CHAPTER 3

DESCRIPTION OF STUDY AREA

3.1 Chennai City

Chennai, formerly known as Madras, is the capital of Tamil Nadu, India. It is located on the Coromandel Coast off the Bay of Bengal. It is the biggest industrial and commercial centre in South India and a major cultural, economic and educational centre. It is known as the "Detroit of India" due to the presence of a number of units in the automobile sector (The Financial Express 2014).

As per Census of India 2011, the city’s population is 4,681,087 making it the sixth most populous city in India. The population density in the city is 24,682 per sq.km making it one of the most densely populated cities in the world. Chennai has a sex ratio of 986 females per 1000 males. The average literacy rate in the city is also very high at 80.14% as compared to the overall literacy rate of India which is only 64.5%.

The city is host to the third largest expatriate population in India after Mumbai and Delhi, with 35,000 in 2009 and steadily climbing to 82,790 in 2011. Chennai is the only city in South Asia and India to figure in the "52 places to go around the world" (The New York Times 2014).

In 2011, the jurisdiction of the Chennai Corporation area was expanded from 174 sq.km to 426 sq.km. Chennai city is governed by the Chennai Corporation which is headed by an Indian Administrative Service officer. The
Mayor and the Councillors of the Chennai Corporation are elected through a popular vote by the residents.

3.2 Chennai Metropolitan Area

The Chennai Metropolitan Area (CMA) is the urban agglomeration, which comprises the city and its suburbs, is home to approximately 8.9 million, making it the fourth most populous metropolitan area in the country and 31st largest urban area in the world. The extent of CMA is 1189 Sq.km. It comprises the city of Chennai, 16 Municipalities, 20 Town Panchayats and 214 Village Panchayats in 10 Panchayat Unions. The Chennai Metropolitan Development Authority (CMDA) is the nodal agency responsible for planning and development of Chennai Metropolitan Area.

CMA spreads over three Districts viz. Chennai District (Chennai Municipal Corporation area) 176 sq.km, part of Thiruvallur District 637 sq.km (out of 3427 sq.km) and part of the Kancheepuram District 376 sq.km (out of 4433 sq.km) totaling 1189 sq.km. Its residential, commercial and industrial activities are expanding quickly along the Old Mahabalipuram Road in the east and the Grand Southern Trunk Road (GST Road) in the south and towards Ambattur, Koyambedu and Sriperumbdur in the west (CMDA). CMA covering Chennai District, a part of Tiruvallur District and a part of Kanchipuram District is shown in Figure 3.1.
Figure 3.1 Chennai Metropolitan Area depicting the Chennai District and parts of Tiruvallur and Kanchipuram Districts.

(Source:http://www.cmdachennai.gov.in/pdfs/smp/1_CMA_AdministrativeUnits_Tamil1.pdf)
3.3 Geography of Chennai

Chennai Metropolis (with latitude between 12°50′49″ and 13°17′24″ and longitude between 79°59′53″ and 80°20′12″) is located in the north–eastern part of Tamil Nadu on a flat coastal plain known as the Eastern Coastal Plains. Two rivers viz. Cooum and Adyar pass through CMA and these rivers are placid and meander on their way to the sea.

Buckingham Canal, a man made canal, is another large waterway, 4 km (2.5 mi) inland, runs north-south parallel to the coast, linking the two rivers through the Metropolis. A third river, the Kosasthalaiyar, flows through the northern fringes of the city before draining into the Bay of Bengal, at Ennore. The Otteri Nullah, an east–west stream, runs through north Chennai and meets the Buckingham Canal at Basin Bridge (Chennai District - District Profile - Location and Area).

Sholavaram Lake, Red Hills Lake and Chembarambakkam Lake are the three large lakes in the area. Some areas of the city have the problem of excess iron content in groundwater. Chennai’s soil is mostly clay, shale and sandstone. Chennai is classified under Seismic Zone III, indicating a moderate risk of damage from earthquakes (Chennai District – District Profile - Geographical and Physical features).

3.4 Climate of Chennai

Chennai lies on the thermal equator and it is hot and humid for most of the year. The hottest part of the year is late May to early June with maximum temperatures around 35–40 °C. The coolest part of the year is January, with minimum temperatures around 15–22 °C. The lowest recorded temperature was 13.8 °C on 11 December 1895 and January 29, 1905. The highest recorded
temperature was 45 °C on 30 May 2003. The average annual rainfall is about 140 cm. The highest annual rainfall recorded is 257 cm in 2005. The city gets most of its seasonal rainfall from the north–east monsoon winds, from mid–October to mid–December. Cyclones in the Bay of Bengal sometimes hit the city. Prevailing winds in Chennai are usually south-westerly between April and October and north-easterly during the rest of the year.

3.5 Economy of Chennai

Chennai has a diversified economic base anchored by automobile, software, hardware manufacture, health care, financial services and industries. As of 2012, the city is India's second largest exporter of information technology (IT) and business process outsourcing (BPO) services. Many software companies and software services companies have development centres in the Chennai, which contributed 14 percent of India's total software exports of ₹ 1,442,140 million during 2006–07, making it the second largest Indian city software exporter following Bangalore.

The city has a 30 percent of India's automobile industry and 40 percent of the auto components industry. Since the major part of India's automobile industry is based in and around the Chennai, it has earned the nickname "Detroit of India". A large number of automotive companies including Hyundai, Renault, Robert Bosch, Nissan Motors Ashok Leyland, Daimler AG, Caterpillar Inc., Komatsu Limited, Ford, BMW and Mitsubishi have manufacturing units in Chennai (The Economic Times 2011).

The Heavy Vehicles Factory at Avadi produces military vehicles, including India's main battle tank: Arjun MBT (The Times of India 2012). The Integral Coach Factory at Perambur manufactures railway coaches
and other rolling stock for Indian Railways. The Ambattur–Padi industrial zone houses many textile manufacturers. A special economic zone (SEZ) for apparel and footwear manufacturing has been set up in the southern suburbs of the city at Trisulam. Chennai makes a contribution of more than 50% to India's leather exports.

Prominent financial institutions, including the World Bank, Standard Chartered Bank, ABN AMRO, Bank of America, The Royal Bank of Scotland, Goldman Sachs, Barclays, HSBC, ING Group, Allianz, Sumitomo Mitsui Banking Corporation, The Bank of Tokyo-Mitsubishi UFJ, Abu Dhabi Commercial Bank, Asian Development Bank, Credit Suisse, BNP Paribas Fortis, Irevna, Deutsche Bank and Citibank have back office and development centre operations in the city. Chennai is home to national level commercial banks, many state level co–operative banks and finance and insurance companies. Telecom and Electronics manufacturers based in and around Chennai include Nokia, Nokia Siemens, Motorola, Dell, Force10, Wipro, Zebronics, Foxconn and Siemens among others. Chennai is currently the largest electronics hardware exporter in India, accounting for 45% of the total exports in 2010–11.

Chennai is also known as the Cultural Capital of South India and is the most visited city in India by international tourists (Euromonitor International). The city also serves as the location of the Madras Stock Exchange and the secondary financial hub in India following Mumbai.

As a growing metropolitan city in a developing country, Chennai confronts substantial urban pollution, traffic congestion, poverty, overpopulation, and other logistic and socioeconomic problems.
3.6 Transportation

The different sources of air pollution in Chennai City are Transport, Industries, Residential and Others.

The major modes of transport such as Air, Sea, Road and Rail are in significant use in Chennai City. However, road network which criss-crosses the entire city primarily influences the local air quality. The total length of roads including interior roads in Chennai is about 7300 km. Most of the roads are made of asphalt (bituminous) roads, while about 1300 km are made of cement concrete roads. The total bus route length is of about 358 km including concrete roads (www.chennaicorporation.gov.in).

In railways, most of the express trains and the metro rail transport system (MRTS) trains within the city for public transport have electric engines and hence do not contribute to the air pollution in the city. The buses and autos (3 wheelers) are the common public transportation modes other than MRTS trains. Large number of privately owned 2 wheelers and four wheelers are also used as modes of transportation. Lorries or trucks are used for transporting goods within the city as well as to the other parts of the country. Railways are used also for transportation of goods to and from the other parts of the country. Airport and Chennai harbour are used for transportation of goods within the country and to import and export from other countries.

3.7 Growth of Motor Vehicles

3.7.1 India

In India, motor vehicles have increased from 0.3 million in 1951 to about 160 million in 2012. The total registered motor vehicles in the country grew at a Compound Annual Growth Rate (CAGR) of 9.9% between 2001 and
2011 (MoRT&H 2012). The growth rate of registered motor vehicles is shown in Figure 3.2.

![Figure 3.2 Total number of Motor Vehicles registered in India during the years 1951 to 2012](image)

At the all-India level, the percentage of two-wheeled vehicles in the total number of motor vehicles increased from 9% in 1951 to 69% in 1997, and the share of buses declined from 11% to 1.3% during the same period (MoST 2000). This clearly points to a tremendous increase in the share of personal transport vehicles. In 1997, personal transport vehicles (two-wheeled vehicles and cars only) constituted 78.5% of the total number of registered vehicles.

The number of two wheelers registered has increased from 38.56 million in 2001 to 82.40 million in 2010 registering an increase of 114% over the period, while the number of Light Motor Vehicles (passengers) and Jeeps showed an impressive growth of 78% and 46% respectively during the same period. The total number of cars registered has been increased from 5.30
million in 2001 to 12.37 million in 2010 which shows a growth of 133% during the period.

From Figure 3.2, it shows a sharp increase in the growth of motor vehicles during the decade 1991-2001. It is mainly due to the Information Technology boom and liberalization, privatisation and globalisation policy that the Indian Central and State governments had conceptualized and implemented resulting in fast industrial development and fast economic growth. It sustained and triggered a big growth in motor vehicle population during 2001 to 2011 as seen in the Figure 3.2.

3.7.2 Tamilnadu

The motor vehicles registered in Tamilnadu during the years 2002 to 2012 are shown in the Figure 3.3 (Tamilnadu State Transport Authority).

![Figure 3.3 Total number of Motor Vehicles registered in Tamilnadu during the years 2002 to 2012](image)

Figure 3.3 shows a near stagnation of registered motor vehicles from the year 2008 to 2009. It synchronizes with the economic slowdown during that period. There is a tremendous increase in the purchase of motor vehicles from
2009 to 2010 and from 2010 to 2011 due to economic progress. During other years there is a gradual growth in purchase of motor vehicles.

### 3.7.3 Chennai

The growth of motor vehicles in Chennai has also been very palpable as shown in the Table 3.1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Registered Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>120,000</td>
</tr>
<tr>
<td>1986</td>
<td>228,000</td>
</tr>
<tr>
<td>1991</td>
<td>544,000</td>
</tr>
<tr>
<td>1996</td>
<td>812,000</td>
</tr>
<tr>
<td>1998</td>
<td>975,000</td>
</tr>
<tr>
<td>2012</td>
<td>3,760,000</td>
</tr>
</tbody>
</table>

(Source: DGP Office, Chennai)

The motor vehicles registered in 1981 were 0.12 million only. Thereafter within 3 decades it has been increased to 3.76 million by 2012 (about 31 time’s growth). The same is represented in graphical format in the Figure 3.4.

The total Number of Registered Vehicles in Chennai as on 1st December 2013 are 40,75,756, out of which the two wheelers are 31,97,986. The motor vehicles growth during last 20 years in Tamilnadu is about 750
percent. In the entire Tamilnadu, there are 1.5 crore motor vehicles registered up to 1st December 2013. Thus the total numbers of motor vehicles in Chennai city is nearly 30 percent of whole Tamil Nadu State (The Hindu – Tamil version, Dated 30-12-2013).

3.8 Increase in Air Pollution due to Traffic

As seen in the section 3.7, the substantial increase in the number of vehicles has resulted in a significant increase in the emission load of various pollutants. The quantum of vehicular pollutants emitted is highest in Delhi followed by Mumbai, Bangalore, Calcutta, Ahmadabad and Chennai (MRTH 2012). Vehicles are a major source of air pollutants in the metropolitan cities.

The share of air pollution load from the different sectors has been given in Figure 2.3. It shows the air pollution load in Delhi and Chennai are 70% and 71% respectively due to Traffic.

3.9 Recently reported Health Effects due to Air Pollution in Chennai

“Excerpts from the reports published in daily news papers about the adverse effects due to air pollution” are as under:

(i) By Janani Sampath on November 20, 2013, published in The Times of India titled “Chronic respiratory illness cases rise with air pollution”.

Chronic Obstructive Pulmonary Disease (COPD) which causes severe breathing problems is not necessarily confined to smokes. Vehicular pollution, which is increasing rapidly in our cities, is equally harmful. In Chennai, where the number of vehicles is growing alarmingly, ENT and pulmonology clinics
are seeing a surge in cases of respiratory illnesses caused due to severe air pollution.

**Dr G S Vijayachandar**, pulmonologist at the Institute of Thoracic Medicine, says 200 of the 300 patients suffer from blockages in the airway tract due to air pollution. "Episodes of difficulty in breathing can be triggered by allergens, infections and environmental pollutants. A large chunk of patients with asthma and bronchitis suffer from dust allergy," he says.

The Pollution Control Board's permissible limit for respirable suspended particulate matter (RSPM) is 100 microgram/cubic metre. "But the levels of pollutants are twice the permissible amount in several city areas, and with nearly 40 lakh vehicles on the roads every day, immediate steps have to be taken to control the situation," he adds.

(ii) By **DC Correspondent** on August 16, 2014, published in **Deccan Chronicle** titled “**Chennai city pollution affecting kids most**”

“Respiratory physicians in the city say they are now-a-days seeing more school-going children with complaints of persistent cough and cold. Often misdiagnosed and given antibiotics, these children end up becoming asthmatics.”

The chronic respiratory disease, asthma, arising from allergies is more prevalent among urban children compared to rural kids. “We see many parents accompanying kids with recurring episodes of wheezing, breathlessness and coughing. A school kid travels at least six km from home to school and they are exposed to vehicle emission and air pollution.”
Parents drop kids to school on two-wheelers, some kids travel in buses and three wheelers. They are often exposed to vehicle emission in the traffic signals with no mask to cover the face, according to Dr R. Sridharan, founder of Asthma and Allergy Resource Centre.

While pollution masks are available for adults, there are hardly any for children. The asthma specialist who orders special masks for these kids say anybody can wear these masks, especially kids who are allergy prone should use the masks so as to protect from the outdoor pollution.

Simple cotton masks or use of dupatta or handkerchief does not fully protect one from pollution, but people have a false sense of security that they are protected against dust particles, doctors say. Allergy leads to cough and cold and slowly it again leads to sinus and subsequently asthmatic inflammation.

“There are food allergens, indoor, outdoor and occupation allergens. Automobile emission, cigarette smoking, industrial emission all come under outdoor category,” says Dr Sridhar.

Both Dhanisha Niwakar and Charulatha say their kids were first misdiagnosed and were just given antibiotics. “My son had chronic cold and cough that he was on antibiotics for a while before he was diagnosed as asthmatic. For many years now he has been using inhalers and even went on a trek to the Himalayas,” says Charulatha.

“Considering the effectiveness and lower side effects, children suffering from asthma should be considered for inhalation therapy, depending on the requirement and severity of the disease,” says consultant respiratory physician Dr Prassana Kumar Thomas.”
Everyone takes the breathed air for granted, but many city doctors feel the need to focus on respiratory health is more pressing now. The rapid increase in vehicle population in the city has led to ENT and pulmonology clinics seeing a surge in cases of respiratory illnesses caused due to severe air pollution.

The allergy and pulmonology clinic at the Madras ENT Research Foundation (MERF), which registered 823 cases of respiratory illnesses in 2011, saw more than 1,472 cases last year with asthma and chronic obstructive pulmonary disease (COPD) topping the list.

"With its humid weather acting as a trigger, Chennai seems to choke with respiratory issues and the situation will ease only when the pollution levels come down," says MERF Managing Director Dr Mohan Kameswaran. He said 90% of the patients coming to the clinic suffered from dust allergy that stemmed from environmental pollution. "Earlier only adults had such problems. Now, even children are suffering. We see patients who come in with wheezing, nasal bleeding and inflammation where there is a block in the airway, all the result of inhaling soot and carbon particles emitted by vehicles," he said.

“Clean air is a public good; Indeed no other resource exhibits the same degree of ‘publicness’; Land can be parcelled and fenced; Water can be bottled; Scenery can be hidden; One can even isolate himself from noise; But man has no choice but to breathe the air around him – polluted or not.” – Anonymous (Galcano et al 2001).