INFLUENCE OF TRAFFIC ON INDOOR AIR QUALITY OF NATURALLY AND MECHANICALLY VENTILATED BUILDING LOCATED NEAR AN URBAN ROADWAY

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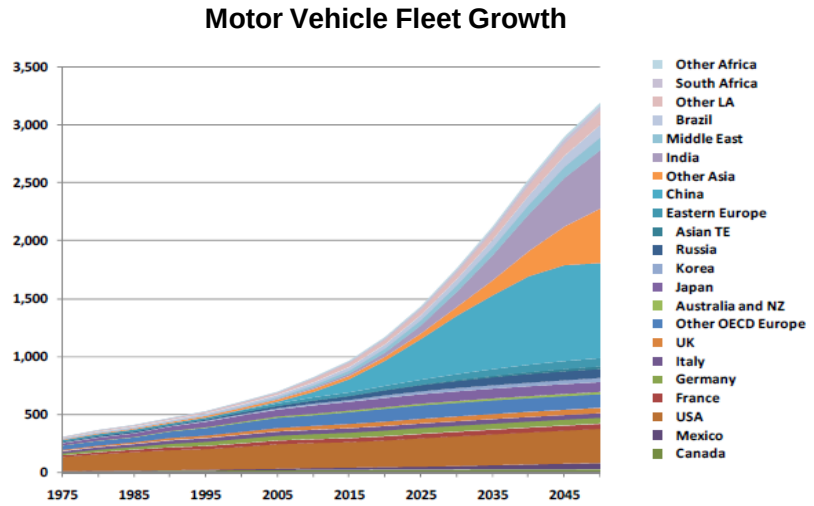
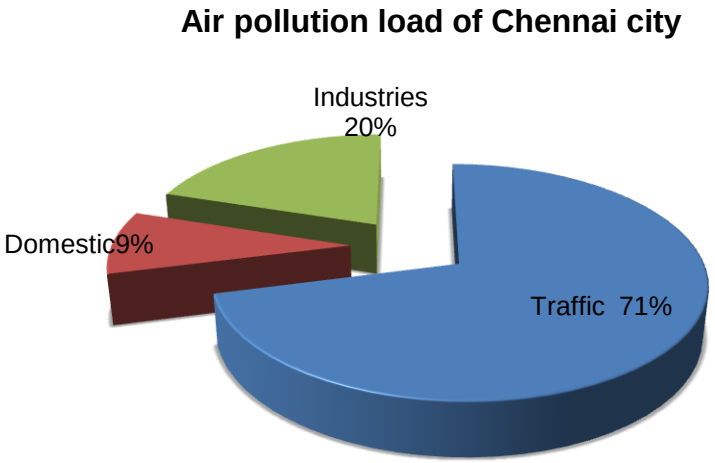
Introduction

- Over the past decades there has been a rapid increase in Motor vehicle population in Indian cities.
- Vehicular emissions are the main source of air pollution in urban environment.
- Vehicular air pollutants such as carbon monoxide(CO),oxides of nitrogen(NOx), hydrocarbons(HC), and particulate matter(PM) concentrations in many urban areas are sufficiently high to cause adverse health effects.





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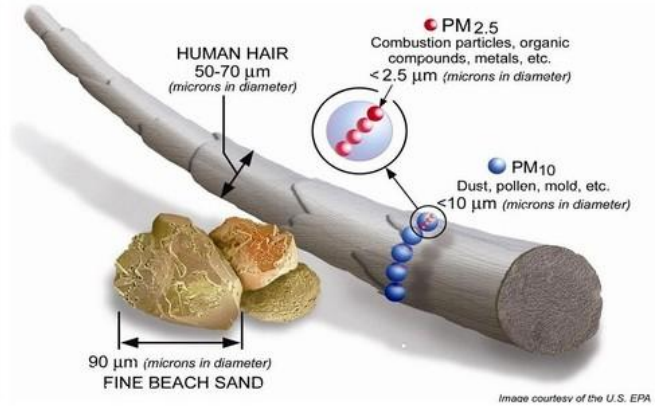
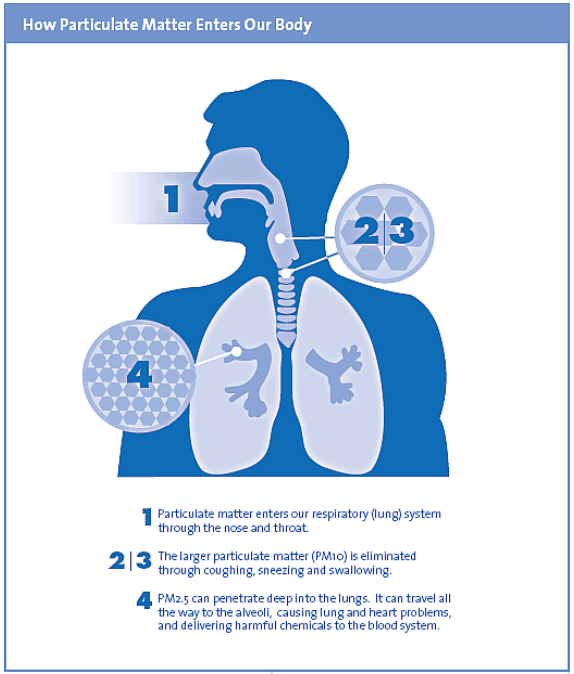
- Particulate matter and CO has been identified as major vehicular pollutants in many urban areas.
- Exposure to particulates with aerodynamic diameter less than10micron is associated with higher rates of mortality and morbidity.
- Fine particles can penetrate deep into the human respiratory systems and cause lung cancer, aggravated asthma and mortality
- Excess intake of CO concentrations can cause acute CO intoxication since it disrupts the transfer of oxygen to human tissues.





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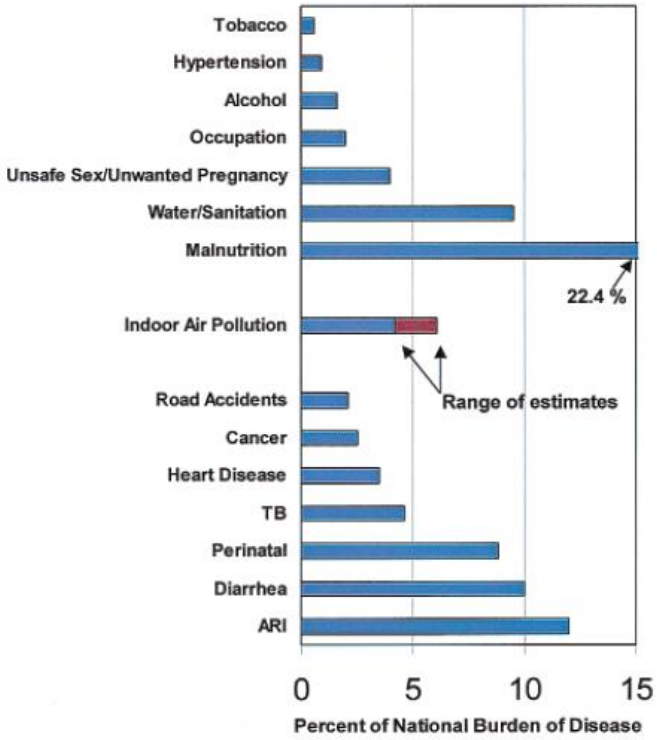
- People spend about 90 percent of their time in indoors.
- Outdoor air pollutant concentrations were having significant impact on indoor air quality of buildings located close proximity to traffic (Wjst et.al 1993; Van et.al 1998; Fischer et.al 2000; Dainius et.al 2008).
- Several studies indicated that indoor air pollutant concentrations are often higher than that of outdoor concentrations.
- In India only limited studies are available regarding the effect of outdoor traffic on indoor air quality.

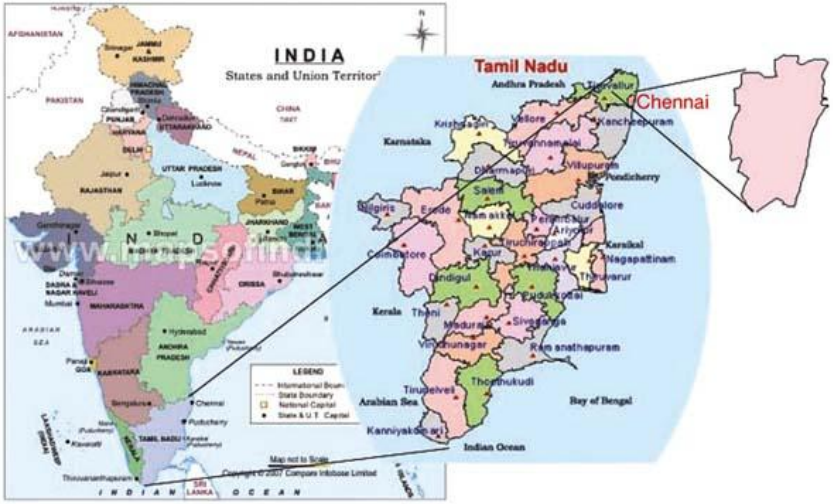


AIM

The Aim of this research work is to study the influence of traffic related emissions on indoor air quality in naturally and mechanically ventilated buildings located close to busy roadway in Chennai city.

About Chennai

- Chennai (E80º14’51” and N13º03’40”) situated on the shores of the Bay of Bengal is the capital of the Tamil Nadu state .
- Fourth largest metropolis in India.
- Chennai lies on the thermal equator and most of the year it is hot and humid.
- The hottest time period is typically May-June with a maximum temperature of about 42º C
- Coolest period is January with a minimum temperature of about 20ºC
- Chennai gets most of the rainfall from the north east monsoon (mid September to mid December)



Chennai city Area : 174 Sq.Km

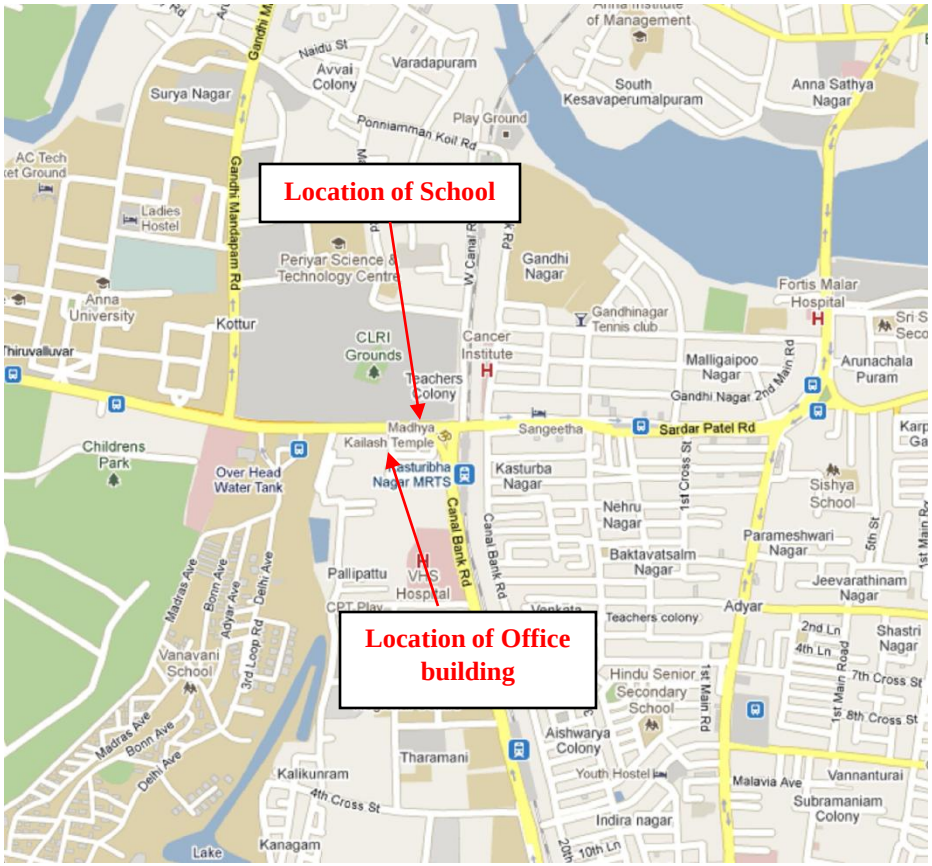
Elevation above the sea level: 6 m

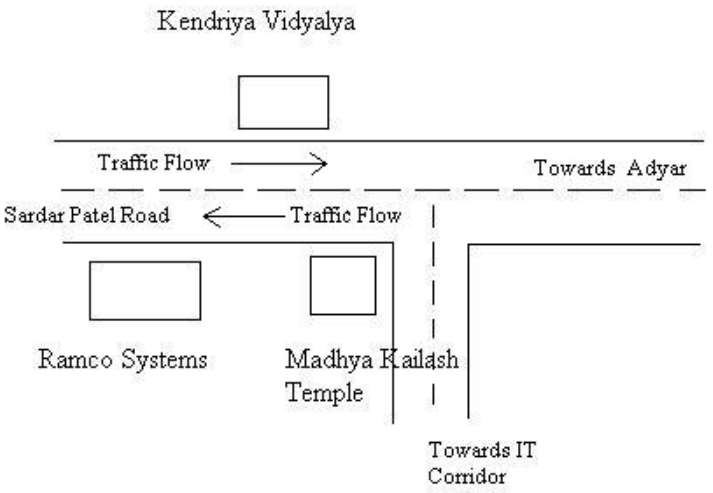
Population: 4.68 million (2011 census)

Floating population: about 20 lakhs

Study area

- Kendriya Vidhyalaya School at Central Leather Research Institute campus
- Ramco Systems





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- The School has strength of nearly 1000 students and offers education from pre- school to 12th class in two different buildings.
- The study room is in the primary block; occupied by 43 pupils.
- Ramco Systems is an 11 storied building, which is mechanically ventilated with centralized air conditioning system.
- The study room is in 2nd floor of the building with an occupancy of 120 employees.

Monitoring instruments

Dust Monitor Model 1.107
(PM10, PM2.5, PM1)

Dust Monitor Model 1.108
(PM10, PM2.5, PM1)

Wind monitor (wind speed, wind direction, T)

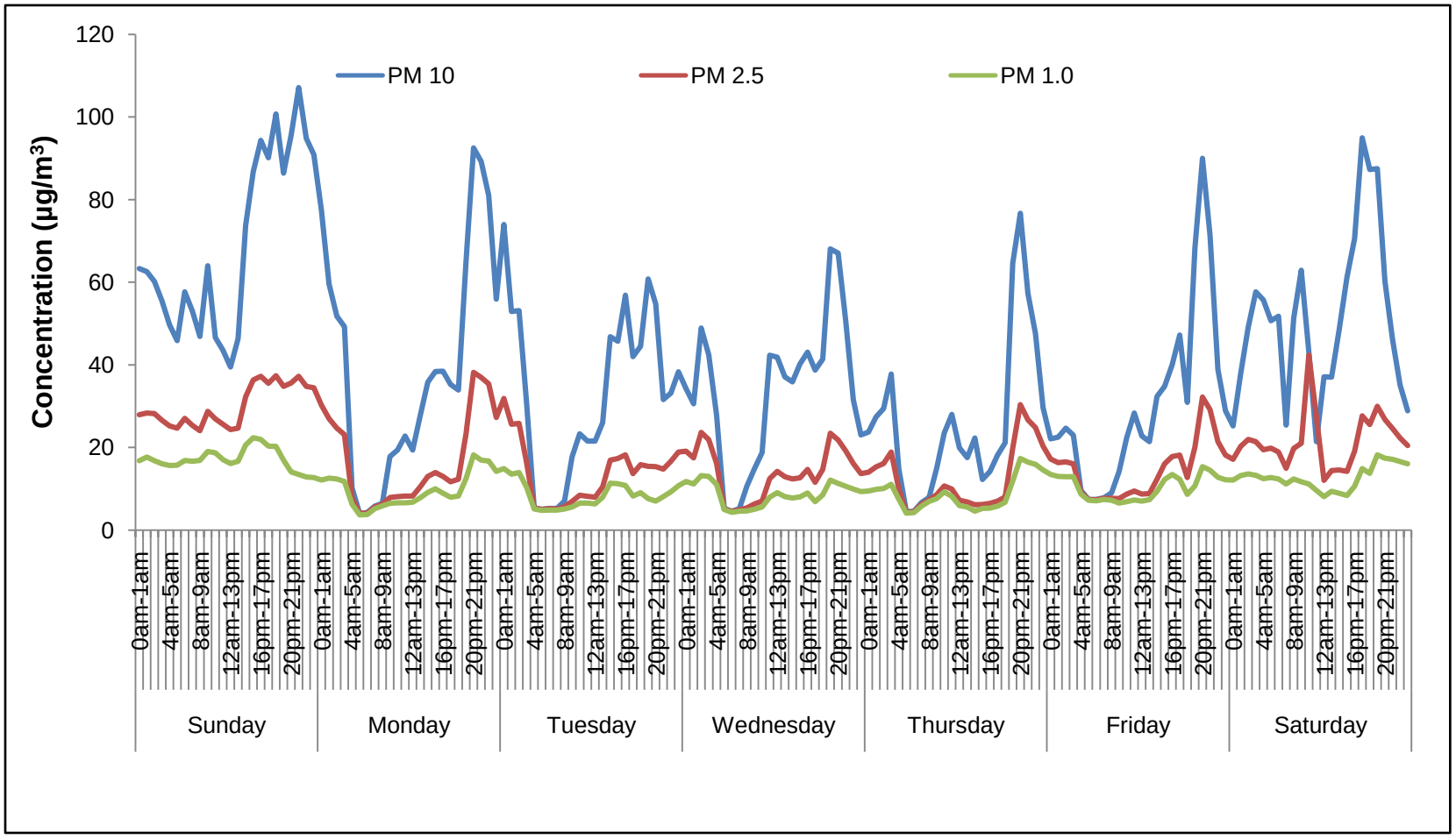
Indoor air quality meter
(CO, CO2, T, RH)

IAQ parameters	Monitoring Instruments	Working principle/ Sensor type	Accuracy
Particulate matter (PM10, PM2.5, PM1)	GRIMM Dust Monitor	Light scattering	±2%
Carbon monoxide	Indoor Air Quality Meter	Electrochemical	±3%
CO_2	Indoor Air Quality Meter	Non dispersive infrared (NDIR)	±3%
Temperature		Thermistor	0.1°C
Relative humidity		Thin film capacitive	±3%
Wind speed	wind monitor	Anemometer	
Wind direction		Potentiometric sensor	
Temperature		Thermistor	

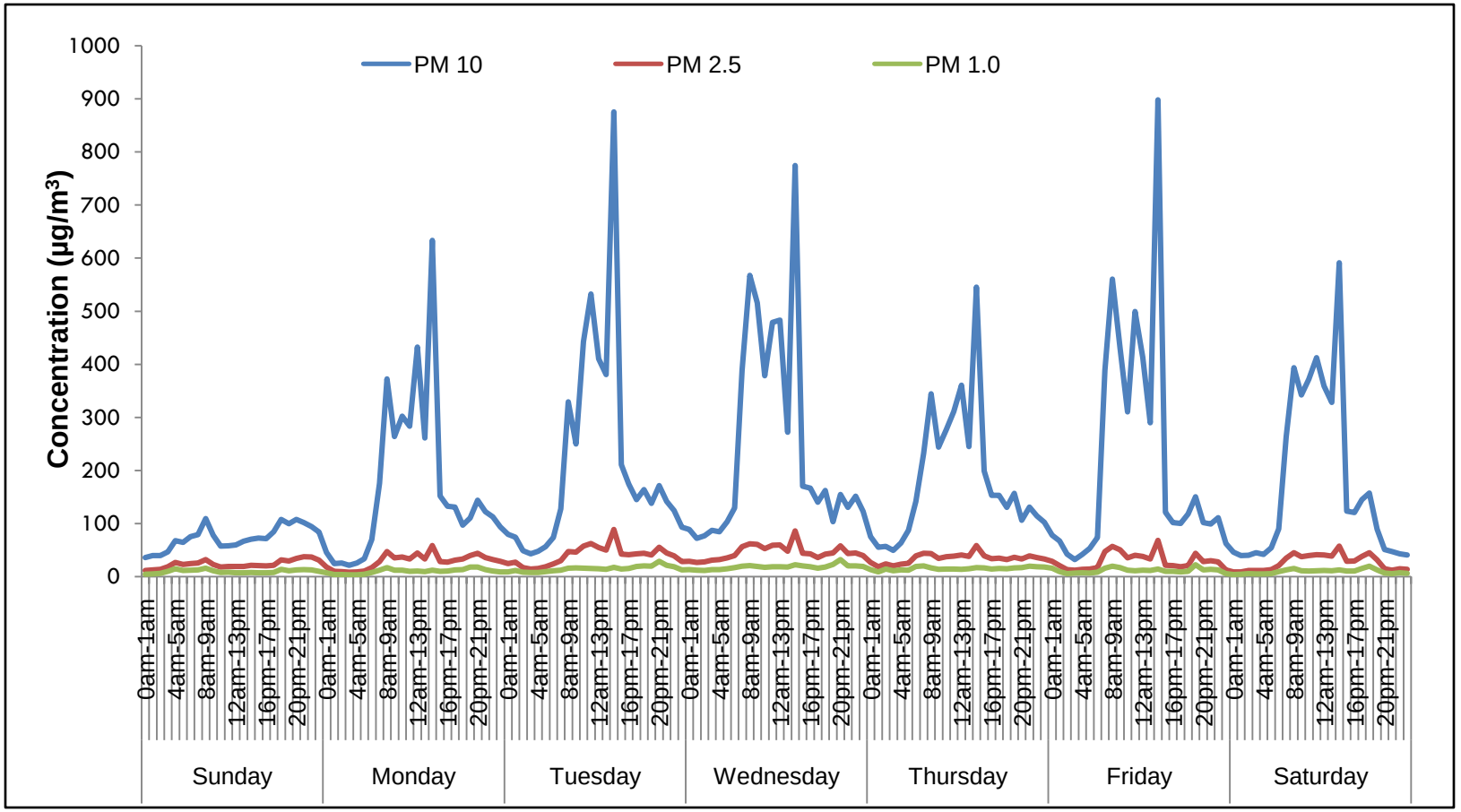
Traffic Monitoring

- Traffic count at SP road was carried out for one week.
- Video recording of the diurnal traffic followed by manual counting.

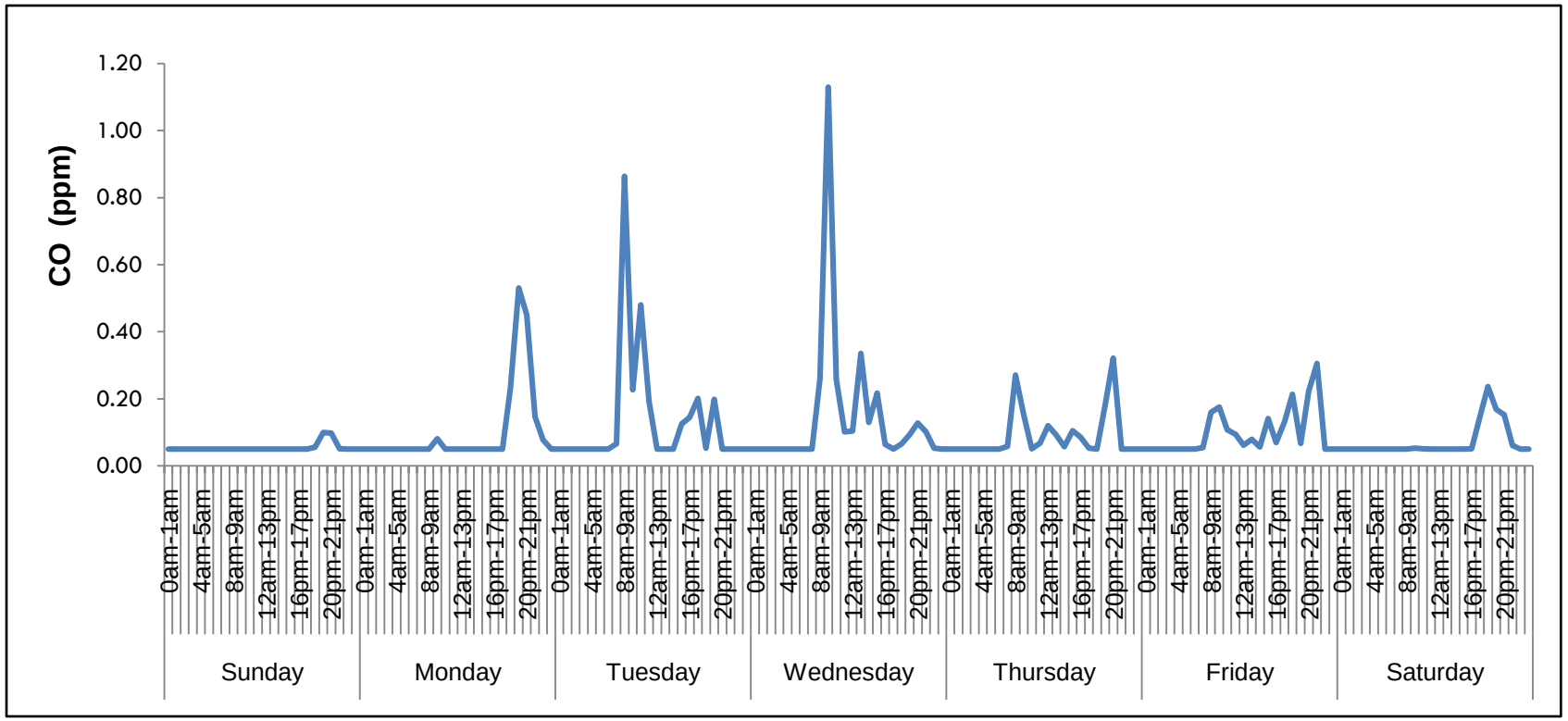
Results: Particulate matter Concentration - Office Building



Particulate matter Concentration - School Building



CO Concentration – School and office building



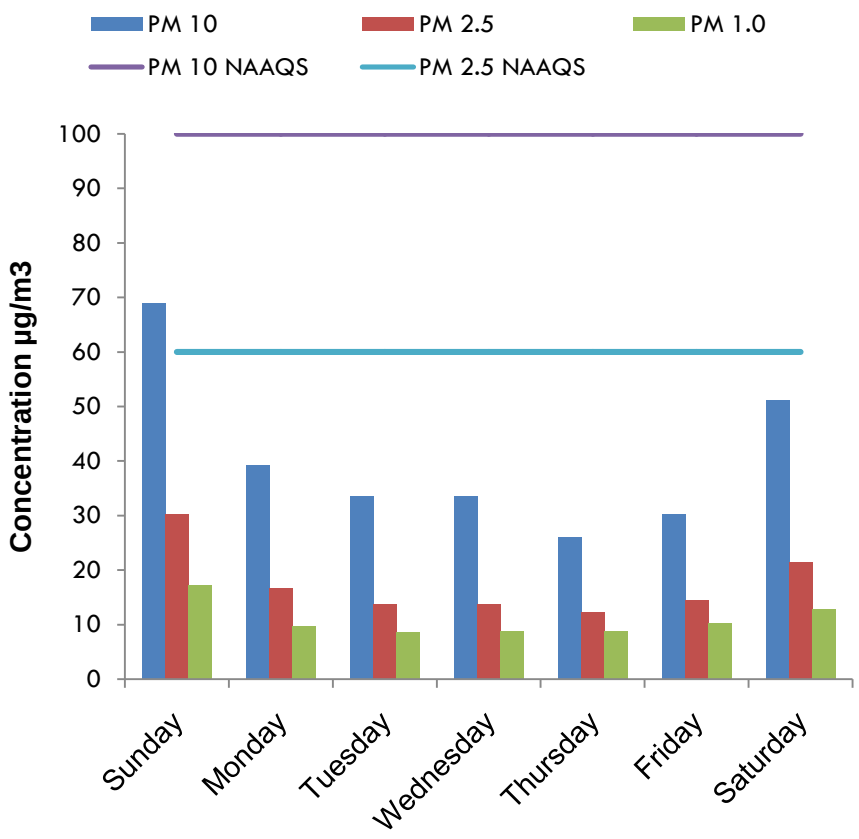
CO Concentration was observed as below detectable limit (BDL) for all the days in the office building

CO_2 Concentration – School and office building

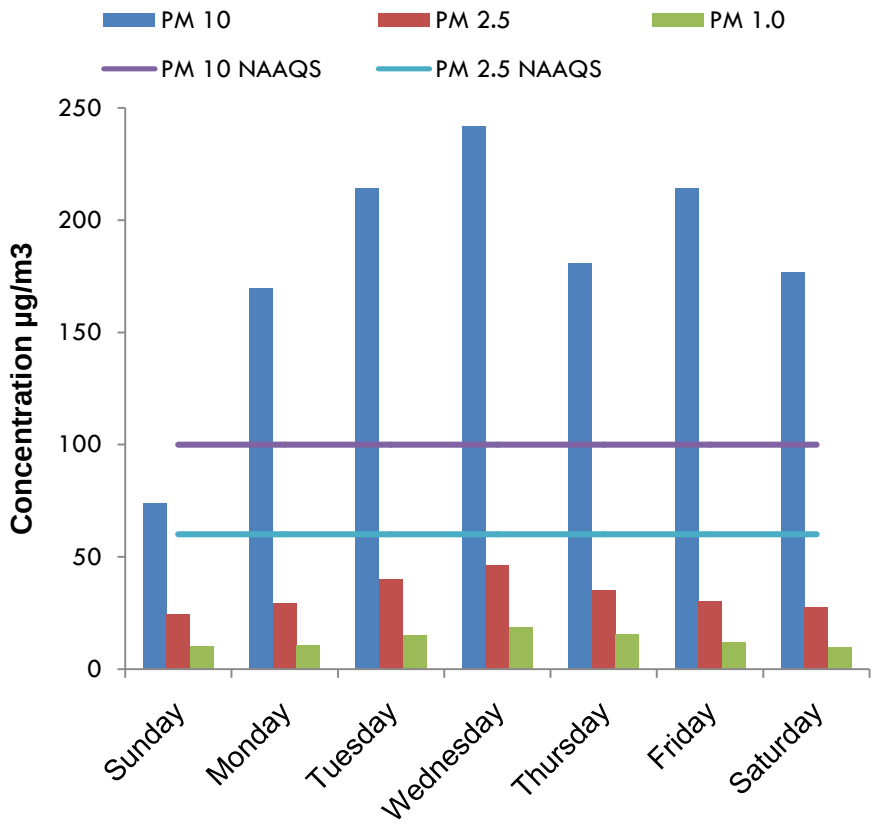
Building	Statistics	CO_2 concentration (ppm)
School	Average	259
	Max	426
	Min	208
	STDEV	46
Office	Average	546
	Max	1274
	Min	249
	STDEV	303

CO_2 exceeded 1000 ppm in office building shows inadequate ventilation

Comparison with NAAQS

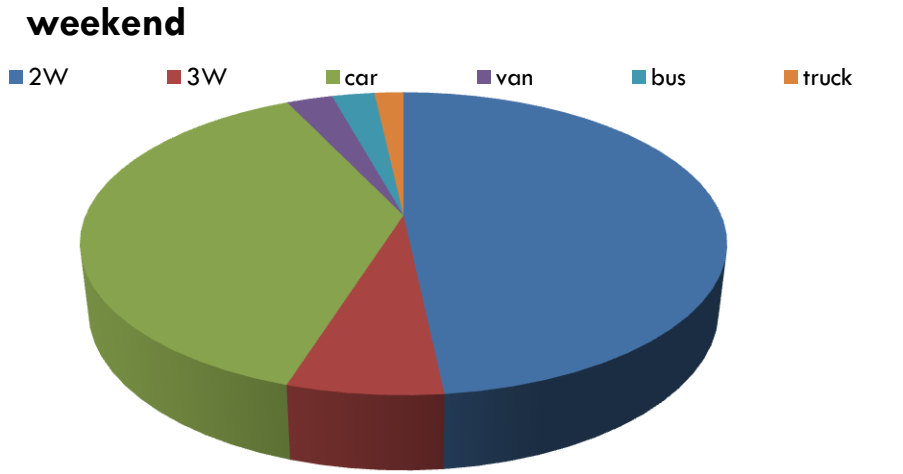


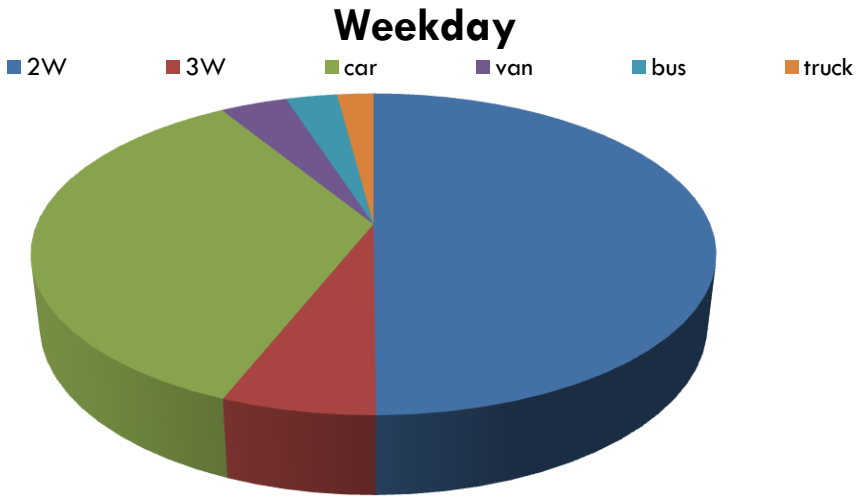
Office

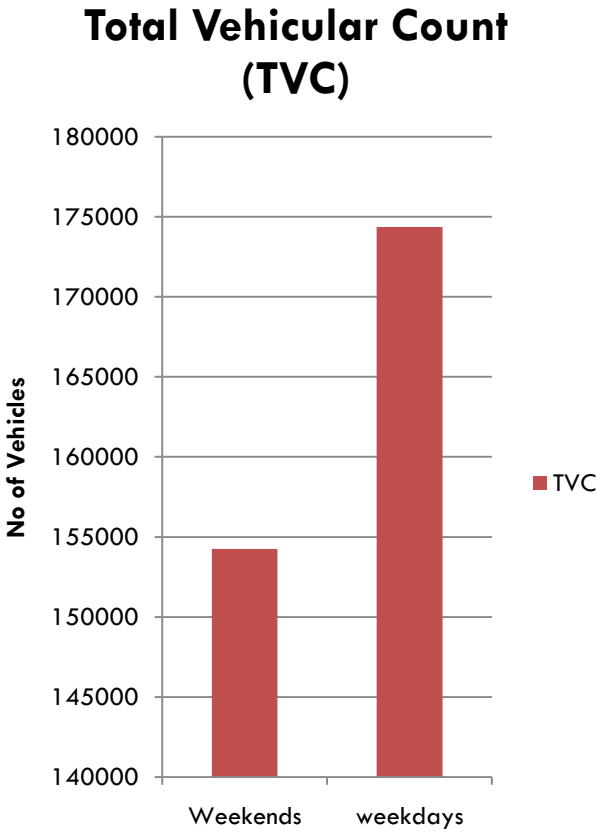


school

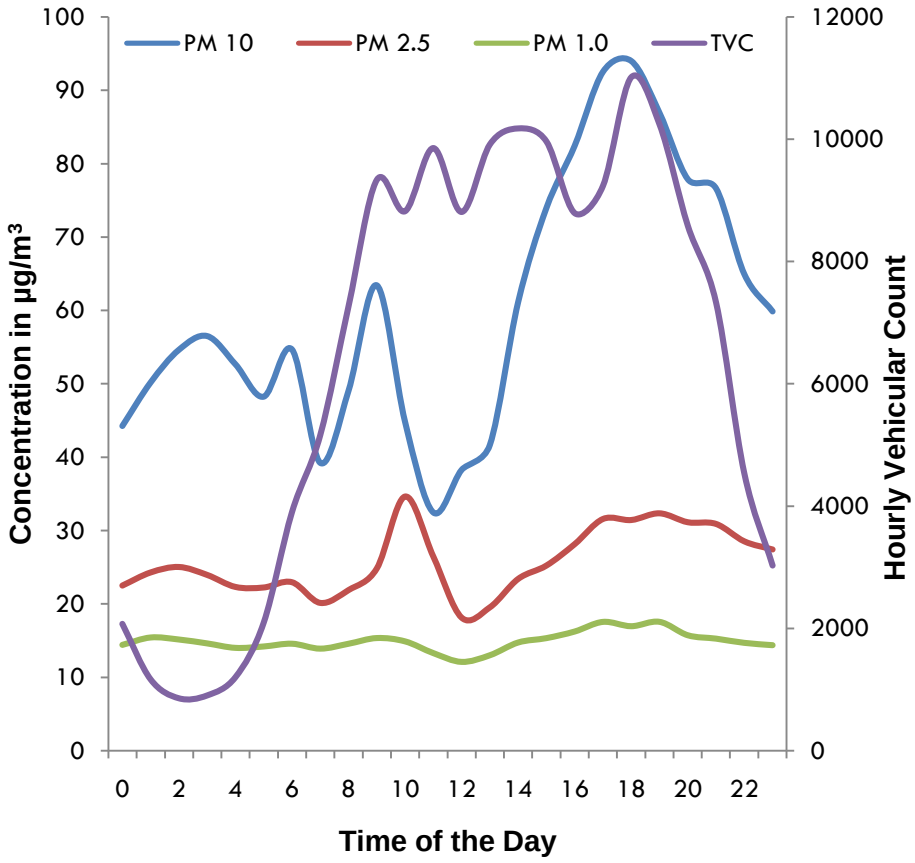
Traffic characteristics



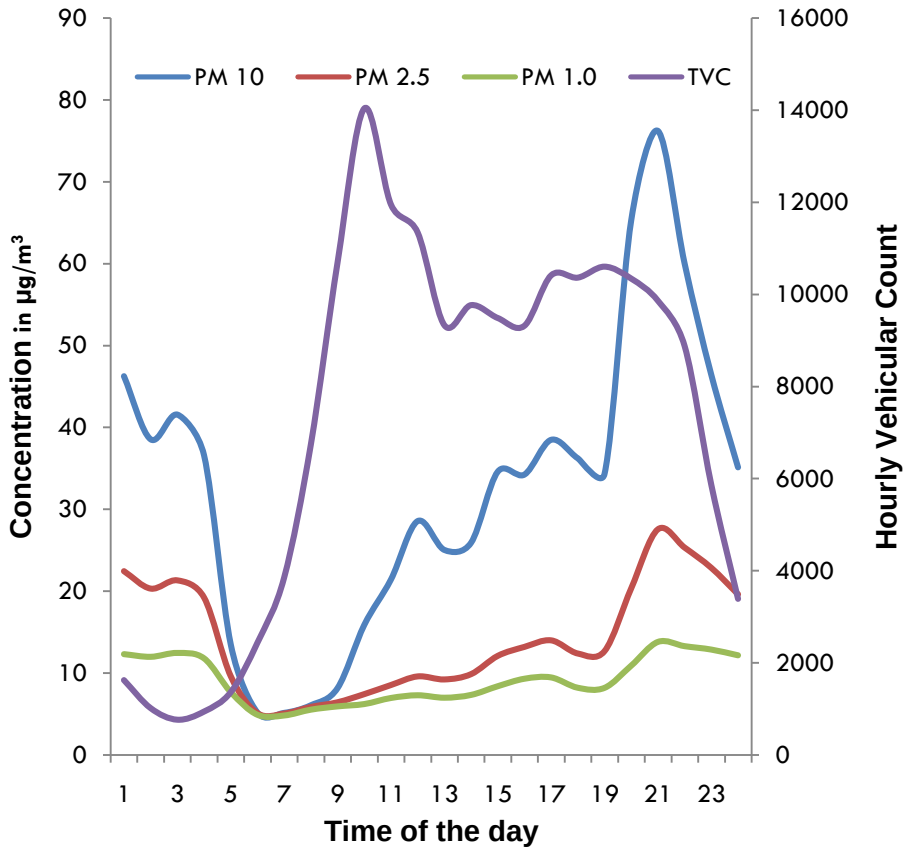




PM VS TVC: Office Building

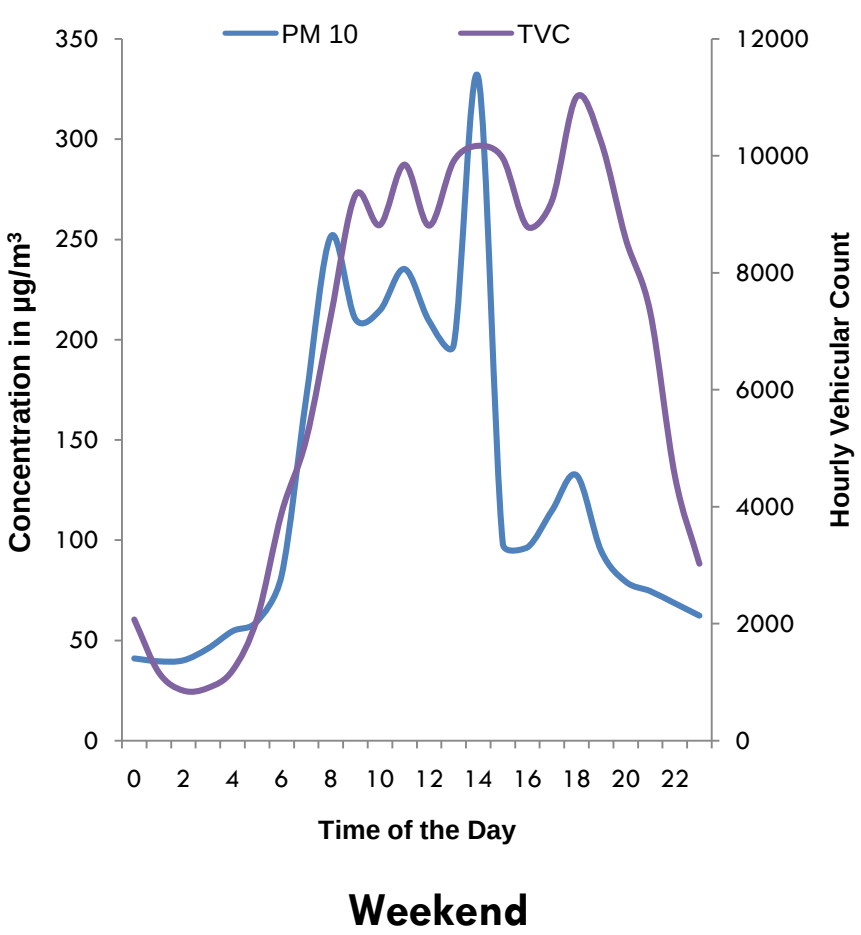


Weekend

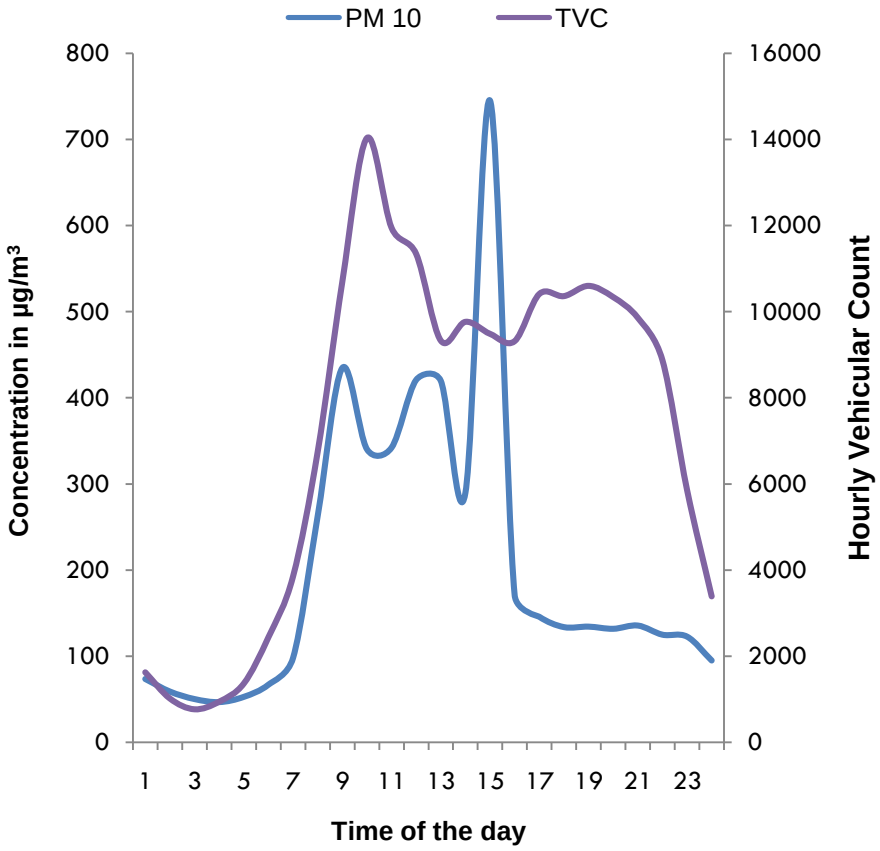


Weekday

Coarse PM VS TVC: School Building

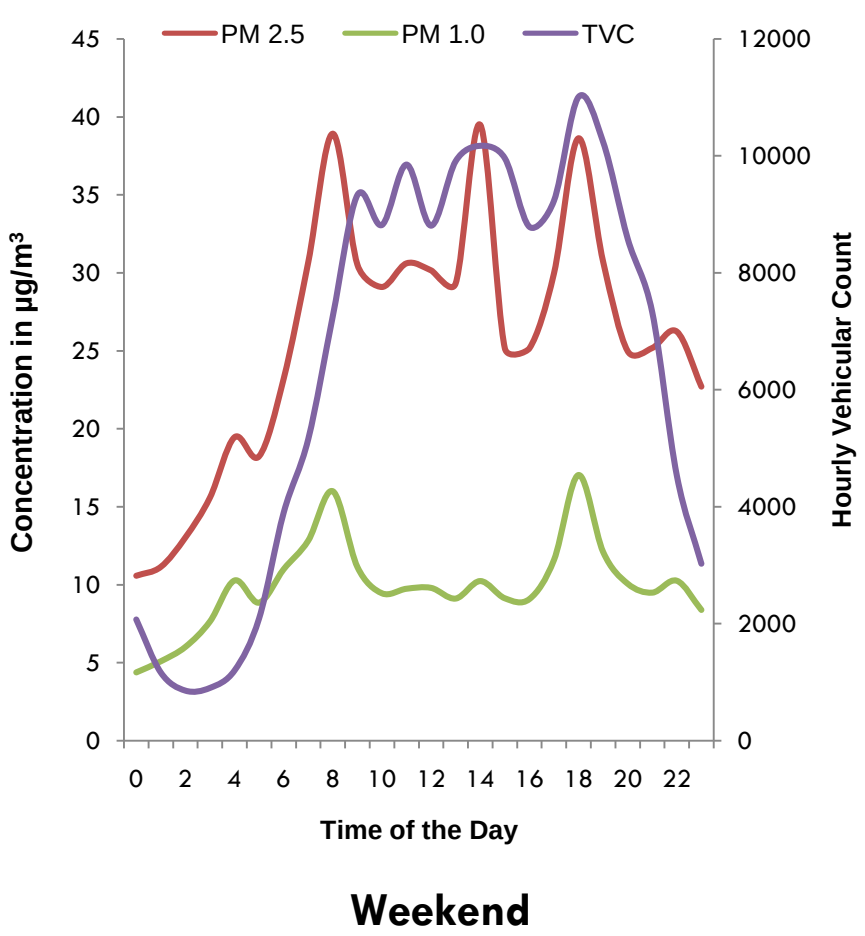


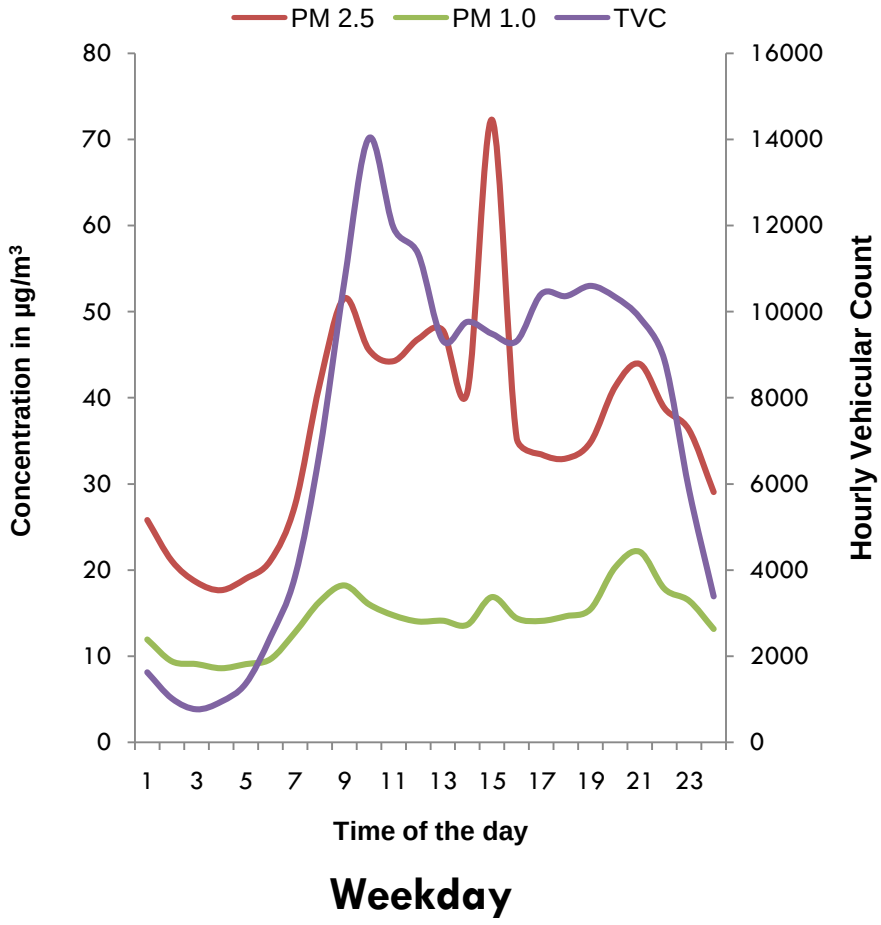
Weekend



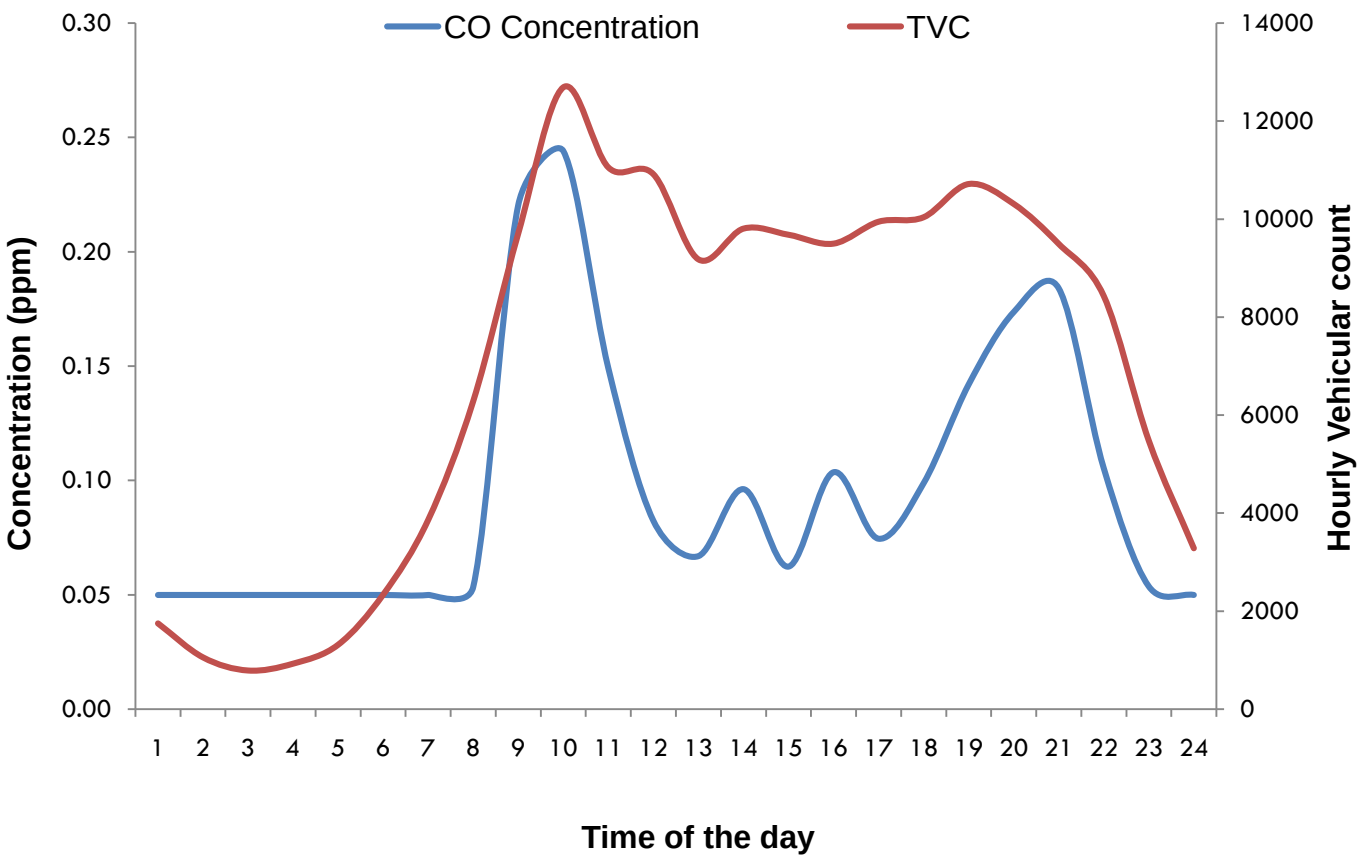
Weekday

Fine PM and TVC: School Building





CO VS TVC: School Building



Conclusions

- The IAQ parameters (PM10, PM2.5, PM1, CO, CO_2, relative humidity and temperature) were monitored in a naturally and mechanically ventilated buildings.
- Among the indoor air pollutants monitored, PM concentrations were found to be significant in the classroom than the office building.
- It was found that most of the days the indoor PM10 and PM2.5 levels in school building were exceeding the NAQQS.
- Since there was no significant indoor source of particles human activity seems to be an important factor accounting for elevated indoor levels of coarse particles.
- The finer PM fractions and CO in the indoor air has significantly influenced by vehicular emissions.

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Thank you