CHAPTER-V
PERFORMANCE OF SELECTED SERVICES
5.1 INTRODUCTION

In the process of development planning, the urban authorities have to play an effective and important role. They must function in a manner which facilitates the fulfillment of the goals and targets of social and economic development. Local authorities can afford an opportunity to the local people to participate in local activities and schemes with in the general framework of national policies. They can also stimulate local initiative and interest. In this new role, the urban local government provides for the training of the citizens in economic and social planning. By equalizing living conditions, it brings the community near to the goal of socialism.

The social and economic changes ensuring from the developmental efforts and problems created in the process of urbanization impose new responsibilities upon local governments. For citizens issues at local level are a reality of their daily lives. They are primarily concerned with the state of their local streets and drains, local parks where children can play or removal of garbage from their doorsteps. For them the meaning of city government is involvement at the local level with issues that are closer to the people.\(^1\)

Another important aspect of economic planning is the accelerated pace of industrialization. There is no doubt that urban centers have magnetic attraction for a large number of people to leave saturated village economies in order to find new opportunities and success in the glamorous metropolitan areas. This has led to a rapid increase in the population of urban areas.\(^2\)

Moreover, in the wake of economic liberalisation, globalization is bringing more capital, income, jobs and pressure on the already overstrained infrastructure of urban localities. Thus, this has further resulted in putting severe pressure on municipal institutions in providing civic services to all.


In such a situation, where increasing population is posing enormous challenges to the municipal system in providing basic services in an efficient manner, it becomes imperative to make an indepth study of the performance of municipal institutions.

The performance of the Municipal Council S.A.S. Nagar (Mohali) with regard to the following three select services has been discussed at length in the following pages:

SANITATION
WATER SUPPLY
ROADS

5.2 SANITATION
Sanitation is a health related package, a way of life. It is a prime parameter in upgrading quality of life. It has to be interwoven as an ingredient of sustainable community development programme. As it has a cumulative effect on our physical, social, mental and spiritual personality. Therefore, sanitation is not only the problem of keeping clean, it is a development issue without which a healthy society is not possible.

“Sanitation is a field of public health which involves various efforts to prevent and control diseases.”

"Sanitation refers to interventions to reduce people's exposure to diseases by providing a clean environment in which to live. This usually includes disposing of waste for personal and domestic hygiene."4

Thus, sanitation involves both behaviours and facilities which work together to form a hygienic environment. And a hygienic environment can only be achieved through the adoption and practice of preferred hygiene behaviours coupled with the appropriate use of adequate sanitation facilities.

Sanitation besides helping in promoting decent health also enhances aesthetic sense and quality of life. In the Indian scriptures, it has been rightly said that Laxmi, Goddess of wealth resides where there is sanitation. Nirmala

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Deshpande, and eminent Gandhian in this regard highlights the significance of sanitation in terms of cleanliness and she further links it with godliness. Thus, cleanliness is godliness and unless cleanliness becomes a part of our daily lives we cannot be true devotees of God.  

5.2.1 Sanitation in S.A.S. Nagar (Mohali)

Sanitation is one of the major basic services being provided by the Municipal council S.A.S. Nagar (Mohali). It claims around 10% of the budget of the Council.

The whole area under the Council has been divided into four zones and there has been a system of Public Private Partnership (PPP) of each sanitary zone. PPP is a mode of implementing government functions in partnership with the private sector. The PPP is one of the ways available to municipal bodies to take in hand the improvement of urban infrastructure and delivery of services. It is intended to provide municipalities with better flexibility to enhance infrastructure and service delivery needs.  

The system of contracting out sanitary zones has been prevailing in S.A.S. Nagar (Mohali) since 2002. Earlier the council was responsible for discharging all the functions relating to sanitation. But due to a sharp increase in the population during the last decade (1991-2001) and shortage of staff, the service was contracted out.

The Executive officer (E.O) of the Council has been authorised to invite tenders from private parties for giving each zone on contract on annual basis. He is responsible to fix up the terms and conditions of the tender in accordance with The Punjab Municipal Act-1911. And the tender is uniform for all the zones. Till now a total of 6 tenders from 2002-2008 has been invited and passed by the E.O. of the council. After passing the tender an MOU is signed between the private contractor and the E.O. The terms and conditions of the

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MOU are also determined by the E.O. in accordance with the Punjab Municipal Act-1911.

Table-5.1

Zone-Wise Distribution of Area and the Number of Sweepers

<table>
<thead>
<tr>
<th>Zones</th>
<th>No. of Sweepers</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>88</td>
<td>Ph. 1, 2, 3, 6, Ind. Area Ph. 1 to 3, Vill. Mohali and Shahi Majra</td>
</tr>
<tr>
<td>2</td>
<td>102</td>
<td>Ph. 3BI, 3BII, Ph. 7, 8, 9 Ind. Area Ph. 7&amp;8</td>
</tr>
<tr>
<td>3</td>
<td>66</td>
<td>Ph. 10, 11, Sec-48C (Guru Nanak Road) and Ind. Area Ph. 9</td>
</tr>
<tr>
<td>4</td>
<td>79</td>
<td>Ph. 4, 5, Sec-70, 71, Ind. Area Ph. 4, 5, 6 and Vill. Matour</td>
</tr>
</tbody>
</table>

There have been a total of 4 contractors appointed in all the zones. Each contractor has been authorised to appoint sweepers in his zone in accordance with The Punjab Municipal Safai karamchari Service, Rules 1984.

The contractor is responsible to provide salary and other benefits such as gratuity and provident fund to the sweepers at such rates as is admissible to such category of employees of Punjab Government. He is also responsible to provide them with identity cards and uniforms. However, the actual situation was found to be quite different. As most of the sweepers in all the zones were not wearing uniforms. On being asked about it, the sweepers replied that they usually do not wear it and they were not even known the utility of wearing uniforms. As wearing uniforms not only give adequate safety to them from dirt but also give recognition to their segment. Besides, it was also observed that a very few of them were wearing identity cards. Along with the sweepers, the contractors were also found not to be much bothered about such things.

Along with the staff of the contractors, the permanent staff of the sanitary wing of the Council has also been engaged for performing clerical as well as supervisory functions. These include-superintendent-1, Clerk-1, Sanitary inspector-4, Head Zamadars-2.

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* Safai Karamchari according to Oxford Dictionary is a person who sweeps streets with a broom.
5.2.2 Vital Components of Sanitation
Sanitation comprises two vital components-
i) Solid Waste Management
ii) Public Toilets

Municipal Council S.A.S. Nagar (Mohali) is responsible to perform all the functions relating to solid waste management, whereas functions relating to public toilets are the responsibility of Panjab Urban and Development Authority (PUDA) S.A.S. Nagar (Mohali). Now it is called Greater Mohali Area Development Authority (GMADA).

i) Solid Waste Management
It can further be studied as-
i) Solid Waste
ii) Management

i) Solid Waste:-
Solid waste can be defined as material that no longer has any value to the person who is responsible for it, and is not intended to be discharged through a pipe. It does not normally include human excreta. It is generated by domestic, commercial, industrial and health care activities and accumulates in streets and public places.

Solid waste is “useless or worthless material; stuff to be thrown away”. The words “garbage”, “trash”, “refuse”, and “rubbish” are used to refer to some solid waste. Thus, solid waste is known as refuse, consists of garbage and trash from cities and towns and by products of farming, mining and manufacturing.”

“Solid waste is all inclusive, encompassing the heterogeneous mass of throwaways from the urban communities.”

Highly household waste is the only contributor to Municipal Solid Waste (MSW). House hold waste contains anything that we choose to discard. That includes still usable and recyclable items; waste food, papers and

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newspapers, packaging bottles, metal cans, batteries, grass clippings and other yard waste, clothing, furniture and appliances and household hazardous waste (HHW). HHW includes residual paints, oily products such as automotive maintenance products and pesticides. Other generating MSW are commercial business including restaurants, grocery, stores and offices. Industrial and medical institutions also generate MSW, although industrial process waste generated through chemical processing and medical process waste generated in the diagnosis, treatment or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biological phenomena are not MSW, and are handled separately.9

Thus, the term municipal solid waste means all waste materials discarded for disposal by households, including single and multifamily residences, hotels and motels. The term also includes waste materials generated by medical, commercial, institutional and industrial sources, to the extent such wastes are essentially the same as waste normally generated by households or were collected and disposed of with other MSW as part of normal MSW collection services.10

ii) Management:-
Management of solid waste i.e. solid waste management involves the management of various activities associated with generation, storage, collection, transfer and transport, processing and disposal of solid wastes in an environmentally compatible manner adopting principles of economy aesthetics, energy and conservation.

Generally, solid waste is disposed off in sanitary landfills in which the whole waste is dumped and covered with a layer of dirt everyday. This method

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helps control pollution as it prevents accumulation of insect and rodent populations, spread of disease and odours.\textsuperscript{11}

The process involved in solid waste management has been presented in the following chart-

\begin{center}
\textbf{Chart – 5.1}

\textbf{The Process involved in Solid Waste Management (SWM)}
\end{center}

\begin{center}
\begin{tikzpicture}
  \node[rectangle,draw] (a) {Street Sweeping};
  \node[rectangle,draw, right of=a] (b) {Collection of Waste};
  \node[rectangle,draw, right of=b] (c) {Transportation of waste};
  \node[rectangle,draw, below of=c] (d) {Segregation of Waste};
  \node[rectangle,draw, left of=d] (e) {Incineration of Waste};
  \node[rectangle,draw, right of=d] (f) {Composting/Recycling};
  \node[rectangle,draw, right of=f] (g) {Disposal of Waste};
  \draw[->] (a) -- (b);
  \draw[->] (b) -- (c);
  \draw[->] (c) -- (d);
  \draw[->] (d) -- (e);
  \draw[->] (d) -- (f);
  \draw[->] (f) -- (g);
\end{tikzpicture}
\end{center}

\textbf{Process involved in Solid Waste Management System}

\textbf{i) Street Sweeping:-}

As the name implies sweeping is cleaning and it refers to the collection and removal of paper, leaves and other visible debris scattered on the road surface.\textsuperscript{12} An equally important, but less visible benefit is the removal of metal particles and other hazardous waste products left by the passing vehicle. Street sweeping is an effective method of removing both large and microscopic pollutants that collect on city streets. Street sweeping can be possible through three different modes\textsuperscript{13}.

\begin{itemize}
  \item[i)] Manual street sweeping
  \item[ii)] Mechanical street sweeping
  \item[iii)] Vacuum-type street sweeping
\end{itemize}


\textsuperscript{12} F. Kreith, \textit{Integrated Solid Waste Management: Option For Legislative Action}, Genium Publishing Corporation, New York, 2000, p.21

\textsuperscript{13} T.V. Ramachandra, \textit{Management of Municipal Solid Waste}, Capital Publishers, New Delhi, 2006, p.119
Manual street sweeping is generally done manually by the sweepers employed by the urban local bodies. Mechanical street sweeping is done through machines and vacuum type street sweeping is done through Vacuum cleaners. In India largely the first method i.e. manual street sweeping has been adopted by the municipal bodies including metropolitan cities like Delhi, Bombay, Chennai and Kolkatta. However, the concept of mechanical street sweeping has been practicing in some states like Tamilnadu, Andhra Pradesh, Karnataka and U.T. Chandigarh along with all the four metropolitan cities.

Street sweeping is the first and foremost step in solid waste management and the sweepers engaged by civic authorities have been entrusted with the responsibility of sweeping the roads and collecting the waste on convenient points.

In area falling under Municipal council S.A.S. Nagar (Mohali) street sweeping is carried out manually by sweepers working in groups, who are assigned specific areas within their respective zones known as 'Beats'. They are responsible to sweep the roads of their respective beats and take sweepings to roadsides.

ii) Collection of Waste:-
The second step in solid waste management includes the collection of pilled up waste from roadsides and transferring it to near-by community bins through hand crafts. These community bins are installed on roadsides and are owned by civic authorities.

Community bins have been installed on roadsides all over the city under Council area and whole of the waste collected by the sweepers on roadsides is transferred to such bins through handcrafts. The citizens hire private garbage collector for door to door collection of their daily household waste on monthly payment of Rs. 30. This amount is fixed by the association of private garbage collectors of the area and is common to all the phases.

iii) Transportation of Waste:-
This is normally done by the garbage collecting staff, who transfer garbage from bins to the vehicles. After bins are emptied, the vehicle along with the
workers moves to the next bin so on till it is fully loaded. Certain municipal vehicles such as trucks and trolleys are used for transportation of waste to dumping site.\textsuperscript{14}

In S.A.S. Nagar (Mohali) a total of 4 million tonnes (40 tonnes) of garbage is collected daily. There are 67 community bins and 30 open containers installed all over the city in residential/industrial and market area. The whole garbage collected from such bins and containers is taken to dumping site with the help of certain vehicles-

3 dumper places, which carry the bins through hydraulic power system and after throwing the garbage in dumping ground keep bins back at their places;

1 refuse collector, which transfers the waste from open container to its body and through pressing, makes it compact;

1 tipper truck and 11 trolleys, tipper truck is used to transfer waste through its tip from open spaces to trolleys.

\textbf{iv) Segregation of waste:-}

In an “as collected,” commingled state, municipal solid waste is essentially unusable. Certain waste components such as paper, plastics, glass and metals can be recovered from MSW for remanufacturing into new products. The process of sorting usable materials such as paper, plastics, glass and metals from commingled MSW is known as segregation.\textsuperscript{15}

Segregation is generally done through manual sorting which is carried out by the rag pickers, who at the dumping site collect recyclable materials such as bottles, metal, plastic, paper from the waste and sell it to scrap dealer who further sell it to private firm for recycling.\textsuperscript{16}

In S.A.S. Nagar (Mohali) the waste at the dumping site is segregated by the rag pickers. Generally, rag pickers come early in the morning or in the


\textsuperscript{15} T.V. Ramachandra, op.cit., p.122

\textsuperscript{16} Satpal Singh, Solid Waste Management in Delhi: Problems and Prospectives, Nagarlok, XXXIII, April-June 2001, p. 61.

* Leaching refers to a liquid that seeps through solid waste in a landfill.
afternoon before the arrival and departure of the council staff at dumping site. They collect the recyclable material such as bottles, paper metal and plastic from the waste sell it to scrap dealer. The scrap dealer has contact with the private firm, who after buying waste from rag pickers sell it to such firms for recycling.

Rag pickers play very important role in sorting the valuable material from the waste, however, there are number of health risks involved in the collection of waste by the rag pickers. The risk of disease comes from two main sources. Firstly, primary pathogens-Primary pathogens are generally bacteria, protozoa or viruses and represent a potential risk of infection to healthy individuals. Secondly, secondary pathogens-Secondary pathogens are those which may develop during the processing itself.17

v) Disposal of waste:-
The final functional element in the sold waste management system is disposal. Disposal of waste refers to dumping of waste into a landfill. The disposal of waste by land filling is the ultimate fate of all solid wastes. A scientific sanitary landfill is not a dump; it is an engineered facility for disposing of solid waste on land or within the earth’s mantle without creating nuisances or hazards to public health or safety, such as breeding of rats, insects and the contamination of ground water.18

In S.A.S. Nagar (Mohali) after segregation of waste by rag pickers, it is dumped into a scientific landfill, which is spread on an area covering 13.30 Acres of land and a depth of 10 feet. It has been observed that mostly the recyclable waste is segregated by the rag pickers; the other wastes such as household waste and non hazardous municipal solid waste* (industrial, institutional and medical) are dumped together without any segregation. Due to mixing of both household waste and non hazardous wastes at the dumping

18 George Tchobanoglous and Hillary Thespian, op. cit., p.15.
* The non hazardous municipal solid waste includes only the industrial, institutional and medical waste, the hazardous industrial and medical processing wastes are not included in the municipal solid waste.
sites, serious health and environmental risks arise due to contamination of ground water caused by leaching into the ground. Thus, leaching creates potential liquid management problems including water and air pollution (e.g., odour). 19

To avoid such mixing, firstly, segregation of waste at source is needed and the most effective way of separation is manual sorting in households prior to collection. This can be done through door-to-door waste collection by providing citizens easily identifiable containers into which the householder can deposit segregated recyclable material. In many cities like Bangalore, Chennai, etc., such systems are routinely used. Secondly, public participation is required for segregation of waste which can be possible through involvement of non-governmental organisations in creating public awareness through providing information, education and communication (IEC) material, posters and informal door to door counselling of residents. There are around 14 such NGOs’ working in the field of SWM in several parts of Delhi.20

vi) Composting/Recycling:-
The composting is a process consists of overturning of waste with a monitoring of the moisture content and temperature. There is no overturning during the maturation phase. After about four months final product is obtained.21

Composting is considered to be recycling. It is also a form of biotreatment as microorganisms degrade the biodegradable waste to yield manure. Biodegradable waste arises from a variety of human, agricultural and horticultural sources; and can be considered to form three general groups;

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waste of directly animal origin (faeces/manures), plant materials (grass clippings, vegetable pilings) and processed materials (food wastes).  

Once used energy resources dissipate into heat energy, can’t be recycled. Other resources in contrast, retain their physical and chemical properties during use and under proper conditions can be recycled. 

In S.A.S. Nagar (Mohali) due to non segregation of bio-degradable waste, the composting is not done. And the whole such waste is dumped together with the other waste. This results into degradation of environment through leaching into the ground.

vii) Incineration of waste:-

Incineration represents a treatment option for the destruction and safe transformation or reduction of waste. Incineration itself is a generalized term which covers a wide range of combustion techniques from open pits through furnaces to sophisticated high temperature dedicated facilities.

Features of the incineration include the following-

1. The hazard composition of the waste is destroyed.

2. The volume and weight of the waste is reduced to a fraction of its original size.

3. Waste reduction is immediate; it doesn’t require long term residence in a biological treatment pond.

4. Waste need not to be transported to a distant area. 

It is a process of destroying or inactivating the hazardous waste (metals, ferrous (iron containing) material gaseous, liquids etc.) produced by industrial processing units and hazardous waste (human anatomical waste, tissues, organs, body parts, hypodermic needles syringes etc.) produced by medical institutions. This is done through burning the waste in an incinerator (burner) at

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the temperature of 1000°C or above, which produces steam and electricity. Thus, incineration not only makes good use of waste but produces electric power also.\textsuperscript{25}

The industrial and medical institutions have their own incinerators, set up on their own premises and those industrial and medical institutions, which do not have such facility, hire incinerators on some payment from incinerators possessing units.

In S.A.S. Nagar (Mohali) incinerators have been set up by the industrial and medical institutions on the guidelines prescribed by the Govt. of Punjab and those industrial and medical institutions which don’t have their own incinerators sell waste generally on payment of Rs.15-20 per Kilogram to incinerators possessing units.

5.2.3 Problems of Citizens associated with Solid Waste Management at S.A.S. Nagar (Mohali)

i) Irregular sweeping and collection of garbage

As per the provisions of Municipal Act-1911 and MOU signed between the contractors and the Municipal council S.A.S. Nagar (Mohali) daily cleaning of streets and drains, and collection as well as disposal of garbage at places fixed by the council is required. But citizens complain that sweepers come thrice a week instead of coming daily for sweeping of roads and collection of garbage. Though sweepers come daily, the sweeping is done on selective basis sometimes back lanes and sometimes front lanes i.e. on alternative days. This results into scattering of litter and leaves on streets and in front of houses, which not only create aesthetic nuisance but also block the sewer.

This is all due to lack of supervision on the part of the Council. The MOU clearly specifies that in case of any lapse or the work of the contractor is found not to be satisfactory in terms of non fulfillment of any of the provisions of MOU or on receiving complaint from citizens, the contract will be cancelled. No such instance has happened yet on this base except two cases of blacklisting.

\textsuperscript{25} S.A. Tabish, \textit{Hospital And Health Services Administration- Principles And Practices}, Oxford University Press, New Delhi, 2001, p.194
of two firms for one year on overall non-performance. This provision becomes insignificant where proper supervision is not done by the Council. As presently, the area under all the 4 zones has been divided into 3 sanitary inspectors for daily supervising the work of the contractors and their men. Each sanitary inspector supervises the work of 5 residential phases, 3 industrial phases and a village. But due to geographical distance they are able to inspect the sanitary conditions of 2-3 phases and 1 industrial phase or a village daily. So, it is required to employ more sanitary inspectors for more of efficiency and effectiveness in supervisory work.

ii) Burning of dead tree leaves/garbage

Citizens complain that generally the sweepers instead of disposing dead tree leaves at community bins, burn the leaves as well as garbage, which results into complete absence of humidity in the air and rising temperature, which further aggravate the problems relating to asthma, chronic bronchitis, respiratory infections etc. and sometimes leading to pneumonia. Prof. S.K. Jindal, Head Department of pulmonary Medicine at PGIMER Chandigarh explained that harmful gases, oxides of nitrogen and sulphar dioxide are produced due to burning of leaves. As little can be done to check the dryness in the air and the rising heat which aggravates asthma in patients and impaired respiratory defences, while chronic bronchitis is long term fall out of the burning leaves".26

Even the Indian Express reported,

"The employees of sanitation contractor regularly burn dead tree leaves and garbage all over the city, causing pollution."27

"Dry leaves are set on fire by employees of sanitation contractor in various parts of the town in violation of pollution control norms".28

Most of the time such violations get unnoticed and violators do not get any punishment. Though, a system of imposing fine by the council is there, that is not much effective. So, there is a need to create a mass awareness about

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26 The Tribune, 29.04.06
27 The Indian Express, 11.04.2006
immediately informing the Council on phone or otherwise and taking action against them strictly.

iii) Throwing of waste on open spaces

Generally, sweepers make piles of collected waste on roadsides or throw waste at any place convenient to them. Open spaces, footpaths, parks are common dumping sites. This results into increase in number of mosquitoes and flies and sufferers are the residents near to such spaces. This situation becomes worse during monsoon as garbage stinks and water gets accumulated in open pits and become a breeding ground for mosquitoes. As per World Development Report roughly half of the solid waste goes uncollected, pilling up on streets and in drains and contributing to flooding and spread of disease.\(^29\)

A total of 67 community bins have been installed all over the city and it has been observed that generally garbage has been overflowing from the bins. Resultantly, people throw waste in open spaces or at any place convenient to them. So, there is a need to put more of such bins. Moreover, the Municipal Solid Waste Management (MSW) and Handling Rules, 2000 requires door-to-door collection of waste by the Council.\(^30\) But the citizens hire private garbage collector for this on payment of Rs.30, who throw waste on unofficial places. The officials on being asked about this said that this trend has been prevalent even much before the setting up of the Council in 1995 when it was a Notified Area Committee and people do not have any complaint against it. Moreover, they do not mind in giving such a meager amount to poor people. So, it is required that fine should be imposed by Council on throwing waste on unofficial spaces.

iv) Problem of stray cattle and dogs

Fourthly, the MSW (Management and Handling) Rules, requires that stray cattle and dogs should not be allowed to be moved around the collected waste.\(^31\) But these can be seen scattering the whole garbage from the

\(^{30}\) Rule 1 (i), The Municipal Solid Waste Management Rules, 2000.
community bins. This not only causes inconvenience to passer-bys but also become a major cause of accidents at night. Though Council has created a team of its employees to catch hold such animals, it is ineffective to control this menace. So, it is suggested that this work should be contracted out to some private agency.

5.3 WATER SUPPLY:

Water is the most vital natural resource available on this planet and it is being harnessed by the mankind to sustain all types of life, viz, human, animal and plant. It has been well said that water is life's matter and matrix, mother and medium, nay, water is life itself.

The history of ancient civilization reveals that the earliest man lived in close proximity to water sources as evidenced by human settlements such as those found along the great lakes of East and Central Africa, rivers, such as Euphrates and Tigris in ancient Mesopotamia, Nile in North Africa, and Indus in India. This is corroborated by the importance the Greek Philosopher Pinder (5th century, BC) attached on water, who once said, "water is the best of all things". The importance of water in earlier civilization was also clearly portrayed by another Greek Philosophers named Empedocles of Argricentrum (490-430 BC), that water is one of the four primary elements, namely, water, fire, air and earth, for which water is the pillar of all things.

In contemporary times, famous cities such as New York, Tokyo, Hong Kong, have their origin traced near major water sources, where they evolved and sustained over the years as a result of continued availability of this means of survival; water.

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35 Govt. of India, Oxford Student Atlas for India, Oxford University Press, New Delhi., 2004, p. 58
Thus, water is one such input without which no civilization can survive. So, in the present context, the major thrust of many countries of the world including India, is to ensure the provision of adequate and potable water to their urban populations.

5.3.1 Water Resources:

Planet earth has above three fourth of its surface covered with water. 97.3% of it is available in the form of sea water and hardly 2.7% fresh water, of which 1.74% is in the form of glaciers, drawing about total 7,000 cubic meter per capita renewable fresh water.

India roughly accounts for about 2.5% of the land mass and 4.5%, fresh water resources. According the report of the high level National Commission for Integrated Water Resource Development Planning (NCIWRDP), set up in 1999 by the Ministry Water Resources India, the recent estimates of water resources are

<table>
<thead>
<tr>
<th>Water Resources</th>
<th>Water in Cubic Km.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available surface water</td>
<td>1953</td>
</tr>
<tr>
<td>Available ground water</td>
<td>432</td>
</tr>
<tr>
<td>Total surface and ground water</td>
<td>2385</td>
</tr>
<tr>
<td>Usable surface water</td>
<td>690</td>
</tr>
<tr>
<td>Usable ground water</td>
<td>396</td>
</tr>
<tr>
<td>Total usable water</td>
<td>1086</td>
</tr>
<tr>
<td>Precipitation over the Indian Landmass</td>
<td>4000</td>
</tr>
</tbody>
</table>

From the above table it can be drawn that out of 2385 km$^3$ of total surface and ground water 1086 km$^3$ is usable surface and ground water against the

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precipitation of 4000 km³. Thus, a large gap exists between the demand and supply of water.

5.3.2 Water Conservation:
Water conservation is a strategy for maximising sustainable utilisation of scarce water by adopting carry over storages, ground water and surface water storage and optimal utilisation of water through integrated operation of storages.  

In order to bridge the gap between the demand and supply of water, dams are built to create reservoirs for storing water to be used for various purposes, viz., domestic, irrigation, flood control etc.

In India there has been considerable development of dams since independence. With less than 293 large dams at the time of independence, the number of dams has grown to more than 5,000 with a live storage capacity of 162 km³ of water. An additional 77 km³ would be available from projects under construction. Further, 131 km³ is under planning, taking the total to 380 km³.

Along with this, water shed development and rain harvesting techniques are also working towards conservation of water. Water Shed Development Technique aims at conserving basic resources of soil, rain water and vegetation through run off water management techniques and rain harvesting aims at recharging ground water storage through capturing the abundant rains.

One of the studies of Central Ground Water Authority shows that rain water harvesting potential in India is enormous. If India harvests rain water over 0.5 million square Kilometers of land, about 15% of India's total land areas can meet its water needs.

5.3.3 Rapid Urban Growth and Increased Water Demand
The population in urban areas is growing at an average growth rate of 35% and presently the urban population is estimated to be 25% of the total population.

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39 Amitabh Tewari and Suruchi Tewari, op. cit. pp. 418-419.
population and which figure is expected to touch by 60% by the year 2025. India’s urban population has grown more than five times from 62 million to 326 million from 1951 to 2001. Thus, it can be argued that urbanisation has been taking place at a very rapid pace in India, owing to multiple factors, such as migration from rural to urban areas, industrialization, development of trade, centralization of administration and growing educational and employment opportunities.

The increase in population not only generates greater demand for water, but it also creates problems related to the quality of water and hence to the general health of the people. According to experts, “Population growth creates water shortages not only by adding the number of consumers but also by increasing population density beyond the level that nearby water supplies can serve.”

5.3.4 Water Coverage
The United National Conference on Human Settlements held in June 1976 at Vancouver recommended that safe water supply and hygienic waste disposal should receive high priority from national governments and international agencies so as to enable national governments to achieve targets of serving the whole population by 1990. The objectives were further reiterated in the UN Water Conference held at Mar de Plata, Argentina in 1977. It was declared that the period, 1981-90 be designated as the international Drinking Water Supply and Sanitation Decade (IDWSSD). The conference recommended closer cooperation between international organisations and increased technical and financial assistance from external, bilateral and multi-lateral agencies. The 31st UN General Assembly approved the recommendations and India had pledged its full support for the IDWSSD Programme. Consequently, the IDWSSD Programme was launched in India on April 1, 1981 with a view to achieve definite targets by the end of the decade. Recognising the need for coordinated

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action and approach to achieve the decade goals, the Government of India constituted three working groups

(i) Financial Resources,

(ii) Materials and Equipment and

(iii) Programme and Manpower.41

At the end of the decade it was found that water coverage in urban areas improved from 72.3% to 84% during 1981 to 1990. Later, in the year 2001 the reported level stood at 89% and recently in 2004 it has come out 91%.42

In quintessence, it can be concluded that despite achieving unique and positive results during the decade, the continuing increase in population has been posing a great challenge, which has to be met. Moreover, the poorer sections of society have yet to be served. The focus should therefore be not mere increase in aggregate coverage but coverage which focuses on the unserved and underserved segments of the population.

5.3.5 Water Pollution

One of the most serious problem facing water policy makers in India is the severity of its polluted water. According to experts in India, a staggering 70% of the available water in India is polluted, and an estimated 73 million workdays costing Rs. 60 million are lost every year due to water related health problems.43 As per WHO, 80% of diseases are water borne like diarrhoea, typhoid, jaundice, cholera, dysentery, etc.44

Three primary sources of pollution have been identified in India: (i) discharging of industrial effluents, (ii) dumping of untreated sewage (which is responsible for 90% of the pollution, (iii) contamination of underground water from Chemical fertilizers and pesticides.

42 http://www.planningcommission.nic.in.
All the above said factors lead to inefficient use of water resources, which results into water shortages.

In 1974, the Indian Government, enacted the first major law related to water pollution – the Water Act of 1974. The scope of the Act was quite broad. It covered all physical, chemical and biological aspects of water pollution and damage not only to human lives but also to plants, animal and aquatic organisms. The Act also specified penalties for various offences. But unfortunately, the Act turned out to be inefficient because of existing political and social barriers such as bureaucratic corruption, mass apathy, feudalistic economy, and the power of industry.45

5.3.6 National Water Policy

In 1977, the UN Water Resources Council adopted Mar del Plata Action Plan which recommended that every country should formulate national policies for use, management and conservation of fresh water. Included in each programme should be research activities, appropriate institutional structures and laws for accelerating development and orderly administration of water resources. It took India about 10 years to follow up these recommendations. The National Water policy was adopted in India in 1987. Under the policy highest priority was assigned to drinking water, followed by irrigation, hydropower, navigation and industrial uses etc. The policy further recommended that the quality of surface water and ground water should be monitored. However, mere adoption of National water policy did not improve water-related situation in India and increased water demand for irrigation, domestic and industrial consumption and water pollution necessitated a change in the administrative structure.46

Thus, in October 1985, erstwhile Department of Irrigation was redesigned as Ministry of Water Resources. Its Primary responsibility was to develop, conserve and manage water as a natural resource. It was also responsible for formulating broad policy guidelines and programmes for

development and regulation of water resources. It included sectoral planning, coordination of policies and various boards and state level efforts, technical examination and assistance in water resource projects.

The National Water Policy 2002, emphasized the need for an integrated approach to water resources by planning, development, conservation and management of water with a national perspective; adoption of integrated and multi-disciplinary approach for implementation of projects; water sharing guided by a national perspective with due regard to water resources availability and needs within the river basin.

However, in the absence of an effective and meaningful institutional arrangement for planning and managing water resources, the National Water Policy has remained but a pious statement of intent.47

5.3.7 Commissions, Boards and Committees
Several commissions and boards were constituted under the Ministry of water resources.

(i) Central Water Commission was set up in 1945 to initiate, coordinate and provide expertise to the states in preparing schemes for water conservation flood management, irrigation, navigation and hydropower generation.

(ii) National Water Board was set in 1990 to review the progress of implementation of Nation Water Policy 1987.

(iii) K. Hanumantha Rao Committee was set up in 1993 to look into the problems related to Drought Prone Areas Programme (DPAP), Desert Development Programme, soil conservation, water resource conservation and development, and forestation.

Along with this there have been many national and international conferences such as UN Conference on the Human Environment, Stockhold (1972); the water conference; Mar del Plata, Argentina (1977), and the adoption of Agenda 21 at the Earth Summit, Rio (1992). All these summits addressed the

importance of water to enhance the quality of human life, the concern about the increased withdrawal of water globally, problems related to water shortage.

The forgoing discussion on India's administrative infrastructure related to water resource management seems impressive. But the problem facing India is severe and in many ways the Government has failed to provide sufficient, adequate and clean water to masses. Policies are formulated but these are never properly implemented.48

It has also been pointed out that there is "undue centralisation" in administering the water resource schemes and in policy formulation which results into uncoordinated efforts.49 So, there is need to make efforts for effective and efficient management of water in the years to come.

5.3.8 Financial Allocations

As far as the financial allocation on water supply is concerned under five year plans, the total outlay for urban water supply and sanitation, which was Rupees 43 crores under the First Five Year Plan, increased to Rupees 550 crores by the Fifth Plan. But despite a rapid increase in the urban population in the ensuing years, there has been a gradual shift in priority from urban to rural sector from the sixth plan onwards. The percentage share to the sector out of the total Public Sector outlay only showed a marginal increase from 1.28% to 1.38% between first and eighth plans. In the Ninth Plan, the share dramatically improved to 2.17%.50

In the Tenth Five Year Plan, based on the recommendations of the group on urban water supply and sanitation constituted by the Planning Commission, the requirements of the funds for achieving population coverage 100% with drinking water facilities and 75% sewerage and sanitation facilities in the urban areas is:

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50 Government of India, Mid-Term Appraisal of Ninth Five Year Plan (1997-2002), Planning Commission, New Delhi, October, 2000, p.11
The Tenth Plan outlay for urban water supply, rural water supply and urban sanitation and rural sanitation under the state sector is Rs. 44,206.55 cr. Under the central sector the outlay for urban development is Rs. 12,161.45 crore which includes Rs. 900 cr. for extension of accelerated urban water supply programme to small towns, Rs. 299.35 cr. for sanitation and Rs. 10 cr. for transport. There is central sector outlay of Rs. 700 cr. for north eastern states also.\(^5\)

Under XIth five year plan the amount sanctioned under water and sanitation has been almost twice the amount sanctioned under Xth plan. Hence, it can be drawn that efforts have been made in the direction of improving financial allocations on water supply, the improvement in terms of water coverage is marginal. As the present situation still portrays a grim picture; since nearly 10% of the urban population remains without access to water supply against the targeted goal of 100% water coverage in urban areas. Thus, it can be said that despite achieving unique and positive results in terms of water coverage, the continuing increase in urban population in India would continue to pose growing challenges, which have to be met through proper planning and management of available water as well as financial resources.

### 5.3.9 Water Supply in S.A.S. Nagar (Mohali)

Water supply is one function which is being performed by the Municipal council in collaboration with the Public Health Circle, S.A.S. Nagar (Mohali). A brief description of the functions of the circle relating to water supply has been given below.

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51. [http://www.ministry of water resources. nic.in](http://www.ministry of water resources. nic.in)

144
Functions of Public Health Circle relating to Water Supply

Public Health Circle, S.A.S. Nagar (Mohali) has been serving residents of Mohali with water since its creation in 1985. It has been covering around 90% of the population and spending around 77% (5.2 cr.) annually on it out of its total budget of 6.8 cr. rupees. The remaining 23% (1.6 cr.) is spent on sewerage and storm water drainage system, which is also being looked after by this department.

The circle is responsible to cater to the needs of the residents of following area:—

(i) All the 15 residential phases
(ii) Industrial phases (1-5) and
(iii) Villages Shahi Majra, Matour and Mohali

The Dept. works under the overall leadership of the Superintending Engineer. The other staff members include-
Table-5.3
Organisational Set-up of Public Health Circle, Mohali

Superintending Engineer

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Supdt. (1)</td>
<td>H. Draughtsman (1)</td>
<td>Supdt. (1)</td>
<td>H. Draughtsman (1)</td>
</tr>
<tr>
<td>Asst. (2)</td>
<td>Draftsman (1)</td>
<td>Asst. (2)</td>
<td>Draftsman (1)</td>
</tr>
<tr>
<td>Clerks (2)</td>
<td>Chefs (2)</td>
<td>Clerks (2)</td>
<td>Chefs (2)</td>
</tr>
<tr>
<td>Peon (1)</td>
<td>Sweeper (1)</td>
<td>Peon (1)</td>
<td>Sweeper (1)</td>
</tr>
<tr>
<td>Sweeper (1)</td>
<td></td>
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</tbody>
</table>

Sub Div. – 1 (Sub. Div. Eng.)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SDC (1) (Sub Div. Clerk)</td>
<td>J.E. (4)</td>
<td>SDC (1)</td>
<td>J.E. (4)</td>
<td>SDC (1)</td>
<td>J.E. (4)</td>
<td>SDC (1)</td>
<td>JE (4)</td>
</tr>
<tr>
<td>Clerks (4)</td>
<td>P. Operator (60)</td>
<td>Clerks (4)</td>
<td>P. Operator (60)</td>
<td>Clerks (4)</td>
<td>P. Operator (60)</td>
<td>Clerk (1)</td>
<td>P. Operator (60)</td>
</tr>
<tr>
<td>Meter Reader (1)</td>
<td>Fitter (4)</td>
<td>Meter Reader (1)</td>
<td>Fitter (4)</td>
<td>Meter Reader (1)</td>
<td>Fitter (4)</td>
<td>Meter Reader (1)</td>
<td>Fitter (4)</td>
</tr>
<tr>
<td>Peon (1)</td>
<td>Beldar (20)</td>
<td>Peon (1)</td>
<td>Beldar (20)</td>
<td>Peon (1)</td>
<td>Beldar (20)</td>
<td>Peon (1)</td>
<td>Beldar (20)</td>
</tr>
<tr>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
<td>Chowkidar (1)</td>
</tr>
</tbody>
</table>
The water supply under the circle is mainly from two sources:—

(i) Bhakhra Canal

(ii) Tubewells

The system draws about 10 Million Gallons of water per day (MGD) from Bhakhra main line through water works situated at Kajauli and about 5 MGD from local tubewells. Thus, total supply of water is about 15 MGD against the total requirement of 20 MGD (as per GOI's norm of 80 gallons per head per day).

A total of 29,060 connection have been fed by the circle daily through two water works-

<table>
<thead>
<tr>
<th>Water Works</th>
<th>Water Works Ph. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feeding Area</td>
</tr>
<tr>
<td></td>
<td>Resi. Phases 1-7</td>
</tr>
<tr>
<td></td>
<td>Indi. Phases 1-5</td>
</tr>
<tr>
<td></td>
<td>Village Mohali, Shahi</td>
</tr>
<tr>
<td></td>
<td>Majra, Motour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Works Ph. 4</th>
<th>Feeding Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resi. Phases 9-11</td>
<td></td>
</tr>
<tr>
<td>Sector 70, 71, Parts of Sec. – 48.</td>
<td></td>
</tr>
</tbody>
</table>

Along with supplying water to the residents, the circle is responsible to sanction water connection, collection of bills and listening to the complaints of consumers.

**Functions of Municipal Council Relating to Water Supply**

Before the creation of Municipal Council S.A.S. Nagar (Mohali) all the functions relating to water supply were being performed by the Public Health Circle S.A.S. Nagar (Mohali). But due to shortage of staff, some of the newly created areas i.e. from Industrial Area Phase-6 to Industrial Area Phase-9 were transferred to the council with its creation in 1995. Thus, a very smaller area is being served by the council, due to which no outsourcing has yet been introduced in this area.
This division comes under the overall headship of Municipal Engineer. The other staff members who assist the Municipal Engineer in discharge of his functions include —

**Table-5.5**

Organisational Set-up of Public Health Division of Municipal Council S.A.S. Nagar (Mohali)

<table>
<thead>
<tr>
<th>Municipal Engineer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Administrative Branch</td>
<td>Drawing Branch</td>
</tr>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Supdt.(1)</td>
<td>A.M.E.(1)</td>
</tr>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Asst.(1)</td>
<td>JE (1)</td>
</tr>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Clerk(1)</td>
<td>P. Operator (23)</td>
</tr>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Peon(1)</td>
<td>Meter Reader(4)</td>
</tr>
<tr>
<td></td>
<td>↓</td>
</tr>
<tr>
<td>Fitter(2)</td>
<td>↓</td>
</tr>
<tr>
<td>Foreman (1)</td>
<td>↓</td>
</tr>
</tbody>
</table>

**Major Components of Water Supply in S.A.S. Nagar (Mohali)**

(i) Water Resources  
(ii) Water Connection  
(iii) Water Usage Charges  
(iv) Listening to the complaints of citizens

(i) **Water Resources:**—

The Council is responsible to cater to the needs of industries, where supply is through tubewells only. It has total 9 tubewells drawing about 2 MG of water per day.
Table-5.6
Total Supply and Requirement of Water (in MGD)
1995-2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Supply</th>
<th>Requirement As per GOI's norm of 5400 gallons per acre per day</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0.44</td>
<td>4.49</td>
<td>4.05</td>
</tr>
<tr>
<td>1998</td>
<td>1.10</td>
<td>5.17</td>
<td>4.07</td>
</tr>
<tr>
<td>2001</td>
<td>1.55</td>
<td>5.78</td>
<td>4.23</td>
</tr>
<tr>
<td>2005</td>
<td>2.00</td>
<td>6.67</td>
<td>4.67</td>
</tr>
<tr>
<td>2008</td>
<td>2.29</td>
<td>8.56</td>
<td>6.27</td>
</tr>
</tbody>
</table>

The Table shown above indicates the increasing gap between the supply and demand of water from 1995 to 2008.

Due to the increasing gap between the demand and supply of water the consumers have to face the problem of low water pressure. The consumers are mainly from industries. As such these industries need not much of water because these industries are considered as 'dry industries' and these do not require water for the type of production and activities they carry out. The examples of such industries are – manufacturing of tractors, telephones, wires, furniture items, revolving chairs, geysers, inverters, metal products, car spare parts etc. Though the dependency of these industries on water is much less, the employees working in these industries complain that water comes for 3-4 hrs. in the morning and evening- 5 A.M. to 9 A.M. in the morning and 6 P.M. to 9 P. M. in the evening. During this time, the pressure is so low that they are not able to fill their containers.

In order to fill the gap between demand and supply of water, it is necessary to increase the supply by installing more tubewells. For this, a total of 22 tubewells are needed. Installation of a tubewell costs approximately 16 lakh and running expenses including maintenance and power bills costs 3 lakh annually. So installation of 22 tubewells would cost approximately 4.18 cr. to the Council.
As far as the problem of low water pressure is concerned, it can be tackled by replacing the old and rusted pumping machinery and pipelines which decelerate the pace of water. Leakages in pipelines also affect the supply and result into low water pressure. According to one of the findings of the Karnataka government’s World Bank funded project on water supply improvement (2004), due to leakages on an average, 30% to 50% of urban water is wasted. Empty and leaking pipelines are prime breeding ground for bacteria during non supply hours.52

So, there is a need check leakages regularly. For this, J.E. should be given responsibility of giving weekly report to S.D.E. regarding such leakages falling under his area. As presently, there is no system of detection of leakages. The only way of knowing about leakage is through citizens complaints.

(ii) Water Connections:—
A total of 881 connections have been fed by the division daily through one waterworks situated at Ind. Area Phase – 7. The overall responsibility of sanctioning water connection to consumers lies with the Municipal Engineer.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Water Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>605</td>
</tr>
<tr>
<td>1998</td>
<td>692</td>
</tr>
<tr>
<td>2001</td>
<td>771</td>
</tr>
<tr>
<td>2005</td>
<td>881</td>
</tr>
<tr>
<td>2008</td>
<td>923</td>
</tr>
</tbody>
</table>

The Table clearly indicates an increase from 605 connections in 1995 to 923 connections in 2008.

For getting a water connection, firstly the consumer has to fill a form and attach certain documents in a file such as a copy of building plan, power of attorney, industry registration certificate, allotment letter, possession letter, and affidavit claiming the total work force in industry and the receipts of deposit of

52 Hindustan Times, 27.7.2009.
road cut. The form along with these documents has to be submitted to the office of S.D.E. situated at Ind. Area Ph. 7, where file is submitted to concerned clerk, who after verifying the documents pass it to J.E., J.E. further pass it to S.D.E. And after getting approval from the S.D.E. file goes to the office of M.E. situated at Ph.-9. Thus, finally, the connection is sanctioned by the M.E.

**Problems faced by citizens for getting water connection:**

As far as the satisfaction of citizens is concerned the citizens are highly dissatisfied with the procedure of getting water connection because

**Firstly,** the residents are not satisfied with the time period of getting water connection. The main reason for their dissatisfaction revolves around the dilatory and cumbersome procedures to be followed for getting connection, as the residents are required to pay a number of visits to the offices of S.D.E. and M.E. to enquire about the arrival of their files. And sometimes the files are lost in the due process, and then the consumer again has to approach to these offices/officials.

**Secondly,** the residents of all the zones faced difficulties on account of rigorous rules and regulations to be followed for getting water connection. They have explained that the rules for getting water connection are neither specified nor publicized anywhere. Though a checklist is provided by the division, it does not ensure clarity. As it only specifies the list of documents to be attached with the application form. But it does not mention anywhere by whom and from where these certificates are to be issued. Lack of clarity leads to confusion in the minds of consumers and whenever any document is unattached, the concerned officials instead of helping them scold them. The required procedure is much more painful for the residents of villages for most of them are uneducated and ignorant about the required administrative procedures to be followed. The tale of woes does not end here as the consumers have to meet a number of officials to get their application forms sanctioned. And the officials are rarely available because of their preoccupied officials’ duties/responsibilities.
To overcome the problem of paying visits to the offices of the Council situated in different parts of the city and enquiring about the arrival of file by the consumers, the system should be centralised i.e. single window system should be adopted in providing all types of connections whether it is water or electricity; Secondly, the power of sanctioning water connection may be transferred from the Municipal Engineer to S.D.E. As the M.E. has been vested with the power of sanctioning water connection on the basis of the report received from the office of S.D.E. If S.D.E. gets this power, the time will be saved and it will also save consumer from roaming around the office of M.E.

Thirdly, the difficulties of citizens are associated with attaching too many documents with the application form for getting water connection such as a copy of building plan, power of attorney, industry registration certificate, allotment letter, possession letter, and affidavit claiming the total work force in industry and the receipt of deposit of road cut. The citizens complained that industry registration certificate is issued by the Punjab State Industrial Development Corporation, Punjab for establishing industries in the state on the basis of the certain documents such as building plan, power of attorney, allotment letter, possession letter, and affidavit claiming the total work force in industry. And when industry registration certificate is attached for getting water connection, what is the need of asking for these documents again. Therefore, it is suggested that industry registration certificate and receipt of deposit of road cut should be required to be submitted with the application form. This would help in avoiding too much of paperwork and thus in simplifying the procedure.

Fourthly, The citizens faced difficulties due to discourteous behaviour of the staff of the Council. As they asserted that their behaviour is not helpful towards them in solving their difficulties.

i) The major causes of dissatisfaction with the behaviour of staff are the delays and the unavailability of the concerned officials as the majority of them opined that it is very difficult to get things done quickly and timely in public dealing offices like council where the employees are always busy in chatting among themselves. Secondly, it is very difficult to locate
place/person from where one can get information and the functionaries around are unable to tell about the whereabouts of the missing one. So, they are ‘shuttled’ from one employee to other.

ii) Those who are satisfied with the behaviour of municipal staff reiterated that it is not possible to get things done in the Council unless you have personal relations with one or the other employee.

The major reason found behind such indifferent behaviour towards general public is non-filling of vacant posts. Due to which the burden falls on the existing staff which is already overburdened with the functions. So, their conduct does not reach up to the expectations of the citizens.

(iii) Water Usage Charges

Water usage charges in Mohali are as under:

<table>
<thead>
<tr>
<th>Year</th>
<th>Residential Charges</th>
<th>Commercial Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0.70</td>
<td>3.00</td>
</tr>
<tr>
<td>1999</td>
<td>1.80</td>
<td>5.00</td>
</tr>
<tr>
<td>2005</td>
<td>3.20</td>
<td>6.00</td>
</tr>
</tbody>
</table>

It can be inferred from the table drawn above that the water usage charges have increased from 0.70 Rs. to 3.20 Rs. per Kiloliter for domestic use and from 3.00 Rs. to 6.00 Rs. per K.L. for commercial use during 1995 - 2005.

Citizens are not satisfied with the water charges as the charges are too exorbitant and it has become very difficult for them to afford such high prices. More dissatisfaction was found in the residents who have been paying exaggerated bills due to defective meters. They are required to pay bill on an average basis till the replacement of the defective meters. So, they suggested that the hike in prices should be after 10 years as the period of 5-6 years is very short to bear such burden.
(iv) Listening to the Complaints of Citizens

The Council is responsible to listen to the complaints of citizens regarding low water pressure, water leakages, defect in meter, bursting of pipelines etc. For this, a complaint centre has been in operation since 1998 at Ind. Phase 7, where citizens can register their complaints and complaints can also be made through telephone.

As far as the citizen’s views regarding the registration of complaints are concerned they complain that their problems are not solved even after so many days say 10 or 15 days. Moreover the complaints on phone are not received properly by the staff as phone is either busy or if the complaint is attended the person on other side either do not listen to the complaint or disconnect the phone without giving appropriate reply.

After inquiring about such indifferent attitude of staff towards listening to the complaints of citizens, shortage of staff was found to be the major reason behind such callous attitude of staff. So there is urgent need of equipping complaint centre with adequate staff.

5.4 ROADS

Transportation is the movement of goods or people from one location to another location. This includes just about every type of movement possible. More specifically, transportation is the movement of goods beyond their local production area and the movement of people between different geographical locations.\(^{53}\) Transportation contributes to the economic, industrial, social and cultural development of any country. Transportation is vital for the economic development of any region since every commodity produced whether it is food clothing, industrial product or medicine needs transport at all stages from production to distribution. In the production stage, transportation is required for carrying raw materials like seeds, manure, coal steal etc. In the distribution stage, transportation is required from the production centers viz; farms and factories to marketing centers and later to the retailers and the consumers for distribution. The inadequate transportation facilities retard the process of socio-

economic development of the country. The adequacy of transportation system of a country indicates its economic and social development.54

Improved transportation has important implication in reducing sectionalism within the country and international understanding for better peace and order. Moreover, the prosperity and employment opportunities of urban area attract the population from other areas resulting in enhanced economic activities.

Among the four modes of transportation i.e. roadways, railways, water ways and airways, the transportation by road is the only mode which could give maximum service to one and all. This mode has the maximum flexibility for travel with reference to route, direction, time and speed of travel etc. through any mode of road vehicles. The other three modes, viz, airways, waterways, railways have to depend on transportation by roads for the service to and from their respective terminals, airports, harbours or stations. The road transport is preferred because of its inherent advantages, viz., easy availability, adaptability, individual needs, and door-to-door service and reliability.55

The road network is therefore needed not only to serve as feeder system for other modes of transportation and to supplement them, but also to provide independent facility for road travel by a well planned network of roads throughout the country.56

5.4.1 Roads in S.A.S. Nagar (Mohali)

There are two types of functions relating to roads in S.A.S. Nagar (Mohali):

i) Construction of Roads

ii) Maintenance of Roads

Construction of roads in S.A.S. Nagar (Mohali) is the overall responsibility of Greater Mohali Area Development Authority (GMADA), while their maintenance is the responsibility of Municipal Council, S.A.S. Nagar (Mohali).

A brief description of functions of GMADA relating to construction of roads is given below.

Greater Mohali Area Development Authority (GMADA)

GMADA was created on August 14, 2006. After the creation of S.A.S. Nagar (Mohali) as 18th district of Punjab on April 13, 2006, the GMADA took over the entire work of Punjab Urban Development Authority (PUDA), (Mohali zone) and (its staff) started doing what the PUDA had been doing earlier i.e. all the functions relating to construction of roads, public health, horticulture and electrical functions.

i) Construction of Roads:-

Construction of roads is one of the major functions of the GMADA. As out of the total budgetary outlay of Rs. 30,952 lakh (2006-07), 110 crores are spent on construction of roads and till date it has developed 129 km of road length in S.A.S. Nagar (Mohali).

Construction of roads comes under the roads wing of GMADA, which covers the whole city of S.A.S. Nagar (Mohali) including all the 15 phases (residential and industrial) and three villages namely vill. Mohali, Shahi Majra and Matour. This wing works under the overall headship of the Chief Engineer of GMADA.

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57 Section 39 (1) of The Punjab Regional Town Planning and Development Act 1995.
Table 5.9
Organizational Set-up of Roads Wing of GMADA
Chief Engineer (Roads Wing)

<table>
<thead>
<tr>
<th>Superintending Engineer</th>
<th>Divisional Engineer</th>
<th>Administrative Branch</th>
<th>Accounts Branch</th>
<th>Drawing Branch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Superintendent (1)</td>
<td>Sr. Accts. officer (2)</td>
<td>SDE (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assistant (2)</td>
<td>Jr. Accts. officer (1)</td>
<td>JE (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerk (2)</td>
<td>Peon (1)</td>
<td>Head Draftsman (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peon (1)</td>
<td>Jr. Draftsman (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draftsman (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peon (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the head of the roads wing, the chief Engineer has been charged with the responsibility of construction of roads, footpaths roundabouts, parking lots, road berms, and back-lanes in the city. For this, he invites tenders and gives work on contract to some private agency. The contract mentions the terms and conditions, which the contractor and his men have to follow during a given period of time for the completion of work.

Under the MOU signed between the contractor and the Chief Engineer, the contractor is liable to follow certain provisions regarding the construction of roads:

i) To carry out construction work of roads, footpaths, roundabouts, parking lots, road berms, and back-lanes.

ii) To provide at his own cost requisite construction material such as bitumen, concrete, stone metal, sand and charcoal along with the tools and machinery;
iii) to properly execute the work in accordance with the drawings and specification prescribed by the Ministry of surface Transports and Highways, Indian Roads Congress and Punjab Public Works Department regarding the length, width and height of roads;

iv) to properly execute the work under the guidance of chief Engineer and the work is open for him for inspection at any time;

v) to provide salary and other allowances such as provident fund and gratuity to the men working under him under the Punjab Contract labour, Rules, 1973, and to provide them with uniforms and identity cards.

ii) Maintenance of Roads:-

The responsibility of maintaining roads, developed by GMADA lies with the council. The Roads division of the council has been divided into two parts-
i) Ph. 1 to 7, Ind. Ph. 1 to 8 and vill. Mohali Shahi Majra and Matour

ii) Ph. 8 to 11 and Ind. Ph. 9

This division is responsible for maintenance of roads, roundabouts, parking lots, foot paths and cleaning up of road-berms and back-lanes. The division comes under the overall headship of the Municipal Engineer.

Table 5.10

Organizational Set-up of Roads Division of Municipal Council S.A.S. Nagar (Mohali)

<table>
<thead>
<tr>
<th>Municipal Engineer (Roads Division)</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Administrative Branch</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Supdt. (1)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Assistant (2)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Clerk (2)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Peon (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawing Branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Assistant Municipal Engineer (2)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Junior Engineer (5)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Supervisor (2)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Mates (6)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Beldar (10)</td>
</tr>
<tr>
<td>↓</td>
</tr>
<tr>
<td>Peon (1)</td>
</tr>
</tbody>
</table>
The Municipal Engineer (ME) is responsible for keeping the history of each road of the city. For this, a register is maintained in which all the details relating to the construction of roads such as date of its making, time taken for its construction and the name of the contractor are registered. It is his duty to see the roads which demand recarpentry on completion of the recarpentry period of 3-5 years and also to ensure recarpentry of roads which break before this time period. This is generally done on the basis of the report received from the J.E. of the concerned area. After getting the report, the ME inspect the roads and invite tenders for giving repairing work on contract to some private firm.

After passing the tender an MOU is signed between the ME and the contractor, which specifies the terms and conditions to be followed by the contractor and his men for a given time period for the completion of work. These terms and conditions of MOU are determined by the ME in accordance with the Punjab Municipal Act 1911.

The provisions mentioned under the Act are as follows:-

i) to carry out repairing work of the broken roads, footpaths, roundabouts, road-berms and back-lanes.

ii) to provide at his own cost the requisite material for carrying out repairing works such as tools, ladders, scaffolding etc.

iii) to execute the work in accordance with the specifications prescribed by the Indian Roads Congress, Ministry of Surface Transport and Highways and Punjab Public Works Department regarding the length, breadth and height of the roads.

The work is open for inspection by the ME at any time and generally 2-3 inspections are carried in a period of six months. He is authorized to deduct Rs 200 on finding any worker missing from duty on duty hours. It has been found that generally, 3-5 workers are found to be missing during inspections.

If the work is found to be imperfect or material used is of inferior quality, the ME can ask contractor to rectify the structure and failing to do so within the period specified by ME, the contractor is liable to pay compensation
at the rate of 1% of the total estimate of tender for every day. It has been found that two such firms had to pay compensation on this basis since the beginning of the system of outsourcing in the year 2002.

Along with this, the contractor is responsible to give salary and other allowances such as gratuity, provident fund and compensation to the Workers in accordance with the Punjab Municipal works Rules, 1978. And to avoid road accidents, uniforms and identity cards are also provided by him. However, it has been observed that most of the workers generally do not bother to wear uniforms and identify cards. So, the council should make it mandatory to make them wear uniforms and identity cards while working as it would not only provide safety to the workers but also to the passer byes.

5.4.2 Issues in Urban Road Transport in India

The increased level of urbanization is putting severe strain on the civic services leading to decline in quality of life. The Urban transport sector is the major sufferers of this phenomenon. The existing transportation facilities have not been keeping pace with the high growth in transport demand because of following reasons.\textsuperscript{58}

i. Vehicular Congestion
ii. Road Accidents
iii. Vehicular Pollution

\textbf{Vehicular Congestion:-}

While growth in transport brings some positive benefits, such as productivity gains which are good for economy, it also has negative impacts in terms of damage to the environment and increased road congestion.\textsuperscript{59}

Congestion on roads is considered to be one of the major problems confronting urban transportation in India. It is a state of excessive accumulation or overfilling or overcrowding on roads.


\textsuperscript{59} Proceedings of The International Seminar on Regulatory Reforms on Road Freight Transport, 2001, France.
The high degree of vehicular congestion that occurs during a weekday morning and evening rush hours on local streets within downtown or central city areas and on above many high speed, limited access urban freeways that serve these areas. In certain specially crowded districts, excessive street congestion exists throughout the duration of the working day. Street and highway congestion imposes the social and economic costs upon society. Specifically, congestion increases travel time, increases the accident rate, result in higher motor vehicle operating cost due to greater fuel and motor oil consumption and wear, and tear increases the costs of goods. Street and highway congestion affects private automobile as well as public surface transit vehicles (buses and trolley coaches). Congestion raises the real costs of manufacturing, distributing and selling goods and services of doing business in general - within urban areas. It thus acts as a tax upon the entire metropolitan economy in the form of higher product prices. Congestion augment the other powerful economic and social forces that encourage business and household decentralization (sub-urbanisation) and consequently congestion helps to accelerate the economic and social decline of central cities.\(^{60}\)

Congestion is generally due to a mismatch between the population, number of registered vehicles and road length.

**Population versus Number of Registered Vehicles versus Road Length**

It comprises following three parts

i) Population, Registered Vehicles and Road Length in India

ii) Population, Registered Vehicles and Road Length in Punjab

iii) Population, Registered Vehicles and Road Length in S.A.S. Nagar (Mohali).

i) **Population, Registered Vehicles and Road length in India**

In India transportation demand in urban areas continues to increase rapidly as a result of both population growth and excessive growth in number of vehicles. India Development Report 2004 reveals that the number of registered vehicles

in India has outgrown the number of people i.e. the growth in motor vehicles has outpaced the population growth.\textsuperscript{61} According to World Bank, motor vehicle ownership and use in developing countries is growing faster than population.\textsuperscript{62} While the urban population increased from 230 million to 326 million with the growth rate of 3.7\% during 1991 to 2001, the number of registered vehicles raised from 21374 thousands to 54991 thousands with the growth rate of 14.2\% during the same period. Thus, the growth of motor vehicles is almost three times faster than the growth of population. This in turn would result into almost choking up of roads and increasing the atmospheric pollution.\textsuperscript{63}

Growth in the number of vehicles does not match with the corresponding expansion in road length. The Indian road network covering a length of 3.34 million kms. is the world’s second longest network.\textsuperscript{64} It is further divided into following:-

<table>
<thead>
<tr>
<th>Table-5.11</th>
</tr>
</thead>
<tbody>
<tr>
<td>India’s Total Road Length</td>
</tr>
<tr>
<td>National High Ways</td>
</tr>
<tr>
<td>State High Ways</td>
</tr>
<tr>
<td>Urban Roads</td>
</tr>
<tr>
<td>Other Roads</td>
</tr>
</tbody>
</table>

Source: - www.Ministry of Road Transport and Highways. nic.in

Though a good network of roads coupled with an efficient mass urban transport system plays an important role in India’s urban growth, there is also growing trend towards an increasing number of personalized vehicles,


especially two-wheelers, which account for 60 to 80 per cent of motor vehicles. This results in congestion on the roads, slowing down of traffic and atmospheric pollution. Narrow carriageways and poor road surface add to the problems.

Thus, the growth in the number of vehicles has been largely driven by the growth in the number of two wheelers. The figure shown below reveals that the sale of two wheelers has dominated the vehicles sales between 1991-2003.\(^\text{65}\)

### Table-5.12
Total Number of Registered Vehicles in India 1991-2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Two wheelers</th>
<th>Cars, Jeeps and Taxis</th>
<th>Buses</th>
<th>Goods vehicles</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>14200</td>
<td>2954</td>
<td>331</td>
<td>1356</td>
<td>2533</td>
<td>21374</td>
</tr>
<tr>
<td>1996</td>
<td>23252</td>
<td>4204</td>
<td>449</td>
<td>2031</td>
<td>3850</td>
<td>33786</td>
</tr>
<tr>
<td>1997</td>
<td>25729</td>
<td>4672</td>
<td>484</td>
<td>2343</td>
<td>4104</td>
<td>37332</td>
</tr>
<tr>
<td>1998</td>
<td>28642</td>
<td>5138</td>
<td>538</td>
<td>2536</td>
<td>4514</td>
<td>41368</td>
</tr>
<tr>
<td>1999</td>
<td>31328</td>
<td>5556</td>
<td>540</td>
<td>2554</td>
<td>4897</td>
<td>44875</td>
</tr>
<tr>
<td>2000</td>
<td>34118</td>
<td>6143</td>
<td>562</td>
<td>2715</td>
<td>5319</td>
<td>48857</td>
</tr>
<tr>
<td>2001</td>
<td>38556</td>
<td>7058</td>
<td>634</td>
<td>2948</td>
<td>5795</td>
<td>54991</td>
</tr>
<tr>
<td>2002</td>
<td>41581</td>
<td>7613</td>
<td>635</td>
<td>2974</td>
<td>6121</td>
<td>58924</td>
</tr>
<tr>
<td>2003</td>
<td>47525</td>
<td>8619</td>
<td>727</td>
<td>3488</td>
<td>6674</td>
<td>67033</td>
</tr>
</tbody>
</table>

Source: [www.ministry of Road Transport and Highways.nic.in](http://www.ministry.of.road.transport.highways.nic.in)

A huge investment is involved in urban transportation system under five year plans in India\(^\text{66}\).

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\(^{66}\) [http://www.planning.commission.nic.in](http://www.planning.commission.nic.in)
Thus, a sum of rupees 17283.16 were given to road transport under various plans. But unfortunately, present investment in urban road transport has been proved to be insufficient to meet the fast growing transportation needs of urban areas. Therefore, the present infrastructure is just not able to cater to the exponential growth of vehicles and population leading to congested and longer journeys on roads.67

Congestion on roads has been presenting similar trends in Punjab as well as in S.A.S. Nagar (Mohali), as being followed at the all India level. As the present mismatch between the population, registered vehicles and road length can also be seen in Punjab and Mohali.

ii) Population, Registered Vehicles and Road Length in Punjab

Punjab is situated in the north western corner of the country. It is spread on an area of 50,362 sq. km. covering a population of 243.59 lakh. It has total road network of 54,836 km.

<table>
<thead>
<tr>
<th>National Highways</th>
<th>1729 km</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Highways</td>
<td>2166 km</td>
</tr>
<tr>
<td>Urban Roads</td>
<td>3021 km</td>
</tr>
<tr>
<td>Other Roads</td>
<td>47941 km</td>
</tr>
</tbody>
</table>

Source: http://www.Punjabgovt.nic.in

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Table 5.14
Population, Registered Vehicles and Road Length in Punjab
1991-2001

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>2001</th>
<th>Decadal Growth</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population in lakh</td>
<td>59,83,180</td>
<td>82,62,511</td>
<td>22,79,331</td>
<td>3.4%</td>
</tr>
<tr>
<td>Registered Vehicles in Lakh</td>
<td>13,29,482</td>
<td>27,16,650</td>
<td>13,87,168</td>
<td>9.4%</td>
</tr>
<tr>
<td>Road Length in kms</td>
<td>2,403km</td>
<td>3,021km</td>
<td>618km</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

Source: Economical and Statistical Abstract, Punjab, 2005

The Table shown above depicts that the urban population of Punjab has grown by 3.4% from 59,83,180 lakh to 82,62,511 lakh, while the registered vehicles have increased by 9.4% from 13,29,482 lakh to 27,16,650 lakh and road length has increased by 2.3% from 2,403 km to 3021 km from 1991 to 2001. Thus, the growth of vehicles in Punjab is faster than the growth of population as well as road length. The data on total registered vehicles population as well as road length.

As far as allocations on urban road transport system under five year plans is concerned, a sum of rupees 52,529.51 lakh were sanctioned under IX plan (1997-2002) and 2,71,150.00 lakh were sanctioned under X plan (2002-2007). But these allocations have not yet solved the problem of congestion on urban roads in Punjab. Thus, congestion is a serious problem in Punjab.

iii) Population, Registered Vehicles and Road Length in S.A.S. Nagar (Mohali)

Since the formation of the Municipal council S.A.S. Nagar (Mohali) in 1995, a total road network of 234 km has been developed by the Greater Mohali Area Development Authority (GMADA). Approximately a sum of rupees 110 crore is spent on the development of roads annually by GMADA and around 3-4 crores of rupees is spent by the council on maintenance of roads developed by
GMADA. But the problem of congestion in S.A.S. Nagar (Mohali) is as serious as is found at the state level or center level.

**Table-5.15**

**Population, Registered Vehicles and Road Length in S.A.S. Nagar (Mohali)**

<table>
<thead>
<tr>
<th>Years</th>
<th>Growth Rate</th>
<th>Decadal Growth</th>
<th>Growth Rate</th>
<th>1995</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>96,091</td>
<td>1,59,522</td>
</tr>
<tr>
<td><strong>Population (projected)</strong> (in thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Registered vehicles</strong> (in thousands)</td>
<td></td>
<td></td>
<td></td>
<td>2,422</td>
<td>11,471</td>
</tr>
<tr>
<td><strong>Road length (in kms)</strong></td>
<td></td>
<td></td>
<td></td>
<td>96 km</td>
<td>225km</td>
</tr>
</tbody>
</table>

The table shown above depicts that the population of S.A.S. Nagar (Mohali) has grown by 5.2% annually from 96, 091 to 1,59, 522 during 1995-2005, while registered vehicles increased by 8.3% form 2,422 to 11, 471 and road length has increased by 4.5% from 96 km to 225 km during the same period. Thus, increase in number of vehicles has outpaced the growth of population as well as road length in a decade.

**Table-5.16**

**Total Number of Registered Vehicles in S.A.S. Nagar (Mohali)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Two Wheelers</th>
<th>cars/jeeps</th>
<th>Buses</th>
<th>Goods vehicles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1,445</td>
<td>692</td>
<td>77</td>
<td>208</td>
<td>2,422</td>
</tr>
<tr>
<td>1996</td>
<td>1,676</td>
<td>804</td>
<td>89</td>
<td>241</td>
<td>2,810</td>
</tr>
<tr>
<td>1997</td>
<td>1,913</td>
<td>947</td>
<td>116</td>
<td>275</td>
<td>3,251</td>
</tr>
<tr>
<td>1998</td>
<td>2,181</td>
<td>1,114</td>
<td>146</td>
<td>304</td>
<td>3,745</td>
</tr>
<tr>
<td>1999</td>
<td>2,553</td>
<td>1,313</td>
<td>171</td>
<td>347</td>
<td>4,384</td>
</tr>
<tr>
<td>2000</td>
<td>3,075</td>
<td>1,581</td>
<td>197</td>
<td>417</td>
<td>5,270</td>
</tr>
<tr>
<td>2001</td>
<td>3,660</td>
<td>1,813</td>
<td>227</td>
<td>477</td>
<td>6,177</td>
</tr>
<tr>
<td>2002</td>
<td>4,241</td>
<td>2,132</td>
<td>263</td>
<td>552</td>
<td>7,188</td>
</tr>
<tr>
<td>2003</td>
<td>4,863</td>
<td>2,458</td>
<td>314</td>
<td>635</td>
<td>8,270</td>
</tr>
<tr>
<td>2004</td>
<td>5,694</td>
<td>2,822</td>
<td>366</td>
<td>748</td>
<td>9,630</td>
</tr>
<tr>
<td>2005</td>
<td>6,818</td>
<td>3,359</td>
<td>427</td>
<td>867</td>
<td>11,471</td>
</tr>
<tr>
<td>2006</td>
<td>8,013</td>
<td>3,998</td>
<td>498</td>
<td>1,004</td>
<td>13,513</td>
</tr>
<tr>
<td>Total</td>
<td>38,119</td>
<td>19,035</td>
<td>2,393</td>
<td>5,071</td>
<td>64,618</td>
</tr>
</tbody>
</table>

Source: District Transport Authority, S.A.S. Nagar, (Mohali)
The table shows that a total of 64,618 vehicles has been registered from 1995 to 2006. The sale of two wheelers has dominated the total sale of vehicles during this period. As two wheelers have sold by 60%, car/jeeps by 30% and Buses/goods vehicles by 10% of the total sale.

**Problem of Citizens due to Congestion on Roads of S.A.S. Nagar (Mohali)**

The citizens of S.A.S. Nagar (Mohali) face a number of problems due to congestion on roads of the city as-

Firstly, citizens complain that the rush is so heavy on roads that they do not want to send their children alone on bicycle/scooter for school/college/tuition/coaching class, working ladies on scooter/car for office and elderly people for walks. Even it becomes very difficult for them to drive on such congested roads during office hours and usually they get late to office even after starting from home much before the arrival time. This problem becomes acute for daily passengers who work in some other cities like Patiala, Roopnagar, Fatehgarh Sahib etc.

The major cause of such a heavy rush on roads of the city is the non existence of cycle tracks. As slow carriages like rickshaw, car, cycle etc. slow down the pace of other vehicles and thus add to congestion. So, there is a need to separate the slow carriages from other fast moving vehicles by introducing the system of cycle tracks.

Another cause of congestion is passing of goods vehicles like trucks, canters within city on some of the roads like roads coming from nearby villages like Sohana, Balongi etc. So, there is a need to separate goods vehicles by allotting them independent routes outside the city.

The problem of congestion can also be solved through-

i) four planning of certain routes like from Ph XI to Tribune Chowk Chandigarh and road from village Balongi to Ph XI;

ii) finding of certain alternative routes to divert the traffic;

iii) making of flyover or an underground electric train similar to that in Delhi can also be made to divert the traffic.
Secondly, insufficient parking spaces in the city cause disorderly parking of vehicles in parking places in different markets of the city and thus, creating a traffic nuisance. Shopkeepers complain that they cannot take their cars out of market parking as they are the first to park and subsequently parked cars do not give them space to drive out of the parking. And many a times car owners can be seen quarreling over parking problems. Thus, it is suggested that underground parking may be made with separate parking for two-wheelers and four wheelers.

ii) Road Accidents

In India transportation demand in urban areas continues to increase rapidly as a result of population growth and changes in travel patterns. While the demand for urban transport is growing rapidly, the supply of transport infrastructure has not kept pace. Consequently, the mobility levels in cities have been falling. This has resulted in increased travel times fuel consumption, vehicular pollution and road accidents.69

Cities have become accident infested areas with high risk of involvement in some sort of accident or other. Though only 20 to 25% of the population of the country lives in urban areas, about 75% of accidents occurs in cities and towns. The reasons for such high rate of accidents are many- including urbanization, economic growth, tremendous vehicular growth, traffic congestion and so on.

The World Report on Road Traffic Injury Prevention released by the World Health Organization on the world health day (7th April, 2004) has highlighted that nearly 12 lakh people are known to die each year in road accidents globally. Keeping in view the increasing global concerns about the growing impact of road traffic accidents, the United Nations General Assembly and the World Health Organization have declared the year 2004 as the year of road safety.70

69 Vinod Sibal, op. cit., p.342.
The problem of traffic accidents is more in developing countries. Thus, in respect of safety on roads, our own country’s position is far from satisfactory. There is no denying the fact the number of road accidents is high. As more than eighty thousand people are killed and around four lakh injured in about four lakh reported road accidents in India every year.

Table 5.17
Total Number of Road Accidents Occurred and the Persons Killed in India (1991-2003)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total No of road accident occurred</th>
<th>Total no of persons killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>295131</td>
<td>56278</td>
</tr>
<tr>
<td>1992</td>
<td>275541</td>
<td>60113</td>
</tr>
<tr>
<td>1993</td>
<td>284646</td>
<td>60380</td>
</tr>
<tr>
<td>1994</td>
<td>325864</td>
<td>64463</td>
</tr>
<tr>
<td>1995</td>
<td>351999</td>
<td>70781</td>
</tr>
<tr>
<td>1996</td>
<td>371204</td>
<td>74665</td>
</tr>
<tr>
<td>1997</td>
<td>373671</td>
<td>76977</td>
</tr>
<tr>
<td>1998</td>
<td>385018</td>
<td>79919</td>
</tr>
<tr>
<td>1999</td>
<td>386456</td>
<td>81966</td>
</tr>
<tr>
<td>2000</td>
<td>391449</td>
<td>78911</td>
</tr>
<tr>
<td>2001</td>
<td>405637</td>
<td>80888</td>
</tr>
<tr>
<td>2002</td>
<td>407497</td>
<td>84674</td>
</tr>
<tr>
<td>2003</td>
<td>406726</td>
<td>85998</td>
</tr>
</tbody>
</table>

Source: Http://www.Ministry of Road Transport and Highways.nic.in

The analysis of data shown above depicts an increase of 2.3% and 2.2% annually in the total number of road accidents occurred and persons killed respectively in a decade from 1991-2001.

Road Accidents in Punjab

The situation is not different in Punjab, where roads are steadily becoming accident traps, with mishaps increasing each passing day. Going by statistics, every third day a human life is lost in a road accident in the cities of Punjab. The data on road accidents occurred and persons killed in a decade is presented below to have a glimpse of overall situation prevailing In Punjab.
Table-5.18
Total Number of Accidents Occurred and the Persons Killed in Punjab (1991-2001)
(In numbers)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total no. of road accidents occurred</th>
<th>Total No. of persons killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>1894</td>
<td>1208</td>
</tr>
<tr>
<td>1992</td>
<td>2084</td>
<td>1378</td>
</tr>
<tr>
<td>1993</td>
<td>2272</td>
<td>1432</td>
</tr>
<tr>
<td>1994</td>
<td>2535</td>
<td>1479</td>
</tr>
<tr>
<td>1995</td>
<td>2761</td>
<td>1612</td>
</tr>
<tr>
<td>1996</td>
<td>3022</td>
<td>1737</td>
</tr>
<tr>
<td>1997</td>
<td>3287</td>
<td>1968</td>
</tr>
<tr>
<td>1998</td>
<td>3543</td>
<td>2018</td>
</tr>
<tr>
<td>1999</td>
<td>3704</td>
<td>2207</td>
</tr>
<tr>
<td>2000</td>
<td>3876</td>
<td>2406</td>
</tr>
<tr>
<td>2001</td>
<td>4074</td>
<td>2573</td>
</tr>
<tr>
<td>2002</td>
<td>4346</td>
<td>2638</td>
</tr>
<tr>
<td>2003</td>
<td>4429</td>
<td>2580</td>
</tr>
<tr>
<td>2004</td>
<td>4692</td>
<td>2655</td>
</tr>
</tbody>
</table>

Source:- Economical and Statistical Abstract, Punjab, 2005

The analysis of data presented above shows an increase of 3.9 % annually in the total number of road accidents occurred and persons killed during 1991-2001.

Road Accident in S.A.S. Nagar (Mohali)
The city of S.A.S. Nagar (Mohali) has grown very speedily during the last decade (1995-2005). With the increase in population, the congestion on roads has increased a lot, which has resulted into a constant increase in the number of road accidents. The data on road accidents and persons killed during the last decade (1995-2005) has been presented below:-
Table-5.19
Total Number of Road Accidents Occurred and Persons Killed
in S.A.S. Nagar (Mohali)
1995-2006
(In numbers)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total number of accidents occurred</th>
<th>Persons killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>101</td>
<td>46</td>
</tr>
<tr>
<td>1996</td>
<td>119</td>
<td>51</td>
</tr>
<tr>
<td>1997</td>
<td>145</td>
<td>58</td>
</tr>
<tr>
<td>1998</td>
<td>161</td>
<td>69</td>
</tr>
<tr>
<td>1999</td>
<td>182</td>
<td>78</td>
</tr>
<tr>
<td>2000</td>
<td>203</td>
<td>89</td>
</tr>
<tr>
<td>2001</td>
<td>242</td>
<td>103</td>
</tr>
<tr>
<td>2002</td>
<td>278</td>
<td>121</td>
</tr>
<tr>
<td>2003</td>
<td>312</td>
<td>137</td>
</tr>
<tr>
<td>2004</td>
<td>343</td>
<td>149</td>
</tr>
<tr>
<td>2005</td>
<td>368</td>
<td>168</td>
</tr>
<tr>
<td>2006</td>
<td>388</td>
<td>184</td>
</tr>
</tbody>
</table>

Source- District Transport Authority, S.A.S. Nagar, (Mohali)

The analysis of data shows that the number of accidents has increased by 6.6% annually, while the persons killed have increased by 6.8% annually during 1995-2005.

Causes of Road Accidents
According to report of working group for tenth five year plan in India, some of the causes of road accidents are:71

i) Bad Roads
ii) Inadequate lighting on Roads
iii) Stray cattle/dogs

i) Bad roads
Bad roads or broken roads are one of the major cause of accidents on roads. Most of the roads in India are in a pathetic condition. Almost all the roads are full of potholes. The water gets accumulated in these potholes during monsoon

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71 Report of Working Group for Tenth Five Year Plan.
and becomes a major cause of accidents. Poor and improper maintenance of almost all categories of roads produce accidents. About 57% of total roads in India are unsurfaced and unmotorable. An extensive survey conducted by 'The Tribune' on the condition of roads in Punjab reveals that nearly 40% of the roads in Punjab are in bad shape. Even, those roads which were repaired during the past one year have been rendered unsafe for vehicular traffic. In most of the cases, the top bitumen layer has come off, making the road surface vulnerable for crates and potholes which because of ongoing monsoon have been becoming bigger and dangerous posing serious threats to vehicle owners and other road users.

In S.A.S. Nagar (Mohali), almost all the roads of the city are broken. There are number of pits on a single road, Even 'Hindustan Times' reported, 'Almost all the major roads cutting through the district's length and breadth are interspersed with potholes and ditches, make driving a perilous experience.'

The situation gets worsen during rainy days when accumulated water conceals the potholes and vehicles get entrapped in such potholes thus driver become a victim of accident. Hence, there is a need to enhance the life of roads through adopting certain new methods such as making of roads with plastic waste and bitumen. This a unique method discovered by a Bangalore based scientist, which is more durable than present system of making roads with stone metal, bitumen, concrete, sand and charcoal. As it will not only tackle the problem of plastic waste which can be bought from the rag-pickers, but will also have better stress bearing and better riding-surface.

Even Municipal Corporation Chandigarh has started re-carpeting 2.4 km of long stretch slow carriage road along Madhya Marg in sector 27 Chandigarh with bitumen mixed with plastic waste.

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73 The Tribune, 01.08.2006
74 Hindustan Times, 22.04.06
75 The Tribune, 13.07.2006.
ii) Inadequate lighting on roads

Inadequate lighting on roads is another cause of road accidents. This is mainly due to dysfunctional streetlights and road signals. The problem gets acute at night when potholes become invisible and vehicles fall into it or clash with another vehicles.

In S.A.S. Nagar (Mohali) most of the roads at night are without streetlights. Due to which vehicles fell into pits and face accidents. It has also been observed that the telecom firms dig up pits to lay underground wires and after completion of work, labourers don't bother to fill the pits. These open pits become major cause of road accidents. Though, these firms give bank guarantee to council for repairing the roads and footpaths after completion of work, they don't take care about these open pits once their work is done. So, the council should make arrangements to supervise the activities of such firms and fine should be imposed on erring firms.

iii) Stray Cattle/Dogs

Stray cattle and dogs play havoc for people on road. These animals can be seen moving frequently on roads, streets, parks and have become major cause of accidents.

In S.A.S. Nagar (Mohali), the menace of stray cattle/dogs has risen to such a level that people fear to move out of home especially during 8 P.M. to 10 P.M. when farmers from nearby villages leave their cattle for grazing. This is the time when people come from offices. These animals block the way and hurt passer-byes the Tribune reported, the stray cattle menace has assumed alarming proportions in the town with people continuing to face accidents, sustain injuries involving such animals.

The Council keeps on catching these animals but it is not in a position to keep the stray cattle and dogs after catching them. As the city has a very small cattle pound of capacity of 60 to 70 cattle. Besides, it has also problems relating to inadequate fodder and shortage of manpower. So, to deal with this

76 The Tribune, 6.10.2005.
77 The Tribune, 29.01.2005.
problem a bigger cattle pound should be made with better facilities and a separate cell for dogs.

Other causes of road accidents include the fault of driver/pedestrian/passenger, mechanical defect in vehicle, fallen trees, bad weather etc.

**Vehicular Pollution**

Means of transportation are an important infrastructural facility. These play a very important role in the overall development of a country. Availability, intensity, frequency, efficiency and cost of means of transportation are considered as index of development. But as the numbers of vehicles are increasing rapidly, it has slowly but rarely started hindering our atmospheric purity with the vehicular pollution. Thus, rapid increase in road transportation stands squarely in way of growing desire for a cleaner, safer and quieter environment. Road transport has begun to erode the benefits that it once brought and now it is difficult to countenance the impact on the environment of the continuation of current trends.\(^{78}\)

Vehicular pollution is mainly an urban problem. In the modern age of industrialization and technological advancement, the menace of vehicular pollution is increasing day by day and becoming the cause for pollution related respiratory problems. Besides, the direct impacts on respiratory and heart disease, motorized transport produce around a quarter of anthropogenic emissions of gases leading to climate change.\(^{79}\) Indian cities qualify as some of the most polluted in the world and heading the list is the national capital, Delhi which is the fourth most polluted city in the world.\(^{80}\)

The principal pollutants emitted by vehicles are-

i) Carbon Monoxide (CO)
ii) Hydrocarbons (HC)
iii) Oxides of Nitrogen (NOx)
iv) Suspended Particulate Matter (SPM).

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\(^{79}\) B.Metz., et. al., *Climate Change*, Cambridge Press, 2001, p.120.

Petroleum based vehicles also emit polynuclear aromatic hydrocarbons (PAHs) and aldehydes in traces. Depending upon the sulphur content in the fuel, varying amount of SO₂ is also emitted. In addition, the exhaust gases from petrol based fuel vehicles also contain lead compounds.

Thus, all the potentially lethal chemical compounds thrown by vehicles as a result of full combustion need to be monitored regularly. For this, National Air quality Monitoring Programme has been initiated by the government.81

National Ambient Air Quality Programme (NAMP)
The Central Pollution Control Board (CPCB) has been assigned various functions under the Air Act 1981, to plan a nation vide programme for the prevention, control and abatement of air pollutants. Accordingly the National Ambient Air Quality Monitoring programme (NAMP) was initiated in 1984-85. Its network consists of 308 monitoring stations covering 115 cities/ towns in 25 states and 4 Union Territories of the country. The NAMP network is operated with the involvement of various agencies that is State Pollution Control Boards, the Central Pollution Control Board Headquarter and Zonal offices.

Under NAMP three air pollutants Sulphur Oxide (SO₂), Nitrogen Oxide (NO₂) and Suspended Particulate Matter (SPM) have been identified for regular monitoring at all locations. While additional parameters like Carbon Monoxide (CO) and Hydrocarbon (HC) are monitored in Delhi and some other cities but not in all cities.

The levels of SO₂, NO₂ and SPM at four metropolitan cities have been presented below from 1993 to 2003.

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Table 5.20
The Levels of SO₂, NO₂ and SPM at four Metropolitan Cities
(In microgm/cu.m)

<table>
<thead>
<tr>
<th>City</th>
<th>SO₂</th>
<th>NO₂</th>
<th>SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi</td>
<td>13.70</td>
<td>15.60</td>
<td>12.20</td>
</tr>
<tr>
<td>Mumbai</td>
<td>49.50</td>
<td>15.90</td>
<td>7.70</td>
</tr>
<tr>
<td>Kolkatta</td>
<td>65.10</td>
<td>47.20</td>
<td>18.0</td>
</tr>
<tr>
<td>Chennai</td>
<td>10.30</td>
<td>10.30</td>
<td>6.60</td>
</tr>
<tr>
<td>Standard</td>
<td>60</td>
<td>60</td>
<td>140</td>
</tr>
</tbody>
</table>

Source: http://www.centralpollutioncontrolboard.nic.in

The data presented above shows that the Suspended Particulate Matter (SPM) levels in four metropolitan cities is well above the National Ambient Air Quality standards, while Sulphar Oxide (SO₂) and Nitrogen Oxide (NOₓ) are within limits during the last decade from 1993 to 2003.

Vehicular Pollution in Punjab

In Punjab, Punjab Pollution Control Board (PPCB) is responsible for monitoring the levels of SO₂, NOₓ and SPM at different monitoring stations covered under NAMP. The network under NAMP in Punjab includes 9 monitoring stations at Ludhiana, Jalandhar, Patiala, Amritsar, Bhatinda, Naya Nangal, Mandi Gobingarh and Dera Bassi.

Table 5.21
The levels of SO₂, NOₓ and SPM in three major cities of Punjab
(In micro gm/cu.m)

<table>
<thead>
<tr>
<th>City</th>
<th>SO₂</th>
<th>NOₓ</th>
<th>SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ludhiana</td>
<td>20.02</td>
<td>22.05</td>
<td>10.04</td>
</tr>
<tr>
<td>Jalandhar</td>
<td>28.03</td>
<td>34.10</td>
<td>11.11</td>
</tr>
<tr>
<td>Patiala</td>
<td>13.06</td>
<td>05.02</td>
<td>07.01</td>
</tr>
<tr>
<td>Permissible limits</td>
<td>60</td>
<td>60</td>
<td>140</td>
</tr>
</tbody>
</table>

Source: http://www.punjabpollutioncontrolboard.gov.in

176
The data depicted above shows that the SPM levels in all the three major cities of Punjab has crossed the National Ambient Air Quality Standards, while SO\textsubscript{2} and NO\textsubscript{x} have not exceeded their limits during the last decade (1994-2003).

**Vehicular Pollution in S.A.S. Nagar (Mohali)**

The responsibility of measuring the air pollution level of cities other than those which are not covered under National Ambient Monitoring Programme (NAMP) lies with the respective District Transport Authorities. Like in S.A.S. Nagar (Mohali) the pollution level is measured by the District Transport Authority (DTA). Though under NAMP three pollutants SO\textsubscript{2}, NO\textsubscript{x} and SPM are measured, at S.A.S. Nagar (Mohali) only one pollutant i.e. Carbon monoxide (CO) is measured.

The reason for measuring only one pollutant is that the level of CO in the city has been within the permissible limit as prescribed under the Act.\textsuperscript{82} After crossing the limit, it would come under NAMP.

**Chart-5.2**

**The Level of CO in S.A.S. Nagar (Mohali)**

(1995-2008)

\[\text{(In microgm/cu.m)}\]

\begin{center}
\begin{tabular}{c}
063 & 060 & 072 & 076 & 076 & 084 & 091 & 091 & 093 & 098 & 1029 & 1110 & 1221 & 1295 & 1309 \\
065 & 066 & 076 & 076 & 084 & 091 & 091 & 093 & 098 & 1029 & 1110 & 1221 & 1295 & 1309 \\
\end{tabular}
\end{center}

Source- District Transport Authority, S.A.S. Nagar, (Mohali)

\textsuperscript{82} Rule 115(2) of the central Motor Vehicles Rules 1989
The data presented above indicates that the level of CO in S.A.S. Nagar (Mohali) has increased from 603 mg/cu.m to 1309 mg/cu.m with an increase of 3.1% annually and this growth has been falling within the permissible limit of 2000 mg/cu.m during the last decade (1995-2008).

For measuring the level of CO in the city, Smoke Density Test (SDT) is carried out by the Petrol Pump dealers authorised by the District Transport Authority at pollution check centers. Two such centers have been there, one in ph. 3A and other is in ph. VII, where such tests are carried out with the help of an Automatic Emission Analyzer an instrument prescribed under the Act.83

The test is taken by warming up the vehicle after a run of minimum 15 minutes. During the test the vehicle engine is run at idling speed of 40-50 and the sampling probe is inserted into the vehicles exhaust system to a depth not less than 300 mm. In case emission value of CO recorded during the test is not within the limit, the testing is discontinued and the vehicle is sent for repair/service. As the use of vehicles above the time period prescribed by the manufacturer for servicing, tend to emit more pollution.

A pollution control certificate is issued by the dealer to the vehicles conforming to the standards. This is issued for a period of six months on payment of Rs. 35 for two/ three wheelers and Rs. 45 for four/ above wheelers.

Problems of Citizens due to Vehicular Pollution in S.A.S.Nagar (Mohali)
The pollution level of Carbon Monoxide (CO) in the city has yet not crossed the permissible limit; people complain that increasing vehicles have been enhancing the pollution level day by day. As it is enhancing respiratory diseases such as asthma and bronchitis, skin allergies, headache, nose irritation etc. Carbon Monoxide is one of the components of the group of seven major pollutants (sulphur dioxide, carbon monoxide, suspended particulate matters, volatile organic compounds, nitrogen oxide, ozone and lead), which contribute the largest volume of air quality degradation and are considered the most serious threat of all air pollutants to human health and welfare.84 And it has

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84 William P. Cunningham and Mary Ann Cunningham, op.cit., p. 218.
been proved that above 15 mg/cu.m of CO affects the respiratory and central nervous system severely.  

So, there is a need to control the pollution by properly implementing the Central Motor Vehicles Rules, 1989. As firstly, it has been observed that the pollution control certificates are not regularly checked by the traffic police at the traffic intersections. Therefore, people do not bother to get this certificate even after the expiry of the time limit of 6 months. Though a fine of Rs. 500 is imposed on non possession of the certificate. There is no use of such provision, when regular checks are not carried out. Secondly, there is no check on pollution check centers, which are issuing pollution control certificates to vehicles without testing them especially to old and ill maintained vehicles which do not meet the prescribed standards and thus, emits more pollution. So, proper inspections should be carried out to nub the culprits at pollution check centers.

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