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## “Navigating the Pathways of Mobility: An Overview of Transportation Trends and Challenges”

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### Abstract

Geographically, India is the seventh largest country in the world, but when it comes to population, recently it became largest. The country's population is growing quickly, which has caused the size of its cities to expand. India is regarded as one of the developing nations. Over the past few decades, the country has demonstrated remarkable progress in every sector of the economy.

People are moving from rural to urban areas in search of higher living standards. Even though the population is growing daily, other factors like commercial household incomes, the industrial sector, and the transportation sector stay the same. This is because the majority of people are moving to cities as a result of the population growth.

Although transportation is a vital component of our economy, it faces a number of difficulties, including inadequate public transportation infrastructure, inadequate parking spaces and subpar infrastructure, which increase the risk associated with mobility measures. This paper aims to concentrate on Transport sector and important major cities of India, and public transportation.

**Key Words:** Transportation Management, Migration, Urbanization, Public Transport, Intracity transit

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### Introduction

Urban planning and development include transportation management as a key component. Globally, the population living in urban areas is growing at an accelerated rate. The bulk of urban planning affects how much a city fosters human development, and transportation management is crucial to this. The demand for urban transport has been steadily increasing. Large cities have grown quickly as a result of general population growth and rising urbanization, but they are now severely hampered by an abrupt increase in transport demand.

In India, the 1960s and 1970s saw the creation of State transport enterprises, which greatly aided in connecting the nation's towns and villages. India's urban areas, which comprise numerous megacities, cities, and towns, are not very lucky when it comes to intracity transit. Due to both natural population growth and migration from rural areas, most Indian cities have seen a significant increase in the demand for transportation. Pune has developed into a hub of excellence by offering transportation access to visitors, working adults, students, and senior persons. People are moving from other parts of the country to Pune due to the city's rapid industrial boom and job prospects. Approximately 68 lakh people live in the Pune region, which is sponsored by PMPML. And there are only 2100 busses to support this. We have less

busses than Bangalore, which has 90 lakh people living there, with around 6000 buses. Buses are packed too full. Pune Metro was supposed to open in 2021 and accommodate 8–10 lakh people; as of right now, PMPML supports 12–13 lakh passengers. Due to the extremely tiny roadways in the Old Pune City, traffic bottlenecks are a common occurrence, making bus travel extremely irritating. Buses from PMPML may malfunction at any time or location.

### Importance of Study:

Over the course of the year, Pune's transportation system has gradually improved. It was Pune Nagarpalika who came up with the concept for a public transportation system. In 1950, PMT (Pune Municipal Transport) assumed control of the bus service. Pimpri Chinchwad Municipal Transport (PCMT) was established on March 4, 1994. On October 19, 2007, the aforementioned two service providers merged to form PMPML.

The primary transportation provider in Pune and Pimpri Chinchwad city is Pune Mahanagar Parivahan Mahamandal Ltd. The organizations of PMT and PCMT merged on October 19, 2007, giving rise to PMPML. Its primary goal is to offer adequate, dependable, and reasonably priced transportation services. However, it is experiencing significant losses. Accidents caused by a shortage of buses, inadequate maintenance of the bus fleet, safety issues, and low-quality existing 13 depots all have an impact on the working conditions of

employees. Workplace stress is rising, employee needs are not being met, absenteeism is rising, productivity is low, motivation is low, and wages are being negatively impacted financially.

### **History & Evolution of term 'Transport'**

The history of transportation began with the emergence of humans and evolved over time. The human foot served as the first mode of transportation in the beginning. In the past, people used to walk to get from one place to another. In the past, people have adapted various surfaces for use in transportation. Because people knew that logs could easily float on water and carry them to the other side of a river bank, they used them as a means of transportation over the water. Around 3500 BC, the first wheeled vehicle was invented and put into use. To steer the vehicle in the water, people utilized basic logs with oars. The history of transportation was drastically altered by the invention of the wheel. Small loads were previously hitched to carts and chariots. Horses and other animals have been tamed by humans so they can travel around. The invention of wheels at this point in history caused a shift in the development of transportation. For additional movements, tools like wheels, axles, and wheelbarrows were employed. The work has commenced and is gaining steam at this point. Submarines were first used about 1620. Carriages, bicycles, steamboats, and hot air balloons were all started and regarded as operational vehicles on a large scale. The first gas engine was created in 1862 by Jean Lenoir, while the first motor cycle was created in 1867. The Wright brothers created the first engine-powered, manned aircraft in 1903. The first liquid-propelled rocket was launched in 1926. The other vehicles that were created were hovercrafts, jets, and helicopters. Over time, more advanced forms of transportation have become visible. The Wright brothers' invention of the steam engine, the Jumbo Jet, led to the discovery of bullet trains. From walking to establishing connections with the network, the transportation industry has undergone significant transformation.

### **Meaning and Importance of transport**

Transportation is fundamentally the "movement of goods and people "from one location to another." It facilitates the actual transportation of goods and services. A vital role for transportation plays in all economic sectors. It facilitates the transportation of raw materials to the locations where they are needed, and it also transports the finished goods to the market. Between production and consumption, transportation serves as a supply chain. Employment opportunities are created in this sector, either directly or indirectly. Distance barriers are lessened by it. Villages grow more quickly because they are located closer to cities. Transport facilitates the exchange of cultures between different nations. Both domestically and

internationally, transportation aids in the promotion of tourism. It has been demonstrated that people, resources, economies, and transportation are all positively and directly correlated. It is one of the key elements that supports the expansion of both the agricultural and industrial sectors. It eliminates the shortage of goods from various regions of the country, which boosts international trade. Employment opportunities are available to people in all other sectors. When people from various places come together and exchange opinions, it demonstrates the unity of society and culture.

### **Modes of transport**

India is a country that uses a variety of transportation methods, including air, sea, rail, and road transportation. Vehicles that travel on roads, such as cars, trucks, lorries, buses, bicycles, and motorbikes, are referred to as road transport. The first railways were created in the 19th century during the Industrial Revolution. Long-distance freight and passenger transportation is made affordable and comfortable by rail. Transport through water is referred to as water transport. For large, long-distance transportation of bulky items, this is the most affordable option. There are two types of water transportation: ocean water transportation and inland water transportation. Navigable rivers, lakes, and man-made canals are examples of inland water transportation. Here, transportation is accomplished via ships and barges. The most affordable way to transport large items, supplies, and people across international borders is via ocean waters. Helicopters and airplanes are examples of air transportation. It's the newest and most rapid form of transportation. Additional means of transportation include space flight, human-powered transportation, cable transportation, and pipe-line transportation. The earliest form of transportation is powered by animals. Elephants, horses, camels, and donkeys were among the animals used in this transport to move people and cargo.

Human-powered transportation refers to modes of transportation like walking, running, and swimming that require human muscle power to move. Since it was the only form of transportation available at the time and provided cost savings, physical exercise, and a pleasant leisure environment, it was one of the most popular modes of transportation in the past. Transport into space that leaves Earth's atmosphere is known as spaceflight.

The most common form of transportation in hilly regions is cable transport, which moves objects by pulling, sailing, or drives inside of them.

Gas, crude oil, and water are typically transported via pipelines that are hollow. Liquids are primarily carried with this. Road transportation is the most widely used mode of transportation out of

all of them due to its significant social and economic effects on the community. It facilitates travel, whether for business or leisure. It offers services from door to door. In rural areas, road transportation may be the only viable option for moving goods. The feeder system for other forms of transportation is the road system. Additionally, compared to other forms of transportation, this one requires a very small investment. Buses are the most widely used form of transportation on the road because they are affordable, efficient, and environmentally friendly. They also allow a larger number of people to travel at one time to their destination. This makes them popular in both urban and rural areas.

#### **Urbanization and Travel Demand**

India is regarded as a developing nation with a faster-growing urban population. Individuals are relocating from rural to urban areas in search of better living conditions through social and economic advantages. The majority of people are relocating to cities in search of better access to commercial and employment opportunities, housing, healthcare, education, and sanitation. Cities are essential to economic growth and are crucial for the flow of people and goods within and between cities, both of which improve quality of life (Singh, 2005). This puts an excessive amount of strain on urban resources and infrastructure. The growth of many cities has accelerated recently. The desire to travel is rising in the majority of the cities. India's population is reported to have grown significantly. In 1971, it was 109 million; in 1981, it was 160 million; in 1991, it was almost 217 million; and in 2001, it reached 285 million. (Padam & Singh, 2001; Office of the Registrar General of India, 2001). Up until 2021, the population is predicted to reach about 540 million. In metropolitan areas, the cities' size and growth have begun to increase. The urban area is rapidly growing and attracting more people. There is a rapidly increasing trend toward urbanization. Most Indian cities are experiencing rapid urbanization. Humans require more resources and land. Indian cities are becoming more urbanized primarily as a result of city growth, rural-to-urban migration, and sustained high economic growth. How much a city supports human growth is largely determined by its urban planning, of which transportation management is crucial. It shows that most of India's major cities are still becoming more urbanized. Most cities are experiencing a shortage of transportation due to a notable increase in population. Compared to Europe and North America, India is a developing country with more severe issues related to traffic congestion, noise pollution, injuries and fatalities, and limited parking space. Commuter wait times are also longer in India than in other developed nations. (Gwilliam, 2003; Gakenheimer, 1999;

#### **Indian Urban Transport**

India is a very populous country where transportation and urbanization go hand in hand. If we look back over the last few decades, we can see that the world has been rapidly urbanizing. By comparison, in 1950, two thirds of the world's population lived in rural areas and less than one third lived in urban areas. In 2007, for the first time in Indian history, the situation completely changed, with more people living in cities than in rural areas, though the problems still persist. Over 50% of the population moved into cities in 2014. Asia and Africa have higher rates of urbanization than any other continent (World Urbanization Prospects, 2014). The primary drivers of this rapid urbanization were economic growth and industrialization. An avenue to economic activity where there is a rise in travel demand is provided by urbanization. Towns, a variety of megacities, and many others are considered urban areas. It has been noted that the majority of Indian cities have grown during the last ten years. Its expanding economy attests to the remarkable rise in urban mobility. Road transport is a major component of Indian transportation, which is regarded as a vast and significant industry that accounts for nearly 5.2% of the nation's GDP. In terms of urban transportation, the majority of Indian cities are not alike. The majority of traffic on Indian roads consists of non-motorized and motorized walking trips. Bicycles and rickshaws are examples of non-motorized vehicles, while public and paratransit transportation are examples of motorized vehicles. There are two types of public transportation: road and rail. The majority of Indian highways are used for passenger transportation. It is approximately 80%, with rail transportation covering the remaining 20%. Rapid urbanization, rising incomes, inadequate public transportation, and government-facilitated easy access to auto loans have all contributed to the rise in motor vehicles in the majority of developing nations. Due to the significant increase in population, there is a greater need for transportation to support daily activities. In cities, buses are the most widely used and well-liked form of transportation. The majority of Indian cities have access to both road and rail transportation; however, those without rail connectivity must rely solely on a combination of auto rickshaws, buses, taxis, and vans. Utilizing public transportation reduces travel expenses, pollution, and traffic. All things considered, public transportation contributes to a reduction in the emissions and pollutants from moving cars that cause smog. The transportation industry has been unable to meet the needs of everyone, which has resulted in a rise in the number of customized vehicles.

**Unplanned Transport & its impact on the society:** An important factor in developing nations is urbanization. The rate of urbanization in developing countries doubled. If we look at previous decades, we can see that people's purchasing power has slightly increased, which has increased demand for and ownership of vehicles. The majority of developing countries struggle with their infrastructure. India is one of those countries. Different forms of transportation are evident, including private, customized vehicles, motorized and non-motorized, formal and informal, traditional and advanced. In addition, Indian cities lack adequate transportation infrastructure, have weak management systems at all tiers of the hierarchy, lack coordination between the various tiers of the hierarchy, and have a shortage of skilled labor (Gupta, 2007). ( ). Negative effects include excessive traffic because of gridlock on the roadways, erroneous traffic signals and signage, and a disregard for traffic laws and regulations that results in accidents and fatalities. Due to the high level of vehicles operating on the roads, metropolitan areas are the sites of the majority of traffic accidents (Singh, 2009). The WHO's air pollution threshold has been exceeded by the majority of major cities (Singh, 2008). Only three cities were found to have low pollution, and the other 101 cities were found to be partially exceeding the annual average air quality standard for harmful pollutants, according to the National Air Quality Program, which monitored 127 cities for pollution (Central Pollution Control Board, 2009). Furthermore, the majority of roadside pavements are occupied by hawkers, beggars, and parking cars, which reduces the amount of available road space and mostly causes issues during daily rush hours. Individuals with low incomes are more likely to live in nearby chawls or on pavements by the side of the road, where they incur higher transportation costs. The streets are jam-packed with vehicles of all

kinds, causing severe traffic congestion, delayed traffic, fuel waste, vehicle wear and tear, irate drivers' frustration, pollution, and an increased risk of collisions. Furthermore, financial issues are plaguing the government at every tier of the state and local government hierarchy. The best way to solve this issue is to emphasize using public transportation more and more.

**Impact of increased in vehicle population in India-** India is regarded as one of the developing countries with the fastest rate of economic expansion. The country's urban population is growing at a pace of about 3% annually on average. Over the last ten years, the GDP of the nation has grown at an average rate of eight percent. A rise in the GDP indicates an increase in each person's per capita income. Every area of the economy is growing as a result, and transportation is no exception. Consequently, there is a noticeable increase in the number of cars on Indian roads. The data from 1951 to 2009, which shows the total number of motor vehicles registered in India, is provided below. Based on data from the Indian Ministry of Road Transport & Highways, it was found that over the last ten years, the annual growth rate of the vehicle population has been approximately 10%. There has been a significant increase in the number of vehicles, which are primarily concentrated in a few cities, especially metropolitan areas. Between 1999 and 2009, the number of vehicles per 1000 people in metropolitan areas increased to 286 from 132. based on table 2. According to data from 2009, Bengaluru, Chennai, Delhi, and Hyderabad—the four largest cities in India—accounted for 16.6% of all motor vehicles in the nation. India is a country that has a wide range of mixed vehicles, including fast and slow moving, formal, and informal vehicles. In metropolitan areas, cars and two-wheelers account for 85% of all vehicles. Table 1 shows that cars and two-wheelers contribute more than any other type of vehicle.

**Table1:** Total number of registered motor vehicles in India:1951-2009 (in thousands)

Year (as on 31 <sup>st</sup> March)	Two-wheelers	Cars	Buses	Goods vehicles	Others	All vehicles
1951	27	159	34	82	4	306
1961	88 (226)	310 (95)	57 (68)	168 (105)	42 (950)	665 (118)
1971	576 (555)	682 (120)	94 (65)	343 (105)	170 (305)	1865 (181)
1981	2618 (355)	1160 (71)	162 (73)	554 (62)	897 (428)	5391 (190)
1991	14200 (443)	2954 (155)	331 (105)	1356 (145)	2533 (183)	21374 (297)
2001	38556 (172)	7058 (139)	634 (92)	2948 (118)	5795 (129)	54991 (158)
2002	41581 (8)	7613 (8)	635 (1)	2974 (1)	6121 (6)	58924 (8)
2003	47519 (15)	8599 (13)	721 (14)	3492 (18)	6676 (10)	67007 (14)
2004	51922 (10)	9451 (10)	768 (7)	3749 (8)	6828 (3)	72718 (9)
2005	58799 (14)	10320 (10)	892 (17)	4031 (8)	7457 (10)	81501 (13)
2006	64743 (11)	11526 (12)	992 (12)	4436 (11)	7921 (7)	89618 (10)
2007	69129 (7)	12649 (10)	1350 (37)	5119 (16)	8460 (7)	96707 (8)
2008	75336 (9)	13950 (11)	1427 (6)	5601 (10)	9039 (7)	105353 (9)
2009(P)	82402 (10)	15313 (10)	1486 (5)	6041 (8)	9710 (8)	114951 (10)

Source: Transport Research Wing, Ministry of Road Transport & Highways, Government of India, New Delhi. *Road Transport Year Book (2007-09)*.

Note: (1) P indicates provisional. (2) Cars include jeeps and taxis. (3) Others include tractors, trailers, three wheelers (passenger vehicles)/LMV and other

miscellaneous vehicles which are not separately classified. (4) value in the parentheses shows the percentage change over the previous year.

Fig 1. Total number of registered motor vehicles in India:1951-2009

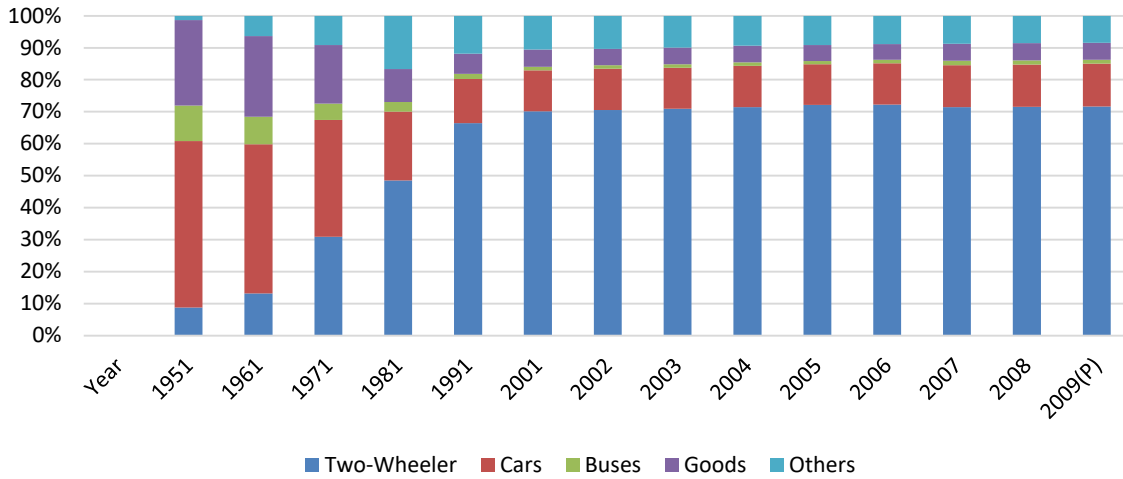


Table 2: Total number of registered motor vehicles in selected metropolitan cities in India:1999-2009 (year as on 31<sup>st</sup> March and no. of vehicles in thousands)

Metropolitan cities	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	CAGR (%)1999-2009
Ahmedabad	739	799	846	899	978	1075	1632	1780	1451	1586	1691	8.6
Bengaluru	1332	1550	1593	1680	1771	1891	2232	2617	2179	2640	3016	8.5
Chennai	1056	1150	1257	1356	1895	2015	2167	2338	2518	2701	2919	10.7
Delhi	3277	3423	3635	36S99	3971	4237	4186	4487	5492	5899	6302	6.8
Hyderabad	951	N.A.	N.A.	1241	1319	1356	1433	1522	2181	2444	2682	10.9
Jaipur	542	598	644	693	753	824	923	1051	1177	1289	1387	9.9
Kolkata	N.A.	N.A.	N.A.	801	842	875	911	948	987	573	581	9.5
Lucknow	N.A.	N.A.	465	556	615	N.A.	N.A.	N.A.	801	962	1025	9.0
Mumbai	911	970	1030	1069	1124	1199	1295	1394	1503	1605	1674	6.3
Nagpur	298	331	416	459	503	543	770	824	884	946	1009	13.0
Pune	568	593	620	658	697	755	827	874	930	1141	1153	7.3

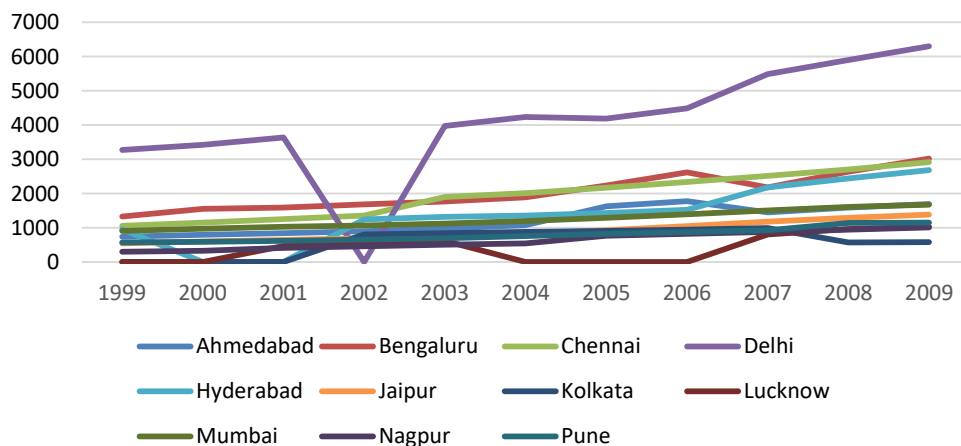
Source: Transport Research Wing, Ministry of Road Transport & Highways, Government of India, New Delhi.

Various Issues. Motor Transport Statistics of India and Road Transport Year Book.

Note: (1) N.A. indicates unavailability of data. (2) CAGR indicates compound annual growth rate. (3) From 2007 to 2008, there is a sudden drop in no. of

vehicles registered in Kolkata because the Calcutta High Court in July 2008 ordered a ban on commercial vehicles registered before January 1, 1993 from Kolkata and its outskirts.

Fig. 2 Total number of registered motor vehicles in selected metropolitan cities in India:1999-2009



### Registration of Motor vehicle in India

India's registered motor vehicles are shown in Table 1. Both transport and non-transport vehicles are included. Cars, two-wheelers, Jeeps, Omni buses, tractors, and trailers are examples of non-transport vehicles. The chart shows registered vehicles in India for the 2019–20 year, with 92% of the vehicles being non-transport vehicles. If we look closely, we can see that since 1951, the number of registered vehicles has been continuously rising. There were 0.3 million registered cars in 1951; by 2019, there were 295.8 million. Vehicle registrations from 1951 to 2019 are included in the data. The graph below makes it clear that the number of registered vehicles is increasing continuously and gradually. Beginning in 1951 and continuing to this day, the rate of motor vehicle registrations is rising daily. It consists of automobiles, trucks, jeeps, buses, cargo vehicles, and other types of two-wheelers. Here, the percentage of all motor vehicles

that were registered was 74.8% in 2019 and 74.4% in 2018. When we look back to 1951, it was 8.80%, and as of 2019, it was 74.8%. As a result, the percentage of two-wheelers increases annually. In 2018, the combined share of cars, jeeps, and taxis among all registered motor vehicles was 13.37%; in 2019, that share was 12.99%. This represents a decline from 52% in 1951. The percentage of buses was 0.69 % in 2019 compared to 11.1% on March 31st, 1951, showing a downward sloping curve. Omni buses were also incorporated into the bus section starting in 2001. The percentage of registered goods vehicles has decreased over time. In 1951, it was 268.8% of all vehicles; in March 2018, that percentage was down to 4.69%, compared to 4.65% in 2019. The percentage of other vehicles increased from 1.3% in 1951 to 6.85% in 2017–18 and 2018–19. The remaining vehicles include light motor vehicles, passenger three-wheelers, tractors, trailers, and other miscellaneous vehicles.

**Table 2.1:** the trends in the category wise share of vehicles in total registered vehicles(%)

As on 31st March	Two Wheelers	Car, Jeeps & Taxis	Buses	Goods Vehicles	Other Vehicles	Total
	(as % age of total vehicle population)					(Million)
1951	8.80	52.00	11.10	26.80	1.30	0.30
1961	13.20	46.60	8.60	2.5.30	6.30	0.70
1971	30.90	36.60	5.00	18.40	9.10	1.90
1981	48.60	21.50	3.00	1030	16.60	5.40
1991	66.40	13.80	1.50	6.30	1 1.90	21.40
2001	70.10	12.80	1.20	5.40	10.50	55.00
2002	70.60	12.90	1.10	5.00	10.40	58.90
2003	70.90	12.80	1.10	5.20	10.00	67.00
2004	71.40	13.00	1.10	5.20	9.40	72.70
2005	72.10	12.70	1.10	4.90	9.10	81.50
2006	72.20	12.90	1.10	4.90	8.80	89.60
2007	71.50	13.10	1.40	5.30	8.70	96.70
2008	71.50	13.20	1.40	5.30	8.60	105.30
2009	71.70	13.30	1.30	5.30	8.40	115.00
2010	71.70	13.50	1.20	5.00	8.60	127.70
2011	71.80	13.60	1.10	5.00	8.50	141.80
2012	72.40	13.50	1.00	4.80	8.30	159.50
2013	72.70	13.60	1.00	4.70	8.00	176.00
2014	73.10	13.60	1.00	4.60	7.70	190.70
2015	73.50	13.60	1.00	4.40	7.50	210.00
2016	73.50	13.10	0.80	4.60	8.10	130.00
2017	73.90	13.30	0.74	4.84	7.27	253.00
2018	74.40	13.37	0.71	4.69	6.85	272.60
2019	74.8	12.99	0.69	4.65	6.85	295.8

Source: Offices of state transport Commissioners/ UT Administration

Note : Other vehicles include tractors, Trailers, Three Wheelers(Passenger Vehicles) / LMV and other miscellaneous vehicles

Which are not classified separately @ include Omni buses since 2001

#### Conclusions:

It has been observed that there is a massive demand for transportation in the majority of Indian cities, and that this enormous shift is primarily due to the country's high rate of population growth.

People are migrating from smaller towns to megacities, and as a result, most Indian public transportation systems are unable to keep up with the current situation. As a result of the sharp rise in demand for transportation, private buses, motor

vehicles, and individual cars have largely replaced public transportation in most Indian cities. The last few decades have seen a shift in travel patterns, which has resulted in overcrowding, numerous injuries and fatalities, and lengthy wait times in Indian cities. People have switched from using public transportation to other options like two-wheelers, auto rickshaws, or taxis as a result of these consequences.

Pune is another significant megacity in the nation where the aforementioned problems are getting worse every day and necessitate the implementation of various measures to improve public transportation.

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