

Smart Transportation - transforming Indian cities

Transportation sector reforms and developments in India



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MESSAGE

I am happy to know that the inaugural Smart Transport India 2016 expo, co-located with the Smart Cities India 2016 expo, and organised by the Exhibitions India Group, will be held at Pragati Maidan, New Delhi, from 11-13th May 2016.

Infrastructure development is a priority for the NDA government. The mission of the Ministry of Road Transport and Highways is to improve the condition of roads and highways in India. Currently, more than 300 road projects are being developed under the NHAI. Robust transport infrastructure and management are key elements for any smart city. Keeping this in mind, Rs. 970 billion has been successfully allocated by the government towards expansion of the road sector.

Expos are platforms to witness technological advancements, share technical solutions, identify key market trends, and to meet and learn from experts.

The organisers of the expo are launching a Knowledge Paper, prepared by Grant Thornton India, on the necessity of smart transportation in today's digital world. The Knowledge Paper provides a brief on how the government of India and our transportation authorities have improved and developed the framework to support the growth of smart transportation in India. It is the government's intention to attain global standards in all aspects of transportation, and with contemporary policies and initiatives, we seek to improve the quality of life for our citizens.

This Knowledge Paper provides useful information, and I congratulate Grant Thornton India and Exhibitions India Group on their initiative.


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Foreword



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The automotive industry in India has been a major contributor to the country's Gross Domestic Product (GDP). Factors such as rising income levels, rapid urban migration of people, favorable demography and availability of largest pool of qualified engineering talent in India has caught the attention of some of the large automobile and component manufacturers in the recent years. This has been further augmented by policy reforms and move towards an investor friendly tax regime by the Government of India.

Ever since the incumbent government has taken the charge in 2014, the focus is on developing the urban and rural infrastructure, improving manufacturing facilities, implementing favorable policies and inviting more Foreign Direct Investments (FDI). Measures such as the proposed Goods and Services Taxes (GST) Bill and 100 percent FDI in some of the manufacturing sectors has made India one of the most preferred investment destinations in the world. The Make in India initiative is targeted towards providing further opportunities to set up manufacturing units as well as employment to large section of Indian youth.

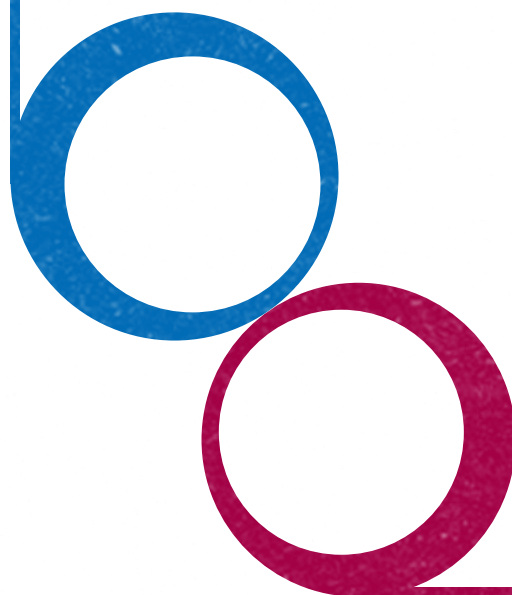
However, a growing economy and rapid urbanisation need a robust urban infrastructure for domestic growth of the automotive sector. This has been boosted by the Smart Cities Mission announced by the Government of India. Under the initiative, the government would provide a funding of INR 50,802 crore (US\$ 7.6 bn) for upgrading the smart cities over a five years period (FY2015-16 to FY2019-20).

One major component of Smart Cities initiative is creating and developing an efficient urban mobility and public transport system that provides a variety of transport options. Towards this objective, recently government has approved several large projects within the ambit of the urban infrastructure development, especially in road transportation. Close to 90 projects in the roads and flyover development segment, around 10 in Mass Rapid Transport (MRT), some in intelligent traffic management and integrated multi-modal transport have already been initiated. The envisaged smart transportation and smart infrastructure would further increase the economic activity in automotive sector in the next decade.



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1. Executive summary

This document elucidates the policy framework measures and institutional structures being created by the Government of India to promote the transportation sector in the country. The holistic approach of the Government of India through policies and schemes such as National Urban Transport Policy 2014, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Automotive Mission Plan (AMP2026), Make in India Scheme, Skill India programme and FAME (Faster Adoption and Manufacturing of Electric/Hybrid) India Scheme would transform the urban transport system into an efficient system over the next decade. It offers an integral perspective on technology advancements, features, and value chains required to make smart transportation a reality while providing an insight on regional variations.

The need to move people and goods from one location to another has kept auto sales consistently strong year after year. The depth of the Great Recession further created a wider platform for the Original Equipment Manufacturers to gain out of the current low car penetration, rising prosperity and higher affordability of end customer.

With increasing opportunities, more initiatives have been taken by Government of India and State Governments towards two of the most required trends in the transportation sector – smart fuel vehicles (hybrid & electric) and smart technology (Electronic Stability Program, Anti-lock braking system, crash testing, smart cards, electronic toll collection, real time parking management, etc.). Though, with India's current position, there are a few inherent challenges – Inadequate/ inefficient infrastructure, air quality and greenhouse gas emissions and inadequately implemented intelligent transport systems. Slow pace of development will definitely result in time lag to keep pace with other countries on technological advancements and other developments for smart transportation.



2. Transportation in India

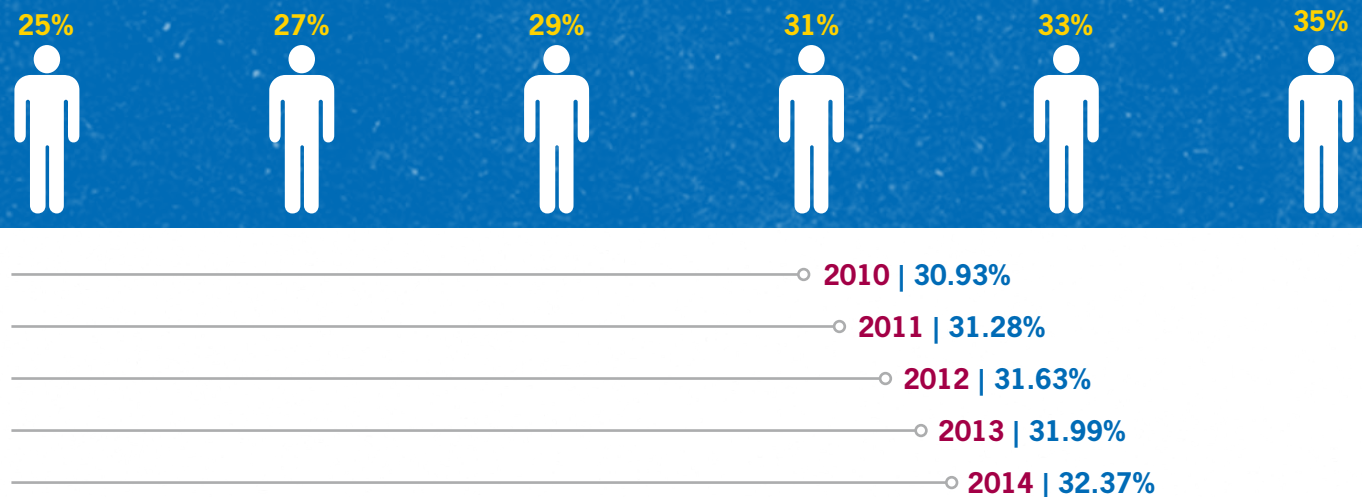
Current state

As per the Government of India data, the automotive sector is a major contributor to the GDP. Currently its share is close to 6.7% which is expected to grow to about 12% of GDP in 2026. It would be one of the biggest sectors in providing employment. As per Automotive Mission Plan 2006-16, 25 mn jobs have been created in automotive sector over the last decade and 10 mn jobs are expected to be created till 2022 (Source: Automotive Sector Skill Council, National Skill Development Corporation). With increase in GDP per capita, there has been a rise in urbanisation along with rising income levels. Currently about 32% population resides in urban areas (as per the 2014 estimates of World Bank data)¹ and is expected to grow to 40% by 2030 along with a contribution of up to 75% of GDP by urban population in 2030².

The graphs below depict urbanisation trends and GDP per capita growth during the last 5 years.

Share of urban population to total population

Share of urban population

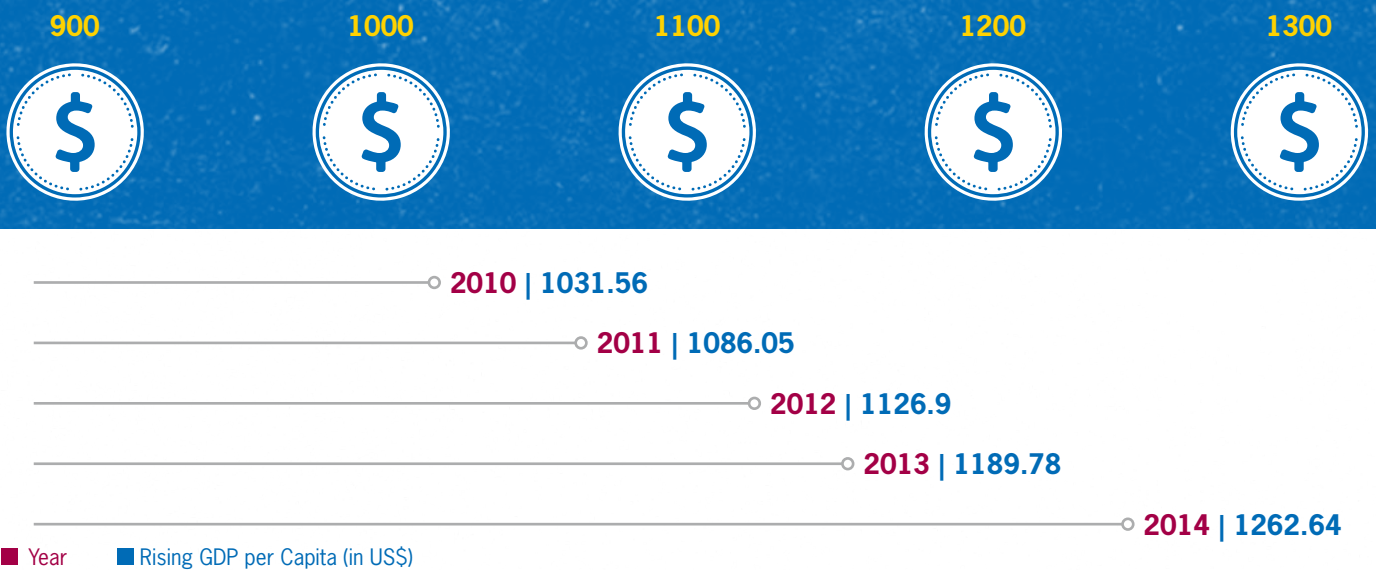


■ Year ■ Share of urban population

Source: Statista, 2016

India GDP per capita

Rising GDP per Capita (in US\$)



Source: www.tradingeconomics.com | world bank

With low car penetration and rising incomes, India offers good growth potential in the auto and auto-component production, domestic consumption and exports. These factors have resulted in a steady demand for automobiles, thereby giving a boost to automobile manufacturing in India. As per the latest data published by Society of Indian Automobile Manufacturing Report (SIAM), 2014-15, total production of vehicles in India has increased by 8.6% from 21.5 mn units in 2013-14 to 23.3 mn units in 2014-15.³

India has one of the largest road networks of approximately 47 lakh kilometers. Around 65% of the total freight and 80% of passenger traffic is carried by the roads, yet the quality of road infrastructure is a matter of concern. Apart from infrastructure, other challenges are road congestion, air pollution due to automobiles running on combustible fuel, inadequate means of public transportation, underutilisation of water transportation and low usage of technology in transportation systems.

Smart transportation

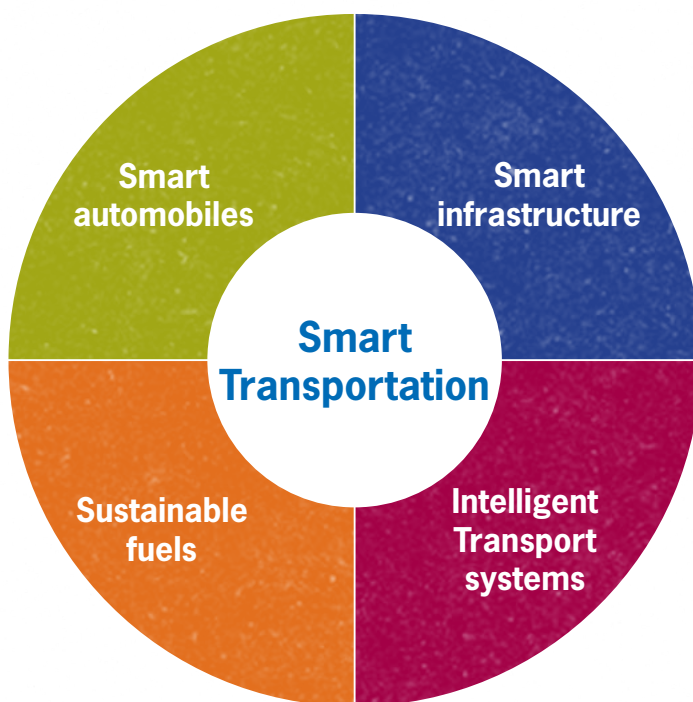
A total of 599 highway projects covering around 12,903 km of national highways have been sanctioned, incurring an expenditure of INR 108,000 crore (US\$ 16.2 bn) over the next 5 years. Under the Smart Cities Scheme, Government of India has already earmarked INR 50,802 crore (US\$ 7.6 bn) for the project with a proposed budget of INR 48,000 crore (US\$ 7.2 bn) to be utilised for developing first 20 Smart cities ^{1/2}. A major component of the scheme is providing efficient urban mobility and public transport system. India plans to build National Highways, Expressways, Mass Rapid Transport (MRT), Bus Rapid Transport (BRT), pedestrian skywalks, walkways, and cycle tracks, in cities. Government has plans to develop 200 low-cost airports in tier-II and tier-III towns across the country. Plans are also in place to develop 111 river-streams as waterways for coastal shipping to achieve the twin purpose of reducing freight costs and as well as the road congestion.

Challenges

While there is a need to augment the work towards improving the transportation in the country, there are some inherent challenges and threats:

Inadequate and inefficient public transport infrastructure	Transport Emissions & Air Quality	Inadequately implemented Intelligent Transport Systems (ITS)
<ul style="list-style-type: none"> Inadequate public transport Road congestion 	<ul style="list-style-type: none"> Greenhouse gas (GHG) emissions India is still following BS IV as against EURO 6 implemented in European countries, which is equivalent to BS VI 	<ul style="list-style-type: none"> Inadequate setups for Electronic toll collection (ETC) and traffic monitoring Fewer Intelligent Transportation Systems (ITS) & multi-level Parking Systems

To move into an era of smart transportation in India, thrust is on better infrastructure, legislative provisions towards sustainable fuels, CNG-based public transport vehicles, and successfully implementing urban mass mobility schemes to efficiently provide mobility services to ever-expanding cities. Smart transportation can be ushered in through improvements in four major areas:



3. Smart automobiles

Technological advancements are helping manufacturers offer many useful features in automobiles. Today emphasis is on refined engines with high performance, safe design, sustainable/green fuels, adherence to latest emission norms (Bharat Stage (BS) IV in India, Euro VI Standard worldwide), connected cars/IoT, wearable devices, driverless vehicles, and fuel efficiency.

Vehicle technologies

Today, auto technology on sale allows cars to “see” all around, gathering data on possible roadway concerns and giving drivers eyes in the back of their heads. Since most of the crashes involve driver error, automakers created a range of safety systems that aid drivers for brief periods to help avoid accidents. Driver assist systems include lane departure and blind spot warnings, adaptive cruise control, automatic braking, telematics control systems and more. Few of the technological advancements made in India include –

Anti-lock braking system & Electronic Stability Program

- With a study showing how Electronic Stability Program (ESP) can save upto 10,000 lives in India and how ABS can play a major part in avoiding most accidents, OEMs and electronic giants in India are on the forefront of the movement asking for these safety systems to be offered as compulsory and standard equipment on all passenger cars in India. A leading auto component giant in India has also conducted a specific research on how ESP in India could help reduce accidents and the preliminary results are quite startling. Based on the same study, it is claimed that up to 70 percent of accidents that involve a vehicle skidding could be eliminated with ESP saving upwards of 10000 lives in India every year. As per the study, currently, nearly 40 percent of all new cars made in India come with ABS fitted. Whereas, only about 4-5 percent of all new cars come with ESP. If automotive manufacturers are serious about road safety, this figure needs to go up drastically in the next few years. Co-incidentally, ABS has already been made compulsory in commercial vehicles from September 1, 2015 with an announcement for ABS in two wheelers over a certain cubic capacity expected any day now.

Automated Manual Transmission - The electronic transmission control unit helps in engaging and disengaging the clutch and gear through an electronic actuator. It also has a sports mode, which enables drivers to move to the manual

shifting of gear to increase and decrease the gear ratios with plus and minus either through gear knob /joystick or the steering.

Crash Testing - The Government of India is finally enforcing stringent crash test norms to be mandatory for all new cars from October 2017, while for upgrades of existing models, the deadline will be October 2018. New minimum safety norms, including frontal and side crash tests, will apply to all cars – entry level, small and cheaper models. As per the new order by Government, cars would be tested for frontal crash norms at 56 kmph, while for the side crash test, it will be at 50 kmph.⁴

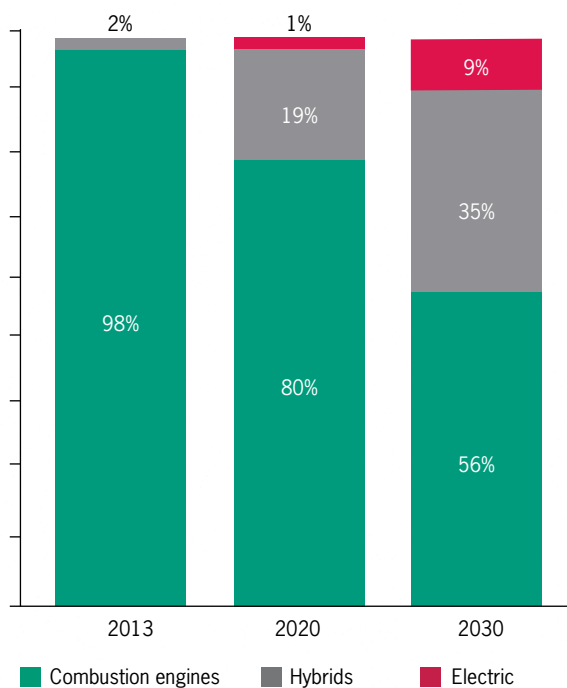
Automation & Traceability – Global leaders in the field of automation and electronic components in automotive industry have come up with a wide gamut of solutions in safety components, automation, auto sensors, etc. Automation is now selectively customised and can trace the genesis of the error. Further, the vision systems in use not only identifies whether the quality is acceptable or not, it can also store the image for future analysis.⁵

Soft-feel interiors - creates a subtle, but powerful emotional connection. From the console, door handle and door trim, to the arm rest and glove box covers, the way a surface feels to the touch – a sensation called “haptics” – lends a feeling of quality to vehicle interiors.

Enhanced driving comfort and safety features such as use of High Strength Steel (HSS) - various strengthening mechanisms are employed to achieve a range of strength, ductility, toughness, and fatigue properties. These steels are uniquely light weight and engineered to meet the challenges of today’s vehicles for stringent safety regulations, emissions reduction, solid performance, at affordable costs.

At the same time at a global level, technologies like driverless cars, Vehicle to vehicle (V2V) communication technology for light vehicles to avoid crashes, Pre-collision technology have also been developed.

Light vehicle production



Source: IHS 2013; University of Duisburg-Essen 2012

Electrical vehicles

As per a 2012 study by the Center of Automotive Research, University of Duisburg-Essen, Germany, the worldwide trend for light-vehicle production is a gradual shift towards hybrid and electric vehicles. By 2030, 56% vehicles produced would use combustion engines, 35% hybrid technologies and 9% electric power. Which means a whopping 44% of small vehicles would not use a combustion engine to produce energy to run the vehicle. This would reduce Green House Gas (GHG) emissions to a significant level.

100% battery-driven electrical vehicles (EVs) are the ultimate goal of the vehicle alternative powertrain development over the next 15-20 years. The focus is towards fuel efficiency and reducing Green House Gas (GHG) emissions. Hence electric vehicles, hybrid electric vehicles (dual fuel) and fuel cell vehicles seem to be the future of vehicle technology. In India dual-fuel vehicles running on petrol/diesel and CNG are becoming popular. In the

electric vehicle segment, brands like Mahindra, Toyota and BMW have created a presence in Indian market.⁶ Indian Government has developed a National Electric Mobility Mission Plan 2020 which proposes to incentivise adoption of green vehicles and facilitate domestic manufacturing capability in automobile sector. As part of the Foreign Trade Policy, Government is providing subsidy in the form of exemption of duties on parts of green vehicles. The Indian market for electric vehicles is still nascent as the challenge is to augment charging infrastructure in big cities immediately to promote migration to electric vehicles.

It has been projected that electric vehicles could account for close to 5% of the Indian car market, or 175,000 cars, by 2017, while the global market for the vehicles could reach about 20 million cars by 2020.⁷

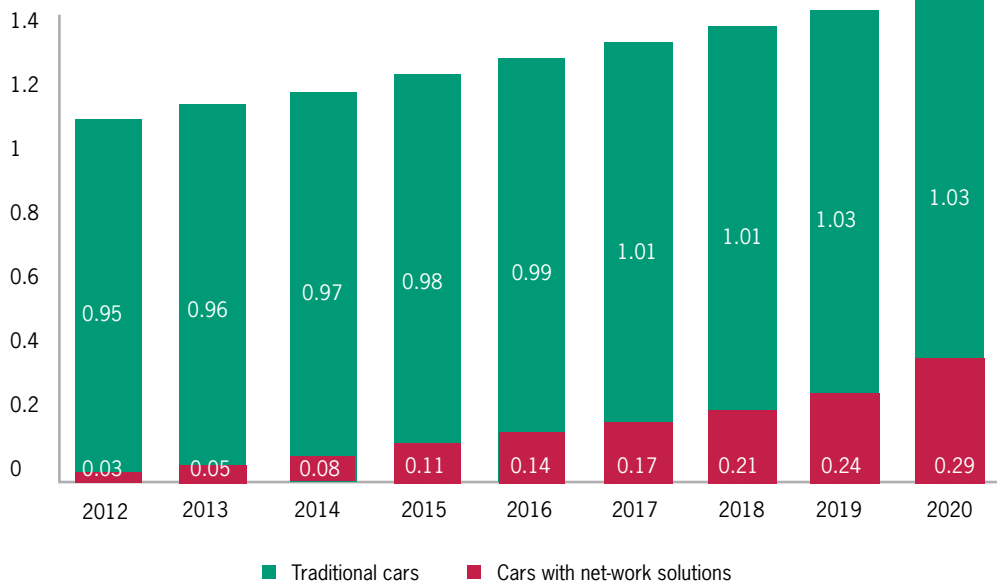
Considering the slow pace of infrastructural development in India, we still have a long way to catch up with the global standards and technologies.

Connected cars/Internet of things (IoT)

Connected cars provide seamless connectivity between different electronic systems such as infotainment, control systems, safety features and navigation features through internet within the car as well as with outside systems more known as Internet of Things (IoT) technology. In the near future, mobile or wearable devices would be communicating with the electronic systems of the car through the internet. This concept is known as V2X connectivity (Vehicle to Vehicle or V2V and Vehicle to Infrastructure or V2I). It would be imperative to design such systems with an inbuilt security for safety of user data throughout its access and processing.

Connected cars technology would encourage collaborations between manufacturers of electronic devices used in cars, mobile devices, wearable devices, IT systems integrators as well as ISPs. The potential is huge and offers interesting possibilities as internet connected cars are on a rise.

Global installed car base (in billion units)



Source: Mckinsey report on Advanced Industries 'the road to 2020 and beyond'

While car makers and software companies are keen to add new features to cars including testing fully autonomous vehicles on the road, there are still significant concerns about the security implications.

Indeed, research carried out by analysts on behalf of application security firm Veracode found that half of drivers are concerned about the security of driver-aid applications in vehicles, such as adaptive cruise control, self-parking, and collision avoidance systems, many of which are increasingly reliant on being connected to the internet.

Last year, security researchers in the US discovered a vulnerability in Jeeps equipped with a Uconnect in-vehicle connectivity system which enabled hackers to take control of the car and drive it off the road.

Therefore, cybersecurity is a big concern for any organisation in the automotive industry, because the consequences of a cyberattack on a moving vehicle could be potentially fatal. Car manufacturers should align their manufacturing practices to combat cyber threats.

4. Smart fuels and better emission standards

Due to rapid urbanisation, there is an increase in Green House Gas (GHG) emissions contributing to an expanding carbon footprint and forcing the need for adoption of a clean and sustainable technology.

As a step to control these emissions, the Supreme Court banned the sale of vehicles with diesel engines of 2,000 cc capacity and more in Delhi NCR. As per estimates from EPCA (Environment Protection and Conservation Authority) reports, during this period, 7,000 to 30,000 vehicles had been diverted away from the city, resulting in a 19-20% fall in pollution levels. However, it has also left manufacturers and dealers with unsold inventory levels and uncertainty in the market. This has resulted in opportunity loss as well as job loss at dealers.

Alternative fuels

Bio-fuels, ethanol, and compressed natural gas (CNG) are clean fuels. Besides these, electric and solar powered vehicles are also being promoted. Vehicles running on hydrogen as fuel and using fuel cell technology are also a clean option. CNG has already become a popular fuel in India due to its low cost. However, it needs infrastructure support in terms of more number of fuelling stations and accessibility.

Biodiesel is another alternate fuel with diesel like qualities. It is synthesized through simple chemical reaction of alcohols with vegetable oils. In India, oil from Jatropha and Karanjia seeds is used to produce biodiesel. The state owned company, Indian Oil is conducting extensive field trials in collaboration with Indian Railways, Haryana Roadways, and TATA Group. Initial studies have suggested significant reduction in smoke density (10-15%) on using biodiesel blends as fuels.

Clean fuel technologies are applicable in all modes of transport, viz. roads/BRTs, MRTs, railways, freight, waterborne transport and aviation. In 2015, for the first time Indian Railways used CNG as a fuel for a passenger train. It has a 1400 HP engine which runs on dual fuel - diesel and CNG - through fumigation technology.

Emission standards

India follows Bharat Stage (BS) emission standards. The emission standards are instituted by the Government of India to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles. These are based on the European standards and are regularly upgraded following the European standards.

In April 2010, Bharat Stage IV standard for 13 Metro cities was implemented and the rest of the country moved to Bharat Stage III. Bharat stage IV has been further extended to additional 20 cities from October 2014.

The Second Auto Fuel Vision and Policy 2025 notified by Government of India in May 2014 lays the map for fuel emission norms up to 2025. In order to adopt the latest emission standards, Government of India has decided to completely skip BS V norms and has announced to adopt and implement BS VI norms from April 2020.

On comparison with other countries, Euro 6 (equivalent to BS VI) has already been implemented in Europe effective 2014. Therefore, besides vehicular technologies and emission norms, other two important factors to be considered in India for reducing carbon emission are periodic inspection, maintenance of in-use vehicles and better road and traffic management.

5. Smart physical infrastructure

India has the second largest road network, fourth largest rail network and ninth largest civil aviation market in the world. The sea port network is also impressive with 13 major ports and 187 minor/intermediate ports. Ten years ago, Jawaharlal Nehru National Urban Renewal Mission (JNNURM) established the base for smart infrastructure development in the country. Its next phase is the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) launched by the Hon'ble Prime Minister Narendra Modi in June 2015. It aims to provide holistic urban infrastructure services such as water supply, sewerage, urban transport and building of amenities in cities to improve quality of life. This is to be implemented over the next five years. Under AMRUT, states will also invest an equal share for the development of urban infrastructure. At the central level, a strict incentive-based approach and release of funds will be followed if the states meet the targets set for the projects.

Smart infrastructure includes development of expressways, highways, waterways and improved and efficient sea and air ports. However, the emphasis will be on surface and water transportation as these two are more cost effective means. Major economic activity is generated through freight transportation. In India, the roads remain the primary infrastructure for freight movement (65% of freight moves through roads).

Besides heavy investment to the tune of around INR 1,00,000 crore (US\$ 15 bn) over the next five years in large scale infrastructure development for urban mobility, the government is also building infrastructure to promote non-motorised transport (NMT) such as bicycles, cycle rickshaws and pedestrian walkways for city traffic.

Road transport

Ministry for Shipping, Road Transport and Highways has a target to achieve 2% of country's GDP through transportation sector and creating 15 lakh jobs. Ministry has also set a target of constructing 30 km of roads per day. Total length of national highways would be increased from 96,000 km to 1.5 lakh km. Besides national Highways, state highways and rural roads will also be improved and increased at length. Pradhan Mantri Gram Sadak Yojna (PMGSY) will augment the road infrastructure in the rural part of India. Dedicated Freight Corridors (DFCs) have been envisaged to augment rail and road networks.

High speed rail programs have been successful in Japan, China and several European countries such as France, Germany and Spain. The High Speed Rail Corporation (HSRC) of India was set up by the government in 2012 to design and implement the country's high speed projects. Through this, feasibility studies for various segments of the 'Diamond Quadrilateral', a proposed high speed network spanning the country, connecting Delhi, Mumbai, Chennai and Kolkata, were initiated. Simultaneously, the government has pushed ahead with plans to develop a segment between Ahmedabad and Mumbai on which it will run "bullet" trains, as high speed trains are often called.

According to United Nations Environment Program (UNEP), the High Speed Rail solution is also cleaner; CO₂ emissions in 2050 are also likely to come down and further emission drops are possible with decarbonisation of electricity. In general, per passenger km, high speed rail has lower Green House Gas (GHG) emissions than road or air transport. It also supports lower emissions over the longer term as road and air passengers shift to trains. However, as the UNEP-DTU (Technical University of Denmark) study says, there is currently a debate on the impact on short term emissions, which may be high owing to embedded emissions (in the construction and manufacturing process).



Waterways and coastal shipping

While the government will construct express highways on major routes the highest priority would be given to developing waterways to reduce transportation costs. Ministry for Shipping, Road Transport and Highways is already working with the Union Ministry of Water Resources, River Development and Ganga Rejuvenation to develop waterways along the 111 rivers in the country.

To give boost to shipping industry, a network of ports is being developed. Twelve big ports and three small ports at Sagar Islands in West Bengal, Maharashtra and Tamil Nadu are already coming up. In a first, in February 2016, domestic cargo was moved through coastal shipping from Chennai Port to Pipav, Gujarat for transporting 800 new units of a car.

Ministry is promoting coastal shipping as it reduces the cost by 25-30%, reduces carbon footprint and congestion on the roads.

Under the AMRUT Scheme, focus of Urban Transport is on developing:

1. Ferry vessels for inland waterways (excluding port/bay infrastructure) and buses.
2. Footpaths/walkways, sidewalks, foot over-bridges and facilities for non-motorised transport (bicycles and cycle-rickshaws).
3. Multi-level parking.
4. Multimodal Integrated MRT/Bus-Rapid Transit System (BRTS).

Smart Infrastructure					
Mass Rapid Transport (MRT)	Multimodal Integrated MRT and BRT	Water Transport/ Freight	Regional and sub-urban connectivity	Non-Motorised Transport (Walk, Cycle, cycle Rickshaw)	Aviation

Government of India has allocated significant amount towards two central schemes: Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and 'Smart Cities' Mission in February 2016. To provide efficient transport facilities and reduced peak time load on roads, government has plans to develop roads/highways/BRTs, high speed trains /MRTs, waterways and pedestrian/non-motorised traffic ways in urban areas, more feeder transport for last mile connectivity for mass transit systems.

6. Intelligent transport systems (ITS)

Intelligent Transportation System (ITS) involves a number of Information and Communication Technology (ICT) interventions used for efficiently managing transportation. Major areas in ITS are:

Passenger information systems



These systems provide real time information to passengers using a public transport system. Usually the expected time of arrival (ETA) is displayed on electronic sign boards at the bus stands, MRT platforms or the Airports and Railway stations. Such systems also sometimes provide information on personal mobile devices for example in the aviation industry and Indian Railways. This reduces the uncertainty about ETA and eases the congestion at waiting areas.

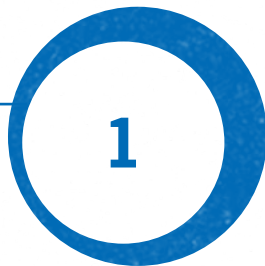
Real-time parking management / Multi level parking



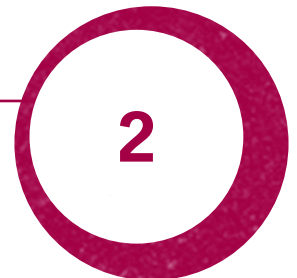
Real-time parking management systems also provide the information related to available parking lots through a publically displayed electronic sign board. This facility is useful for the staff of parking lots as well as the end-users.

Multi level parking benefits with minimal land use, easy entry and exit, multi sensors and safety devices offers low operating and maintenance expenses.

- Passenger Information Systems
- Smart Cards and Integrated Ticketing
- Real time Parking Management



- Automated Speed Enforcement
- Electronic Toll Collection
- Vehicle Control Technologies: Intelligent Cruise Control , Speed Alerts



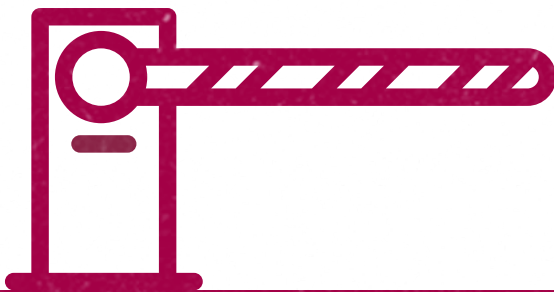
- Cyber Security of Traffic systems
- Connected Cars/IoT (GPS, Infotainment, Parking Sensors)
- Airport Surveillance and Safety equipment
- RFID in freight transportation





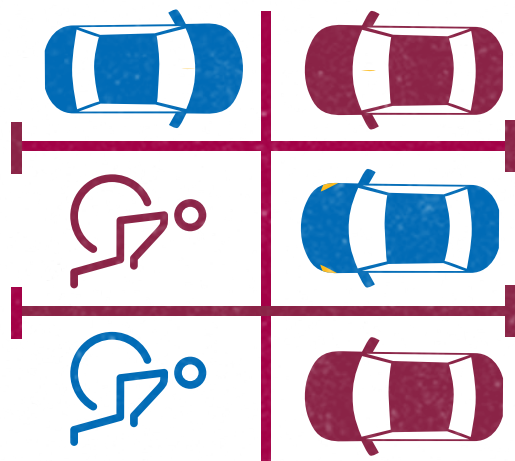
Smart cards

Out of the above technologies, smart cards usage has already started in India especially within the MRTs network. Smart integrated cards are under consideration by Delhi and other State Governments. Smart Integrated cards allow citizens to pay for any type of public transportation through single smart card, ushering into seamless multi-modal transportation systems in large cities. Electronic toll collection systems and automated parking management systems have been installed in Delhi at few locations and in some more cities. The need is for large scale adoption of such smart technologies to improve public transportation in India. This will open up large-scale opportunities for the semiconductor industry.



Electronic toll collection

Electronic toll collection systems are RFID (Radio Frequency Identification) based systems that read from a distance and automatically deduct the toll at each entry. This technology saves queue-time and fuel cost at the toll gates. It also results in better traffic management by reducing congestion. In India, Mumbai-Pune Highway has this facility and more such electronic toll collection centers are being installed at Gujarat SEZs. This technology will give a boost to industries manufacturing RFID devices, semiconductor chips, and related IT systems.



Smart parking assist

A latest development in vehicles technology is the use of sensors. The chassis and the driveline are also equipped with sensors and cameras that help in parking. Being a useful technology for inexperienced drivers and learners, the technology increases safety, efficiency and comfort in driving and parking.

Automated Speed Enforcement



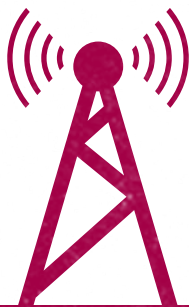
The new generation automated speed program is very well implemented in other countries. However, in India it is yet to be effectively enforced. With the congestion and heavy traffic on roads, it is all the more crucial to benefit from the features such as automated red light, auto traffic management, maximum detection range, multiple car tailgating, etc.

Airport Surveillance & Safety Equipment



It has been an urgent need to revamp the security at airports not only to thwart any misadventure but also to restore confidence of traveling public in the security of air travel as a whole, which was shaken after 9/11 tragedy. With this in view, a number of steps were taken at Indian airports including deployment of CISF for airport security, CCTV surveillance system at sensitive airports, latest and state-of-the-art X-ray baggage inspection systems, premier security and surveillance systems, Smart Cards for access control to vital installations to supplement the efforts of security personnel at sensitive airports.

Radio Frequency Identification (Rfid) In Freight Transportation



Though RFID is not a new technology, however, India has been slow in developing and using the technology. With the growing Indian economy, manufacturing and exports have substantially risen and logistics as a function is being increasingly outsourced by manufacturers. However, the Indian logistics sector in many ways still lags the global standards. As per International Journal of Multidisciplinary Research and Development, India is ranked as low as 46th among 155 countries in the World Bank International Logistics Performance Index.

7. OEMs to benefit from the challenges

The Original Equipment Manufacturer's (OEMs) share of profit growth will come from higher sales. But beyond selling more cars, the industry is changing in more fundamental ways.

Greening gets more expensive -

Carbon dioxide regulation is likely to continue to tighten, not just in Europe; China, the US, and Japan have also enacted laws to reduce emissions. One immediate result will be higher costs. Because the easy things have already been done, the price of cutting future emissions is rising. As per a McKinsey report on 'The road to 2020 and beyond' on automotive industry, in Europe, the 2020 target might be reached with the help of advanced conventional technologies, but to meet the overall fleet targets, more electrification could be necessary (especially for premium players). This will push OEMs to invest more in e-mobility, meaning electrical/hybrid powertrains, lightweight batteries, advanced internal combustion engines, including cylinder deactivation or variable valve timing, etc. On the other hand, they need to invest in alternative powertrain technologies to meet future emissions targets – without knowing which kind of technologies will prevail. Managing these pressures will be a fact of OEM life to 2025 and beyond.

Connectivity becomes more important

Cars on the road are being equipped with danger-warning applications, traffic information services, and a host of infotainment features and increasingly active safety features as well. As per the McKinsey report, 'The road to 2020 and beyond' on automotive industry, number of networked cars will rise 30 percent a year for the next several years; by 2020, one in five cars will be connected to the Internet.

These cars will be in the premium segment (approximately 50 percent) and increasingly in the value segment as well, where many of them will have network solutions by 2020 (compared to 3 percent in 2011). Delivering services through the car – Internet radio, smartphone capabilities, information/entertainment services, driver-assistance apps, tourism information, and the like – is a promising area for differentiation. So is the creation of new technical features for safe, comfortable, and eventually, autonomous driving. To deliver on this, OEMs will have to manage shorter product and service development cycles, such as software and other technology updates. They will also need to build relationships with affiliated firms that build apps tailored to the car.

Research & Development (R&D)

As per AT Kearney research, auto companies spend third most on the research. This further has to be ensured by the OEMs to do sufficient in this field to come at par with consumer demands and technological advancements.

National Automotive Testing and R&D Infrastructure Project (NATRiP) in India, the largest and one of the most significant initiatives in Automotive sector so far, represents a unique joining of hands between the Government of India, a number of state governments and Indian automotive industry to create a state of the art testing, validation and R&D infrastructure in the country. The project aims at creating core global competencies in the automotive sector in India and facilitate seamless integration of Indian automotive industry with the world as also to position the country prominently on the global automotive map.

8. Policy interventions

NUTP 2014
AMRUT
AMP2026
Smart Cities Mission
Make in India
National Manufacturing Policy
Skill India
FAME India Scheme
End of Life policy



1. **National Urban Transport Policy, 2014:** This policy document was prepared by Ministry of Urban Development. It has paved the way for reforms in transportation sector and is likely to give a big boost to the sector.
2. **Atal Mission for Rejuvenation and Urban Transformation (AMRUT):** The focus of this mission is on capacity building, reform implementation, water supply, sewerage and seepage management, storm water drainage, urban transport and development of green spaces and parks. An investment of INR 50,000 crore (US\$ 7.5 bn) will be done by the central government over a period of five years, FY 2015-16 to FY 2019-20. One of its important components is improving urban transport.⁸
3. **Automotive Mission Plan 2016-26 (AMP 2026):** A plan prepared by the Ministry of Heavy Industries and Public Enterprise in consultation with ACMA and SIAM. Upon its proper implementation, automotive industry will emerge as a vehicle for growth of Indian economy. It is expected to boost domestic turnover from INR 2.3 lakh crore (US\$ 35 bn) to INR 9.67 lakh crore (US\$ 145 bn), exports from INR 33,333 crore (US\$ 5 bn) to INR 2.3 lakh crore (US\$ 35 bn) and provide employment to 25 mn people. This will contribute up to 10% of the national GDP by 2026.
4. **Smart Cities Mission:** INR 48000 crore (US\$ 7.2 bn) will be spent over the next five years under this Mission. Names of the smart cities will be finalised through a competition named Smart City Challenge. The first phase of challenge concluded in February 2016 and names of top 20 cities were declared for the funding.
5. **Make in India:** India is a global hub of automobile manufacturing and ranks in the top 10 countries in the world. Domestic vehicle sales of Indian Automobile industry has been growing at CAGR of approximately 9.6% over the period of FY05-FY15 while exports have grown at a CAGR of approximately 18.9%. However in FY13-FY15⁹, domestic sales grew at a CAGR of just about 4.4% mainly due to sluggish economy. On the contrary the export market is showing a growth over the last few years. However, due to increasing stress on infrastructure, government is investing heavily in Urban Mass Mobility Schemes such as Mass Rapid Transport systems (MRTs)/metro rail systems and state-of-the-art buses¹⁰. Hence, manufacturing for mass mobility sector is poised to grow at a high rate in the next few years. This would also give boost to manufacturing related to auto components. Besides vehicles, infrastructure development such as roads, highways, ports, airports, waterways would also require heavy industries to manufacture in India at competitive prices.
6. **National Manufacturing Policy (NMP):** With the objective of enhancing the share of manufacturing in GDP to 25% and creating 100 mn jobs over a decade the Policy aims to achieve the intended target within the stipulated timeframe. A good percentage of jobs are likely to be created in transportation and automotive sector in coming years.
7. **Skill Development:** Currently Automotive sector provides direct and indirect employment to more than 25 mn people. As manufacturing in Transport and Automotive sector is poised to grow, there is a huge demand for skilled manpower. As per the Automotive Sector Skill Council under NSDC, there is a supply vs. demand gap of incremental 35 mn people by 2022. Automotive Sector Skill Council is already working with industry and academia to bridge this gap by developing industry relevant training programs. The transportation infrastructure development schemes would also provide scope for large-scale employment in construction sector. India has 550 mn employable youth which is a big asset for manufacturing sector. This has attracted large FDI of INR 18.67 lakh crores (US\$ 280 bn) during the period April 2000 to December 2012.
8. **FAME India Scheme** On April 8th, 2015 the Government of India announced FAME India (Faster Adoption and Manufacturing of Electric/Hybrid) Vehicles in India – a scheme under the Ministry of Heavy Industries and Public Enterprises. This scheme is under National Electric Mobility Mission Plan (NEMMP), which targets 6-7 million hybrid and electric vehicle sale by 2020, 9,500 million litres of estimated cumulative fuel saving, 2 million tonnes reduction in pollution and GHG emissions, 65,000 direct and 3,00,000 indirect jobs.¹¹
9. **Voluntary Vehicle Modernisation/ End of Life Policy:** In a move aimed at giving thrust to emission control measures, the Union Road Transport Minister has finalised the draft norms of ‘end of life’ policy which will provide atleast 50 percent rebate in excise duty on new vehicles for buyers who surrender their polluting old vehicles. It will result in about 40 percent increase in automobile production and will significantly bring down pollution.

9. Outlook

India is poised for impressive economic growth with economy growing at 7.4% compared to shrinking western economies. India has emerged as most preferred investment destination in the world. This is backed by a 550 mn young human capital base and strong policy environment. Greener technologies and India as a manufacturing hub provides opportunities for collaboration between auto manufacturers and subsidiary industries to reduce cost and improve quality.

The central government has already awarded projects worth INR 1.8 Lakh crore (US\$ 27 bn) in last two years and is expected to award road construction projects worth INR 3 Lakh crore (US\$ 45 bn) by 2017. These developments have made the conditions just ripe for a giant leap in the transportation industry in India.

In the next decade, India will reduce carbon emission from vehicular sources, create huge job opportunities in transport and automotive industry and develop a sustainable and smart transportation system for its growing economic and public mobility requirements. The investments in surface transportation projects will create a world class transportation infrastructure; bring best vehicle technologies, sustainable choices and intelligent transportation system in India. The day is not far when India will showcase its transportation sector to the world. Sustainable choices for public transport coupled with greener fuels will greatly enhance the quality of life for the citizens and give a push to the economic activity in the long term.

With the target of 100 smart cities and the rising urban population, the scenario of public transport and urban mobility needs improvement and further investment. The National Transport Development Policy Committee formed under the aegis of Government of India that presented its report, **India Transport Report – Moving India to 2032**, on behalf of the Planning Commission, Government of India, reported that the total passenger traffic is expected to grow at about 15% per annum to reach 168,875 bpkpm in 2031-32 from 10,375 bpkpm found in 2011-12. The statistics also say that growth in rail passenger traffic is expected to be around 9% per annum, and for road traffic, 15.4%. This kind of expansion requires the support for government and private funding and proper infrastructure. In absolute terms, there is a requirement of about INR 30 trillion (US\$ 570 bn) by 2031-32.

A large portion of this investment should and can go in improving the transportation by way of introducing smart technology. Developed economies around the world have understood the importance of smart transportation. And they are fast adopting various means and modes of transportation that involves the use of electric cars, use of quick, easy mass transit systems, rapid metro rails and the use of advanced technology that controls vehicular movement and mobility across the cities. These means are not just energy saving but are efficient and futuristic.

India remains no different from the use and implementation of smart transportation. Existing and upcoming metro rail network around our capital cities is just a start. India has already chalked out a plan to have electric cars for all by 2030. Union Budget 2015-16 brought FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles). This envisaged a support of INR 795 crore (US\$ 119.24 mn) for hybrid vehicles. The same has been carried this year too. It is likely that the government will have to increase this allocation to improve the attractiveness and acceptance of the hybrid vehicles. A combination of strong policies, regulation, public and private sector investments and public awareness will bring the desired change for implementing and executing the dream of smart transportation in the country.

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