CHAPTER 1

INTRODUCTION

1.1 GENERAL

Rapid urbanization and growth of motor vehicles impose a serious effect on human life and its environment in recent years. Most of the cities of India are being suffered by extremely high level of urban air pollution particularly in the form of CO, SO_2, NO_2, PM (Particulate Matter) and RSPM (Respirable Suspended Particulate Matter). Transport sectors contributes a major share to environmental pollution (around 70%). A among these pollutants CO is the major pollutant coming from the transport sector, contributing 90% of total emission. Hydrocarbons are next to CO. It is indeed interesting to observe that the contribution of transport sector to the particulate pollution is as less as 3-5%, most of the SPM (Suspended Particulate Matter) are generated due to re-suspension of dust out of which PM 10 is the most prominent air pollutant. NOx is another important air quality indicator. All these situations indicate that air pollution becoming a major problem in Indian context and there is an essential need to build up healthy environment and increase level of research around the world. The present study is a review of an assessment model for emitted pollutants and effective strategies to reduce air pollution due to road transport.

The anthropogenic sources of urban air pollution are classified broadly into three categories; point (industrial), area (mainly domestic cooking/heating) and line (vehicular). The main cause of air pollution is fuel combustion through any of these sources. In India, 25% of the total energy (of which 98% comes from oil) is consumed by transport sector only, which is reported to be contributing more than 50% of air pollution problem in most of the metro cities, and in some cases it was even up to 80%. As per an estimate, in 2001, air pollution contribution of transport sector was about 72% in Delhi and 48% in Mumbai.

The population of Delhi has increased from 9.42 million in 1991 to 13.78 million in 2001, registering a decadal growth of 46.3%, against the national growth rate of 21.3%. The total area of National Capital Territory (NCT) of Delhi is 1483 km^2 with an urban segment of 685 km^2 (46.2%) in 1991. The population density has increased to 9294 persons/km^2 in 2001 as compared to 6352 persons/km^2 in 1991.

The rapid population growth together with high rate of urbanization, industrialization and increase in motorized transport have resulted in an increased concentration of various air

pollutants namely; Sulphur Dioxide (SO2), Nitrogen Oxides (NOx), Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM/PM10), Carbon Monoxide (CO), Lead (Pb), Ozone (O3), Benzene, Hydrocarbons (HCs) etc. The adverse effect of pollution from vehicles gets revealed immediately through symptoms like cough, headache, nausea, and irritation of eyes, various bronchial problems and visibility impairment. Long-term exposure to the high level of pollutants is mainly responsible for respiratory and other ailments including lung cancer, asthma and in some cases leading to death. Vehicles in major metropolitan cities are estimated to account for 70% of CO, 50% of HC, 30–40% of NOx, 30% of SPM and 10% of SO2 of the total pollution loads, of which about two third is contributed by two wheelers alone.

In the past couple of decades, considerable research and development efforts have been made towards improving engine efficiency and fuel quality together with adoption of emission reduction technologies (like catalytic converter). In addition, mechanisms for better traffic management have been evolved including construction of flyovers to ensure smooth traffic flow, thereby reducing traffic congestion at major traffic intersections and ultimately reducing emissions as well as travel time. If these measures are implemented effectively, the problem of air pollution due to transport sector could be managed to a greater extent

1.2 AIR POLLUTION

Air pollution is defined as the presence of any particle or gas found in the air that is not part of the original composition.

Air pollution is a change in the physical, chemical, and biological characteristics of the air surrounding us.

1.2.1 AIR QUALITY INDEX

Air quality index (AQI) indicates whether pollutant levels in the air may cause health concerns. AQI ranges from 0 to 500, with a higher number meaning a lower air quality.

The table below provides the AQI limits for human health

Table 1.1: Air Quality Index Table

AIR QUALITY INDEX (AQI)	CATEGORY
0-50	Good
51-100	Satisfactory
101-200	Moderate
201-300	Poor
301-400	Very Poor
401-500	Severe

1.2.2 TYPES OF AIR POLLUTANTS

Air pollutants may be natural, such as wildfires, or may be synthetic (manmade).

Air pollutants are classified as primary pollutants and secondary pollutants.

(i) Primary air pollutants are emitted directly into the atmosphere by the original source

(ii) Secondary air pollutants are formed because of reactions between primary pollutants and other elements in the atmosphere, such as the ozone.

The common air pollutants are discussed below:

i. **Carbon Monoxide** - Carbon monoxide is a colorless, odorless gas. Carbon monoxide can be present in car exhaust and smoke. Carbon monoxide deprives humans of their oxygen supply, which causes headaches, fatigue, impaired vision, and even death.
ii. **Sulfur Dioxide** - Sulfur dioxide is produced when coal and fuel oils are burned and is also present in power plant exhaust. Exposure to sulfur dioxide narrows the airways in the respiratory system, which causes wheezing and shortness of breath.
iii. **Nitrogen Dioxide** - Nitrogen dioxide is both a primary and secondary air pollutant. Nitrogen dioxide is created when nitrogen reacts with oxygen in the atmosphere. Nitrogen dioxide can cause respiratory infections and other respiratory problems.
iv. **Particulate Matter** - Particulate matter contains particles of different sizes that are released into the atmosphere from various sources, including fossil fuels, dust, smoke, and fog. Particulate matter can accumulate in the respiratory system, which can aggravate the heart and lungs and increase the risk of respiratory infections.

v. **Ground-Level Ozone** - Ground-level ozone is formed from automobile, power, and chemical plant exhausts. Ground-level ozone irritates the respiratory system and causes asthma by reducing lung function.

vi. **Smog** - Smog is the combination of gases with water vapor and dust and forms when heat and sunlight react with gases, which is known as photochemical smog

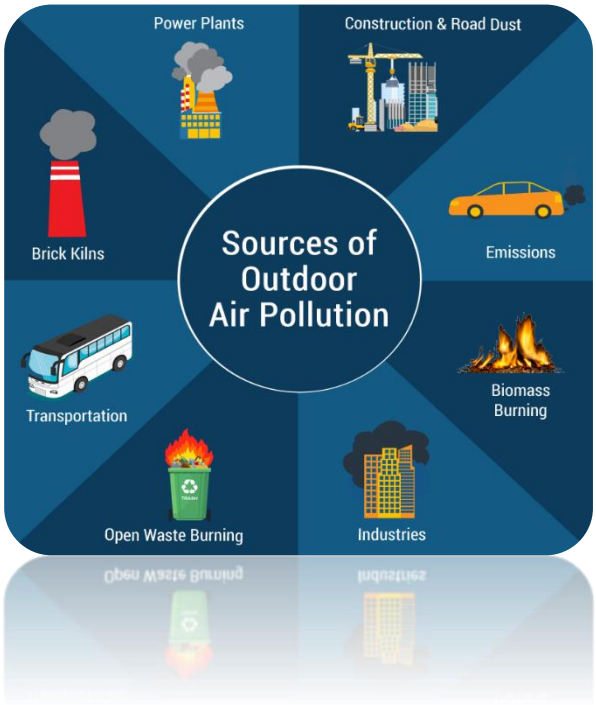

Figure 1.1: Source of Pollution

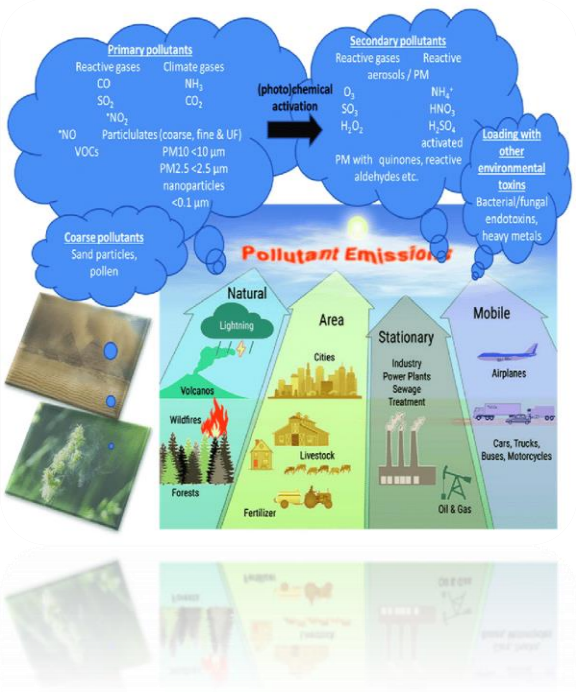

Figure 1.2: Pollution Emissions

1.3 POLLUTION ON THE MOVE

Pollution from human-generated and natural sources is often created in one place and transported through the air. Sometimes chemical reactions in the atmosphere change pollutants before they are deposited. Pollutants in the air can create haze, making it harder to see, and pollutant deposition can have biological effects

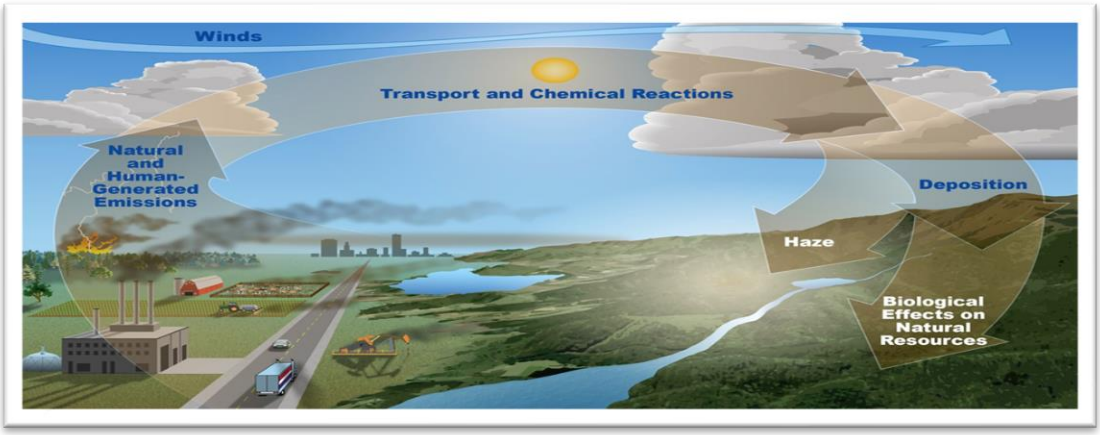

Figure 1.3: Pollution on the move

The main cause of air pollution is fuel combustion through any of these sources. In India, 25% of the total energy (of which 98% comes from oil) is consumed by transport sector only, which is reported to be contributing more than 50% of air pollution problem in most of the metro cities. In some cases, it was even up to 80%. As per an estimate, in 2001, air pollution contribution of transport sector was about 72% in Delhi and 48% in Mumbai. Automobile pollution contribution in terms of CO and NOx is estimated to be more than 80 and 40% respectively. The adverse effect of pollution from vehicles gets revealed immediately through symptoms like cough, headache, nausea, and irritation of eyes, various bronchial problems and visibility impairment. Long-term exposure to the high level of pollutants is mainly responsible for respiratory and other ailments including lung cancer, asthma and in some cases leading to death

1.4 TRAFFIC VOLUME:

Traffic Volume is defined as the procedure to determine the volume of traffic or number of vehicles moving on the roads at a particular section during a particular time period. This time period can be in 'minutes', 'hours' or 'days' etc.

1.5 TRAFFIC FLOW:

Flow is the rate at which vehicles pass a given point on the roadway, and is normally given in terms of vehicles per hour. The 15 minute volume can be converted to a flow by multiplying the volume by four.

1.6 TRAFFIC DENSITY:

Traffic density is the average number of vehicles that occupy one mile or one kilometre of road space, expressed in vehicles per mile. Traffic density is a fundamental macroscopic characteristic of traffic flow, and is used in assessing traffic performance from the point of view of users and system operators.

1.7 SPEED:

Speed is the ratio between distance and time. The formula for calculating speed that is:

S = D/T , Where S = Speed, D = Distance, T = Time.

1.11 NEED FOR STUDY:

- As there is a huge environmental pollution in Tirupati city mainly due to large number of vehicles, it is necessary to conduct the studies relating traffic density (number of vehicles per unit distance) with the air pollution.
- Also, limited studies reported the literature that explicitly relate the traffic density with air pollution level at the given location.
- Therefore, it is necessary to focus on such areas and studies need to be conducted to quantify the air pollution levels and suggest necessary steps to be taken to minimize the environmental air pollution.

1.10 OBJECTIVES:

- To study the traffic density, traffic volume and air quality by using the Breezometer app in peak hour.
- To compare and contrast the values of given past and present data.
- To analyse and correlate traffic density with air quality.
- To suggest ideas, reduce the air pollution and help in addressing the measures.

1.11 SCOPE OF STUDY

1. . **Identification of pollutants**: While the study measured the overall air quality index (AQI), it did not identify the specific pollutants that are contributing to the air pollution.

2. **Health impacts**: The study did not assess the health impacts of air pollution on the residents living in the areas studied.
3. **Traffic patterns**: The study only collected traffic data during peak hours. Future studies could analyse traffic patterns throughout the day to understand the daily traffic flow and identify other potential areas of high traffic density that contribute to air pollution.
4. **Alternative transportation modes**: The study did not investigate the use of alternative transportation modes such as public transit, bicycles, or walking.
5. **Urban planning:** The study did not analyse the impact of urban planning on traffic congestion and air pollution.

CHAPTER-2

LITERATURE REVIEW

S.Gulia and **R.Kumar et.al (2022)** has mainly focused on Urban air pollution and exposure which it is related to health impacts and it is being noticed and discussed. Many cities across the world have witnessed high air pollution levels at traffic junctions and so on. The researcher consider the Site-specific air pollution reduction can be a promising solution for managing the pollution level at highly polluted locations. This study was conducted to manage the ongoing pollution in Delhi and the study is still ongoing thus far the basic results seem to be succeeding according to the authors.

G.Sharmila (2022) has explained about Analysis of air pollutants. Air pollution problems are the top environmental problems persisting. The urban transportation has drastically improved over the recent years contributing to more vehicular growth. Vehicular congestion and traffic have paved ways to increase in vehicular air pollution. The centralizations of toxins near streets are all around connected to transportation, so these markers can be utilized as a pointer of density of residents and also they signify as the metropolitan toxic wastes which pollute the surroundings. This study helps in analysis of the pollutants in and around city.

Sharmila Ganesan, Thaniarasu (2021) have performed a comparative analysis on the pollution data that was collected from three heavy traffic zones in the metropolitan city of Chennai. From the study, comparing with the three locations, based on the vehicle count, among all other vehicles, motorcycles are the highest in count. The paper discusses about the effects growing vehicular congestion and studies the different proportions in which the two wheelers and four wheelers contribute to pollution.

K.Singh and M.Pal et al (2021) mainly focused on Best ways to control air pollution due to industrialization, urbanization and increasing of vehicles air. Now a days particulate matter shows the undesirable effects on plants, animals and human beings also. In this research the author has consider Tree plantation programme. Since it is the best ways to control the air pollution. Most of the plants filter the air by their aerial elements. Air pollution tolerance index can be used as an indicator regarding to the air pollution. By combining biochemical and aggregate factors the anticipated

performance index (API) is prepared which is used as development of green belt. Thus, the assessment of APTI and API potential of different trees are used to control air pollution.

Sagar Shinde (2021) worked on Poor air quality in growing cities. In this paper the author consider the correlation between rising vehicle numbers, particularly two-wheelers – and air quality regarding to health in Delhi, India. Pollutants like carbon monoxide, nitrogen oxides and sulfur dioxide were measured in the city over 2 years. Hence peak values occurred in winter months and those of carbon monoxide and nitrogen dioxide were over double national air quality limits. At last, author proposed the Measures to improve urban air quality. The proposed measures where controlling of the carbon effluents and that emission be reduced through environmental friendly substitutes.

Breeze technologies (2021) has mainly focused on Air pollution related to environmental health risk, killing approximately 7 million worldwide every year. Ambient air pollution accounts for 4.2 million of those deaths, of which traffic and mobility are a major source. Global transport carbon dioxide (CO_2) emissions in 2018 totaled 8 billion tons, of which 74% came from road vehicles. Given that 55% of the world's population live in urban areas, which tend to have the most traffic, city dwellers are at highest risk with the resulting air pollution. The article was the work done under the company where the authors were also the researchers working towards the goal to make urbanization sustainable.

Navroz K Dubash (2020) has explained on Air pollution due to vehicle exhaust. Air pollutants, like PM 2.5 exceeds the standards the most, followed by PM 10, NO2, CO, and Ozone. The only pollutant to comply the national standards is SO2. Sources of each of these pollutants vary, in terms of percent contributions from various sources. However, the main sources contributing to air pollution are well identified and this list is common for all Indian cities – vehicle exhaust, heavy industry including power generation, small scale industries including brick kilns, suspended dust on the roads due to vehicle movement and construction activities, open waste burning, combustion of various fuels for cooking, lighting, and heating, in-situ power generation via diesel generator sets. As the author notices these rates in Delhi, he state the reasons behind the extremity of it.

Usha Gupta (2019) has mainly focused on Monetary benefits to individuals from health damages avoided if air pollution is reduced in the urban industrial city of Kanpur in India. A notable feature of this study is that it uses data from weekly health-diaries collected for three seasons for measuring monetary benefits, the study considers two major components of health cost that is incurred due to adverse effects of air pollution on health. The study estimates that a representative working individual from Kanpur would gain Rs. 165.47 per year if air pollution were reduced to a safe level. The extrapolated annual benefits for the entire population in the city are Rs. 224.55 million.

Lili Jiang et.al (2019) worked on quantify the effects of vehicular emissions beyond just air pollution i.e. on wind, rain and other near surface dynamics. This work has performed a centred around a grid oriented geostatic based approach, where Central Beijing, the capital city of China is the subject of study. The result of this study is to attempt examine the spatiotemporal connections between traffic levels and particulate matter.

Joel Botai et.al (2019) in their research work evaluated that, "The effects of rise in number of road vehicles on the outdoor pollution measurement in another third world country of African continent, Nigeria. A collection of time series data set was done for over a period of 1 year of the mentioned parameters in a total of 19 study sites. The vehicles involved in the count were classified into two wheelers, tri cycles, cars, buses, light duty and heavy duty vehicles. The result of this study is pollution quantification was based on the measured quantities of sulphur dioxide, carbon monoxide and particulate matter."

Zaydoun Abusalem et.al (2019) has done an work on the impact of technical variables like vehicle speed, gradient and traffic volume on the instantaneous tailpipe emissions. This study focuses on environmental issues that can be considered and modelled in order to be included in all generalised plans. The concentrations of CO, NO, TVOC's and SO were monitored periodically at various sampling sites. The study also evaluates how effective prior planning of urban transportation infrastructure can help vastly reduce the noise and air pollution. The result of this paper is concentration of air pollutants is based on traffic flow and transient driving conditions.

Surender Kumar (2019) has worked on Critical overview of urban air pollution and traffic congestion in India. It discusses temporal and spatial variations in the level of urban air pollution and traffic congestion in the country and challenges posed by them. India loses about 2 per cent of its GDP because of urban air pollution. The result of this paper shows

the studies on it affects the air quality due to urbanization of the city from recent findings and surveys of that time writing a thesis referring to those findings.

Artur et.al (2018) mainly focused on Global environmental hazards and Human Population due to Air pollution. It is caused by different chemical compounds emitted by industry, vehicles and households. The latest worldwide research has proven the relationship between the exposure to air pollution and an increased mortality rate due to cardiovascular and respiratory diseases. Air pollution also has an adverse effect on the human reproductive potential. It is the objective of the present article to analyse the current knowledge about the relationship between hazardous substances present in the air and human fertility function. The relationship between the exposure to air pollution and reduced female fertility, as well as the risk of miscarriage and genetic disorders (e.g. Down syndrome), teratogenic effects (congenital heart defects, neural tube defects, cleft palate) and the low birth weight of fetes, has been already confirmed.

Fu-lun Chen et.al (2017) have attempted to establish an important factor to evaluating health risk due to near road air pollution. This study introduces three new traffic density based indices namely the major road density, all-traffic air density, heavy traffic density to better understand the relationship between vehicle emissions and near road air pollution.

Anu Rani Sharma, KVS (2010) in this study the author explained about, impact of vehicular traffic emissions on black carbon aerosol mass concentration, trace gases and ground reaching solar radiation were analysed during nationwide truck strike of 5–12 January, 2009 over urban environment of Hyderabad, India. A significant reduction of about 57%, 60%, 40% and 50% was observed in black carbon, particulate matter, carbon monoxide and ozone respectively during nationwide truck strike period. The is study are important for source apportionment of pollutants as the strike created natural laboratory for studying the impact of diesel operated trucks on urban air quality.

S.K.Goyal, P.Nema et.al (2005) has worked on Problems from Air pollution in megacities and large urban areas throughout the globe, and transportation is recognized as the major source of air pollution in many cities, especially in developing countries. Contribution of automobiles is reported in the range of 40 to 80% of the total air pollution. The paper focuses on deriving the benefits of the implementation of management strategies, supported, scientific and technical data/ interpretation, so that the people can realize and participate in the government's endeavour for clean city drive in a more effective manner

CHAPTER 3

METHODOLOGY

3.1 GENERAL:

The study here has some procedure & few steps includes which help to do the work in proper manner. The steps help us to perform well, it will, it will help to know what to do next. The following flow chart shows step wise process of the methodology adopted.

This includes the following steps they are as follows:

- Problem identification
- Literature review
- Objective formulation
- Selecting the location / study area
- Collection of data
- Analysis of data
- Preliminary result of data
- Results and Conclusions

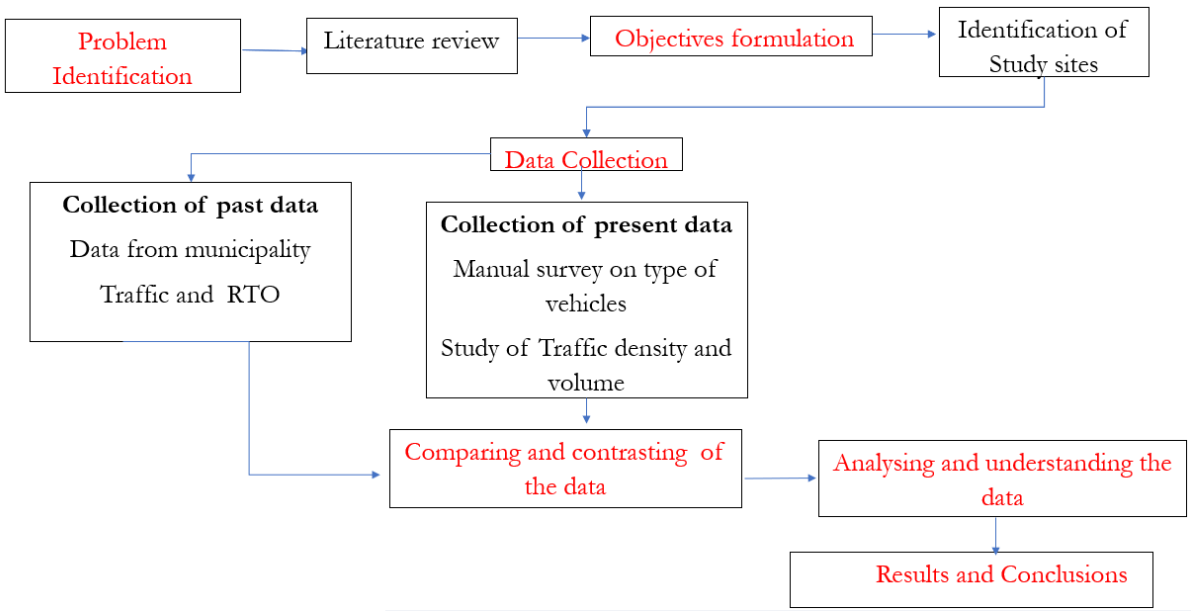

Figure 3.1: Representation of methodology through flow chart

3.2 STEPS OF METHODOLOGY:

1. Problem identification:

In this section we can identify the problem of most busy areas and pollution areas in tirupati and short listed the areas in excel sheet and their air quality index and also we have identified the sites traffic and geo

2. Literature review:

A literature review is an essential component of academic research, which involves a comprehensive and systematic analysis of existing scholarly literature on a specific topic or research question.

3. Objective formulation:

Objective formulation refers to the process of defining clear and specific goals or objectives that outline what an individual, team, organization, or project aims to achieve. Objective formulation is an important step in planning and strategic management as it provides a roadmap for guiding actions, decision-making, and performance evaluation.

4. Selecting the location / study area

Selecting the location / study area is the process of selecting a specific location or area for a particular project or purpose. In the context of traffic and air pollution, site identification involves identifying a location where traffic-related issues and air pollution are prevalent or expected to be a concern.

5. Collection of data

Data collection is a critical step in the process of addressing traffic and air pollution issues at a specific site. It involves gathering relevant information and data related to traffic patterns, air quality, and other factors that can influence the extent and severity of the problem.

Collecting past data is an important step in understanding the historical trends and patterns of traffic and air pollution at a specific site. Collecting present data requires ongoing monitoring and data collection efforts to capture the current status of traffic and air pollution at a specific site.

6. Analysing the Data:

Analysing and understanding the data collected for traffic and air pollution is a critical step in the site selection process, as it helps to identify patterns, trends, and relationships within the date.. the data collected for traffic and air pollution is essential for drawing meaningful conclusions and informing decision-making. It helps identify patterns, trends, and relationships within the data, and provides evidence-based insights that can guide the development of effective mitigation strategies and measures to address traffic and air pollution issues at the selected site.

7. Preliminary result of data :

Comparing and contrasting the past and present data collected for traffic and air pollution at a specific site can provide valuable insights into the changes that have occurred over time and the effectiveness of mitigation measures. This data can provide valuable insights into the changes that have occurred over time and the effectiveness of mitigation measures in addressing traffic and air pollution. It can help inform decision-making and guide the development of targeted and evidence-based mitigation strategies to improve traffic management and reduce air pollution impacts at a specific site.

8. Result and conclusion

After analysing and understanding the data collected for traffic and air pollution, the results and conclusions drawn from the analysis can provide valuable insights for the project.

The results and conclusions of the data analysis are crucial in informing the decision-making process and guiding the development of effective strategies and measures to address traffic and air pollution at the selected site.

CHAPTER 4

IDENTIFICATION OF STUDY LOCATION

4.1. GENERAL:

Choosing the study area for obtaining accurate results is necessary as the study is based on traffic and the type of air pollution to deal with. Each study area is unique and necessary parameters are needed to maintain accuracy.

Depending on the air pollution zones i.e. residential and commercial zones respectively where Tirupati city lies within, these parameters helps in determining the pollutants, type of pollution and AQI levels needed for the study.

4.2. SELECTION OF STUDY AREA:

The selection of the study area is taken in Tirupati city, After analysing different locations for study are , the best possible locations was selected by considering every traffic parameter and factor that is required for the execution of the present study. The particular stretch which accepts all the parameters and factors was adopted and further processes of the study were executed on the stretch.

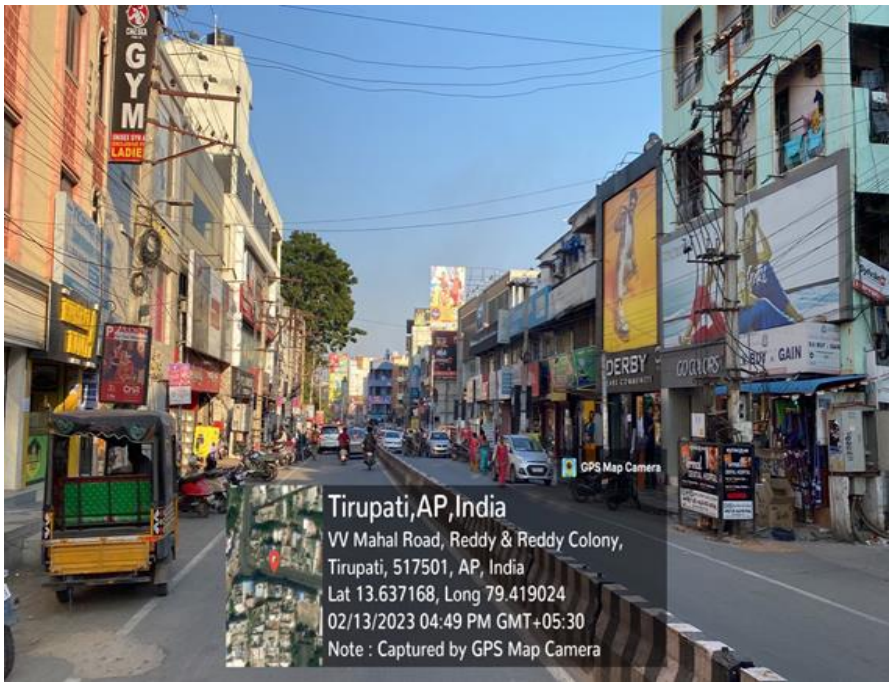

Figure 4.1: V.V. Mahal road

Figure 4.2: Tiruchanoor Road

4.3 STUDY AREA:

Study sections of V.V.Mahal road and Tiruchanoor road were selected as they come under the busiest commercial zones and also connect residential areas. The selection of study sites was based on the air pollution with the help of Breezometer app used to calculate the air quality index of the study area, so that these busy areas in the Tirupati city were taken. busy areas in Tirupati city include V.V.Mahal, Tiruchanoor Road, Air Bypass Road, Prakasam Road, New Balaji Road, Sanidhi Street, Alipiri Road.

And their air pollution data is given as below:

Table 4.1: Average Air quality index of busy areas in Tirupati city

ROAD NAMES	AIR QUALITY INDEX
V.V.MAHAL ROAD TIRUPATI	138
TIRUCHANOOR ROAD TIRUPATI	177
AIR BYPASS ROAD TIRUPATI	132
PRAKASAM ROAD TIRUPATI	104
NEW BALAJI ROAD TIRUPATI	121
SANIDHI STREET	117
ALIPIRI ROAD TIRUPATI	120

Factors for the selection of the study area:

- ❑ High air pollution compare to other busy areas
- ❑ Lies under both commercial and residential zones.
- ❑ It is the busiest as it connects many commercial and residential areas.
- ❑ Many shopping malls, schools and college are present near the circle
- ❑ It is best route as it connects many other roads.
- ❑ APPCB stations are located nearby.

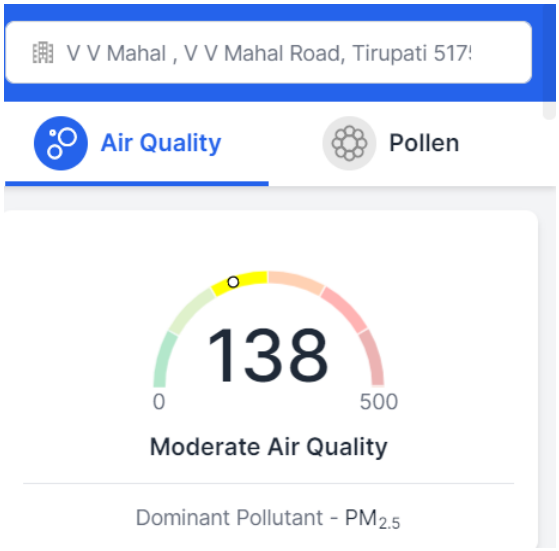

Figure 4.3: AQI of V.V. Mahal Road

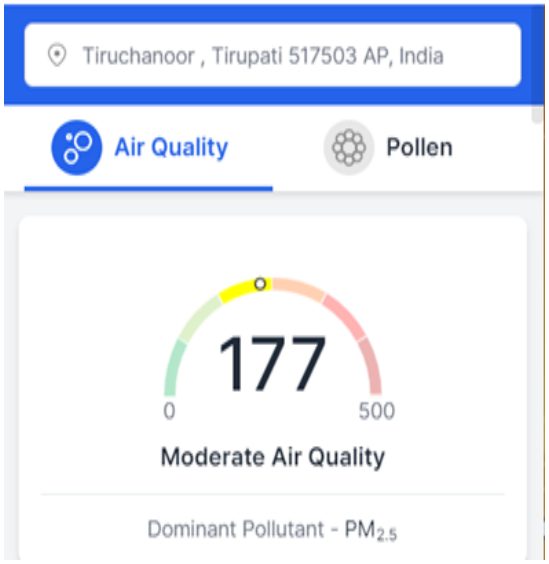

Figure 4.4: AQI of Tiruchanoor Road

- **The GPS view shows the areas connecting through V.V.Mahal and Tiruchanoor road respectively.**

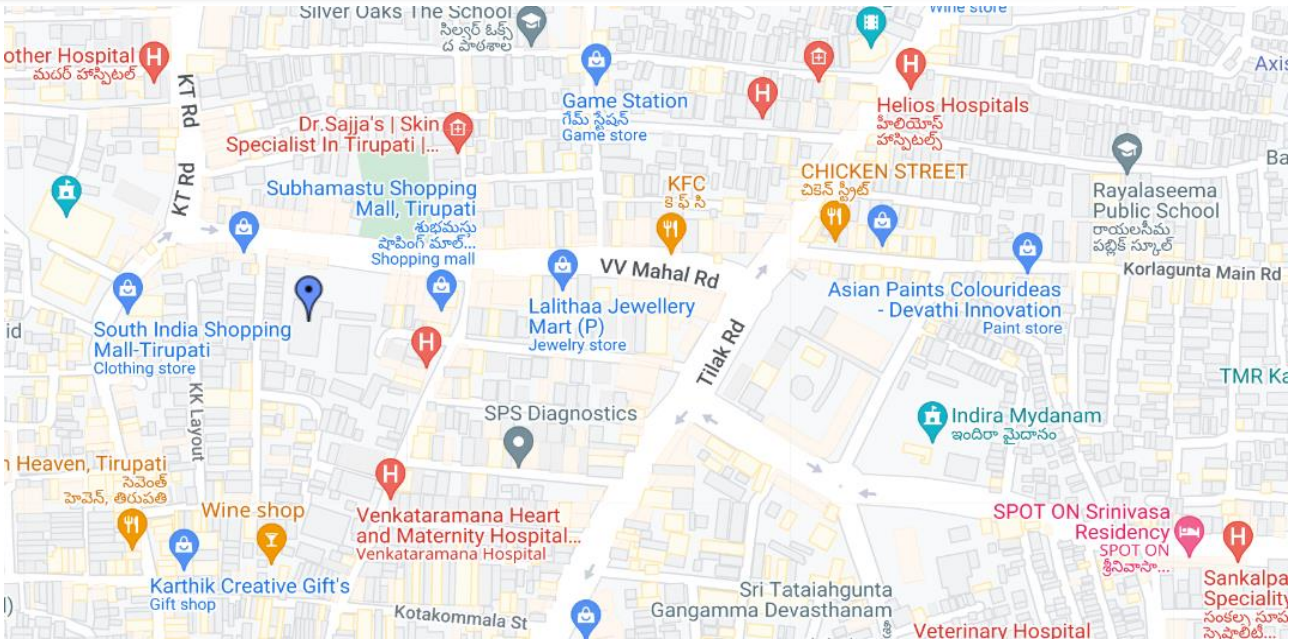

Figure 4.5: GPS view of V.V.Mahal road

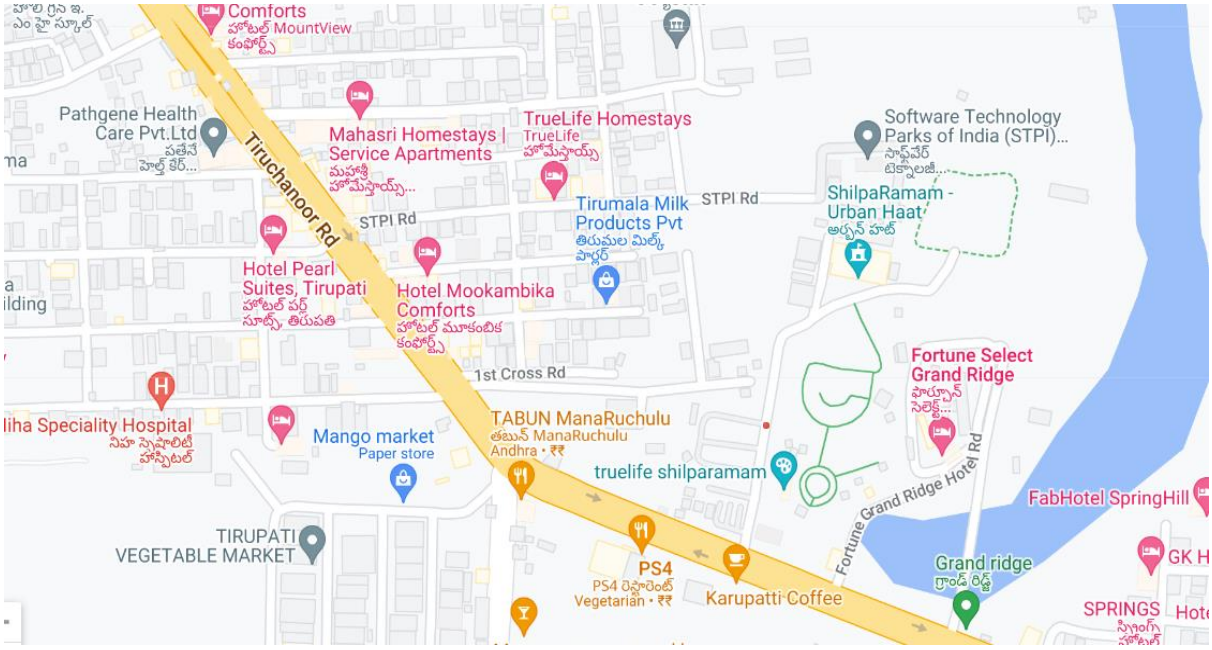

Figure 4.6: GPS view of Tiruchanoor road

4.4. GEOMETRIC DETAILS OF THE SELECTED ROAD STRETCH:

V.V.MAHAL ROAD TIRUPATI

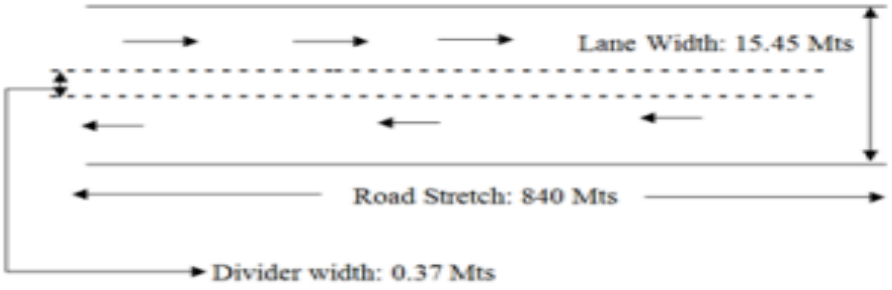

Figure 4.7: Road stretch of V.V.Mahal road

Geometric details:

The total lane width is 15.45 mts , where this is considered a 4 lane road the stretch of road is 840 mts and the length of the divider width 0.37 mts.

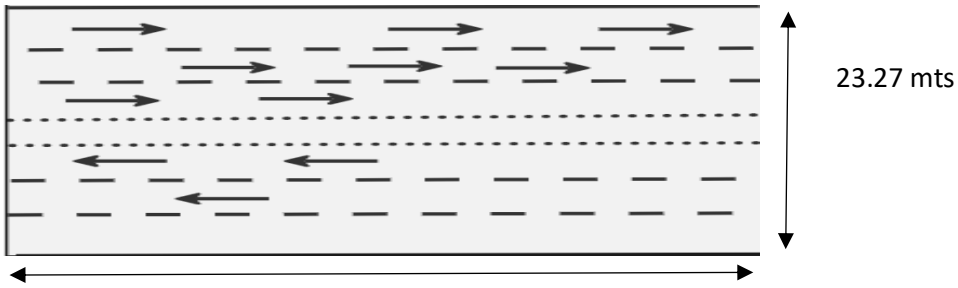

Figure4.8: Road stretch of Tiruchanoor road

Geometric details:

The total lane width is 23.27 mts , where this is considered a 6 lane road the stretch of road is 1.30 km and the length of the divider width 1.7 mts .

CHAPTER-5

DATA COLLECTION

5.1 GENERAL:

After site selection our primary aim is to identify the peak hour of the site. By taking a four hour time slot in the week and collecting the data of both sites in both direction of road stretch V.V.Mahal and Tiruchanoor road in Tirupati. The data required is collected by using mechanical method called (traffic count app) for a time period of 1 hour according to slot time for week. the semi-manual method was used to collect the data in the given timings.

Table No.5.1 Time slots taken for data collection.

Slot 1: 8-9 am	**Slot 3: 5-6 pm**
Slot 2: 9-10 am	Slot 4: 6-7 pm

5.2 DATA COLLECTION:

The interface of the app is shown below:

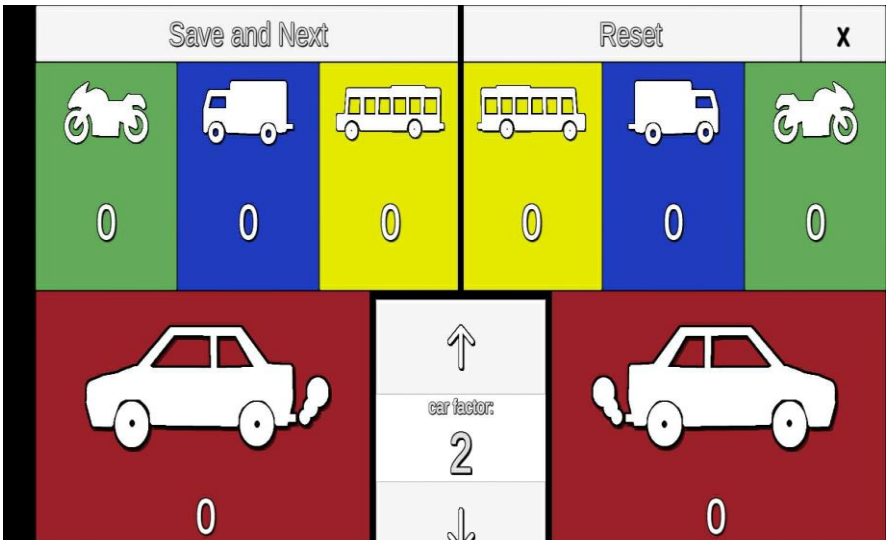

Fig No. 5.1 sample pic of mechanical method of data collection

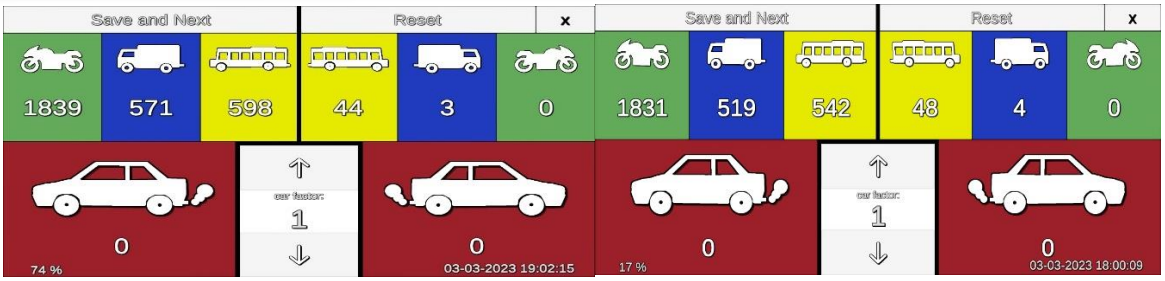

Figure 5.2: Sample pictures of data collection from the study area.

After surveying the site, from the app that was used to collect data, the necessary data was uploaded in excel sheets for better analysis, as shown below.

Table .5.2 Sample pic of data collection in the excel format

ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION E/
DATE	MONDAY	MONDAY	MONDAY	MONDAY	TUESDAY	TUESDAY	TUESDAY
TIME SLOT	8-9 AM	9-10 AM	5-6 PM	6-7 PM	8-9 AM	9-10 AM	5-6 PM
DIRECTION	WEST SIDE	WEST SIDE	WEST SIDE	WEST SIDE	WEST SIDE	WEST SIDE	WEST SIDE
BIKE	1751	1872	1821	1976	1758	1787	1632
AUTO	438	456	522	594	412	481	515
CARS	359	324	371	307	279	325	392
BUS	42	42	60	34	27	42	49
TRACTORS	2	3	3	2	2	4	4
TOTAL COUNT	2592	2697	2777	2913	2478	2639	2592

ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION I	TIRCHANOOR ROAD (VEHICLE DIRECTION W
DATE	MONDAY	MONDAY	MONDAY	MONDAY	TUESDAY	TUESDAY	TUESDAY
TIME SLOT	8-9 AM	9-10 AM	5-6 PM	6-7 PM	8-9 AM	9-10 AM	5-6 PM
DIRECTION	EAST SIDE	EAST SIDE	EAST SIDE	EAST SIDE	EAST SIDE	EAST SIDE	EAST SIDE
BIKE	1697	1784	1991	2092	1636	1750	1592
AUTO	512	545	571	628	512	549	621
CARS	371	392	347	407	297	240	318
BUS	39	43	49	48	39	32	41
TRACTORS	4	5	3	4	3	3	2
TOTAL COUNT	2623	2769	2961	3179	2487	2574	2574

the data in excel sheet in both direction of east to west direction and west east direction of vehicles in both time slot mentioned above. This data was used in the analysis of the peak hours. The 5 categories of vehicles in both the location were taken and in bus categories added the mini-bus, vans, tracks and other heavy vehicles.

The data collected is as follows:

Table No.5.2 Data of V.V.Mahal road

DAYS/TIMIE	8-9 AM	9-10 AM	5-6 PM	6-7 PM
MONDAY	1737	4489	4330	3677
TUESDAY	4862	5900	4870	4577
WEDNESDAY	3413	4164	4702	4535
THURSDAY	2614	4638	4401	4142
FRIDAY	4023	4860	4001	4780
SATURDAY	3772	5003	5477	5121
SUNDAY	6321	6804	7196	6525
TOTAL COUNT	**26742**	**35858**	**34977**	**33357**

Table No.5.3 Data of Tiruchanoor road

Day	8-9am	9-10 am	5-6 pm	6-7 pm
Monday	5215	5466	5738	6092
Tuesday	4965	5213	5166	5271
Wednesday	5087	5724	5992	5822
Thursday	5360	5694	6056	6060
Friday	5354	5830	6043	6132
Saturday	6333	6517	6530	6497
Sunday	6640	6854	6932	7663
Total	38954	41298	42457	43537

5.3 IDENTIFICATION OF PEAK HOUR

After collection of data identification of the peak hours from the data as follows:

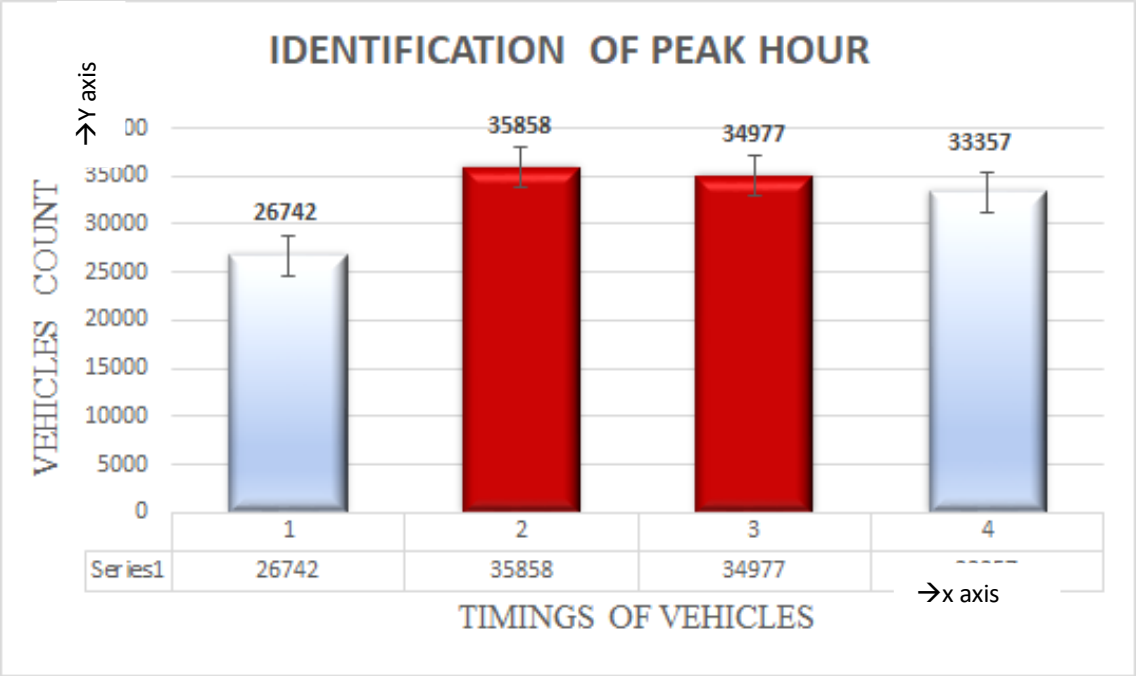

Figure 5.3: Peak hour of V.V.Mahal road

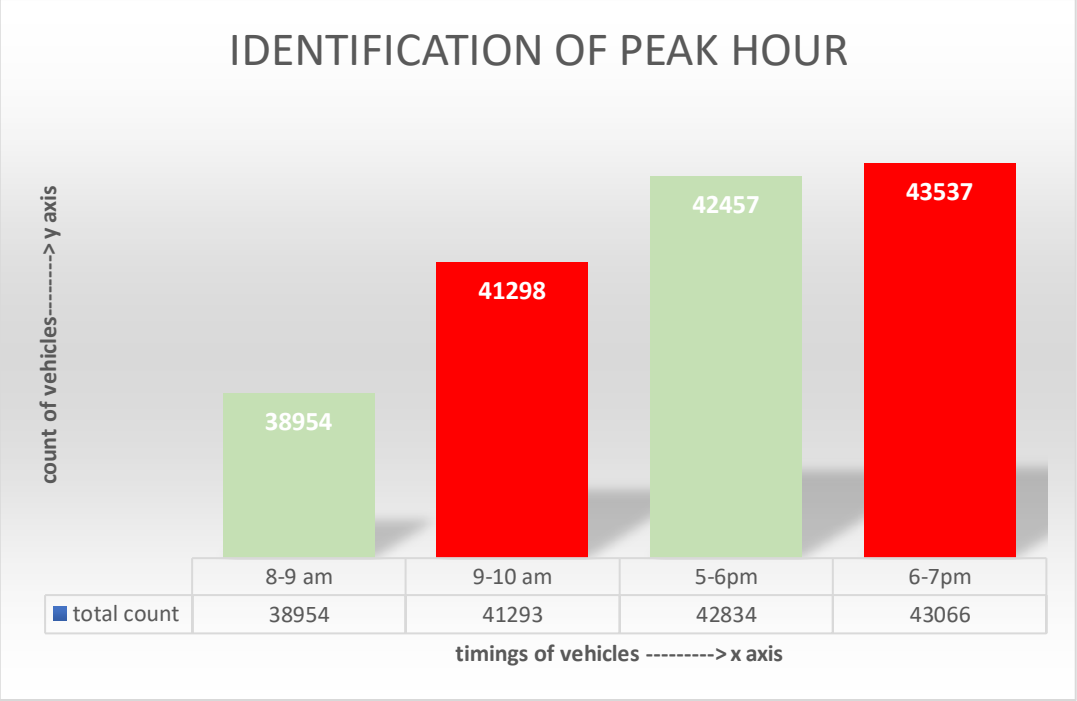

Figure 5.4: Peak hour of Tiruchanoor road

Identification is done based on the vehicles count on the different time slot mentioned. First the data on day wise on slot wise extracted in the excel sheet and the by calculating the total count of vehicles of time slot the identified the peak hour of the site. The above graph represents the vehicles count on different timings.

Peak hour of V.V.Mahal are time slot of morning is 9-10 am and evening time slot 5-6 pm and Tiruchanoor road peak hour time slot is 9-10 am and 6-7 pm.

Table No 5.4 Peak hour of different sites

Peak hour of different sites	
V.V.Mahal road	Slot 1(Morning) 9-10 am Slot 2(Evening) 5-6 pm
Tiruchanoor road Tirupati	Slot 1(Morning) 9-10 am Slot 2(Evening) 6-7 pm

5.4 EXTRACTION OF GRAPH

Different types of vehicles contribution towards the traffic volume in percentages are:

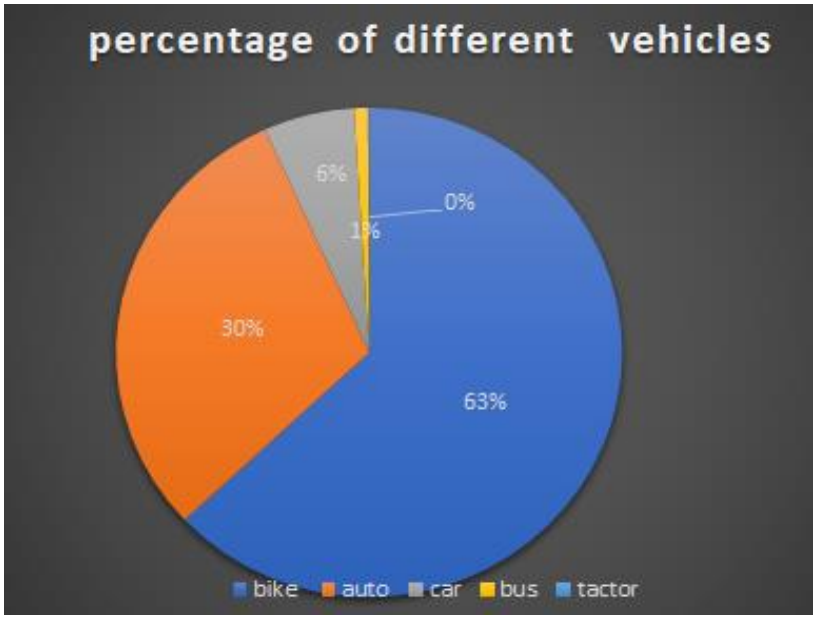

Figure 5.5: V.V.Mahal road different vehicles traffic volume percentage.

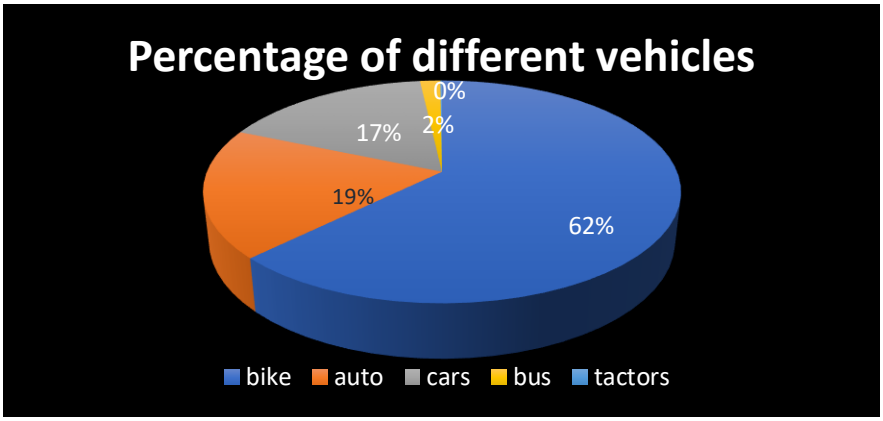

Figure 5.6: Tiruchanor road different vehicles traffic volume percentage.

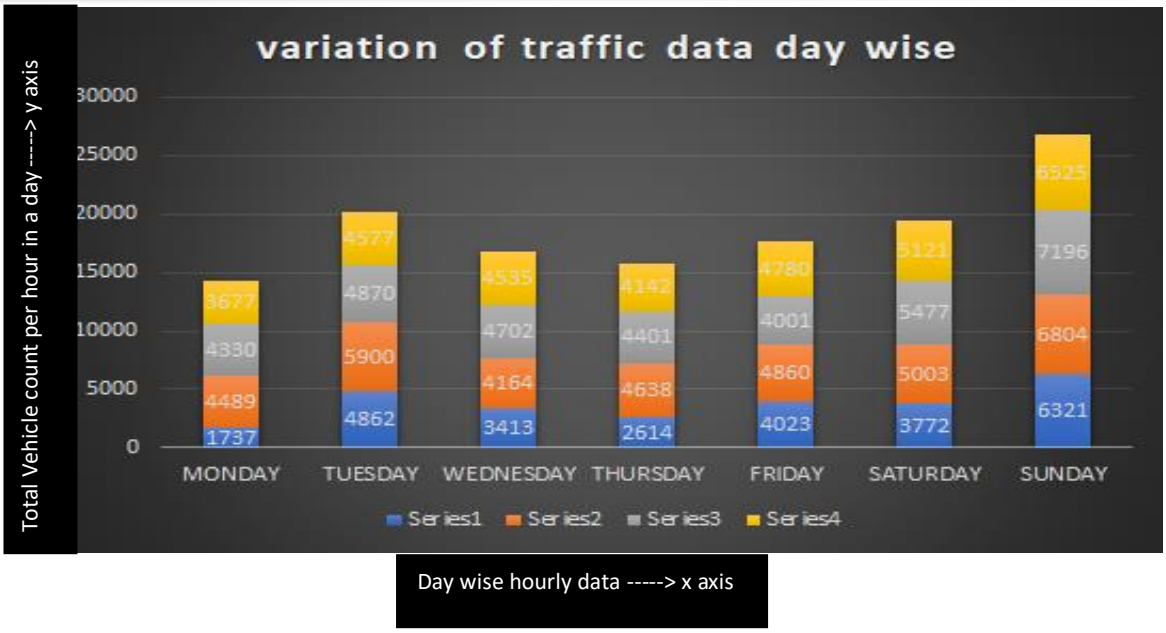

Figure 5.7: variation of traffic data day wise of V.V.Mahal

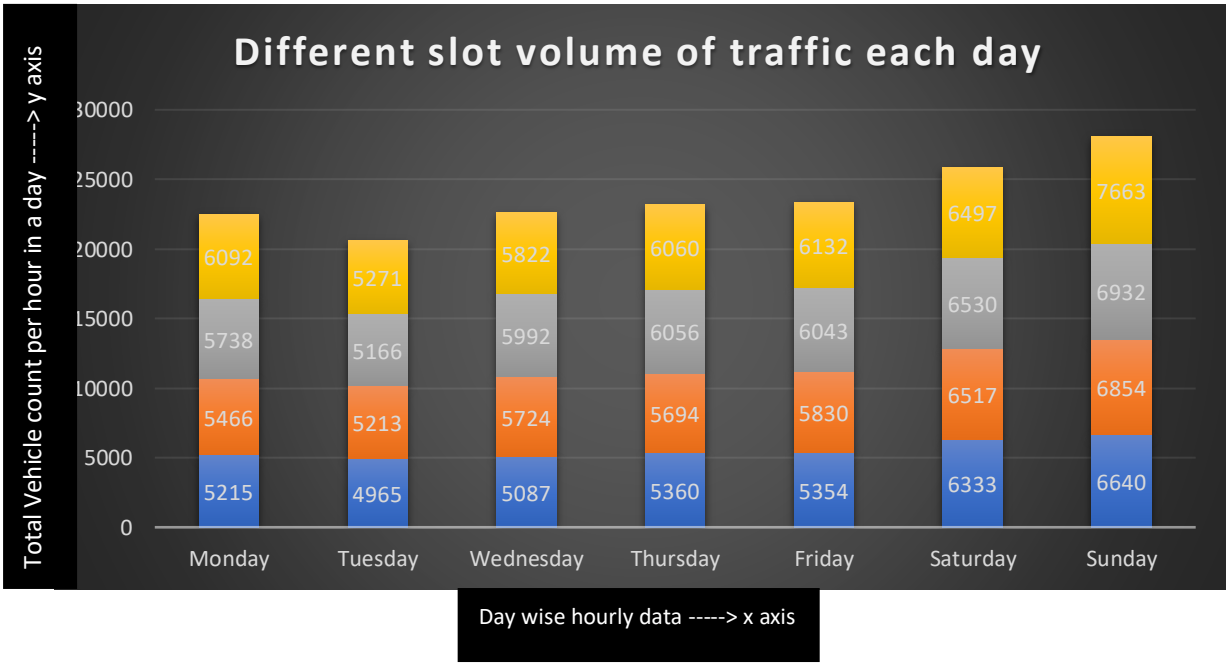

Figure 5.8: variation of traffic data day wise Tiruchanoor road Tirupati

The above graphs explain about the different vehicles count and different type of vehicles in the time slot of site and we can see that the peak hour of V.V.Mahal and Tiruchanoor road have different peak hour and the vehicles count of both the sites are different.

5.5 Present data collection

After identification of peak hour, the present data was collected from the sites The calculation of traffic volume as follows:

- For a week data was collected using the traffic counter app where simultaneously took the video of the traffic flow that helped in determination of peak hours.
- The data was collected on daily basis where the study area was visited daily to study the traffic flow for 4 hours i.e. 2hours morning 2 hours in the evening.
- By the data that had been collected the determination of peak hours was done.
- Peak hours is determined by the highest moving traffic in the surveyed time interval.
- To establish the traffic volume, we have taken the data from the morning and evening peak times, which are each 1 hour long, and divided them by the greatest value of the number of vehicles.
- Traffic volume is calculated with total no of vehicles passing through a stretch of road in the given time interval.
- From these calculation of traffic volume this helps in indicating the density of the traffic

Calculation of the traffic density as follows:

- The collected traffic volume dividing with the speed limit of the road gives us the traffic density.

  Q = k * v

  - Q= volume
  - k=density
  - v=velocity
- The data collected from V.V.Mahal and Tiruchanoor road is used to calculate traffic density and volume as mentioned above
- To the extracted the traffic volume that says the amount of vehicles and density that determines the movement of the traffic .
- From this the calculated AQI data is determined where vehicular emissions are shown

Vehicular pollutants are as follows:

Table 5.5: V.V Mahal past data collection

ROAD	AHAL ROAD TIRUPATI (VEHICLES DIRECTION EAST TO WEST													
DATE	Monday	Monday	Tuesday	Tuesday	ednesda	ednesda	Thursday	Thursday	Friday	Friday	Saturday	Saturday	Sunday	Sunday
TIME SLOT	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM
DIRECTIO	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to we	ast to west
BIKE	1498	1543	1571	1493	1384	1434	1498	1543	1391	1495	1621	1720	1695	1698
AUTO	392	413	512	452	415	492	392	413	430	482	593	612	525	573
CARS	91	97	103	112	94	105	91	97	101	97	132	139	123	129
BUS	17	21	29	21	21	17	17	21	20	19	27	32	28	35
TRACTORS	2	2	2	2	2	1	2	2	2	3	1	2	4	2
TOTAL CO	2000	2076	2217	2080	1916	2049	2000	2076	1944	2096	2374	2505	2375	2437

ROAD	AHAL ROAD TIRUPATI (VEHICLES DIRECTION WEST TO EAST													
DATE	Monday	Monday	Tuesday	Tuesday	Wednesc	Wednesc	Thursda	Thursda	Friday	Friday	Saturday	Saturday	Sunday	Sunday
TIME SLOT	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM	9-10 AM	5-6 PM
DIRECTION	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to e.	west to east
BIKE	1397	1434	1419	1372	1314	1451	1393	1420	1405	1414	1591	1638	1583	1614
AUTO	412	475	451	466	399	412	431	425	502	499	609	625	495	549
CARS	95	90	113	109	101	103	106	110	96	115	133	128	125	119
BUS	25	28	19	23	24	22	26	20	23	24	42	38	29	23
TRACTORS	3	2	1	2	1	3	3	2	1	2	2	3	3	4
OTAL COUI	1932	2029	2003	1972	1839	1991	1959	1977	2027	2054	2377	2432	2235	2309

Table 5.6: Tiruchanoor road present data collection

ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION EAST TO WEST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION EAST TO WEST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION EAST TO WEST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION EAST TO WEST SIDE)		ROAD	TIRCHANOOR
DATE	Monday	Monday	DATE	Tuesday	Tuesday	DATE	Wednesd	Wednesday	DATE	Thursday	Thursday	DATE	Friday	Fri
TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7
DIRECTION	west	west	DIRECTION	west	west	DIRECTION	west	west	DIRECTION	west	west	DIRECTION	west	we
BIKE	1720	1982	BIKE	1635	1843	BIKE	1572	1732	BIKE	1681	1735	BIKE	1608	
AUTO	532	594	AUTO	525	585	AUTO	512	529	AUTO	542	543	AUTO	538	
CARS	391	385	CARS	343	351	CARS	331	328	CARS	382	343	CARS	391	
BUS	39	44	BUS	35	38	BUS	34	29	BUS	28	32	BUS	29	
TRACTORS	5	3	TRACTORS	4	4	TRACTORS	3	6	TRACTORS	4	3	TRACTORS	4	
TOTAL COUNT	2687	3008	total count	2542	2821	total count	2452	2624	total count	2637	2456	total count	2570	

ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION WEST TO EAST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION WEST TO EAST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION WEST TO EAST SIDE)		ROAD	TIRCHANOOR ROAD (VEHICLE DIRECTION WEST TO EAST SIDE)		ROAD	TIRCHANOOR
day	Monday	Monday	DATE	Tuesday	Tuesday	DATE	Wednesd	Wednesday	DATE	Thursday	Thursday	DATE	Friday	Fri
TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7 pm	TIME SLOT	9-10 am	6-7
DIRECTION	east	east	DIRECTION	east	east	DIRECTION	east	east	DIRECTION	west	west	DIRECTION	west	we
BIKE	1642	1972	BIKE	1689	1878	BIKE	1634	1781	BIKE	1721	1823	BIKE	1643	
AUTO	546	573	AUTO	491	539	AUTO	531	548	AUTO	523	531	AUTO	512	
CARS	383	391	CARS	359	374	CARS	393	376	CARS	371	342	CARS	372	
BUS	43	48	BUS	34	41	BUS	27	31	BUS	26	24	BUS	26	
TRACTORS	4	6	TRACTORS	5	3	TRACTORS	4	3	TRACTORS	5	3	TRACTORS	5	
TOTAL COUNT	2618	2990	total count	2578	2835	total count	2589	2739	total count	2646	2723	total count	2558	

5.6 Past data collection

Collecting past data is an important step in understanding the historical trends and patterns of traffic and air pollution at a specific site. Past data can provide valuable insights into the changes that have occurred over time and help establish a baseline for evaluating the effectiveness of mitigation measures. Here are some considerations for collecting past data.

- Historical Air Quality Data
- Historical Traffic Data

Collecting past data requires diligent research and data retrieval from reliable sources. It is important to use validated and standardized data sources to ensure data accuracy and reliability. Historical data can provide valuable information for understanding the long-term trends and

patterns of traffic and air pollution at a specific site, which can inform the development of effective mitigation strategies

Past data collection is essential the analysis of the AQI. This helps us in determining the possible outcomes and the necessary results that is required. Depending on the data collected the official resources where available at. AP. government pollution control board which is headed by the environmental engineer in our local city. This body has stations set up in 4 different areas that are considered as junction point to study AQI. The two of these stations taken were accordingly to the site chosen that is considered as commercial zone and residential zone. As the city has no industrial zone yet. The 2022 year pollution data where taken as the board has given with the pollutants that are exerted in that region. They have suggested few alerts they send to the government body that take care of the pollution emissions in the city. Depending on the data collected it shows the so2 no2 co pm2.5 pm10 emissions in the city. This data taken is compared with the present data as Tirupati city is growing slowly into a smart city. As this city has vast pilgrimage the pollution emissions also vary from station to station. But the overall state of the emissions depends on the overall AQI in the city that in turn will determine the living conditions of the air we are breathing.

S. no	Name of location	Parameters (ug/m^3)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1	Municipal Tirupati	so^2	5.2	5.0	5.2	5.3	5.4	5.3	5.5	5.4	5.6	5.8	4.9	5.0
		No_2	13.2	13.4	14.8	15.3	15.6	15.9	16.3	13.8	15.8	16.7	13.9	13.7
		NH^3	24.1	24.2	24.2	26.8	24.7	24.6	24.4	24.9	24.8	24.3	24.9	24
		PM10	59	54	57	58	56	59	54	56	61	60	48	49
		PM2.5	22.0	21	22	25	19	24	21	17	23	19	13	14
2	APPCB, RO Tirupati	so^2	5	4.6	4.8	4.8	4.9	4.8	4.9	5.1	5	5.2	4.8	4.8
		No_2	12.4	11.5	12.4	12.2	14.1	13.8	13.2	12.1	14.1	14.4	13.2	12.5
		NH^3	23.1	23.2	22.9	23	23.2	23.8	23.8	23.7	23.5	23.3	23.4	23
		PM10	53	59	50	51	49	45	44	45	52	54	40	41
		PM2.5	19	17	20	21	17	18	17	14	19	17	12	13
3	S.V Guest House, Tirupati.	so^2	5.1	4.9	5.1	4.8	5.1	5.4	5.1	5.3	5.7	5.7	5.2	4.9
		No_2	13.9	13.1	13.2	13.9	14.9	15.4	14.6	13.8	15.6	15.8	14	13.1
		NH^3	23.2	23.7	23.8	23.7	23.8	23.9	23.4	24.6	23.5	24.2	24	23.7
		PM10	56	52	54	56	52	55	54	53	57	59	44	46
		PM2.5	-	-	-	-	-	-	-	-	-	-	-	-

The figure below is the APPCB AQI stations pollutants data for the year 2022 fig 5.7: Past data collected from APPCB.

CHAPTER-6

ANALYSIS OF DATA

6.1 GENERAL:

Data extraction is a crucial step in conducting a project report on air pollution released from vehicles. It involves the systematic collection and organization of relevant data from various sources to analyse and draw conclusions about the impact of vehicular emissions on air quality. Here are the key details about data extraction for a project report on air pollution from vehicles

6.2 EXTRACTION OF PEAK HOUR

Extracting peak hour data is an important step in analysing air pollution released from vehicles, as it helps to identify the specific time periods when vehicle emissions are likely to be highest.

After collecting the data from site we have extracted the results from the data here we can see the results of peak hour of both the sites.

The following graph is regarding the peak hour data:

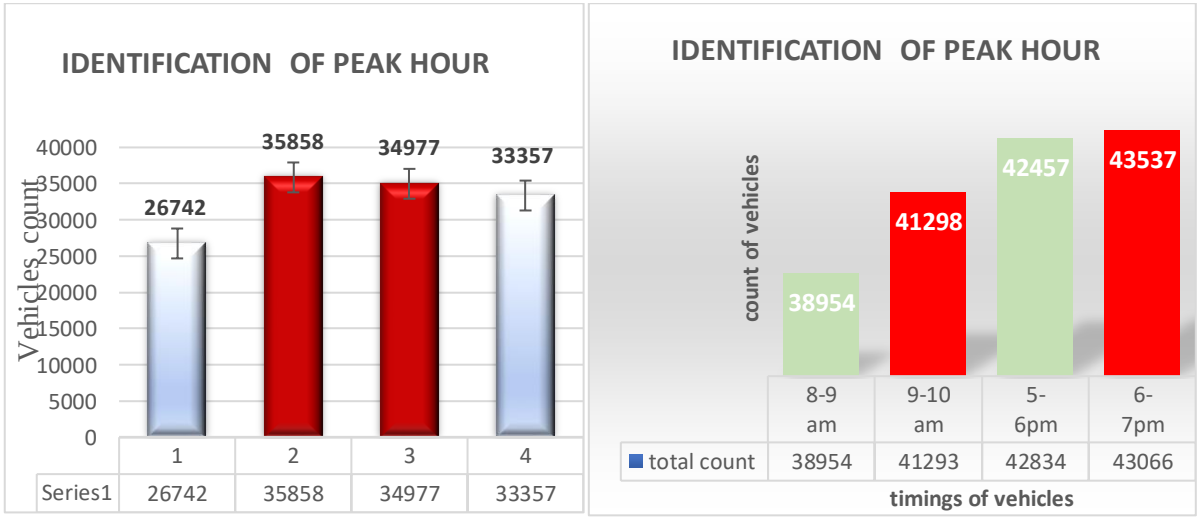

Figure 6.1: Peak hour data of V.V.Mahal road and Tiruchanoor road

6.2.1 VV MAHAL AREA DATA:

The data extracted is given in the table below that tells the vehicle count that was collected each day during peak hours. The number of vehicles helps in the variation of traffic and the traffic flow that is extracted from this information in V.V.Mahal road.

Table No. 6.1: VV Mahal area data

DAYS/TIMIE	8-9 AM	9-10 AM	5-6 PM	6-7 PM
MONDAY	1737	4489	4330	3677
TUESDAY	4862	5900	4870	4577
WEDNESDAY	3413	4164	4702	4535
THURSDAY	2614	4638	4401	4142
FRIDAY	4023	4860	4001	4780
SATURDAY	3772	5003	5477	5121
SUNDAY	6321	6804	7196	6525
TOTAL COUNT	**26742**	**35858**	**34977**	**33357**

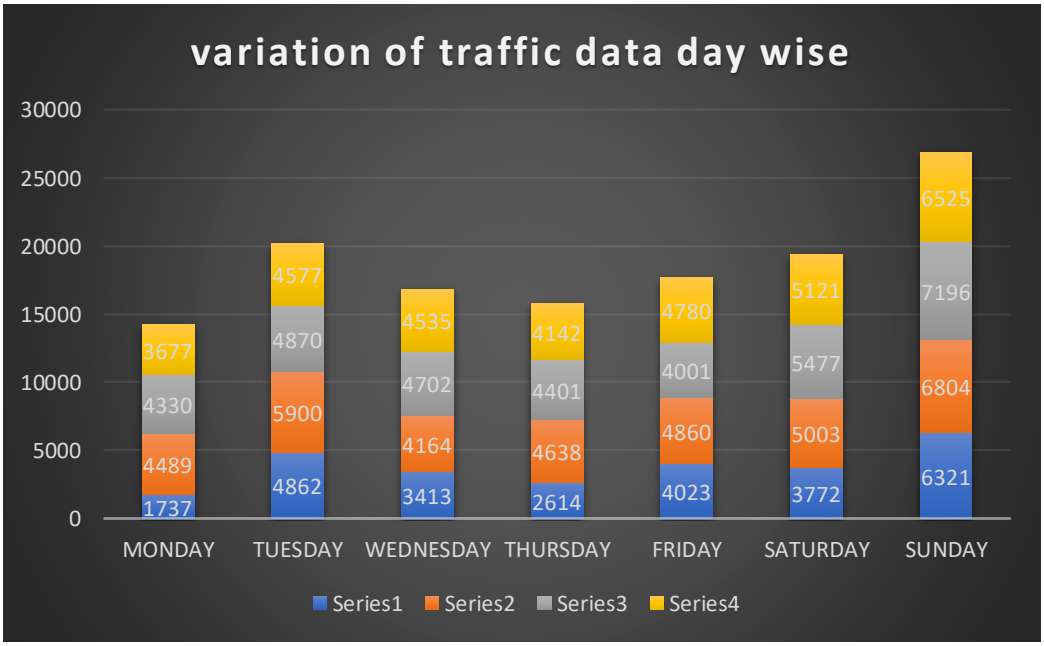

Figure 6.2: Variation of traffic data

6.2.1 TIRUCHANOOR AREA DATA:

The data extracted is given in the table below that tells the vehicle count that was collected each day during peak hours. The number of vehicles helps in the variation of traffic and the traffic flow that is extracted from this information in Tiruchanoor road

Table.No- 6.2: Tiruchanoor area data

Day	8-9am	9-10 am	5-6 pm	6-7 pm
Monday	5215	5466	5738	6092
Tuesday	4965	5213	5166	5271
Wednesday	5087	5724	5992	5822
Thursday	5360	5694	6056	6060
Friday	5354	5830	6043	6132
Saturday	6333	6517	6530	6497
Sunday	6640	6854	6932	7663
total	38954	41298	42457	43537

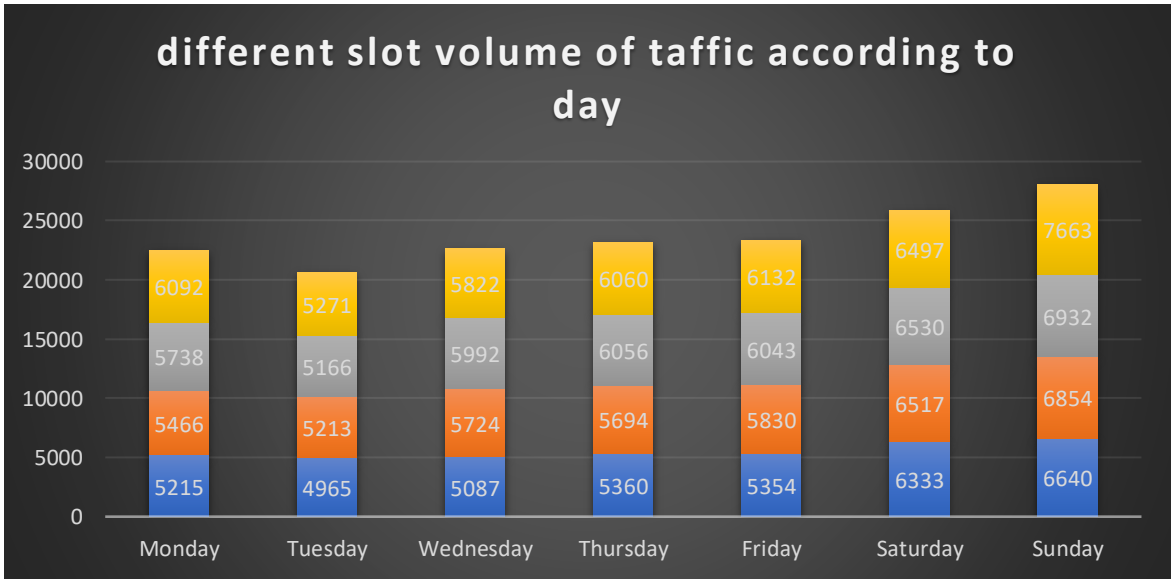

Figure 6.3: Volume of traffic per day

6.3 PRESENT DATA EXTRACTION

Collecting present data is crucial for understanding the current status of traffic and air pollution at a specific site. Present data provides real-time or near-real-time information on the actual conditions and impacts of traffic and air pollution, which can guide the development of timely and effective mitigation measures.

Collecting present data requires on-going monitoring and data collection efforts to capture the current status of traffic and air pollution at a specific site.

Extracted traffic volume from present data collected by using videography method of both sites.

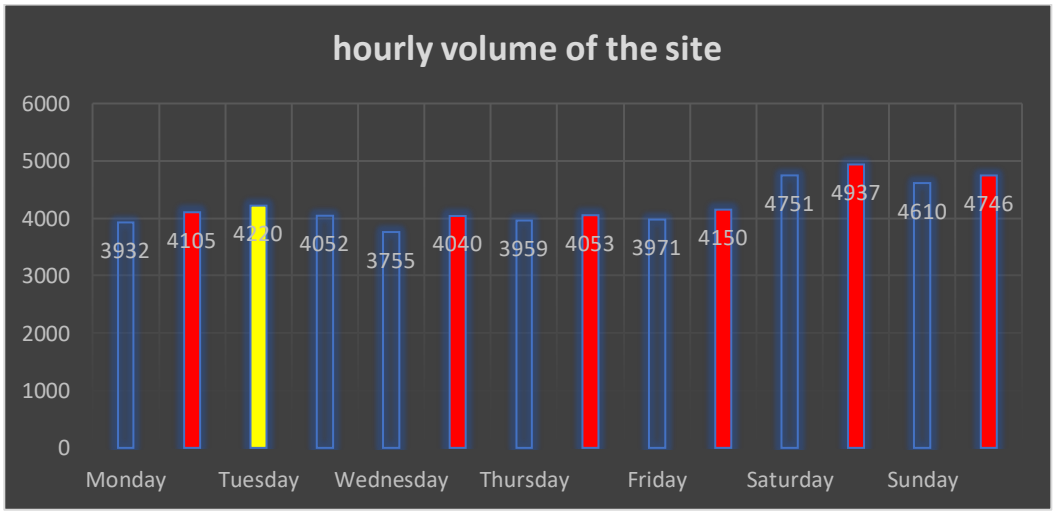

Figure 6.4: Volume of v.v.mahal road tirupati

As we can see that the volume of morning and evening is present in the graphical manner in this site highest volume are mostly noted in the evening times of 5-6 pm.

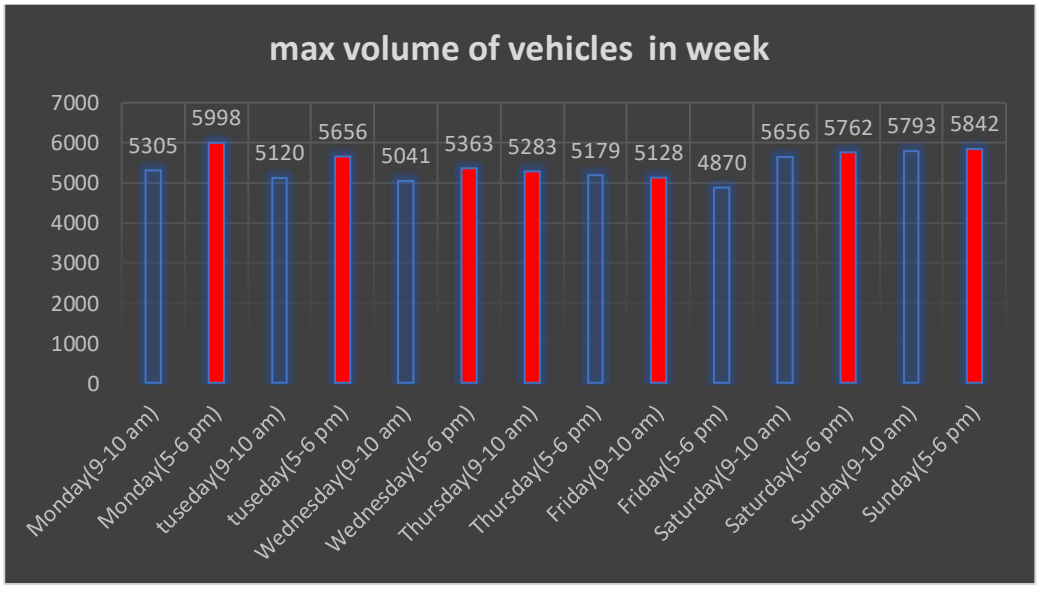

Figure 6.5: Volume of Tiruchanoor road tirupati

As we can see that the volume of morning and evening is present in the graphical manner in this site highest volume are mostly noted in the evening times of 6-7 pm.

6.4 EXTRACTION OF SPEED LIMIT:

Speed limits refer to the maximum or recommended speed at which vehicles are legally allowed to travel on a particular road or highway. Speed limits are typically set by governmental authorities, such as local or state departments of transportation, and are established based on various factors, including road design, traffic patterns, safety considerations, and local laws and regulations.

Speed limits are important for ensuring road safety and minimizing the risk of accidents and injuries. They are designed to provide a standardized guideline for drivers to follow and help maintain a safe and efficient flow of traffic on roadways.

Speed limits may vary depending on the type of road and location. For example, highways and expressways may have higher speed limits than residential areas or school zones. Speed limits may also be subject to change due to weather conditions, construction zones, or other temporary factors. Adhering to speed limits is crucial for promoting road safety. Exceeding speed limits can result in increased risks of accidents, reduced vehicle control, longer stopping distances, and decreased reaction times.

Figure 6.6: Suggested speed limits for the study areas.

6.5 DENSITY CALCULATION

To calculate the density we have used the formula:

Q=k*v

where :q=volume k=density v=velocity.

Here is the sample calculation of density of the site Tiruchanoor road of one direction.

Q=k*v

Q=3932*40

Q=98

Here 3932 is the volume and 40 is the speed limit

Same steps we have followed for the rest of the data.

Table 6.3: the calculated traffic density of v.v.mahal road at morning time

DENSITY CALCULATION			
VOLUME	SPEED LIMIT	DENSITY	AIQ
3932	40	98	144
4220	40	106	146
3755	40	94	144
3959	40	99	145
3971	40	99	145
4751	40	119	150
4610	40	115	150

Table 6.4: the calculated traffic density of V.V.Mahal road at evening time

DENSITY CALCULATION			
VOLUME	SPEED LIMIT	DENSITY	AIQ
4105	40	103	146
4052	40	101	146
4040	40	101	146
4053	40	101	146
4150	40	104	147
4937	40	123	151
4746	40	119	150

Table 6.5: Density of Tiruchanoor road density in morning time

DENITY CALCULATION IN MRONING			
TRAFFIC	SPEED LIMIT	DENSITY	AIQ
5305	45	118	153
5120	45	114	152
5041	45	112	151
5283	45	117	153
5128	45	114	152
5656	45	126	155
5793	45	129	156

Table 6.6: Tiruchanoor road density in evening time

DENITY CALCULATION IN EVENING			
TRAFFIC	SPEED LIMIT	DENSITY	AIQ
5998	45	133	157
5656	45	126	155
5363	45	119	154
5179	45	115	152
4870	45	108	149
5762	45	128	156
5842	45	130	156

6.6 Air Quality Index

We have collected the air quality index values form the app called Breezometer we have taken the values simultaneously when the present data was collecting.The app has shown the study area wise AQI helping in making the study less complicated.

Depending on the time i.e. peak hours taken the AQI has shown its readings accurately.

The next table is the sample reading taken while on study area.

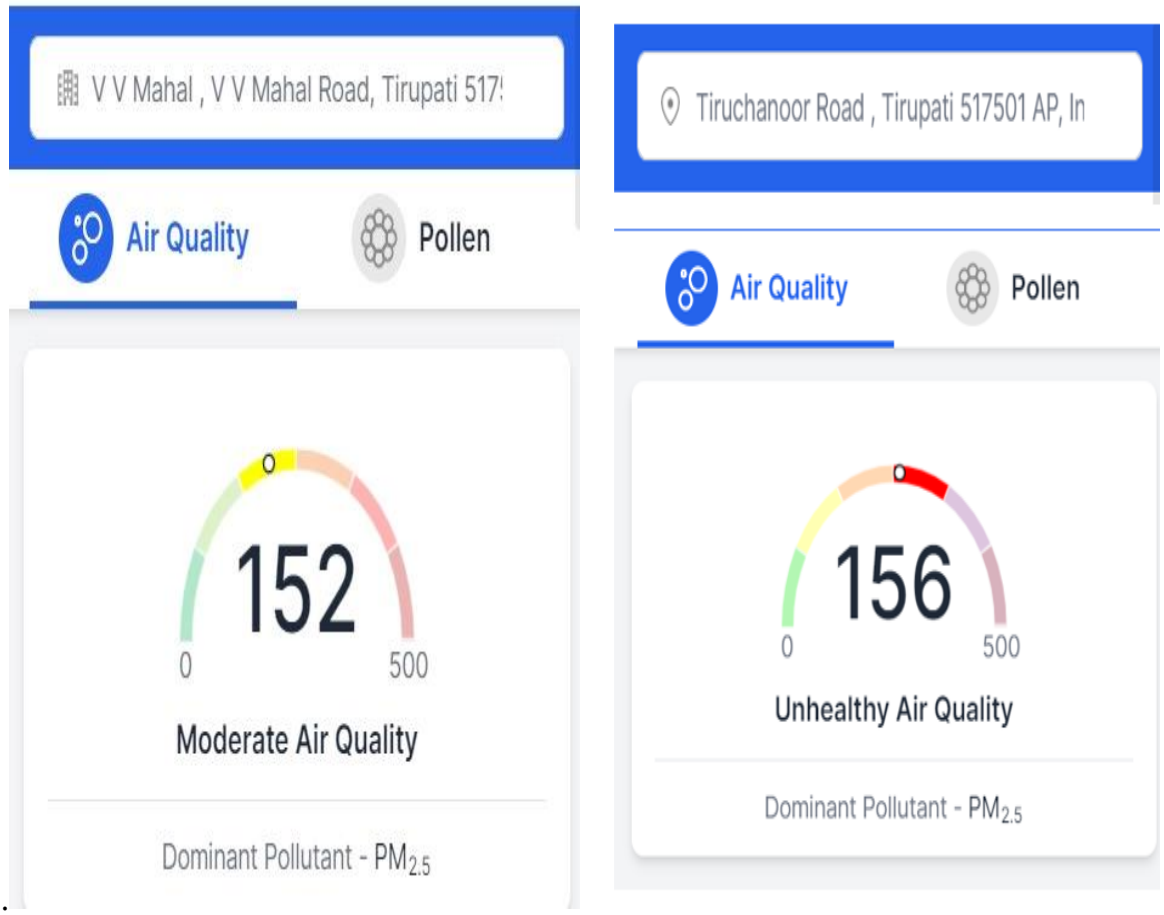

Figure 6.7: Air quality index of V.V.Mahal road and Tiruchanoor road

Table 6.7 : V.V.Mahal and Tiruchanoor road morning and evening pollution data from the app.

AIQ	AIQ
146	144
146	146
146	144
146	145
147	145
151	150
150	150

AIQ	AIQ
153	157
152	155
151	154
153	152
152	149
155	156
156	156

6.7. COMPARISON B/W DENSITY WITH THE AIR QUALITY INDEX:

After calculation of volume and collecting the air quality index we have calculated the density from the data extracted the graphs from it

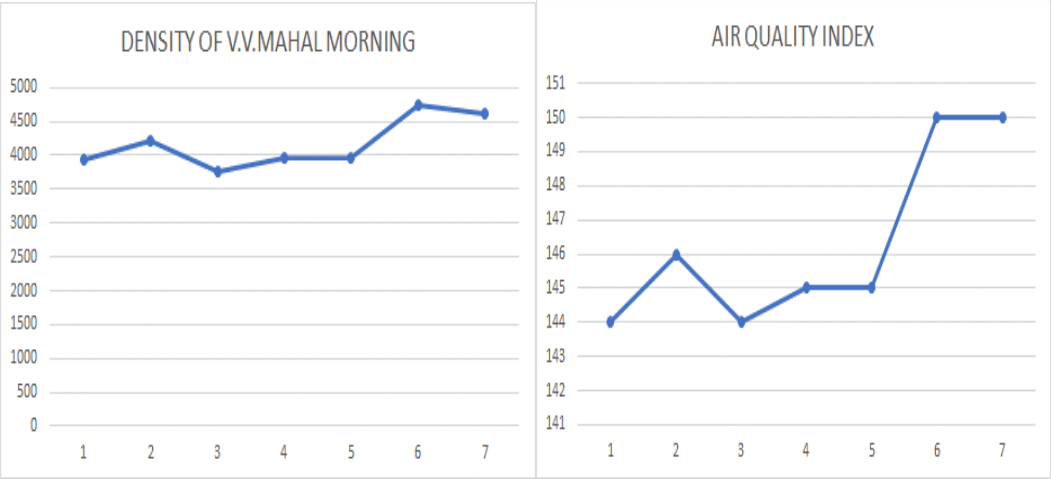

Figure 6.8: V.V.Mahal road density and AQI in morning

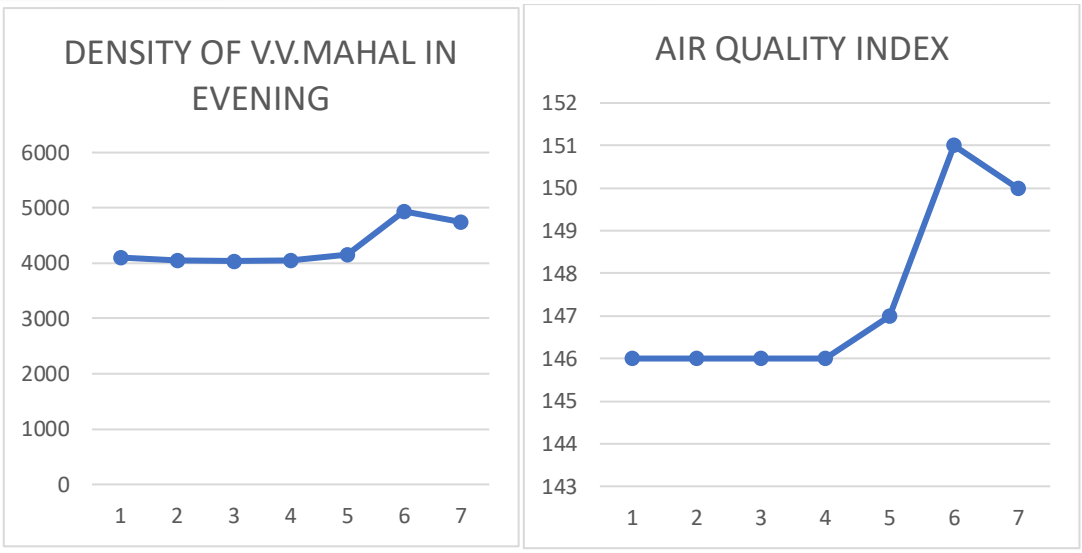

Figure 6.9: V.V.Mahal road density and AQI in evening

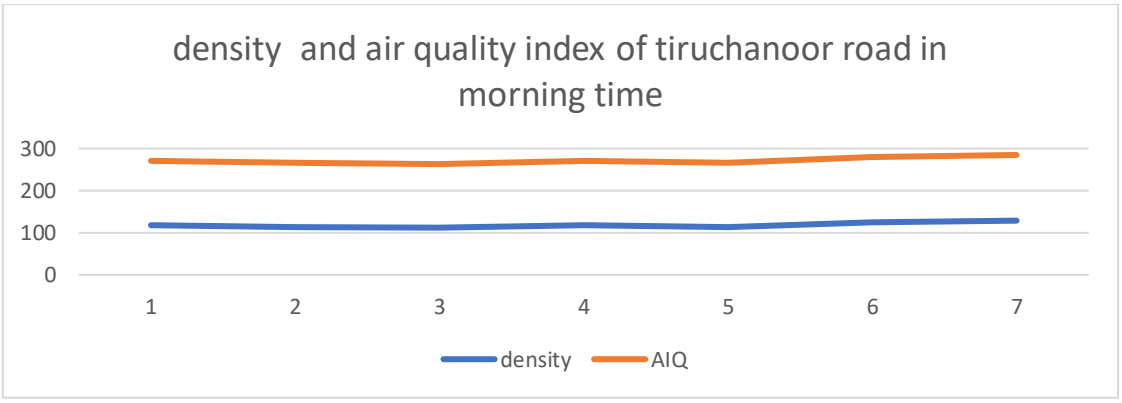

Figure 6.10: Tiruchanoor road density and AIQ in morning

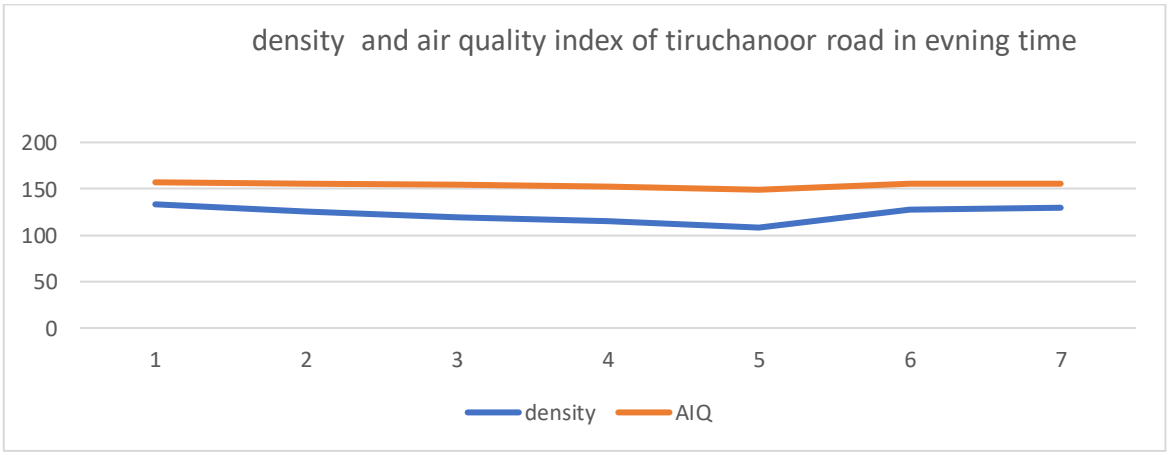

Figure 6.11: Tiruchanoor road density and AIQ in evening

CHAPTER-7

RESULTS AND DISCUSSIONS

The study was conducted on air pollution from vehicles in two major areas of Tirupati, V.V. Mahal and Tiruchanoor Road. The peak hour of V.V. Mahal was found to be 9-10 am and 5-6 pm in the morning and evening respectively, while for Tiruchanoor Road, the peak hour was found to be 9-10 pm and 6-7 pm in the evening. Traffic data was collected during peak hours from both sites, along with the air quality index.

The volume of vehicles during peak hours was 4937 for V.V. Mahal and 5842 for Tiruchanoor Road. The density of vehicles during peak hours was found to be 123 vehicles per hour for V.V. Mahal with an air quality index of 151, and for Tiruchanoor Road, the density was 130 vehicles per hour with an air quality index of 156. The study concluded that there was a direct correlation between the increase in vehicle count and the pollution level.

The study identified the primary source of air pollution in the areas under consideration as the vehicular traffic. Vehicular traffic is a significant contributor to air pollution, releasing a variety of pollutants such as carbon monoxide, nitrogen oxides, sulphuric dioxide, and particulate matter into the atmosphere. These pollutants can have severe health effects, with prolonged exposure leading to chronic respiratory and cardiovascular diseases.

CHAPTER- 8

CONCLUSIONS

The project on air pollution caused by vehicular traffic in V.V. Mahal and Tiruchanoor Road highlights the detrimental effects of air pollution on human health. The study indicates that the increase in the number of vehicles on the road during peak hours is the primary source of air pollution in these areas. The findings of the study emphasize the need for immediate action to reduce the pollution levels caused by vehicular traffic in these areas.

Future Scope:

The study on air pollution caused by vehicular traffic in V.V. Mahal and Tiruchanoor Road is a step towards identifying and mitigating the harmful effects of air pollution on human health. The study can be extended further to include a more comprehensive analysis of the sources of air pollution and the impact of air pollution on public health in other areas of the city.

Future studies can also focus on identifying effective measures to reduce the number of vehicles on the road during peak hours, such as the implementation of sustainable transportation solutions. The study can also include an assessment of the economic and environmental benefits of sustainable transportation solutions, which can help encourage policymakers to prioritize the implementation of these solutions.

Overall, the study on air pollution caused by vehicular traffic in V.V. Mahal and Tiruchanoor Road provides valuable insights into the harmful effects of air pollution on human health. The study highlights the need for immediate action to reduce the pollution levels caused by vehicular traffic in these areas and underscores the importance of promoting sustainable transportation solutions to mitigate the adverse effects of air pollution on public health.

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