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1. Introduction

Punjab is one of the most prosperous states in India. The state has witnessed rapid economic growth since independence in 1947. Located in the fertile plains of the country, Punjab is a landlocked state bordered by Himachal Pradesh to the east, Haryana to the south and southeast, Rajasthan to the southwest, and Pakistan to the west. To the north it is bounded by the Indian state of Jammu and Kashmir.

Spread over an area of 50,362 sq.km, the economy of the state is mostly agrarian with agriculture and allied activities accounting for nearly 20 percent of the state GDP *(Economic Advisor, 2013-14).* The green revolution in 1960s fuelled the economic development of the state and helped achieve higher levels of GDP as well as per capita incomes vis-à-vis other states in India. The rapidly increasing population and economic activities in the state have led to an exponential increase in demand for passenger and freight transport services. The transport infrastructure as a result is facing extreme pressures in terms of meeting this rapidly growing demand. A need is therefore realized to develop the transport sector in the state in a way that it addresses the increasing mobility requirements of the state in a more efficient and 'green' manner.

This chapter seeks to provide a detailed analysis of the existing transport situation in the state highlighting the key trends related to the transport sector for both passenger and freight mobility, the key issues and challenges in the transport sector and the government initiatives undertaken/being undertaken to address/meet the transport demand. Recommendations have also been made to push the state's transport sector on the 'green growth' path.

2. Key trends

The transport sector in Punjab is dominated by road transport followed by railways. This section discusses the key trends related to the sector in context to both passenger and freight mobility.

2.1 Infrastructure development trends

2.1.1 Roads

Network and Density: Road connectivity has long been a priority area for the state government. Punjab has an extensive road network of 64,037 km of roads which comprises 1,739 km of national highways, 1503 km of state highways, 2107 km major district roads and 58,688 km of rural roads *(Economic Survey Punjab, 2013-14)*. Nearly 90 percent of the total road network is surfaced.

In terms of availability of roads per unit area, the road density at the state level is 1.86 km per sq. km, much more than the national average of 1.21 km per sq. km. At 3388 kms, availability of roads in Punjab in terms of road length per million population is also higher

than the national value of 3276 kms (as per 2012 MORTH statistics). The state achieved 100 percent road connectivity to all its villages in mid-seventies.

Table 1: Comparative summary of total road network in Punjab and India (as on 31st March 2012)

	India	**Punjab**
Total Road Network	3,965,394	93,871
Total Surfaced roads *(%age of total road network)*	2,515,388 *(63.43 % of total country's network)*	83,717 *(89.2 % of total state's network)*
National Highways (km)	76,818	1,557
State Highways (km)	164,360	1,477
Other PWD (OPWD) Roads (km)	1,022,287	6,827
Area (sq km)	3,287,590	50,362
Population (persons)	1,210,569,573	27,704,236
Road density per sq km (km)	1.21	1.86
Road length per million population (km)	3276	3388

Source: MoRTH, Basic Road statistics of India (2011-12)

Capacity: Though availability of roads is not much of an issue in Punjab, but the road network faces severe capacity issues. The capacity bottlenecks are more prominent along the major National Highways within the state. The entry and exit points into the state including access points to major growth centers are nearing saturation.*(ECORYS, 2010).*

Road capacity issues especially on the highways have led to severe congestion and inefficiencies in the overall state transport system. Capacity issues are also prominent in the main urban centers (for example, Ludhiana, Amritsar, and others) wherein the problems related to increasing travel times, increasing air and noise pollution levels, and overall depleting quality of life have risen. With increasing demand for road transport owing to demographic and economic growth and also increasing motorization within the state, the burden on the available road infrastructure and its capacity will increase. In the business as usual scenario, the conditions are expected to worsen.

Quality: The road network also faces poor quality and maintenance issues in large parts of the state. The condition of many important roads for example stretches of the Chandigarh-

Jalandhar-Amritsar and Jalandhar-Jagraon roads have deteriorated over time. Chandigarh-Jalandhar highway is one of the busiest road stretch in the state with nearly 50,000 vehicles plying on it alone on a daily basis, however not much has been done to improve the quality of this stretch.

The roads falling within municipal limits of several cities like Jalandhar, Ludhiana, Phagwara, Hoshiarpur, Faridkot, Nakodar, Shahkot and Nawanshahr are also facing neglect[1]. To deal with the capacity and road quality issues especially on the major highways, several road improvement and widening projects are planned and are being implemented by the state government. An expenditure of `17.41crore was incurred during 11th Five Year Plan. An outlay of `520.00 crore has been provided for 12th Five Year Plan for widening/strengthening of roads (Annual Plan 2013-14).

2.1.2 Railways

Indian Railways has a well-developed railway network of nearly 2270 route kilometers in the state accounting for nearly 3.5 percent of the total railway network in India. Punjab ranks third in terms of route kms per 1000 sq. kms of area, only after Chattisgarh and West Bengal, with more than 45 route kilometers per 1000 sq. km. This is more than double the national average of 20 route kilometers per 1000 sq. km. The railway density in terms of route kms per lakh population, the state has around 8.19 route kms per lakh population which is more than the national average at 5.44.

The high railway density in the state clearly indicates availability of well-developed railway infrastructure in the state. Available studies also suggest sufficient capacity of the available infrastructure for the near future (ECORYS, 2010).The figure1 shows the railway network in the state.

Punjab is also a part of the Dedicated Freight Corridor (DFC) planned between Delhi and Mumbai. With construction of the DFC currently planned till Ludhiana, several trade opportunities are expected to open up in the state. Efforts are also being made to extend the rail corridor further till Amritsar with the idea of exploring and promoting international trade options with Pakistan in future. The proposal is under consideration.

Government of India is now also looking at operating high speed rail in India and eight corridors have been identified recently for undertaking feasibility studies. Out of the identified corridors, one important corridor is the 450 km long Delhi-Chandigarh-Amritsar.

[1] http:/ / www.tribuneindia.com/ news/ sunday-special/ perspective/ smooth-and-bumpy-ride-alike/ 53689.html

Figure 1: Graphical Map showing railway network in Punjab

Source: Adapted from ***http://www.mapsofindia.com/maps/punjab/punjabrails.htm***

Railways being a central subject, the state has little to do on this front and hence is not discussed in detail as part of this chapter.

2.1.3 Civil Aviation

At present, there are civil airports at Amritsar, Chandigarh and Ludhiana in Punjab. Besides these three main airports, there are some smaller airports in operation in Punjab. However, the connectivity offered by these airports in Punjab is limited and passenger and air cargo volumes at these airports are not very large (ECORYS, 2010). Out of these, the Amritsar Airport is the largest and most important airport in the state and is also the second busiest airport in North India after Delhi Airport.

Without an overall vision, inadequate planning and investments in the sector, the air transport in Punjab hasn't grown much more the years. It has played a limited role till date with merely 1.1 million passengers a year on a total estimated state population of 27 million. On an average, air cargo traffic has grown also significantly with a CAGR of 14% though in recent years the volume of air cargo has dropped specifically at Amritsar (ECORYS, 2010).

2.2 Vehicle population and growth

Punjab has shown a dramatic increase in the total number of registered motor vehicles in the last few decades. Between 1980-81 and 2011-12, the total number of registered motor vehicles has increased from 0.3 to 6.3 million (Figure 2); indicating an average annual growth rate of 9.74 percent. In 2011-12, the total number of registered vehicles in the state was 6,262,939 as against 5,194,997 in 2010-11; indicating an increase of nearly 21 percent. The increase is enormous especially in the case of personalized or private motor vehicles. This

can be mainly attributed to the rising affordability levels of the people and easy availability of private vehicles. While the passenger vehicles in Punjab have increased at a compounded annual growth rate of 11 percent between 1980-81 and 2010-11; the goods vehicles grew at a rate of 7.5 percent over the same time period. Between 1980 and 2012, the volume of passenger vehicles on the roads of Punjab have increased by nearly 25 times, with maximum increase in two wheelers (27 times), three wheelers (23 times) and cars (24 times).

The vehicle registration records composition in Punjab indicate dominance of passenger transport vehicles, particularly private modes of transport (Figure 2). Cars and two wheelers together constituted 85 percent of the total vehicle registrations in 2011-12. Goods transport vehicles accounted for only 3.2 percent of the total vehicle composition.

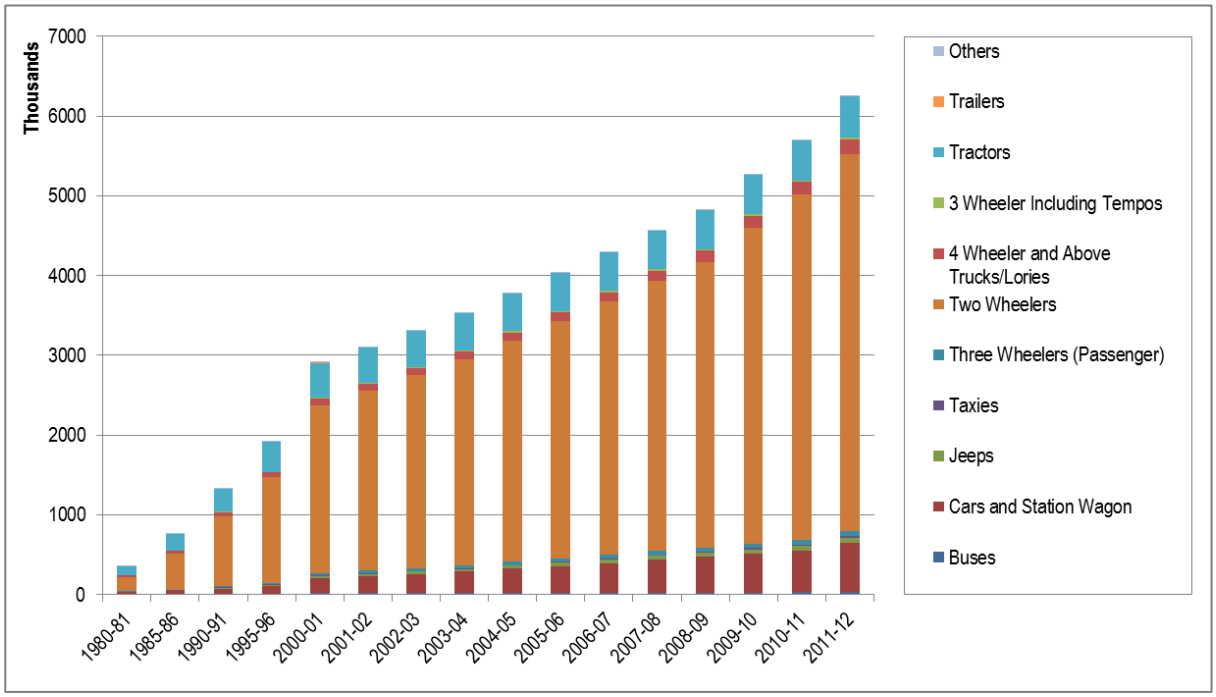

Figure 2: Total number of registered vehicles in Punjab (1980-81 to 2010-11)

Source: Economic Advisor to Govt of Punjab and Statistical Abstract of Punjab[2]

The vehicle density in the state especially in cities has shown a phenomenal increase over the years with an increasing share of personalized modes. This raises serious concern and if the business as usual scenario follows, the cities will face severe problems of congestion, depleting air quality, road accidents, etc. Therefore, a need is felt to control this vehicle growth and adopt strategies to shift from personalized to public transport modes to ensure a greener and more livable environment in the state and its urban centers in future

2.3 Public Transport

Public transport need in the state includes intercity mobility, intra city mobility and connectivity to rural areas. Majority of the passenger trips start and end within the state and only 3-4% of the total traffic is through traffic *(Punjab Road Safety Policy, 2014).*

[2] *downloaded from punjabstat.com*

Provision of adequate passenger transport services is the responsibility of the state government. In Punjab, the passenger public transport services are provided by both government as well as the private sector *(Annual Plan 2013-14, Transport chapter)*. The status of intra state, intercity and intra city passenger transport services have been discussed in the following section.

2.3.1 Interstate and intercity operations

Interstate and intercity transport has long been the focus of the state government along with providing connectivity to rural areas. The interstate and intercity transport passenger services in Punjab are primarily provided by bus services operated by public and private sector.

For intercity bus transport services, Punjab has about 64 buses per 10 lakh population which is lower than the national average of 101 buses per 10 lakh population[3]. (MoRTH 2011)

Government run bus operations

Interstate and intercity bus services are provided essentially by two state run transport corporations in Punjab namely Punjab Roadways, PEPSU Road Transport Corporation (PRTC) and private sector. In 2015, 2,508 public undertaking buses were plying in the state, while the number of private buses was 3,543.[4]

PEPSU Road Transport Corporation (PRTC) was initially created in 1956 to serve the traveling needs of the public in the erstwhile Patiala and East Punjab States Union (PEPSU) area and to the neighbouring states. With redefining of the state boundaries in 1966, the service is now being provided on limited routes of Punjab as well as on interstate routes in Northern India which include the states of Haryana, Rajasthan, Uttaranchal, Delhi, Himachal Pradesh, Uttar Pradesh and Union Territory of Chandigarh.

The total fleet size of PRTC has shown a very slight increase in the last few decades. The total number of buses operated by PRTC has increased from 930 in 1980-81 to 1089 in 2013, recording an extremely low growth rate of 0.5 percent per year over the last three decades. The fleet strength reached its maximum in 2000-01 at 1142 buses, post which the no. of buses has decreased over time.

Punjab Roadways is also a state run transport organization providing bus operations in Punjab. Started in 1948 with a small fleet of only 13 buses, the organization reached its highest fleet strength of 2407 buses in 1985, after which the number of buses has decreased over time. Another company Punjab State Bus Stand Management Company Ltd. (PUNBUS), which is a fully owned Government Company was also incorporated in 1995 to maintain, upgrade and control the bus stands in the state and also help purchase new buses for intercity operations by way of bank loans. Over the years, PUNBUS along with Punjab roadways aims to provide a reliable, efficient and economical means of Passenger transport

[3]Review of the Performance of State Road Transport Undertakings 2010-11, Ministry of Road Transport and Highways, India
[4] http:/ / www.tribuneindia.com/ news/ punjab/ community/ more-pvt-than-public-transport-buses-ply-in-state/ 81134.html

to the common man of Punjab within the state of Punjab with connecting service to adjoining states[5].

In November 2014, the total number of Punjab roadways buses including PUNBUS operating in Punjab was 1680, (including 1164 ordinary buses and 144 AC buses) covering nearly 4.52 lacs kms daily on different state/interstate routes. In 2009-10, nearly six lac passengers travelled daily in these buses (*Annual Administrative Report of Transport Department, Punjab Roadways, 2009-10*).

Road accidents or safety does not seem to be a concern area in government run buses. The total number of accidents in Punjab roadways has decreased considerably from 15 in 2007-08 to 7 in 2009-10. A reduction from 0.05 accidents per one lac kms in 2007-08 to 0.03 accidents per one lac kms in 2009-10 has been observed. Given the low accident rates, PUNBUS and Punjab Roadways were announced 'Winner' and 'Runners-Up' for the State Transport Undertaking with lowest accidental rate in the country for the year 2008-09.

While road safety may not be a concern area, the key factors that have resulted in a decline in bus growth and passenger ridership over the years are as discussed below:

- ***Financial losses:*** Public transport services have always been seen as a social service and hence being subsidized to a large extent by the government. This is also the reason for the low fares set for public transport services. The much higher increase in the cost of inputs incurred by Punjab roadways in comparison to low increase in fares over the years has led to significant losses to the department. Low finances make it extremely difficult for the department to even meet their daily operational and maintenance expenses. This has also adversely affected the overall quality of bus services pushing away people to personalized or other available modes of transport.

- **Competition from private operators:** Lack of availability of adequate and reliable public transport service has led to the emergence of various other private modes offering services in Punjab. Bus transport in Punjab faces significant competition from other modes. These include ordinary/minibuses operated by private operators, tempos, local jugaads like craft fitted peter engines at certain places (known as Peter rehras/Kadukas in local language), etc. Availability of various modes at similar fares on same routes adversely affect ridership and also the traffic earning of public transport buses.

- **Poor condition of buses:** During 2009-10, the average age of Punjab Roadways fleet was reported to be 14 years since March 2010. As per the Annual report 2009-10, 100% of their buses had completed their normal life span compared with the variable norm of four years as suggested by the Planning Commission. However, due to lack of funds, replacement of over aged/condemned buses has not taken place as per the norms[6]. The discussion with the state transport officials also brought forward the poor maintenance regime followed by the Punjab roadways. As a result, the incidents of breakdown per 10,000 buses have increased from 0.35 in 2007-08 to 0.45 in 2009-10.[7] Old poorly

[5] http://www.punbus.in/aboutUs.html
[6] Annual Administrative Report of Transport Department, Punjab Roadways, 2009-10
[7] Annual Administrative Report of Transport Department, Punjab Roadways, 2009-10

maintained bus fleet is also one major reason for popularity of private modes over public run buses amongst passengers.

Private bus operators

Apart from the government run public buses, private sector also plays a dominant role in meeting the mobility needs of the people in Punjab (Figure 3). Operating as stage carriage vehicles on similar routes as the public buses, private run buses give tough competition to the govt run buses. Unlike the government operated buses, the total private bus fleet has increased from a total of 1649 buses in 1980-81 to around 3949 buses in 2008-09 *(Statistical Abstract Punjab, 2013).*

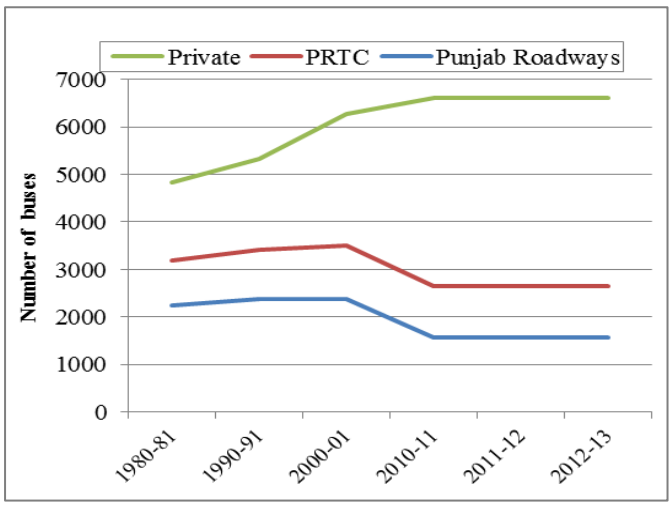

Figure 3: Trends in number of buses by operators in Punjab

Source: Economical Abstract 2013

2.3.2 Intra-city operations

Intra-city services have long been ignored by the government in Punjab and therefore, not much has been done to provide for public transport services within the cities as yet. It is only recently that intra city transport services have caught the attention of the government sector and bus services have been started in some major cities in Punjab.

Public transport buses: Public transport in cities for intra-city mobility is either completely absent or inadequate. Presently, public buses offering intra city travel are operational only in five cities in Punjab namely Amritsar, Ludhiana, Bathinda, Jalandhar and Chandigarh (UT), mostly on public private partnership. Buses have also been sanctioned and purchased in Patiala in 2014, however, have not started operations as yet. Discussions with a Punjab roadways official also brought forward that in certain cities (like Patiala, Amritsar, etc.), more new buses have been purchased, but due to lack of finances and extreme losses faced by the operators, some buses have not been put into operations and are standing idle at city depots. One of the major reasons is the availability of a large number of other modes like auto rickshaws, tata magics, etc. run by the private sector. Bus transport is facing tough competition from these privately run modes and is unable to even make up for its routine operations and maintenance costs.

PT provided by private sector: In absence of adequate government run public transport services, other public transport modes like auto rickshaws, tempos, tata magics, minibuses, etc. operated by the private sector play a dominant role in meeting the rising mobility needs of the people in Punjab. Operating on both individual hire as well as shared basis, these modes have largely emerged in response to an unmet/partially met demand in the state. These modes have gained significant popularity over the years as main modes (particularly in small and medium sized cities), feeder mode as well as modes providing last mile connectivity. Apart from the intra city mobility, some of these modes also play an important role in providing peri-urban connectivity and intercity connectivity. Further, there are also local *jugaads* better known as *peter rehras*/*Kadukas* operating in border areas in the state, where there are no other modes available. These local *jugaads* incorporate diesel generator sets to work as engines and are assembled at the local level and hence have several safety issues related to their use. Due to lack of registration or documentation of indigenous modes like *Kadukas*, it is extremely difficult to account for the total number of such modes operating in the state.

Cycle rickshaws and electric rickshaws are also found commonly in the cities of Punjab, used primarily for shorter distances of upto 3-4 kms. While electric rickshaws are a new emerging mode, it is estimated that more than 3 lakh cycle rickshaws are operational in Punjab. Directly and indirectly cycle rickshaw operations is a source of income for more than 3.2 lakh poor families of Punjab. *(Punjab Road Safety Policy, 2014)*. Despite their significant contribution in meeting the mobility needs and providing employment in the state, cycle rickshaws have faced serious neglect in policy making and transport planning leading to the poor plight of cycle rickshaw pullers and declining numbers in the state.

3. Key Issues

The challenges faced by the transport sector in becoming green are obvious whereby the overall mobility demand over the years, both in case of freight and passengers, has far surpassed the rate of supply of transport infrastructure in the state. The existing systems are unable to meet the growing demands and face several issues which are as discussed below.

3.1 Road network

Punjab fares well in terms of road availability and density. However, increase in vehicles has far surpassed the rate of growth in road transport and infrastructure. As a result, the existing road network is facing capacity constraints leading to severe congestion and other issues like increasing travel times, increasing pollution levels, etc. In some parts, connectivity and poor quality of roads is also seen as an issue leading to system inefficiencies.

3.2 Public Bus Transport

Lack of availability of adequate PT services is one of the major reasons for the depleting traffic conditions in the state. Despite growing needs for mobility, public bus transport in Punjab is facing decline in the overall shares and numbers of buses operating in the state.

Presently, the fleet strength and capacity is extremely low at 63 buses per 10 lakh population available for intercity operations *(Punjab Road Safety Policy, 2014)* whereas the national target is to have 500 buses per ten lakh population *(ECORYS, 2010)*. The existing fleet is also old, outdated and poorly maintained.

While intercity public bus operations has seen a decline over the last few decades, public transport for intra city travel in the cities in Punjab is either completely absent or inadequate. Presently available in only five major cities in Punjab, the existing public bus services are predominantly available only on the core city road network, consisting of mainly the arterial roads and also sub arterial city roads in some cases offering limited network coverage. Physical accessibility of the PT stops/stations is also a key challenge in the cities as limited attention is given to first or last connectivity while planning.

The existing PT services, offering inter as well as intra city operations are also loss making and are unable to even meet their daily operational costs. The government run buses also face significant competition from private modes like autos, magics, minibuses etc. offering flexible, on demand, affordable and door to door services to the locals.

Despite availability of a good network of lines and bus terminals in Punjab, the inter city services are not integrated with urban transport systems e.g. sharing of terminal facilities.

3.3 Non-motorized transport

In Punjab, nearly 45 percent of the traffic mix on roads comprises non-motorized vehicles including pedestrians, cycles, cycle rickshaws, animal driven carts, and others. Despite their huge concentration, NMV's are largely ignored while planning. As a result, the traffic situation in cities in Punjab is rather complicated and special focus needs to be given to non-motorized vehicles especially in the main urban centers in Punjab.

Lack of safe and adequate NMT infrastructure in the cities in Punjab has led to raising concerns of safety for both the motorized vehicle users as well as non-motorized vehicle users. This can be reflected by the high shares of pedestrian deaths in road accident fatality rates in both rural and urban areas in Punjab. Lack of attention to non-motorized modes and increasing investments around building roads/flyovers etc. have also led to issues of poor accessibility in urban centers in Punjab.

3.4 Safety

Road safety is a major concern area in the state of Punjab. The number of accidents and fatality rates are on a rise in the state which has both health and economic burdens on the state. High accident severity rate in Punjab is a major issue in the state, which can mainly be attributed to increasing personal modes and increasing travelling speeds within cities. In 2011, Punjab recorded a total of around 5731 cases of accidents, wherein 3389 lives were lost and 5021 persons sustained injuries. The total number of fatalities witnessed an increase of nearly 26 percent over the last decade.

The present road fatality death rate per lakh population in Punjab is 12, almost at par with the national value of 12.8 road fatality death rate per lakh population *(Punjab Road Safety*

Policy, 2014). About three thousand five hundred lives are lost every year in road crashes in Punjab.

Figure 4 indicates that the increase in total number of accident fatality deaths per year has grown considerably over the years. The numbers have shown a slight decrease in the last three years, however, the numbers are still high and call for immediate attention.

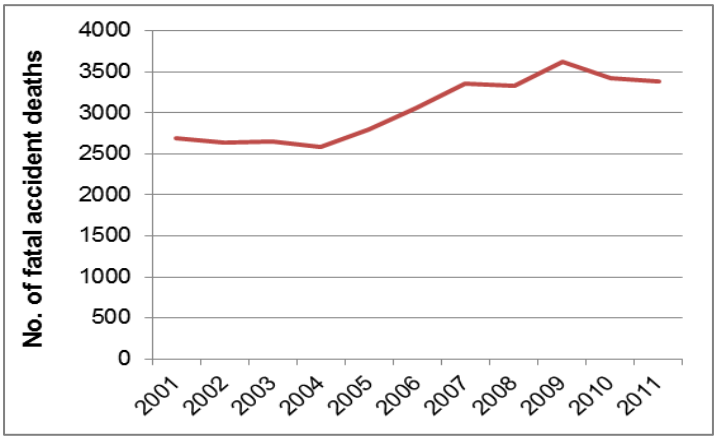

Figure 4: Trends in accident fatality deaths (2001-2011)

Source: Punjab Road Safety Policy (2014)

Nearly 65% of the total road accidents are reported in urban areas in the state and the rest 35% are reported in rural Punjab. It is also worth noting that around 83% of the road fatalities in Punjab have been reported on the 4.8% core road network of Punjab comprising 1739 km of National Highways and 1503 km of State Highways. *(Punjab Road Safety Policy, 2014)*. The traffic composition on this core network of highways is mainly dominated by private modes i.e. two wheelers (40%) and cars (30%). Figure 5 gives the traffic composition on different categories of roads.

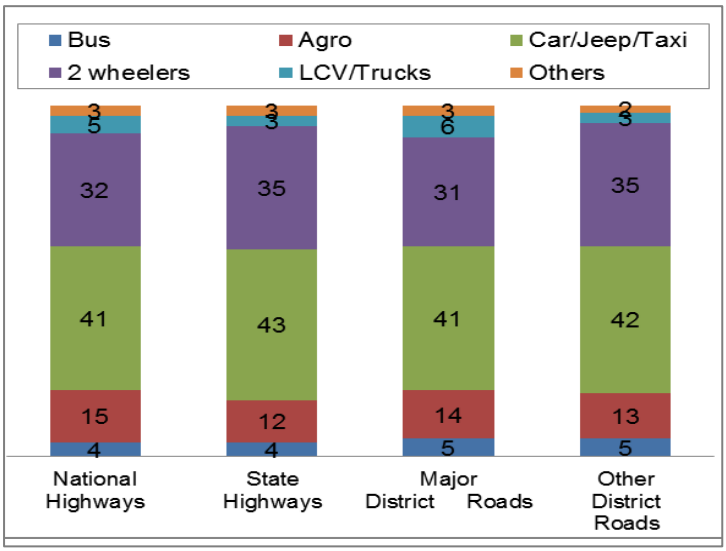

Figure 5: Traffic composition of motorized transport on different categories of roads in Punjab (2011)

Source: Punjab Road Safety Policy (2014)

Six major cities of Punjab – Patiala, SAS Nagar, Ludhiana, Amritsar, Jalandhar and Bathinda account for roughly 50% of the total accidents in the state (Punjab Road Safety Policy, 2014). Roughly 35% of the accidents involving pedestrians, cyclists, motor-cyclists/scooterists and personalized vehicles are reported in urban and semi urban areas. Increasing speeds on the intercity routes has led to high accident severity rate in the state.

It is also important to note that 46% of the total vehicles in Punjab are non-motorized vehicles (mainly animal driven or pedal powered) which account for an almost equal number of trips originated within the state as motorized modes *(Punjab Road Safety Policy, 2014)*. However, due to lack of safe and adequate NMT infrastructure, a high involvement of pedestrians is observed in both urban (18%) and rural (13%) areas. It is also worth noting that the share of tractors and trucks in the total vehicle population of Punjab is merely 9 percent and 3 percent respectively, but are responsible for almost 20 percent and 11 percent road fatalities (Figure 6).

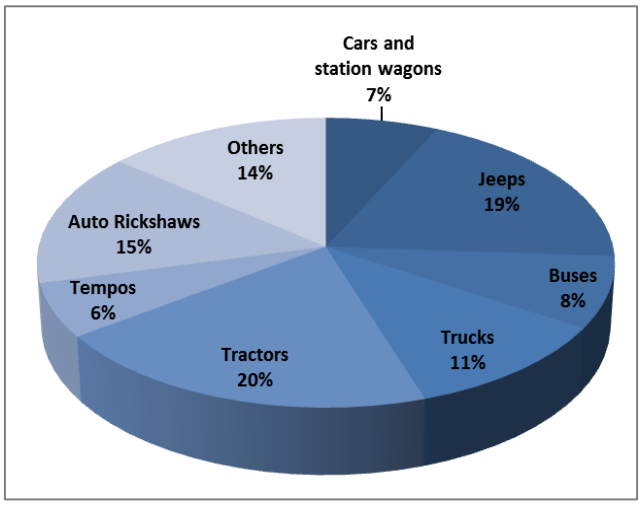

Figure 6: Vehicle involved in road crashes in Punjab (2011)

Source: Punjab Road Safety Policy (2014)

3.5 Pollution

Air pollution is a serious area of concern in urban Punjab which brings along significant economic and health burden on the state. The present fleet in Punjab is largely run on diesel/petrol with almost negligible penetration of cleaner fuels like CNG/LPG. One major reason for the low penetration of clean fuels is the lack of adequate infrastructure in the state for the same.

Increasing share of personal vehicles and declining shares of public transport in Punjab has led to an increased dependence on fossil fuels. At present, majority of the existing fleet in Punjab is operating on conventional fuels (i.e. petrol and diesel) with negligible penetration of cleaner fuels like gas, electricity or biofuels. Consequently, the state is facing problems of high emission rates, rising air pollution levels and an overall depleting quality of life. Large number of industries in the state also contributes significantly to the depleting air quality levels in the state.

The rising problem of air pollution is more prominent in case of urban centers in Punjab. Data collected by Punjab Pollution Control Board indicates that Suspended Particulate

Matter is a major cause of concern with respect to air quality *(state plan for climate change).* According to the WHO's Ambient Air Pollution database 2014, thirty seven cities in India are ranked among the top 100 polluted cities in the world in terms of PM 10 concentration levels. The list includes five main cities from Punjab namely, Ludhiana, Amritsar, Khanna, Jalandhar, and Gobindgarh. Chandigarh and Patiala also are far above the permissible limits in terms of PM 10 concentrations.

The concentration of PM10 in the main cities in Punjab are far above the world's average value of 71 ug/m3 and also the WHO permissible limits of 20 ug/m3 for ambient outdoor air quality (Figure 7). This raises a serious concern of the high pollution levels in the cities which is further expected to worsen in the business as usual scenario.

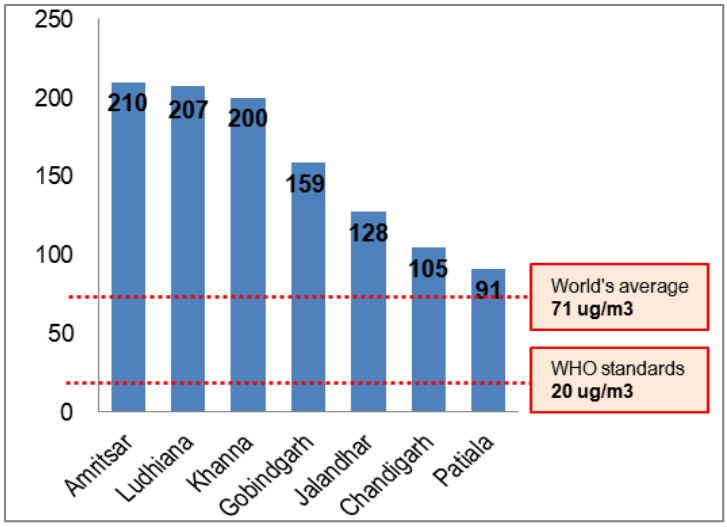

Figure 7: PM10 and PM2.5 concentrations (annual mean values in ug/m3) in main cities in Punjab (2012)

Source: WHO, 2014[8]

The table below gives a summary of the issues faced by the state in the various aspects of the transport sector in Punjab.

Table 2: Summary - Key issues

		Key Issues
1.	**Road Network**	- Capacity constraints - Connectivity - Poor quality of road network in some parts
2.	**Passenger Transport**	
	- Intercity Public transport	- Poor financial performance - High competition from private operators - Poorly maintained existing fleet
	- Urban transport	- Low or no availability of PT in cities - Poor accessibility of PT stops: Lack of feeder services - Poor financial performance of existing PT systems - High competition from privately operated modes - Lack of NMT infrastructure

[8] WHO *Ambient (outdoor) air pollution in cities database,* http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

4.	**Road safety**	- High number of road accidents - High accident severity rate due to increasing speeds and excessive alcohol consumption
5.	**Pollution**	- Increasing pollution levels in urban centers - Increasing health related risks

Source: TERI Analysis

To summarise the above, the state and its cities are facing the growing problems of severe congestion and associated losses in productivity, long traveling hours, poor quality of air, high risk of road accidents, degradation in human health and many more. And if the business as usual follows, the transport situation in the state will further worsen and bring several challenges for the government in terms of meeting the mobility needs. In view of the above, a need is felt to move towards more sustainable patterns of transportation in both passenger and freight transport in the state for better livability.

4. Institutional Framework

The institutional setup in Punjab is extremely fragmented and vertically organized with limited horizontal coordination among institutions. With multiple organizations involved at all levels of governance catering to different aspects of the transport sector, there is no single authority or body with an oversight of the entire transport sector as a whole, neither at the center nor state level. As a result, planning and policy decisions and even projects affecting multiple modes are taken up by different organizations independently and in isolation without considering the effect of performance of the same on other modes or aspects of the transport sector. This makes provision of adequate transport infrastructure and facilities an extremely complicated affair, often resulting in wastage of time and resources both.

Development of roads in Punjab is handled by four institutions: The National Highways are looked after by the Government of India, the state highways by the state Public Works Department (PWD), town roads by the Municipal bodies and the rural roads partly by the PWD and partly by the rural development department. Lack of coordination among these multiple agencies dealing with road construction further complicates the matters. Railways, on the other hand, fall directly under the responsibility of the Central government.

At the state level, all matters related to registration of motor vehicles, issuance of permits, fitness certificates, driving licenses and adherence to pollution norms (as specified under the Motor Vehicles Act 1988 and the rules therein) are handled by the Transport Department, Govt of Punjab and the Regional Transport Authorities set up by the Department. Enforcement of rules and regulations, however, mostly falls under the Traffic Police.

Public bus transport services in the state for interstate and intercity travel are provided by the PEPSU, Punjab Roadways and PUNBUS. Apart from the public bus services, multiple private operators operate within the state offering public transport services in the form of bus services, shared auto rickshaws, or others. These modes are generally run by unions/associations that define the way these modes operate in different cities or areas within the cities. The role of the government in operation of these private modes is limited to registration and issuance of permits and tax collection.

To sum up the above, multiplicity of organizations with lack of clarity of roles and lack of coordination among these multiple agencies are the main issues in the institutional setup that hinders the overall coordinated growth of the transport sector. At present, there are no set or uniform criteria/ procedures/mechanisms set up for evaluation of transport projects or proposals. This accompanied by lack of adequate transparency in decision making procedures and planning processes in the state leaves ample opportunities or room for political interference.

The following table lists the multiple organizations involved at the three tiers to deal with the various aspects of road transport in the state of Punjab:

Table 3: Institutions dealing with various aspects of transport sector

	Roads	Vehicles	Urban Passenger Transport	Intercity passenger transport	Pollution	Road Safety
CENTRE	**Ministry of Road Transport & Highways (MORTH)** - National Highways Authority of India (NHAI)	**Ministry of Road Transport & Highways (MORTH)**	**Ministry of Urban Development (MoUD)** - JNNURM cell		Ministry of Environment and Forests (MoEF) - Central Pollution Control Board (CPCB)	--
	Ministry of Rural Development (MoRD) - National Rural Roads Development Agency (NRRDA)					--
STATE	**Punjab Infrastructure Development Board (PIDB)**	**State Transport Department**	**Punjab Urban Development Authority (PUDA)**	**State Transport Undertakings (STU's)** - PEPSU - Punjab Roadways - PUNBUS	**Punjab State Pollution Control Board (PSPCB)**	--
	Punjab Roads & Bridges Development Board (PRBDB)	**Regional Transport offices (RTO's)**		**Private operators**		--
	Punjab Municipal Infrastructure Development Company (PMIDC)					--
LOCAL	**Public Works Department (PWD)**		**Urban Development authority/ department**	**Special Purpose Vehicle (SPV)** especially set up for provision of PT services	**City monitoring stations**	--
	Municipal Corporations *(for maintenance activities)*		**Municipal Corporation**			--

5. Government role and initiatives to deal with the transport issues

5.1 Policies and Programmes

At present, there is no comprehensive policy governing the entire transport sector in Punjab. While railways is a Central subject and handled in its entirety by the national government, the different aspects of road sector (vehicles, public transport, road safety, etc) are dealt in a fragmented way at different levels of governance.

Roads and Highways: Intercity road network in the transport sector is being developed/improved/ expanded under several national and state programmes. Under the National Highways Development Programme (NHDP) of the Government of India (GoI), 1739 kms of national highways have been built that pass through the state. Another national level program, Pradhan Mantri Gramin Sadak Yojana (PMGSY) provides all weather road connectivity to the rural areas in the state. Road widening/upgradation works are also supported by several other central sponsored schemes like World Bank Scheme for Road Infrastructure, NABARD Assisted Project-Construction/Widening of Roads and construction of bridges and infrastructure (for rural areas), Central Road Fund (CRF) and others. Most of these schemes are on a sharing basis between the central and state government with majority of the funding assistance provided by the central government. Apart from the above, there are several state funded schemes or initiatives taken up at the state level including schemes focusing on development of roads and bridges, widening (4/6 laning) of existing roads, etc.

Intercity Public Transport: Provision of transport services is a state level subject. Despite this, there is no transport policy at the state level to guide and synchronize the public transportation planning and development in Punjab. The focus of the state government until recently has mostly been on providing road connectivity and providing intercity and rural transport services in the state.

Urban Transport: Urban (or intra city) transport has been a neglected area until the launch of the national level urban transport policy (or the NUTP) in 2006. The national level policy is, however, not a mandate and acts only as a broad guiding document for the states to help cities plan for more people centric urban transport solutions. The policy though brought in significant attention to urban transport on the whole, but lack of any state level transport policy in Punjab acts as a vacuum leading to slow progress. The policy was further linked to a central assistance fund, Jawaharlal Nehru National Urban Renewal Mission (JnNURM) to support state and local investment in urban development. The mission provided a timely platform for providing significant financial support for investments in urban transport infrastructure. As a mandatory requirement to avail funding under the mission, five cities in Punjab namely Amritsar, Ludhiana, Pathankot, Jullundur, Patiala and Bathinda have prepared Comprehensive Mobility Plans (CMP's); out of which only three have been approved and sanctioned by the Ministry. The mission has financially supported procurement of public transport buses for intra city transport services in few of these cities.

Road Safety: Road safety is a multi-dimensional and multi sectoral issue entailing both engineering aspects (of both roads as well as vehicles) and the provision of emergency health and hospital services for trauma cases. The Punjab government recently launched its Road Safety transport Policy in November 2014 to deal with the long neglected issue of rising accident deaths in the state. The new state road safety policy promotes road safety on the concept of inform, warn, control, guide and forgive (the errant behavior of the road user) in all the three pre-crash, post-crash and in crash scenarios (Punjab Road Safety Policy, 2014).

It is seen that the existing policies in the transport sector in Punjab are piecemeal in nature and lack a holistic approach to ensure the symbiotic growth of all transport modes in ways that complement each other. *(ECORYS, 2010)*. In absence of a coherent transport policy, development policies are often translated into actions at the level of transportation projects, compromising upon the many benefits of a comprehensive multimodal transportation policy.

5.2 Ongoing/Future Projects

Roads: As the existing highways in the state have either reached or are nearing saturation, the state government is paying significant attention to road upgradation projects (4 laning/6 laning) under public private partnership model, with first priority to the national highways in the state. During 11th Five Year Plan, 405 km road length of National Highways was upgraded to four lanes with an investment of Rs.1916 crore (Economic Survey Punjab, 2013-14). Additionally, work of four laning of certain stretches (Kurali-Kiratpur Sahib (45 km), Bhogpur-Mukerian (22 km) stretch, Amritsar-Pathankot highway) has been completed recently and work is underway for 4/6 laning of other highway stretches including Ludhiana-Moga-Talwandi Bhai road, Jalandhar-Dhilwan stretch and Sangrur to Dogal Kalan stretch. To ease the congestion on some highways, bypass and elevated roads are also proposed in the state.

During the 12th Five Year Plan, 5 national highways of 893 km road length of Zirakpur-Bathinda, Jalandhar-Dhilwan, Amritsar-Shri Ganga Nagar, Jalandhar-Jind and Kharar-Ludhiana will be upgraded to 4/6 laning under Public Private Partnership with an estimated cost of Rs.5000 crore. Once these works are completed nearly the entire network of national highways will have been upgraded to 4/6 lanes. (Economic Survey Punjab, 2013-14).

Significant progress has also been made in regard to state highways and major district roads as well. During the 12th Five Year Plan, there is a proposal to construct and upgrade 575 km of road length under BOT basis at an estimated cost of Rs.2500 crore. 28 Road over Bridges (RoBs)/Road under Bridges (RuBs) with the cost of Rs. 485 crore have also been completed and made operational in the state. 5 High Level Bridges (HLBs) including HLBs over river Sutlej at Sarai Ka Pattan & Makhu and Multi lane HLB over UBDC have been completed with the cost of Rs.135 crore. The work on 10 RoBs/RuBs and 6 high a level bridge is in progress. There is also a proposal to construct 12 RoBs/RuBs at the estimated cost of Rs.290 crore during 2013. (Economic Survey Punjab, 2013-14)

The state government also upgraded 705 km of state roads under the World Bank Funded Road Project of Rs. 1500 crore. 204 km of more state roads length will be upgraded through long term 10 years tenure under Output and Performance Based Road Contracts (OPRC). Under PMGSY, during 11th Five Year Plan, 3193 km of rural roads have been upgraded at a cost of Rs. 1175 crore. During 12th Five Year Plan, 3200 km of rural road length at a cost of Rs. 1600 crore will be taken up, besides upgradation of rural roads of 2000 km in border belt. (Economic Survey Punjab, 2013-14)

Public Transport: With the idea of providing and promoting PT services in its cities, the state government has bought new buses under JnNURM in five cities in Punjab namely Ludhiana, Amritsar, Bathinda, Jullundur and Patiala. Most of these bus services are being provided on PPP model. Under the 12th five year plan, Ludhiana and Amritsar received central assistance for provision of bus services. The numbers of buses allocated were 200 and 150 respectively of various capacities. However, discussions with a state transport official brought forward that the operators are facing severe financial losses and as a result not all buses are being run on ground. Only 125 buses in Ludhiana and 40 buses are being run at present in Ludhiana and Amritsar; the rest are standing at the depots. This suggests that a lot needs to be done than purchasing buses in order to ensure strengthening of the PT systems in cities.

The state government is also pushing introduction of bus rapid transit systems (BRTS) in two of its cities – Amritsar and Ludhiana. While, work on BRTS has started in Amritsar, Ludhiana is still awaiting approval. Apart from the above, the state government has been considering bringing in metro services in few cities like Ludhiana, Jalandhar and Chandigarh. However, the metro projects are in consideration and not much progress has been made on this front.

Pollution: In view of the rising pollution and depleting air quality in cities of Punjab, government has made efforts to encourage the use of petroleum gas in last few years. In 2009, a ruling was passed by the Punjab and Haryana High court banning the registration of diesel-run autos in three major cities including Amritsar, Jalandhar and Ludhiana. The main idea of the ruling was to promote the use of gas and encourage LPG/CNG run auto rickshaws in the three cities to curb the rising pollution levels. But due to lack of adequate infrastructure in these cities, LPG/CNG run auto rickshaws have not picked up. Infact, new models have come up over time like Mahindra Gios, Tata magics, etc. running on diesel and offering similar services like auto rickshaws. As a result, the efforts to curb pollution have not achieved much success. At present, the state government is in discussions with the Ministry of Petroleum & Natural Gas (MoP&NG) to bring in the CNG line and is exploring ways to promote cleaner fuels in the main cities in Punjab.

Safety/Accidents: The state government has recently released its Road safety policy in November 2014. The proposed policy looks at establishing a dedicated multidisciplinary road safety authority for the state along with a Road Safety Officer appointed at the district level. The policy also looks at establishing a road safety database management system in coordination with the traffic police department in the state, treatment of identified blackspots, and creation of a road safety fund.

6. Way forward

Efforts are being made in isolation to deal with the multiple issues of the transport sector in Punjab, however, there is no attention given to promoting integrated multimodal transport systems in the state. The assessment of the current trends, challenges faced and the ongoing initiatives in the sector clearly suggest a need for a **unified or integrated transport policy** that enhances socio economic development of the state, makes it more competitive while at the same time promotes green growth. It is realized that a range of possible measures can be adopted by the state government to better its transport situation and push it further on the green growth agenda. These measures range from integrated and strategic planning to infrastructure development and upgradation to mobility management.

In Punjab, where road transport forms the backbone of the transport system, the transport policy must aim to arrest the rising motorization trends in the state especially the rapidly increasing shares of personal modes, and declining shares of sustainable modes like public transport and non-motorized transport. The state must look at promoting the more sustainable and environment friendly modes like PT and NMT. Improving the efficiency of the existing fleet and transport systems also needs significant attention. Immediate priority, however, must be given to removal of capacity bottlenecks in the core road network in the state.

The key essential measures required to shift the transport sector in Punjab on a green growth path are discussed below:

6.1 Upgrade and strengthen existing road network

Roads form the backbone of the transport sector in the state. Its dominance is further enhanced in view of the fact that other important modes like Railways are also dependent on road transport for their first /last mile linkages. Upgradation and strengthening of the existing road network hence achieves importance in the state for continued economic growth. To do so,

- The state government should give first priority to removal of road capacity bottlenecks in the state.
- A roadmap must be developed for upgradation and strengthening of the existing road network in the state so that the future mobility demands of the state are met in an efficient manner.
- Connectivity and quality issues of the network also need to be given adequate attention.

6.2 Provide and strengthen Public transport services

A strong and efficient public transport system is a must for overall green growth of the transport sector. The government should give priority to developing and expanding the capacity of the existing public transport systems, both intrastate as urban. Given the huge

financial and managerial resources required to build and strengthen the PT system in the state, this is advised to be taken up in phases and spread out over a longer period of time

- The state government must develop safe and adequate public transport systems, both intercity as well as intra-city travel. At the regional level, government must look at expanding the capacity of the regional bus systems.

- At the city level, appropriate transport system specific to each city must be planned and developed after carefully analyzing the local needs, city structure and feasibility of various transport modes, for example, buses, metro, BRTS, or others.

- Issues like poor financial performance, high competition from private sector etc. faced by the existing public bodies/agencies offering intercity and intracity travel services in the state (eg. PEPSU, Punjab Roadways and other public agencies) must be dealt with on priority basis.

- Enhancing the quality of services should also be given adequate attention so as to be able to serve as an attractive alternative to personalized transport modes. The transport systems should ideally be a mix of low cost basic services and high quality services so as to make sure that people from all classes are catered to.

- Improving accessibility of PT services by providing adequate feeder services and ensuring adequate safe NMT infrastructure.

- Adequate measures should be taken to improve and integrate informal modes (like auto rickshaws, tata magics, cycle rickshaws etc.) in city transport systems.

- Adopt appropriate measures that enable a shift from private modes to public transport in the long run. This would include both measures to discourage use of personal modes as well as to promote public transport services.

6.3 Develop multimodal transport systems and infrastructure

The government should focus on developing multimodal systems and transport infrastructure that altogether helps in seamless end to end efficient travel at reasonable costs. This would entail developing multimodal transfer stations and development of efficient feeder services. The critical interchanges that need to be given attention include interchange from bus station to railway station, railway station to urban transport service stations, bus stations to both urban transport feeder facilities (organized feeder facilities or informal and intermediate transport modes like auto rickshaws, cycle rickshaws, etc.) and intercity transport service terminal. It is also important that accessibility of stations by walking is also improved by way of development of safe and adequate NMT facilities.

6.4 Improve the efficiency of existing fleet

Old, outdated and poorly maintained vehicle fleet in Punjab pose serious risks in terms of safety and harmful emissions. To mitigate these risks,

- Setting up of an effective inspection and maintenance regime attains paramount importance. This would include strengthening of vehicle maintenance standards and stricter enforcement mechanisms.

6.5 Promote use of alternate/clean fuels

In view of the rising adverse impacts of the traditional fuels on the environment and health, the government of Punjab should aggressively promote the use of cleaner fuels, for example petroleum gas, electricity, etc. To do so,

- A proper roadmap must be prepared that enables a safe and significant penetration of clean fuels over time in Punjab. This would involve ensuring availability of fuel in the long run to meet the current and future fuel demands and development of adequate and required infrastructure to facilitate the shift to the newer fuels.
- As first steps, government can look at switching the public run fleet from traditional fuels to cleaner fuels. This would primarily entail renewal (replacement/ retrofitting) of existing public transport vehicles.
- Incentivize use of cleaner personal vehicle fleet

6.6 Integrated transport and land use planning

To ease the urban mobility stress in the cities in Punjab, it is suggested that integrated landuse and transport planning is given due attention. The spatial arrangement of the various land uses or activities across the city is a very important factor in determining the intra city travel demand. Therefore, any efforts towards integrated landuse and transport planning can significantly help in reducing the need to travel and lead to reduction in associated costs. For more integrated development in cities, city officials should be encouraged to develop integrated land use transportation plans in a way that serves the entire population as well as considerably reduces the need to travel.

The Table 4 below lists the interventions required in the transport sector in Punjab. Only measures related to roads and road transport are discussed here as other modes namely, railways and civil aviation fall under the purview of the central government. The role of state government is mainly limited to acquisition of private land and allotment of government land for setting up the required infrastructure, providing basic urban services (water supply, sanitation, etc), provision of surface access through multi-modal linkages and maintenance of law and order. The concerned authorities (state/local bodies) should provide well designed roads linking the stations/terminals to the city along with an integrated good multi modal transport system including provision of sufficient parking space.

Table 4: Interventions suggested for green growth of the road transport sector in Punjab

Roads	- **Upgrade and strengthen road infrastructure to meet mobility demands** o **Removal of capacity bottlenecks** o **Improve connectivity (missing links)** o **Improve quality of roads**
Intercity Public Transport	- Plan to address issues of existing bus corporations (poor financial performance, competition from private operators, etc) - Increase bus fleet as well as supporting capacity of the bus agencies to meet the growing demand
Urban Transport	- Develop city mobility plans with NMT as an important component - Operationalize PT buses in cities that have already been procured in cities - Plan for BRTS for larger cities - Prioritize NMT projects - Improve and integrate informal systems in the city's transport system - Manage travel demand through introduction of pricing strategies, etc.
Pollution	- Develop a roadmap to promote use of clean fuels in the state - Develop Air Quality improvement Plans for the most polluted cities - Organize Vehicle scrapping program - Introduce Green tax for old, poorly maintained vehicles - Create no emission zones or pedestrianized zones as per the air quality plans
Safety	- Set up a road safety body with clear goals and functions - Treat hot spot areas - Organize Road Safety Awareness Program (driver training, children education, etc)

Source: TERI Analysis

7. Enabling instruments

To effectively implement the above roadmap in the state, reforms in terms of required institutions, finances, etc. are required so as to allow and facilitate transition to a green economy. A wide range of reforms could support greening of the transport sector in Punjab; these include

7.1 Institutional instruments

The institutional reforms do not aim to reorganize the existing institutional setup in the state but looks at developing a more robust policy monitoring mechanism for effective implementation of the integrated transport policy and ensuring more coordinated development of the transport sector in the state on a greener path. To do so, the following suggestions are made:

- ***Setting up a Unified Punjab Transport authority at the state level:*** In view of the envisaged priority areas that reflect need for green interventions across various dimensions of the transport sector in Punjab, it is suggested that a unified transport authority/body with clearly defined roles and functions must be set up at the state level. This body will be primarily responsible for coordination, integration and overseeing implementation of the transport policy i.e. monitoring the performance of the transport sector in accordance with the agreed upon objectives and targets on a regular basis. It is

at this level that clear roles and responsibilities of the multiple city and state-level entities with regard to public transport, land use and public transport integration, multi-modal integration, safety, facilities for walk and NMT, etc. must be defined.

For effective functioning of the institution, it is realized that the state transport authority must be provided with adequate control, capacities and financial resources to be able to steer integrated transport planning and infrastructure development in the state. The body should be empowered enough to be able to screen investments in the transport sector according to the 'green transport' criteria. It is suggested that tools like Life Cycle Analysis (LCA) framework should be used to evaluate and appraise programmes and projects, before decisions on funding in the transport sector are made.

- ***Improved functioning of the existing institutions:*** Improving the functioning of existing institutions involved in the transport sector is also essential. This would include strengthening of the institutions in terms of human resource development through training and capacity building and improving transparency and accountability in procedures and systems.

- ***Empower city governments through UMTA's to deal with city specific urban transport issues:*** Urban transport responsibilities should be transferred to metropolitan and city authorities with time. The states should empower the city governments through setting up of a dedicated authority for urban transport at the city level. The main role of this organization should be responsible for coordination among the various agencies/institutions involved in urban development, delivery of urban services and transport planning at this level.

7.2 Financial instruments

There is a need to shift the finances and funding from supporting unsustainable forms of transport to more greener forms of transport in all aspects i.e. technology, capacity building, infrastructure, operations etc. It is also essential to ensure the financial flows from different sources (government/multilateral agencies/others) complement each other and collectively works towards the larger objective of promoting green growth of the sector.

- ***Creation of Punjab Mobility Fund*** at the state level can help in ensuring supply of funds into the transport sector in the state. However, it is important that the transport projects/programmes are critically evaluated on the criteria of sustainability in the transport sector.

- ***Attract or promote Private sector funding:*** Public private partnerships in the transport sector are increasingly becoming common. It is advised given the huge costs involved in developing transport infrastructure in hilly regions; the government should look at leveraging private financing in different aspects of the transport sector by way of designing appropriate markets through incentivizing investments in developing and operating green transport interventions (eg. bus systems, ropeways, etc).

7.3 Other instruments

- ***Build transport database:*** For better management of the sector and performance monitoring, some basic pre requisites in terms of availability of adequate information/data must be ensured. To begin with, it is important to generate an overview of which information/data is available and also assess the reliability or accuracy of the gathered information. Subsequently, identify data/information gaps and plan for collection of the same. A database management center should also be set up at state and city level where all the collected information is made easily available to all the relevant organizations working in the transport area.

- ***Sensitization and awareness generation:*** Increasing awareness of the general public about alternate modes of transport or methods of travel can lead to modal choices and behavioral changes. By communicating the social and environmental implications of motorized transport and the many benefits of green transport in ways that directly relate to people's lives (eg improved health, reduced costs, etc.) can lead to shift in modal choices. Organizing public awareness campaigns for different target groups and driver training and education are some representative examples.

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Annexure 1: Total Registered vehicles in Punjab (1980-81 to 2011-12)

	Passengers Vehicles						Goods Vehicles		Others			
Year	Buses	Cars and Station Wagon	Jeeps	Taxies	LMV (Passengers)	Two Wheelers	4 Wheeler and Above Trucks/Lories	3 Wheeler Including Tempos	Tractors	Trailers	Other vehicles not covered	**Total All Vehicles**
1980-81	5,850	25,888	5,496	1,867	2,897	176,555	19,174	2,918	118,845		665	**360,154**
1981-82	6,363	27,689	5,904	2,256	3,520	213,849	22,497	3,178	146,532		779	**432,567**
1982-83	6,095	29,222	6,319	2,267	4,011	252,941	25,442	3,391	163,550		901	**494,139**
1983-84	6,355	30,859	7,025	2,691	4,425	311,095	27,918	3,674	181,680		1,085	**576,717**
1984-85	6,560	32,842	7,704	2,705	5,136	376,653	29,681	3,911	195,513		1,491	**661,896**
1985-86	7,078	35,908	8,307	3,070	6,566	452,217	31,931	4,281	208,614		1,273	**759,245**
1986-87	7,590	39,448	9,091	3,161	8,127	532,674	34,857	4,593	222,183		1,435	**863,159**
1987-88	8,134	45,487	9,779	3,302	10,135	613,665	38,517	4,868	239,121	102	1,636	**974,746**
1988-89	8,662	51,366	10,528	3,395	11,293	690,415	41,684	5,184	253,716	303	1,820	**1,078,366**
1989-90	9,361	58,405	11,469	3,726	12,559	784,183	44,601	5,449	260,511	303	1,928	**1,200,495**
1990-91	9,470	66,312	12,453	4,034	13,550	877,837	48,375	5,936	289,064	303	2,351	**1,329,482**
1991-92	10,235	72,519	13,071	4,209	14,508	948,184	51,971	6,263	307,002	304	2,183	**1,430,449**
1992-93	10,885	78,427	13,871	4,766	15,279	1,025,162	55,267	6,652	324,350	304	2,257	**1,537,220**
1993-94	11,249	83,495	14,816	4,953	16,103	1,099,469	57,542	6,691	338,494	304	2,287	**1,635,663**
1994-95	11,713	89,640	15,772	5,104	17,417	1,205,417	60,481	7,194	354,378	304	2,334	**1,769,754**
1995-96	12,366	95,350	16,955	5,124	18,945	1,320,010	64,140	7,698	371,720	309	2,442	**1,915,059**
1996-97	12,862	106,440	18,610	5,122	20,419	1,463,689	69,024	8,581	387,007	309	2,556	**2,094,619**
1997-98	13,823	119,958	20,028	5,166	22,337	1,630,068	73,362	9,217	398,927	309	2,722	**2,295,917**
1998-99	14,685	148,616	21,555	5,392	24,508	1,789,093	77,516	10,335	411,615	309	2,895	**2,506,519**
1999-00	15,708	170,925	23,111	6,065	26,664	1,954,764	81,071	11,627	423,140	400	3,175	**2,716,650**
2000-01	16,425	194,756	24,705	7,192	29,071	2,103,526	84,070	12,633	434,032	403	3,823	**2,910,233**
2001-02	16,917	216,851	27,033	7,905	31,745	2,255,749	86,992	13,678	442,562	407	3,715	**3,103,147**
2002-03	17,601	241,743	29,791	8,647	34,442	2,414,928	90,509	14,999	450,956	410	3,988	**3,307,604**
2003-04	18,579	269,914	32,797	9,447	36,838	2,587,181	94,154	16,412	459,424	414	4,354	**3,529,100**
2004-05	19,855	303,193	36,751	9,616	39,664	2,777,147	100,571	18,195	466,480	417	4,634	**3,776,106**
2005-06	21,136	337,887	41,670	9,937	43,280	2,975,198	107,534	20,186	473,354	22,315	4,982	**4,035,164**
2006-07	21,982	370,401	46,889	10,318	46,218	3,181,759	111,415	21,639	479,845	23,088	8,496	**4,298,962**
2007-08	24,457	409,572	49,555	10,932	50,428	3,385,088	129,797	20,186	485,781	26,752	6,783	**4,572,579**
2008-09	25,682	447,071	52,193	11,708	53,670	3,581,837	139,065	20,186	492,220	28,599	7,899	**4,831,531**
2009-10	27,146	486,670	54,798	13,231	57,879	3,956,279	149,367	20,186	498,517	30,652	10,181	**5,274,254**
2010-11	28,377	526,681	57,208	9,393	61,433	4,332,540	159,179	20,186	504,310	-	12,408	**5,194,997**
2011-12	30,160	616,549	63,527	18,539	66,734	4,729,594	180,706	21,052	517,743	1,172	17,163	**6,262,939**

Source: MORTH

About TERI

A unique developing country institution, TERI is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while TERI's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues. TERI has grown to establish a presence in not only different corners and regions of India, but is perhaps the only developing country institution to have established a presence in North America and Europe and on the Asian continent in Japan, Malaysia, and the Gulf.

TERI possesses rich and varied experience in the electricity/energy sector in India and abroad, and has been providing assistance on a range of activities to public, private, and international clients. It offers invaluable expertise in the fields of power, coal and hydrocarbons and has extensive experience on regulatory and tariff issues, policy and institutional issues. TERI has been at the forefront in providing expertise and professional services to national and international clients. TERI has been closely working with utilities, regulatory commissions, government, bilateral and multilateral organizations (The World Bank, ADB, JBIC, DFID, and USAID, among many others) in the past. This has been possible since TERI has multidisciplinary expertise comprising of economist, technical, social, environmental, and management.

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