International Journal Of Humanities Education And Social Sciences ***(IJHESS)*** *E-ISSN:* **2808-1765**
Volume 3, Number 1, August 2023, *Page. 469 - 480*
Email : editorijhess@gmail.com

Study of Air and Noise Pollution due to Transportation in Tarnaka

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Abstract
To assess the concentration of carbon monoxide and carbon dioxide, and level of temperature and noise due to transportation vehicles from Secunderabad to Uppal. Road vehicles are primary source of air pollution in urban cities and they also are a considerable source of noise pollution. During this study, pollutants like Carbon monoxide, carbon dioxide were studied besides other parameters like temperature and noise levels were studied for a period of seven days, that is five working and two nonworking days' from 4th of March till 10th of March 2018, at different time intervals in one of the busiest routes of Hyderabad. The area selected for the study stretches from Secundrabad Railway Station to Uppal Ring Road with ten sampling points. Relative frequency distribution and cumulative relative frequency distribution are used for assessing noise, temperature, CO and CO_2 levels. The results of this study identify the status of carbon monoxide, carbon dioxide, and noise pollution. During these days and these different sampling locations, I could come to a conclusion that maximum CO is 12 PPM, CO_2 887 PPM, temperature 41°C and noise is 78 decibels. The study concludes with suggestions for control of air pollution and noise pollution to avoid any health-related issues.

Keywords: ***Air pollution, Health, Noise, Vehicle*****.**

INTRODUCTION

Automobile commonly known as cars, allow ease of movement and hence their usage has become essential for people. Due to the dramatic increase in the world's population and car ownership, hence, the number of vehicles roaming the roads have growth. At present the world population is growing with a rate of 1.05%, which is estimated to be 81 million people per year (Worldometer, 2020). Based on the statistics done by the International Organization of Motor Vehicle Manufacturers (OICA), sales of automobile have increased from 66 million units in 2005 to 91 million in 2019, including both passenger cars and commercial vehicles (IOMVM, 2019). The growth in the number of vehicles on the roads has many consequences on the environment As well as on people. Firstly, there is an increase in traffic congestion, rush hours have become irregular and hence unpredictable. Traffic congestion has relation with difference between the road traffic performance and its actual condition. congestion happens when the number of automobile present on a particular road at the same time exceeds its capacity. Generally, traffic congestion has negative impact on the economy because of time wastage, but it also has a negative effect on fuel consumption, which in turn causes air pollution, noise pollution, and ultimately on vehicle wear and tear and on road safety (C P and Karuppanagounder, 2018). The delays caused by congestion make passengers waste a lot of time leading to late arrivals to work and possibly missing important meetings, and more over delays in delivery of goods often causing customer dissatisfaction. Hence, traffic gam impacts the economy. Traffic gam makes cars stop and start many times, leading to more fuel consumption than vehicles that travel without stopping. Based on a research done in Slovenia in 2018, it has been detected that fuel consumption during acceleration was 2.65 times more than the average fuel consumption (Jereb et al., 2018). Moreover, the number of road traffic accidents is highly related to the number of cars. The World Health Organization stated that around 1.35 million people die yearly because

of road accidents, and many more suffer from dangerous injuries (WHO, 2020).and in addition, the environment, and in consequence humans, are also affected. The increase in usage of vehicles and their omnipresence led to extremely high pollution rates inside cities.

For example, The Ministry of State for Environmental Affairs of Egypt estimates that vehicle emissions represent about 26% of total pollution caused by suspended particulate matter (PM10) in Greater Cairo, 90% of carbon monoxide (CO) and 50% of nitrogen oxides (NOx) (Abou- Ali and Thomas, 2011). Figure 1. Showing CO levels and physical symptoms. Transportation systems including cars are also responsible for around 25% of Carbon Dioxide (CO_2) emissions in the world (BBC, 2020). Figure 2. Show increase of CO_2 during the time. CO_2 is one of the greenhouse gases. Greenhouse gases have an extremely dangerous impact on the ozone layer of our planet. They lock in the heat causing climate change, also known as global warming (USEPA, 2018). In 2018, transportation was considered the largest source of greenhouse gases in the United States of America with a contribution of 28.2% of the emissions as shown in Figure 3 (USEPA, 2018).

Obviously, inhaling the particles from vehicles' emissions also have a harmful, and sometimes deadly effect on human and other living beings. A report of the government of Canada (2019) states that the exposure to air pollution causes lung related diseases, such as allergies and asthma, moreover to heart related diseases e.g. heart attack, heart failure and hypertension. Moreover, the report concluded that more than 14,000 premature deaths per year in Canada can be correlated to air pollution (Canada, 2019). (Kumar, 2017) claims that vehicles emissions cannot be 100% prevented unfortunately. Nevertheless, they can be monitored and controlled in order to reduce them as much as possible to decrease their harmful impacts. The amount of harmful emissions is directly proportional to the vehicles age and usage. Also, they depend on whether the car gets maintenance properly and on a regular basis or not.

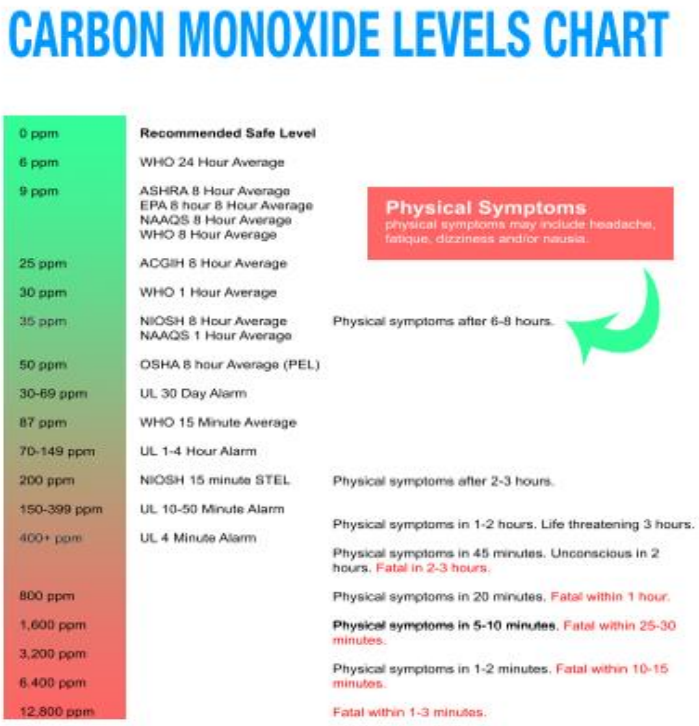

Figure 1. CO levels and physical symptoms.
Source: GASLAB.COM.

Air pollution is one part of the case. the second part lies in the rate of noise pollution. There are several sources of noise pollution in an automobile. noise could stem from its engine, especially if it is old and does not get proper maintenance, squealing brakes, different resonating parts, etc. Moreover, a car has human controlled noise sources such as the probable excessive use of the car's horn, the use of high volume radio and music systems, etc. According to the conclusions of the Environmental Burden of Disease report by the World Health Organization, noise pollution is ranked the second environmental threat in Europe after the air pollution (WHO, 2011). Figure 4. Show the ambient air quality standards in respect of noise.

Noise pollution has several negative effects on human health. Noise causes emotional and behavioral stress. An exposure to a sudden loud noise may cause severe damage to the eardrum and may lead to hear loss. It can also cause headaches, heart failure and high blood pressure (Subramani et al., 2012). In addition, noise is the major cause of sleeplessness and sleep disturbance, hyperactivity, psychological disorders and learning difficulties in children moreover fatigue and reduced productivity (Wokekoro, 2020). The European Environment Agency estimates that around 10,000 people die prematurely every year because of their exposure to noise pollution (EEA, 2020). Thus, noise originating from cars should also be managed and reduced as much as possible. Road traffic vehicles are hence considered to be the main contributor to both air and noise pollution. Approvingly, the World Health Organization (WHO) states that both air and noise pollution are the most harmful environmental problems (EEA, 2019).

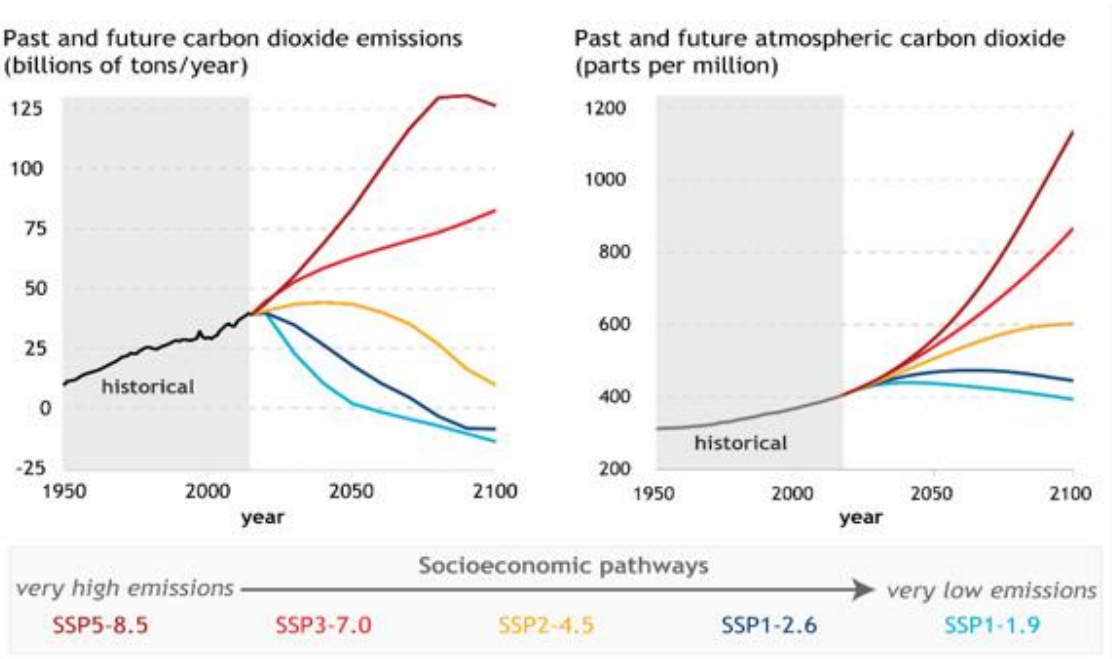

Figure 2. increase of CO_2 by time.
Source: NOAA Climate.gov, adapted from IPCC AR6 Technical Summary.

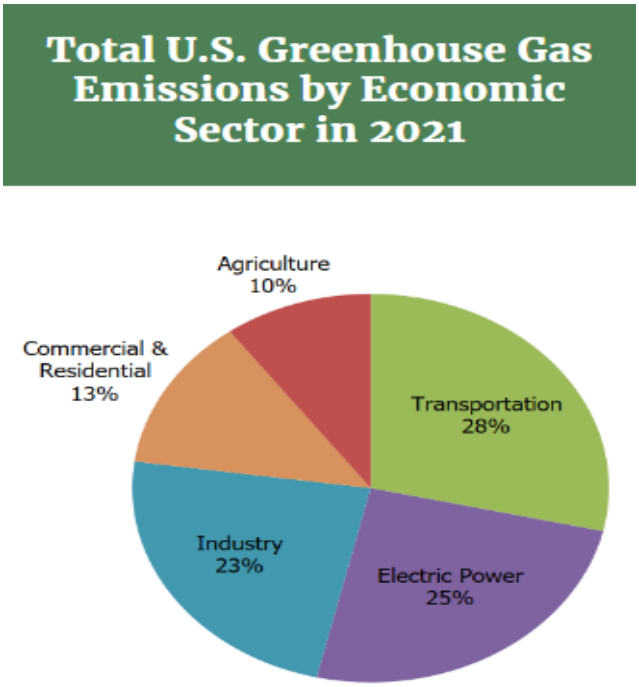

Figure 3: Sources of Green-house Gases in the United States.
Source: (USEPA, 2021).

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:- 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

Figure 4. the ambient air quality standards in respect of noise.

Noise is measured in Decibels-dB using sound sensors or sound level meters. However, measuring noise levels produced from a specific source is difficult, because the noise signals produced from the intended source are affected by the surrounding noises. Hence, the noise sensors read inaccurate values (Subramani et al., 2012).

A sensor node was implemented by (Miralavy et al., 2019) on the vehicles exhaust system to monitor its emissions. They then sent the sensed data along with the vehicles information to a base station that is monitored by the authorities. If the vehicles pollution level exceeds a certain limit, the authorities should warn the vehicle owner to fix it. And if the problem persists, the vehicle owner would be charged.

(Dhingra et al., 2019) implemented a sensor network in specific locations around the city. These sensors collect data about the air pollution level. Firstly, they collect the data from the sensors that are connected to an Arduino board. The Arduino board sends then these readings to a cloud platform to store them. The Arduino board uses a Wi-Fi module to connect to the internet. When the driver enters the source and the destination of the journey, the system gets the route between them using Google Maps Routing API, then predicts the pollution level of the entire route and send warnings to the user if the pollution level is much high, so the driver can reroute their car. The system also keeps track of the history of the predictions. Another study by (Guanochanga et al., 2019) implements a wireless network with gateway nodes that have internet access and sensor nodes. The sensor nodes dispatch the air pollution measurements to the corresponding gateway node. Then, the data is sent to a cloud server via the gateway node. After that, it will be published on a web page that is available for the users and accessible using web browsers or smartphones.

Measuring traffic noise is complicated because it is influenced by many attributes, Traffic density, traffic flow, vehicles velocity, road surface type and condition, tires, vehicle mass, road inclination, etc. All these attributes are not constant. Therefore, traffic noise level constantly varies in time and space (Prezelj and Murovec, 2017). (Afsharnia et al., 2016) used a TES sound meter to measure the traffic noise power in the city of Birjand in Iran. the objective of this study is to compare the noise pollution level in Birjand with national standard levels. The TES sound meter is used to measure daily sound levels at several stations and during four different time periods morning, noon, evening and night. The average results of the measurements are 78.1dB in the morning, 82.25dB in the noon, 81.21dB in the evening, and 81.01dB in the night. The study concluded that generally morning has lower noise levels than noon, and evening is also quieter than night. Moreover, a study by (Ballesteros et al., 2015) focused on figuring out the noise source of a pass by car. The authors aimed to prove that Beam forming can identify the noise source of a moving vehicles and get more insight to the mechanisms of the generated noise. They used a planar 56 microphone array with 28 additional microphones, located on 8 external arms attached to the center array, they also limited the measurement area with two light barriers. From the generated noise source maps, they concluded that the noise is mainly located near the center of the car tread, and it is slightly higher in the front tires than in the back ones. (Lopez Aparicio et al., 2020) analyzed the effect of reducing the vehicles speed limit on the traffic noise levels. study showed that reducing traffic speed limit has an effective result in reducing the noise pollution caused by cars.

RESEARCH METHODS

1. Study Area

Hyderabad is the capital of the Indian state of Telangana, occupy 650 KM^2 along the bank of Musi river, it has a population of about 10.82 million, making it the fourth most populous city and sixth most populous urban agglomeration in India. At an average altitude of 542 m. much of Hyderabad situated on hilly terrain around artificial lakes, including Hussain sager. Predating the city's founding north of the city center. As it is crystal clear and mentioned above, Hyderabad is most populated and traffic city, it holds large population and commuting systems. therefore, these two phenomena cause to bring up huge air pollution and noise pollution. Air pollution and noise pollution belong to the residential and non-residential areas. There are areas that hold huge air pollution and noise pollution such as Secunderabad, Uppal, Kotti, Mahdipatnam and so on. There are also areas that hold low and medium level of air and noise pollution such as Mula-Ali, Sun City, Hi-Tech City and so on. Since Secunderabad to Uppal is considered one of the populated places therefore my study location cover distance from

Secunderabad Railway Station to Uppal Ring Road, it is approximately 8 Km or 5 Miles or 4.3 Nautical Miles. This area is one of the busiest areas and main road in Hyderabad that contains residential area for different levels of people as well as some prestige universities, institutes, research centers, small scale study centers, medium scale study centers and some other business centers and markets or malls. Travel time refers to the time taken if the distance is covered by car.

Table 1: List of Sampling Location

S.No.	Sampling Location
1.	Secunderabad Railway Station (10No. Bus Stop)
2.	Secunderabad Rathafile Bus Stand
3.	Uppal Bus Stop
4.	Allagada Bavi Bus Stop
5.	Mettuguda Bus Stop
6.	Tarnaka Bus Stop
7.	Centre for cellular and molecular biology (CCMB) bus stop
8.	National geophysical research institute (NGRI)
9.	Survey of India
10.	Uppal Ring Road

2. Sampling location

For present study of CO, CO_2, Temperature, and Noise from Secunderabad to Uppal

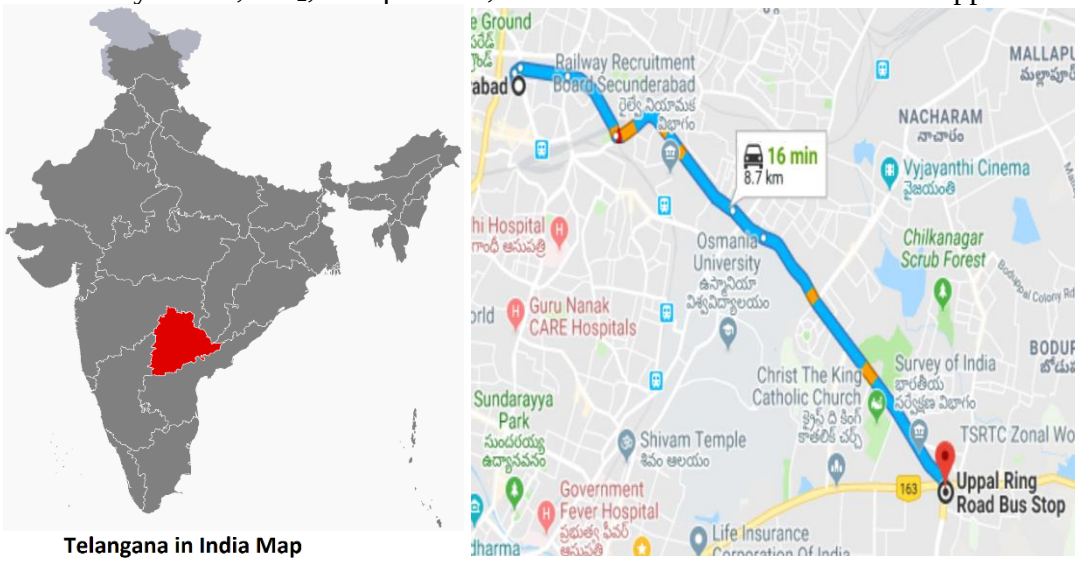

Figure 5: sampling location Secunderabad up Uppal.
Source: google map.

3. Carbon Monoxide Meter

Description:
Model: GCO-2008
CO range: 0 to 1,000 ppm.
CO response CO METER
time: 30 second.

Fig 6. Carbon Monoxide Meter.

4. Carbon Dioxide and Temperature Meter
Description:
Model: GC-2008
LUTHRA made
Range: 0-4000ppm
Functions: CO_2, Temperature

Figure 7. Carbon dioxide and Temperature meter.

5. Noise mètre
Description :
Model :SL-4001
Taiwan made
Range:50-100 dB
Functions: Noise meter

Figure 8. Noise meter

6. Methodology:

- The CO, Noise, CO_2 and temperature meters was first switched ON and was allowed to warm up.
- Using the meters, the concentration of CO, CO_2 and the level of temperature and noise at 10 different locations from Secunderabad to Uppal Ring road was recorded.
- It was recorded at 3 different timings between 9:00 AM to 10:00 AM, 1.30 PM to 2.30 PM, 8:00 PM –9:00 PM at main road.
- The above procedure was repeated for 7 days 5 working days and in which 2 were non-working days

- The above data was tabulated. Hence the results are comprehended.

Table 2: Average concentration of CO and CO_2 and level of Temperature and Noise on Working days.

S.No	Sampling Area	CO	CO2	Temperature	Noise
1	Secundrabad 10, number bus stop	10.2	751.7	34.6	73.2
2	Secundrabad Rathfile bus stop	9.4	734.1	35.2	72.6
3	Uppal bus stop	9.9	653.5	35.1	71.4
4.	Allguddabani bus stop	5.4	499.2	33.8	69.5
5.	Mettuguda bus stop	5.3	491.6	33.4	69.5
6.	Tarnaka bus stop	7.2	599.4	34.6	71.3
7.	CCMB bus stop	5	522.5	34.6	69.3
8.	NGRI	2.2	357.7	32.6	67
9.	Survey of India	3.8	505.1	34.1	71
10.	Uppal Ring Road	8.9	673.4	35.9	75.4

Table 3: Average concentration of CO and CO_2 and level of Temperature and Noise on Non-Working days.

S.No	Sampling Area	CO	CO2	Temperature	Noise
1	Secundrabad 10, number bus stop	9.6	668.1	35.2	72.8
2	Secundrabad Rathfile bus stop	9.3	692.1	33.6	72.1
3	Uppal bus stop	8.9	668.7	33.5	71.5
4.	Allguddabani bus stop	5.5	503.9	32.7	68.2
5.	Mettuguda bus stop	4.8	507	32.6	68.4
6.	Tarnaka bus stop	7.4	558.6	33.6	71
7.	CCMB bus stop	2.9	477.5	33.7	69.7
8.	NGRI	2.8	407.6	32.7	66.7
9.	Survey of India	5.3	572.8	34.4	69.6
10.	Uppal Ring Road	10.1	712.4	35.6	74.2

Table 4: Average concentration of CO and CO_2 and level of Temperature and Noise on Working and Non-Working days.

S.No	Sampling Area	CO	CO2	Temperature	Noise
1	Secundrabad 10, number bus stop	9.9	709.9	34.9	73
2	Secundrabad Rathfile bus stop	9.35	713	34.4	72.35
3	Uppal bus stop	9.4	661.2	34.3	71.45
4.	Allguddabani bus stop	5.45	501.55	33.25	68.85
5.	Mettuguda bus stop	5.05	499.3	33	68.95
6.	Tarnaka bus stop	7.3	578.5	34.1	70.5
7.	CCMB bus stop	3.95	500	33.65	69.5
8.	NGRI	2.5	382.65	32.65	66.85
9.	Survey of India	4.55	538.95	34.25	70.3
10.	Uppal Ring Road	9.5	692.7	35.75	74.8

RESULT AND DISCUSSION

The concentration of CO, CO_2 and level of temperature and noise is measured at 10 different locations from Secunderabad up to Uppal at different time intervals both working and non-working days.

On working days, in the morning the concentration of CO, ranges from 1-12 ppm with an average of 7.5 ppm. the concentration of CO is maximum at Secunderabad 10 number bus stop 12 ppm and minimum at NGRI 1 ppm. in the afternoon the concentration of CO ranges from 1-10 ppm with an average of 5.4 ppm the concentration of CO is maximum at Uppal ring road 10 ppm and minimum NGRI 1 ppm. in the evening the concentration of CO ranges from 2-13 ppm with an average of 8.3 ppm the concentration of CO is maximum at Uppal ring road 13 ppm and minimum NGRI 2 ppm

On non-working days in the morning the concentration of CO ranges from 2-11 ppm with an average of 7.2 ppm. the concentration of CO is maximum at Secunderabad 10 number bus stop 11 ppm and minimum NGRI 2 ppm. in the afternoon the concentration of CO ranges from 2-10 ppm with average of 5.4 ppm the concentration is maximum at Uppal ring road 10 ppm and minimum at NGRI 2 ppm. in the evening the concentration of CO ranges from 2-13 ppm with an average of 8.3 ppm the concentration of CO is maximum at Uppal ring road 13 ppm and minimum at NGRI 2 ppm. The average CO concentration on working days and non-working days is 6.69 ppm.

On working days, in the morning the concentration of CO_2 ranges from 320-824 ppm with an average of 613 ppm the concentration of CO_2 is maximum at Uppal bus stop 824 ppm and minimum at NGRI 320 ppm. in the afternoon the concentration of CO_2 ranges from 360-873 ppm with an average of 638.9 ppm the concentration of CO_2 is maximum at seconderabad 10 number bus stop 873 ppm and minimum at NGRI 360 ppm. in the evening the concentration of CO_2 ranges form 350-883 ppm with an average of 678 ppm. the concentration of CO_2 is maximum at Secunderabad 10 number bus stop 883 ppm and minimum at NGRI 350 ppm.

On non-working days, in the morning the concentration of CO_2 range from 410-847 ppm with an average of 599.5 ppm the concentration of CO_2 is maximum at Secunderabad Rathfile bus stop 847 ppm and minimum at CCMB bus stop 410 ppm. in the afternoon the concentration of CO_2 ranges from 330-680 ppm with an average of 525.5 ppm the concentration is maximum at Uppal ring road 680 ppm and minimum at NGRI 330 ppm. in the evening the concentration of CO_2 range from 410-870 ppm with an average of 649 ppm. the concentration of CO_2 is maximum at Secunderabad Rathfile bus stop 870 ppm and minimum at NGRI 410 ppm. the average CO_2 concentration on working and non-working days is 577.77ppm On working days in the morning the level of temperature ranges from 28.8-37 ℃ with an average of 34.86 ℃, the of temperature is maximum at Uppal ring road 37 ℃ and minimum at Mettiguda bus stop 28.8 ℃. in the afternoon the level of temperature ranges from 35-41℃ with an average of 39.8 ℃ the level of temperature is maximum at Tarnaka bus stop 41 ℃ and minimum at CCMB bus stop 35 ℃. in the evening the level of temperature ranges from 28-34 ℃ with an average of 30.86 ℃. the level of temperature is maximum at Secunderabad 10 number bus stop 34 ℃ and minimum at survey of India 28 ℃.

On non-working days, in the morning the level of temperature ranges from 30.7-39.4 ℃ with an average of 34.63 ℃, the level of temperature is maximum at the Uppal bus stop 39.4 ℃ and minimum at Uppal ring road 30.7 ℃. in the afternoon the level of temperature ranges from 35.5-39.5 ℃ with an average of 37.32 ℃ the level is maximum at Uppal ring road 39.5 ℃ and minimum at Uppal bus stop 35.5 ℃. in the evening the level of temperature ranges from 28.9-33 ℃ with an average of 30.18 ℃, the level of temperature is maximum at Secunderabad 10

number bus stop 33 ℃ and minimum at NGRI 28.9 ℃. the average temperature level on working and non-working days is 34.025 ℃.

On working days, in the morning the level of noise ranges from 64-74 dB with an average of 70.1 dB, The level of noise is maximum at Uppal ring road 74 dB and minimum at NGRI 64 dB, in the afternoon, the level of noise ranges from 66-76 dB with an average of 72.2 dB, the level of noise is maximum at Uppal ring road 76 dB and minimum at NGRI 66 dB, in the evening, the level of noise ranges from 66-78 dB with an average of 72.46 dB, the level of noise is maximum at Secunderabad 10 No bus stop 78 dB and minimum at NGRI 66dB.

On non-working days, in the morning the level of noise ranges from 66-75.6 dB with an average of 69.78 dB the level of noise is maximum at Secunderabad 10 number bus stop 75.6 dB and minimum at NGRI 66 dB in the afternoon, the level of noise ranges from 65.1-75 dB with an average of 69.4 dB the level is maximum at Uppal ring road 75 dB and minimum at Allugadabvi bus stop 65.1 dB in the evening the level of noise ranges from 63-77 dB with an average of 72.31 dB the level of noise is maximum at Secunderabad 10 number bus stop 77 dB and minimum at NGRI 63 dB the average noise level on working days and non-working days is 70.655 dB

The concentration of CO and CO_2 with the level of temperature and noise is more on working days when compared to non-working days as frequency of vehicles is more on working days. the concentration CO, CO_2 and level of temperature and noise is maximum at Secunderabad 10 number bus stop and Uppal ring road on both working and non – working days as largest bus stop is in Secunderabad and at Uppal ring road is a big bus stop as well, hence movement of vehicles is more.

CONCLUSION

The concentration of CO and CO_2 was measured at 10 different locations from Secunderabad up to Uppal. Similarly, the temperature and noise level were measured in the same location both in working and non-working days. The average CO concentration is 6.69 PPM which is above CPCB limit. The average of CO_2 concentration is 577.77 PPM which is upper the common out door concentration, also the average level of Nose is 70.655 dB that is shows an upper Noise level than ambient noise standard, and the average temperature level is 34.025℃ that is higher than the normal temperature of mentioned time period, Since the level of pollution in these areas are high and it is a threat to the life of the residents of this area it is recommend that the government of Telangana must take action toward this problem. The government is suggested to make new policies and update the old policies, in order to improve greenery creation and encourage people to make use of metro instead of old busses, furthermore the government should take serious action to stop old vehicles uses in this area if this actions are taken, I assure that the pollution will decrease in a considerable level in this area.

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