2011-12 | 2nd Edition

Operational Efficiency of Freight Transportation by Road in India

Joint Study Report by

TCI
LEADERS IN LOGISTICS

INDIAN INSTITUTE OF MANAGEMENT
CALCUTTA

Contents

Foreward

In the recent years, Indian transportation has been playing a pivotal role in shaping the nation's economic growth and development. India has become the prime destination for logistics service providers all over the world.

However the growth of logistics infrastructure has not kept pace with economic growth and warrants much needed consideration. The modes are over stretched and capacity expansion and modernization is the need of the hour. With GST on the cards, arrangements like Logistics Park and FTWZs, that would be built along the corridors, would not only help companies consolidate their already scattered storage locations but also improve the service levels considerably due to reduction in custom clearance time and better logistics connectivity

In 2008, TCI had commissioned the first edition of this study. The objectives of the 2011-12 study, was to compare and identify any changes , make an overall assessment of the efficiency of freight transport by road and to suggest recommendations accordingly. The 2011-12 survey is more focused with a comprehensive analyses of public-private partnerships (PPP) in road projects, electronic toll collection (ETC), access-controlled expressways and logistics parks/hubs. These are important parameters to the development of the sector and the economy as a whole.

We believe that the issues and the recommendations highlighted in this report would help in furthering the cause of the sector so that it is able to truly realize its potential and contribute further more to the growth of the economy.

I sincerely thank the IIMC team for their support and dedication in helping to bring out this report.

D.P Agarwal - Vice Chairman & Managing Director
Transport Corporation of India

The TCI-IIMC joint study on the operational efficiency of national highways for freight transportation is a timely one that highlights the problems faced by the transportation sector and suggests recommendations for transporters and the Government as to how to mitigate the problems and contribute to the economic growth of India. The project is a sequel to an earlier project also commissioned by TCI in 2008 to assess the operational efficiency of freight transportation.

The study points out that India needs to build a large access-controlled expressway network with ITS capabilities for improved road safety and security. The proposed expressway projects may be taken up with private participation in the PPP mode. The Government should facilitate by acquiring the land, providing the basic infrastructure and giving quick approvals besides extending economic incentives such as exemptions from taxes and duties. Also, a National Expressway Authority of India (NEAI), in line with NHAI, should be set up for construction, operation and maintenance of the expressways.

The study also emphasizes the need for India to build large-scale logistics parks and scale up the existing parks in order to compete with the logistics parks in Hong Kong, Shanghai, Singapore and Dubai for international cargo. Logistics parks not only lead to economic development and generate employment, but also promote multi-modal transportation including the use of railways to increase efficiency and reduce pollution.

Multi-modal transportation should be encouraged where long-distance transportation services may be provided by railways and the last-mile connectivity may be provided by roads. Multi-modal transportation needs coordination among different ministries, i.e. Ministry of Road Transport and Highways, Ministry of Railways, Ministry of Shipping and Ministry of Civil Aviation. The present study recommends setting up of an apex body with representations from different ministries to coordinate and facilitate the use of multi-modal transportation.

The TCI-IIMC study is an illustration of how the premier educational institutes in the country can provide faculty resources to analyze the pressing issues facing the country today and suggest workable solutions to these problems. The faculty members in these institutes in turn benefit from exposure to real world problems. I am hopeful that the spillover from such research into classroom will have non-negligible benefits for both faculty and students.

Prof. Anindya Sen - Dean (Acedemic)
Indian Institute of Management Calcutta

Transport Corporation of India Ltd.

Profile

TCI group with a revenue of INR 20 Billion (Approx. $ 400 Million USD) is India's leading Multimodal Integrated Supply Chain Solutions Provider with a Global presence.

With expertise developed over five decades, customer centric approach and world class resources, TCI is equipped with an extensive set up of 1000 plus branch offices, a large workforce, huge fleet of customized vehicles and managed warehouse space of 9.25 million sq ft.

Leveraging on its extensive infrastructure, TCI offers seamless multi-modal logistics solutions and moves 2.5% of India's GDP by value and has a well performing script in premier stock exchanges like Bombay Stock Exchange and National Stock Exchange.

TCI is also a part of World Economic Forum's Community of Global Growth Companies (GGC). GGC is a platform to engage dynamic high growth companies with the potential to be tomorrow's leader and become a driving force of economic and social change. TCI's membership at GCC is a reflection of its consistent growth, its potential and its initiative to build global business and exemplary executive leadership.

Business Divisions and Services

TCI Freight

TCI Freight is India's leading surface transport entity. With an extensive and strategically located branch network, the division is fully equipped to provide total transport solutions for cargo of any dimension or product segment. Apart from road, the division also provides rail transportation using bulk rakes, containers, wagons etc.

TCI XPS
EXPRESS DISTRIBUTION SPECIALISTS
Domestic | International

TCI XPS is an Express Distribution Specialist offering time-sensitive and door-to-door service. Equipped with an ISO 9001:2008 certified operations TCI XPS can deliver to 13000 locations in India and 200 countries.

TCI Supply Chain Solutions

With a mission to be "The most admired service provider of integrated supply chain solutions", TCI Supply Chain Solutions is a single window enabler of supply chain solutions right from conceptualizing and designing the logistics network to actual implementation. The division has dedicated industry verticals for Auto, Retail and Consumer products, Hi-Tech, Telecom, Life Sciences & Health Care and Cold Chain.

TCI Global
GLOBAL LOGISTICS

The global business division of TCI provides complete logistics and supply chain solutions across boundaries comprising freight forwarding (sea and air), custom clearance, express and courier, warehousing and transportation.

TCI Seaways

TCI Seaways has modern well-equipped fleet and caters to coastal cargo requirements, transporting container and bulk cargo from islands and ports to various neighbouring countries.

The Indian Institute of Management Calcutta

The Indian Institute of Management Calcutta (IIMC) was established as the first national institute for post-graduate studies and research in Management by the Government of India in November 1961 in collaboration with Alfred P. Sloan School of Management (MIT), and with the support of the Government of West Bengal, the Ford Foundation and Indian industry. Over the years, IIMC has developed into a centre of excellence in management education with a global reputation. It has played a pioneering role in professionalizing Indian management through its post-graduate and doctoral level programmes, executive training programmes, research and consulting activities. IIMC alumni today occupy leadership positions as corporate managers, academicians and successful entrepreneurs worldwide.

The vision of the Institute is to emerge as an international centre of excellence in all aspects of management education. Over the past five decades, IIMC has blossomed into one of Asia's finest business schools. Its strong ties with the business community make it an effective mechanism for the promotion of professional management practices in Indian organizations. Today, IIMC attracts the best talent in India - a melting pot of academia, industry and research. The best and the brightest young men and women pursue its academic programmes.

One of the biggest strengths of the Institute is its world renowned faculty. The faculty members have distinguished academic achievements in different areas of management and the related basic disciplines, and are actively involved in teaching, training, research and consulting. They carry out consultancy assignments to keep in touch with real-life management problems in public and private corporations, financial institutions, government agencies and international agencies. This dynamic learning process at IIMC enriches teaching and training activities of the faculty. It also helps in developing case studies and identifying directions of research relevant for business and industry.

Author Profile

Subrata Mitra is a Professor of Operations Management at IIM Calcutta. He received his B.E. in Electronics and Telecommunications and M.E. in Production Management from Jadavpur University, Kolkata and Fellowship (Ph.D.) from IIM Calcutta. He has four years of industry experience and eleven years of teaching experience. He has research interests in sustainable supply chain management, vehicle routing problems and third-party logistics (3PL), and has published in international journals such as European Journal of Operational Research, Computers & Industrial Engineering, Omega, Journal of the Operational Research Society, Asia-Pacific Journal of Operational Research, International Journal of Applied Logistics and Supply Chain Forum: An International Journal. Prof. Mitra serves on the Editorial Review Board of the Journal of Supply Chain Management. He was a recipient of the Fulbright Senior Research Fellowship in 2006 and the Fulbright-Nehru Visiting Lecturer Fellowship in 2011.

Executive Summary

This project, henceforth referred to as the 2011-12 survey, was commissioned by Transport Corporation of India (TCI) to assess the operational efficiency of freight transportation by road in India. The project is a sequel to an earlier project, henceforth referred to as the 2008-09 survey, also commissioned by TCI in 2008 to analyze data for 10 major routes to assess the operational efficiency of freight transportation. In the 2011-12 survey, data for an additional 7 routes were collected by TCI besides the 10 routes for which data were collected in the 2008-09 survey.

The objectives of the 2011-12 survey were to compare the route statistics with the same for the 2008-09 survey to identify major changes, if any, make an overall assessment of efficiency of freight transportation by road, and suggest recommendations for the improvement of the operational efficiency of freight transportation.

To put into perspectives, a summary of the 2008-09 survey immediately follows this section. While the focus of the 2008-09 survey was on a detailed analysis of the trucking industry and the comparison of roads with railways in terms of freight transportation, the 2011-12 survey was more focused on comprehensive analyses of public-private partnerships (PPP) in road projects, electronic toll collection (ETC), access-controlled expressways and logistics parks/hubs. As mentioned before, primary data were collected by TCI. Secondary data were collected from various reports and websites. Telephonic discussions with TCI officials in Gurgaon were also held to receive inputs and clarifications.

India has the second largest road network in the world with a road length of 4.24 million km. India's road density is among the highest in the world with 1.29 km of roads per sq. km of area. However, India's national highways and expressways constitute only 1.67% of the road length, and the percentage of paved roads is only 49.3%, lagging behind both the U.S. and China. While India's road freight volumes are increasing at a compounded annual growth rate (CAGR) of 9.08% and the population of vehicles (all types) is increasing at a CAGR of 10.76%, the road length is increasing at a CAGR of only 4.01%, indicating the paucity of roads. Moreover, roads are of poor quality, lacking maintenance and pedestrians and animals have uncontrolled access to roads, resulting in slow speed of vehicles, break-downs and accidents.

It has become imperative that new roads should be built, and the existing roads should be widened and properly maintained. However, these projects require massive investments, which are beyond the budgetary provisions and borrowings from banks and financial institutions. Therefore, private investments in the form of PPP must be sought for road development and maintenance projects. However, there are some concerns regarding project viability such as uncertain traffic volume, diversion of traffic, projected demand and revenue realization, toll structure and toll collection, and return on investments. The Government should adequately address these concerns, and to attract private investments, offer incentives such as Viability Gap Funding (VGF), land acquisition, waiver of taxes and duties etc. It is expected that in the 11th Five-Year Plan (2007-12), more than 50% of the investments in roads will be contributed by the private sector. Also, henceforth all National Highways Development Projects (NHDP) will be implemented in the PPP mode.

Toll collection is an alternative way of financing road development and maintenance projects. The majority of Indian toll plazas employ manual tolling systems. Manual toll collection is a slow process, leading to congestions and long queues of vehicles at toll plazas. A CRISIL study estimates that a vehicle has to wait for about 5-10 minutes in the queue before it can pay the toll and leave the toll plaza. The data available for the Delhi-Mumbai route in the 2011-12 survey also confirmed that the average waiting time at a toll plaza was

about 10 minutes. Moreover, the data for the Delhi-Bangalore and Delhi-Mumbai routes showed that toll delays and toll expenses as percentages of total stoppage delays and total stoppage expenses, respectively, had increased in 2011-12 over 2008-09, indicating the requirement of a thorough analysis of the toll collection process and toll structure.

To expedite the toll collection process, India should gradually move towards electronic toll collection (ETC). Implementation of ETC will not only reduce congestions and long queues at toll plazas, but also reduce operating costs for toll operators and plug revenue leakage. However, there are some concerns such as cost implications for users and toll operators, inter-operability of different ETC systems and so on, which need to be addressed before ETC can be implemented. The Committee, set up by the Government and chaired by Mr. Nandan Nilekani, recommended the use of the passive Radio Frequency Identification (RFID) technology, which is not only fast becoming the popular global standard, but also less expensive and less complex to implement. The Committee recommended that the existing manual toll plazas be gradually converted to ETC plazas and the new toll plazas be built with ETC capabilities. The Government has accepted the recommendations of the Committee for implementation of ETC in India.

As mentioned before, India's roads and highways are easily accessible to slow-moving vehicles, pedestrians and animals, resulting in a low average speed of vehicles and a high number of accidents. India has a meager 600-700 km of access-controlled expressways compared to 74,000 km of expressways in China. India needs to build more high-quality, access-controlled expressways for faster connectivity between cities and towns.

The expressways should be equipped with Intelligent Transportation Systems (ITS) including round-the-clock CCTV surveillance for monitoring real-time traffic data and ensuring safety and security of users. A recent study recommends that 18,637 km of expressways need be built by the end of the 13th Five-Year Plan period, i.e. 2022. However, the massive investment required for the expressway projects is estimated at Rs. 450,000 crore. The Government, under NHDP-VI, has already given the approval for constructing 4 expressways of more than 1,000 km length at a financial outlay of Rs. 16,680 crore.

Therefore, it is suggested that private participation in expressway projects in the form of PPP should be encouraged. There are, of course, concerns regarding projected traffic volumes, revenue realization and profitability of such projects. Besides adequately addressing these concerns, the Government should also facilitate land acquisition, provide the basic infrastructure, give quick approvals, and offer economic incentives such as waiver of taxes and duties. Revenues may be realized through toll collection and property development in the vicinity of the expressways. For reference, brief descriptions of 3 major expressways, namely Mumbai-Pune, Ahmedabad-Vadodara and Delhi-Gurgaon expressways have been included in the section on access-controlled expressways.

The report also highlights the importance of logistics parks/hubs. Logistics parks differ from ordinary warehouses in terms of offering value-added services shared by multiple users. Benefits accrued to users include cost savings to the extent of 50% through economies of scale and scope, efficient use of multi-modal transportation, and availability of value-added services under one roof. According to an estimate, strategic locations of logistics parks may save India USD 13-16 billion in logistics costs. The scale of Indian logistics parks is very small (Only 3-4% of the warehouses may qualify as multi-modal logistics parks) compared to the same in China and other developed Asian countries.

India needs to scale up its logistics parks and clearly differentiate them from ordinary warehouses if it wants to compete with the logistics parks in Hong Kong, Shanghai, Singapore and Dubai to capture a reasonable share of international cargo. There are some existing and promising hubs, which have already been identified based on their locations, proximity to economic and industrial activities, and connectivity by rail, road etc.

The Ministry of Railways has also proposed to set up a number of multi-modal logistics parks along the dedicated freight corridor. However, there are some concerns such as the low level of containerization of cargo in India and the required investment for setting up logistics parks. For logistics parks to be successful, the scale of containerization of cargo has to increase. While in developed countries, 80% of the cargo is containerized, in India, the figure is only 20%. Out of the 560 million containers handled across the world in 2010, India handled only 9.4 million containers while China, Singapore and Hong Kong handled 150 million, 28 million and 24 million containers, respectively. While India has 130 Container Freight Stations (CFS) and 61 Inland Container Depots (ICD), there are 3,000 CFS and ICD in China.

Number of containers handled in 2010 (In million)

Therefore, the Government has to play an active role in setting up more CFS and ICD to promote the containerization of cargo. To build and operate logistics parks, investments from the private sector would have to be sought in the PPP mode with appropriate economic incentives. For reference, brief descriptions of some of the logistics parks set up by the private sector have also been included.

Finally, the potential of Nagpur as an emerging air cargo and logistics hub has been discussed. Nagpur already boasts of a number of logistics parks because of its location and connectivity through rail, road and air. The proposed logistics hub spread over 4,354 hectares, which is expected to be completed by 2035 at an estimated cost of Rs. 2,581 crore, will also include an integrated township and a Special Economic Zone (SEZ). Once completed, the project is expected to serve 14 million passengers, handle 0.87 million tonnes of cargo and generate revenues worth Rs.5,280 crore annually. If developed properly, Nagpur has the potential to emerge as the logistics hub not only for India but also for the South-East Asian region.

As far as the route surveys are concerned, no appreciable differences in parameters related to the operational efficiency of freight transportation by road have been observed in 2011-12 compared to 2008-09. Although it seems that the mileage of vehicles has marginally improved, the average speed of vehicles, stoppage delay per km and stoppage expenses per tonne-km have more or less remained at the same level. Average trip expenses and freight rates per tonne-km have, of course, increased due to inflation. Average contribution and profit margins, on the other hand, show no specific trend and depend on the route under consideration.

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One observation, specific to the Delhi-Bangalore and Delhi-Mumbai routes, which were surveyed in detail, was of importance, i.e. on these routes, it was found that the number of toll stops as a percentage of the total number of stops, toll delay as a percentage of the total stoppage delay and toll expenses as a percentage of the total stoppage expenses were higher in 2011-12 than in 2008-09.

This observation indicates the growing contributions of toll delays and toll expenses to total stoppage delays and total stoppage expenses, respectively. Although, costs of delay were not significant for individual trips, an estimate indicated that the annual cost of delay to the Indian economy was of the order of Rs. 270 billion or USD 5.5 billion. Also, another estimate showed that the impact of additional fuel consumption due to delay and slow speed of vehicles on the Indian economy was of the order of Rs. 600 billion or USD 12 billion per annum.

Annual Cost

Delay to the Indian Economy	**Rs. 270 billion (USD 5.5 billion)**
Additional Fuel Consumption due to Delay	**Rs. 600 billion (USD 12 billion)**

Recommendations :

Based on the findings of the survey, the following recommendations are being made, which are to be read along with the recommendations made in the 2008-09 survey.

- The study shows that freight volumes and vehicles are growing more rapidly than the growth of road lengths over the years, putting more pressure on the existing roads and seriously affecting their quality and maintenance. Therefore, the Government should pay immediate attention to the development of new roads, and widening and maintenance of the existing roads. However, these require massive financial outlays for which the Government must seek private investments in the PPP mode. To attract investments from the private sector, the Government, apart from offering economic incentives, should adequately address the concerns of the private sector in terms of uncertain traffic volumes, demand and revenue realization, toll structures and toll collection, political interference, and returns on investments.
- Now, the National Highways Authority of India (NHAI) acts as the regulator for roads and highways. In the context of private investments, an independent regulatory authority like the Telecom Regulatory Authority of India (TRAI) should be set up to assess costs/benefits, service levels, safety measures and tariff structures.
- The study shows that on two major routes, toll delays and toll expenses are making higher contributions to stoppage delays and stoppage expenses, respectively, in 2011-12 than in 2008-09, necessitating a detailed examination of the toll collection activities at toll plazas. There is an urgent need for reducing toll delays and rationalizing the toll structure to divert more traffic to toll roads and plug leakages. The solution to the problem of toll delays is to gradually move towards electronic toll collection (ETC) systems. The majority of Indian toll plazas employ manual toll collection and only a handful of them are equipped with ETC. There are some concerns, however, regarding the deployment of ETC such as cost implications for users and toll operators, inter-operability of different ETC systems etc., which need to be taken care of.

The recommendations of the Committee chaired by Mr. Nandan Nilekani have been accepted by the Government for implementation of ETC in India.. Implementation of ETC will not only reduce toll delays, but also reduce fuel consumption and environmental pollution. To address the issue of rationalizing the toll structure, an independent regulatory authority need to be set up, as already mentioned before.

- India needs to build a large access-controlled expressway network with Intelligent Transportation Systems (ITS) capabilities for improved road safety and security. The proposed expressway projects may be taken up with private participation in the PPP mode. The Government should facilitate by acquiring the land, providing the basic infrastructure and giving quick approvals besides extending economic incentives such as exemptions from taxes and duties. Revenues may be realized through toll collection and property development in the vicinity of the expressways. Also, a National Expressway Authority of India (NEAI), in line with NHAI, should be set up for construction, operation and maintenance of the expressways.
- India needs to build large-scale logistics parks and scale up the existing parks in order to compete with the logistics parks in Hong Kong, Shanghai, Singapore and Dubai for international cargo. New logistics parks should be built in the PPP mode with economic incentives such as waiver of taxes and duties for the private sector. Logistics parks not only lead to economic development and generate employment, but also promote multi-modal transportation including the use of railways to increase efficiency and reduce pollution. Nagpur, on the other hand, should be developed as an international air cargo hub since Nagpur has the potential to emerge as the logistics hub not only for India but also for the entire South-East Asian region.
- Presently, in India, freight transportation is heavily tilted towards roads, which carry about 60% of the total freight volumes whereas railways carry about 35% of the total freight volumes. The trend is different in the U.S. and China where railways carry about 47-48% of the total freight volumes. According to a report by McKinsey & Company, the ideal modal mix for India should be evenly balanced between roads and railways, each carrying about 46-47% of the total freight volumes. Multi-modal transportation should be encouraged where long distance transportation services may be provided by railways and the last-mile connectivity may be provided by roads. More use of railways, as mentioned before, is environment-friendly. However, multi-modal transportation needs the coordination among different ministries, i.e. Ministry of Road Transport and Highways, Ministry of Railways, Ministry of Shipping and Ministry of Civil Aviation. Ideally, an apex body should be set up with representations from different ministries to coordinate and facilitate the use of multi-modal transportation.

India	**191 CFS and ICD**	**600-700 Km Access-controlled Expressways**	**35% Freight Movement by Rail**
China	**3,000 CFS and ICD**	**74,000 Km Access-controlled Expressways**	**48% Freight Movement by Rail**

Summary of the report on the 2008-09 survey

The Indian trucking sector contributes about 4.5-5% (~ USD 55-60 billion) of the GDP. However, the sector is plagued with many problems. The first and foremost problem faced by the sector is the paucity of good-quality highways and expressways. While road freight volumes increased at a compounded annual growth rate (CAGR) of 9.06% and the number of vehicles (all types) on Indian roads increased at a CAGR of 10.13% during the period 1950-51/2007-08, the GDP at market prices grew at a CAGR of only 7.35% during the same period, indicating that road freight volumes and the number of vehicles (all types) grew at faster rates compared to the GDP during this period. The total length of roads, on the other hand, increased at a CAGR of only 3.77% during the period 1950-51 / 2007-08 implying thereby that the growth in roads has not been able to keep pace with the growths in road freight volumes and the number of vehicles (all types) on Indian roads during the same period. Today, national highways constitute only 2% of the total road network, but carry 40% of the road traffic. Highways are also not access-controlled allowing humans, animals and all types of vehicles simultaneously, which results in slow speed of vehicles, uncertain journey time and accidents. Poor maintenance of roads also leads to slow speed, equipment breakdown and accidents.

The second major problem faced by the sector is interstate and intrastate checkpost delays. Since different states have different documentation requirements for sales tax compliance, a considerable amount of time is wasted at interstate checkposts for completing sales tax-related formalities. Besides, delay is experienced at checkposts and on-road for filling in forms required by various government departments, checking of documents and physical checking of the vehicle, driver and consignment by RTO and traffic police, and collecting highway toll and taxes. On top of this, there are police harassment and corruption soliciting unofficial payments from drivers. Survey data show that on-road stoppage expenses (Toll/RTO/ST/Octroi etc.) including unofficial payments made to government officials and traffic police amount to, on an average, 15% of total trip expenses.

The sector has its own share of problems. It is highly fragmented with 80% of it being accounted for by the unorganized sector. On the one hand, there are diseconomies of scale due to the small size of operators. On the other hand, these small operators collude with corrupt officials and police, and flout all rules and regulations, evade taxes, resort to overloading of vehicles and indulge in other unethical practices. Since organized players have to directly compete with small operators, there is immense downward pressure on pricing. Also, because India has one of the lowest freight rates in the world, transporters make little margins or even losses. Reports indicate unorganized players make about 4-5% and organized players make about 10-15% margins. With this little margin, transporters have few options to invest in assets and technologies. Vehicles that ply on Indian roads are old and fuel-inefficient, and need immediate replacement. There is inadequate adoption of information technology for tracking shipments on a real-time basis leading to poor service quality. Problems are compounded by the fact that the sector is yet to receive industry status, which makes it difficult for transporters to raise capital and debt through organized banking and financial channels. Lack of skilled manpower is another concern for transporters.

Poor road conditions, checkpost delays and old vehicle fleets result in a daily coverage of maximum 250-400 km by a truck compared to 700-800 km in developed countries. While a truck on Indian roads can cover only 60,000-100,000 km in a year, in the U.S., a truck can travel up to 400,000 km in a year. The average speed of trucks in India is merely 20 km per hour, which was also confirmed by the present survey. The survey found that the stoppage delay as % of the journey time varied between 5% and 25%, and was very much dependent on the characteristics of routes. Costs of delay were also estimated and found not to affect margins by significant amounts. However, a conservative estimate showed that the annual cost of delay to the economy was of the order of Rs. 30 billion (~USD 600 million). Similarly, another estimate was made on additional fuel consumption due to stoppages and slow speed of vehicles, which indicated that had the mileage of vehicles been at desired levels, the annual savings to the economy would have been of the order of Rs. 240 billion (~ USD 4.8 billion).

The study recommends that the Government should invest heavily in extending, widening and upgrading the highway network, build more high-quality arterial roads, implement access-control mechanisms and allocate adequate funds for road maintenance. Private participation may be actively sought in road development and maintenance through public-private partnerships (PPP). The Government may expedite the introduction of uniform Value-Added Tax (VAT) across all states that would reduce paperwork and checkpost delays significantly.

Also, a system similar to the TIR Carnet system prevailing in the European Union (EU) that requires no checking of consignments, sealed at the origin, at interstate checkposts may be adopted to facilitate the smooth flow of high-value, perishable and time-sensitive items. Electronic tolling systems may be introduced and investments that are required to be made by transporters may be subsidized by the Government. Rules and regulations have to be strictly enforced by government officials and traffic police to avoid the evasion of tax, overloading and other unethical practices by drivers. Offenders should be handed out exemplary punishments.

The Government may consider according industry status to road transportation so that transporters can avail of the benefits of being part of an industry. Construction of more transportation hubs and logistics SEZs should be initiated to create more common, shared facilities for transporters. Multi-modal transportation involving rail and road that not only reduces transportation costs through economies of scale, but also saves precious fuel may be encouraged where the last mile connectivity would be provided by road.

Transporters may be encouraged to replace existing old vehicles with multi-axle tractor-trailer units that would reduce fuel consumption, save transportation costs, create less damage to roads and emit less pollutant to the environment. Transporters may be provided with tax breaks and/or reduced toll rates to facilitate the purchase of relatively expensive tractor11 trailer units.

Driver training institutes may be set up and periodic training of drivers on vehicle maintenance, road safety, hygiene standards and health hazards may be made mandatory for driving on highways. To deal with the problem of skilled manpower shortage, the Government may spread awareness by organizing workshops/seminars/conferences in collaboration with academia and industry associations.

1 : India's Road Network

Roads are the lifeline of a country's economy, carrying passengers and freight from one end of the country to another. India has the second largest road network in the world. The total length of roads has increased over 10 times from 0.4 million km in 1950-51 to 4.24 million km in 2010-11. While the U.S. tops the list with 6.5 million km of road network, China lags behind India with 3.7 million km of roads. As far as the density of roads is concerned, India with 1.29 km of roads for every square km of area is among the top in the world. Table 1 shows the total road lengths and road densities for the U.S., India, China and Brazil. The last column indicates the latest year for which data are available for a particular country.

Table 1: Road Lengths and Road Densities for the U.S., India, China And Brazil

Country	Road length (million km)	Road density (km/sq. km)	Year
U.S.	6.5	0.68	2009
India	4.24	1.29	2010
China	3.7	0.39	2008
Brazil	1.75	0.21	2004

Source: World Bank (http://www.worldbank.org), Ministry of Road Transport and Highways, GOI (http://www.morth.nic.in), Bureau of Transportation Statistics, Govt. of U.S. (http://www.bts.gov)

Indian roads can be broadly classified into four categories – (a) National highways/Expressways, (b) State highways, (c) Major district roads, and (d) Rural roads. While national highways and expressways connect important cities and towns of different states across the country, state highways and major district roads connect cities, towns and rural roads within a state with the national highway network. Table 2 shows the lengths of different categories of highways/roads and the corresponding percentages of the total road network.

Table 2: Lengths and percentages of different categories of highways/roads

Category of highway/road	Length (km)	% of total road network
National highways/Expressways	70,934	1.67
State highways	154,522	3.65
Major district roads	2,577,396	60.84
Rural roads	1,433,577	33.84

Source: Ministry of Road Transport and Highways, GOI (http://www.morth.nic.in)

Table 3 shows the percentages of paved roads and national highways/expressways for U.S., China and India.

Table 3: Percentages of paved roads and national highways/expressways for the U.S., China and India

Country	% of paved roads	% of national highways/expressways
U.S.	67.4	4.13
China	53.5	2
India	49.3	1.67

Source: Ministry of Road Transport and Highways, GOI (http://www.morth.nic.in), World Bank (http://www.worldbank.org)

Note: Data related to the percentages of paved roads pertain to the year 2008

It is observed from Table 3 that although India has the second largest road network in the world, it is still behind the U.S. and China with respect to the percentages of paved roads and national highways/expressways. India's national highways constitute only 1.67% of the total road network, but they carry 40% of the road traffic. National and state highways constitute less than 6% of the total road network, but they account for almost 80% of the road traffic. Out of 70,934 km of national highways/expressways, 17,752 km (25%) is single lane/intermediate lane, 36,995 km (52%) is double lane, and 16,187 km (23%) is four/six/eight lane[1].

The shortage of multi-lane highways coupled with poor road conditions and stoppage delays cause congestions, accidents, break-downs, and high maintenance costs of roads and vehicles. A vehicle on Indian roads can clock an average speed of only 20-25 km per hour covering 250-400 km in a day whereas in other developed countries, a vehicle can cover 700-800 km in a day. Vehicles in India cover only 80,000-100,000 km in a year while in the U.S., vehicles cover up to 400,000 km in a year.

The conditions of rural roads are even poorer. 40% of Indian villages do not have access to all-weather roads and are cut off during the monsoons. The problem is more acute for the north-eastern states, which are poorly connected with the rest of the country. Urban road networks, on the other hand, are inadequate creating congestions and limiting vehicular speeds to 10-15 km per hour during rush hours.

2 : Freight Transportation by Road

In India, about 60% of the freight by volume is carried by roads, the remaining being carried by the railways, waterways and airlines. While the transport sector contributes about 6.6% to India's GDP, the contribution of road transportation alone is about 4.7%. Therefore, considering India's GDP of USD 1,727.11 billion in 2010[2], the contribution of road transportation is USD 81.17 billion.

Road freight volumes are expected to increase from 6 billion tonne km (BTKM), about 14% of total freight volumes, in 1950-51 to 1,315 BTKM (projected), about 60% of total freight volumes, in 2012-13[3], registering a compounded annual growth rate (CAGR) of 9.08%.

India's GDP, on the other hand, has increased from USD 20 billion in 1950-51 to USD 1,727.11 billion in 2010-11, registering a CAGR of 7.71%. Therefore, it is observed that the growth in road freight volumes has outpaced the growth in GDP, signifying the contribution of freight transportation by roads to GDP. The vehicle (all types) population also grew from 306,000 in 1950-51 to about 115 million in 2008-09 at a CAGR of 10.76%.

The population of goods vehicles increased from 82,000 to 6.04 million during the same period at a CAGR of 7.7%. The share of goods vehicles in all types of vehicles decreased from 26.8% to 5.25% indicating higher growths of passenger vehicles including two wheelers and four-wheelers.

However, during the period 1950-51/2010-11, the total road network increased from 0.4 million km to 4.24 million km registering a CAGR of only 4.01%. The CAGR of national highways is even lower at 2.2%. Therefore, the growth in road lengths has not been commensurate with the growths in road freight volumes and vehicular traffic.

Although India has one of the highest road densities in the world, the growth in roads has not been able to match the growths in freight and vehicles, leading to congestions, long delays and substantial costs to the environment and the economy.

Table 4 shows the growths in GDP, road freight volumes, vehicles and road lengths. The figures in brackets indicate the years for which the data are relevant.

Table 4: Growths In GDP, Road Freight Volumes, Vehicles and Road Lengths

GDP/Freight/ Vehicle/Road	Unit	1950-51	2008-09 2010-11 2012-13	CAGR (%)
GDP	USD billion	20	1,727.11 (2010-11)	7.71
Road freight volumes	BTKM	6	1,315 (2012-13)	9.08
Vehicles (All types)	Million	0.306	115 (2008-09)	10.76
Vehicles (Goods)	Million	0.082	6.04 (2008-09)	7.7
Road lengths	Million km	0.4	4.24 (2010-11)	4.01

Source: Ministry of Road Transport and Highways, GOI (http://www.morth.nic.in)
World Bank (http://www.worldbank.org)

Freight movement in India heavily depends on roads, which account for about 60% of total freight volumes, while in the U.S. and China roads carry about 37% and 22%, respectively, of total freight volumes where railways also carry a significant portion of freight[4].

Although India has one of the highest road densities in the world, the growth in roads has not been able to match the growths in freight and vehicles, leading to congestions, long delays and substantial costs to the environment and the economy.

It is estimated that an additional 4 million vehicles will be required to carry the projected road freight volume of 1,315 BTKM in 2012-13. Therefore, new roads should be built, the national highway network should be extended, and national highways/expressways should be multi-laned at a faster pace.

3. Road Development Programmes and Financial Outlays

The Ministry of Road Transport and Highways of the Government of India (GOI) is responsible for highways development, maintenance, regulations and safety. Massive highway development projects under the National Highways Development Project (NHDP) implemented by the National Highways Authority of India (NHAI) have been undertaken that would oversee the completion and widening of the 5,846-km long Golden Quadrilateral (GQ) connecting the four major metros, Kolkata, Delhi, Mumbai and Chennai, and the 7,142-km long North-South, East-West corridors connecting Srinagar with Kanyakumari and Silchar with Porbandar at an estimated cost of Rs. 65,000 crore at 2004 prices. Other projects undertaken by NHDP are the upgradation and four/six/eight laning of national highways, construction of ring roads and bypasses in major towns and construction of flyovers, elevated roads, tunnels, underpasses etc[1].

It has been estimated that approximately Rs. 221,758 crore would be required as financial outlays for developing and maintaining national and state highways during the 11th Five- Year Plan (2007-12), the break-up being Rs. 121,758 crore and Rs. 100,000 crore for national and state highways, respectively[5]. It has also been estimated that a massive programme for development of highways under NHDP is required to be completed during the period 2005-15 with an investment of Rs. 235,690 crore in a phased manner[1]. A McKinsey & Company report estimates that road spend is going to touch USD 250 billion between 2008 and 2020 based on current trends[4].

Funding for road development and maintenance comes from budgetary support (including tax-free infrastructure bonds and borrowings from World Bank, Asian Development Bank, Japan Bank for International Cooperation etc.) and various forms of taxes such as tax collected on vehicle purchase, vehicle registration fees, road tax, road permit fees, tax collected at inter-state check posts and by local authorities, highway tolls, cess on fuel etc.

The Government of India has created a Central Road Fund (CRF) with Rs. 2 per litre collection of cess on petrol and high-speed diesel oil for development, maintenance and safety of national highways, state roads, rural roads and railway over/under bridges. However, budgetary support including borrowings, taxes and surcharges, and fees collected against services are not adequate for funding the massive investments required for roads. In the budget for the financial year 2011-12, a plan expenditure of Rs. 20,000 crore has been provisioned for roads and highways, well short of the required total financial outlays[6]. Therefore, private participation in the form of public-private partnerships (PPP) has become inevitable for the development and maintenance of roads, bridges, flyovers and tunnels.

4. Public-Private Partnerships in Road Projects

Traditionally, development and maintenance of roads have been the sole responsibility of the Government. However, the massive road development programme undertaken by the Government necessitated the revision of the National Highways Act of 1956 to encourage private sector participation in road development projects in the PPP mode allowing them to build, operate and maintain roads, and collect and retain fees.

The primary advantages of involving the private sector are the following – no overheads for the Government, greater efficiency, better quality, flexible procurement and decision-making procedures, no cost overrun and early completion of projects. Some of the state governments have also adopted the PPP approach for the development of roads in their states. However, there are some concerns regarding private participation. Since financing is the sole responsibility of the private concessionaire, the quantum of capital investments is a cause for concern. Also, when user fees are to be collected by the private concessionaire, the quantum of fees that can be charged as per Government rules and the lack of accurate information on the volume of traffic flows make revenue predictions highly uncertain.

To address these concerns and facilitate private investments in roads, the Government has announced several incentives including declaring the road sector as an industry, allowing 100% foreign direct investments, taking responsibilities of land acquisition, feasibility studies, environmental clearance, cutting of trees and shifting of utilities, providing subsidies up to 40% of the project cost (Viability Gap Funding or VGF), equity participation up to 30%, soft loans and 100% tax exemption, and waiving of customs duty on the import of modern road construction equipment[5,7]. Presently, NHAI acts as the regulator. However, in the long run, an independent regulatory authority (like the Telecom Regulatory Authority of India or TRAI) is required to be set up to assess benefits, costs, service levels, safety measures, and the rationality of the tariff structure.

The PPP projects for road development generally fall in the following three categories – (a) Build, Operate and Transfer (BOT) Toll basis: The concessionaire builds, operates and manages the road, and collects and retains user fees (tolls). The ownership of the road is transferred to the Government after the concession period (maximum 30 years) is over, (b) Build, Operate and Transfer (BOT) Annuity basis: This is similar to the BOT (Toll) basis except that user fees are collected by the Government and the concessionaire receives a fixed annuity payment every year during the concession period, and (c) Special Purpose Vehicle (SPV) basis: SPVs are separate legal entities in which the Government may have an equity stake. Rest of the capital may have to be raised from other organizations and financial institutions in the form of equities and debt. SPVs have to recover their expenses on road development through the collection of user fees, and when the concession period is over, the ownership is transferred to the Government and SPVs are disbanded.

In the 11th Five-Year Plan, it is estimated that out of the Rs. 121,758 crore financial outlay for national highways, Rs. 87,735 crore will be invested by the private sector, and out of the Rs. 100,000 crore investment in state highways, Rs. 32,000 crore will come from the private sector[5]. As of 30 November, 2011, 149 projects of length 13,791.25 km have been awarded on the BOT (Toll) basis and 29 projects of total length 3,311.42 km have been awarded on the BOT (Annuity) basis[8]. The Government has planned that henceforth all NHDP projects will be implemented through the PPP mode. In the next five years, NHDP envisages an investment of USD 70 billion with a major share by way of PPP[9].

5. Toll Collection and Related Issues

Irrespective of public-funded or PPP projects, toll is collected from users on many segments of national highways to recover the upfront investment and carry on operations and maintenance activities. Collection of toll may be thought of as an alternate source of financing road development and maintenance projects besides taxes and surcharges, thereby relieving the Government of the pressure of making appropriate budgetary provisions. Also, collection of toll is an efficient mode of financing since revenues realized are dedicated to the operations and maintenance of the segment of the highway for which toll is collected, and there is no dependence on the allocation of funds from the common pool of resources, as in the case of collection of taxes and surcharges. Collection of toll is based on the principle – "users pay", i.e. only the vehicles that pass through the toll road have to pay toll whereas taxes and surcharges are levied from every vehicle that may or may not pass through the toll road. There are a few other secondary objectives of toll collection such as to reduce road congestions, to encourage the use of public transportation and to cross-subsidize the development of roads in other geographical regions.

Toll rates vary across countries and across different regions within a country. However, there are some common factors based on which toll rates are determined. For example, toll rates are proportional to the length of the toll road, and are dependent on the type of vehicle, the number of axles/tyres, the time of day or day of week, which is also sometimes referred to as congestion pricing, etc. Goods vehicles are normally charged higher toll rates than passenger vehicles. Also toll rates per km for tunnels and bridges are higher than those for roads due to higher per km construction costs and unavailability of alternative routes. Reduced toll rates may be applicable for frequent users and vehicles registered within a certain radius of the toll plaza. In India, toll rates are linked to the Wholesale Price Index (WPI). Indicative toll rates for different types of vehicles are available on the website of the Ministry of Road Transport and Highways, GOI[10].

Many countries do not have toll roads. Even if a country has toll roads, the length of the toll roads is typically less than 5% of the total road network[11]. China houses more toll roads than any other country with Chinese toll roads representing more than 70% of the world's total toll roads[12]. In the financial year 2009-10, the total length of toll roads in India was 8,502.48 km and toll collection was Rs. 4,363.57 crore[13]. The Government is planning to increase the total length of toll roads to 30,000 km in the next five years[14]. In the financial year 2010-11, a total length of 2,871 km of national highways was targeted for tolling and the toll collection target was Rs. 1,500 crore. Up to December, 2010, 849 km of national highways was brought under tolling and Rs. 1410.06 crore was collected as toll[1].

Toll may be collected in one of the following three ways – (a) manual tolling, (b) mixed tolling, i.e. partly manual and partly electronic, and (c) electronic tolling where there is no manual toll collection. Depending on the traffic conditions, manual tolling may cause congestions, long queues, delays, additional fuel consumption, environmental pollution, and leakage through toll avoidance and

under-reporting of toll collections. Also, since manual tolling is a slow system, more toll lanes are required than electronic tolling to achieve the same throughput, which may lead to land acquisition problems, especially in densely populated areas, and higher operating costs for the toll operator. According to a CRISIL study, there are about 525 toll plazas operating on national and state highways in India through which more than 20,000 vehicles cross each day, queuing up for approximately 5-10 minutes awaiting their turn to pay the toll.

The average delay at a toll plaza is confirmed by the data available for 30 round trips of 15-tonne vehicles on the Delhi-Mumbai route. The average delay on 16 toll plazas on the route was about 160 minutes, which translates into an average delay of 10 minutes per toll plaza. Also, the average total delay (including RTO and Octroi stoppage delays) on the route was about 200 minutes, meaning thereby that delays at toll plazas constituted about 80% of the total stoppage delay. Toll expenses on the same route were also a major contributor to the total stoppage expenses, contributing as high as 86% of the stoppage expenses. Delays lead to additional fuel consumption in terms of slowing down before a toll plaza, idling and picking up speed after crossing the plaza.

The CRISIL study estimates that 0.5 – 1 litre of fuel is consumed per hour at a toll plaza leading to a wastage of Rs. 3 – 6 crore daily and Rs. 1,000 crore annually. The same study estimates that based on an industry average of 10% leakage, the annual loss to road developers is of the order of Rs. 1,200 crore[15,16,17].

In terms of environmental pollution, road transportation is the worst among roads, railways and waterways, contributing 64 gm of CO2-equivalent greenhouse gases to the environment per tonne-km compared to 28 gm and 15 gm, respectively, for railways and waterways[4]. Therefore, reducing delays at toll plazas would not only reduce additional fuel consumption, but also reduce emissions to the environment.

5.1 Electronic Toll Collection

Electronic toll collection (ETC) that automatically deducts the applicable toll from users' accounts as vehicles cross the toll plaza, may remedy the deficiencies of manual toll collection by allowing users to pass through the toll plaza without stopping, thereby adding to user convenience, saving time, eliminating congestions and long queues, and reducing accidents, additional fuel consumption and emissions to the environment.

On the other hand, toll operators will be benefited by reduced operating costs at toll plazas, maintenance of electronic records and plugging of revenue leakage. According to an estimate of the transportation authorities in the U.S., the annual operating cost for a manual toll lane varies from USD 150,000 to USD 180,000 whereas the annual cost of operating a dedicated ETC lane is less than USD 5,000[18]. Also, since ETC is faster than manual tolling, the throughput in terms of the number of vehicles crossing the toll plaza per hour will be higher enabling the toll operator to collect more tolls per hour. There are, of course, some concerns about ETC such as (a) vehicle registration database –information on all registered vehicles, including the account details, eligible for electronic toll collection is to be

maintained in a database, (b) communication–communications between the toll plaza and vehicles, and between the toll plaza and the remote server that maintains the vehicle registration and account details are to be up and active on a real-time basis, (c) inter-operability – different toll operators may follow different standards leading to the compatibility issue, (d) a large number of occasional users – the use of ETC is more meaningful when the number of occasional users is small, and (e) enforcement – since vehicles are not required to stop at toll plazas, proper enforcement laws are to be framed to deal with defaulters, and distinguish between willful evasion and genuine cases.

The above-mentioned concerns notwithstanding, ETC has been shown to provide numerous benefits on record such as reducing delays, fuel consumption and environmental emissions. For example, the Intelligent Transportation Systems (ITS) of the Department of Transportation, U.S. reported that the New Jersey Turnpike's introduction of ETC saved fuel worth 1.2 million gallons annually across 27 toll plazas, Baltimore reduced environmental emissions by 16-63% at toll plazas that were upgraded to ETC, and the introduction of Open Road Tolling or ORT where vehicles cruise past the toll plaza at near-highway speeds in addition to ETC in Florida helped decrease delay by 50% and increase speed in ETC lanes by 57%[19].

ETC has been operational in Europe since 1987 and in the U.S. since 1990. Today, such systems collect more than 50% of all toll revenues, and for some systems, the figure is close to 80%[20]. In the U.S., 83% of toll plazas have ETC capabilities and 98% of toll lanes offer ETC[21]. Although ETC continues to develop in the U.S. and Europe, the biggest growth potential is in Asia (China, India, Thailand and Australia) and South America (Brazil and Chile)[22].

China introduced domestic ETC standards in 2007. In 2008, China started to promote ETC, first with pilot projects in several provinces and regions, and then expanded them to build a national ETC network[23]. Today, the ETC system is available on more than 1,600 highways in China[24]. According to a recent study by Global Industry Analysis, Inc., the global ETC system market is going to reach USD 5.9 billion by 2017. The U.S., which is the largest market worldwide, is expected to make an investment of USD 210 billion in ITS, a substantial portion of which will go into ETC. China, on the other hand, represents the fastest growing market for ETC systems at a CAGR of 20%[25].

In India, the majority of the toll plazas still operate in the manual mode. ETC is available only in a few highways and bridges such as Delhi-Gurgaon highway, Bangalore electronic city elevated highway, Noida toll bridge, Delhi-Faridabad skyway, Ahmedabad-Mehsana expressway etc. However, to increase the throughput from 300-500 vehicles per hour to 1200-1800 vehicles per hour, India needs to convert manual toll lanes into ETC lanes[26]. It has been decided that all new road projects are going to be equipped with ETC lanes and manual toll lanes are to be upgraded to ETC lanes[14,27].

However, there are some roadblocks to the smooth roll-out of the ETC system in India such as the lack of a computerized vehicle registration database and hence a back-end central data processing centre, cost implications for users and toll operators, interoperability of different ETC systems and the absence of a regulatory framework for dealing with defaulters[28].

The Ministry of Road Transport and Highways, GOI, vide a notification dated 20 April, 2010, constituted a committee under the chairmanship of Mr. Nandan Nilekani, Chairman, Unique Identification Authority of India (UIDAI) to examine all available ETC technologies and recommend the most suitable one for implementation throughout India.

The committee submitted its report to the Ministry on 28 June, 2010. The committee recommended the passive RFID (Radio Frequency Identification) technology, which is not only fast becoming a common and popular standard worldwide, but also less expensive, and less complex, for both users and toll operators. An RFID tag, also known as the On-Board Unit (OBU), which is to be stuck to the windscreen of the vehicle, costs only about Rs. 100, works almost life-long, and is also very small, light and tamper-proof. The Road-Side Unit (RSU) or the reader costs about Rs. 2 lakh, lower than the cost for many other technologies. Another advantage of the recommended technology is that there are multiple vendors, leading to competition and further lowering of prices.

The committee emphasized the need for inter-operability among different ETC systems, and noted that unlike in the U.S. and Europe where interoperability became an issue since different vendors used different ETC systems, India, like China, could develop a common ETC standard, which could be adopted by different vendors during implementation.

The committee provided further recommendations with regard to Automatic Vehicle Identification (AVI) (Each vehicle is assigned a unique id), Automatic Vehicle Classification (AVC) for determining the toll amount based on the type of vehicle, number of axles etc., setting up a Central Toll Clearing House (CTCH) for accounts maintenance, recharging, debiting the applicable toll amount from the user's account and crediting the toll operator's account, sharing data among multiple toll operators and revenue reconciliation, handling vehicles violating toll conditions with the enforcement of an appropriately designed regulatory framework, and scalability for future applications such as tracking vehicles, paying fines and parking fees etc.

To begin with, the committee suggests, one-half of the lanes at a toll plaza may be made ETC compliant, gradually moving towards 100% ETC-compliance based on the interim experience[29]. The Ministry accepted all the recommendations made by the committee and set up an Apex Committee to finalize the specifications of the different components of the ETC system, which, vide a resolution dated 28 September, 2011, specified the requirements for the RFID transceiver, RFID tag, and data exchange formats between the toll plaza client and the CTCH server[30].

6. Access-Controlled Expressways

Expressways are the highest class of roads with access control for two-wheelers, three wheelers and other slow-moving vehicles, pedestrians and animals. They are designed to be elevated, running slightly above the ground surface, with paved shoulders and fencing on both sides for safety and access control. Expressways, which are generally 6 to 8 lanes wide dual carriageways, are built with far superior quality and safety standards compared to other roads and highways to provide a smooth and hassle-free driving experience.

The purpose of building expressways is to provide convenient, comfortable and faster connectivity among the industrial and economic hubs. Ideally, there should be interchanges along expressways to allow traffic movement from/to other highways and towns, and also since they are access-controlled, there should be underpasses at frequent intervals for the crossing of local residents and animals. Facilities such as rest areas, petrol/diesel pumps, telephone booths, grocery stores, eateries, repair shops and breakdown services should also need to be set up at required intervals. Since building expressways needs substantial financing, private participation in public projects is generally sought. In case of public-private partnerships, two common modes of financing are BOT (Toll) and BOT (Annuity).

However, due to the uncertainties associated with projected traffic volumes and toll collection, if private parties show a lack of interest in bidding for projects in the BOT mode, the Government will have no other option but to finance on its own with the involvement of private parties as EPC (Engineering, Procurement and Construction) contractors. Besides toll collection, other means of revenue generation would be through property development in the vicinity of expressways.

The length of expressways in India is not at all comparable with the same in developed countries and even in China. India has approximately 600-700 km of expressways vis-àvis 74,000 km of expressways in China. A pre-feasibility study commissioned in the late 1990s recommended an expressway network of 15,776 km by 2020. A more recent study, based on the existing highway network, socio-economic conditions of different regions and connectivity requirements, recommended a total length of 18,637 km of expressways to be built by the end of the 13th Five-Year Plan period, i.e. 2022[31]. The financial outlay for this massive construction activity is estimated to be Rs. 450,000 crore. It is suggested that 13,411 km of expressways be built in the BOT (Toll) mode and the rest 5,226 km of expressways be built in the BOT (Annuity) mode.

It is also suggested that a National Expressway Authority of India (NEAI), in line with NHAI, be created for construction, operation and maintenance of expressways. Intelligent Transportation Systems (ITS) should be adopted as far as possible in terms of CCTV surveillance for improved safety and security, monitoring real-time data for traffic diversion and congestion avoidance, and electronic toll collection for a smooth flow of vehicles.

The Government of India, under NHDP-VI, has approved the construction of 4 expressways of more

than 1,000 km length at a financial outlay of Rs. 16,680 crore[1]. The proposed expressways are Vadodara-Mumbai expressway (400 km), Delhi-Meerut expressway (66 km), Kolkata-Dhanbad expressway (277 km) and Bangalore-Chennai expressway (334 km)[32].

Among the existing expressways, some of the prominent ones are Mumbai-Pune expressway, Ahmedabad-Vadodara expressway, Delhi-Gurgaon expressway, Delhi- Noida direct flyway, Taj expressway etc. Brief descriptions of the first three expressways, as mentioned above, follow highlighting their special features, modes of financing and administrative issues.

6.1 Mumbai-Pune expressway[33,34]

The expressway, officially called the Yashwantrao Chavan Expressway, is India's first 6- lane, access-controlled expressway connecting Mumbai, the commercial capital of India, with Pune, an auto, IT, industrial and educational hub. The expressway became operational in 2002. The length of the expressway is 95 km, and it has reduced the commuting time between Mumbai and Pune, about 180 km apart, from 4-5 hours on the existing National Highway 4 (NH 4) to 2-3 hours. Presently, the daily traffic volume on the expressway is about 30,000 PCUs (Passenger Car Units), which is designed to handle up to 1 million PCUs.

The expressway is access-controlled for two-wheelers, three wheelers, tractors, pedestrians and animals. Two extra lanes have been provided on both sides for constructing paved shoulders and barb-wire fencing to bar access to the expressway. This has raised the safety level for both pedestrians and animals, and vehicles moving at a very high speed, and reduced the number of accidents, about 400 per year, significantly. In addition to saving time and reducing accidents, the expressway has also enabled vehicles to save fuel and reduce operating costs.

The expressway runs through the Western Ghats, and has 5 tunnels, separate for traffic in each direction, of total length of about 6,000 metres. There are plans to plant 80,000 trees along the 26 expressways. Also, there are underpasses at frequent intervals for local villagers and cattle, major interchanges for traffic from/to other towns, provisions for petrol pumps, rest areas, motels, eateries, groceries and recreation facilities, and services including first aid, telephones, emergency repair and break-down vans, and police patrolling.

There was always a need for a high-speed corridor between Mumbai and Pune. The Mumbai-Thane-Pune urban belt contained 72% of factories, provided 77% of industrial employment, controlled 88% of working capital, and yielded 86% of total state industrial output. The traffic on the Mumbai-Pune section of National Highway 4 (NH 4) was increasing rapidly, which led to congestions, delays, and frequent break-downs and accidents. In 1990, the Government of Maharashtra commissioned a feasibility study for the expressway, which, in the report submitted in 1994, recommended the construction of a 10-lane expressway on the BOT (Toll) basis. The estimated project cost at 1994 prices was Rs. 1,146 crore. Projecting a traffic diversion of 40-45% to the expressway, the Internal Rate of Return (IRR) for the project was estimated at 17.81%, compared to the Planning Commission's cut-off rate of 12%, making the project economically viable. Besides the collection of toll, revenue would be realized through property development in the vicinity of the expressway.

However, the bidding process for the expressway failed, with 6 companies purchasing the tender

documents but only one company, Reliance Corporation, submitting a bid. The Reliance bid of Rs. 3,600 crore was not accepted since it was more than twice the estimated cost of the expressway. The bidding process failed despite the government-announced incentives including a guaranteed 20% return on investment, single-window clearance, tax benefits, reduced duties on imported equipment and up to 40% Viability Gap Funding or VGF. The foremost reasons cited for the lack of response from the private sector were the uncertainties and risks associated with the expected traffic density and the collection of toll.

The Government of Maharashtra then set up the Maharashtra State Road Development Corporation (MSRDC) in 1996 to expedite work related to road sector development in the state. Construction of the Mumbai-Pune expressway was entrusted to MSRDC in 1997 on a BOT (Toll) basis with the right to collect toll for 30 years.

The environmental and forest clearances were obtained from the Ministry of Environment and Forest in the same year. Six internationally-renowned Project Management Consultants (PMC) were appointed to prepare detailed estimates, designs and bid documents, and supervise construction work to ensure quality. The entire stretch of the expressway was divided into 4 sections for each of which bids were invited separately with the objective of awarding the contracts for constructing 4 sections to 4 different contractors.

The work related to the construction of 5 tunnels was entrusted to the Konkan Railway Corporation. The contractors were selected based on their technical and financial bids. The estimated project cost based on the financial bids was Rs. 1,488 crore, slightly more than the cost of Rs. 1,200.46 crore estimated by the PMCs. The contracts for 4 sections were fixed-price EPC (Engineering, Procurement and Construction) contracts whereas the tunneling work was given out on a cost-plus contract. The fixed-price EPC contracts also incorporated a bonus clause for early completion and a penalty clause for late completion.

The Government of Maharashtra facilitated the construction work by acquiring land, cutting trees, shifting utilities, setting up power sub-stations and petrol/diesel pumps, ensuring speedy clearance of bills, providing construction materials at sub-market prices, absorbing inflation, and reimbursing taxes and customs duties on imports.

The expressway was finally made open to the public in 2002. The actual project cost including escalations was Rs. 1,630 crore. The operation and maintenance of the expressway was entrusted to a private party for a period of 15 years. MSRDC financed the construction of the expressway by borrowing from financial institutions and issuing bonds, guaranteed by the Government of Maharashtra. Initially when toll collection would not be as high as expected, it was decided that revenue would be generated through property development and laying ducts along the expressway that could be leased for running cables for utility services.

The Mumbai-Pune expressway is a good example of public-private partnership projects in the road sector. Although this is a BOT (Toll) project, the BOT operator is not a private concessionaire, but instead is a state government undertaking, i.e. MSRDC. The experience from the project indicates that the private sector is not yet ready to shoulder the full responsibility for such a large-scale project

with uncertain returns on investment. 28 Nevertheless, the project was executed in a BOT mode with the state government as the facilitator. The private contractors also rose to the occasion and delivered within a tight time schedule an expressway of such a scale with unprecedented quality and safety standards. Sophisticated construction equipment and new technologies were used for the first time in the construction industry, which not only enhanced the knowledge and skills of many a small and medium construction company, but also improved their capacity and productivity. The expressway project is surely going to be a trend-setter for private participation in public projects in the construction industry.

6.2 Ahmedabad-Vadodara expressway

The expressway was conceived as India's first 4-lane dual carriageway between Ahmedabad and Vadodara. However, due to land acquisition and political issues, the project was delayed and the expressway was finally opened in 2004. The expressway is numbered as National Expressway 1 (NE 1). This is a part of the Golden Quadrilateral (GQ) highway project, stretching about 95 km and reducing the journey time between Ahmedabad and Vadodara from 2.5 hours on National Highway 8 (NH 8) to less than 1 hour. Special features of the expressway include rest areas, access control for two wheelers and proposed conversion to 6 lanes[35].

Work on the 400-km long Vadodara-Mumbai expressway is expected to begin by May, 2012. The expressway will be 6 to 8-lane wide and will take 4 years to complete. The projected cost of the expressway is approximately Rs. 17,000 crore[36]. The project will be awarded on a Design, Build, Finance and Operate (DBFO) basis. The expressway is to be connected to the Ahmedabad-Vadodara expressway, which will reduce the journey time between Mumbai and Ahmedabad to 5 hours[37].

8.3 Delhi-Gurgaon expressway

The expressway, which became operational in 2008, connects Delhi with Gurgaon, one of the busiest inter-city routes with about 180,000 PCUs commuting daily between these 29 two cities. The expressway is 6 to 8-lane wide with a stretch of about 28 km. This is part of the Golden Quadrilateral (GQ) highway project, which has shortened the journey time between Delhi and Gurgaon from 1 hour to about 20 minutes. The expressway is one of the largest BOT (Toll) projects of NHAI so far, awarded to the concessionaire, Delhi Gurgaon Super Connectivity Limited on a negative grant (The concessionaire actually paid to the Government for the concession) for a concession period of 20 years.

The project cost was approximately Rs. 1,000 crore; however, being a high-volume traffic route, the concessionaire is expected to recover the investment through toll collection and real estate development much quicker than any other comparable BOT project. There are three toll plazas including one 32-lane toll plaza with electronic toll collection facility at the Delhi-Haryana border, which is one of the largest toll plazas in the world. Other features of the expressway include emergency telephones every 1.5 km and CCTV surveillance[38,39].

7. Logistics Parks / Hubs

A logistics park facilitates the trade of Export-Import (EXIM) and domestic cargo with a host of value-added services shared by multiple users. While an ordinary warehouse leases out space to customers for temporary storage and distribution of goods, a logistics park, on the other hand, provides users with many facilities including customized warehousing, cold storage, Inland Container Depot (ICD)/Container Freight Station (CFS), multi-modal transportation, truck terminal, rail head, aggregation/disaggregation of cargo, break-bulk operations, cross-docking, manufacturing, mechanized handling, sorting, grading, packaging, labeling, banking, insurance, office and commercial space, rest areas, restaurants and recreational centres.

Users are benefited from cost savings through economies of scale/scope, shared value-added services, efficient use of multiple modes of transportation, consolidation of cargo, reduced transit time, processing time, inventory and damages, improved service level, multiple facilities under one roof, logistics outsourcing, and cooperation among companies operating within a park.

An estimate indicates that a company moving into a logistics park may reduce its logistics cost by as much as 50%. To give an example, in the 600-acre logistics park developed by Sri City Pvt. Ltd., 300 companies have set up operations with many of their customers located within a radius of 3-4 km.

Manufacturing companies, who have shifted base to the logistics park, have taken only 15 acres each and outsourced logistics activities to the park. Co-located companies within the logistics park are enjoying 7-8% cost savings. The logistics park has the provision for centralized warehousing, can accommodate 50-wheel vehicles and allows duty-free movement of goods between Special Economic Zones (SEZ).

Another logistics park is going to be set up at the Kalinga Nagar steel hub in Orissa by the Container Corporation of India (CONCOR) on an area of 30 acres at an investment of Rs. 70 crore. The project is expected to be commissioned within 3 years of acquisition of land, and is set to offer multi-modal transport solutions for existing and upcoming steel industries in the cluster. The facilities proposed at the park include 2 full-length railway lines, paved surface for handling containers, warehousing for domestic and EXIM cargo, bulk and break-bulk operations, modern container and bulk handling equipment. CONCOR is also keen on setting up multi-modal logistics parks at other industrial clusters like Angul and Jharsuguda in the state.

The precursor to logistics parks is the Free Trade and Warehousing Zone (FTWZ), the creation of which was announced in the Foreign Trade Policy, 2004-09. FTWZs are Special Economic Zones (SEZ) with a focus on trading and warehousing, created to leverage India as a global trading and trans-shipment hub. While FTWZs are located close to ports and are meant for EXIM cargo, logistics parks may be located inland and generally cater to domestic cargo.

Although, many a time, traditional warehouses are promoted as logistics parks, in reality, these warehouses have a long way to go to evolve into truly world-class, multi-modal logistics parks.

According to an estimate, 80-85% of the warehouses belong to the fragmented/unorganized sector, have less than 10,000 sq. ft. of storage space with poor infrastructure, and lack in modern equipment, standards and specifications, leading to large-scale pilferage and spoilage. Only about 7-8% of the warehouses have about 50,000 sq. ft. of storage space with modern infrastructure, leak-proof structures, palletization and standardization, 24-hour security and state-of-the-art IT and surveillance systems to minimize pilferage and losses. Only 3-4% of the warehouses may qualify as multi-modal logistics parks.

The location of a logistics park is important. Since logistics parks occupy a substantial space, and getting space of such a magnitude within city limits is not only difficult but also expensive, logistics parks are generally located off city limits. Ideally, they should be located between production and consumption points, and close to major industrial and commercial centres. Also, they should be well-connected by rail, road, port and airport. For example, Bhiwandi, a well-established transportation and warehousing hub, is located on the outskirts of Mumbai, well-connected by highways and exempted from octroi. However, it lacks multi-modal connectivity since the nearest port is 60 km away and the nearest airport is 55 km away. Road transportation is the only feasible option.

According to a report by Cushman and Wakefield, 110 logistics parks spread over 3,500 acres at an estimated cost of USD 1 billion will be operational by 2012. Around 45 million sq. ft. of warehousing space will be created in the next four years. According to the report, the established hubs are Mumbai, Kolkata, Chennai and Hyderabad. Mumbai has emerged as the preferred location with the development of 7-8 logistics parks on 600 acres around the city at an investment of USD 200 million. Kolkata, Chennai and Hyderabad are also characterized by excellent rail, road and port connectivity, and are witnessing significant investments in infrastructure. High concentration of retail, established manufacturing hubs and proposed SEZ developments will further augment the attractiveness of these locations.

Besides the established hubs, a number of hubs such as Nagpur, Vizag and Gurgaon have also emerged. Currently, they are lagging behind in support infrastructure. However, because of their locational advantages, connectivity, and proximity to existing and proposed manufacturing clusters and SEZs, they are also emerging locations for the future.

Investments in infrastructure would increase the attractiveness of these locations in the next 3-5 years. Gurgaon has the additional advantage of being located on the Golden Quadrilateral (GQ) with easy access to the dedicated freight corridor. Apart from the established and emerging hubs, the Cushman and Wakefield report also identifies Bangalore, Indore, Jamshedpur, Ahmedabad, Ambala and Alwar as the promising hubs and Kochi as a nascent hub. Although the promising hubs do not rate high in geographic locations, infrastructure, retail penetration and manufacturing activities, these locations are touted to be emerging manufacturing hubs promoting the logistics industry in these locations. Kochi, on the other hand, is well-connected throughout southern India, and connected to the rest of the country and the world through its port and international airport. However, the challenges facing Kochi are the lack of infrastructure development and manufacturing activities, which rate this location lower than other locations.

According to an estimate, strategic locations of logistics parks may save India USD 13-16 billion in logistics costs.

Indian logistics parks should graduate to compete with other Asian logistics parks and hubs such as in Hong Kong, Shanghai, Singapore and Dubai to become a major trading and trans-shipment hub in South-East Asia. Global integrators such as DHL, UPS and FedEx, for instance, have developed their hubs in Hong Kong, Shanghai and Dubai, respectively. Indian logistics parks need to match the scale of dedicated logistics parks such as in Shanghai. Singapore, on the other hand, set up its first airport logistics park near the Changi airport in 2003, and declared it as a 24-hour one-stop free trade zone where companies can repack, consolidate or store cargo without any need for documentation or customs duties. As far as global logistics parks are concerned, one of the largest parks, called the Rickenbacker logistics park, is situated in Columbus, Ohio, U.S. surrounding the Rickenbacker International Airport and is adjacent to the new Norfolk southern intermodal terminal. The logistics park is capable of handling 28 million sq. ft. of development, is located in a pro-business environment, and offers 15-year, 100% real property tax abatements aimed at reducing the overall costs of doing business.

To promote the development of logistics parks in India, the Government should play an active role by facilitating the acquisition of land at subsidized prices, providing the basic infrastructure, extending economic incentives such as waiver of taxes and duties, expediting approvals through single window clearances, and promoting the development of industry clusters. Many opine that logistics parks should be developed in the public-private partnership (PPP) mode with specialized infrastructure service providers as developers. Presently, parks are being designed, constructed and operated by third-party logistics (3PL) providers or property developers. Parks developed by 3PL providers are generally accessible to their customers only while parks developed by property developers may ignore essential provisions such as cold storage, automated machinery, canteens for drivers and parking space, and end up as standard warehousing facilities for all. There is also no clear distinction between warehouses and logistics parks. There are ambiguities regarding classifying logistics parks as commercial or industrial spaces. Commercial space is more expensive whereas for an industrial property, one has to comply with a number of laws such as pollution act, labour act etc.

The Ministry of Railways and the Government of India (GOI) have planned to construct dedicated freight corridors covering 3,287 route km on two corridors: eastern and western corridors. The Railway Ministry along with the state governments is also planning to set up 10 multi-modal logistics parks (MMLP) within 300 km of each other alongside the dedicated freight corridors. These MMLPs, spanning an area of 400 to 500 hectares (988 to 1,235 acres), would be developed with both government and private funding. The MMLPs will contain rail sidings with sheds, container depots, warehouses and office buildings for logistics operators, and assembly units for processing raw materials. They are expected to bring down the logistics cost and time by 20-30%.

One of the major roadblocks to the development of logistics parks in India is the scale of containerization of cargo. The primary advantages of containerization are standardization of cargo and easy transportation from one mode to another. While in developed countries, 80% of the cargo is

containerized, in India, the figure is only 20%. Out of the 560 million containers handled across the world in 2010, India handled only 9.4 million containers while China, Singapore and Hong Kong handled 150 million, 28 million and 24 million containers, respectively. India has 130 CFS and 61 ICD compared to 3,000 CFS and ICD in China. Therefore, the Government of India (GOI) should invest more in CFS/ICD to increase the percentage of containerization of cargo.

Logistics parks are beneficial not only from the user's point of view, but also from the economic and social perspectives. On the one hand, logistics parks promote industrial and commercial activities, and generate employment, and on the other hand, they promote multi-modal transportation and increased use of the railways, and reduce pollution. Therefore, the Government should put in every effort in creating an environment conducive to the development of logistics parks and hubs[40-54].

7.1 Nagpur as an emerging air cargo and logistics hub

Nagpur has the potential to develop into a major air cargo and logistics hub. The Government of Maharashtra has embarked upon an ambitious project, called Multi-Modal International Hub Airport at Nagpur (MIHAN), of developing Nagpur as an international air cargo hub and a Special Economic Zone (SEZ) with integrated townships at an estimated cost of Rs. 2,581 crore by 2035. The project is financed by multiple Indian banks with a total loan amount of Rs. 300 crore along with investments from the Government of Maharashtra and the Airport Authority of India (AAI). Once completed, the project is expected to serve 14 million passengers, handle 0.87 million tonnes of cargo and generate revenues worth Rs. 5,280 crore annually.

The location of Nagpur has several advantages. It is not only centrally located, but also well-connected to the other parts of the country by rail, road and air. It has the potential to emerge as the hub for not only India but also the South-East Asian region. Nagpur is located midway between Europe, Middle-East and Africa on the west, and South-East Asia, Far East and Australasia on the east. More than 300 international flights fly over Nagpur every day. Also, Nagpur is situated within 750-1,250 km of almost all major industrial and commercial centres. Large tracts of land are available in Nagpur for development while there is a limited availability of land around Mumbai and Delhi airports. Seventeen percent of Nagpur's workforce is already engaged in transport services forming a ready supply base of experienced personnel.

The logistics hub, which will spread over 4,354 hectares, will have the following facilities – extended airport with additional longer and wider runways to handle bigger aircraft, international air cargo and passenger hub, multi-modal transportation, railway terminal for cargo and passengers, truck terminal on 60 hectares for parking up to 1,000 trucks, 14 godowns with additional space for private players to develop their own warehouses, captive power plant, Special Economic Zone (SEZ), hotels, restaurants, duty-free shops, rest areas, educational centres, multiplexes, shopping complexes, value-added commercial services, and residential areas. Once completed, the logistics hub is expected to provide direct employment to about 120,000 people by 2018.

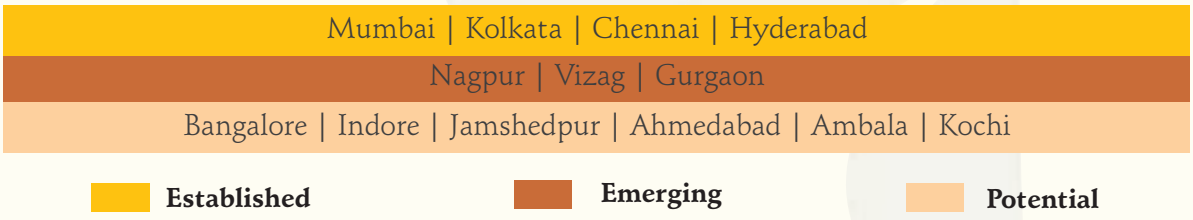
However, the project hit a roadblock in 2008 when many companies backed out of the proposed SEZ

due to the global financial crisis. Also, manufacturers, traders and logistics service providers have the apprehension that although Nagpur is centrally located and well-connected, it may not be the ideal choice for locating the hub since the bulk of the freight movement is currently between west and south, west and north, and south and north due to the skewed distribution of industrial and consumption centres.

As far as international cargo is concerned, the western part, mainly Mumbai, receives the maximum volume, followed by the northern and southern parts, from the western countries such as the U.S., Europe and Middle-East. In this scenario, it does not make any business sense to offload cargo in Nagpur and then ship it back to, say, Mumbai, resulting in delay and additional fuel consumption. Logically, Mumbai and Delhi are better suited than Nagpur to develop as hubs.

For Nagpur to flourish as a logistics hub, more industrial activities are required to be centred in and around Nagpur, and the volume of international cargo movement to and from China, Far East, ASEAN and SAARC countries should be justified. Here, the Government may play an active role by making policies and procedures conducive to investments and offering incentives such as tax exemption, waiver of charges and so on. Although there may be skepticism about the success of Nagpur as a logistics hub, it is nonetheless attracting investments from infrastructure and logistics companies such as Transport Corporation of India Ltd. (TCI) and Future Supply Chain Solutions Ltd. Therefore, it is expected that upon sorting out all the problems, Nagpur will eventually emerge as a successful international air cargo and logistics hub in the near future[55-59].

Established, Emerging and Potential Logistics Hubs in India



Proposed creation of Logistic Hubs/ ICD/CFS/ FTWZs along DFC/DMIC

Logistic Parks/Transshipment Zones Proposed on Western DFC

As part of the development of Western Dedicated Freight Corridor (DFC) between Delhi and Mumbai, Indian Railways has proposed development of Freight Logistics Parks at six locations along the DFC to enhance rail based traffic. These locations include:

(i) Navi Mumbai (ii) Vapi (Gujarat) (iii)Ahmedabad (Gujarat)

(iv) Gandhidham (Gujarat) (v) Jaipur (Rajasthan) (vi)National Capital Region of Delhi

These parks are proposed to be develop as joint venture with Railways or with respective state governments where Railways will offer land.

Proposal for development of Logistics Parks / Hubs in Gujarat along DFC/DMIC

As per the Ministry's directive to identify suitable locations for proposed hub facilities, the Government of Gujarat has identified six sites, Ahmedabad and Gandhidham in accordance with Ministry's recommendations, Dahej, Hazira, Palanpur and Surendra Nagar (instead of Vapi).

Modern Rail Terminal at Boraki, Greater Noida

Government of Uttar Pradesh has proposed to develop Boraki as the major passenger and goods based rail terminal with state-of-the-art infrastructure through public private partnership. It is expected to serve as a convenient location for evacuation of goods from Delhi/Ghaziabad region and help in decongesting the rail terminals. Boraki is close to the proposed 2500 Acre SEZ, 1000 Acre Handicraft SEZ, Container Depot at Dadri. Moreover, Boraki is proposed to be connected to the Container Depot at Tughlakabad with a new alignment that connects with Noida as well. The state government has already received in-principle approval from the Ministry of Railways.

Proposal for Logistics Parks / Hubs in DMIC Region of Madhya Pradesh

In Madhya Pradesh, the state government, as part of its vision for the sector, had short listed locations for developing Logistics parks along DFC. The most suitable locations in the DMIC Region for immediate development include:

- Ratlam, Jhabua and Dewas, as most suitable locations for immediate development
- Neemach and Shajapur, as potential locations for future development

Proposed Initiatives of Haryana State Government along DFC & DMIC

As part of development of the proposed Western Peripheral Expressway (Kundli-Manesar-Palwal Expressway), the Government of Haryana has proposed development of Dry Port in the vicinity of Palwal over an area of 2 Sqkm (200 Ha). In addition, the state government is also contemplating setting up Logistics Park at Rewari/ Bawal to cater to the region's requirements.

Existing & Proposed Initiatives of Rajasthan State Government for DMIC

In addition to Kota, Jaipur and Jodhpur, Government of Rajasthan had set up Dry Ports/ Logistic facilities at Bhiwadi, Bhilwara to cater to the regions' logistic requirements. Areas of Kishangarh, Rajsamand are also proposed to be developed as key areas of DMIC.

Free Trade Warehousing Zones

Government of India, through its Foreign Trade Policy 2004, had announced development of Free Trade Warehousing Zones (FTWZs) to increase the percentage share of global merchandise trade in India.

Services Offered in FTWZ

- **Warehousing space on lease**
  - Space for warehousing on lease basis and even space to construct the warehouses, to be leased out and ready to use facility customized as per the storage requirement of the specific products.
  - Basic infrastructure facilities like power, water and sewerage drainage system.
- **24 hours Customs Clearance**
  - The customs office placed inside the FTWZ with customs clearance facility available to FTWZ users all round the clock.
- **Freight Management Support**
  - The FTWZs are also expected to provide freight services to the FTWZ users in terms of transportation means to and from the Zone.
- **Common equipments sub-lease**
  - The FTWZ would also make available general facilities for effective storage and movement of cargo through equipments such as counter balance fork-lifts, cranes and grabs, stackers, push carts, picking trolleys and bins, shelves and storage bins, strapping and electronic scales.
- **Activities that can be undertaken inside FTWZ :**
  - Manufacturing facilities will not be allowed within the FTWZ. However, activities such as packing, de-stuffing, knitting, splitting and other activities required for storage purposes will be allowed within the FTWZ.
  - With customs clearance procedures being simplified, the delivery time would be significantly reduced.
- **Single product storage facilities**

Locations of FTWZ along DFC/DMIC

Free Trade Warehousing Zones are proposed to be located in three locations along DFC. These include, Greater Noida, Kandla, Mumbai.

8. Comparisons with China

Although India is ahead of China in terms of the total length and density of the road network (While India has a road network of 4.24 million km and a road density of 1.29 km per square km, China's road network is 3.7 million km long and its road density is 0.39 km per square km), China has higher percentages of highways/expressways and paved roads compared to India (China's highways/expressways constitute 2% of the road network and 53.5% of its roads are paved compared to 1.67% of highways/expressways and 49.3% of paved roads in India). Also, China boasts of 74,000 km of expressways, second only to the U.S., well ahead of India's expressway network of 600-700 km. China's modal mix has been historically tilted towards railways and waterways, while for India, roads and railways carry the maximum volume of freight.

According to a 2007 estimate by McKinsey & Company, in China, roads, railways and waterways carried 22%, 47% and 30%, respectively, of the freight volume, while the corresponding figures for India were 57%, 36% and 6%. Airlines carried less than 1% of the freight volume for both the countries[4].

China's infrastructure sector received a boost since China was recognized as a global manufacturing hub. While India has been referred to as the back-office of the world, China has been recognized as the factory of the world. Along with increased export/import volumes and economic activities, living standards and domestic consumption were also on the rise in China, leading to higher volumes of freight movement (China's freight movement in 2007 was 5,275 billion tonne km[4] compared to India's projected freight movement of 1,315 billion tonne km in 2012-13) and a greater 40 demand for roads and highways. Parallely, car sales also zoomed making China the largest car market in the world, which necessitated the construction of more roads and expressways.

Sensing the importance of growth of the infrastructure sector, the Chinese government allocated a lion's share of 38% of the USD 586 billion stimulus package introduced in 2008 and a major portion of this package went to the road sector. While China invested USD 90 billion in roads during 2005-10, the estimated investment in roads during 2010-20 is USD 120 billion. China's expressway network, which was merely 147 km long in 1989, now has a length of 74,000 km, and is expected to reach 85,000 km by 2020. While the objective of building expressways is to interconnect major cities with ports, the Chinese government has also plans to build and modernize about 270,000 km of rural roads to integrate rural areas in the economic development process.

For financing road projects, the Chinese government predominantly relies on budgetary provisions and borrowings. Public-private partnerships (PPP) in expressway projects are at a formative stage in China. While financing and management of the expressway network lie in the domain of the public sector, private investment may be sought in the form of a joint venture to form a public limited expressway corporation after completion of the expressway for collection of toll. The equity invested in the joint venture is then used to build new expressways.

The Chinese government follows the "one-road-one company" model, which holds a private company responsible and accountable for one road project only. The Build, Operate and Transfer (BOT) model of

PPP for construction and management of roads has only been recently introduced in China. Overall, private sector financing constitutes a mere 7% of expressway financing in China. On the contrary, PPP play a major role in financing road projects in India. In the 11th Five-Year Plan, more than 50% of the investment in the road sector is expected to be received from the private sector. Also, henceforth all NHDP projects will be implemented in the PPP model. Therefore, while China has relied heavily on the public sector, India encourages and banks on private investments in the development of the road sector.

China's toll roads and expressways are, of course, not without problems. Toll rates, for example, seem exorbitant at USD 0.12 per mile, which is more than the cost of fuel for many types of vehicles. A trip from the south of China to its capital Beijing may cost about USD 200 in tolls. This poses a major challenge for toll road companies seeking to maximize toll revenues and profit margins. One possible solution has been the adoption of the weight-based toll methodology for freight vehicles, which has shown results in terms of increased toll revenues and profit margins. Toll collection has often been affected by the uncertainty in traffic volumes, which are in turn sensitive to domestic as well as international macroeconomic conditions.

China had the same experience during the global economic crisis when export volumes declined and traffic levels on toll roads that connected important ports for serving export activities also dwindled. Another concern is the rapid expansion of the expressway network that may exceed the existing demand and lead to a diversion of traffic from the toll roads built earlier and reduce revenues for such toll roads.

Finally, the Chinese government has committed USD 300 billion for the construction of a high-speed railway network over the next 20 years, which may pose significant competition to the toll roads leading to lower revenues and profit margins.

Overall, China's logistics cost also is at a very high level, which is 18-20% of the GDP compared to 13-14% of the GDP for India and 9-10% of the GDP for developed countries[60]. Problems of toll roads, expressways and high logistics costs notwithstanding, the outlook of China's logistics sector, which is growing annually by about 14% for the last 4 years, appears to be very bright.

Toll roads are experiencing significant growths in toll revenues and profit margins. Export activities gave the initial boost to the Chinese economy, followed by an increase in domestic consumption. Even if the GDP growth rate moderates somewhat, increased domestic demand will facilitate the growth of China's logistics sector[12].

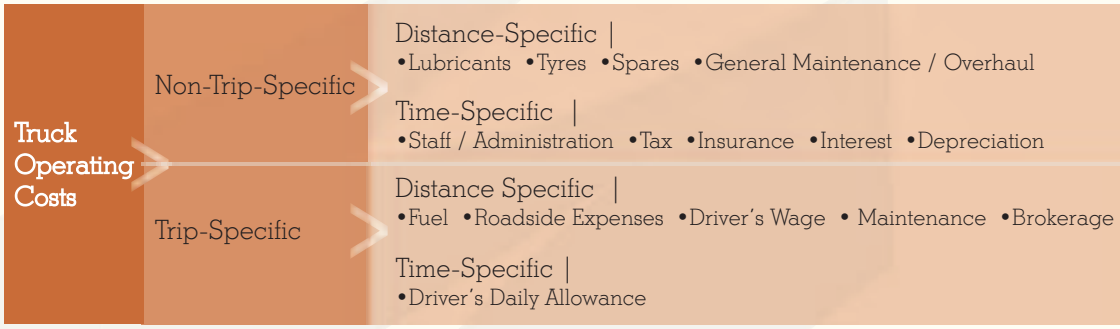
9. Costs of Operations and Delay

When a vehicle runs on roads, there are costs of operations (tangible) as well as there are costs of delay (intangible) that the vehicle has to experience en route to its destination. The components of these costs of operations and delay are given as follows.

9.1 Costs of operations

The components of the costs of operations can be classified as "non-trip-specific" and "trip-specific" as shown in Figure 1, which has been reproduced from the report on the 2008-09 survey.

Figure 1: Components of Truck Operating Costs



Non-trip-specific costs are actually overhead costs whereas trip-specific costs are variable costs associated with individual trips. To determine the "true" operating cost of a vehicle on a route, the trip-specific or variable costs are to be added to the non-trip-specific or overhead costs apportioned based on the distance travelled and time taken on the route.

9.2 Costs of delay

The costs of delay can be further classified into (a) the cost to the transporter and (b) the cost to the shipper, the component-wise break-ups of which are given below.

(a) Cost to the transporter

- Cost of fuel due to slow speed and idling
- Loss of profit due to delay
- Depreciation, interest, tax and insurance
- Extra daily allowance paid to the driver due to delay

(b) Cost to the shipper

- Additional inventory carrying cost due to delay

Details about the components of the costs of delay are available in the report on the 2008-09 survey.

10. Findings of the Survey

To estimate the costs of operation of a 15-tonne truck, a survey was carried out on 17 major routes in 2011-12 to collect the required data. Table 5 shows the routes and the number of trips for each route for which data were collected. It may be noted that a trip can be either way and henceforth trips are referred to as roundtrips.

Table 5: Routes and Number of Trips

Route Between		Number of Trips
Delhi	Bangalore	30
Delhi	Mumbai	30
Delhi	Chennai	4
Delhi	Kolkata	4
Mumbai	Chennai	4
Mumbai	Kolkata	4
Chennai	Kolkata	4
Indore	Guwahati	4
Pune	Hyderabad	4
Ahmedabad	Coimbatore	4
Ahmedabad	Bangalore	4
Ahmedabad	Delhi	4
Bangalore	Mumbai	4
Guwahati	Delhi	4
Hyderabad	Delhi	4
Kolkata	Bangalore	4
Nagpur	Delhi	4
Total		120

For each of the Delhi-Bangalore and Delhi-Mumbai routes, data were collected on 30 roundtrips (15 trips from Delhi to Bangalore/Mumbai and 15 trips from Bangalore/Mumbai to Delhi). Similarly for each of the remaining 15 routes, data were collected on 4 round trips (2 trips on either way). Since each of the Delhi-Bangalore and Delhi-Mumbai routes constituted 30 round trips, they were analyzed in detail and compared among themselves. Also, since the same routes were analyzed in the 2008-09 survey, a longitudinal comparison was also made to identify if there were any significant differences. For the remaining 15 routes, since the number of observations is small, the survey results for these routes are only indicative and not necessarily generalizable. The last 7 routes in Table 5 are new additions in the 2011-12 survey over the 2008-09 survey.

10.1 Findings of the Delhi-Bangalore Route Survey: Comparison with the 2008-09 Survey

Table 6 shows the summary statistics for 30 roundtrips on the Delhi-Bangalore route.

Table 6: Summary Statistics for the Delhi-Bangalore Route

Parameter	Unit	Minimum	Maximum	Average
Distance	Km	2087	2203	2143.57
Journey time	Hours	86	100	94.47
Average speed	Km/hour	21.02	25.43	22.71
Mileage	Km/Lt	4	4.45	4.06
Loading/documentation time	Hours	0.75	7.5	3.68
No. of stops	—	29	32	30.33
Stoppage delay	Hours	5.38	6.37	5.90
Stoppage delay per km	Hours/km	0.0025	0.0030	0.0028
Stoppage expenses	Rs./tonne-km	0.13	0.20	0.15
Trip expenses	Rs./tonne-km	0.97	1.07	1.02
Freight rate	Rs./tonne-km	1.42	1.84	1.56
Contribution margin	%	36.46	81.74	53.68

Table 7 compares the 2008-09 survey with the 2011-12 survey based on some important statistics.

Table 7: Comparison between the 2008-09 and 2011-12 Surveys

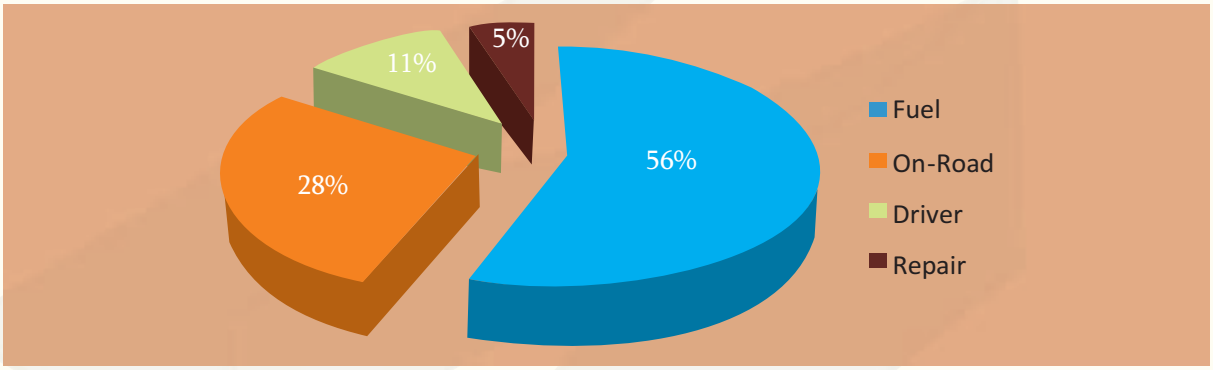
Parameter	Unit	2008-09 Average	2011-12 Average
Journey time	Hours	102.18	94.47
Average speed	Km/hour	21.73	22.71
Mileage	Km/Lt	3.6	4.06
No. of stops	—	25.30	30.33
No. of toll stops	—	15.47	21.13
Stoppage delay per km	Hours/km	0.0024	0.0028
Toll delay per km	Hours/km	0.0012	0.0019
Stoppage expenses	Rs./tonne-km	0.15	0.15
Toll expenses	Rs./tonne-km	0.07	0.11
Trip expenses	Rs./tonne-km	0.99	1.02
Freight rate	Rs./tonne-km	1.39	1.56
Contribution margin	%	40.40	53.68

It may be observed from Table 7 that in 2011-12, there have been marginal improvements in terms of the average journey time, average speed and mileage. On the other hand, the average number of stops and stoppage delay per km due to RTO, toll, octroi, sales tax, entry tax etc. have worsened. The average number of toll stops as a percentage of the average number of stops has increased from 61.15% to

69.67%. Also, the average toll delay per km as a percentage of the average stoppage delay per km has increased from 50% to 67.86%. Although the average stoppage expenses per tonne-km have remained the same, the average toll expenses per tonne-km as a percentage of the average stoppage expenses per tonne-km have increased from 46.67% to 73.33%. Therefore, it is imperative that toll stops and toll expenses have been making increasing contributions to stoppage delays and stoppage expenses, respectively, over the years. Rationalizing the toll structure and improving the toll collection infrastructure, both stoppage delays and stoppage expenses can be reduced. It is also observed from Table 7 that while the average trip expenses per tonne-km have increased marginally, the freight rate per tonne-km has increased by 12.23%, resulting in an increase in the contribution margin from 40.40% to 53.68%.

Figure 2 shows the composition of trip expenses including fuel cost, on-road stoppage and other expenses, driver's wage/allowance, and maintenance/repair cost.

Figure 2: Composition of trip expenses



The composition is almost the same as in the 2008-09 survey with fuel cost being the largest (56%) contributor to trip expenses.

10.1.1 Allocation of overhead expenses

Based on the data on the annual distance-specific and time-specific overhead expenses for a 15-tonne truck as shown in Table 8, the overhead expenses to be allocated to individual trips are determined, which are then added to the variable trip expenses to obtain the actual trip expenses including overheads.

Table 8: Annual overhead expenses for a 15-tonne truck

Overhead	Unit	Expense
Distance-specific overhead		
Lubricants	Rs.	19,200
Spares	Rs./km	0.16
Tyres	Rs./km	2.67
Time-specific overhead		
Staff/Admin	Rs.	43,000
Depreciation	Rs.	288,000
Interest	Rs.	108,000
Tax/Insurance	Rs.	44,000
Annual vehicle utilization and operating hours		
Vehicle utilization	Km	120,000

The annual cost of lubricants is Rs. 19,200, which divided by the annual vehicle utilization of 120,000 km gives the cost of lubricants per km, i.e. Rs. 0.16/km. Similarly the annual cost of spares is also Rs. 19,200, which again gives Rs. 0.16/km as the cost of spares per km. For a 15-tonne truck, 10 tyres, which run 60,000 km, cost Rs, 160,000 giving Rs. 2.67/km as the cost of tyres per km. Therefore, the distance-specific overhead cost is Rs. 3/km, which divided by the truck capacity of 15 tonnes gives Rs. 0.20/km as the distance-specific overhead cost per tonne-km.

The break-up of the annual staff and administrative expenses of Rs. 43,000 is as follows: Rs. 25,000 towards the annual staff salary and Rs. 18,000 towards National Permit and other annual administrative expenses. The annual depreciation and interest charges are 16% and 6%, respectively, of the purchase price of a 15-tonne truck, i.e. Rs. 18 lakh. Finally, the break-up of the annual tax and insurance expenses of Rs. 44,000 is as follows: Rs. 13,000 towards tax and fitness and Rs. 31,000 towards insurance. Therefore, the annual time-specific overhead cost for a 15-tonne truck is Rs. 483,000, which divided by the annual operating hours gives the time-specific overhead cost per hour, i.e. Rs. 80.5/hour. For a particular trip, this figure is multiplied by the journey time, and then divided by the distance travelled and the capacity of the truck to obtain the time-specific overhead cost per tonne-km for that trip. To give an example, if the journey time is 96 hours and the distance travelled is 2,087 km for a trip, the time-specific overhead cost is Rs. (80.5 x 96)/(15x 2,087) per tonne-km, i.e. Rs. 0.25/tonne-km for that trip.

The average distance-and time-specific overhead cost for 30 roundtrips comes out to be Rs. 0.44/tonne-km. Adding the same with the average trip expenses of Rs. 1.02/tonne-km, the average overall trip expenses including overheads become Rs. 1.46/tonne-km. Considering the average freight rate of Rs. 1.56/tonne-km, the profit margin turns out to be 6.8% (or 6.4% revenue margin). The figure is indicative of the margins that transporters generally make. However, the actual profit margin depends on a host of factors such as the route, commodity, time of year, and the transport markets at the origin and the destination. Table 9 shows the summary statistics in terms of the trip expenses including overheads, freight rate and profit margin for the 30 roundtrips.

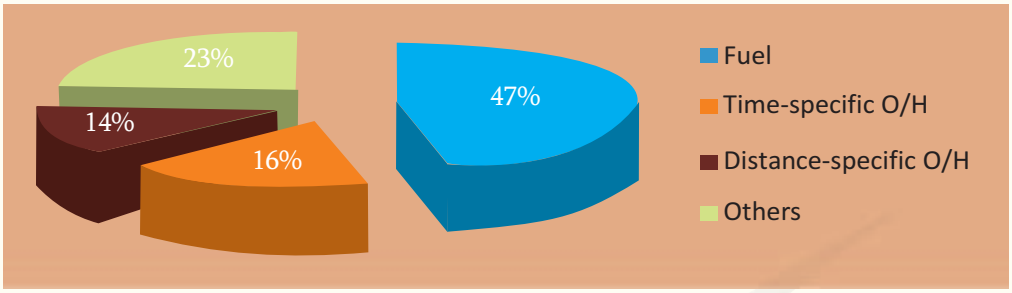
Table 9: Trip expenses including overheads, freight rates and profit margins

Parameter	Unit	Minimum	Maximum	Average
Trip expenses including overheads	Rs./tonne-km	1.41	1.48	1.45
Freight rate	Rs./tonne-km	1.42	1.84	1.56
Profit margin	%	-3.40	26.29	7.49

It was observed from the data that 2 out of the 30 roundtrips did actually incur "losses" when overhead costs were included.

Figure 3 shows the composition of trip expenses including overheads.

Figure 3: Composition of trip expenses including overheads (O/H)



The above observation is more or less similar to that from the 2008-09 survey, i.e. fuel and overheads constitute the major portions of the trip expenses, contributing 47% and 30%, respectively.

10.1.2 Cost of delay

The cost of additional fuel consumption has already been taken into consideration by the actual fuel expenses for a trip. However, the other components of the cost of delay have to be ascertained based on the additional data presented in Table 10.

Table 10: Additional data required for estimating delay cost components

Parameter	Unit	Value
Annual profit	Rs.	250,000
Cost of capital	Re/Year	0.10

The annual profit, interest charges, depreciation, tax and insurance together amount to Rs. 690,000, which, divided by the annual operating hours (6,000 hours), gives the cost of delay per hour, i.e. Rs. 115/hour. When the driver has to be paid an additional daily allowance due to delay, the same also has to be accounted for. Table 11 shows the summary statistics in respect of trip expenses and contribution margins with the addition of the costs of delay.

Table 11: Trip expenses and contribution margins including the costs of delay

Parameter	Unit	Minimum	Maximum	Average
Cost of delay	Rs./hour	115	151.04	123.89
Trip expenses	Rs./tonne-km	0.99	1.09	1.04
Increase in trip expenses	%	1.88	2.83	2.24
Real contribution margin	%	33.95	76.84	50.30

The average cost of delay is Rs. 123.89/hour and the average trip expenses after including the costs of delay are Rs. 1.04/tonne-km, which is merely 2.24% more than the trip expenses without accounting for the costs of delay (Rs. 1.02/tonne-km). Also, the contribution margin reduces slightly from 53.68% to 50.30%. The observations are in line with those from the 2008-09 survey.

To include the shipper's inventory carrying cost due to delay, the value of commodity is multiplied by the cost of capital and the delay time, and then added to the aforementioned cost of delay to obtain

the per hour cost of delay inclusive of the additional inventory carrying expenses borne by the shipper. The average cost of delay including the shipper's expenses is Rs. 150.75/hour. The figure may seem insignificant; however, the effect of delay on the economy may not be insignificant. Considering the average annual operating hours of a goods vehicle on Indian roads to be 5,000 hours of which 6% or 3 0 0 hours are spent on various types of stoppage delays, and the cost of delay to be Rs. 150/hour, the annual cost of delay for a goods vehicle is Rs. 45,000. If there are 6 million goods vehicles, the annual cost of delay to the Indian economy is a whopping Rs. 270 billion or USD 5.5 billion!

10.1.3 Cost of additional fuel consumption

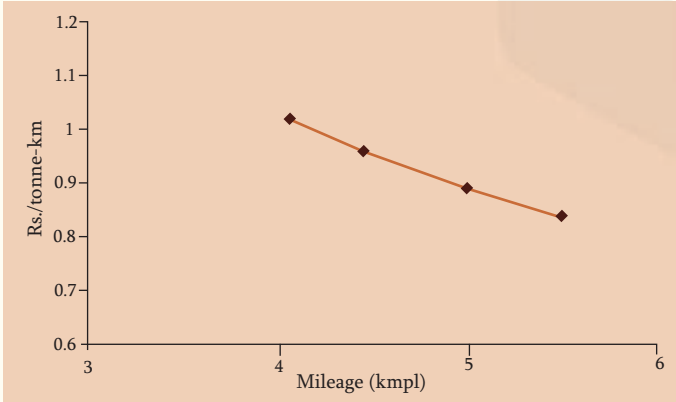
Additional fuel is consumed due to poor road conditions, slow speed of vehicles and idling at stoppages. If vehicles are made more fuel efficient, road conditions are improved and stoppage delays are minimized, vehicles will have more mileage, leading to lower trip expenses and higher contribution margins. A sensitivity analysis was carried out to ascertain the effect of increased mileage on trip expenses and contribution margins. According to the given data for 30 roundtrips, the average mileage of vehicles was 4.06 kmpl, average trip expenses were Rs. 1.02/tonne-km and contribution margin was 53.68%.

It was observed that the maximum mileage achieved across 30 roundtrips was 4.45 kmpl. Had all the trips achieved the same mileage, i.e. 4.45 kmpl, the average trip expenses would have come down to Rs. 0.96/tonne-km and the average contribution margin would have gone up to 63.30%. The same sensitivity analysis was also carried out for 5 and 5.5 kmpl, which showed drastic reductions in average trip expenses and significant improvements in average contribution margins for higher mileage. Table 12 shows the effect of mileage on average trip expenses and contribution margins. Figure 4 shows the effect of mileage on average trip expenses.

Table 12: Effect of mileage on average trip expenses and contribution margins

Mileage	Average trip expenses	Average contribution margin
(kmpl)	(Rs./tonne-km)	(%)
4.06	1.02	53.68
4.45	0.96	63.30
5	0.89	75.78
5.5	0.84	86.25

Figure 4: Effect of mileage on average trip expenses



If mileage can be improved by increasing fuel efficiency, improving road conditions and reducing stoppage delays, the impact on the economy will be huge. To give an example, if Re 1/km can be saved due to increased mileage and if the average distance travelled by a goods vehicle in a year is 100,000 km, the annual saving realized by a goods vehicle would be Rs. 100,000. For 6 million goods vehicles, the saving to the economy would be of the order of Rs. 600 billion or USD 12 billion!

10.2 Findings of the Delhi-Mumbai route survey: Comparisons with the 2011-12 Delhi-Bangalore route survey

Table 13 shows the summary statistics for 30 round trips on the Delhi-Mumbai route.

Table 13: Summary statistics for the Delhi-Mumbai route

Parameter	Unit	Minimum	Maximum	Average
Distance	Km	1327	1412	1373.90
Journey time	Hours	51	78	65.13
Average speed	Km/hour	17.01	27.47	21.35
Mileage	Km/Lt	4	4.3	4.15
Loading/documentation time	Hours	0.50	19.25	2.83
No. of stops	–	18	18	18
Stoppage delay	Hours	2.18	4.25	3.33
Stoppage delay per km	Hours/km	0.0016	0.0030	0.0024
Stoppage expenses	Rs./tonne-km	0.20	0.26	0.22
Trip expenses	Rs./tonne-km	1.04	1.15	1.09
Freight rate	Rs./tonne-km	1.27	1.99	1.49
Contribution margin	%	10.31	86.71	36.95

Table 14 compares the 2008-09 survey with the 2011-12 survey for the Delhi-Mumbai route and the 2011-12 surveys for the Delhi-Mumbai and Delhi-Bangalore routes based on some important statistics.

Table 14: Comparisons between the 2011-12 surveys for the Delhi-Mumbai and Delhi-Bangalore routes

Parameter	Unit	Delhi-Mumbai Route 2011-12	Delhi-Bangalore Route 2011-12
		Average	Average
Journey time	Hours	65.13	94.47
Average speed	Km/hour	21.35	22.71
Mileage	Km/Lt	4.15	4.06
No. of stops	--	18	30.33
No. of toll stops	–	16	21.13
Stoppage delay per km	Hours/km	0.0024	0.0028
Toll delay per km	Hours/km	0.0019	0.0019
Stoppage expenses	Rs./tonne-km	0.22	0.15
Toll expenses	Rs./tonne-km	0.19	0.11
Trip expenses	Rs./tonne-km	1.09	1.02
Freight rate	Rs./tonne-km	1.49	1.56
Contribution margin	%	36.95	53.68

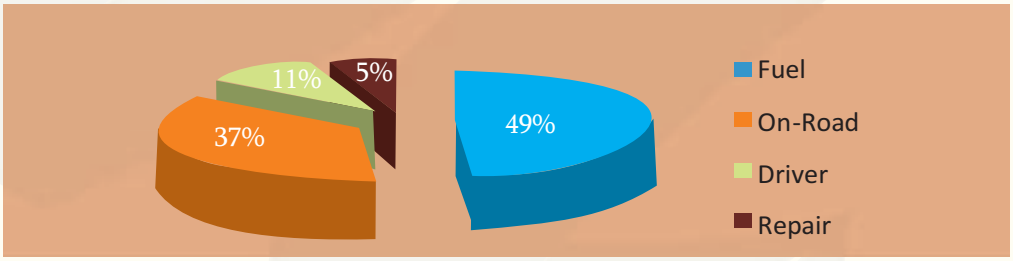
When the Delhi-Mumbai route is compared with the Delhi-Bangalore route, one may observe that the average speed and mileage are almost the same. However, the number of toll stops as a percentage of the total number of stops is higher for the Delhi-Mumbai route (88.89%) than for the Delhi-Bangalore route (69.67%). Toll delay per km as a percentage of stoppage delay is higher for the Delhi-Mumbai route (79.17%) than for the Delhi-Bangalore route (67.86%). Also, toll expenses as a percentage of stoppage expenses are higher for the Delhi-Mumbai route (86.36%) than for the Delhi-Bangalore route (73.33%).

Therefore, it seems that for the Delhi-Mumbai route, toll delays and toll collections make more significant contributions to stoppage delays and stoppage expenses, respectively, than for the Delhi-Bangalore route, which indicates that efforts should be put in to improve the toll collection infrastructure to reduce delays and rationalize the toll structure to reduce expenses on the Delhi-Mumbai route.

Average trip expenses per tonne-km are also higher for the Delhi-Mumbai route than for the Delhi-Bangalore route whereas average freight rates per tonne-km for the Delhi-Mumbai route are lower than the same for the Delhi-Bangalore route, resulting in a lower average contribution margin for the Delhi-Mumbai route. The reasons cited for the same were higher toll tax and fuel cost, lower import/export activities, and fluctuations in availabilities and rates of trucks on the Delhi-Mumbai route.

Figure 5 shows the composition of trip expenses including fuel cost, on-road stoppage and other expenses, driver's wage/allowance, and maintenance/repair cost.

Figure 5: Composition of trip expenses



It is observed from Figure 5 that fuel cost and on-road stoppage and other expenses are the major components of the trip expenses, contributing 49% and 37%, respectively.

10.2.1 Allocation of overhead expenses

Based on the data shown in Table 8, overhead expenses were computed according to the rationale presented thereafter. The overhead expenses were added to the trip expenses to get the actual trip expenses.

Table 15 shows the summary statistics in terms of the trip expenses including overheads, freight rate and profit margin for the 30 roundtrips.

Table 15: Trip expenses including overheads, freight rates and profit margins

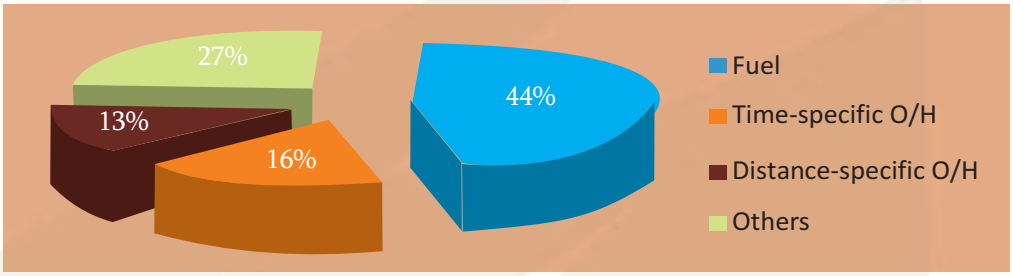
Parameter	Unit	Minimum	Maximum	Average
Trip expenses including overheads	Rs./tonne-km	1.45	1.65	1.54
Freight rate	Rs./tonne-km	1.27	1.99	1.49
Profit margin	%	-18.38	31.59	-3.42

It may be observed from Table 15 that even if the average contribution margin is 36.95%, the Delhi-Mumbai route has actually incurred an average loss of 3.42% when overheads were included. Out of the 30 roundtrips, 16 have actually resulted in "losses" while 15 out of these 16 trips were from Delhi to Mumbai.

It was also observed from the data that the average trip expenses for the 15 trips from Delhi to Mumbai were Rs. 1.11/tonne-km, which were more than the overall average of Rs. 1.09/tonne-km, and the average freight rate from Delhi to Mumbai was Rs. 1.33/tonne-km, which was lower than the overall average of Rs. 1.49/tonne-km, showing that the Delhi-Mumbai (one-way) route is less profitable than the Mumbai-Delhi (one-way) route. This also validates the fact that trip expenses and freight rates may vary depending on the route.

Figure 6 shows the composition of trip expenses including overheads.

Figure 6: Composition of trip expenses including overheads (O/H)



It may be observed from Figure 6 that fuel and overhead expenses contribute 44% and 29%, respectively, to the overall trip expenses.

10.2.2 Cost of delay

As for the Delhi-Bangalore route, the cost of delay for the Delhi-Mumbai route was also calculated, and the statistics related to trip expenses including the cost of delay and the real contribution margin are shown in Table 16.

Table 16: Trip expenses and contribution margins including the costs of delay

Parameter	Unit	Minimum	Maximum	Average
Cost of delay	Rs./hour	115	182.42	122.79
Trip expenses	Rs./tonne-km	1.06	1.18	1.11
Increase in trip expenses	%	1.15	3.01	1.82
Real contribution margin	%	8.26	83.08	34.51

The average cost of delay is Rs. 122.79/hour. Average trip expenses increase by 1.82% to Rs. 1.11/tonne-km and the average contribution margin decreases from 36.95% to 34.51%. If the shipper's inventory carrying cost due to delay is included, the cost of delay becomes Rs. 147.05/hour. As already estimated before, the cost to the economy due to delay runs into billions of rupees.

10.2.3 Cost of additional fuel consumption

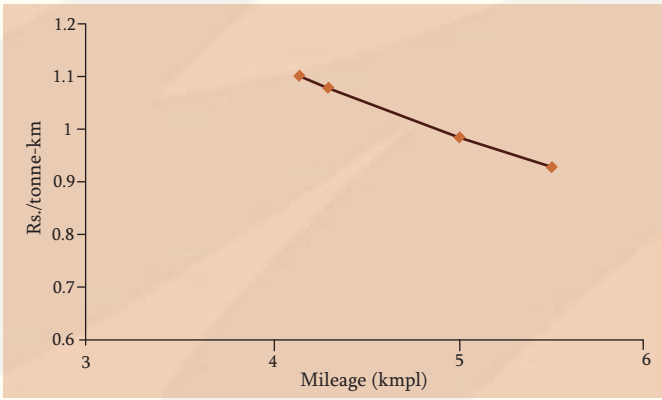
The average trip expenses and contribution margin were Rs. 1.09/tonne-km and 36.95%, respectively, for an average mileage of 4.15 kmpl. The maximum mileage that was achieved on 30

roundtrips on this route was 4.30 kmpl. A sensitivity analysis was carried out to check the impact of increasing mileages of 4.30, 5 and 5.5 kmpl on the average trip expenses and contribution margin. Table 17 shows the effect of mileage on average trip expenses and contribution margins. Figure 7 shows the effect of mileage on average trip expenses.

Table 17: Effect of mileage on average trip expenses and contribution margins

Mileage (kmpl)	Average trip expenses (Rs./tonne-km)	Average contribution margin (%)
4.15	1.09	36.95
4.30	1.07	39.90
5	0.98	52.92
5.5	0.92	61.31

Figure 7: Effect of mileage on average trip expenses



Again, if mileage can be improved, that might save billions of U.S. dollars in foreign exchange for the import of crude oil.

10.3 Findings of the other 15 routes survey

Tables A.1 – A.15 in the Annexure show the summary statistics for the other 15 routes. Out of these 15 routes, 8 routes were also covered in the 2008-09 survey. For these 8 routes, comparisons between the 2008-09 and 2011-12 survey data were also made, which showed mixed results. For example, while the average speed has increased for 2 routes, the same has decreased for 6 other routes. The average mileage has marginally improved for 6 routes while the same has decreased for 2 routes.

The average stoppage delay per km has shown improvement across 7 routes while on 1 route, it has increased. Similarly, the average stoppage expenses per km have shown improvement across 5 routes while on the 3 other routes, there has been deterioration of the same. Average trip expenses and freight rates per tonne-km have expectedly increased for all the 8 routes.

The average contribution margin, on the other hand, has increased for 4 routes and deteriorated for the rest of the routes. However, since only 4 roundtrip data are available for each of these 8 routes, it may be difficult to draw any general conclusion.

Table 18 compares among the 17 routes with respect to some key parameters. These 17 routes are high-volume routes representing freight transportation by road in India. Therefore, for each parameter, the average has been computed across all the 17 routes, which is indicative of the national average for that parameter.

Table 18: Comparison among 17 major routes

Parameter / Route	Avg. speed (kmph)	Avg. mileage (kmpl)	Avg. delay per km (Hrs/km)	Avg. stoppage expenses (Rs./tonne/km)	Avg. trip expenses (Rs./tonne/km)	Avg. freight rate (Rs./tonne/km)	Avg. contribution margin (%)
Delhi-Bangalore	22.71	4.06	0.0028	0.15	1.02	1.56	53.68
Delhi-Mumbai	21.35	4.15	0.0024	0.22	1.09	1.49	36.95
Delhi-Chennai	19	3.91	0.0021	0.08	0.98	1.64	66.44
Delhi-Kolkata	25.02	3.84	0.0023	0.19	1.17	1.37	17.09
Mumbai-Chennai	17.9	3.87	0.0019	0.17	1.19	1.69	42.26
Mumbai-Kolkata	17.91	3.69	0.006	0.43	1.4	1.57	12.14
Chennai-Kolkata	23.84	4.54	0.002	0.15	1.01	1.45	44.05
Indore-Guwahati	16.57	3.56	0.002	0.11	1.17	1.67	43.51
Pune-Hyderabad	22.07	4.34	0.0027	0.17	1.38	1.77	28.65
Ahmedabad-Coimbatore	17.86	4	0.0049	0.14	1.06	1.58	49.21
Ahmedabad-Bangalore	17.09	4.03	0.0053	0.11	1.07	1.57	46.09
Ahmedabad-Delhi	21.05	4.9	0.0033	0.13	0.82	1.16	40.73
Bangalore-Mumbai	24.57	3.51	0.0038	0.24	1.22	2.11	75.14
Guwahati-Delhi	15.13	3.92	0.0029	0.1	0.97	1.52	57.35
Hyderabad-Delhi	16.7	4.04	0.0014	0.13	1.02	1.56	52.3
Kolkata-Bangalore	13.55	3.57	0.0067	0.13	1.13	1.6	41.73
Nagpur-Delhi	23.38	3.44	0.0018	0.1	1.05	1.67	59.08
National Average	19.75	3.96	0.0032	0.16	1.1	1.59	45.08

Different routes show different characteristics. However, some of the noticeable aberrations are as follows. The average delay per km is on the higher side for the Mumbai-Kolkata, Ahmedabad-Coimbatore, Ahmedabad-Bangalore, Bangalore-Mumbai and Kolkata- Bangalore routes. Average stoppage expenses per tonne-km are higher for the Mumbai-Kolkata route. Average trip expenses per tonne-km are higher for the Delhi-Kolkata, Mumbai-Chennai, Mumbai-Kolkata, Indore-Guwahati, Pune-Hyderabad and Bangalore-Mumbai routes. Average freight rates per tonne-km, on the other hand, are on the lower side for the Delhi-Kolkata route. These aberrations are mostly caused by external factors such as poorer road conditions, more number of stops and higher delays, higher stoppage and other on-road expenses, and lower freight rates due to fluctuations in demand and supply of trucks in the origin and destination markets. However, caution should be exercised in drawing any general inference since except for the Delhi-Bangalore and Delhi-Mumbai routes, for each of the other 15 routes, data are available only for 4 roundtrips.

11. Conclusions and recommendations

The 2011-12 survey is a sequel to the 2008-09 survey. In 3 years, no appreciable differences in parameters related to the operational efficiency of freight transportation by road have been observed. Although it seems that the mileage of vehicles has marginally improved, the average speed of vehicles, stoppage delay per km and stoppage expenses per tonne-km have more or less remained at the same level. Average trip expenses and freight rates per tonne-km have, of course, increased due to inflation. Average contribution and profit margins, on the other hand, show no specific trend and depend on the route under consideration. One observation, specific to the Delhi-Bangalore and Delhi-Mumbai routes, which were surveyed in detail, was of importance, i.e. on these routes, it was found that the number of toll stops as a percentage of the total number of stops, toll delay as a percentage of the total stoppage delay and toll expenses as a percentage of the total stoppage expenses were higher in 2011-12 than in 2008-09. This observation indicates the growing contributions of toll delays and toll expenses to total stoppage delays and total stoppage expenses, respectively.

While in the 2008-09 survey, the trucking industry and road vs. rail transportation of freight were analyzed in detail, the focus of the 2011-12 survey was on public-private partnerships (PPP) in road projects, electronic toll collection (ETC), access-controlled highways and logistics parks/hubs. Investments to the tune of billions of dollars are needed for building and maintenance of roads. Budgetary provisions made by the Government and borrowings from banks and financial institutions are not sufficient to meet the projected expenses.

Therefore, private participation in road projects in the form of PPP has become extremely important. It is expected that more than 50% of the investment in the road sector during the 11th Five-Year Plan will be received from the private sector. Also, all NHDP projects will henceforth be implemented in the PPP mode. However, there are some concerns with regard to the profitability of these projects.

Apart from giving economic incentives to the private sector for PPP projects, the Government should also adequately address the concerns with respect to the demand and utilization of toll roads, toll collection and profit margins. In connection with toll collection, as mentioned before, toll delays and toll expenses are making higher contributions to stoppage delays and stoppage expenses, respectively. Therefore, toll delays have to be reduced by introducing ETC and toll structures have to be rationalized to minimize toll leakages and maximize revenue collection. There are, however, issues such as cost implications for users and toll operators, interoperability of different ETC systems etc., which need to be addressed before the implementation of ETC.

India has a negligible stretch of expressways whereas China boasts of the second largest expressway network in the world. Expressways are the highest class of roads with access control for slow-moving vehicles, pedestrians and animals. Since most of the Indian roads and highways are accessible to two-wheelers, three-wheelers, bicycles, pedestrians, animals, hand-carts, cattle-driven carts etc., vehicles cannot pick up speed and also there are frequent fatal accidents.

Therefore, India needs to build a network of access controlled expressways, which require massive investments. It is expected that a major portion of the financial outlay would be contributed by the private sector in the PPP mode. Finally, the importance of logistics parks/hubs has been highlighted.

Logistics parks differ from ordinary warehouses in terms of offering value-added services shared by multiple users. Benefits accrued to users include cost savings through economies of scale and scope, efficient use of multi-modal transportation, and availability of value added services under one roof. The scale of Indian logistics parks is very small compared to the same in China and other developed Asian countries. India needs to scale up its logistics parks and clearly differentiate them from ordinary warehouses if it wants to compete with the logistics parks in Hong Kong, Shanghai, Singapore and Dubai to capture a reasonable share of international cargo. There are some existing and promising hubs, which have already been identified based on their locations, proximity to economic and industrial activities, and connectivity by rail, road etc.

The Ministry of Railways has also proposed to set up a number of multi-modal logistics parks along the dedicated freight corridor. However, there are some concerns such as the low level of containerization of cargo in India and the required investment for setting up logistics parks. For logistics parks to be successful, the scale of containerization of cargo has to increase. Therefore, the Government has to play an active role in setting up more CFS and ICD to promote the containerization of cargo. To build and operate logistics parks, investments from the private sector would have to be sought in the PPP mode with appropriate economic incentives. Lastly, the potential of Nagpur as an emerging air cargo and logistics hub has been discussed. Nagpur already boasts of a number of logistics parks because of its location and connectivity through rail, road and air. The proposed logistics hub, which is expected to be completed by 2035, will also include an integrated township and SEZ. If developed properly, Nagpur has the potential to emerge as the logistics hub not only for India but also for the South-East Asian region.

The 2011-12 study recommends the following, which should be read along with the recommendations made in the report on the 2008-09 survey.

- The study shows that freight volumes and vehicles are growing more rapidly than the growth of road lengths over the years, putting more pressure on the existing roads and seriously affecting their quality and maintenance. Therefore, the Government should pay immediate attention to the development of new roads, and widening and maintenance of the existing roads. However, these require massive financial outlays for which the Government must seek private investments in the PPP mode. To attract investments from the private sector, the Government, apart from offering economic incentives, should adequately address the concerns of the private sector in terms of uncertain traffic volumes, demand and revenue realization, toll structures and toll collection, political interference, and returns on investments.
- Now, NHAI acts as the regulator for roads and highways. In the context of private investments, an independent regulatory authority like TRAI should be set up to assess costs/benefits, service levels, safety measures and tariff structures.
- The study shows that on two major routes, toll delays and toll expenses are making higher contributions to stoppage delays and stoppage expenses, respectively, in 2011-12 than in 2008-09, necessitating a detailed examination of the toll collection activities at toll plazas. There is an urgent need for reducing toll delays and rationalizing the toll structure to divert more traffic to toll roads and plug leakages. The solution to the problem of toll delays is to gradually move towards electronic toll collection (ETC) systems. The majority of Indian toll plazas employ manual toll collection and only a handful of them are equipped with ETC. There are some

concerns, however, regarding the deployment of ETC such as cost implications for users and toll operators, inter-operability of different ETC systems etc., which need to be taken care of. The Committee chaired by Mr. Nandan Nilekani recommended the use of the passive RFID technology, which is not only fast becoming the global standard, but also less expensive and less complex to implement. The Committee recommended gradual conversion of the existing manual tolling systems into ETC and building subsequent toll plazas with ETC capabilities. The Government has accepted the recommendations of the Committee for implementation of ETC in India. Implementation of ETC will not only reduce toll delays, but also reduce fuel consumption and environmental pollution. To address the issue of rationalizing the toll structure, an independent regulatory authority need to be set up, as already mentioned before.

- India needs to build a large access-controlled expressway network with ITS capabilities for improved road safety and security. The proposed expressway projects may be taken up with private participation in the PPP mode. The Government should facilitate by acquiring the land, providing the basic infrastructure and giving quick approvals besides extending economic incentives such as exemptions from taxes and duties. Revenues may be realized through toll collection and property development in the vicinity of the expressways. Also, a National Expressway Authority of India (NEAI), in line with NHAI, should be set up for construction, operation and maintenance of the expressways.

- India needs to build large-scale logistics parks and scale up the existing parks in order to compete with the logistics parks in Hong Kong, Shanghai, Singapore and Dubai for international cargo. New logistics parks should be built in the PPP mode with economic incentives such as waiver of taxes and duties for the private sector. Logistics parks not only lead to economic development and generate employment, but also promote multi-modal transportation including the use of railways to increase efficiency and reduce pollution. Nagpur, on the other hand, should be developed as an international air cargo hub since Nagpur has the potential to emerge as the logistics hub not only for India but also for the entire South-East Asian region.

- Presently, in India, freight transportation is heavily tilted towards roads, which carry about 60% of the total freight volumes whereas railways carry about 35% of the total freight volumes. The trend is different in the U.S. and China where railways carry about 47-48% of the total freight volumes. According to a report by McKinsey & Company[4], the ideal modal mix for India should be evenly balanced between roads and railways, each carrying about 46-47% of the total freight volumes. Multi-modal transportation should be encouraged where long distance transportation services may be provided by railways and the last-mile connectivity may be provided by roads. More use of railways, as mentioned before, is environment-friendly. However, multi-modal transportation needs the coordination among different ministries, i.e. Ministry of Road Transport and Highways, Ministry of Railways, Ministry of Shipping and Ministry of Civil Aviation. Ideally, an apex body should be set up with representations from different ministries to coordinate and facilitate the use of multi-modal transportation.

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13. Annexure: Summary statistics for 15 major routes

Table A.1: Summary statistics for the Delhi – Chennai route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	2300	2245
Journey time	Hours	109	117
Average speed	Km/hour	21	19
Mileage	Km/Lt	3.54	3.91
Loading/documentation time	Hours	6	1.06
No. of stops	—	16	16
Stoppage delay	Hours	8.54	4.67
Stoppage delay per km	Hours/km	0.0037	0.0021
Stoppage expenses	Rs./tonne-km	0.11	0.08
Trip expenses	Rs./tonne-km	0.93	0.98
Freigt rate	Rs./tonne-km	NA	1.64
Contribution margin	%	NA	66.44

Table A.2: Summary statistics for the Delhi – Kolkata route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	1497	1467
Journey time	Hours	108	115
Average speed	Km/hour	27.73	25.02
Mileage	Km/Lt	3.63	3.84
Loading/documentation time	Hours	2.75	3
No. of stops	—	18	26
Stoppage delay	Hours	22.38	6.27
Stoppage delay per km	Hours/km	0.0148	0.0023
Stoppage expenses	Rs./tonne-km	0.11	0.19
Trip expenses	Rs./tonne-km	0.84	1.17
Freight rate	Rs./tonne-km	1.12	1.37
Contribution margin	%	35.95	17.09

Table A.3: Summary statistics for the Mumbai – Chennai route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	1381.67	1389.75
Journey time	Hours	63.67	77.75
Average speed	Km/hour	21.75	17.9
Mileage	Km/Lt	3.45	3.87
Loading/documentation time	Hours	2.25	4.5
No. of stops	—	23.67	22.75
Stoppage delay	Hours	3.64	2.62
Stoppage delay per km	Hours/km	0.0026	0.0019
Stoppage expenses	Rs./tonne-km	0.20	0.17
Trip expenses	Rs./tonne-km	1.05	1.19
Freight rate	Rs./tonne-km	1.54	1.69
Contribution margin	%	47.71	42.26

Table A.4: Summary statistics for the Mumbai – Kolkata route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	2007.5	2078.25
Journey time	Hours	93.5	117.75
Average speed	Km/hour	21.64	17.91
Mileage	Km/Lt	3.16	3.69
Loading/documentation time	Hours	2.83	2.38
No. of stops	—	27	36.75
Stoppage delay	Hours	14.13	12.47
Stoppage delay per km	Hours/km	0.0071	0.0060
Stoppage expenses	Rs./tonne-km	0.20	0.43
Trip expenses	Rs./tonne-km	1.01	1.40
Freight rate	Rs./tonne-km	1.27	1.57
Contribution margin	%	7.29	12.14

Table A.5: Summary statistics for the Chennai – Kolkata route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	1700	1763.5
Journey time	Hours	96	74
Average speed	Km/hour	17.75	23.84
Mileage	Km/Lt	4	4.54
Loading/documentation time	Hours	2.5	4.25
No. of stops	—	28	30
Stoppage delay	Hours	4.5	3.46
Stoppage delay per km	Hours/km	0.0026	0.0020
Stoppage expenses	Rs./tonne-km	0.17	0.15
Trip expenses	Rs./tonne-km	1.01	1.01
Freight rate	Rs./tonne-km	0.98	1.45
Contribution margin	%	3.28	44.05

Table A.6: Summary statistics for the Indore – Guwahati route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	2176	2214.25
Journeytime	Hours	130	133.75
Average speed	Km/hour	16.75	16.57
Mileage	Km/Lt	3.66	3.56
Loading/documentation time	Hours	3.5	1.38
No. of stops	—	19	16
Stoppage delay	Hours	32.41	4.43
Stoppage delay per km	Hours/km	0.0149	0.0020
Stoppage expenses	Rs./tonne-km	0.18	0.11
Trip expenses	Rs./tonne-km	1.03	1.17
Freight rate	Rs./tonne-km	1.42	1.67
Contribution margin	%	37.56	43.51

Table A.7: Summary statistics for the Pune – Hyderabad route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	615	651.25
Journey time	Hours	28.5	29.5
Average speed	Km/hour	21.88	22.07
Mileage Km/Lt	3.89	4.34	
Loading/documentation time	Hours	1.5	1.19
No. of stops	—	9	12
Stoppage delay	Hours	2.13	1.75
Stoppage delay per km	Hours/km	0.0034	0.0027
Stoppage expenses	Rs./tonne-km	0.15	0.17
Trip expenses	Rs./tonne-km	1.00	1.38
Freight rate	Rs./tonne-km	1.77	1.77
Contribution margin	%	79.26	28.65

Table A.8: Summary statistics for the Ahmedabad – Coimbatore route

Parameter	Unit	Average	
		2008-09	2011-12
Distance	Km	1919	1947.25
Journey time	Hours	63.5	109
Average speed	Km/hour	30.25	17.86
Mileage	Km/Lt	4.03	4
Loading/documentation time	Hours	3.5	1.81
No. of stops	—	15	28
Stoppage delay	Hours	4	9.62
Stoppage delay per km	Hours/km	0.0021	0.0049
Stoppage expenses	Rs./tonne-km	0.15	0.14
Trip expenses	Rs./tonne-km	1.02	1.06
Freight rate	Rs./tonne-km	1.42	1.58
Contribution margin	%	39.33	49.21

Table A.9: Summary statistics for the Ahmedabad – Bangalore route

Parameter	Unit	Average
Distance	Km	1585.25
Journey time	Hours	92.75
Average speed	Km/hour	17.09
Mileage	Km/Lt	4.03
Loading/documentation time	Hours	3.31
No. of stops	–	20
Stoppage delay	Hours	8.4
Stoppage delay per km	Hours/km	0.0053
Stoppage expenses	Rs./tonne-km	0.11
Trip expenses	Rs./tonne-km	1.07
Freight rate	Rs./tonne-km	1.57
Contribution margin	%	46.09

Table A.10: Summary statistics for the Ahmedabad – Delhi route

Parameter	Unit	Average
Distance	Km	939
Journey time	Hours	47.5
Average speed	Km/hour	21.05
Mileage	Km/Lt	4.9
Loading/documentation time	Hours	2.44
No. of stops	–	16
Stoppage delay	Hours	3.13
Stoppage delay per km	Hours/km	0.0033
Stoppage expenses	Rs./tonne-km	0.13
Trip expenses	Rs./tonne-km	0.82
Freight rate	Rs./tonne-km	1.16
Contribution margin	%	40.73

Table A.11: Summary statistics for the Bangalore – Mumbai route

Parameter	Unit	Average
Distance	Km	984.25
Journey time	Hours	41.25
Average speed	Km/hour	24.57
Mileage	Km/Lt	3.51
Loading/documentation time	Hours	2.75
No. of stops	–	22.5
Stoppage delay	Hours	3.74
Stoppage delay per km	Hours/km	0.0038
Stoppage expenses	Rs./tonne-km	0.24
Trip expenses	Rs./tonne-km	1.22
Freight rate	Rs./tonne-km	2.11
Contribution margin	%	75.14

Table A.12: Summary statistics for the Guwahati – Delhi route

Parameter	Unit	Average
Distanc	Km	2137.5
Journey time	Hours	142.5
Average speed	Km/hour	15.13
Mileage	Km/Lt	3.92
Loading/documentation time	Hours	1.69
No. of stops	–	14
Stoppage delay	Hours	6.16
Stoppage delay per km	Hours/km	0.0029
Stoppage expenses	Rs./tonne-km	0.10
Trip expenses	Rs./tonne-km	0.97
Freight rate	Rs./tonne-km	1.52
Contribution margin	%	57.35

Table A.13: Summary statistics for the Hyderabad – Delhi route

Parameter	Unit	Average
Distance	Km	1628
Journey time	Hours	97.5
Average speed	Km/hour	16.7
Mileage	Km/Lt	4.04
Loading/documentation time	Hours	3.75
No. of stops	–	14.25
Stoppage delay	Hours	2.25
Stoppage delay per km	Hours/km	0.0014
Stoppage expenses	Rs./tonne-km	0.13
Trip expenses	Rs./tonne-km	1.02
Freight rate	Rs./tonne-km	1.56
Contribution margin	%	52.30

Table A.14: Summary statistics for the Kolkata – Bangalore route

Parameter	Unit	Average
Distance	Km	1961
Journey time	Hours	144.75
Average speed	Km/hour	13.55
Mileage	Km/Lt	3.57
Loading/documentation time	Hours	2.5
No. of stops	–	34
Stoppage delay	Hours	13.13
Stoppage delay per km	Hours/km	0.0067
Stoppage expenses	Rs./tonne-km	0.13
Trip expenses	Rs./tonne-km	1.13
Freight rate	Rs./tonne-km	1.60
Contribution margin	%	41.73

Table A.15: Summary statistics for the Nagpur – Delhi route

Parameter	Unit	Average
Distance	Km	1166
Journey time	Hours	50
Average speed	Km/hour	23.38
Mileage	Km/Lt	3.44
Loading/documentation time	Hours	4.19
No. of stops	–	12
Stoppage delay	Hours	2.14
Stoppage delay per km	Hours/km	0.0018
Stoppage expenses	Rs./tonne-km	0.10
Trip expenses	Rs./tonne-km	1.05
Freight rate	Rs./tonne-km	1.67
Contribution margin	%	59.08

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