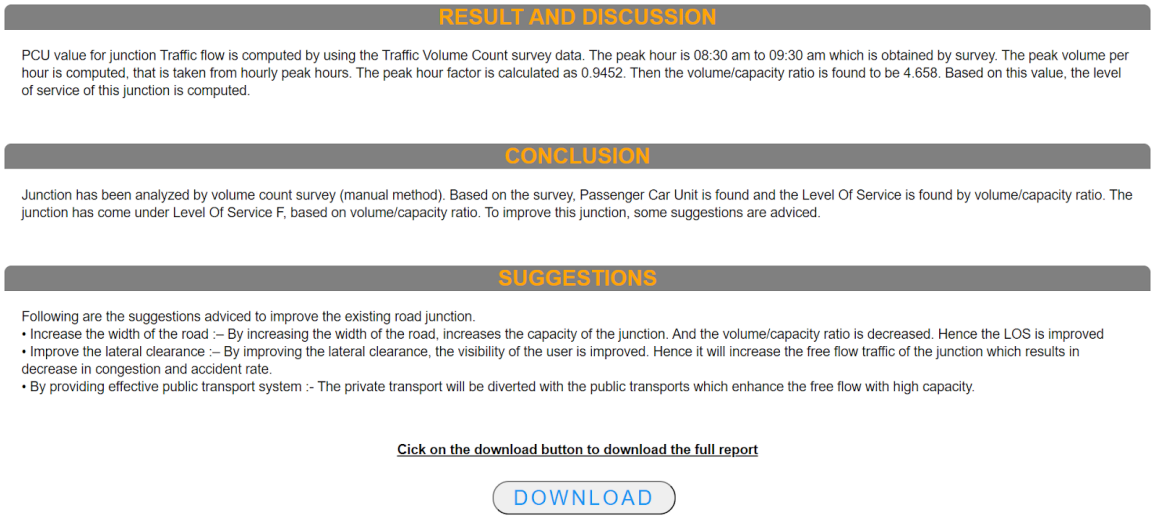

FIG 10. RESULT DISCUSSION PAGE SHOWCASED IN A WEBPAGE

4.3 OUTCOME

- A real-time Application that automatically predicts the type of road traffic system.
- It helps to design and analyse a highway that would reduce the traffic congestion and carry out necessary projects quickly.
- It also helps to adapt new road techniques for existing road designs.
- Aims to affect dramatically the operation of the current highway system from both the vehicle and infrastructure points of view.
- To make the common man know about the proper and improper systems.

4.4 FURTHER UPGRADES

- Upgrading the webpage to several different junction analysis by conducting surveys and updating it to the webpage.
- Making the webpage useful for the government to undertake repairs or upgrade the existing road systems.
- Letting the common man access to the webpage to make them well informed about their road and its condition.
- Upgrading the traffic counts from manual to automatic using google API's or by establishing cameras at the junction for live traffic data thus updating the website to real time.

- Updating the webpage by introducing new methods of calculation, formulas so as to keep updated.
- Introducing new aspects like accident count and its surveys, speed limits for better understanding of the road system.
- Ongoing construction monitoring and its updates to be added to the webpage.

Chapter 5

RESULTS AND DISCUSSIONS

5.1 GENERAL

The present chapter deals with the results and various solutions that have been derived as a result of the collected data related to study area as well the analysis of the same data. It also deals with the discussions that have come across based on the derived results. The data that has been collected in this research work includes vehicle traffic counting in order to find the traffic volume and thus, the peak hour volume, at the intersection of the study area. The various results have derived after the analysis of traffic data that have been collected after the primary survey of study area.

5.2 TRAFFIC DATA

The traffic volume data was collected about the study area by doing traffic count at the study area. The various vehicles arriving at the junction from all three sides were observed and counted which includes buses, trucks, tractors, two-wheelers, etc. After counting of vehicular traffic, the peak hour volume was found out about the study area. The study about the traffic volume was also proved to be helpful to know about the level of serviceability according to the standard values of capacities given in the Highway Capacity Manual (HCM). The various results related to traffic data survey are as follows

1) The traffic survey of the study area shows that the maximum traffic occurs in between 08:30 AM to 09:30 AM which includes heavy vehicles, light vehicles as well as two wheelers.
2) The analysis of traffic data is done in order to find the level of serviceability during the peak hours and the study shows that the national highway approaches an unstable traffic flow during peak hours.
3) The peak volume per hour is computed i.e., taken from hourly peak hours.
4) The Level of Service of this Nanthoor highway lies under category “F” found by volumetric/capacity ratio.

Chapter 6

ADVANTAGES AND DISADVANTAGES

Advantages

1. It can works throughout the day and night for the desired period, recording the total hourly volume.
2. It does not require any supervision
3. It is suitable for long counts.
4. Reduces traffic volume at a particular section.
5. Can be done in bad weather as well.
6. Data can be used immediately after collection.

Disadvantages

1. It is not possible to get the traffic volume of various classes of traffic.
2. It does not give the details of turning movements.
3. This is not practicable for long duration count and when flow is high.
4. Error is common especially when volume is high.

Chapter 7

CONCLUSION

6.1 GENERAL

The present study dealt with various analytical results related to traffic volume data. On the basis of data analysis as well as design of control devices, various conclusions and recommendations that have been made. These can beexplained as follows.

1. After analyzing all the parameters such as traffic volume, speed and capacity it is concluded that the present situation of the traffic on the road is very high and does not match up with the capacity of the road.
2. The traffic during the morning and evening peak hour is very high and the speed is very low as it does not provide the requiredlevel of service.
3. The traffic volume at intersection was calculated and it has been concluded that the volume exceeds the practical capacity. The Level of Service of national highway has been found under category "F".
4. The channelizing is required to be done in order to improve the level of serviceability and the signal designing should be done based on the traffic volume enters during peak hours.
5. Immediate attention needs to be given to the current condition of the road as it does not provide the required level of service.
6. Very important for urban planning are data and maps on traffic volumes and noise impact, as here local actions such as speed reduction, green noise barriers and route planning can be more easily adapted.
7. Serious measures have to be taken by the authorities to control traffic and promote the use of public transport.
8. Development of public transport network at economical rates is essential. Implementation of traffic safety rules by traffic police is a must. People should drive more sensibly and responsibly.

7.2 RECOMMENDATIONS

On the basis of above mentioned conclusions, various recommendations can be made which have been described as follows

1) By increasing the width of the road, increases the capacity of the junction. And the volume/capacity ratio is decreased. Hence the LOS is improved.
2) By improving lateral clearance, the visibility of the user is improved. Hence it will increase the free flow traffic of the junction which results in decrease in congestion and accident rate.
3) By providing effective public transport system, which enhance the free flow with high capacity.
4) The proper and strict enforcement is recommendable at the study area in order to have safe and efficient traffic flow.
5) It is recommended to have separate lanes for the waiting vehicles which, otherwise, restrict the capacity of the junction.
6) It is recommended on the site to have STOP and GIVE WAY signs and these should be appropriately visible to the road users.

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