MEASUREMENT OF VEHICULAR EMISSION CASE STUDY: PANJRAPOLE INTERSECTION, AHMEDABAD

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Abstract: This research paper presents measurement of different pollutants at panjrapole intersection, Ahmedabad India. Pollution measurement survey by using high volume air sampler is conducted. Pollutants measured are SO2, NO2, PM2.5, and PM10. Pollution measurement yield that the pollution level at intersection is higher and the air quality is unhealthy. On the basis of results, various suggestions and recommendations were hence put for resolving air pollution problem at intersection.

***Index Terms*- Traffic intersection, air pollution, vehicular emission**

I. INTRODUCTION

1.1 General

Vehicular traffic is rapidly increasing in urban city, which in turn increasing the air pollution. According to the recent report by RTO Gujarat the vehicle count in 2017 is 20,361,296 which is very high. An air pollutant is a material in the air that can have adverse effects on human health and the ecosystem .Air pollution can cause premature deaths also it includes respiratory infections, heart disease, COPD, stroke and lung cancer. Currently the traffic on the road rises constantly and traffic volume overdoes normal limit.

Intersection is the hub for vehicular pollution emission. Due to stoppage at intersection the vehicle emission is maximum. Cars are the greatest contributing agent of pollution in most cities across the globe. Emissions from car exhaust contain a range of toxic substances. They include carbon monoxide, nitrogen dioxide, sulphur dioxide, benzene, formaldehyde, polycyclic hydrocarbons lead and tiny suspended particles. Air pollution is a growing problem in many cities in India, including Ahmedabad and other major cities of Gujarat. In last 10 years,Amdavadi's have added 24.59 Lakh more vehicles on city road. Red Lights Air Pollution Hot Spots:waiting at an intersection is not just frustrating if are running late but also it affects health of an individual.The study has found that waiting at spotlights and then accelerating increases exposure to pollutants.It has found that the concentration of harmful particles are 24 times higher at spotlights than when people are driving down the road.

II. LITERATURE REVIEW

2.1 Massimiliano Gastaldi, Claudio Meneguzzer , Rosa Arboretti Giancristofaro, Gregorio Gecchele, Luca Della Lucia, Maria Vittoria Prati 2017 This paper focuses on the environmental impact of road intersection operations, and in particular of alternative types of traffic control . The purpose of this study is to provide experimental evidence about this issue based on direct measurement of CO2 emissions produced by a vehicle under traffic signal versus roundabout control. By installing portable emission Measurement System installed in the Test car ,data is collected and a before and after analysis was conducted on an intersection where a roundabout is replaced a traffic solution.

A total of 396 trips were carried out by two drivers in different traffic conditions and in opposite directions along a designated route.Using statistical methods, the existence of significant differences in CO2 emissions in relation to the type of intersection control was investigated based on the collected data, also considering the effect of other explanatory variables and focusing in particular on peak traffic conditions.The results of these analyses support the conclusion that converting a signal controlled intersection to a roundabout may lead to a decrease in CO2 emissions.

2.2 Ravindra Kumar ,Purnima Parida, Devesh Tiwari, and S.Gangopadhyay 2015 The paper determine the Variety of transport modes based on roads are catering to the transport demand ply in large number on the road system of urban india,due to which the problem on roads are increasing or we say aggravating day by day.This results in increase in traffic congestion increased air and noise pollution ,accidents,delays etc. In this paper a review of the study for exploring suitable mitigation

measures to improve the signalized intersections are presented.The estimation of of reduction of fuel losses is done by different people one of them has developed an integrated microscopic traffic emission simulation platform to estimate vehicle which captures intantaneous vehicles modal activities and also quantify the relationship between motor vehicles exhaust emission and vehicles operating modes.

To minimise delays construction of flyovers and interchange,turning movement restrictions,optimization of cycle timings,widening of road and synchronized traffic signals are done. This paper concludes that Coordination and optimisation of signal time, strategies to conserve fuel through increased patronage of public transportation system like BRT, appropriate land use and transport policy, restraining the motorized traffic, encouraging non motorized modes, switch-off vehicles during red light phase and use of advance driver alert system

2.3 Claudio Meneguzzer , Massimiliano Gastaldi , Riccardo Rossi , Gregorio Gecchele , Maria Vittoria Prati WCTR 2016 In this paper the comparison of alternative types of road intersection control has focused mainly on efficiency and safety The instantaneous emissions of CO2,NOx and CO have been measured by using a portable Emission Measurement System (PEMS)on test car over repeated trips along a designated route under different condition and chosen route.A total of 396 trips have been carried out.

On the bases of experimental data the existence of significant differences in emissions attributable to the type of intersection control by using statistical method. Finally, results are less clear for CO emissions, and differences are statistically non significant in most cases.The results indicate that replacing the traffic signal with the roundabout tends to reduce CO2 emissions. In this paper it is concluded that NOx is lower in signalised intersection and the differences are statistically significant in all cases.

2.4 Rao Qian, Zhang Lun*, Yang Wenchen, Zhang Meng 2013 In this paper the qualitative analysis and the quantitative analysis based on numerical statistics are adapted in order to analyze the traffic signal evaluation indexes.Also on the bases of selecting principle of evaluation index,selected performance indicators for the emission factors are taken into consideration while establishing the traffic signal timing model based on relative evaluation index system. Then to solve the traffic signal timing model an improved real coded genetic algorithm is presented.

Lastly, the three algorithms are proved by a great deal of numerical calculation. The result shows that the presented algorithm has a high precision while solving the models, and has a very good effect on reducing emissions and the efficient of controlling the traffic roads.

III. STUDY AREA

3.1 Briefing of the Location

Panjrapole area is situated in Ahmedabad city,gujarat India.Panjrapole intersection is near the main university area.Panjrapole is 120 feet ring road.Panjrapole intersection is of 4 phase signalised intersection consisting of BRTS lane.The signal cycle is for 1 minute and 17 seconds.The roads are First phase of panjhrapole intersection is gujarat university to nehrunagar.Gujarat university,cept university, L.D.college of engineering and different major educational institutes are located near panjhrapole which adds upto to the traffic flow from phase gujarat university to nehrunagar road.

Figure 3.1 pollution emission at Panjrapole intersection.

IV. DATA COLLECTION

Pollution measurement by high volume air sampler.

Vehicles are one of the major contributors in air pollution.The vehicle which are continousely moving hinder air pollution than the vehicle which are idle and the vehicle is not switched off.this condition mostly takes place at an intersection where maximum number of vehicles are gathered hence intersection can be called as the hub of vehicular pollution.

for my survey the apm 550 device was been installed at panjrapole junction. the measurement of particulate matter 2.5 (pm2.5) and particulate matter 10 (pm10) was measured and also gasses like sox and NOx are measured. This survey was taken in morning for 2 hours afternoon for 2 hours and evening for 2 hours. two part cabinet ensures that temperature of pm 2.5 filter remains close to ambient temperature .imported brush-less pump with a low noise. lower sampling rate of 1m3/hr reduces filter choking even in areas having high fpm level.

Table 4.1 Emission details at panjrapole intersection day 1

SAMPLE TYPE	Ambient air
SAMPLE PROTOCOL TYPE	IS:5182/Grab sampling
SAMPLING DATA	**4 Dec 2018**
DURATION OF SAMPLING	04 hour
SAMPLING LOCATION	Panjrapole intersection
AMBIENT Min.Temp./Max.temp	27'C-31'C
WIND DIRECTION	North East to south west
AVERAGE HUMIDITY	34%
AVERAGE wind velocity	15.0Km/h
VOLUME OF AIR SAMPLED	PM 10:2.0 cubic metre PM 2.5:2.0 cubic metre other gas:0.24 cubic metre

Table 4.2 Results of pollutants day 1

Sr. No.	PARAMETER in micro g/m3	RESULT 9-11 AM	RESULT 1-3 PM	RESULT 6-8 PM	TEST METHOD
1	Particulate matter (PM 2.5)	242	175	295	USEPA & CPCB gideline method
2	particulate matter (PM 10)	360	241	409	IS:5182 (PART23)2012
3	sulfur dioxide(SO2)	38	18	22	IS:5182 (PART-2)2012
4	Nitrogen oxide(NO2)	116	105	162	IS:5812 (PART-6)

Calculation of volume of air sampled:

V=Qt

Where V = volume of air sampled, in m3;

Q = average flow rate, in m3/min;

And t = total sampling time, in min.

Calculation of PM 10 in ambient air:

PM 10(Micro g/m3) = (W2-W1)/V
W1 = initial of filter, in g
W2 = final weight of filter, in g;
V= volume of air sampled, in m3;
10^6 = conversion of g to micro g.

Table 4.3 Emission details at panjrapole intersection day 2

SAMPLE TYPE	Ambient air
SAMPLE PROTOCOL TYPE	IS:5182/Grab sampling
SAMPLING DATA	**5 Dec 2018**
DURATION OF SAMPLING	04 hour
SAMPLING LOCATION	Panjrapole intersection
AMBIENT Min.Temp./Max.temp	23'C-31'C
WIND DIRECTION	North East to south west
AVERAGE HUMIDITY	34%
AVERAGE wind velocity	15.0Km/h
VOLUME OF AIR SAMPLED	PM 10:2.0 cubic metre PM 2.5:2.0 cubic metre other gas:0.24 cubic metre

Table 4.4 Pollution emission data day 2

Sr. No.	PARAMETER in micro g/m3	RESULT 9-11 AM	RESULT 6-8 PM	TEST METHOD
1	Particulate matter (PM 2.5)	180	245	USEPA & CPCB gideline method
2	particulate matter (PM 10)	235	364	IS:5182 (PART23)2012
3	sulfur dioxide(SO2)	25	22	IS:5182 (PART-2)2012
4	Nitrogen oxide(NO2)	138	167	IS:5812 (PART-6)

V. CONCLUSION

The rapid increase in vehicles is a serious issue faced by most of the metropolitan cities in India. Continuous migration from rural to urbanization results in the increased numbers of vehicles on road. Environment is suffering as vehicular emission is high on the roads. The study states that vehicular pollution is higher on the intersections.

The WHO standard for permissible levels of pm2.5 in the air (annual) is 10 micrograms per cubic metre, but India's national ambient air quality standard for pm2.5 is four times higher at 40 micrograms per cubic metre. According to the results the amount of pm10 is very much higher in the evening hours. To avoid the idling of vehicle on intersections different remedies should be taken like construction of flyover, intersection or any island, by reducing the stoppage time at signals or redesigning the traffic signal cycle.

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