

# Status of Air Pollution in Hyderabad City, Telangana State

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**ABSTRACT:** A consensus has been emerging among public health experts in developing countries that air pollution, even at current ambient levels, aggravates respiratory and cardiovascular diseases and leads to premature mortality. Recent studies have also presented well-founded theories concerning the biological mechanisms involved and the groups of people that are probably more susceptible to health effects caused or exacerbated by inhalation of ambient particulate matter (PM.). Air quality in Hyderabad, India, often exceeds the national ambient air quality standards, especially for particulate matter (PM), which, in 2010, averaged  $82.2 \pm 24.6$ ,  $96.2 \pm 12.1$ , and  $64.3 \pm 21.2 \mu\text{g}/\text{m}^3$  of  $\text{PM}_{10}$ , at commercial, industrial, and residential monitoring stations, respectively, exceeding the national ambient standard of  $60 \mu\text{g}/\text{m}^3$ . A study was conducted to quantify source contributions to PM pollution in Hyderabad, using the chemical mass balance receptor model for 180 ambient samples collected at five stations for  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  size fractions. The receptor modelling results indicated that the  $\text{PM}_{10}$  pollution is dominated by the direct vehicular exhaust and road dust (fugitive dust) (more than 60 %).  $\text{PM}_{2.5}$  with higher propensity to enter the human respiratory tracks has mixed sources of vehicle exhaust, industrial coal combustion, garbage burning, and secondary PM. In order to improve the air quality in the city, these findings demonstrate the need to control emissions from all known sources and particularly focus on the low-hanging fruits like road dust and waste burning, while the technological and institutional advancements in the transport and industrial sectors are bound to enhance efficiencies.

**KEYWORDS:** Hyderabad, Ambient Air Quality, Particulate Matter, AQI.

## I. INTRODUCTION

Rapid urban sprawl of Hyderabad city during the recent decades is one of the major factors for air pollution. The major sources of air pollution are vehicular emissions, large scale construction activities, fugitive dust, industries, bio-mass burning, fuel adulteration and traffic congestion. Delhi producing 9.7 tons/day particulate matter from vehicular emissions (DPCC 2007) and in Hyderabad city the PM contribution from vehicular emissions is around 50% of total emission load (APPCB,2007)[1]. Vehicular pollution is mainly due to two stroke engines, poor fuel quality, inadequate maintenance, congested traffic, poor road conditions and traffic management system. The present public transportation is inadequate & poor and usage of individual vehicles is also a major contributor to the pollution. The vehicular pollution has grown at an alarming rate due to urbanisation and has become a serious problem. The main pollutants from automobile are hydrocarbons, lead, benzene, carbon monoxide, sulphur dioxide, Nitrogen dioxide and particulate matter.

## II. RELATED WORK

Short term health impacts of air pollution have been extensively studied for developed countries using time series and case-crossover studies (Lee et al., 2014). Indian cities today are among the most polluted in the world and it is estimated that outdoor air pollution leads to approximately 670,000 deaths annually (Lim et al., 2013). In India, the Central Pollution Control Board (CPCB) set up under the Air Act of 1981(MoEF, 1981), is mandated with setting and reviewing the National Ambient Air Quality Standards (NAAQS). Current standards, for particulate matter set by the

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CPCB (CPCB, 2009) are much higher than those recommended by the World Health Organization. In addition, unlike other countries, the CPCB does not take into account findings from health literature when deciding on air quality standards (Balakrishnan et al., 2011).

### III. STATUS OF AMBIENT AIR QUALITY

The Telangana State Pollution Control Board has wide network of air quality monitoring stations which include 5Nos. of Continuous Ambient Air Quality Monitoring Stations (CAAQMS) and 19Nos. of manual operating stations. Out of these 19 stations, 7 are operated under National Ambient Air Quality Monitoring Programme (NAMP) in collaboration with CPCB and 12Nos. are operated by State Pollution Control Board.

**Table 1: Continuous Ambient Air Quality Monitoring Stations:**

S. No.	Name of the station	Significance of station	Year of establishment
1	AP Pollution Control Board, A-3, Industrial Estate, Sanathnagar, Hyderabad (then under combined state)	Centre of the city and Balanagar IDA	2005
2	Hyderabad Central University, Gachibowli	Downstream of industrial area and sensitive zone	2014
3	Zoo Park	Sensitive zone	2014
4	Punjagutta Police Station	Highly traffic density zone	2014
5	Pashamylaram	Industrial Area	2014

The above 5 CAAQM systems measure Particulate Matter size less than 10  $\mu\text{m}$  ( $\text{PM}_{10}$ ), Particulate Matter size less than 2.5  $\mu\text{m}$  ( $\text{PM}_{2.5}$ ), Sulphur Dioxide ( $\text{SO}_2$ ), Nitrogen Dioxide ( $\text{NO}_2$ ), Ammonia ( $\text{NH}_3$ ), Ozone ( $\text{O}_3$ ), Carbon Monoxide (CO) and meteorological parameters such as wind speed, wind direction, solar radiation, humidity and temperature. The  $\text{PM}_{10}$  data the Sanathnagar CAAQMS station for years 2006 – 2013 is shown in Figure-1. The CAAQMS station is stopped due to refurbishing of the laboratory in the year 2014 and the latest parameter  $\text{PM}_{2.5}$  is monitored at the same place for the year 2015 as only one head for  $\text{PM}_{10}$  or  $\text{PM}_{2.5}$  is available at this station. In 2015  $\text{PM}_{2.5}$  is measured at Sanathnagar station. The monthly  $\text{PM}_{2.5}$  values are shown in the Graph **Figure-2**. The other three CAAQM stations which were monitored in the year 2014 and 2015 is presented in **Figures-3 to 5** for  $\text{PM}_{10}$ .

#### Trends of $\text{PM}_{10}$ under CAAQMS:

- **Sanathnagar station:** The annual average  $\text{PM}_{10}$  levels at Sanathnagar ranges from 91.7  $\mu\text{g}/\text{m}^3$  (2013) to 148  $\mu\text{g}/\text{m}^3$  (2008). The value in 2006 was 129  $\mu\text{g}/\text{m}^3$ , subsequently which increased to 148  $\mu\text{g}/\text{m}^3$  in 2008. The annual average standard for  $\text{PM}_{10}$  is 60  $\mu\text{g}/\text{m}^3$ . The annual average  $\text{PM}_{2.5}$  levels at Sanathnagar for the year 2015 is 51  $\mu\text{g}/\text{m}^3$ .
- **Zoo Park station:** The annual average  $\text{PM}_{10}$  levels at Zoo Park for 2014 is 112  $\mu\text{g}/\text{m}^3$  and average value for year 2015 is 108  $\mu\text{g}/\text{m}^3$ .
- **Hyderabad Central University (HCU) station:** The annual average  $\text{PM}_{10}$  levels at HCU for 2014 is 71  $\mu\text{g}/\text{m}^3$  and average value for the year 2015 is 76  $\mu\text{g}/\text{m}^3$ .
- **Punjagutta station:** The annual average  $\text{PM}_{10}$  levels at Punjagutta for 2014 is 117  $\mu\text{g}/\text{m}^3$  and average value for the year 2015 is 115  $\mu\text{g}/\text{m}^3$ .

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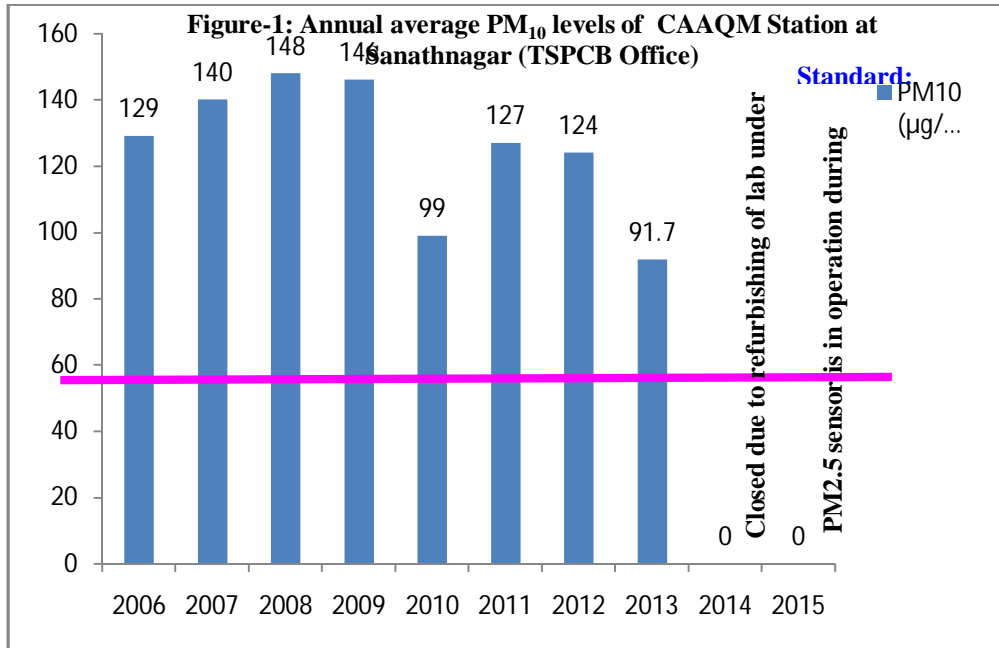


Figure-1 shows the PM<sub>10</sub> levels of CAAQM station at Sanathnagar from the year 2006 to 2015. All the particulate matter levels obtained are above the standard value of 60µg/m<sup>3</sup>.

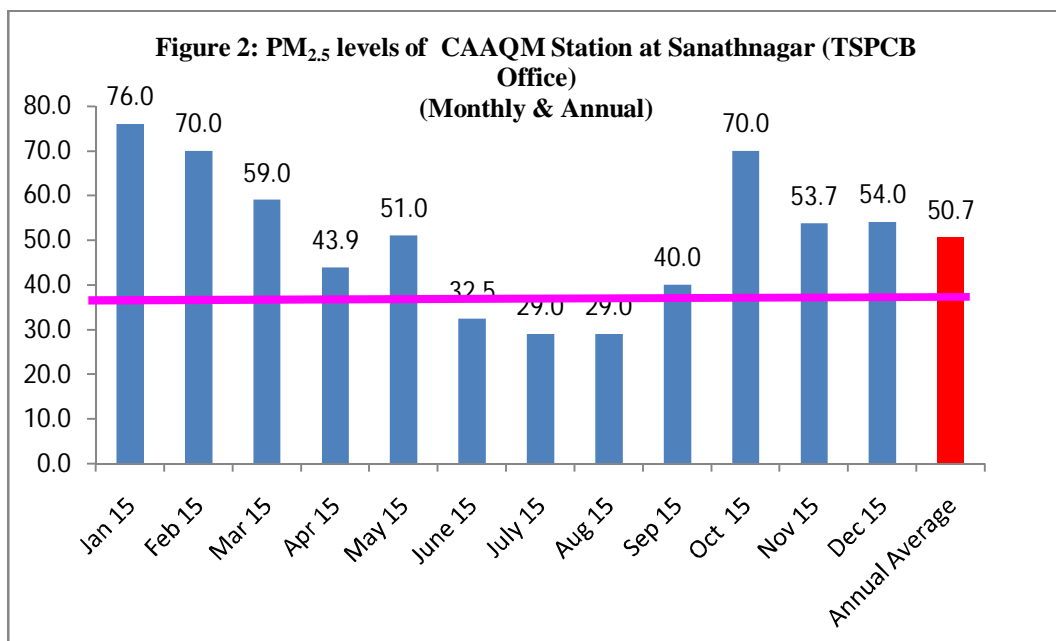


Figure-2 shows the PM<sub>2.5</sub> levels of CAAQM station at Sanathnagar from January 2005 to December 2015 and an annual average value is also taken into consideration. Except June, July, August & September, all the particulate matter levels and the annual average value obtained are above the standard value of 40µg/m<sup>3</sup>.

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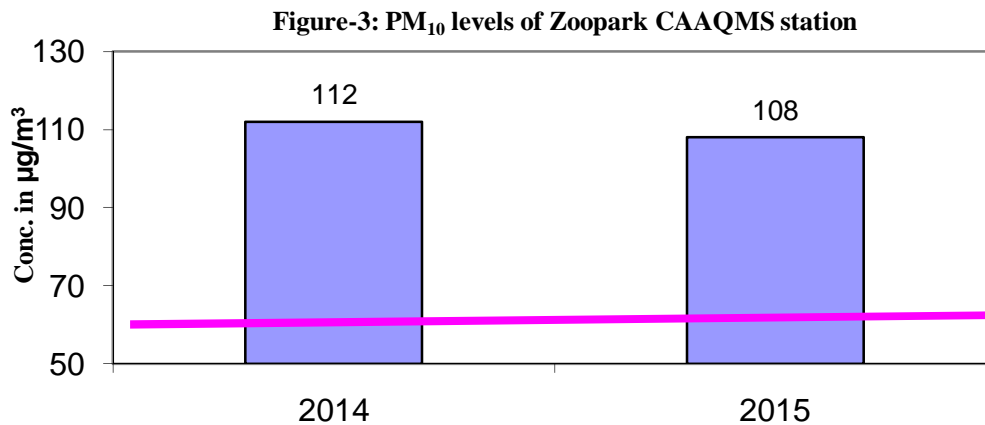


Figure-3 shows the PM<sub>10</sub> levels of CAAQM station at Zoo Park for the years 2014 and 2015. All the particulate matter levels obtained are above the standard value of 60µg/m<sup>3</sup> and show a decrease in the PM<sub>10</sub> levels from 2014 to 2015.

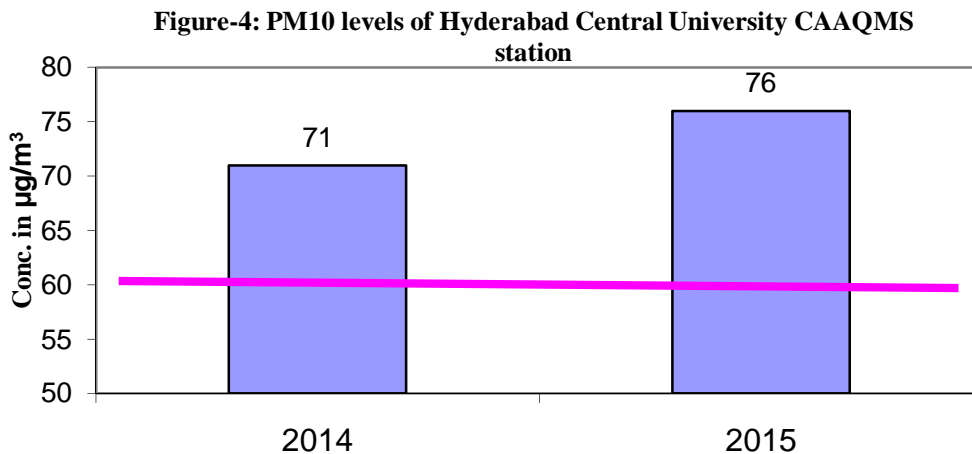


Figure-4 shows the PM<sub>10</sub> levels of CAAQM station at Hyderabad Central University for the years 2014 and 2015. All the particulate matter levels obtained are above the standard value of 60µg/m<sup>3</sup> and observed an increase in the PM<sub>10</sub> levels from 2014 to 2015.

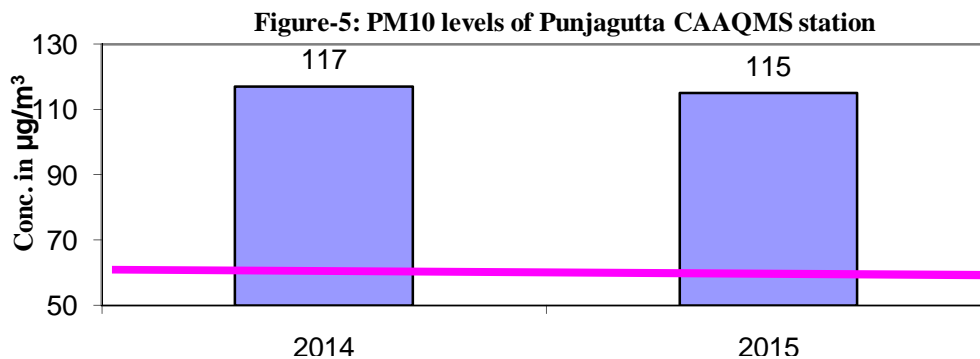


Figure-5 shows the PM<sub>10</sub> levels of CAAQM station at Punjagutta for the years 2014 and 2015. All the particulate matter levels obtained are above the standard value of 60µg/m<sup>3</sup> and observed a slight decrease in the PM<sub>10</sub> levels from 2014 to 2015.

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### Trends of gaseous pollutants under CAAQMS:

The CAAQMS stations are having analysers for SO<sub>2</sub>, NO<sub>x</sub>, CO, Ozone, and BTX Analysers. The data for the 4 CAAQMS stations existing in the city showed the following trends pertaining to the gaseous parameter.

#### Sulphur dioxide:

The concentration of sulphur dioxide gas is well within the limit of 50µg/m<sup>3</sup> and always ranged from 9 to 14 at Sanathnagar and 2.9 to 10.3 at Hyderabad Central University, 8.0 to 13.8 at Zoo Park and 6.7 to 24.9 µg/m<sup>3</sup> at Pashamylaram IDA. In addition, the manual stations also showed 4 to 6 µg/m<sup>3</sup>. This may be due to utilization of ultra-low sulphur diesel in the Hyderabad metro. The SO<sub>2</sub> levels are well within the NAAQS limits.

#### Nitrous oxides:

The limits for NO<sub>2</sub> is 40µg/m<sup>3</sup>. The data of CAAQMS for 2015 at Sanathnagar is ranged between 27 to 58.4 µg/m<sup>3</sup> in the year 2015 and 32.4 to 66.7 µg/m<sup>3</sup> at Punjagutta busiest traffic junction and 23.7 to 87.7 µg/m<sup>3</sup> at Hyderabad Central University and 26.7 to 157.7 at Zoo Park and 52.1 To 93.3 µg/m<sup>3</sup> at Pashamylaram IDA. The increased levels of NO<sub>2</sub> may be due to vehicular pollution in the city and industrial emissions at Pashamylaram IDA. The other manual operating stations have shown the NO<sub>2</sub> values from 15.2 to 32 µg/m<sup>3</sup> at various places. The annual average of NO<sub>x</sub> levels were well within the NAAQS limits.

#### Carbon Monoxide (CO):

The prescribed limit for CO is 4 mg/m<sup>3</sup>. The CO levels are ranged between 0.4 and 0.9 mg/m<sup>3</sup> at Sanathnagar and 1.6 to 2.5 mg/m<sup>3</sup> at Punjagutta, 0.5 to 1.2 mg/m<sup>3</sup> at Hyderabad Central University and 0.3 to 0.9 mg/m<sup>3</sup> at Pashamylaram. 0.6 To 1.4 mg/m<sup>3</sup> at Zoo Park. The average of CO levels were well within the NAAQS limits.

#### Ammonia (NH<sub>3</sub>):

The limits for Ammonia is 100 µg/m<sup>3</sup>. The ammonia levels ranged from 10.4 to 32.5 at Punjagutta and 10.2 to 43.5µg/m<sup>3</sup> at HCU, 19.8 to 41.8µg/m<sup>3</sup> at Pashamylaram, 10.4 to 47.6µg/m<sup>3</sup> at Zoo Park. The results from manual monitoring also showed that the ammonia values were high at Jeedimetla IDA i.e., annual average of 120 and 96 to 241 µg/m<sup>3</sup> and other 6 NAAQM stations have shown below annual averages. The average of ammonia levels were well within the NAAQS limits except in IDAs.

#### Ozone (O<sub>3</sub>):

The limits for Ozone is 100 µg/m<sup>3</sup> for 8 hours and 180µg/m<sup>3</sup> for 1hr. The O<sub>3</sub> values ranged from 29.0 to 69.3 at Sanathnagar and 3.6 to 36.7 at Punjagutta, 14.7 to 51.8 at HCU, 14.7 to 54.7 at Pashamylaram and 30.8 to 63.9 at Zoo Park. The ozone levels were well within the NAAQS limits.

#### BTX:

The limits for benzene is 5µg/m<sup>3</sup>. The values at Sanathnagar were from 1.2 to 3.8, 1.5 to 9.0 at Punjagutta and 0.8 to 2.1 at HCU, 0.2 to 0.8 at Pashamylaram, 0.6 to 3.4 at Zoo Park. It may be seen that the busiest traffic junction Punjagutta is showing annual average of 5.5 µg/m<sup>3</sup> which is exceeding the limits. This may be due to severe traffic congestion and vehicular mobility. Remaining other places, the average values were within the limits.

### Trends of Meteorological data under CAAQMS:

The TSPCB has CAAQMS where continuous meteorological data installed at 5 places. The stations will give the data of wind speed, wind direction, vertical wind speed, relative humidity, barometric pressure, rainfall, solar radiation, etc.

#### Sanathnagar station:

The data from 2006 to 2015 shows that the annual wind speed is 0.7 to 2.7m/s during all these years and wind direction is predominantly mostly towards south east to north west in 2006, 2007, 2008, south west to north east and west to east, north east to south west in 2009, 2010, 2011, 2012. In 2013 is predominantly southwest to north east. In 2015, the directions are totally changed and from north to south and northwest to southeast and occasional south east to northwest.

#### Zoo Park:

The data shows that the annual wind speed is 1.4m/s and wind direction is predominantly mostly towards east to west in 2014.

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**HCU:**

The data shows that the annual wind speed is 2.3m/s and wind direction is predominantly mostly towards east to west in 2014 and north east to south west in 2015.

**Pashamylaram:**

The data shows that the annual wind speed is 3.0m/s and wind direction is predominantly mostly towards south east to North West in 2014-15. It shows wide fluctuation of wind directions as it is away from the city.

**Punjagutta:**

The data shows that the annual wind speed is 2.7m/s and wind direction is predominantly mostly towards south east to north-west in 2014-15.

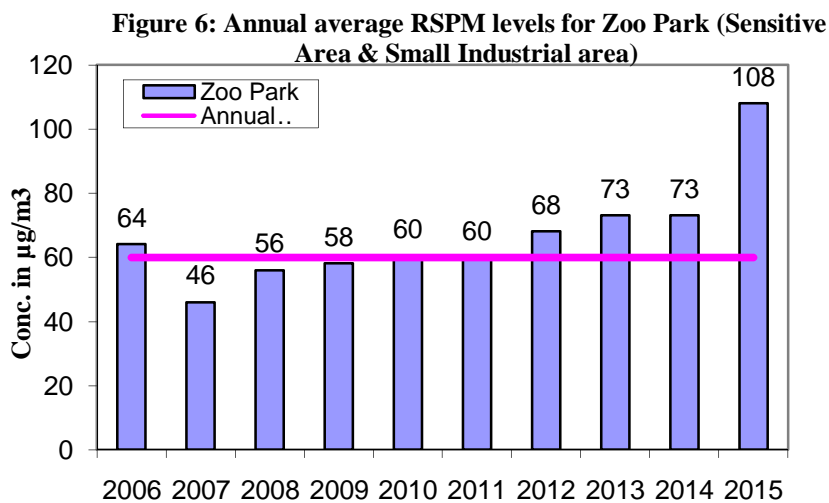


Figure-6 shows the Annual average RSPM levels at Zoo Park from the year 2006 to 2015. From the year 2012, all the RSPM levels obtained are above the standard value of 60µg/m<sup>3</sup>.

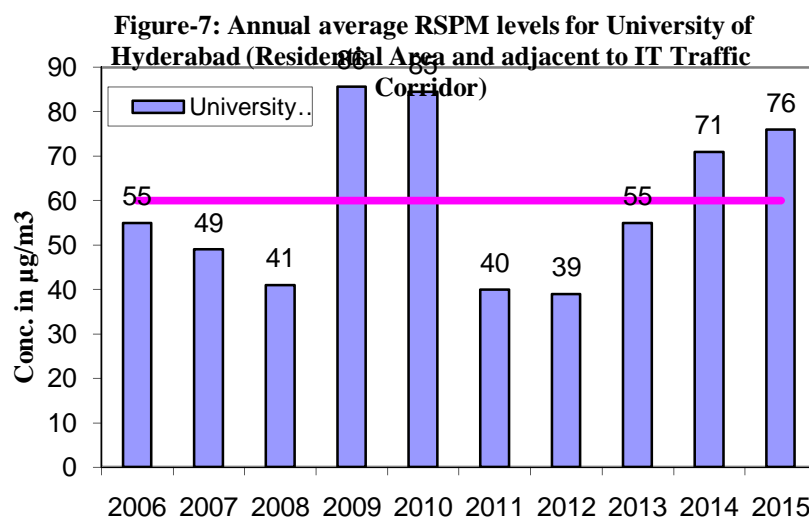


Figure-7 shows the Annual average RSPM levels at University of Hyderabad from the year 2006 to 2015. Due to adjacent traffic corridor, there is an uneven fluctuation in RSPM levels. On an average from 2006 to 2015 we consider a standard value of 60µg/m<sup>3</sup> from the obtained data.

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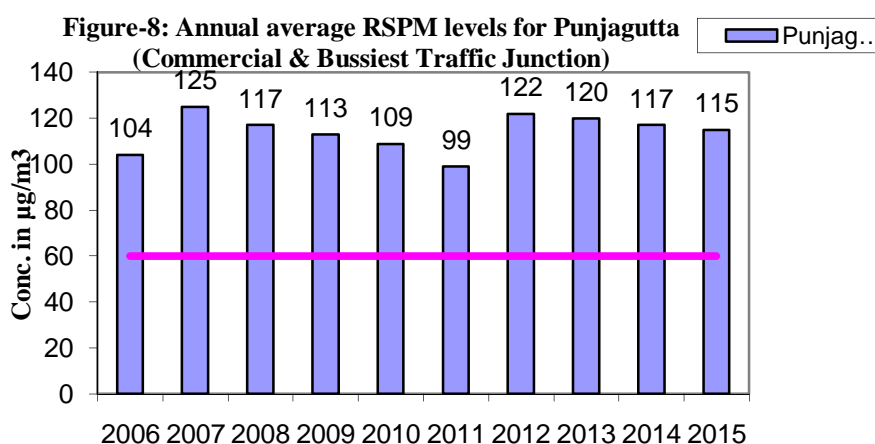


Figure-8 shows the Annual average RSPM levels at Punjagutta for the years 2006 and 2015. All the RSPM levels obtained are above the standard value of 60µg/m<sup>3</sup>.

### Trends of Ambient Air Quality (AAQ) monitored under manual stations:

State Pollution Control Board has been carrying out ambient air quality monitoring since 2006. At present, 19 manual stations are located in Hyderabad. The air quality data pertaining to RSPM i.e., PM<sub>10</sub> values monitored by TSPCB from 2006 to 2015 (Annual average statement) is enclosed at **Figure 9**.

It may be noted that some of the monitoring stations like KBRN Park, Hyderabad Central University, Rajendranagar Agricultural University, Shameerpet, Madhapur, BPPA office in the city (near Secretariat), Zoo Park area, Jubilee Hills area, Sainikpuri are showing marginal values of PM<sub>10</sub> levels. Whereas other traffic junction places and industrial areas like Balanagar, Charminar, Jeedimetla, Paradise, Punjagutta, Uppal and Abids have shown higher values of the PM<sub>10</sub> due to various factors like congestion of vehicles, fugitive dust, etc.

**Figure 9: Annual average values of RSPM levels**

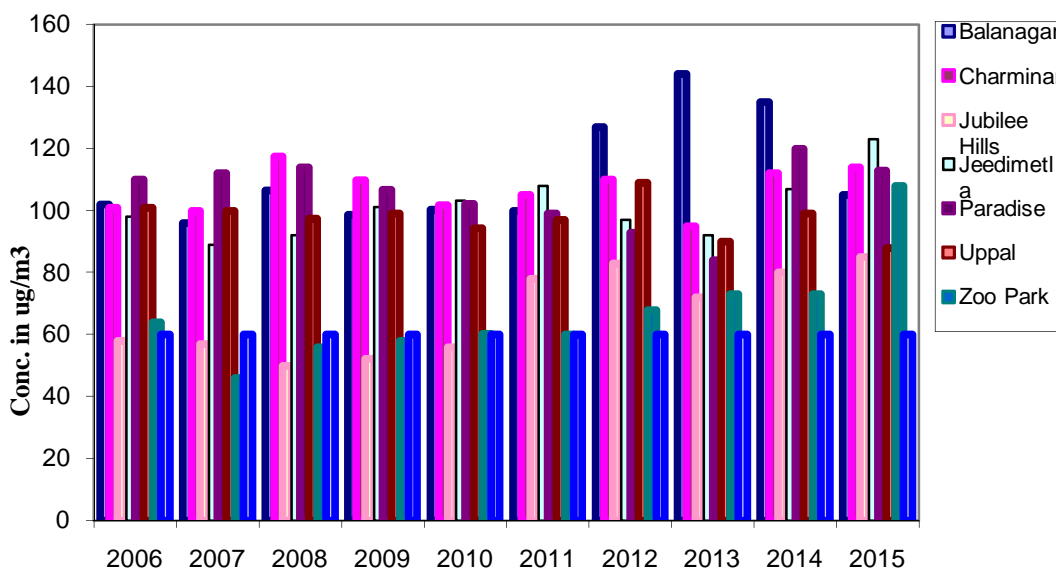


Figure-9 shows the Annual average RSPM levels of Balanagar, Charminar, Jubilee Hills, Jeedimetla, Paradise, Uppal, Zoo Park and Annual Standard for the years 2006 and 2015.

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## National Ambient Air Quality Monitoring Stations (7):

- 1. Paradise station:** The annual average PM<sub>10</sub> levels at Paradise ranged from 84 µg/m<sup>3</sup> in 2011 to 113 µg/m<sup>3</sup> in 2015. The value in 2006 was 110 µg/m<sup>3</sup>, subsequently which increased to 120 µg/m<sup>3</sup> in 2014 and 113 µg/m<sup>3</sup> to 2015.
- 2. Charminar station:** The annual average PM<sub>10</sub> levels at Charminar ranged from 95 µg/m<sup>3</sup> (2013) to 118 µg/m<sup>3</sup> (2008). The value in 2006 was 101 µg/m<sup>3</sup>, subsequently increased to 118 µg/m<sup>3</sup> in 2008 and in 2015, the value was 114 µg/m<sup>3</sup>.
- 3. Zoo Park station:** The annual average PM<sub>10</sub> levels at Zoo Park ranged from 46 µg/m<sup>3</sup> (2007) to 73 µg/m<sup>3</sup> (2013). The value in 2006 was 64 µg/m<sup>3</sup>, subsequently increased to 73 µg/m<sup>3</sup> in 2013. Presently, the continuous ambient air quality station is in operation. 108 µg/m<sup>3</sup> was the value for 2015.
- 4. Balanagar station:** The annual average PM<sub>10</sub> levels at Balanagar ranged from 96 µg/m<sup>3</sup> (2009) to 144 µg/m<sup>3</sup> (2013). The value in 2006 was 102 µg/m<sup>3</sup>, subsequently increased to 144 µg/m<sup>3</sup> in 2013. Presently, the value was 105 µg/m<sup>3</sup> for the year 2015.
- 5. Uppal station:** The annual average PM<sub>10</sub> levels at Uppal ranged from 90 µg/m<sup>3</sup> (2013) to 109 µg/m<sup>3</sup> (2012). The value in 2006 was 101 µg/m<sup>3</sup>, subsequently increased to 109 µg/m<sup>3</sup> in 2012. Presently, the value was 88 µg/m<sup>3</sup> for the year 2015.
- 6. Jubilee Hills station:** The annual average PM<sub>10</sub> levels at Jubilee Hills ranged from 50 µg/m<sup>3</sup> (2008) to 83 µg/m<sup>3</sup> (2012). The value in 2006 was 58 µg/m<sup>3</sup>, subsequently increased to 83 µg/m<sup>3</sup> in 2012. Presently, the value was 85 µg/m<sup>3</sup> for the year 2015.
- 7. Jeedimetla station:** The annual average PM<sub>10</sub> levels at Jeedimetla ranges from 89 µg/m<sup>3</sup> (2007) to 108 µg/m<sup>3</sup> (2011). The value in 2006 was 98 µg/m<sup>3</sup>, subsequently which increased to 108 µg/m<sup>3</sup> in 2011. Presently, the value is 123 µg/m<sup>3</sup> for the year 2015.

## State Ambient Air Quality Monitoring Stations (12):

- 1. Abids station:** The annual average PM<sub>10</sub> levels at Abids ranged between 81 µg/m<sup>3</sup> (2013) and 115 µg/m<sup>3</sup> (2008). The value in 2006 was 104 µg/m<sup>3</sup>, subsequently increased to 115 µg/m<sup>3</sup> in 2008. The value for 2015 was 92 µg/m<sup>3</sup>.
- 2. KBR National Park station:** The annual average PM<sub>10</sub> levels at KBR National Park ranged from 44 µg/m<sup>3</sup> (2013) to 60 µg/m<sup>3</sup> (2012). The value in 2006 was 46 µg/m<sup>3</sup>, subsequently increased to 60 µg/m<sup>3</sup> in 2012. The value for 2015 was 54 µg/m<sup>3</sup>.
- 3. Buddha Purnima Project station:** The annual average PM<sub>10</sub> levels at Buddha Purnima Project ranged from 54 µg/m<sup>3</sup> (2013) to 81 µg/m<sup>3</sup> (2008). The value in 2006 was 61 µg/m<sup>3</sup>, subsequently increased to 81 µg/m<sup>3</sup> in 2008. The value for 2015 was 64 µg/m<sup>3</sup>.
- 4. MG Bus Station:** The annual average PM<sub>10</sub> levels at MG Bus Station ranged from 66 µg/m<sup>3</sup> (2011 & 12) to 84 µg/m<sup>3</sup> (2009). The value in 2006 was 74 µg/m<sup>3</sup>, subsequently increased to 84 µg/m<sup>3</sup> in 2009. The value for 2015 was 67 µg/m<sup>3</sup>.
- 5. Chikkadapally station:** The annual average PM<sub>10</sub> levels at Chikkadapally ranged from 68 µg/m<sup>3</sup> (2010) to 87 µg/m<sup>3</sup> (2011 & 12). The value in 2006 was 72 µg/m<sup>3</sup>, subsequently increased to 87 µg/m<sup>3</sup> in 2012. The value for 2015 was 81 µg/m<sup>3</sup>.
- 6. Langar House station:** The annual average PM<sub>10</sub> levels at Langar House ranged from 91 µg/m<sup>3</sup> (2014) to 153 µg/m<sup>3</sup> (2007). The value in 2006 was 122 µg/m<sup>3</sup>, subsequently increased to 153 µg/m<sup>3</sup> in 2007. The value for 2015 was 177 µg/m<sup>3</sup>. The PM<sub>10</sub> value is high because HMWS carried out new pipeline laying work.
- 7. Madhapur station:** The annual average PM<sub>10</sub> levels at Madhapur ranged from 45 µg/m<sup>3</sup> (2009) to 88 µg/m<sup>3</sup> (2013). The value in 2006 was 70 µg/m<sup>3</sup>, subsequently increased to 88 µg/m<sup>3</sup> in 2013. The value for 2015 was 50 µg/m<sup>3</sup>.
- 8. Shamirpet station:** The annual average PM<sub>10</sub> levels at Shamirpet ranged from 38 µg/m<sup>3</sup> (2009) to 79 µg/m<sup>3</sup> (2014). The value in 2006 was 58 µg/m<sup>3</sup>, subsequently increased to 79 µg/m<sup>3</sup> in 2014. The value for 2015 was 70 µg/m<sup>3</sup>.



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9. **Kukatpally station:** The annual average PM<sub>10</sub> levels at Kukatpally ranged from 71 µg/m<sup>3</sup> (2007) to 137 µg/m<sup>3</sup> (2013). The value in 2006 was 73 µg/m<sup>3</sup>, subsequently increased to 137 µg/m<sup>3</sup> in 2013. The value for 2015 was 123 µg/m<sup>3</sup>.
10. **Sainikpuri station:** The annual average PM<sub>10</sub> levels at Sainikpuri ranged from 50 µg/m<sup>3</sup> (2008) to 113 µg/m<sup>3</sup> (2013). The value in 2006 was 66 µg/m<sup>3</sup>, subsequently increased to 113 µg/m<sup>3</sup> in 2013. The value for 2015 was 112 µg/m<sup>3</sup>.
11. **Rajendranagar station:** The annual average PM<sub>10</sub> levels at Rajendranagar ranged from 33 µg/m<sup>3</sup> (2014) to 49 µg/m<sup>3</sup> (2006). The value in 2006 was 49 µg/m<sup>3</sup>, subsequently decreased to 33 µg/m<sup>3</sup> in 2014. The value for 2015 was 41 µg/m<sup>3</sup>.
12. **Nacharam station:** The annual average PM<sub>10</sub> levels at Nacharam ranged from 74 µg/m<sup>3</sup> (2010&13) to 94 µg/m<sup>3</sup> (2014). The value in 2006 was 76 µg/m<sup>3</sup>, subsequently increased to 94 µg/m<sup>3</sup> in 2014. The value for 2015 was 101 µg/m<sup>3</sup>.

Source Apportionment Studies taken-up by State Pollution Control Board in collaboration with USEPA, DRI, NREL indicated contribution of PM<sub>10</sub> mainly due to mobile sources (vehicles 49%), road dust (33%), secondary pollutants (8%), bio-mass burning (4%) and other 6%.

### Air Quality Index and its significance:

- There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints). AQ sub-index and health breakpoints are evolved for eight pollutants (PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>, NH<sub>3</sub>, and Pb) for which short-term (upto 24-hours) National Ambient Air Quality Standards are prescribed.
- Based on the estimated ambient concentrations of a pollutant, sub-index is calculated, which is a linear function of concentration (e.g. the sub-index for PM<sub>2.5</sub> will be 51 at concentration 31 µg/m<sup>3</sup>, 100 at concentration 60 µg/m<sup>3</sup>, and 75 at concentration of 45 µg/m<sup>3</sup>). The worst sub-index determines the overall AQI. AQI categories and health breakpoints for the eight pollutants are as follow:

Table 2: Air Quality Index

AQI Category	AQI	Concentration Range*							
		PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO	SO <sub>2</sub>	NH <sub>3</sub>	Pb
Good	0-50	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory	51-100	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted	101-200	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor	201-300	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very Poor	301+400	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe	401-500	430+	250+	400+	748+*	34+	1600+	1800+	3.5+

\* CO in mg/m<sup>3</sup> and other pollutants in µg/m<sup>3</sup>; 2h-hourly average values for PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, NH<sub>3</sub>, and Pb, and 8-hourly values for CO and O<sub>3</sub>.

Based on the above criteria, the AQI index of Hyderabad for year 2015 for 5 CAAQMS stations and 19 manual stations shows that **Good to moderately polluted**.

### IV. VARIOUS STEPS TAKEN BY THE GOVERNMENT FOR CONTROLLING AIR POLLUTION

1. The Environment Forest, Science & Technology (EFS&T) Department, Government of Andhra Pradesh (GoAP) has issued G.O.Ms.No.124 dt:07.10.1999 for control of automobile pollution to improve ambient air quality in twin cities of Hyderabad & Secunderabad by stating the following:

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- i. No four wheeled and above vehicles more than fifteen years old (age of vehicle derived from the chassis number) shall be renewed of Fitness Certificate in twin cities of Hyderabad and Secunderabad and the surrounding areas covered by Hyderabad Urban Development.
  - ii. No three wheeled transport vehicles shall be registered in the Twin cities and surrounding areas covered by Hyderabad Urban Development Authority (HUDA). However, old vehicles can be replaced by four stroke rear engine petrol driven vehicles or by diesel driven vehicles. However, there shall be no restriction on new and converted vehicles operated on alternate fuel such as battery, CNG, LPG or solar energy etc., for new registration and permit.
  - iii. No four wheeled diesel taxis which are more than eight (8) years old from the date of their first registration or chassis number whichever is earlier shall ply in the twin cities and surrounding areas covered by the Hyderabad Urban Development Authority If any diesel taxi violates the above condition, the registration of such vehicles shall be deemed to be cancelled and such of the vehicles shall be liable for confiscation.
  - iv. No new registration of two (2) wheeled, two-stroke vehicles shall be permitted from the 1<sup>st</sup> April, 2000. The existing two-stroke 2-sheeled vehicles shall not be permitted to ply on roads of the area covered by "Hyderabad Urban Development Authority" from the 1<sup>st</sup> April, 2010. The registration of such vehicles shall be deemed to be cancelled after the date. However, this registration is not applicable to the vehicles that operate on alternate fuel such as battery, CNG, LPG or source of energy that any include solar power etc.
2. The EFS&T Department, GoAP has issued directions to implement action plan for Vehicular pollution management in twin cities of Hyderabad and Secunderabad vide G.O.Rt.No.409 & 410 dt: 23.11.2001.
- i. To check adulteration of oil and fuel.
  - ii. To ban the Sale of loose 2T oil within HUDA limits.
  - iii. APSRTC to initiate a plan for converting buses into CNG or LPG. Approved fuel mode within 3 months.
  - iv. To condemn Government vehicles which are more than 15 years. Old numbering approximately 3,000 in Hyderabad Urban Development Authority (HUDA) area.
  - v. To improve and expedite Public Transport System of Rail-cum-Road in HUDA limits.
3. The Food, Civil Supplies & Consumer Affairs Department, GoAP issued G.O. Rt.No.61, dt:04.05.2002 has constituted Task force to check the adulteration of petrol, diesel, oils and lubricants in the petrol bunks and also outside the petrol bunks in private premises in twin cities of Hyderabad and Secunderabad in HUDA limits.
4. The EFS&T Department, GoAP has issued G.O.Rt.No.267, dt:24.07.2002 for phasing out the 15 years old Government vehicles within Hyderabad Urban Development Authority limits.
5. The Transport, Road & Buildings Department, GoAP issued G.O.Ms.No.137, dt:06.08.2002 for restriction on 3 wheeled contract carriages in Hyderabad.
6. The EFS&T Department, GoAP issued G.O.Ms.No.89 dt:04.11.2003 directing all concerned enforcing department / agencies for strict implementation of measures recommended by the sub-committee and to implement all the directions of the Hon'ble Supreme Court to improve the air quality in the HUDA area.
7. The EFS&T Department, GoAP issued G.O.Ms.No.115 dt:30.09.2004 constituting Group of ministers to monitor the implementation of action plan on vehicular pollution management.
8. The General Administration Department, GoAP issued G.O.Ms.No.265, dt:24.06.2005 for Phasing out of +15 years old govt. vehicles by adopting appropriate schemes i.e., the existing petrol vehicles may be converted into LPG and the Euro – 3 compliant vehicles should be hired.

### A. Steps taken by the Greater Hyderabad Municipal Corporation and Hyderabad Metropolitan Development Authority:

The GHMC constructed 17 number of fly-overs to ease the traffic flow and avoid traffic jam. In addition, an express high way from Mehadipatnam to Aramghar with a length of 11.5Km is already commissioned for commuters of airport.

The Government has taken up major infrastructure facilities in the city of Hyderabad and one of them is the construction of an orbital linkage to decongest the traffic flow on the existing major arterials. The Outer Ring Road (ORR) is an initiative in this direction. The HMDA is constructing an Outer Ring Road (ORR) which is in completion stage. This is road-cum-area development project aim is the development of well-planned and well-connected urban settlements around the Hyderabad Metropolitan area. The 159km. ring road connects Patancheru-

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Shamshabad-Hiyathnagar-Medchal-Patancheru, providing connectivity to various State Highways and national Highways, to by-pass the city of Hyderabad.

The GHMC has been stipulating following conditions for controlling and preventing the Air Pollution while granting the building construction permission:

- i. As per Clause 3(e) of GO Ms. No.168 MA, dated: 07.04.2012, it is mandatory to obtain the Environmental Clearance from State Environment and Forests, Govt. of India for the building with 20,000 sq. mts. And above built-up area. To this effect, a condition is being stipulated on the plans and the compliance is insisted while issuing the occupancy certificate.
- ii. A condition also being stipulated in the sanctioned plan as to the effect that the applicant erect temporary screen (blue tin sheet) around the construction area to avoid spilling of building materials outside the plot during the construction to stop environmental pollution and to ensure safety & security in the Neighbouring / Surrounding areas.
- iii. Another important condition being stipulated is that the building owner / applicant shall not dump the building materials on foot path / road side or Neighbours premises and shall dump the materials inside the premises without creating nuisance and air pollution. To this effect an undertaking is being obtained from the applicant before release of Building Permission. The same is being strictly implemented and the Vigilance Wing of GHMC will verify this aspect during field inspections and penalize the violations.
- iv. Apart from the above, the GHMC is insisting a minimum 1 meter wide continuous planting strip / lawn shall be provided around the building to prevent the air pollution. This same is being verified for compliance while issuing occupancy certificate. If the strip of Greenery / Lawn and the organized open space (Tot-lot) are not maintained, occupancy certificate is denied and additional property tax being imposed.

### **Initiations taken by the GHMC by issuing instructions to the concerned officers for controlling and preventing the air pollution due to burning of “municipal solid waste”:**

- i. Take stringent action against open burning of bio-mass / leaves / tyres, etc. to control such activities and submit periodic status reports.
- ii. Ensure proper collection of horticulture waste (bio-mass) and composting-cum-gardening approach
- iii. Decentralization of composting in apartments
- iv. Organic waste to be decomposed
- v. Call back options
- vi. Ensure strict enforcement of ban on burning of agriculture waste and crop residues.
- vii. After receiving any complaint with regard to the burning of Municipal Solid Waste through the Toll free no. /online by the concerned officer, the AMOHs & DCs shall proceed to take action in accordance to law and penalize the offender with Rs.5000/- instantaneously for polluting environment.
- viii. The Police Dept., and Corporation Authorities shall not permit burning of plastic and allied produces and if they notice any burning of such material, they would not only ensure that such activity does not persist, but even would be entitled to seize the entire material which is illegally and un-authorized stored and not processing license or authorization for dealing such products in accordance with the plastic waste (M&H) Rules, 2011.

### **B. Multi Modal Transport System:**

Multi Modal Transport System (MMTS), jointly developed by GoAP and Ministry of Railways, has been implemented, by making use of the augmented capacity of existing railway lines covering 43Kms. The no. of services have been increased from 87 to 92 and some of the peak time service capacity is augmented by converting 6 car rake in to 9 car rakes. Because of the above steps, this year the number of passengers travelling by MMTS services are increased from 52,000 to 1, 30,000 every day. To encourage commuters to shift from road to rail, the approaches to the MMTS stations for the convenience of the pedestrians, footpaths, zebra crossing and pelican signals street lightings are being developed.

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### **C. Augmentation of CNG supply for public transport:**

M/s.Bhagyanagar Gas Ltd., Hyderabad is supplying the CNG gases for RTC and autorickshaws. The Govt. of India has allocated a 53000 scmd of gas to the Bhagyanagar Gas Ltd., and at present they are receiving 49500 to 51000 scmd of CNG. This gas is stored at mother station at Shameerpet and supplied through booster daughter stations at Medchal and Hakimpet and cantonment RTC bus depots. Presently, 132 buses are being run by CNG gas at the above three depots.

The Telangana State Pollution Control Board has communicated directions of Hon'ble National Green Tribunal (NGT) orders dt: 10.04.2015 & 17.04.2015 in Original Application (OA) No.21 of 2014 and O.A.No.95 of 2014 to all the concerned stakeholder departments for compliance.

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