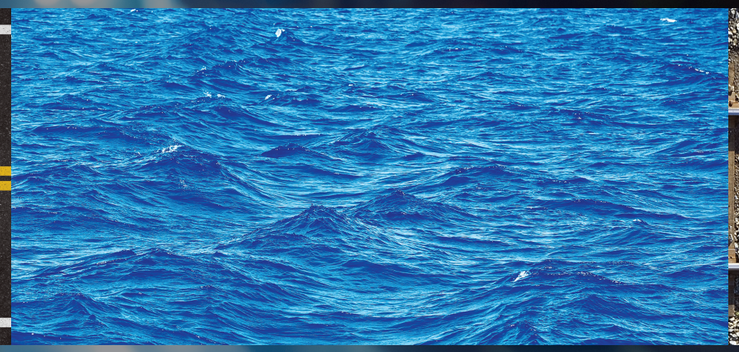
VOLUME III
SECTOR REPORTS
PART I

INDIA TRANSPORT REPORT

NTDPC INDIA TRANSPORT REPORT



MOVING INDIA TO 2032

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Government of India
National Transport Development
Policy Committee
भारत सरकार
राष्ट्रीय परिवहन विकास नीति समिति

January 31, 2014

Dear Hon'ble Prime Minister,

I have great pleasure in submitting to you the Report of the National Transport Development Policy Committee.

I regret very much the great delay in submission of this report. Covering all the transport sectors in detail, while also addressing the various cross cutting issues, entailed a large amount of technical work, which proved to be time consuming. Much of the sectoral work was accomplished through the appointment of corresponding working groups. We also examined international best practice to inform our work; consulted state governments and other stakeholders; and commissioned research studies and papers on specific topics.

Projecting transport requirements and policy over a twenty year horizon is a complex task. This was made more difficult in the current circumstances of an economic slowdown. In our projections we have, however, assumed that the pace of overall economic growth will return to its potential in the coming years and ensuing decades. Transport investment is a response to emerging demand, but it is also an economic growth driver in itself. Transport planning and provision therefore must be seen as central to the growth planning process. That all modes of the country's transport network are under severe pressure is clearly evident. It will be difficult to achieve the kind of growth envisaged if adequate transport investment is not made in an efficient and timely manner.

We find that there has been an accelerating shift of traffic from the railways in favour of roads, partly in response to the stepped up allocation of resources to the roads sector. A massive effort is now required to carry out a similar enhancement of investment in the railways, which will also involve very significant modernization and reorganization, and will also lead to greater environmental sustainability.

The next two decades will witness very significant changes in energy prices, in the discovery and application of new technologies, demographic shifts, and in consumer requirements and tastes in transport. Any projections and policy recommendations made now are almost certain to need modification over time. We have therefore emphasized the importance of institution building for transport governance and of the need for capacity building in the human resources area to raise the level of skills and professional knowledge in the sector, and for research and development. We have also placed special emphasis on institution building and measures for the promotion of safety in all transport modes, and for protection of the environment.

A particular focus of the report is highlighting the need to achieve much greater transportation integration with the South and South East Asia regions. In a world characterized by rapidly increasing economic linkages between countries our region stands out as being among the least integrated. This must be repaired.

Our vision is that a well-developed and competent institutional system for planning, management and execution of transport should be in place as soon as possible, as it blends investment in and delivery of transport services by the public, private and joint sectors alike. The Report abstracts from current methodologies to solve today's problems, while forging a coherent strategy for the transport sector as a whole and for each of the modes of travel.

To meet the needs of India in the 21st century, radical structural change is necessary along with a new strategy for investment.

I would like to acknowledge the generous help and time given by all Members of the NTDPC, the staff of the secretariat, and many other colleagues.

With warm regards,

Yours sincerely,

(Rakesh Mohan)

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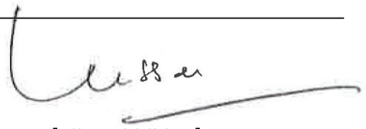

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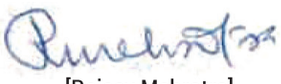

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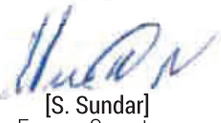

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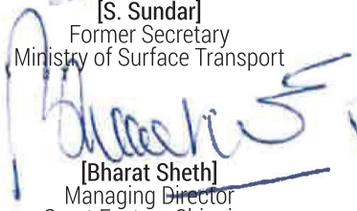

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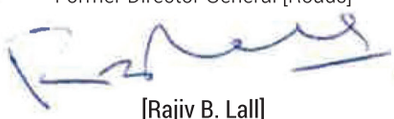

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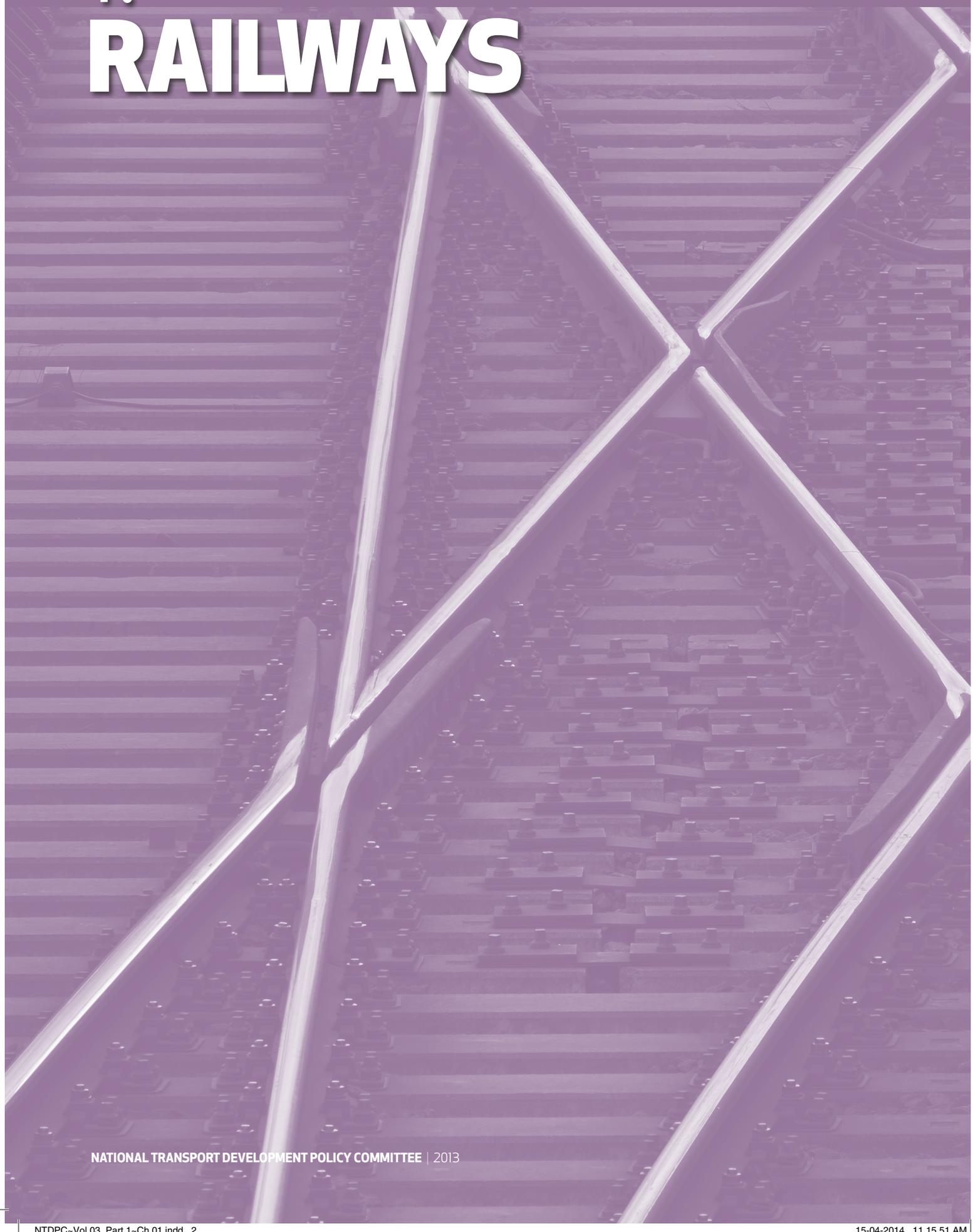
PART II

1. RAILWAYS



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1. RAILWAYS

Indian Railways (IR), managed directly by the Ministry of Railways, Government of India (GoI), is the third largest railway network in the world under a single management. With its network of 64,974 route km, IR has played a critical role in integrating markets and connecting communities throughout the length and breadth of the country.

INTRODUCTION

It is rightly referred to as 'the lifeline of the Indian economy' as it facilitates industrial and economic development by transporting materials such as coal, iron ore, fertilisers and foodgrains. It touches the lives of people in both tiny villages and urban metropolises and assists the evolution of social forces like urbanisation and inclusive development.

Railways in India are a tool for development, equity and integration of all parts to the mainstream. Railways are considered critical not only from the standpoint of connecting remote regions and providing affordable transportation services (especially passenger services) but also from the perspective of defence movements, (which cannot be passed on to the private sector) and meeting the transportation requirement in the wake of national emergencies and natural catastrophes. Given the strategic role played by railways in the transportation space, rail transportation has been one of the three areas reserved for public sector in successive industrial policies of the country (the others being atomic energy and defence).

IMPORTANCE OF RAILWAYS IN THE INDIAN TRANSPORT NETWORK

IR occupies a unique and crucial place in the country's transport infrastructure. Presently, it operates 19,000[1] trains a day, transporting 2.65 million tonnes of freight traffic and 23 million passengers. IR is the topmost rail passenger carrier (in terms of passenger km) and the fourth largest rail freight carrier in the world. During 2011-12, the freight loading by IR stood at 970 million tonnes, and the passengers transported, at 8.22 billion. The corresponding numbers in 1950-51 were 73.2 million tonnes and 1.28 billion respectively. Further, suburban traffic constitutes about 55 per cent of the total originating passengers and indicates the predominant role of IR in urban transport segment in the four metro cities of India. However, when viewed in terms of passenger kilometres—a measure of throughput—suburban transport makes up about 15 per cent of the total.

Over the years, the share of railways in freight and passenger transport has declined and road transport is emerging as the predominant mode for passenger and freight transport. The dominance of the road sector in freight transport in India is corroborated by two independent studies carried out by RITES Ltd[2]. and McKinsey[3]. Both the studies estimate the share of Railways in freight transport in Net Tonne Kilometres (NTKMs) in India to be around 36 per cent[4] (Tables 1.1 and 1.2). The modal share of railways in freight transport is much lower in India relative to other comparable large countries like the US and China whose share is close to 50 per cent (Table 1.2). Annex 1.1 summarises the railways' share of domestic freight for seven countries and highlights the country specific factors affecting the modal share of freight.

The RITES study also shows that over the years IR's share (in originating tonnage) has come down

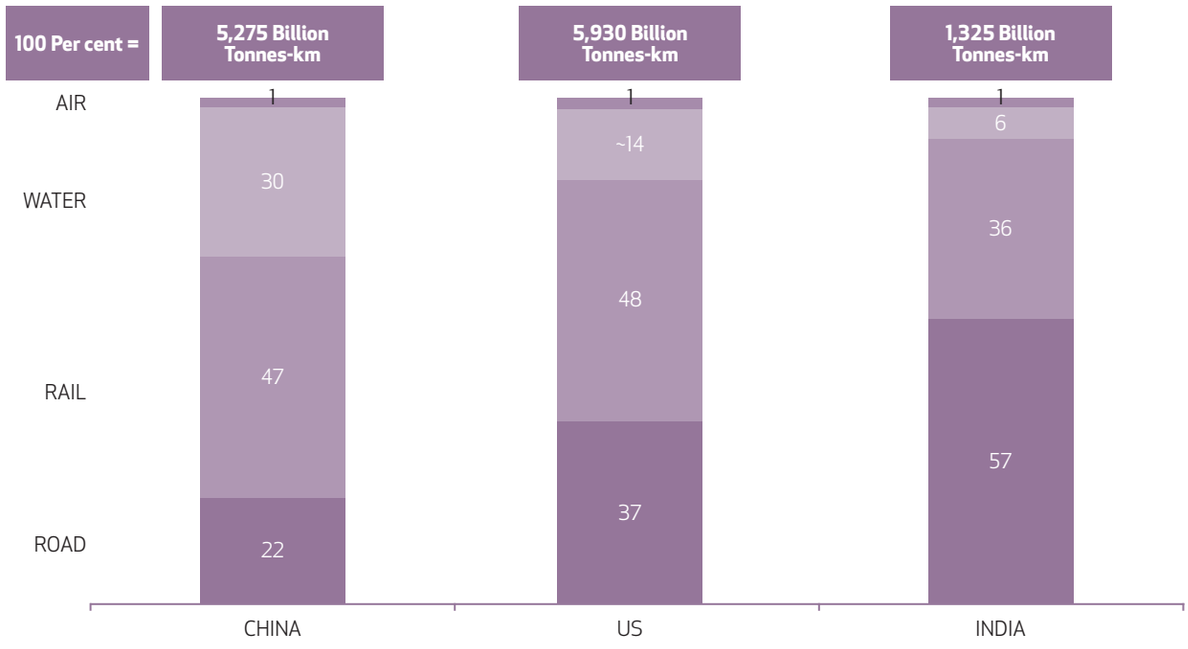
1. Comprising 12,000 passenger trains and 7,000 freight trains.
2. Total Transport System Study (TTSS) on traffic flows & modal costs carried out by RITES for Planning Commission, GoI.
3. McKinsey's Building India: Transforming the nation's Logistics Infrastructure, 2010.
4. It is estimated that the share of railways in freight transport has declined further to about 33 per cent in 2011-12.

Table 1.1
Mode Share in Freight Traffic (2007-08)

MODE	MODAL SHARE IN TOTAL ORIGINATING TRAFFIC		PERCENTAGE SHARE IN TOTAL TRANSPORT OUTPUT (PER CENT)	
	TONNES(MILLION)	NTKMs (BILLION)	TONNES	NTKMs
Rail*@	769	508	30	36
Highways (Road)@	1,559	706	61	50
Coastal Shipping	59	86	2.3	6
Airways	0.28	0.29	0.01	0.02
IWT	55	3.5	2.1	0.24
Pipelines	113	105	4.5	7.5
TOTAL	**2,555**	**1,409**	**100**	**100**

Source: Total Transport System Study (TTSS) by RITES Ltd. (for Planning Commission, GoI).
Note:
* Includes IR & KRC 'non-revenue' inter-regional traffic as well as NTPC's MGR traffic aggregating to 1.86 million tonnes and 26.1 million tonnes respectively.
@ Excluding intra-regional traffic of 96.6 MT by rail and 4640 MT assessed separately.

Table 1.2
Mode Share in Freight Traffic
(Per cent of NTKM)



Source: McKinsey's Building India: Transforming the nation's Logistics Infrastructure, 2010.
Note: Mode share estimated for 2007, excluding pipelines.

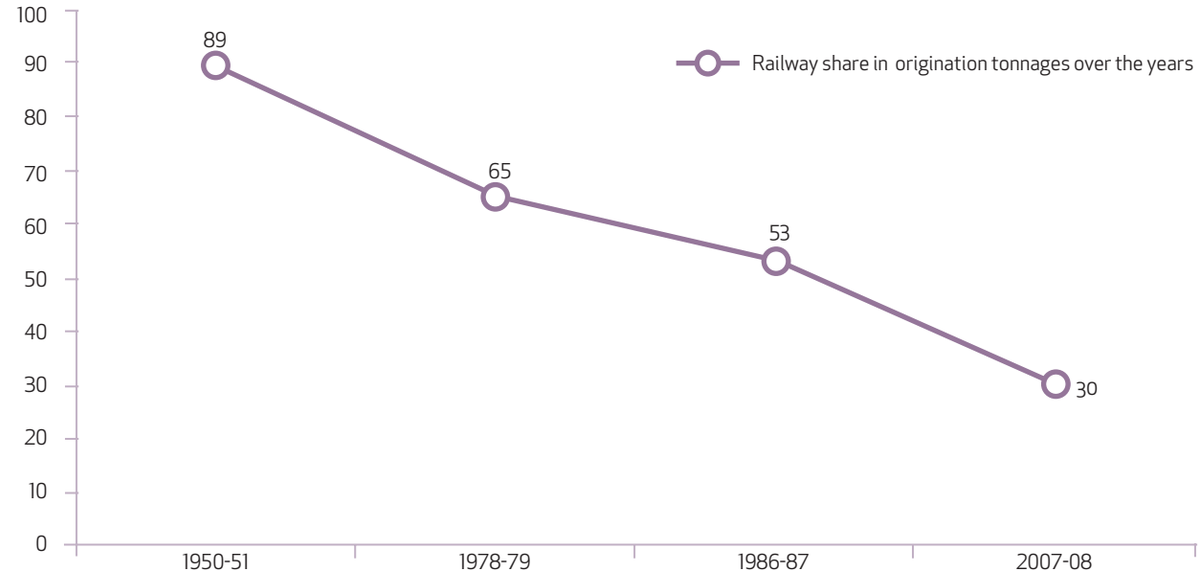
from 89 per cent in 1951 to 30 per cent in 2007-08 (Figure 1.1). A similar trend is observed in passenger transport, where the share of IR (in PKMs) has declined from 74.3 per cent in 1951 to 12.9 per cent in 2004-05, while the share of road has increased from 25.7 per cent to 86.7 per cent during the period[5] (Figure 1.2). While the accuracy of this number could be open to challenge, the broad conclusion that road transport accounts for an overwhelming share of the total passenger transport is beyond dispute.

UNBALANCED MODAL MIX AND COST TO THE ECONOMY

Studies show that excessive reliance of India's freight transport on the roadways is not sustainable from the standpoint of both logistics and resource cost to the economy. The McKinsey study shows that transportation by road is the most economical form of transport for distances up to 400 km. However, as distance increases rail and waterways become more economical. Given that close to 65 per cent of the

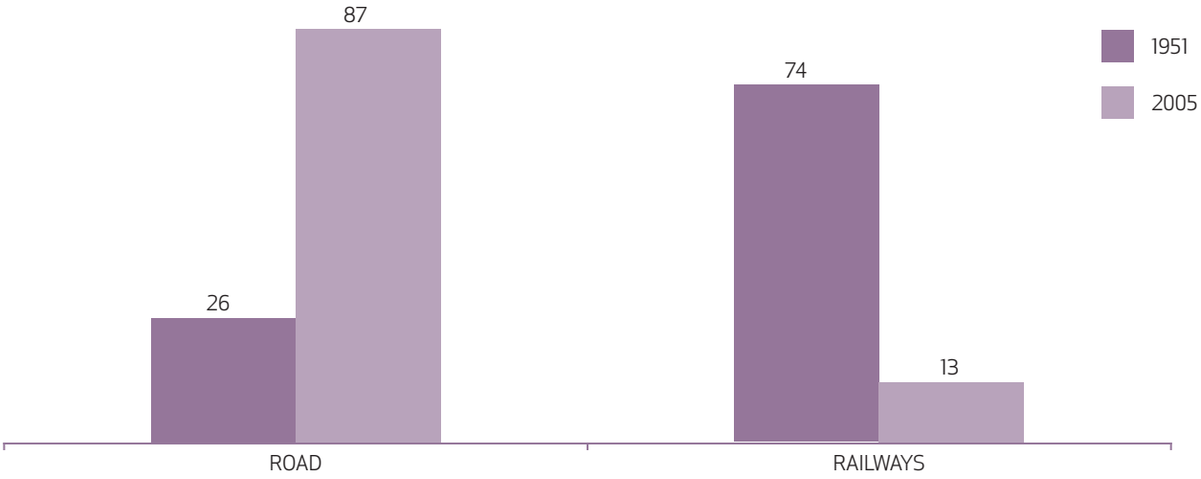
5. Report of the Working Group on Railways, NTDPC (2012).

Figure 1.1
Railways' Share in Originating Tonnage
[Per cent]



Source: Total Transport System Study (TTSS) by RITES Ltd. (for Planning Commission, GoI)

Figure 1.2
Relative Share: Passenger Transport
[Per cent]



Source: Report of the Working Group on Railways, NTDPC (2012).

India's freight traffic comprise bulk commodities and over 75 per cent (in NTKMs) is transported over distances of more than 400 km, it can be more economically served by rail and waterways[6].

The RITES Total Transport System Study (TTSS) has estimated the total resource costs associated with different modes of transport, on the basis of financial user costs as well as the social costs, and based thereon had carried out an optimisation exercise that would assign transport flows to different modes based on their total resource cost and break-even distances derived therefrom. The assessment of actual and optimal modal mix computed on the basis of this methodology is summarised in Table 1.3.

It shows that total throughput could increase by 44 billion tonne km (around 3 per cent) while cost of transportation could decrease by Rs 385 billion (constituting about 16 per cent of the total cost incurred on transportation during 2007-08), if the optimisation exercise could be undertaken in actual practice.

6. McKinsey and Company (2010).

Table 1.3
Actual vs Optimal Modal Mix (2007-08)

MODE	ACTUAL MODAL MIX			OPTIMAL MODAL MIX		
	FLOWS	COST	THROUGHPUT	FLOWS	COST	THROUGHPUT
	Million Tonnes	Billion Rs	Billion NTKM	Million Tonnes	Billion Rs	Billion NTKM
Rail	736	497	499	1,704	1,423	1,169
Road	1,559	1,556	692	591	245	66
Coastal	60	34	90	60	34	90
Total	**2,355**	**2,087**	**1,281**	**2,355**	**1,702**	**1,325**

Source: Total Transport System Study (TTSS) by RITES Ltd. (for Planning Commission, GoI).
Note: Coastal flows not subjected to the optimal analysis.

Table 1.4
Comparison of Environmental and Social Sustainability of Rail and Road Transport

Energy Consumption	• As compared to road, rail consumes 75 per cent to 90 per cent less energy for freight traffic and 5 per cent to 21 per cent less energy for passenger traffic
Financial Costs	• Unit cost of rail transport was lower than road transport by about Rs 2 per NTKM and Rs 1.6 per PKM (in the base year 2000)
Environmental Damage	• Rail transport emits 17 gram CO_2 equivalent per PKM as compared to 84 gram per PKM in case of road transport • Rail transport emits 28 gram CO_2 equivalent per NTKM as compared to 64 gram per NTKM in case of road transport
Accident Costs	• Accident costs on road are significantly higher than those on rail • For passenger transport, road accident costs are 45 times higher than rail • For freight transport, road accident costs are 8 times that of rail
Social Costs (All-Inclusive Costs)	• In terms of all-inclusive costs or social costs, railways have a huge advantage over road transport (the advantage is more in case of freight traffic) • For urban areas, the cost advantage of rail (in the base year 2000) was as much as Rs 2.8 per NTKM and Rs 1.7 per PKM • For non-urban areas, the cost advantage of rail (in the base year 2000) was as much as Rs 2.5 per NTKM and Rs 1.7 per PKM

Source: AITD report on 'Environmental and Social Sustainability of Transport- Comparative Study of Rail and Road' (2000); International Union of Railways (UIC); McKinsey's Building India: Transforming the nation's Logistics Infrastructure, 2010; Report of the Working Group on Railways (NTDPC).

However, the optimisation model should be used with due caution as it represents an extreme theoretical case, with the share of rail in total throughput estimated as 88 per cent.

Social and Environmental Costs: A number of studies carried out in the global context have established that railways are more energy-efficient and eco-friendly than other modes of transport (Table 1.4). Any shift of traffic from road to rail, especially in freight, would, therefore, result in substantial savings in energy consumption as well as reduced social costs. In view of the expected uncertainties related to the availability of future crude oil supplies, the attendant implications for energy prices, and the adverse environmental impact of fossil fuels, it is essential that an attempt be made to maintain the recommended modal mix in favour of railways. This requires making a strategic decision in terms of the relative allocation of resources between rail and road, and accompanying pricing and taxation policies which can then be used to nudge transport demand towards the desired modal shares.

NEED FOR A STRATEGIC PLAN FOR IR

India needs an efficient and sustainable transport infrastructure to sustain the pace of economic growth. The quality, capacity and performance of railways would be of crucial importance in this regard. Roads are the dominant mode of transportation in India today (for both passenger and freight traffic), while IR has been suffering from severe capacity constraints and remains underinvested.

Figure 1.3
Mode Share in Freight: 2010 to 2020

Source: McKinsey's Building India: Transforming the Nation's Logistics Infrastructure, 2010.

The road sector has witnessed a surge in investments (both public and private) as the government launched the ambitious National Highways Development Project (NHDP).

IR is uniquely placed to serve the needs of the rapidly expanding and modernising Indian economy and meet the aspirations of the country. It is imperative for IR to draw out a strategic plan/programme so as to restore the balance in intermodal mix, as the current trajectory will reduce the share of railways in freight transport to 25 per cent by 2020 (Figure 1.3). IR has to institutionalise a strategic planning process taking a forward view over the next 20 years. The strategic plan has to be necessarily prepared involving the Zonal Railways and key stakeholders and will clearly lay down the goals to be aimed at and attained and the path to be traversed. A multi-year investment plan fully supported by a credible funding plan will form the bedrock of the strategic plan.

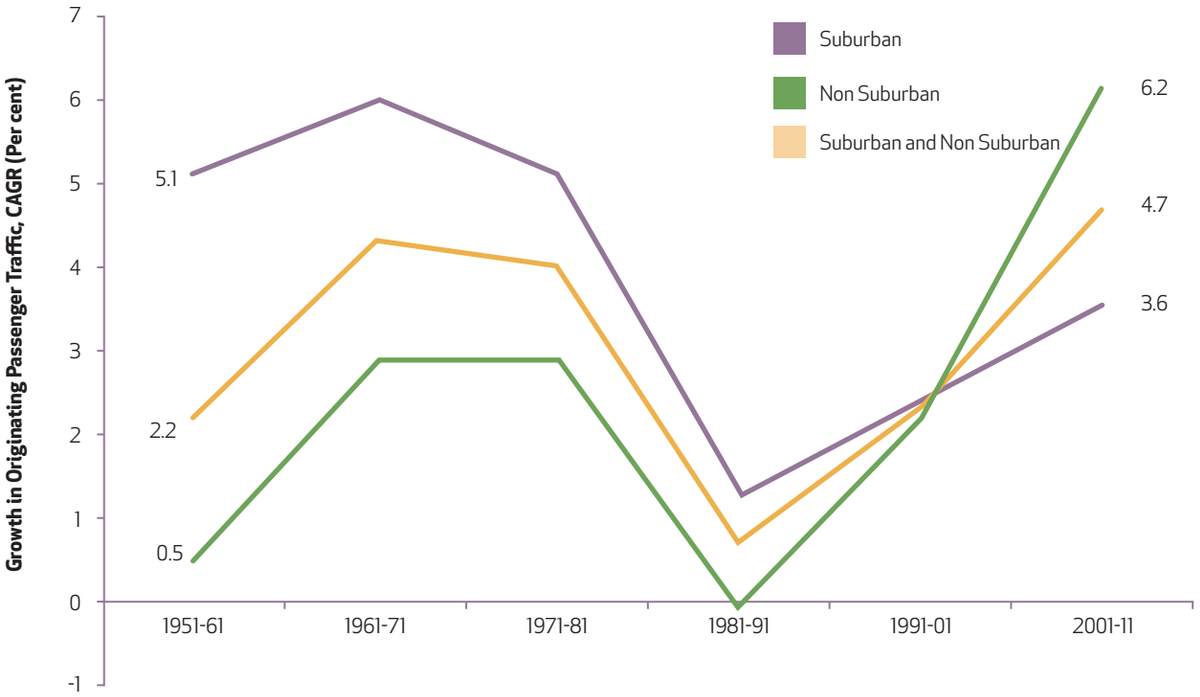
CURRENT STATE OF INDIAN RAILWAYS

In order to analyse the current state of IR, operations and performance in each of its business segments have been looked into separately (passenger, freight, parcel and others). We have focused on the growth experienced in the passenger and freight businesses underlining current trends, followed by an examination of the productivity and financial performance of IR as a whole. International benchmarking is necessary to realise the gap in productivity and technology that is prevalent in IR and the urgency needed to bridge this gap becomes clearly evident. Finally, a deeper analysis of tariffs and cost structures in the passenger and freight business brings out the challenges that currently exist due to cross-subsidisation, current tariff practices and capacity constraints. These practices have had a significant impact on IR's financial and operational performance over the years and understanding the current state of affairs of railways is the first step forward towards positive change.

PASSENGER BUSINESS

As mentioned earlier, Indian Railways provides passenger services of a large magnitude in both the suburban and non-suburban (that is, intercity/long distance) segments. In the latter category, there is a large variety—Rajdhani, Shatabdi, non-stop Duronto, mail/express, passenger trains, etc. Yet, IR is not able to meet the demand in full. Railways have an excellent operating protocol in place to run around 12,000 passenger trains a day. Train services are, by

Figure 1.4
Growth in Originating Passenger Traffic, CAGR
[Per cent]



Source: Report of the Working Group on Railways (NTDPC), Yearbook 2010-11.

and large, reliable and popular. However, these do not compare with best–in-class passenger railway systems elsewhere in the world in terms of speed, reliability and comforts; for a host of reasons such as infrastructural and capacity limitations, low level of technology, maintenance systems and procedures and poor upkeep of stations and coaches. While most developed countries have high speed railways (speeds up to 300-350 km per hour) and have rebuilt their conventional tracks for speeds up to 200 km per hour, the maximum permissible speed on IR is only 150 km per hour and the average speed actually achieved, lower in the range of 60-70 km per hour.

Over the last six decades, the number of **originating passengers** on IR has increased by almost six times, from 1.3 billion in 1950-51 to 7.6 billion in 2010-11. During the period 1951–2001, the suburban passenger category was driving the growth in total originating passengers with a compounded annual growth rate (CAGR) of 4 per cent as compared to a CAGR of 1.6 per cent for non-suburban category. However, during the last decade (2001-11) the trend reversed and non-suburban passenger category has been the key driver of growth in total originating passengers with a CAGR of 6.2 per cent, compared to 3.6 per cent for the suburban passengers (Figure 1.4).

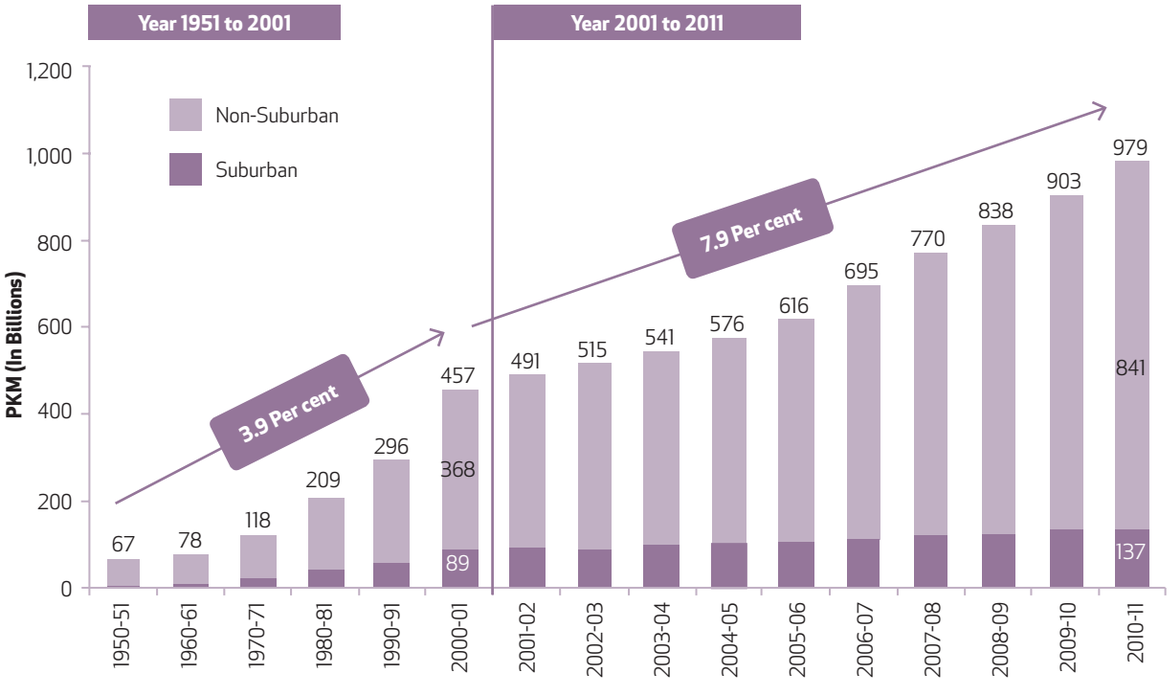
Total passenger kilometres (PKM) increased to almost 15 times, from 67 billion in 1951 to 979 billion by 2011. The growth in PKM has been exceptionally high over the last decade (2001 to 2011), as it increased by 522 billion PKM (CAGR of 7.9 per cent), in comparison to an increase of only 390 billion PKM (CAGR of 3.9 per cent) during the preceding 40-year period (1951 to 2001). The growth in PKM over the last decade has been supported by the fast growth witnessed in non-suburban traffic. As of March 2011, non-suburban passengers comprised 47 per cent of the total originating passengers and accounted for close to 86 per cent of total PKM (Figure 1.5).

The **average lead** of passengers has increased from 52 km in 1951 to 128 km in 2011. While average lead in suburban category has become twice (16 km to 34 km), average lead in non-suburban category has grown more than 3.5 times (66 km to 234 km) over the same period. Further, over the last decade, lead in the non-suburban category increased much faster (CAGR of 3 per cent) compared to suburban category (CAGR of 0.8 per cent) over the same period (Figure 1.6).

Within the non-suburban category, passenger lead for the upper class segment has shown the highest rise, as it quadrupled from 152 km in 1950-51 to 623 km in 2010-11; while leads for the other two segments (second class ordinary and mail/express) doubled during the same time period (Figure 1.7).

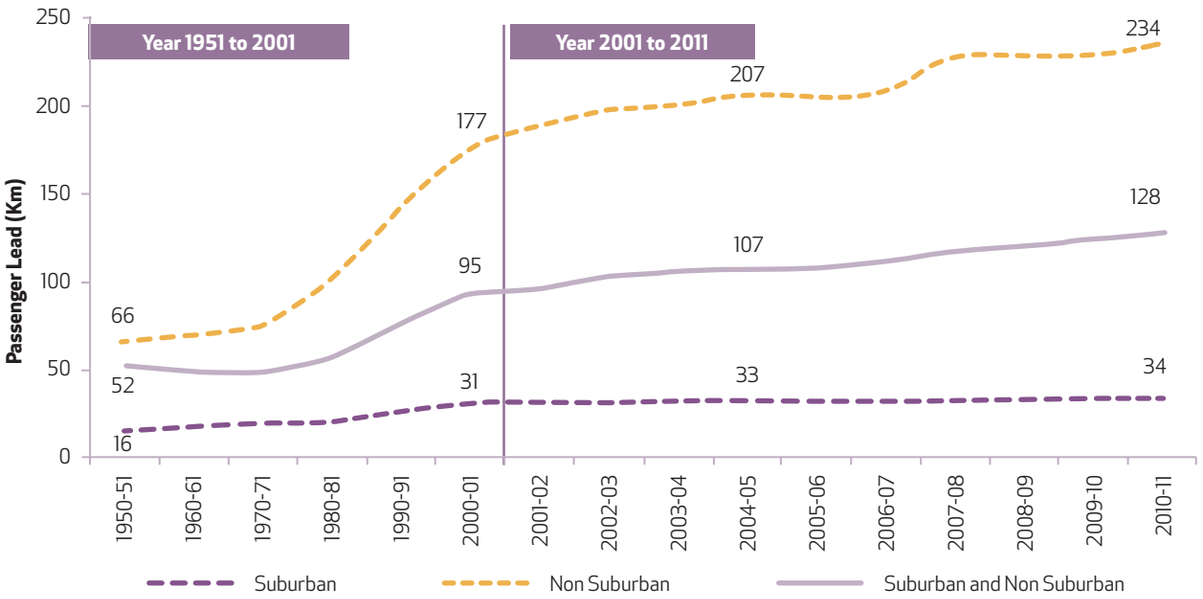
However, despite the spectacular rise in passenger lead, the upper class segment accounts for only 7 per cent of total PKM of the non-suburban cat-

Figure 1.5
Passenger Kilometres on IR
[in Billions]



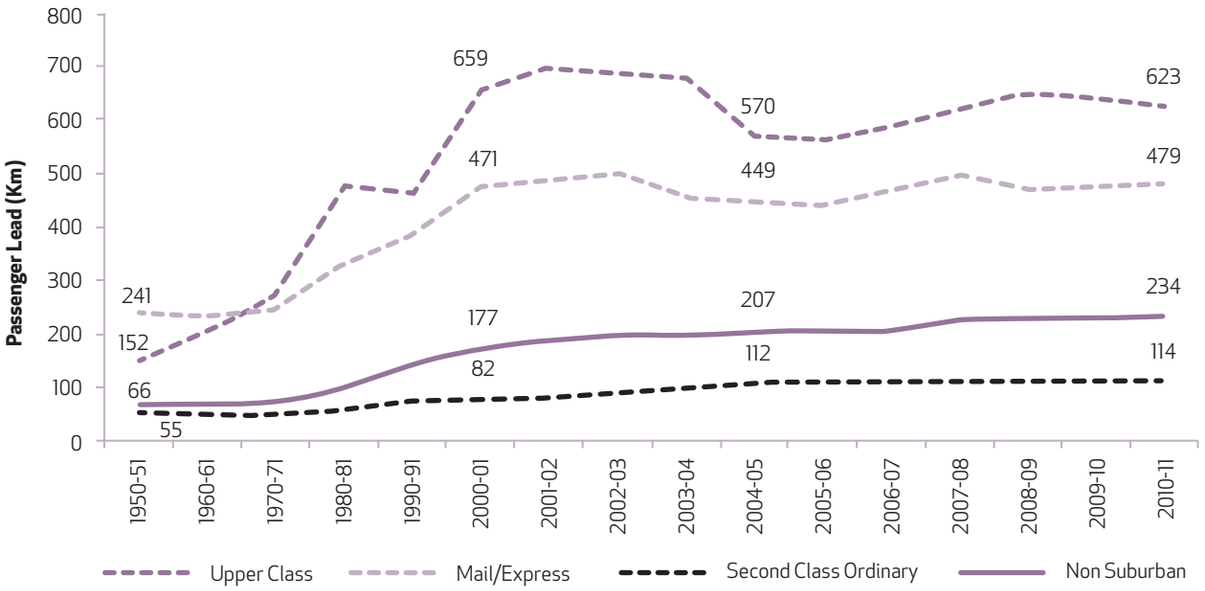
Source: Report of the Working Group on Railways (NTDPC), Yearbook 2006-2007, Yearbook 2010-11.

Figure 1.6
Passenger Lead on IR
[Km]



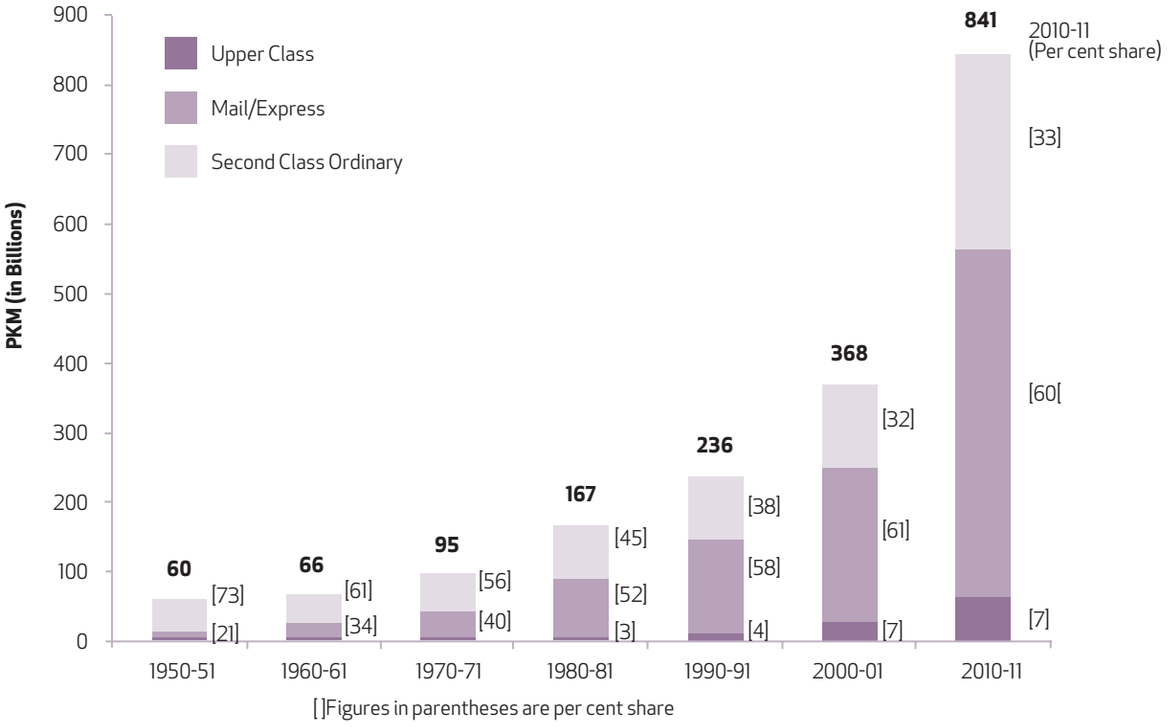
Source: Report of the Working Group on Railways (NTDPC), Yearbook 2006-2007, Yearbook 2010-11.

Figure 1.7
Passenger Lead in Non-Suburban Category
[Km]



Source: Report of the Working Group on Railways (NTDPC), Yearbook 2006-2007, Yearbook 2010-11.

Figure 1.8
Passenger Kilometres for Non-Suburban Category
[in Billions]



Source: Report of the Working Group on Railways (NTDPC), Yearbook 2006-2007, Yearbook 2010-11.

Box 1.1

Indian Railways' Network Capacity

64,460 km Length of route network as of March 2011

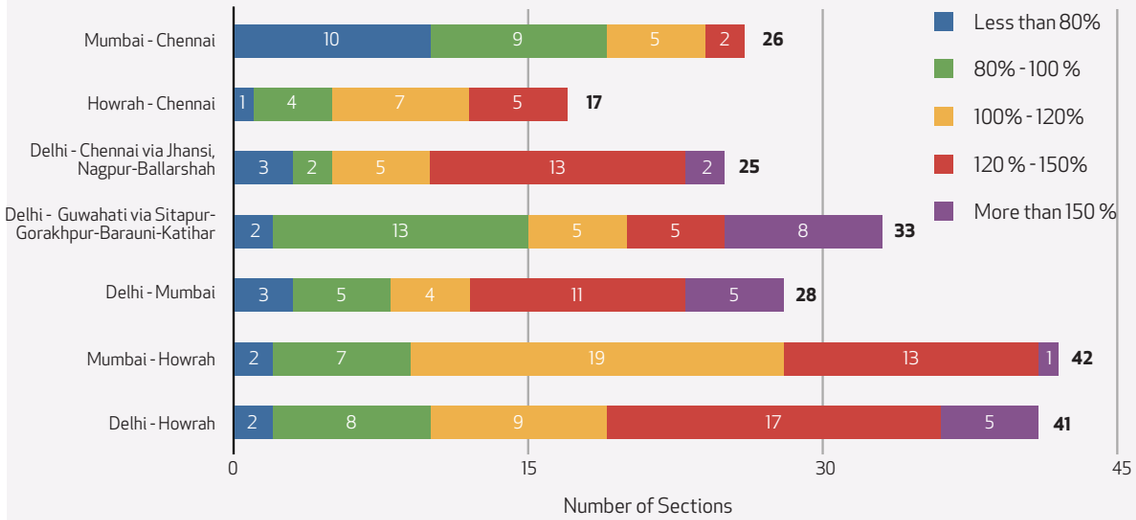
85.6 per cent Broad Gauge (BG)

10.6 per cent Metre Gauge (MG)

3.8 per cent Narrow Gauge (NG)

Traffic flows on IR's network are highly uneven and imbalanced. As of March 2011, the BG network, though forming 85.6 per cent of the route, generated almost 98 per cent of the passenger output (PKMs) and 99.9 per cent of the freight output (NTKMs). Further, passenger trains utilise nearly 65 per cent of network capacity but contribute to less than 30 per cent of the revenue. The Golden Quadrilateral and the diagonals connecting the four major metros, vis., Delhi, Kolkata, Chennai and Mumbai (along with the east-west diagonal extending to Guwahati) constitute less than 16 per cent of the route, but account for more than 50 per cent of the passenger and freight traffic. These routes have reached over saturated levels of capacity utilisation and at present are strained to the breaking point (See chart). A line-capacity utilisation of 80 per cent is considered optimum as smooth operation of trains requires some slack in the line-capacity to absorb and recover from unforeseen disruptions.

LINE CAPACITY UTILISATION OF SECTIONS ON HIGH DENSITY NETWORK IN 2009-10



212 Total sections on the High Density Network (HDN)

141 Sections with line capacity utilisation exceeding 100 per cent

189 Sections with line capacity utilisation exceeding 80 per cent

Source: Ministry of Railways, Yearbook 2010-11.

egory, as this segment has a small base of originating passengers (100 million in 2010-11), equating to 3 per cent of the non-suburban passengers and 1 per cent of the total passengers (Figure 1.8).

FREIGHT BUSINESS

Freight trains constitute approximately 35 per cent of the total 19,000 trains run daily on IR network, but yield more than 65 per cent of the revenue. Freight services share the track and infrastructure with passenger trains, but have lower priority vis-a-vis the latter in operational matters. There is a huge imbalance in the pattern of train operations: the trunk routes of the railways, which comprise 16 per cent of the network (connecting the four metro cities), carry close to 60 per cent of the freight and more than 50 per cent of the passenger traffic and are, therefore, oversaturated (Box 1.1).

Box 1.2
Efficiency of Heavy Load Trains

In most of the freight railways reviewed high density flows of rail-friendly traffics have created beneficial opportunities to operate longer, heavier trains and attain lower unit costs. Australia, Brazil, Canada, China, Russia and the USA have all pursued heavy axle loads, better wagon design and minimisation of dead-running to provide higher net-to-tare ratio, coupled with longer freight train length to reduce unit crew costs and (in some cases) release useable capacity. Germany and Japan are more constrained by the limited market availability of bulk freights (particularly coal), by their relatively short freight-hauls, and by the constraints of network parameters basically geared to passenger demands, but nevertheless they have also sought within their constraints to achieve the same sorts of efficiencies.

COUNTRY	EXAMPLES OF HEAVY-LOAD TRAINS AND TYPICAL FREIGHTERS
Australia	Typical interstate freighters: East-West 5,000 tonnes, North-South 2-3,000 tonnes. **Dedicated freight lines**: Rio Tinto: 30,000 tonnes iron ore trains BHP Billiton: 44,500 tonnes iron ore trains Leigh Creek: 10,000 tonne coal trains
Brazil	Typical freighters: Various **Dedicated:** Carajas Railway: 23,000 tonne iron ore trains
Canada	Typical long-distance freighter: Canadian National bulk trains: up to 20,000 tonnes
China	Typical long-distance freighter: 4,000 tonnes **Dedicated:** Daqin Railway (mainly coal): 20,000 tonne coal trains
Germany	Trains typically constrained to 740 metres but 835 m trains being introduced Hamburg to/from Denmark and long-term feasibility of running 1,500 m trains on key routes is being examined.
Japan	N/A
Russia	Typical long-distance freighters: 4,000 tonnes Iron ore to Finland: 5,500 tonnes
United States	Typical freighters: 3,000-5,000 tonnes. Double-stack container trains: typically 5,000-8,000 tonnes Some iron ore and coal trains: 10-20,000 tonnes

International containers have been a major rail freight growth market in all the countries reviewed. The USA and Canadian railways are leaders in the field with further multi-billion dollar investments planned. Double stacking has been facilitated by the USA's high average axle-loads (more than 50 per cent higher than Europe) and the fact that primarily diesel locomotive haulage provides higher loading gauge than would an electrified system with overhead wires. Australia has introduced double-stack wherever density of flows and the loading gauge permit it and China is currently adapting a number of routes from ports for double-stack. In the other countries constraints of current loading gauge and/or lack of market density make it difficult economically to justify the heavy cost of adaptation works, but it is likely that at least a few key routes will be fitted for double-stack in due course.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Paul Amos, July 2011.

Lower operational priority and oversaturation have implications for quality of service of freight trains and severely restrict IR's ability to meet customer expectations. Speed of freight trains has largely remained stagnant and improved only marginally from 25 to 29 km per hour over the last three decades. These capacity constraints need to be further viewed in the context that IR does not operate truly heavy-haul freight trains that bring high level of cost-efficiency to freight operations as the infrastructure is common to both, the passenger and freight trains (Box 1.2). The maximum gross load carried on trains in IR is 5,400 tonnes, compared to 20,000-37,000 tonnes in China, South Africa, Brazil and Australia. The position can change only when the Dedicated Freight Corridors (DFCs) get operational, as trains with maximum gross load of 12,000 tonnes are expected to run on the DFCs.

Furthermore, freight services are managed with excessive stress on productivity of assets rather than satisfaction of customers' needs. Productivity of assets is undeniably a worthwhile objective to pursue and improved rake utilisation over the years has enabled IR to meet requirements of bulk customers. However, there is a need to strike a balance between

Box 1.3
Auto-Carriage Opportunities

Auto-carriage is a typical example of what railways are losing and why. Globally, automobiles are mostly carried by rail. IR's share in India's growing automobile production and transportation is a mere 2 per cent. Railways do not have proper wagons to transport automobiles efficiently, nor well designed terminals. The few make-shift wagons that have been designed are not capable of carrying optimum number of cars per wagon. The terminal infrastructure for handling is absent. Investment by automobile companies does not come forth as the facilities cannot be shared with competitors and single-user volumes may not justify stand-alone investment. Automobile companies or third-party logistics providers can bring proven wagon designs from, say, the USA or Europe, but the RDSO's approval process is tedious, protracted and uncertain. Similar issues beset the transport of bulk cement, fly-ash and other potentially voluminous commodities not carried by rail in any sizeable quantity now.

The Ministry did announce a large number of policy initiatives in 2010 under the Public Private Partnership model to attract private sector investment in several areas - auto-carriage rolling stock, terminal development, development of ware houses, construction of railway lines, operation of tourist trains etc.

The initiatives have not been successful, indicating the need for a review of the terms and conditions including a dialogue with the interested parties for setting at rest their apprehensions.

Source: Report of the Working Group on Railways (NTDPC).

optimising asset utilisation and fulfilling the customer's requirements if the aim is to increase railway's share of cargo handled. IR does not perceive or define the freight business in terms of delivering transport or logistics solutions. Railways' customers have negative perceptions on its handling of demurrage (detention of rolling stock at terminals) and disposal of claims. Parcel size of cargo is presently restricted between the ranges 2,400 metric tonnes and 3,800 metric tonnes and, therefore, cuts out many customers even in the bulk cargo segment.

IR does not take responsibility for last-mile connectivity, nor does it incentivise customers to invest in such facilities. There is no institutional arrangement to attract and aggregate traffic of smaller parcel sizes (less than train-loads). As a result, IR is losing out in high potential markets like fast-growing consumer durables and information technology (CDIT), fast moving consumer goods (FMCG), hazardous chemicals, bulk cement, fly ash, automobiles and containerised cargo; where their share is low or negligible (Box 1.3). This traffic now moves mostly by road.

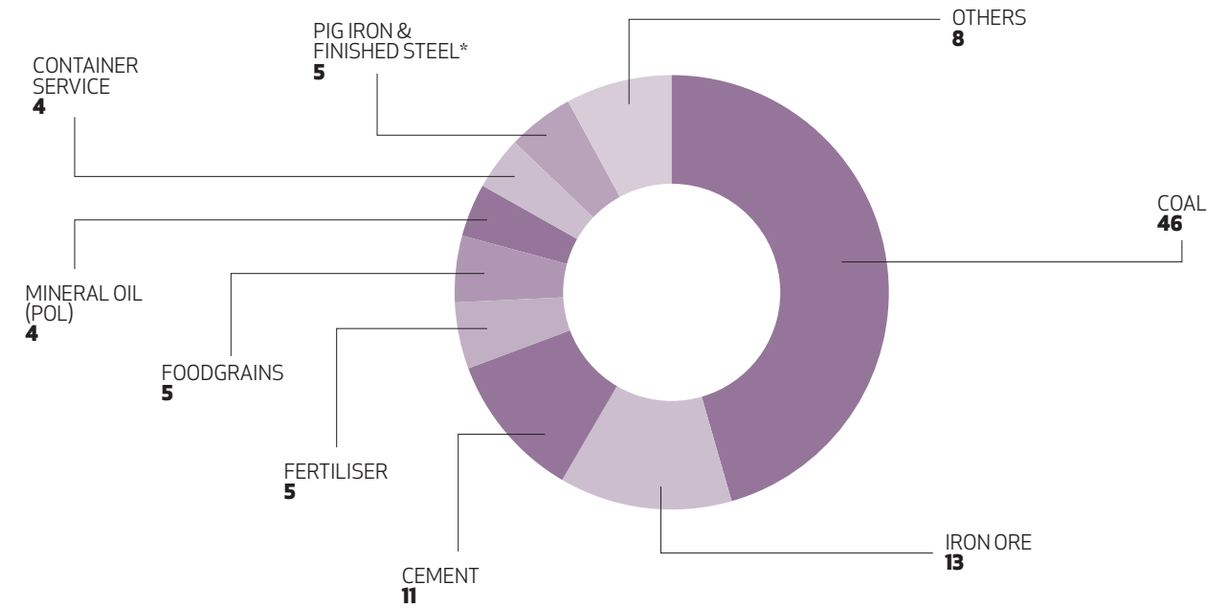
Given the above constraints, IR has focused on carrying bulk cargo in train-loads dominated by a narrow basket of nine commodities such as coal (46 per cent), iron ore, cement, fertilisers, steel, raw materials for steel plants except iron ore, foodgrains, petroleum products and container traffic, together these account for over 90 per cent of the freight traffic (Figure 1.9a). Figure 1.9b provides commodity-wise trends in freight growth over the period 2001-02 to 2010-11.

Growth and Performance of Freight: Figure 1.10 provides the growth of freight traffic in terms of total loading and freight output (in million tonnes and billion NTKMs respectively), as well as average lead (in km). Total loading of revenue earning freight traffic during 2010-11 was 922 million tonnes compared to 73 million tonnes in 1950-51. Similarly, the freight output increased from 38 billion NTKMs to 626 billion NTKMs over the same period. Further, during the last decade (2001-11), the growth rate in freight loading and output has been much faster (CAGR close to 7 per cent[7]), compared to the preceding five decades (1951-2001) when they grew at CAGR of around 4 per cent. The average lead increased from 513 km in 1950-51 to 754 km in 1980-81, but it consistently declined thereafter and stood at 679 km in 2010-11.

Despite the higher growth witnessed in freight traffic during the last decade, IR's performance is much below the potential. Given the average GDP growth of around 8.5 per cent from 2005-06 to 2010-11, and the transport elasticity to GDP of 1.25, IR's freight could have grown at CAGR of greater than 10 per cent, while it grew only close to 7 per cent during the period. In meeting the demand generated by the economic upturn, the main challenges faced by IR were the constraints of infrastructure, particularly line capacity on busy routes, and terminal detentions on account of underinvestment.

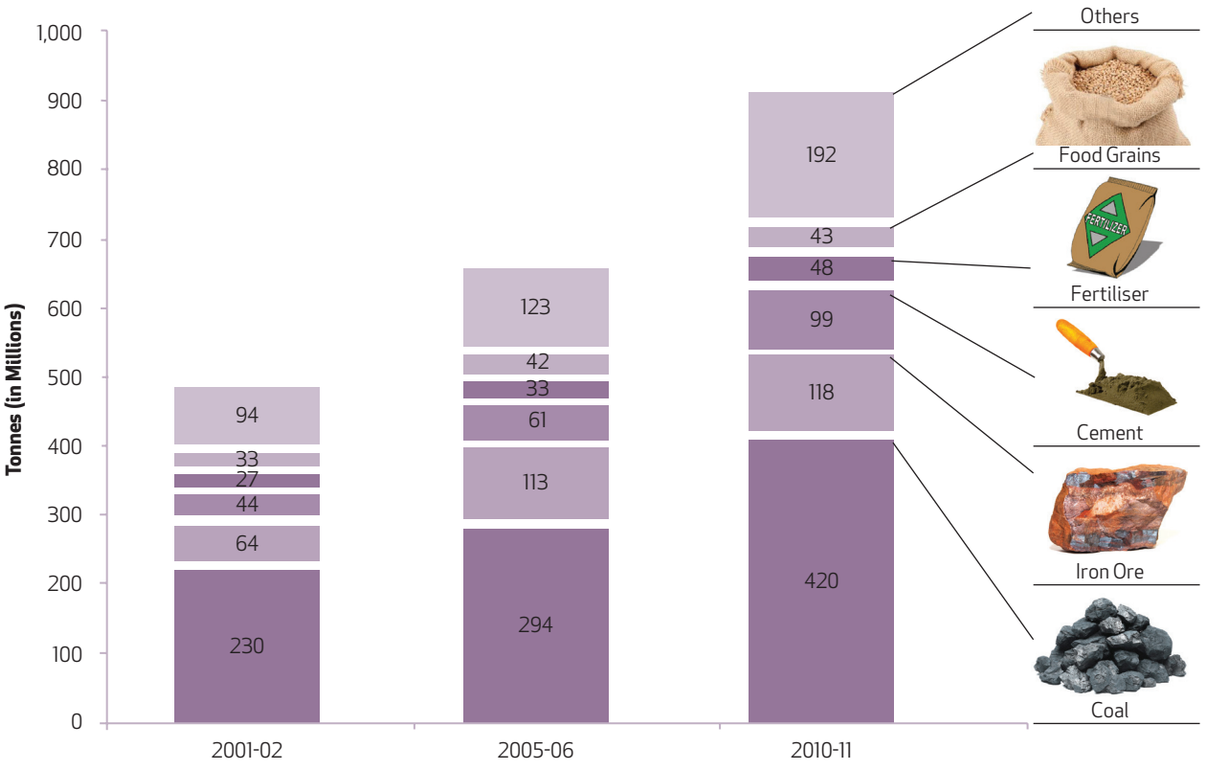
7. There was a dip in freight growth in 2008-09 due to the economic slowdown and the target of 850 MT of loading could not be met; consequently freight growth was only 5 per cent.

Figure 1.9a
Commodity Basket for IR (2010-11)
[Per cent]



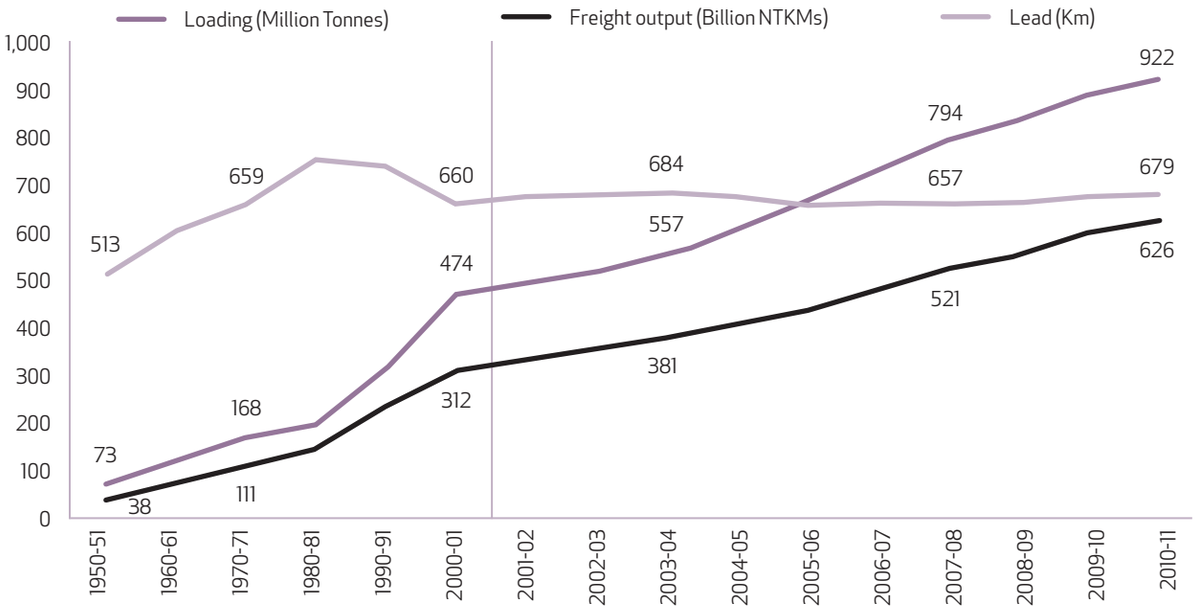
Source: Yearbook 2010-11.
Note: *Pig iron and finished steel includes raw material for steel plants except iron ore.

Figure 1.9b
Freight Growth: Select Commodities



Source: Ministry of Railways Yearbook 2010-11, Yearbook 2005-2006, Yearbook 2004-2005.

Figure 1.10
Freight Traffic on IR



Source: Report of the Working Group on Railways (NTDPC), White Paper on Indian Railways, Year Book 2010-11.

Table 1.5
Parcel Traffic and Earnings

YEAR	TONNAGE (MILLION TONNES)	INCREASE OVER PREVIOUS YEAR (PER CENT)	EARNINGS (RS BILLION)	INCREASE OVER PREVIOUS YEAR (PER CENT)
2001-02	3.4	-	4.4	-
2002-03	3.5	3.2	4.6	5.0
2003-04	3.9	10.8	4.8	3.9
2004-05	4.2	7.2	5.3	11.7
2005-06	4.6	10.5	6.4	19.7
2006-07	4.9	6.7	9.0	41.2
2007-08	5.5	12.2	10.0	12.0
2008-09	5.9	6.7	10.8	7.2

Source: Special Study for setting up of FBO for parcel traffic, CRISIL Infrastructure Advisory, ADB TA No. 4053.

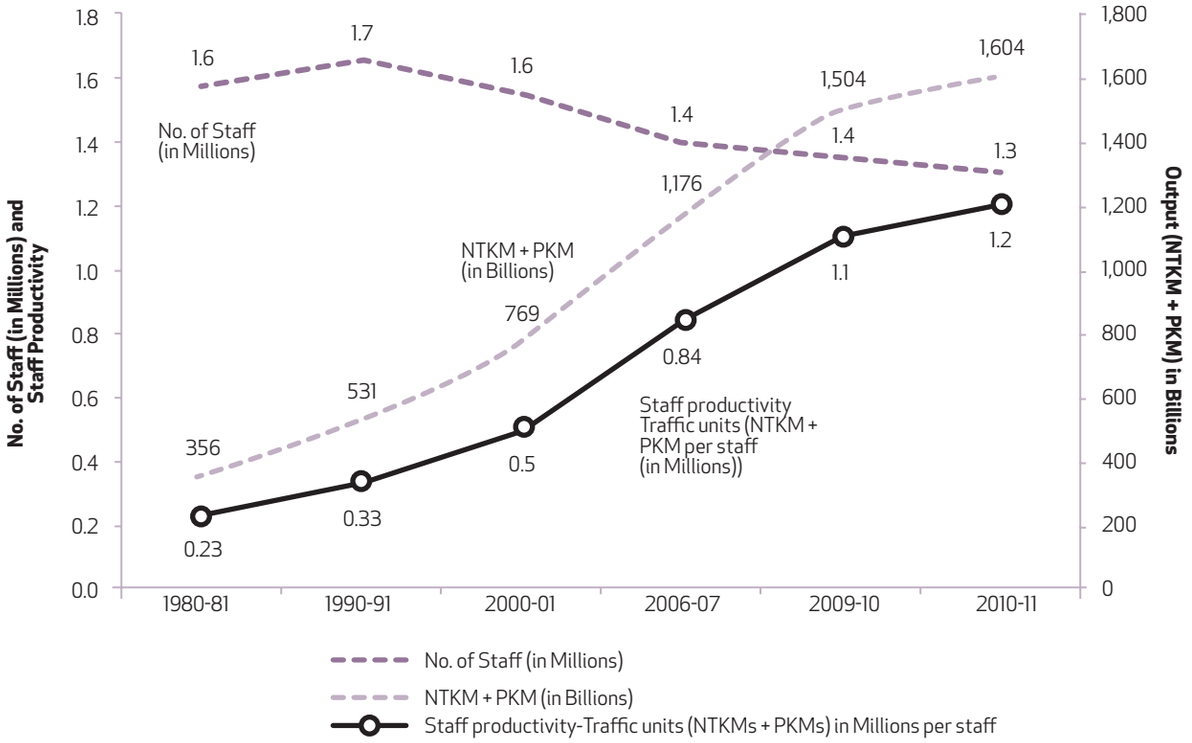
PARCEL BUSINESS

At present, parcel services are treated as a peripheral activity and managed as an associated service along with passenger trains; Railways Act defines a 'parcel' as 'goods entrusted to a railway administration for carriage by a passenger train or parcel train', there being no other elaboration or explanation. There is little marketing support and backward/forward services by IR. Freight and passenger segments of the business receive the attention of IR's management at all levels and at all times; this is not the case with parcel traffic. This has handicapped the growth of the business. The end result is carriage of parcels is a loss-making activity for the IR; in the financial year 2008-09, the net loss for this segment of business was estimated to be as high as Rs 18 billion.

The importance IR attaches to this segment of business can be gauged from the fact that no separate statistics pertaining to parcels is maintained and published; the Indian Railways Statistical Year Book gives no figures. Table 1.5 indicates the quantum of parcel traffic carried along with other related statistics.

The higher growth, both in terms of tonnage and earnings, has been due to a number of steps taken by the IR such as leasing of parcel vans, relating tariff to the class of service chosen, instead of commodity as earlier; obtaining, designing higher capacity parcel vans and running of point-to-point parcel trains. And, despite the growth, in absolute terms, the quantum of parcel traffic is insignificant. A study done by CRISIL Infrastructure Advisory (for Asian Development Bank) for setting up of a focused business

Figure 1.11
Staff Productivity



Source: Report of the Working Group on Railways (NTDPC), Year Book 2009-10, Year Book 2010-11.

organisation for parcel traffic estimated[8] that movement by road was over 400 million tonnes in 2007-08; IR's share is thus just 1 per cent.

The size of the parcel business in the country is huge and expanding rapidly but IR's share is negligible. A shift from road to rail is obvious for leads of 500 km and above. An efficient 'rail-borne parcel traffic' has to be multimodal if it has to be user-centric; institutional aggregation is a basic requirement. Collection and delivery have to be at locations decided by the users, with a single agency dealing with all maters documentation, enquiries, tracking, financial and tariff-related issues, claims, etc. This activity needs to be managed professionally as a separate business unit that combines the advantages and strengths of rail movement with those of road; otherwise IR will not be able to take advantage of the opportunities in the market for parcel movement.

OTHER BUSINESSES

Sundry earnings from sources like advertising and commercial utilisation of surplus land currently contribute around Rs 34 billion per annum (2010-11). The vastness of the network and large masses of people who use railway stations and facilities offer an attractive opportunity for advertising on freight and passenger trains, CCTVs at stations, on-board magazines for passengers, merchandising opportunities on tickets, foodstuffs and other materials served on trains, etc. Laying optic fibre along the railway tracks and leveraging the optic fibre network for broadband would be yet another avenue. IR has not been able to fully exploit the potential from these sources as these activities are not managed professionally as separate profit-centres.

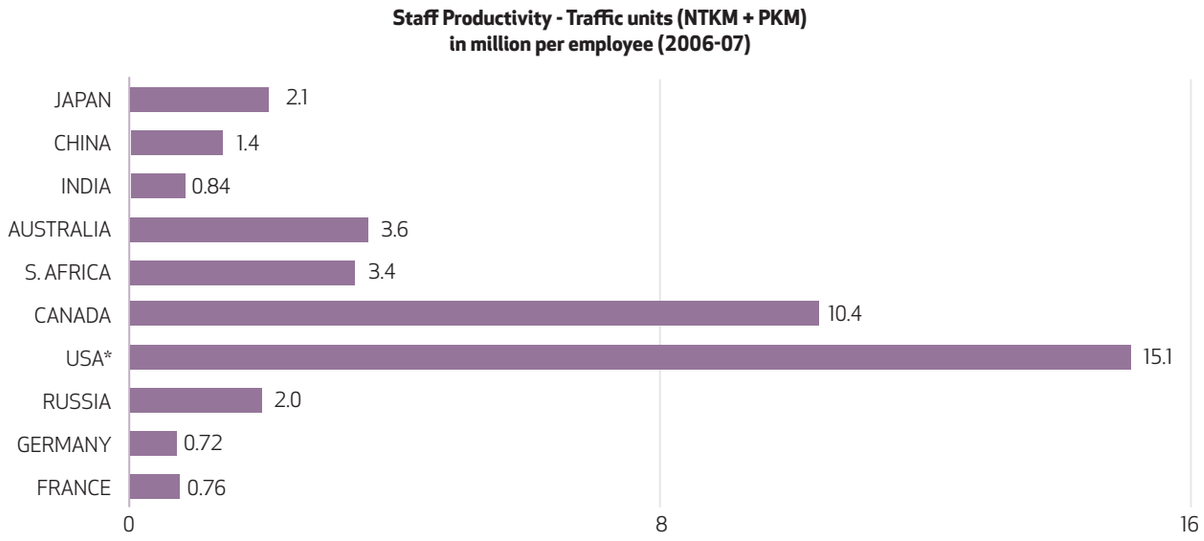
PRODUCTIVITY IN INDIAN RAILWAYS

Staff Productivity: Over the years, productivity measured in terms of transport output (NTKM+PKMs in millions) per employee of IR has increased from 0.23 (1980-81) to 1.2 (2010-11) (Figure 1.11). The major force driving the marginal increase in productivity has been the increase in transport volumes due to technology upgrade and appropriate operating strategies, combined with reduction in the number of employees from a peak of 1.65 million in 1990-91 to 1.32 million in 2010-11.

It is, however, important to compare productivity figures internationally. On doing so, we see that the productivity of employees measured in terms of average transport output for 2006-07 is relatively low for India (0.84) compared to the US (15), Canada (10.4), Japan (2.1), Russia (2) and China (1.4) (Figure 1.12). The much higher staff productivity in the US and Canada vis-à-vis India; China and Russia can be partly explained by the difference in overall freight and passenger mix, as the larger passenger volumes handled in India, China and Russia require

8. Based on the Total Transport System Study done by RITES, and 22 commodities that are amenable for transport as parcels by rail.

Figure 1.12
Staff Productivity Comparison (2006-07)



Source: Report of the Working Group on Railways (NTDPC), White Paper on Indian Railways, UIC 2007.
Note: * US data for AAR Class 1 and Amtrak.

a more labour-intensive service response than freight. Similarly, several other factors such as the state of the infrastructure, the level of technology, the skill of the workforce and quality of the management, the degree of outsourcing, etc. also influence the productivity as measured by conventional parameters.

Asset Productivity: Box 1.4 provides estimates (based broadly on 2009 data) of asset productivity for India and five other countries.

FINANCIAL PERFORMANCE

Figure 1.13a provides a snapshot of IR's financial performance over the period 2004-05 to 2010-11. A combination of factors such as booming growth in the core sector and mineral industries; and IR's decisions to raise the axle load of existing wagons from 20.8 tonnes to 22.8 tonnes (thereby increasing the carrying capacity by 15 per cent), operate longer passenger trains, rationalise freight classification and introduce market-focused tariffs (e.g. lean season and empty flow discounts) contributed to improvement in the railway finances during the period 2005-06 to 2007-08. However, once these had run their course and the impact of award of the Sixth Pay Commission had to be absorbed, the operating ratio, which is used as a rough index of the health of the railway finance, has climbed back into the 90-100 range, leaving very little surplus for reinvestment. The sharp deceleration in revenue generation is mainly due to non-revision of passenger tariff for 10 years in a row and slowdown in the growth of the core sector, which is a primary contributor to railway freight. Further, capacity constraints hamper IR's effort to diversify into other segments. Increase in expenditure due to higher wage and fuel bills complete the picture of financial distress.

Working Expenses: Operating and maintenance expenses incurred by IR can broadly be divided into staff costs (including payment of pension), fuel costs, material costs, lease charges and other miscellaneous expenditure. Of these, wages and pension constitute about 51 per cent, fuel 16 per cent, stores for operation and maintenance 4 per cent, lease charges for rolling stock procured through borrowings 4 per cent and miscellaneous expenditure 8 per cent of the earnings. Contribution to the depreciation reserve fund (DRF) for the replacement of assets takes away another 4 to 6 per cent of the earnings. Thus close to 85 per cent of the revenue is committed and invariable in the short run. Drastic restructuring or staff rationalisation and wage freeze are not politically and administratively feasible. Viability in the short run, therefore, dictates that the volumes expand at viable tariff levels. In 2008-09, there was a considerable jump in the working expenses of the railways, on account of the disbursement of Sixth Pay Commission arrears and increased salaries and wages and rates of allowances. Manpower productivity has steadily improved over the years and this has contributed to an increase in earnings and lower costs. However, the challenges of the coming years would necessitate much higher levels of productivity.

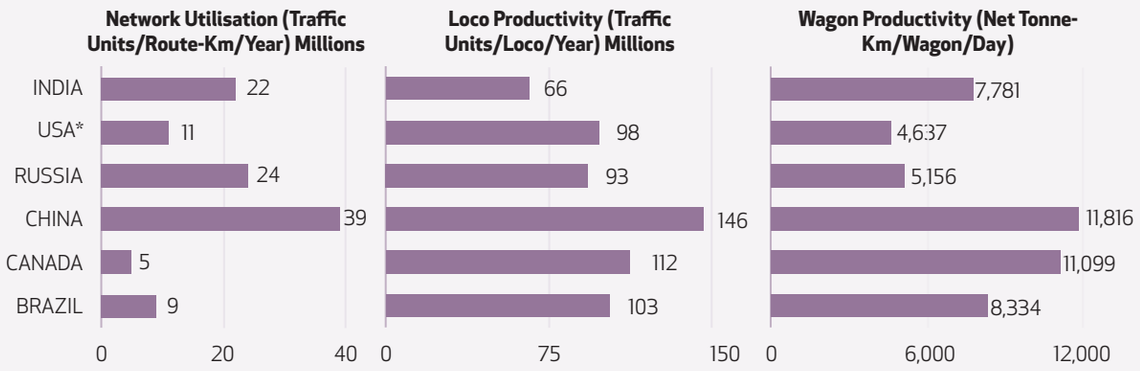
Earnings: Total earnings of IR have doubled over the period 2004-05 to 2010-11 from Rs 470 billion to Rs 945 billion (Figure 1.13b). Freight earnings have

Box 1.4
International Comparison of Asset Productivity

Network utilisation: The three networks that handle substantial passenger volumes (India, China and Russia) as well as freight have the highest overall network use, but such use can also be heavily influenced by the technology and operational standards. The average is also affected by the relative intensity of use of different parts of the network. For example, whereas nearly China's entire network is heavily used, the Indian average contains around 9,000 kms (more than 14 per cent of the network) of little-used non broad-gauge lines carrying only around 1 per cent of rail traffic.

Locomotive productivity: The achievable productivity is partly influenced by the markets offering, which differ from country to country. Modern locomotive types and technologies also have higher haulage capability. Productivity is also influenced by the maintenance standards and efficiency of equipment. India is significantly behind other countries in locomotive productivity.

Asset Productivity Estimates (2009)



Note: * USA data for Class 1 railroads only

Wagon productivity: The achievable productivity depends partly on traffic mix; other things equal, it should be higher with longer length of haul, higher proportions of bulk relative to non-bulk traffic, and the use of non-specialist wagons for a variety of traffic types. It is also influenced by train operating strategies and the efficiency of customers' terminal operations. High utilisation generally assists in controlling operating costs, but it can occur at the expense of customers: for example many customers may prefer to use specialised wagons.

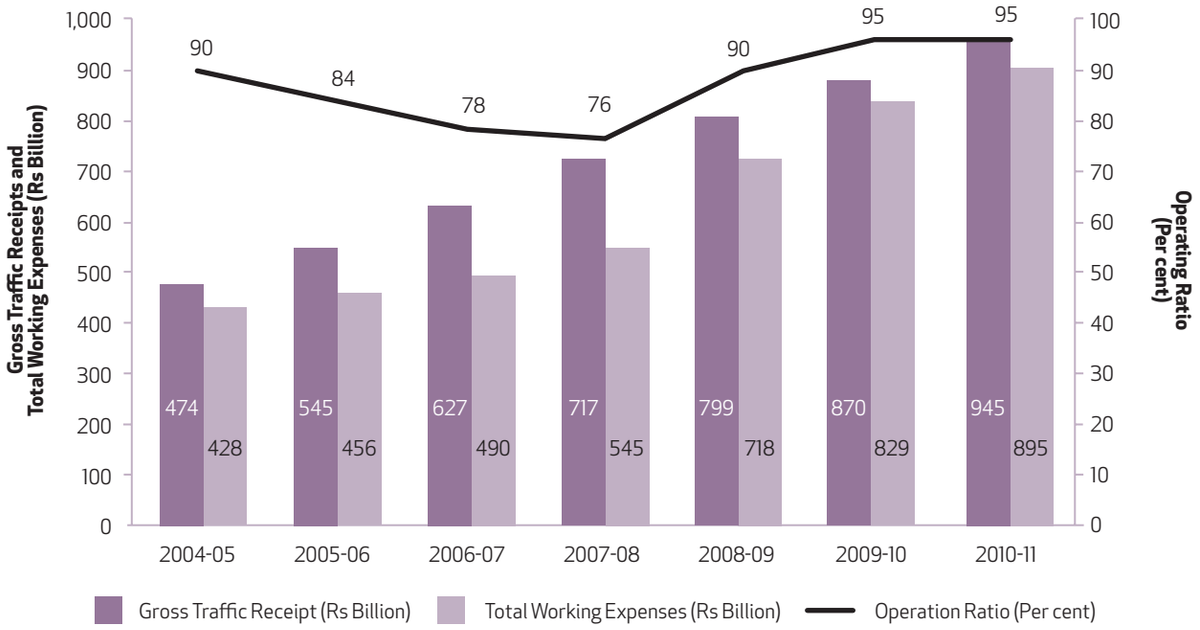
Source: Freight Railways Governance, Organisation and Management: An International Roundup; The World Bank; Paul F. Amos, 7 July 2011.

been the backbone of IR's revenues, accounting for almost two-thirds of the total earnings. Earnings through commercial publicity account for a very small percentage of IR's earnings even though great scope exists for advertising initiatives in the interiors of trains and at stations. Figure 1.14 shows the growth rate of earnings over the reference period. The growth rate of total earnings has declined in the recent years, after growing at CAGR of more than 14 per cent during 2004-05 to 2008-09 (led by the strong economic growth during that period). The growth of freight earnings has also declined to single digits in recent years, after growing at a peak of 18 per cent during 2005-06.

Investments & Sources of Funding: The total investment in railways in each successive plan started increasing at a sharp rate from the 6th Plan (1980-85) onwards. The total public sector investment has increased manifold from around Rs 66 billion in the 6th Plan, to around Rs 1,900 billion in the 11th Plan. However, the IR's expenditure as a percentage of the transport sector expenditure has varied considerably over the Plan periods, as it moved from a peak of 67 per cent in the 3rd to a low of 30 per cent in the 11th Plan (Figure 1.15).

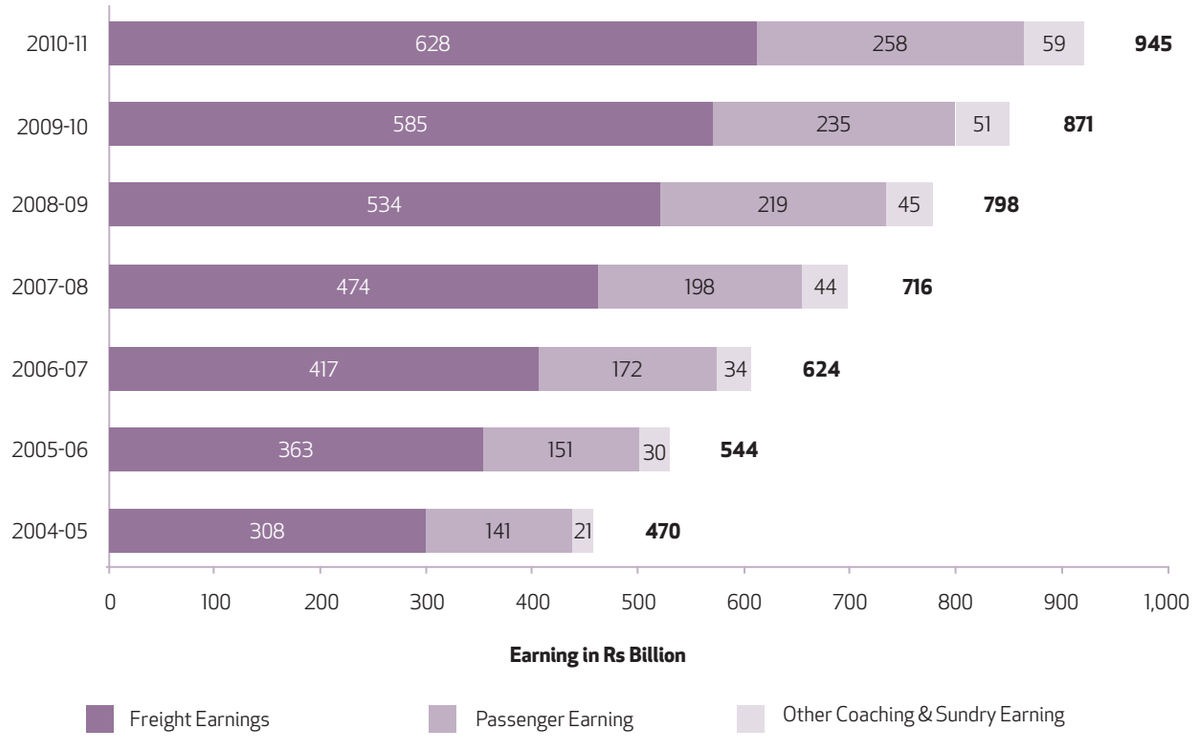
One of the key challenges faced by IR is finding resources to finance rail infrastructure that must be improved to bridge the current technology gap and capacity constraints. IR must not only meet operational expenses but must also generate adequate resources for replacement and planned investments. Railways Plan expenditure is financed through a combination of internal generation; money from the general exchequer extended as gross budgetary

Figure 1.13a
Gross Traffic Receipts, Total Working Expenses and Operating Ratio



Source: Report of the Working Group on Railways (NTDPC), Yearbook 2010-11.

Figure 1.13b
Total Earnings
[Rs Billion]



Source: Report of the Working Group on Railways (NTDPC), Yearbook 2010-11.

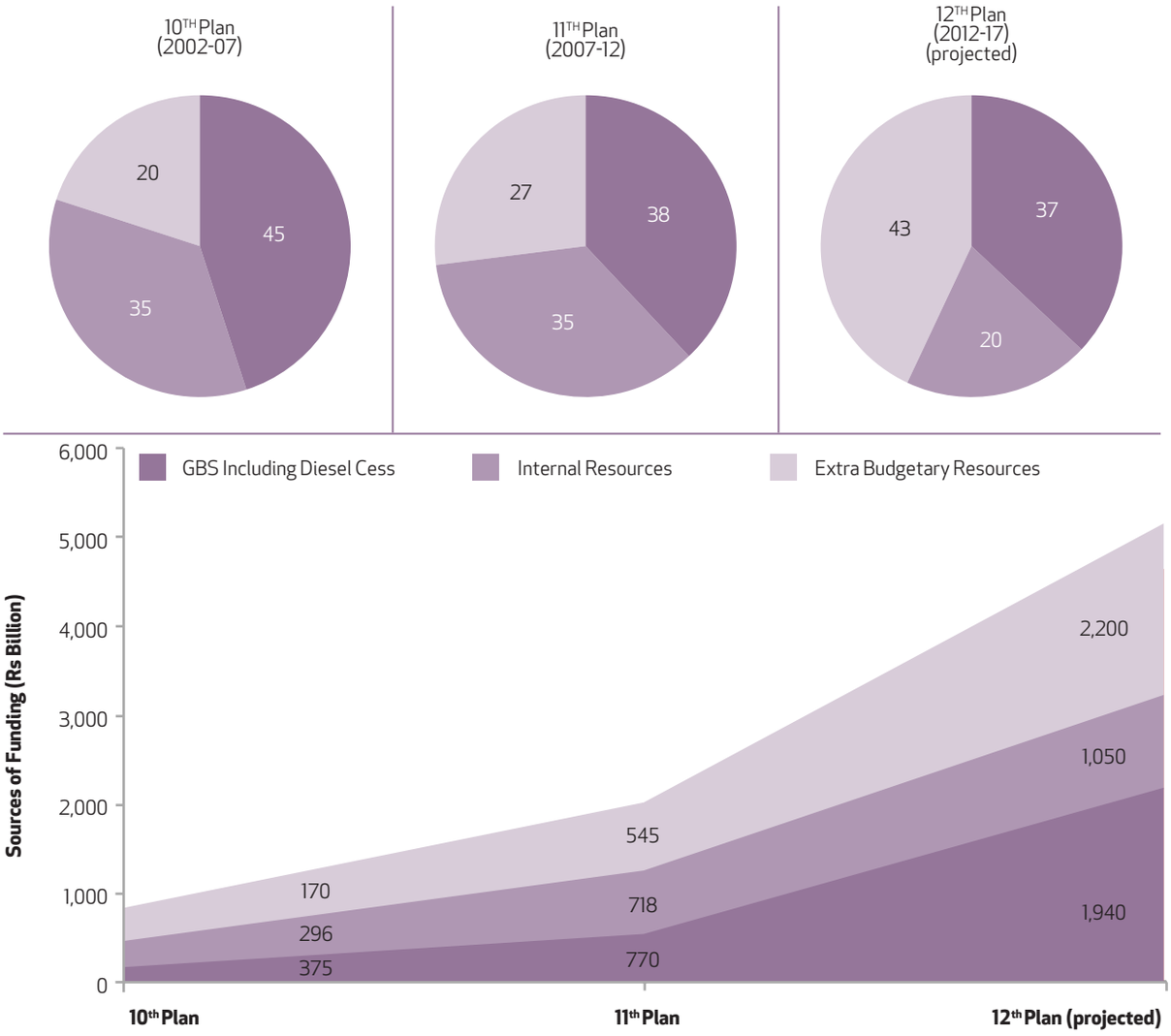
Figure 1.14
Growth in Earnings
[Per cent]

Source: White Paper on Indian Railways 2009, Yearbook 2010-11.

Figure 1.15
Trends in Railway Investments

Source: Various Five Year Plans, Planning Commission.

Figure 1.16
Sources of Funding for 10th, 11th and 12th Five Year Plans
[Per cent and Rs Billion]



Source: White Paper on Indian Railways 2009, Report of the Working Group on Railways (NTDPC), Ministry of Railways.

support (GBS), and market borrowings. Internal resources of IR are operated through the DRF, the Development Fund (DF) and the Capital Fund (CF).

The share of different sources of finance has varied significantly over the Plan periods. The share of GBS started declining from 75 per cent during the 5th Plan (1974-78) to a low of 23 per cent during the 8th Plan (1992-97). However, with the beginning of the 9th Plan in 1997, the trend reversed and share of GBS started rising and increased from a low of 18 per cent in 1996-97 to 56 per cent in 2004-05. In this period, internal generation levels were low and reviving the internal resource generation capability of IR became a key concern. Figure 1.16 compares the share of different sources of finance during the last two Plan periods (10th and 11th) with the projections of the 12th Plan period. The Plan expenditure, which increased by 2.5 times from the 10th Plan (~ Rs 840 billion) to the 11th Plan (~Rs 2,000 billion), is again projected to increase by about 2.5 times to reach close to Rs 5,200 billion for the 12th Plan.

Further, IR has set an ambitious target for public private partnerships (PPP) and borrowings through IRFC, given that the share of GBS remains at the same level (about 37 per cent); and share of internal resource generation is expected to fall from 35 per cent during the last two Plan periods to 20 per cent in the 12th Plan. As a result the share of extra budgetary resources (borrowings and PPPs) is slated to rise from 27 per cent in 11th to 43 per cent in the 12th Plan.

Considering the increasing dependence of IR on budgetary support from the government, it may be useful to review the financing framework and fund-

Box 1.5

China's Self-Funding Railways: A Sustainable Model for India?

The Chinese railway is the only one in the world of a similar scale to India's. The government has increasingly required China's railways as a whole to be **self-funding.** The Ministry of Railways (MOR) is responsible for the railway financing through 18 regional rail administrations. Although MOR is part of the government, the railway sector is not treated as part of the government budget. **China Rail receives no operating subsidies from the national budget for either train or infrastructure maintenance,** and only modest support for capital investment for new lines to remote areas–less than 5 per cent of current capital funds.

China Rail earns a financial surplus overall; freight transport finances the greater part of China's network infrastructure operating, maintenance and capital costs. This is unsurprising as freight constitutes roughly 75 per cent of total traffic-kms and comprises customers with greater capacity to pay than passengers. The author considers it likely that passenger traffic as a whole more than covers its train operating expenses and makes a positive financial contribution to network infrastructure costs.

China has not adopted any policy of explicit payments for specific loss-making passenger public service obligations. China does not have the kind of suburban or intra-regional service networks (it actively discourages shorter distance passenger trips) which in many countries constitute the most loss-making parts of a passenger railway business. Nevertheless, a mixture of more or less profitable services exists, whether looked at by route or time of day. Different regions also exhibit a range of financial performance (mainly related to freight density) and MOR reallocates net revenues between regional rail authorities to ensure financial balance in each.

The **Rail Construction Fund Surcharge is an important source of funding** for major new construction projects and is possibly unique to China Railways. The surcharge has been imposed on the basic freight tariffs since 1990 and generates around 16 per cent of revenue. The surcharge revenue is 'ring-fenced' by the Ministry of Finance who administers the Fund. It is not subject to tax and can only be used for major upgrading, new construction and associated debt service. A second, electrification surcharge, was introduced in 1993 for all freight traffic moving on electrified lines and this revenue is used for extending electrification over the network.

A **joint venture (JV) model** was adopted in 2005 which is funded 50:50 by debt from local banks and equity from MOR and third parties (typically provinces and potential customers). Provincial equity often comes in the form of cleared land (and associated population resettlement costs). The JV model is now used for almost all new construction and upgrading projects, though regional rail administrations continue to operate the train services and question marks remain about how to get the right balance between railway system co-ordination/integration and protecting the interests of individual JV investors. China's MOR also raises **debt through loans and bonds** (usually short term), mostly through China's state-owned banks. The rapid build-up of such debt to finance the development of the High-Speed Rail network has provoked much comment regarding its sustainability. The burden would be mitigated if the debt were refinanced over tenures much more appropriate to the long-term nature of infrastructure provision. It is possible that the sovereign may need to absorb part of the debt directly.

Source: Passenger Railway Institutions and Financing, Paul F. Amos, 5 September 2011.

ing sources in Chinese Railways which require only modest support from the government (Box 1.5).

INDIAN RAILWAYS: AN ASSESSMENT OF DEMAND AND GOALS FOR 2032

In any exercise of transport planning with a time horizon up to 2032, delineating the role the IR will have to play, an assessment of the desirable market share for the railways, both in the freight and passenger segments, is essential, as also an enunciation of the strategies to achieve the objective.

VISION FOR INDIAN RAILWAYS

The Ministry of Railways has set up several expert groups in the recent past to formulate a vision for the Railways. **Report of the Expert Group on Railways** of 2001 (headed by Dr. Rakesh Mohan), the

White Paper on Indian Railways and **'Indian Railways Vision 2020'** brought out by the Ministry in 2009, the recent **Report of Sam Pitroda Committee** on **Modernisation of Railways** and **the Dr. Kakodkar Report on Safety,** provide guidance on strategies to aid transformation of the railways.

In **Indian Railways: Vision 2020**, the Ministry of Railways has articulated the following vision:

'Indian Railways shall provide efficient, affordable, customer-focused and environmentally sustainable integrated transportation solutions. It shall be a vehicle of inclusive growth, connecting regions, communities, ports and centers of industry, commerce, tourism and pilgrimage across the country. The reach and access of its services will be continuously expanded and improved by its integrated team of committed, empowered and satisfied employees and by use of cutting-edge technology.'

It is of the utmost importance that the various strategies set forth and the objectives mentioned in the above documents are pursued with determination for a transformational change of IR. An example of resoluteness to improve infrastructure that can be quoted is of NHDP which has brought about a phenomenal improvement in the national highways. Any failure to achieve the objectives or any slackening of the effort will only accelerate the loss in the IR's transport share to road, leading to greater pollution and environmental degradation. IR has to make a bold beginning in this direction, together with the required organisational changes.

An efficient railway transport system, along with expansion of the network, will bring in collateral benefits for the economy through industrial growth resulting from an efficient transport infrastructure and the enhanced demand for steel, wagons, engines, coaches, telecom, signalling, etc. The 12th Plan should initiate policies that encourage modern manufacturing facilities and innovation in these critical areas.

PLANNING FOR 2032

If India has to emerge as one of the largest economies of the world by 2032, railways must play its part in facilitating it. To be able to play its rightful role and attain the optimal share in the freight and passenger transport, IR would need to critically assess the business environment it faces and the internal capabilities it has. It also has to envision the future and align its resources towards attainment of the goals.

Existing scenario of freight and passenger traffic

Transport in India is dominated by road; in freight tonne-km, it contributes 57 per cent as against 36 per cent by the railways. In comparably large countries (examples: US. and China), railways' share is 50 per cent (McKinsey's study: Building India: Transforming the Nation's Logistics Infrastructure). RITES in their Total Transport System Study have estimated that the railways' share in originating tonnage has come down from 89 per cent in 1951 to 30 per cent in 2007-2008; and by assigning transport flows to different modes, based purely on total resource costs and break-even distances derived there from, non-optimal intermodal distribution has cost the economy Rs 385 billion in 2007-2008, constituting 16 per cent of the total transport cost. This is a theoretical exercise as it implies railways' increasing its share to 75 per cent of the total transport output; further, nearly half of the commodities transported by road are non-bulk in nature, not easily amenable for movement by rail without an organised intermodal transport arrangement. Notwithstanding this, consistent shift of traffic to road is at considerable cost to the economy.

The McKinsey study too has touched upon this extra cost to the economy in its above study and estimated it at 4.3 per cent of the GDP. If the present trajectory of modal share continues, the railways' share in freight tonne km may decline to 25 per cent by 2020 and 20 per cent by 2030. McKinsey estimates the loss to the nation's economy at 5 per cent of the GDP by 2020. GDP growth at 9 per cent is also at risk.

Similarly, road transport has emerged as the predominant mode of passenger transport over the last few decades. The share of road assessed in passenger km has increased from around 26 per cent in 1951 to 87 per cent in 2005 while that of the railways has declined from 74 per cent to 13 per cent.

The current trend is unsustainable from resource cost to the economy. Energy security would become increasingly important in times to come, as also environmental and social considerations, making a positive shift towards rail transport an imperative.

An integrated approach and an enabling policy framework are required to correct the existing distortion in favour of road. And it is obvious that IR will have to be prepared to rise to the challenge. The paragraphs that follow deal with desirable market share for sustainable growth of the economy.

Desirable Market Share for sustainable growth of economy

a. Potential for Freight Business

As discussed, RITES, in their Total Transport System Study, have estimated the total transport output in 2007-2008 at approximately 1,400 billion NTKMs (Table 1.1). Further, the TTSS has also estimated the total transport output (for select 52 commodities) in 2007-2008 at approximately 1,200 billion NTKMs, and the total transport demand for the year 2025-2026 at approximately 5,300 billion NTKMs (for these 52

Table 1.6
Projections of Total Freight Traffic
[Billion NTKM]

TERMINAL YEAR OF THE PLAN PERIOD	11TH PLAN 2012	12TH PLAN 2017	13TH PLAN 2022	14TH PLAN 2027	15TH PLAN 2032
GDP Growth Projections (Per cent)		6.9[P]	8.0[E]	8.5[E]	9.0[E]
Transport Elasticity	1.2				
Freight Traffic (Billion NTKM)	2,053[E]	3,056	4,834	7,856	13,118

Source: NTDPC.
Note:
1. P: Projected in 12th FYP document.
2. E: Estimated (based on NTDPC research).

commodities). This figure has been arrived at by assessing the increased transport demand due to growth of 11 commodities that constitute a share of 53 per cent in a basket of a total of 52 commodities, and then applying the figure so arrived at for all the 52 commodities. The CAGR in percentage terms comes to 8.5 per cent. If the projection of RITES is extrapolated to 2032 at the overall growth rate of 8.5 per cent, the size of inter-regional freight movement comes to about 8,700 billion NTKMs.

The above approach is too conservative. A fast-growing Indian economy is expected to be accompanied by a proportionately high demand for transportation. If the country's GDP grows at an average of 8 per cent per annum over the 20-year period (2013-2032) and the elasticity of total freight traffic-to-GDP is estimated at 1.2, the transport growth rate would come to about 9.7 per cent per annum. At this rate, the total freight tonne kilometres would grow by a factor of 6.4, from about 2,050 billion NTKMs in 2011-12 to more than 13,000 billion NTKMs by 2032 (Table 1.6).

No attempt has been made for any detailed commodity-wise projections but the current trends and development plans of major freight generating sectors corroborate the conclusion that transport would continue to grow. Major freight generating sectors such as power, steel and cement industries and consequently coal, both domestically mined and imported, are poised for a massive expansion. Coal constitutes close to 45 per cent of the total railways' freight movement. Although part of the coal movement may shift to non-rail alternatives (e.g. pit-head or port-based power plants relying on merry-go-round or conveyor belt systems), concerns on pollution overload and energy security at state/regional level would lead to continued expansion of thermal generation capacity across the country. Both the volume and lead of coal transport would increase as a result. A large part of the movement would involve linkages to new mines or ports. IR can grow very fast in these segments and increase its share provided network and terminal capacity are built up expeditiously and its service offerings satisfy the increasingly cost-conscious customers who now operate in a fiercely competitive environment. According to the McKinsey study, 65 per cent of the total freight traffic is bulk in nature and 75 per cent of the traffic, in terms of NTKMs, moves over distance slabs exceeding 400 km. This presents a huge opportunity for railways to increase their share.

As mentioned earlier, nearly half of the freight moved by road is in the non-bulk segment, and a substantial part of it, with a lead of over 500 km. If the objective of a shift to rail is to be achieved, the imperative need is for an organised intermodal transport system which will combine the advantages of rail with that of road. In this context, the need for the IR to capture a significant share of the fast-growing FMCG, Consumer Durable and Information Technology (CDIT), containerised cargo and other segments like automobiles, where its presence is negligible or minimal, is obvious. The 12th Plan has also recommended containerisation as a major strategy to gain share of the freight market (Box 1.6). Internationally also large rail freight providers have redefined their role beyond just running trains into the larger world of multi-modal freight transport and logistics (Box 1.7).

Given the realities of cost, economics and customer convenience, as also the modal share in comparable countries (China and the US), the Working Group on Railways (for NTDPC) has recommended that the Indian Railways must achieve a market share of 50 per cent by developing a sharper commercial focus. Table 1.7 provides the estimates for rail freight output till 2032.

In order to attain the desired market share of 50 per cent, railways' freight traffic has to grow at an average of 12 per cent over the next 20 years, which looks challenging given the growth rate of 8 per cent achieved in the last six years. A business as usual approach is just not an option as growing at 8 per cent per annum, while the transport market expands

Box 1.6
Containerisation in Railways

Due to the economic and technological attributes of the railways, it has always been a challenge to attract consignments which are less than at least a thousand tonnes. Container trains combine the operational efficiency of unit trains with the commercial flexibility of booking 20 tonnes or even less at a time. According to the Total Transportation Study (TTS) conducted by RITES for the Planning Commission, the volume of non-bulk traffic in 2006–07 was 227.17 million tonnes out of the total traffic of 2386.97 million tonnes.

Indian Railways set up Container Corporation of India (Concor) in 1988 as a public sector company to spear head containerisation. It commenced operations in 1989 at which stage Indian Railways transferred all Inland Container Depots (ICDs) and container related business to Concor. From the 7 ICDs it took over from Indian Railways at inception, Concor has now expanded the network to more than 44 ICDs and 14 domestic and port side terminals and has 213 rakes of flat wagons. Using IR's network and haulage, it has pioneered the concept of multi-modalism through its core activities as a carrier of rail borne container traffic and terminal operation.

Anticipating higher container traffic at Indian ports, Railways liberalised the entry of private players in the area of rail-based haulage of containers in 2005. The response has been quite good with 15 new entrants. These 15 new operators have procured 132 rakes and developed 9 new terminals. Sizeable on-track competition has emerged in some of the exim sectors as well as the domestic sector. Competition also led to an increase in the growth of rail based intermodal traffic at a rate of 15.5 per cent in the period 2007–08 till 2011–2012 although there has been a negative growth rate in the domestic sector during 2011–12 due to introduction of container class rate for some of the commodities moved normally by conventional wagons. There is a need to expand containerisation business and improve Railways share in transport sector. Policies in the 12th Plan will aim at this.

Source: 12th Five Year Plan, Planning Commission, GoI.

Box 1.7
Intermodalism, Multimodalism and Logistics Capability

Larger rail freight providers in the 8 countries (refer table below) have redefined their role beyond just running trains into the larger world of multi-modal freight transport and logistics. They have done so not only to better serve their markets but also to avoid becoming disconnected from final markets, and thereby becoming passive 'price-takers' from the 'middlemen', including freight forwarders and logistics companies who in many countries are increasingly responsible for overall transport organisation under contract to ultimate freight shippers or receivers. By engaging more effectively in supply chains the railways have increased market 'reach' without increasing network length.

COUNTRY	RAILWAYS AND LOGISTICS
Australia	Rail freight operators have had close partnering arrangements with freight forwarders for decades but since railway restructuring freight companies with wider logistics businesses now run most interstate freight trains in Australia.
Brazil	Many of Brazil's railways deal with bulk mining and agricultural products but the company with the largest network (with concessions in Brazil and Argentina) 'America Latina Logistica', markets itself as a full service logistics company.
Canada	CN promotes itself as a transportation company that offers integrated services: rail, intermodal, trucking, freight forwarding, warehousing and distribution. Canadian Pacific stresses ability to plan and manage logistics solutions and provides one-stop shopping for door-to-door transportation using long-haul capabilities of the railway and the local market access of trucking, for both rail and non- rail served customers.

(Contd...)

COUNTRY	RAILWAYS AND LOGISTICS
China	China Railway Container Transport Company was established to manage the container business, including rail and intermodal transport, cargo handling and delivery, the sale and leasing of wagons, containers and facilities. JV with international investors to establish 18 major intermodal centres linked by regular container train services.
Germany	DB Schenker, the main national rail freight operator, is a multimodal transport company offering through separate LOB divisions and subsidiaries services in rail freight, land transport, air freight, ocean freight, contract logistics.
Japan	With limited bulk traffic Japan Rail Freight Company has necessarily concentrated on efficient intermodal logistics linking 140 container rail terminals with road, sea, and air routes.
Russia	Has established subsidiary companies to provide overall logistics services in shipping containers, domestic container service, automobiles, perishable goods.
United States	Many different models but Class 1 railways now typically have overall Logistics Planning capability offering solutions and management of logistics across modes, as a LOB or as subsidiary or associated companies.

One early form of integration with other modes was the so-called piggy-back service. After about 1975, there was substantial growth in the carriage of road truck trailers on rail flat-cars in N.America. The modest net/tare ratio of such arrangements and the sometimes cumbersome and labour- intensive loading process inevitably raises the costs of train operations and potential margins are at best thin. More substantially, maritime freight containerisation over the last 30 years has created a new niche for railways in an integrated transport market. This is particularly so for ISO containers on routes between international ports and inland cities but traffic can then take advantage of unbalanced container loadings and the availability of the low-cost container liner services. In the last few years' intermodal traffic has overtaken coal as the single biggest generator of revenue in US railways. But the trailer traffic has declined & container transport, which is more cost-efficient for railways to handle (even more so with double-stacking) now dominates the intermodal market.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Paul Amos, July 2011.

Table 1.7
Projections of Rail Freight Output
[Billion NTKM]

TERMINAL YEAR OF THE PLAN PERIOD	11TH PLAN 2012	12TH PLAN 2017	13TH PLAN 2022	14TH PLAN 2027	15TH PLAN 2032
GDP Growth Projections (Per cent)		6.9[P]	8.0[E]	8.5[E]	9.0[E]
Transport Elasticity	1.2				
Freight Traffic (Billion NTKM)	2,053[E]	3,056	4,834	7,856	13,118
Modal share: Rail Freight (per cent) (Assumption)		**35**	**39**	**45**	**50**
Rail Freight Output (Billion NTKM)		1,070	1,885	3,535	6,559
CAGR (per cent) - Rail Freight Output		10	12	13	13

Source: NTDPC.
Note:
1. P: Projected in 12th FYP document.
2. E: Estimated (based on NTDPC research).

at close to 10 per cent, would mean that railways' share would actually decline to less than 24 per cent by 2032. Even to retain the existing share of 36 per cent, IR has to keep growing at more than 10 per cent per annum. However, given the severe capacity constraints and various other challenges, a more realistic goal would be to grow at 9-10 per cent till 2022 and accelerate the growth to 14-15 per cent per annum thereafter to reach 50 per cent market share by 2032. This will also be consistent with the proposed capacity creation and augmentation plans, whereby the two Dedicated Freight Corridors (DFCs) are likely to be operational only after 2017.

Table 1.8
Passenger Growth for IR

YEAR	PASSENGER KILOMETRES (IN BILLIONS)		
	SUBURBAN (PER CENT)	NON-SUBURBAN (PER CENT)	TOTAL
2011-12[A]	144 (14)	903 (86)	1,047
2016-17	189 (12.5)	1,320 (87.5)	1,509
2021-22	253 (11)	2,047 (89)	2,300
2026-27	342 (9.5)	3,254 (90.5)	3,596
2031-32	461 (8)	5,304 (92)	5,765

Source: NTDPC, Report of the Working Group on Railways (NTDPC).
Note:
1. A: Actual (from Railways Yearbook 2011-12)
2. GDP growth projections:
   - 12th Plan: 6.9 per cent (projected in 12th FYP document);
   - 13th Plan: 8 per cent; 14th Plan: 8.5 per cent; 15th Plan: 9 per cent (NTDPC estimates).

b. Potential for Passenger Business

The RITES study did not attempt an assessment of the size of the total passenger transport market in the country and its intermodal distribution among the various modes. Reliable information is available only in respect of rail and air transport, the two sectors which maintain statistics on a continuous basis.

RITES has also not carried out any optimisation exercise in respect of passenger transport, as has been done for freight. There is thus no reference base available for determination of an optimal share for the railways and projection of figures for 2032. This approach, that is, 'optimality consideration', may not be relevant as railways' passenger transport has long been operating under manifest supply constraints. There is also an imbalance in the passenger mix in that a preponderant proportion of passengers carried by IR are of short lead in nature, which perhaps could be better served by road.

Urban population constituted 30 per cent of the total population in 2010; this is projected to grow to 40 per cent by 2030 (India Urbanisation Econometric Model, McKinsey Global Institute). India's economic growth rate also presents a potential for higher demand for transportation; rapid urbanisation and the on-going structural transformation of the Indian economy would give rise to increased demand for travel. Extensive use of information technology for ticketing, reservation and overall improved convenience of passengers in recent years also presents an opportunity for the growth in passenger travel. Past trends may not, therefore, be an accurate guide for projecting the figures for 2032.

Over the past 15 years, the elasticity of growth of passenger kilometres vis-a-vis GDP growth has been 1.1. Using this elasticity and the GDP growth estimates, the passenger traffic (in PKM) is expected to grow by a factor of 5.5 over the next 20 years. Further, the current trends of progressively declining proportion of suburban passengers and the increasing share of upper class and longer lead passengers would also need to be taken into account in planning. On the basis of this assumption, projected passenger growth is shown in Table 1.8.

c. Potential for Parcel Business

Parcel traffic, mostly transported along with passenger services, presently forms an insignificant proportion of about 2 per cent of the non-bulk traffic of the country. As per the data for 2011-12, IR transported approximately 7 million tonnes of parcels, generating revenue of about Rs 16 billion. Parcel business is at present a loss-making activity for IR.

The potential, however, is large. As mentioned earlier, CRISIL Infrastructure Advisory study has assessed the total movement by road of 22 commodities, out of a basket of 52 commodities, carried as per the data for 2009-10, at about 400 million tonnes. These 22 commodities are easily amenable for movement by rail as parcels for distances of 500 km and over.

If the modal share of the railways has to improve, a shift of long distance (500 km and above) trans-

port of parcels essentially non-bulk packaged items to rail is a must. It needs no reiteration that the IR has a major share of bulk movement and the need is for an ever-increasing market share of the non-bulk commodities.

The above would, however, need a market oriented strategy, with focus on total logistics support, value added services, rational cost and value based tariff, state-of-the-art IT applications for providing real-time online access to information on movement of consignments and adequate and appropriate rolling stock and public private participation in terminal operation and road bridging. Dedicated parcel terminals with mechanised handling facilities, specifically targeted at agricultural produce, automobiles, other industrial products and general parcels and a focused business organisation that would concentrate on marketing, sales and transport of parcel services within an agreed transit time through time-tabled trains and parcel specials form an essential feature of the strategy.

Indian Railways Vision 2020 recognises the above and has set a target of revenue of Rs 80 billion by 2019-2020. However, this segment being small on the whole cannot be the mainstay of freight traffic volumes.

SERVICE DELIVERY AND CUSTOMER ORIENTATION

IR must provide services to meet customers' requirements and expectations. It has to devise solutions that anticipate and meet customers' needs in different segments. In the freight service, bulk and non-bulk commodities would demand different approaches. In passenger services, premium and non-premium passengers, and suburban and intercity passengers would similarly demand different approaches.

The goal for service delivery should provide for the following:

A. FREIGHT BUSINESS

The goal for freight business is to have segregated freight corridors, improving the speed of transit and cost-efficiencies in bulk transport. The strategy for freight business should also specifically provide for:

- **Construction of six Dedicated Freight Corridors.**
- **Setting up of a focused business organisation for multimodal transport** of non-bulk commodities (e.g. parcels) under the PPP mode, combining the efficiency and advantages of rail and road.
- Improved connectivity to industry clusters as well as significant ports (major and non-major), based on their current and projected traffic volumes. Development of last-mile connectivity should be encouraged through PPPs.
- **Development of 15 to 20 logistics parks** as the main network hubs viz. Mumbai Bengaluru, Cochin, Hyderabad, Kolkata, Delhi NCR, Ahmedabad, Nagpur, Vishakhapatnam and Siliguri, etc. IR must work in **partnership (in a joint venture) with state and city authorities** to set up rail-based multi-modal logistics parks to attract increasing volumes of miscellaneous cargo to rail.
- Upgrade rail wagons (higher axle load, better tare to payload by shifting away from carbon steel to stainless steel and aluminium/other light-weight bodies, increased payload of covered wagons (BCN) through use of well wagons, better maintenance cycles, etc).
- Upgrade wagons and track to 25 tonnes axle load.
- Improved infrastructure and rolling stock maintenance.
- Running of freight trains at 100 km per hour.
- Running of premium freight services with differential pricing and assured deliveries.
- Supply of rakes on demand with differential pricing for different demand lead times.
- Running of trains on schedule with guaranteed transit time.
- Development of a few selected corridors for heavy-haul operations.
- Running of automobile, hazardous material trains, movement of bulk cement, etc by private train operators.
- Reduction in cargo parcel size to 1,000 tonnes and aggregation mechanism for even smaller parcel-sizes.

B. PASSENGER SERVICES

Quality of services in terms of punctuality, safety, security, sanitation, and other value-added services needs to be upgraded. Access to railway services needs to be improved using existing and innovative networks of distribution channels like Internet, mobile telephones and other vending mechanism. Speed of trains should be enhanced on segregated passenger routes. The strategy for passenger business will include:

- Augmentation of supply (more trains and longer trains) to ensure full satisfaction of demand.
- Shift of focus to long-distance and inter-city transport and suburban corridors involving dense passenger movements.
- Upgrade speed to 160-200 kmph on selected corridors.
- Redevelopment of stations for smooth flow and comfortable experience of passengers as also to ensure clean and hygienic environment.
- Redesign of coaches to enhance travel comfort.
- Conversion of all stopping passenger trains to EMUs/DMUs or railcars; invitation to state governments to manage uneconomic and unpatronised services.

Box 1.8
A Competitive Freight Market

Indian Railways' freight services are moving from a captive to a competitive market. In order that the freight segment grows to its full potential, reliance on marketing alone will certainly not suffice. Even marketing in combination with innovating pricing solutions will not be adequate. The target customer and traffic stream needs to be considered at the stage of designing the scope of projects and determining the investment.

Developing a strategy for the bulk/non-bulk freight business:
Railways have traditionally focused on the bulk long haul traffic. With the increasing growth rates of the non-bulk segment, there is need to address the long haul non-bulk segment. This would involve developing multi-modal transportation solutions with road and other private industry participation. A detailed assessment of the bulk and non-bulk transport opportunities available for the Railways as also the organisational imperatives that need to be addressed to increase customer focus and responsiveness would be a critical step towards developing a profitably growing freight business.

The non-bulk and manufactured goods are high value traffic that can bear higher freight rates and yield higher profit. To improve the mix of goods as well as earn higher revenues and higher profits, it is necessary that Railways devise cost effective and efficient services, pricing structures and operational strategies to cater to this traffic. Railways must adopt the principle of logistics and supply chain management that offer total transportation solutions to the customers. For this purpose, it must move towards integration and partnership with complementary entities in other modes of transport and promote multi-modal transport systems.

The key imperatives and challenges to develop a cohesive strategy for the freight business would be to involve freight customers in the exercise and to gear the organisation for improved customer focus.

Source: The Indian Railways Report 2001: Expert Group on Indian Railways.

- Development of select High Speed Rail (HSR) corridors (speed of 350 kmph), if and when deemed to be economically viable.

INVESTMENT REQUIREMENTS AND FINANCING PLAN

INVESTMENT REQUIREMENTS[9]

The previous section sets out the following broad goals for IR for 2032:

- Achieve 50 per cent share in freight transport; and
- Meet the passenger service demand in full.

However, while the potential to grow in both freight and passenger traffic segments is immense, without adequate capacity all efforts to capture traffic would come to naught. *Therefore, capacity creation is the single biggest challenge confronting IR in the next few years. It is of the utmost importance that a vision similar to that of NHDP is laid down for the railways now so that we may expect a transformed network by 2032.*

Plans for capacity creation must encompass both infrastructure and rolling stock and cater to projections for both, the existing traffic streams and capacity needed to cater to new traffic streams. An analysis done by Long Range Decision Support Systems (LRDSS) of Ministry of Railways indicates that most of the traffic growth would come along the existing Golden Quadrilateral and Diagonals. This is also reinforced by the McKinsey report. Further, investments needed to modernise the railway system and ensure a zero-accident and fully reliable systems need to be ensured.

An investment plan for 20 years clearly articulating the goals and fully backed by a funding plan is needed. The following sections discuss the investment needs[9] (tentative) over a time-horizon of 2012 to 2032, spanning four Five Year Plans (12th to 15th). The broad heads for investments are as follows:

- Capacity Augmentation (including safety works)
- Rolling Stock
- Stations & Terminals, Technological upgrade and modernisation

CAPACITY AUGMENTATION

Any serious effort at capacity augmentation must first and foremost focus on decongestion of congest-

9. The investment needs have been estimated assuming that IR attains a freight share of 50 per cent by the year 2032 with high GDP growth rate (about 9 per cent).

Box 1.9

Dedicated Freight Corridors (DFCs): A Game Changer for the Indian Rail Sector

The Dedicated Freight Corridors on the Western and the Eastern routes is a strategic capacity augmentation initiative taken by Railways and involves construction of 3,338 kms of dedicated freight lines to carry predominantly coal and steel on the Eastern corridor and containers on the Western corridor. The ports in the Western region covering Maharashtra and Gujarat would be efficiently linked to the Northern hinterland and similarly on the Eastern side, coal would move to the power plants in the North. The Project completion cost is estimated at Rs 959 billion. A major part of the project is being financed through multilateral/bilateral debt. World Bank funding of part of Eastern DFC is estimated at US $2.73 billion (Rs 136 billion) and Japan International Cooperation Agency (JICA) funding of 504 billion Yen (Rs 315 billion). Dankuni–Sonnagar section of Eastern DFC (Rs 100 billion) is to be implemented through PPP. The balance requirement would need to be met through Budgetary Support. Both Eastern and Western DFCs are targeted for completion in the terminal year of the 12th Plan.

Dedicated Freight Corridor can be justifiably called an innovation in rail transport in India because of a number of reasons. The average speed of freight trains will go up from 25 kmph to 70 kmph which will reduce the transit time by less than half from the present levels.

Railway technology would get a major up-gradation with the help of heavy hauled freight trains of 15,000 tonnes capacity and 1500 metres length. The axle loads of DFC routes will also go up from 25 tonnes to 32.5 tonnes which would enhance the track loading capacity from 8.67 tonnes per metre to 12 tonnes per metre. Wagons with much better pay load to tare ratio would also get introduced through this technology. Newer technology in signaling, train communication, track-maintenance and operations would get introduced in the Indian Railways system. The capacity released by freight trains can be used for running more passenger trains at higher speeds after upgrading the existing mixed corridors of Indian Railways.

In addition, this initiative is expected to offer significant reduction of Greenhouse Gas (GHG) emissions in transport sector of India.

Pre-feasibility studies have also been completed on the four new Freight Corridors, vis. North-South, East-West, East-South and Southern corridors and Preliminary Engineering cum Traffic Survey (PETs) is being undertaken by RITES. Based on the outcome of the PETS a beginning would be made in the Twelfth Plan in implementation of the new corridors in a phased manner.

Source: 12th Five Year Plan, Volume II, Planning Commission, GoI.

ed routes and segregation of freight and passenger traffic on the most heavily trafficked routes. This can be achieved by:

- Construction of Dedicated Freight Corridors (DFCs) on the busy high density network such as Delhi-Mumbai, Delhi-Kolkata, Delhi-Chennai, Kolkata-Mumbai, Chennai-Goa and Kolkata-Chennai routes, with specifications that enable high traffic and heavy-haul freight operations; and
- Construction of third and fourth lines on other saturated routes.

Six DFCs totalling 9,538 km that would be needed are:

- Western DFC (Delhi-Mumbai) 1,534 km;
- Eastern DFC (Ludhiana-Kolkata) 1,839 km;
- East West DFC (Howrah-Mumbai) 1,976 km;
- East-Coast DFC (Kharagpur-Vijaywada) 1,097 km;
- South DFC (Chennai –Goa) 902km; and
- North South DFC (Delhi-Chennai) 2,190 km.

Of these the first two are already under construction (expected to be commissioned by March 2017), and for the others pre-feasibility studies have been carried out. It is suggested that private sector participation should be encouraged by IR for development and operations of the DFCs.

Quadrupling (non-DFC lines) and fifth and sixth Lines: In addition to the DFCs, a number of other saturated stretches (approximately 14,500 km) would also need third and fourth lines. Lines approaching major metropolises would also require additional fifth and sixth lines to effectively segregate commuter lines from non-commuter lines.

Doubling and Gauge conversion: Similarly, around 24,000 km of single lines facing congestion

would need to be doubled. In other words, roughly 48,500 km of the network (which should exceed 90,000 km by 2032) would need to be either double or quadruple lines. Gauge conversion would have to be completed for the remaining part of the network (roughly 8,000 km).

Freight bypasses and traffic facility works such as splitting of block sections, construction of terminals and additional loops, etc. would also need to be taken care of in full.

Speed raising: A major effort is also required to upgrade speed on segregated passenger corridors to 160-200 kmph this would imply deployment of advanced signalling technology (ATP/Cab signalling/CTC), elimination of level crossings, fencing of tracks, removal of permanent speed restrictions, etc. The investment on this account would be of the order of Rs 1,000 billion.

Other safety works (signalling, removal of level-crossings, renewal/modernisation works for track/signalling, etc.) will entail investment to the tune of Rs 2,500 billion.

New Lines: Since independence, the pace of new lines construction has been roughly 200 km per annum. The Working Group on Railways (for the NTDPC) has suggested that network expansion by way of new lines should be planned on a much bigger scale than has been done so far, and recommended to accelerate the construction of new lines to a level of at least 2,000 km per annum over the next 20 years. Accordingly, the Working Group envisaged that the total length of new lines to be constructed would be around 30,000 km (including national projects and projects required for strategic regions and international corridors), costing around Rs 3,000 billion at present-day costs.

However, the Committee (NTDPC) is of the view that it is essential to abandon or not commence work on the many extraneous lines that have been initiated in the past, and on which almost no work has been done if consistent economic growth of 8-10 per cent per annum is to be achieved and IR has to achieve the goal of 50 per cent share in freight transport over the next 20 years. These extraneous lines are not only expected to be uneconomic routes but also meet the traffic requirements to a very limited extent. The 12th Plan also emphasises that excessive sanctioning of new projects annually, much beyond the resources available is a major problem in the railways and it only increases the throw-forward (number of projects under implementation). It shows that 132 new line projects (totalling about 14,200 km in length) are under implementation as of April 2012.

Further, acknowledging the importance of enhancing transport connectivity for inclusive growth, the Committee (NTDPC) recommends that focus should be on developing interconnectivity between different modes, e.g. instead of investing resources in uneconomic rail lines, the connectivity to the existing rail network should be strengthened through investments in improving road connectivity (e.g. PMGSY) and bus transport. This will ensure that people have access to economic transport services at a lower overall cost to the economy.

High Speed Rail (HSR): HSR is defined as a distinct category of passenger rail transport system that normally operates with separate track and rolling stock at speeds faster than 250 kmph. HSR has been in operation for nearly 50 years in Japan and for over 30 years in France. As of July 2012, about 17,500 km of HSR tracks were in operation, about 9,300 km were under construction and another 15,500 km were in the planning stage globally.[10] China has the longest HSR network in the world today, even though it launched its HSR network only in 2003.

A review of the most important HSR projects carried out to date around the globe highlights that the potential demand for services must be particularly high in order to make investment in them socially profitable and that these projects must target the corridors linking densely-populated metropolitan areas, suffering from severe road congestion, and having deficient air links. Table 1.9 summarises the lessons learned from HSR implementation across Japan, France, Germany, Spain and Italy.

The Working Group on Railways (for the NTDPC) has suggested that about 4,000 km of high-speed corridors costing Rs 4,000 billion could be planned in India. *However, the Committee (NTDPC) is of the view that given the current financial situation of IR (limiting the funds available for expansion), priority should be given to projects such as DFCs which are self-financing, as compared to projects such as HSR network which require continuous fiscal support (Box 1.10).*

Further, the Committee believes that a more integrated approach is required to be taken of transport as a whole and choices will need to be made on the priorities to be placed on different investments. At present, this prioritisation and decision-making is disjointed as the decisions on investments in road expressways, on the one hand, and potential railway DFCs and high speed trains, on the other, are being made in isolation of each other. The investment in DFCs is critical if IR has to achieve the target of 50 per cent share of railways in freight transport by 2032. With the construction and commissioning of DFCs, freight trains would get substantially diverted

10. Singh (2013).

Table 1.9
Summary of Lessons Offered by International Experiences of HSR Projects

	SUMMARY OF LESSONS
Motivation	HSR has to be devoted to solving congestion in corridors between large populated cities. Political or administrative objectives and extension of lines for regional equity and development lead to the economic failure of the project.
Design and Functions	The international experience shows that passenger-oriented HSR has a minimum economic impact on the territory served. Lower construction costs are associated with combining HSR and conventional rail. Routes have to be established according to demand (commercial basis). Adequate multimodal connections are needed.
Economic Cost	The development of an HSR network entails huge construction and operation costs (especially important land expropriation cost, bridges, and tunnels). The key decision that affects cost concerns complementarities (passenger/freight) and the extent of combination with existing conventional rail. Political pressures (connection and station costs) can increase HSR cost and constrain its profitability because of opportunism or private interests from both politicians and bureaucrats.
Mobility Impacts	Provide significant travel time savings when compared to conventional rail services, but similar door-to-door timings are reported for air transportation on routes of around 400 miles. Modal distribution of traffic is affected when HST starts operation, with the greatest impact on the airline industry.
Environmental Cost	Energy consumption and carbon dioxide emissions are lower for HST than for air transportation. However, they are also greater for HST than for conventional rail per seat mile. In fact, it is necessary to wait more than three decades to compensate energy and pollution generated during construction.
Economic and Regional Effects	HSR does not generate any new activities, nor does it attract new firms and investment, but rather it helps to consolidate and promote ongoing processes as well as to facilitate intraorganisational journeys, for which mobility is essential. For regions and cities whose economic conditions compare unfavorably with those of their neighbors, a connection to the HSR may even result in economic activities being drained away and an overall negative impact. Medium-sized cities may suffer the most because of the centralisation of activities in large nodes. Tourism and the services sector are the only activities favored, while no effects are reported for industrial and agricultural activities.

Source: HSR: Lessons for Policy Makers from Experiences Abroad, *Public Administration Review*, June 2012.

to the new freight corridors. This would present an opportunity to increase the maximum permissible speed of passenger trains on the existing corridors to 160-200 kmph (at present the maximum permissible speed for passenger trains on IR is 150 kmph for a few trains and the average commercial speed is in the range of 70 kmph). This would, in turn, enable operation of overnight inter-city services in the distance range of 1,000-1,500 km, as also help connect cities within distance of 500-700 km with high-speed day services.

Increasing speeds to 160-200 kmph would need inputs by way of removal of speed restrictions, yard remodelling, fencing, improved signalling, easing of sharp curves etc; the most opportune time would be to commence the exercise and implement the scheme when any section of the Dedicated Freight Corridor gets commissioned, relieving the pressure of operating freight trains on an existing congested section. The aim can be to successively increase the average speed in phases, reaching 120 kmph ultimately. The end result is shown in Table 1.10. These services would be able to satisfy the requirement of high speed travel in a large measure. Annex 1.2 shows a map of the suggested routes for increasing the maximum permissible speed to 160-200 kmph.

Thus, given the substantial funding required from government to implement HSR projects, a programme for raising speed to 160-200 kmph on selected existing routes should be undertaken till the time the HSR projects are found commercially justified or operationally required to cater to the country's growth and mobility needs.

Summary of Capacity Augmentation: Figure 1.17 shows the summary of investments required for capacity augmentation by 2032. The total cost for various capacity augmentation initiatives discussed above is close to Rs 12,500 billion, excluding the investments on new lines and HSR (the investment requirement increases to Rs 18,200 billion including these initiatives).

ROLLING STOCK

Along with the envisaged investments in capacity augmentation, there would be a huge requirement of rolling stock, both for replacement combined with technological upgrade and increased needs of traffic, if IR has to achieve the goals set for freight and

Box 1.10
High Speed Rail in Indian Context

High-speed rail (HSR) is defined as a distinct category of passenger rail transport system that normally operates with separate track and rolling stock at speeds faster than 250 kmph. It uses a different level of rail technology and management principle that positions it at an unbeatable advantage vis-a-vis other modes like cars and air-planes in the distance range of 500-1000 kilometres.

HSR has emerged as a fast and efficient transportation system for medium-distance travel of up to 1000 km. Some of the main reasons for introduction of HSR internationally are need for generation of additional capacity on the conventional network; regaining share from airlines and road; and energy security and environmental concerns. HSR network has various benefits such as lower energy consumption, lesser land usage for a given capacity compared to motorways, decongestion of metro cities, significant savings in journey time etc.

However, HSR networks world over require continuous fiscal support due to high costs of construction and rolling stock. It is estimated that an annual ridership of at least 20 million passengers are required just to cover the working expenses and interest costs and probably double that number to have any possibility of recovering the capital cost. In India, the cost of construction of a high-speed double line rail corridor between Pune-Mumbai-Ahmedabad has been estimated at Rs 630 billion (excluding rolling stock) for 640 kms i.e. around Rs 800 million per km. In comparison, cost of the construction for DFC is estimated to be Rs 250 million per km.

Source: Report of the Working Group on Railways (NTDPC).

Table 1.10
Possible Savings in Travel Time with Speed Raising on Suggested Routes

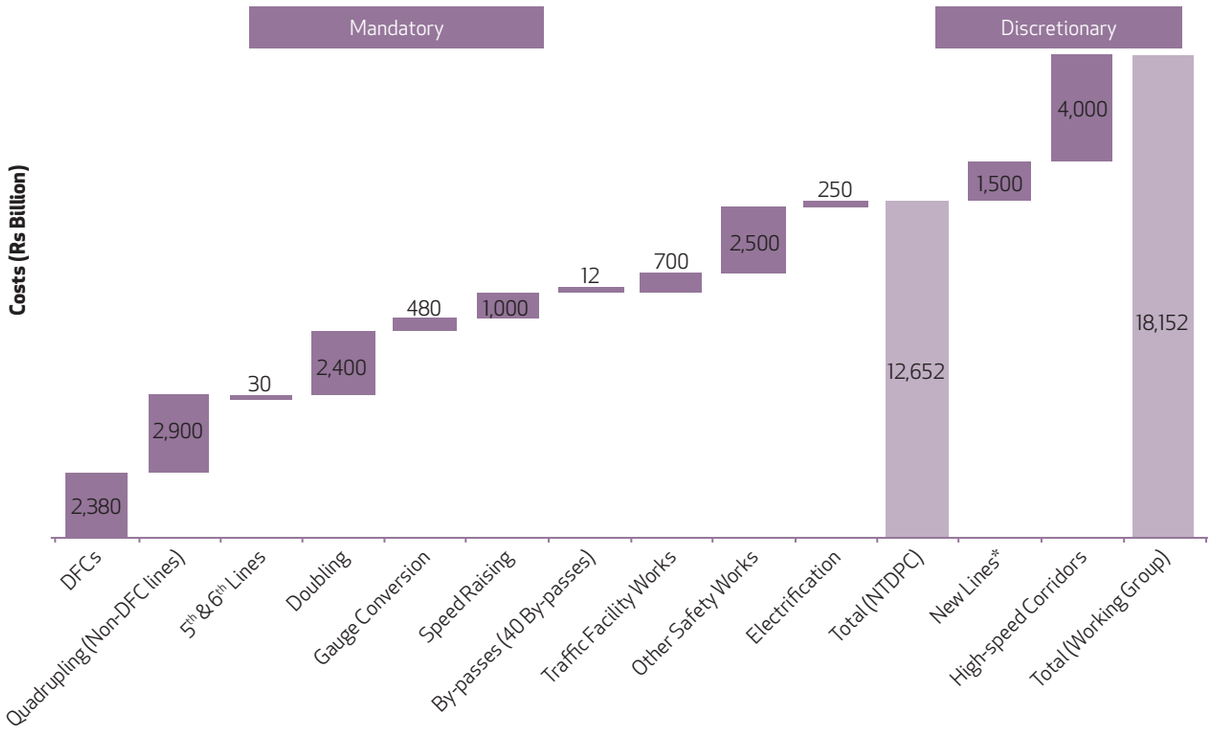
ORIGIN	DESTINATION	DISTANCE (KMS)	CURRENT DURATION (HOURS)	PROPOSED DURATION (HOURS)	TIME SAVING (HOURS)
Delhi	Ahmedabad	934	13.5	8.0	5.5
Delhi	Mumbai	1,384	16	11.5	4.5
Delhi	Allahabad	634	7.5	5.5	2.0
Delhi	Kolkata	1,453	16.5	12.0	4.5
Delhi	Chennai	2,176	28.5	18.0	10.5
Mumbai	Ahmedabad	491	6	4.0	2.0
Mumbai	Kolkata	1,968	26.5	16.5	10.0

Source: NTDPC.
Note:
1. Current duration has been calculated based on scheduled departure and arrival timings of Duronto or Rajdhani trains between the origin and destination.
2. Proposed duration has been calculated assuming an average speed of 120 kmph, post commissioning of DFC and upgradation of speeds on the identified corridors.

passenger transport. Figure 1.18 provides the rolling stock requirement on the basis of the projections discussed earlier (Table 1.7). The rolling stock requirement has been worked out by taking into account 100 per cent improvement in utilisation of freight wagons, 50 per cent improvement in efficiency utilisation of freight locomotives, 20 per cent improvement in utilisation of passenger locomotives and the replacement requirements. These improvements may appear to be too high, but would need to be aimed at and realised given the scale of investment in track capacity, zero-accident/failure and high-horse power locomotives envisaged. The investment required for rolling stock is estimated to be close to Rs 15,000 billion. In addition to the above, upgrade of Production Units (PUs) and Workshops for maintenance of the rolling stock would also require investment to the tune of Rs 750 billion.

The Committee is of the view that given the massive investment requirement for rolling stock, IR should encourage participation of private players (both domestic and international) in setting up manufacturing facilities for rolling stock and components.

Figure 1.17
Investment Requirement for Capacity Augmentation Needed by 2032



Source: Report of the Working Group on Railways (NTDPC), NTDPC.
Note: Investment for new lines includes - (a) 132 projects already sanctioned and under implementation (11,200 km to be constructed out of 14,200 km); (b) new lines for economic development serving the industry estimated at 200 km p.a. for 20 years (these include international corridors and port connectivity works).

This would facilitate induction of world-class technology, besides being a source of capital for the resource constrained IR. As a first step, IR should corporatise its existing PUs/workshops. This aspect has been discussed in detail in the section on Organisational Reforms.

STATIONS AND TERMINALS

Indian Railways' operations require efficient terminals to make any impact in the transport market. At present, most of the freight transport is carried out in customer-owned private sidings. These are basically meant for exclusive use of major customers. There are roughly 1,300 goods sheds owned and managed by the Railways. Of these, around 500 handle more than 10 rakes per month. IR needs to augment some of its good sheds to handle at least one rake per day with planned investment in lighting, circulating area, approach roads and facilities for customers. Moreover, the private sector should be encouraged to come forward and build efficient terminals, equipped with related logistics services like warehousing and inter-modal transfers, etc.

Similarly, major passenger stations catering to more than one lakh passengers a day must be upgraded. This would require segregation of incoming and outgoing passengers, seamless connectivity with the surrounding city, ample parking space, comfortable concourse areas and platforms, etc. Further, modern coaching maintenance terminals capable of ensuring quick maintenance and washing of train-rakes with utmost safety and cleanliness will also be needed.

While investment for redevelopment of stations (roughly Rs 1,000 billion) and development of freight terminals (roughly Rs 500 billion) could be mobilised through private sector participation, investment in coaching terminals (around Rs 500 billion) would have to be publicly funded.

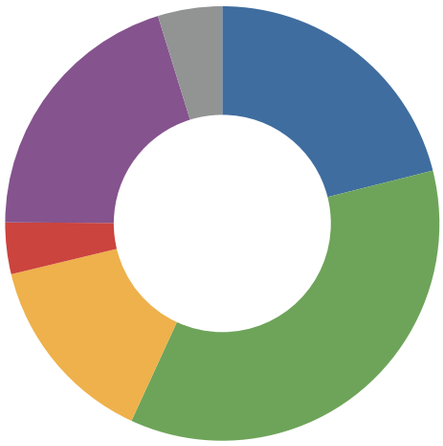
TECHNOLOGICAL UPGRADATION

In order to match the best of the railways in terms of technology and safety standards, investment would be required for upgrade of assets (track and bridges for better loading standards, relocation of structures to permit larger moving dimensions, signal and telecom, etc.), information technology and research & development. Given the prevailing security environment in India, investment would also be needed in beefing up security at stations, in trains and other railway installations. It is estimated that all these

Figure 1.18

Rolling Stock: Estimated Investment Requirement; Current Holding and Incremental Requirement

(RS BILLION)



(IN NUMBERS)

	CURRENT HOLDING	INCREMENTAL REQUIREMENT*
Freight Wagons	220,000	1,100,000
Electric Locomotives	3,849	28,000
Diesel Locomotives	5,000	15,000
EMUs/MEMUs	6,694	30,000
Coaches	50,000	210,000
Upgradation of PUs/Workshop	Nil	Nil *Including replacement

Source: Report of the Working Group on Railways (NTDPC).

works may add up to about Rs 4,000 billion over the next 20 years.

SUBURBAN TRANSPORT

Indian Railway's network running through the country's fast-growing urban agglomerations, including major state capitals, already carries significant volumes of commuter traffic. In cities like Mumbai and Kolkata (and to some extent, Chennai), IR's commuter network constitutes the lifeline of suburban transport. As per central government policy, urban mass transport is now under the purview of state governments and Ministry of Urban Development. However, the existing suburban services on IR would continue to meet passenger demand. Its role will continue to be relevant despite the advent of metro rail networks that have started altering the urban transport landscape in several cities.

From the railways' standpoint, the foremost concern stems from the operational losses suffered on these services, in addition to the capacity constraints. These services are loss-making and have become a bottleneck for running of long-distance trains and freight trains on the same tracks. They contribute roughly 53 per cent in number of passengers over the IR's total passenger traffic; however, their earning share is only 7 per cent (2010-11).

Railway networks in urban areas were primarily built for long-distance inter-city transport. It is suggested that IR should achieve physical separation of the long-distance network and the suburban network. The segregation of suburban and long-distance passenger/freight traffic is necessary for efficient provision of commuter service. A separate organisation should be created for suburban services with freedom to coordinate with state governments for connectivity/integration (Box 1.11). Modern accounting practices would ensure that infrastructure and rolling-stock resources used by these lines of business can be properly costed and charged for. MRVC in Mumbai and MMTS in Hyderabad are two successful models of financial participation and cooperation with state governments. Other states need to be engaged for similar initiatives. Viable cost-sharing arrangements need to be created for both infrastructure and rolling stock investment and management of commuter operations.

It is envisaged that over the next 20 years, IR's share of expenditure (@ 50 per cent) in augmentation of suburban networks would amount to roughly Rs 600 billion (Rs 30 billion per annum). In addition, two elevated rail corridors using the existing right of way of railways in both Western and Central Railways in Mumbai (Churchgate-Virar and Mumbai VT to Karzat) costing approximately Rs 400 billion could be implemented through PPP along with Viability Gap Funding (VGF). Similar other projects in Mumbai and other cities will come up in future. Overall, it is estimated that an investment of the

Box 1.11
Separation of Suburban Services from Other Train Services

Suburban services could be separated from other train services. The sequencing of actions could be separation of accounting, followed by organisational separation creating suburban entities, followed by partnership with state government and private sector in SPV. Such SPV should also have the mandate for modernisation and upgradation of services at the request of state government.

State Governments should agree to finance on the basis of Peak Cash Deficit Funding by the Indian Railways similar to the funding of Phase II of the rail component of the MUTP being implemented through MRVC. SPV should enter into an agreement with IR for gradually reducing the operating losses reaching zero within a time frame of 5-10 years. SPV should be allowed to develop alternative sources of revenues through advertising rights, leasing of spaces to service providers etc. IR should get better track availability for its long distance passenger and freight trains after such upgradation.

Source: Report of the Working Group on Railway Programmes for the 11th Five Year Plan.

order of Rs 1,000 billion would be required for suburban transport over the next 20 years.

SUMMARY OF INVESTMENTS REQUIRED AND PHASING OF FUNDING

Figure 1.19 provides a summary of the investment required over the next 20 years (2012 to 2032) along with its phasing over the corresponding Five Year Plan periods. The total investment required over the 20-year period is estimated to be around Rs 35,000 billion[11]. It is envisaged that bulk of the funding and project execution will take place during the 13th and 14th Five Year Plan periods (between 2017 and 2027). By the 15th Plan Period (2027-2032) most of the network capacity and modernisation works would have been completed and the spending would, therefore, slow down in the final five years.

The bottom-up assessment of the investment required has been crosschecked from a macroeconomic perspective. In 2009-10, investment in IR was 0.6 per cent of GDP. It is considered essential that the investment in railway infrastructure is ramped up to reach at least a level of 1.3 per cent of GDP by 2030 and stay at that level till 2032[12]. Following this approach would imply that approximately Rs 58,000 billion would need to be invested in railways during the period 2012-13 - 2031-32, i.e. Rs 2,900 billion per annum on an average over the next 20 years[13]. The gap is explained by the fact that the Committee has been conservative on certain investment-intensive projects like HSR. Further, the Committee feels that once growth-inducing investments are made, enhanced efficiencies could bring down the need for more investment purely from the view point of satisfying demand for freight and passenger traffic at the improved service level.

PRIORITISATION OF INVESTMENTS IN RAIL NETWORK

Given the massive investment requirements for development of the railway network, it is essential that priority is given for development of projects/routes that can quickly ease the capacity constraints or improve the operations and that have the highest impact. Further, given the high share of bulk commodities in India's freight traffic[14], it is suggested that investments in railways be prioritised as follows:

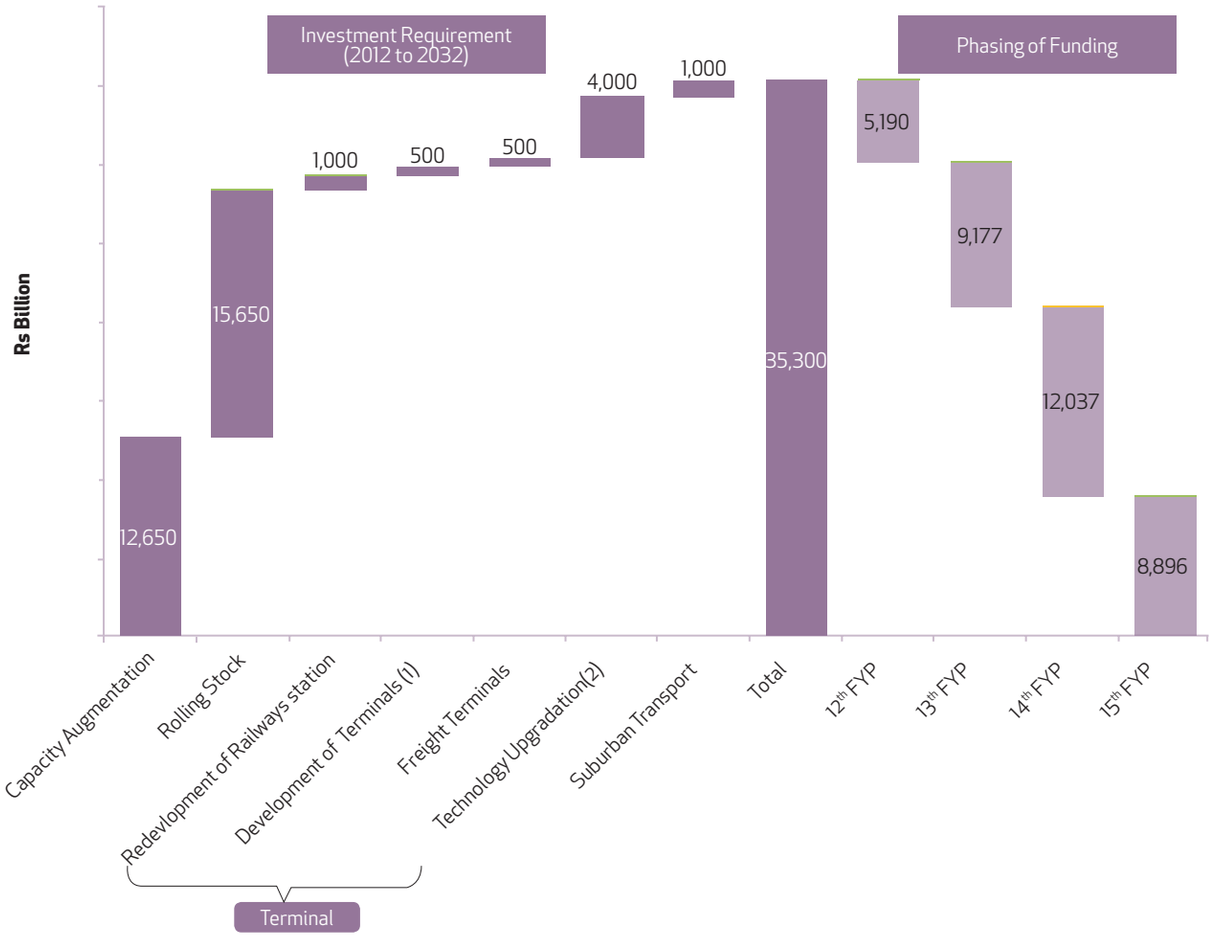
- **Prioritisation of Dedicated Freight Corridors (DFCs):** As discussed in the Chapter 8 on Transportation of Energy Commodities, the Eastern DFC is likely to carry an overwhelming share of the long distance coal traffic, with its share increasing from about half currently to about two-thirds by 2031-32. Therefore, **the Eastern DFC must be given the highest priority among the DFCs, and should be completed within the 12th Five Year Plan.**

  The Western DFC will carry imported coal and container traffic mostly from Gujarat to the northern and north-western states, and is already slated for completion by the end of the 12th Plan. However, because it is not as important for movement of bulk materials, we suggest that about 80 per cent of the investment be done in the 12th Plan and the remaining 20 per cent in the 13th Plan. The East-West, East-Coast and North-South DFCs will carry about

11. Rs 40,500 billion if investment in HSR and new lines is included.
12. In the year 2001, investment in Chinese Railways by the Government of Republic of China represented 0.8 per cent of the GDP. In the year 2009, this figure stands at approximately 1.7 per cent of GDP.
13. This is based on the assessment of GDP growth @ 9 per cent made by the NTDPC secretariat.
14. 65 per cent of the total freight traffic is bulk in nature and 75 per cent of the traffic, in terms of NTKMs, moves over distance slabs exceeding 400 km (McKinsey: Building India: Transforming the nation's Logistics Infrastructure, 2010).

Figure 1.19

Investment Required by 2032 and Phasing of Funding



Source: Report of the Working Group on Railways (NTDPC); NTDPC.
Notes: 1. Development of coaching maintenance terminals.
2. Technological upgrade and modernisation (tracks, bridges, Signal & Telecom, Information Technology, Research & Development and other miscellaneous works).

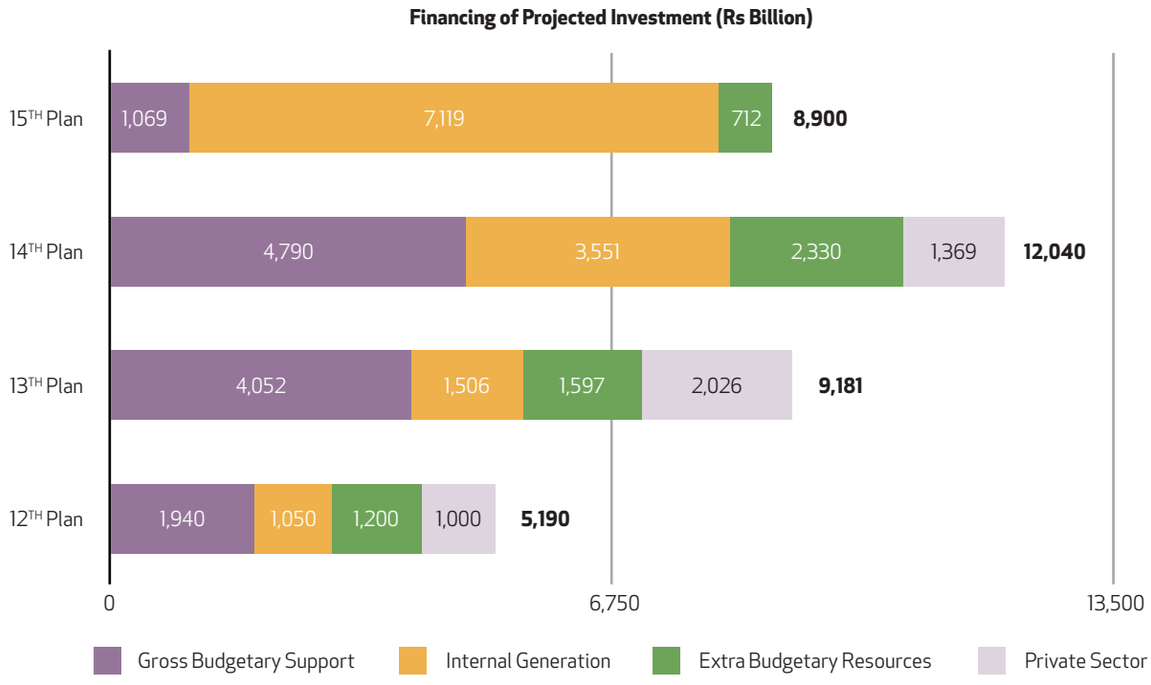
the same amount of coal as each other but much less than the Eastern DFC and should be completed by the end of the 13th Plan. The Southern DFC, which is not important for movement of bulk commodities and is expected to carry almost no coal, can be completed by the end of the 15th Plan.

- **Construction of Eastern, East-West and East Coast DFCs must start from the eastern end:** The traffic on these three DFCs will be highest closest to the coal-fields and will decrease as coal is unloaded at successive states on the route to the furthest state. For example, the eastern end of the Eastern DFC is likely to carry coal destined for several states: Bihar, Uttar Pradesh, Delhi, Haryana and Punjab, but by the time it gets to the western part of the country, it will be carrying coal only for Haryana and Punjab, the rest of the coal having been unloaded en-route in Bihar, UP and Delhi.

  This importance of the eastern end would also apply to the other DFCs for similar reasons. Another reason for focusing on the eastern end of the DFCs is that transport of coal within coal-producing states and to neighbouring states is likely to use sections of DFCs that are short but the volume of traffic is likely to be high. Almost all the use of short sections of DFCs will occur in the eastern part of the country.

- **Critical Feeder Routes at Mines (coal, iron ore):** Feeder routes that will carry coal and iron ore from mines to the trunk routes are critical to ensure that power generation and steel production keep up with the economy's requirements. However, eight critical feeder routes for coal with a combined length of about 600 km and several other critical links for the steel industry with a combined length of about 2,340 km are awaiting completion (See Chapter 8 on 'Transportation of Energy Commodities' for a detailed list of these routes). *The total cost of these routes will be about Rs 35 billion for coal routes and Rs 117 billion for steel routes (under 3 per cent of the Railways*

Figure 1.20
Funding Sources
[Investment in Rs Billion at 2011-12 prices]



Source: Report of the Working Group on Railways, NTDPC (2012).

budget for the 12th Plan); but with large benefits for the economy. These critical routes must be completed on the highest priority within the 12th Plan.

- **Feeder routes to Power Plants within Coal Producing States:** In-state consumption of coal for power is likely to increase and much of this new capacity will come up in clusters of about 3,000-4,000 MW each. Accordingly feeder routes from the mines to the power plants will need to be provided. We estimate that such links will be about 70-100 km long and will be required to carry about 20 mtpa each. Consumption of domestic coal within coal-producing states is expected to grow at about 24 mt per year in the country. Therefore, roughly one such feeder route to a cluster of power plants will be required every year in the tri-state region of Odisha, Jharkhand and Chhattisgarh.

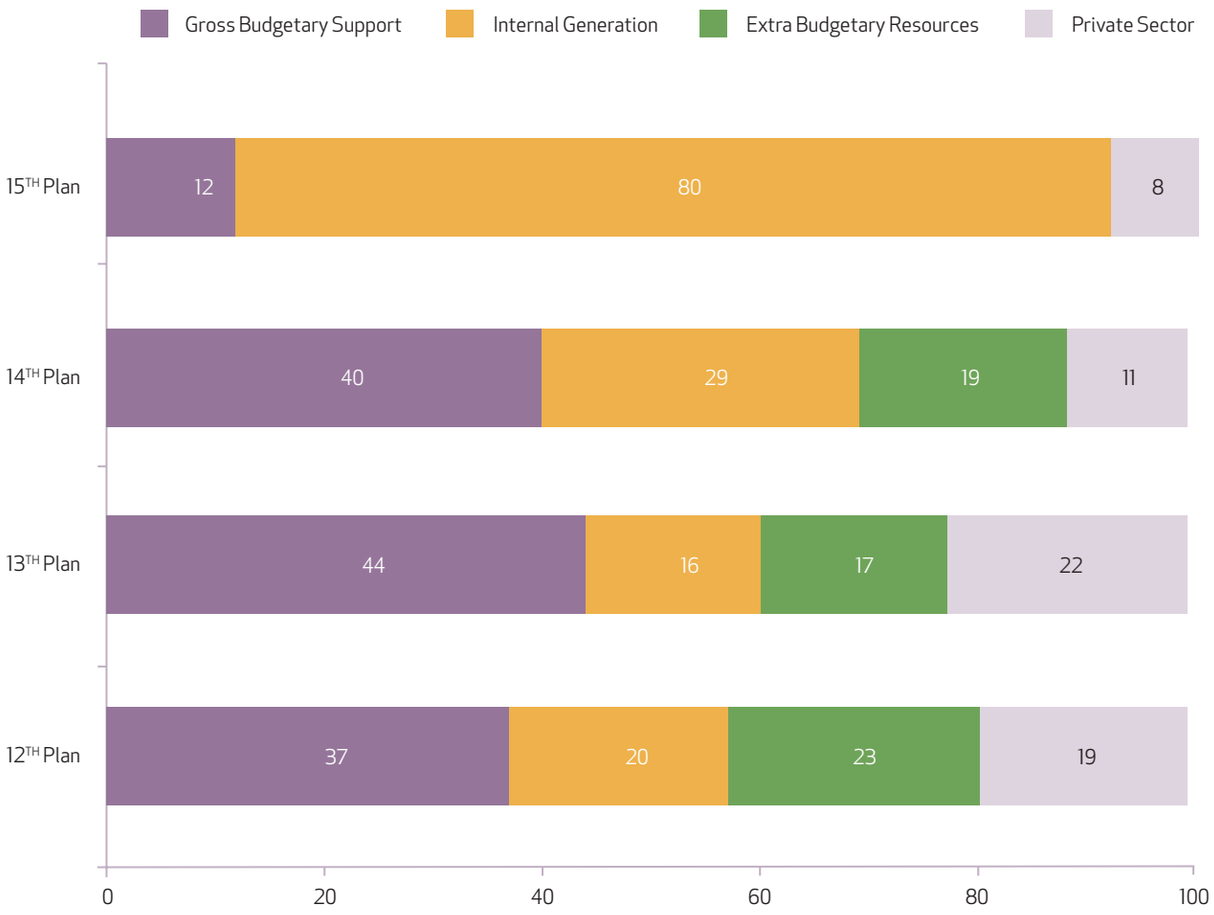
  These links should be designed for heavy haul technology where a rake per day carries 4 Mtpa. It is likely that some of these feeder routes may overlap to some extent, with each other or the feeder routes that bring coal from the mine to the trunk route. Because each such feeder route will take a minimum of six years to complete, planning for these routes must be coordinated with investments being planned in the power sector, and decisions for the corresponding transport investment should be taken simultaneously.

RESOURCE MOBILISATION AND SOURCES OF FUNDING

As discussed earlier, railways' Plan expenditure is financed through a combination of internal generation; money from the general exchequer extended as gross budgetary support (GBS), and market borrowings. Although it is difficult to determine the precise mix of funding sources over the next 20 years, the projections for resource mobilisation have been worked out on the basis of investment requirement of Rs 35,000 billion. In order to meet the massive investment requirement, public investment would have to play a significant role in creating the necessary capacity for growth in the initial 10 years, supplemented by borrowings (within prudent limits) and implementation of select projects through PPPs.

Figures 1.20 and 1.21 show the estimated contribution of different sources over the next 20 years. The proposed funding plan relies heavily on budgetary resources in the initial period. Internal generation is expected to pick up and contribute an overwhelmingly large share in later periods. The share of internal generation rises from about 20 per cent in the 12th

Figure 1.21
Funding Sources
[Per cent share]



Source: Report of the Working Group on Railways (NTDPC).

Plan to 80 per cent by the 15th Plan. The share of GBS is expected to be in the range of 40 per cent till the 14th Plan and falls to about 12 per cent in the 15th Plan. Box 1.12 lists the major assumptions based on which the projections for mobilisation of internal resources have been worked out.

IR aims at mobilising over Rs 5,000 billion through private sector participation (PSP) during the 20-year period. PSP/PPP programmes may start with a few identified projects where quick wins are scored and then scaled up further. PPP mode may be tried for projects such as segments of dedicated freight corridors, elevated rail corridor in Mumbai, last-mile connectivity, high speed rail corridors, rolling stock and other service provisions, etc. PPPs and partnerships with state governments can also play a significant role in implementation of suburban projects. The projections show that if capacity is built, market share goals are achieved and rationalisation of tariff is carried out, IR would be able to finance its investments by 2027-32 mostly through internal generation with little need for reinvestment of dividends payable.

Needless to say, attainment of the ambitious growth is dependent on necessary investment in capacity augmentation and enhancement and modernisation of the network. IR's ability to implement this programme would be a critical determinant in achieving these projections.

MAJOR ISSUES CONFRONTING RAILWAYS

In order to meet the ambitious goals set for 2032, it is essential to identify and address the major issues being faced by the IR. The following paragraphs discuss the major issues confronting the network, classified under the following broad heads:

- Capacity constraints;
- Lack of clarity on social and commercial objectives;
- Safety;
- Inadequate Research & Development;
- Optimisation of land use;

Box 1.12
Assumptions for Internal Generation Projections

The projections for mobilisation of internal resources are based on, inter alia, the following assumptions:

- Rail freight traffic would grow at slightly more than 10 per cent in the first nine years and at close to 13 per cent in the next 10 years to reach around6,500 billion NTKMs by 2032. Thereafter, rate of growth could slow down and match the rate of GDP growth. This would represent roughly 50 per cent of the country's freight transport task in that year compared to 606 billion NTKMs in 2010-11.
- Passenger traffic (PKM) will grow at close to 9 per cent p.a. to reach around5,700 billion passenger kms in 2032 compared to 1047 billion passenger kms in the year 2011-12.
- Revenue per NTKM (i.e. the freight tariff) will remain unchanged in real terms but revenue per PKM (passenger tariff) will grow by 4 per cent p.a. in real terms to reach a level of 54.7 paise in 2030 compared to 26 paise at present. If this is done, the freight to fare ratio which is roughly 4 at present will be corrected to 2. The ratio will still not be equal or close to unity as in case of countries like France and China.
- Other coaching earnings and sundry earnings will increase 5 per cent p.a.
- Operating ratio will start at 98 per cent in 2010-11 and will improve by 1 per cent p.a. till 2016-17 and 2 per cent p.a. thereafter for the next four years to reach 84 per cent in the year 2020-21 where it will get stabilised.
- Net dividend to exchequer will grow by 10 per cent p.a. and appropriation to Depreciation Reserve Fund will also grow 10 per cent p.a. from the level of Rs 70 billion budgeted for 2011-12.

Source: Report of the Working Group on Railways (NTDPC).

- Energy conservation;
- Organisational and Human Resource issues.

CAPACITY CONSTRAINTS

A major reason why Indian Railways has suffered a steady decline in its share in freight and passenger transport is that its network is plagued by infrastructural and carrying-capacity constraints. This has forced IR to focus on bulk cargo and forego the immense opportunity for growth in non-bulk and non-train-load segments. In passenger traffic, this has meant that the supply of seats/berths has always lagged demand.

As discussed earlier, traffic flows on IR's network are highly uneven and imbalanced. As of March 2011, the BG network, though forming 85.6 per cent of the route, generated almost 98 per cent of the passenger output (PKMs) and 99.9 per cent of the freight output (NTKMs). The Golden Quadrilateral and the diagonals connecting the four major metros, viz., Delhi, Kolkata, Chennai and Mumbai (along with the east-west diagonal extending to Guwahati) constitute less than 16 per cent of the route, but account for more than 50 per cent of the passenger and freight traffic. These routes have reached over-saturated levels of capacity utilisation and at present are strained to the breaking point (Figure 1.22).

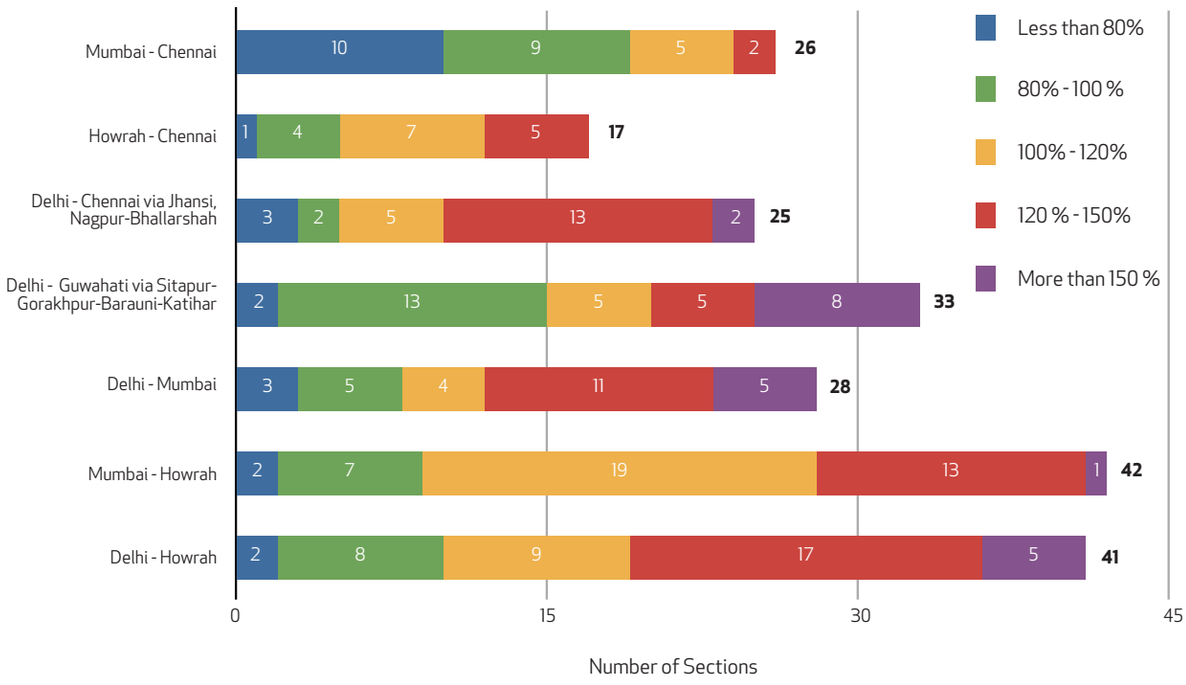
A line-capacity utilisation of 80 per cent is considered optimum as smooth operation of trains requires some slack in the line-capacity to absorb and recover from unforeseen disruptions. Figure 1.22 shows that 189 sections out of the total 212 on the high density network (HDN) have already reached saturation in line capacity utilisation. Moreover, 141 sections have already crossed 100 per cent utilisation. The unsatisfactory state of affairs extends to seven other secondary HDN corridors feeding to or distributing traffic from the primary HDNs.

Further, both passenger and freight trains share the same track capacity. *The passenger trains utilise nearly 65 per cent of network capacity but contribute to less than 30 per cent of the revenue*. While mixed traffic is beneficial for efficient use of capital-intensive railway infrastructure, such operation of mixed traffic in the face of saturation on the network imposes insuperable constraints on running of heavy-haul freight trains and high speed passenger trains, categories that can yield maximum efficiency in transport.

According to the McKinsey Report[15], 'India's current infrastructure is over-stretched and even with a conservative annual growth rate of 7.5 per cent, India's freight traffic is most likely to more than double by 2020. A two-and-a-half times increase in freight traf-

15. McKinsey and Company (2010).

Figure 1.22
Line Capacity Utilisation of Sections on High Density Network (2009-10)



Source: Report of the Working Group on Railways (NTDPC).

fic in the next decade will put further pressure on India's logistics. Moreover, investments in the current network design will only lead to increased inefficiencies and losses.'

LACK OF CLARITY ON SOCIAL AND COMMERCIAL OBJECTIVES

The report of the Expert Group on Indian Railways headed by Dr Rakesh Mohan in 2001 mentioned that 'IR has been suffering from a split personality. On the one hand, IR is seen by the government, and by itself as a commercial organisation. It should therefore be financially self-sufficient. On the other hand, as a department of the government it is seen as a social organisation which must be subservient to fulfilling social needs as deemed fit by the government. It is now essential for these roles to be clarified'.

For long-term sustainability, railways have to be run as a business on sound commercial principles. However, the several social/national responsibilities of the IR prevent it from operating on a purely commercial basis. A large section of the population views it as a public utility and expects IR to discharge a number of social obligations ranging from sanction and construction of un-remunerative lines, provisions of suburban and other passenger services below cost, transportation of essential commodities at a loss, etc.

While IR has to fulfil both the roles, it is essential that the commercial and social roles are kept distinct and separate. The commercial part of the business has to be run with a clear set of objectives and judged by commonly accepted financial measures such as revenue, profit, return on capital, productivity of assets, etc. The social part of the business would need to meet different goals and judged by parameters such as improvement in connectivity, service level, patronage and efficiency of delivery/ provision of projects/services.

It is imperative for IR that the projects taken up on social considerations must be categorised separately and their funding must come separately either through national /strategic projects or from state governments. The two categories of projects must not be mixed up and must be handled by different project organisations with different project leaders.

The lack of clarity between its public-service obligations and commercial objectives affects several other operational practices/systems of IR, such as, investment planning, project execution, costing & tariff practices, accounting system, etc., making it even more difficult to reconcile these roles. Some of the challenges imposed by these systems are:

INVESTMENT PLANNING

Investment planning on Indian Railways is politically and departmentally directed rather than

Table 1.11
Off Track: Time and Cost Overruns in Railway Projects

PROJECT	DATE OF COMMISSIONING		DELAY IN MONTHS	COST OVERRUN (PER CENT)
	ORIGINAL	ANTICIPATED		
Udhampur-Baramulla (new line)	March-01	Dec-17	201	700
Bankura-Srinagar-Damodar (Gauge conversion)	March-05	June-16	135	1162
Tamluk Digha (Line doubling)	June-05	June-16	132	270
Belapur-Seawood-Uran (Electrified double line)	March-04	March-14	120	276
Howrah-Amta-Champadanga (New line)	March-07	March-15	96	1,489

Source: Project Implementation Overview, December 2012, MOSPI, GoI.

need-driven. The consequence of political control in a departmental set up has been the extension of a number of uneconomic lines with every budget. The project approval process is loaded in favour of uneconomic, un-remunerative and socially desirable projects, rather than focus on projects which remove bottlenecks, ease congestion, and augment IR's capacity to carry traffic, or improve the productivity of operations.

For an organisation struggling with crippling capacity constraints over its most important routes, the purpose and direction of investment planning should be clear and obvious. A complete revamping of the investment planning system is required.

IR needs to shift to a programme approach from the current project-oriented approach. Plan-head wise investment approach has to be dispensed with as it distorts investment priorities and promotes departmentalism. Investment should be focused on total capacity creation including rolling stock, asset renewal, technology induction, information technology and identified investments in modernisation, etc. This should be quantifiable in terms of incremental tonne kms.

Prioritisation of projects is crucial especially since IR is struggling with a large shelf of sanct_ioned projects in the face of limited resources. Investment in railways has to be focused and directed towards solution of the capacity constraints or improvement of operations. More investment should be directed towards projects and activities that would remove bottlenecks and generate the greatest returns. Operationally urgent and quick pay-off projects that can ease capacity constraints the fastest (such as doubling) need to be prioritised for full funding and time-bound execution. For rolling stock, procurement must be linked to the traffic projections so as to avoid excessive procurement of rolling stock which is less in demand, or under procurement of rolling stock actually required for meeting demand.

Replacement and renewal of assets should be ensured. For this purpose, the ad hoc approach presently followed in respect of appropriation to Depreciation Reserve Fund needs to be overhauled. A rule-based approach that adequately meets the requirement needs to be put in place; and such an approach must satisfactorily provide for the replacement of fixed assets and rolling stock that bring in technological upgrade with increased productivity, efficiency and reduced outgo on maintenance.

PROJECT EXECUTION

IR has a poor track record of project execution. Several projects of IR are suffering from time and cost overruns. For example, as of October 2011, out of the total of 132 projects costing more than Rs 1.5 billion, in 101 projects the anticipated cost is 181 per cent higher than the original estimated cost. Moreover, 26 projects are having time overruns ranging from two to 213 months (Economic Survey 2011-12). Table 1.11 highlights the extent of delays and time overruns in railway projects.

Some of the major reasons for project delays are as follows:

- At present, a large number of projects are started without adequate funding and without a specified date of completion. And more often than not, they are sanctioned without adequate field investigation, followed by a detailed project report. The funds available are spread on numerous projects instead of providing adequate resources for a select few and getting those completed. As a result, every project suffers from time and cost overruns.
- Railway's project organisation is also organised on a zonal or a territorial rather than on a project basis. This further reinforces the ingrained practice and bias towards distribution of funds, rather than rational allocation of funds to projects that need to be completed on priority.
- Incentives for project teams and leaders to deliver projects on time and within budget are also absent.
- Other reasons for project delays include issues

Box 1.13
Building China's Railways

China's railways entered a new phase of development with the Mid and Long-Term Plan (MLTP) adopted in 2004 and revised upwards in 2008. It currently aims to increase the total rail network from 75,000 to 120,000 route-km by 2020. It includes construction of 16,000 km of high-speed routes, three new regional inter-¬city networks, new dedicated coal lines and substantial double tracking and electrification.

China has successfully managed to deliver project after project much faster than is typical of just about any other country. A project that in China might take about 5-6 years from government approval of project concept to system commissioning would, in the authors' experience, take 7-15 years in almost any other country. For example, the 1,068 km Wuhan-Guangzhou high-speed railway, started construction in 2005 and was commissioned in December 2009.

Following three factors dominate the reasons for this exceptional project delivery:

- **Single-Point Responsibility:** China's Ministry of Railways (MOR) enjoys a potent combination of: (a) the responsibility to plan, design and deliver major projects; (b) the legal and institutional power it needs to do so, and; (c) access to the operating cash flows of one of China's largest single businesses to borrow against, together with a dedicated capital fund from railway construction surcharges on freight. This heady confluence of responsibility, power and resources, has created a goal-driven culture at all stages of project delivery.
- **Strong Technical Capacity and Process:** MOR adopted the 'six in one' principle as the foundation for railway project implementation; which encompasses quality, safety, completion time, investment benefit, environmental protection, and technical innovation. Following are some of the initiatives taken across all stages of the project cycle, from planning to commissioning:
  - **Planning and Design:** The priority and time-frame for project implementation (including the budget, technical parameters, preliminary design and schedule for each project) are frozen at the point of National Development and Reform Commission (NDRC) approval. The detailed and meticulous planning and design facilitate timely implementation as there are minimal changes during construction.
  - **Procurement:** Standardisation of designs and technical specifications, administering procurement through professional tendering companies, emphasis on physical and financial capacity on contractors, tight contract award process etc. are some of the factors that assist expeditious procurement.
  - **Project Management:** MOR establishes a project management team which is delegated the funds, the design and above all the authority to implement the project. The project team remains together until the job is done and is held fully and collectively accountable. This continuity, together with significant financial incentives built into team earnings for timely delivery of the project, acts as a strong motivator of team performance.
- **The Programme Effect:** The articulation of the MLTP and its scale resulted in a programme effect. The programme effect created a whole new industry that was confident in the continued long-term development of China's railways, and led to a huge increase in the capacity of the industry, from technical institutes through to contractors, manufacturers, service suppliers and many others.

Source: China Transport Topics No. 03; Fast and Focused– Building China's Railways; World Bank Office, Beijing.

like land acquisition, clearances, shifting of utilities resettlement & rehabilitation, etc.

IR must review and adopt some of the best practices in project execution from China's railway sector, which has built an astonishing number of large and complex railway projects over the past few years (Boxes 1.13 and 1.14).

RECOMMENDATIONS

Following are some of the recommendations which should be implemented to improve the project execution on Indian Railways:

- Considering the need for massive capacity augmentation over the next 20 years, it is recommended that a separate body/organisation, partially independent of the Ministry of Railways should be set up to expedite the delivery of projects. Such a body should have greater autonomy, for example, the authority to finalise tenders for projects. Box 1.15 provides some recommendations on the institutional arrangement for speeding up capacity enhancement and project execution on IR. Here it may be mentioned that in the Railway Budget 2011-12, a Central Organisa-

Box 1.14

China's Railways' Building Skills and Knowhow to Improve Project Delivery

The short time taken for delivering projects on China Railways follows years of investment in building skills and know-how. Ministry of Railways (MOR) in China undertook years of capacity building leading up to the MLTP. For e.g., in case of high-speed passenger lines, specialised units were set up many years in advance to study and adapt technologies employed internationally such as track systems, rolling stock design, signalling and communications, and electric traction. The technologies selected were absorbed, in some cases by technology transfer agreements with foreign manufacturers, but with considerable adaptation to match China's needs.

There are six major railway design institutes in China. All except one are legally independent of MOR, though they are commercially dependent on MOR contracts, for which they compete (all are state owned enterprises). Their role typically includes route surveys, environmental assessments (sometimes with specialist environmental firms), project feasibility reports and preliminary and detailed designs.

Typically each major design institute employs about 3,000-4,000 people. This capacity together with a singular focus provides the means and the ability to produce a feasibility report within a 6-12 month time frame. In most countries feasibility studies for major railway construction projects take up to two years to specify, procure, complete and report.

Source: China Transport Topics No. 03; Fast and Focused— Building China's Railways; World Bank Office, Beijing.

tion for Project Implementation (COPI)[16] was proposed to be set up with offices in Delhi, Kolkata, Mumbai and Bengaluru, each headed by an officer of GM rank. COPI was to ensure uniformity of systems/methodologies, follow the best practices and optimise on resources. It was expected to monitor and ensure that the funds allocated to different projects are fully utilised and not surrendered or diverted, and that the projects are completed in time. However, no progress has been made on the ground for setting up of the COPI. In any event, the entire issue of setting up agencies for project execution needs a review, considering that as on date, zonal railways, Rail Vikas Nigam Limited (RVNL) and Dedicated Freight Corridor Corporation of India Limited (DFCCIL) are involved in execution; a rationalisation with the objective of 'in time delivery' with massive investments contemplated is the objective.

- DFCCIL, besides handling the Eastern and Western corridors, should also be given the project execution responsibility for the other four proposed high speed corridors. Additionally, it may be given the responsibility for capacity augmentation of the entire high density network. DFCCIL should be given more autonomy - instead of the Chairman Railway Board (CRB) acting as the part time Chairman of DFCCIL, the Managing Director should be made the Chairman.
- Funding should be earmarked for each project before it is taken up for time-bound commissioning. The concept of financial close (as in case of PPP projects) should be introduced for each project.
- The project managers should continue in their positions till successful completion of the project, and they along with the project teams should be held accountable for timely completion of the projects.
- Performance-linked incentives should be provided and penalties for failure should also be imposed. Best practices in contract management should be identified and introduced.

ACCOUNTING SYSTEM

Being a ministry of the GoI, the accounting system of the Indian Railways is organised to cater to government budget and control functions and does not follow accounting standards as prescribed in the Companies Act 1956. The Acworth Committee (1920-21) recommended the separation of railway finances from the general exchequer, because the budget of IR formed a significant portion of the total government finances and there was considerable unease in keeping it as an integral part of the overall budget. The separation of railway finances (effected in 1924) and the creation of an in-house accounting machinery, however, also intended to ensure flexibility in the financial administration of the railways as a commercial undertaking.

The accounting and financial systems of IR have been reviewed by various committees since 1924, and each one of them have found the existing system unsatisfactory and affirmed that the original intention

16. Speech of the Railway Minister, introducing the Railway Budget 2011-12.

Box 1.15

Institutional Arrangement for Speeding Up Capacity Enhancement on IR

IR carries out its construction projects through a construction wing which works in every Zone under the General Manager. The budget of this department varies from Rs 2.5 billion to around Rs 10 billion, a bulk of which goes unutilised for tailor made reasons which are endemic on every Zone. The annual budget of IR for such construction works is around Rs 300 billion and for achieving the growth envisaged for the year 2032, we may have to upscale it to Rs 1,000 billion. At present, works on IR are sanctioned at current rates and token allocation of funds is made till the project takes off. After this, the political sagacity compels allocation of funds to as many projects as possible and speedy completion becomes the first victim of the process. There is an urgent need for an organisational restructuring - both functionally as well as administratively.

Following are some recommendations:

- All works having a budget outlay of more than Rs 5 billion (or may be Rs 10 billion) should be entrusted to an 'Authority', which may be called the **'National Railway Construction Authority' (NRCA).**
- The NRCA would be an umbrella organisation having a national level presence, fully autonomous, and having extensive powers for award of works. It will award contracts for construction, supervise quality of construction and would ensure smooth flow of funds for the works to continue unimpeded. Repayment of loans, tax-free bonds etc. would be channelised through it.
- The projects should be taken up as EPC contracts with fixed time-outlay and watertight fund provision. No time over-run and cost over-run may be allowed.
- Sanction of the project should be for the cost as envisaged till its completion so that no further sanctions are necessary.
- The chief of the NRCA should be selected through Public Enterprises Selection Board (PESB). He may be allowed to have his team selected through another well-defined process of selection to scout and attract best talents available in the country.
- The NRCA will have a multi-disciplinary structure to ensure that all decisions relating to every facet of construction are taken under single roof. It may engage Advisors of international and national repute in various fields to assist it in discharging its duties in the best possible manner.
- Various agencies instituted by the Railway Ministry for expediting construction like DFCCIL, RVNL etc. may either be transferred under NRCA's control or allowed to participate in the bidding process for award of contracts for construction to have better competition.

The establishment of NRCA can go a long way in ensuring speedy completion of important Railway capacity enhancement projects.

Source: NTDPC.

of commercialisation has not been achieved. IR has continued to be run like a government department rather than as a commercially oriented enterprise, and its accounts are not in line with normally used commercial conventions recommended by ICAI. The financial results of IR, as presented to Parliament and for public information, include a Statement of Revenue Receipts and Expenditure (Profit and Loss account) and a Balance Sheet, however, the contents of these documents depart substantially from the disclosure standards that are expected of going concern entities. Box 1.16 highlights some of the anomalies and limitations of the present accounting system of IR.

It is imperative that IR's accounting system is revamped for the following reasons:

- *IR requires a substantial infusion of funds from sources other than budgetary support and internal surplus over the next 20 years*, in order to undertake the envisaged capacity augmentation to improve the modal share of IR in freight transport. *In order to access capital from external sources, it is essential to recast IR's accounts in a format that is readily interpretable by lenders and investors*. The present system of accounting does not give a true and fair financial picture of IR. For example, the balance sheet does not show depreciation provisions and as a result it is impossible to ascertain the net block of IR. Similarly, there is a no clear separation between revenue and capital, or between 'top of the line' and 'below the line', and the data is presented in a way in which one cannot ascertain labour productivity or employee cost.
- *IR must focus on financial discipline and targeting so as to ensure generation of sufficient*

surplus for investing in capacity enhancement. The present system of accounting gives little information on how to control costs, as accounts are kept on 'heads of account' rather than on the basis of activities. The accounts do not provide a clear segregation on the cost and revenue of various activities and services. As a result, computation of the losses on various activities and the contribution made by various services is difficult. It is critical for any business entity to gain an appreciation of its profit centres to manage them better. *IR's accounting system should be revamped to accurately reflect the cost of various activities and throw light on train-wise and route-wise profitability to aid managerial decision-making*. This would help assess the usage charge of infrastructure and rolling-stock resources and also in accurate allocation of overheads. It would also help in computation of the cost of operation of trains and services and appraisal of profitability of various business lines.

- It is important for IR and the Railway Board to know how the organisation would fare if its accounts were presented as per the Indian GAAP followed by companies incorporated under the Companies Act.

Only with a credible accounting system, IR can manage the commercial and social parts of the business on a rational footing. The commercial part of the business must be managed to yield a surplus for reinvestment in the system.

RECOMMENDATIONS

Following are some of the recommendations which should be implemented in a mission mode approach to ensure timely completion:

- It is important that the accounts of the Railways should be recast into a company account format in line with the Indian GAAP so that the true state of Indian Railways finances become clearer. It would provide activity-based revenue cost data meeting generally accepted accounting standards. Such an accounting reform would facilitate assessment of profitability of different operations, routes and sections and accounting separation of various lines of business and services within the lines of business. The principles for identification and allocation of joint costs and methodology for computation of operation and maintenance cost should be possible. Such recasting is feasible since it has already been done on a pilot basis first by the Railways Capital Restructuring Committee, 1994 and by the 2001 Expert Group.
- Codification of these principles and development of an IT-based system to provide timely compilation of accounting and budget statements should be attempted. This would facilitate determination of cost of infrastructure services and the operational activities with an acceptable degree of exactitude and help decisions on rational pricing on the basis of train-wise, route-wise profitability analysis.

The need for Accounting Reform has been recognised and accepted in the Railway Board. An Accounting Reform project was initiated and sanctioned in 2004-05. However, the work has made a tardy progress and the final results are far off yet. There is a need to hasten and complete the process.

If the railways undertake the kind of accounting reform proposed, it will become much easier to make informed decisions on the areas of investment where budgetary support is to be given. For example, budgetary support could be provided in three parts. First, support could be provided to the commercially justified remunerative projects which are part of a strategic plan. Second, where the government mandates new lines for social considerations, funds could be provided on a grant basis. Third, budgetary support could also be provided for the projects/schemes that result in immediate benefit by way of increased throughput for greater efficiency or cost reduction or on the grounds of safety considerations, that is, implementation of a 'modernisation plan'.

COSTING & TARIFF PRACTICES

Costing and tariff practices have had a long-term impact on the expenses and earnings of IR, and the ability of managers to assess and control the same.

Current costing practices are based on a top-down approach, using total cost at an aggregate level, and are not based on activity-level costing. However, disaggregated information is necessary for pricing. Further, since the costs on railway networks are largely common (or joint) to different services and a substantial part of the costs are fixed, the economies of scale can be fully exploited only with large traffic volumes. This renders a certain degree of cross subsidisation between services and/or between segments of the network unavoidable. This has matched well with the conventional theory of price discrimination which provided the basis for differential pricing (differing price elasticities) and hence cross subsidisation.

Historically, passenger services have been incurring losses at the aggregate level, made good by cross-subsidy from freight services. The cross subsidisation exists at different levels[17]:

a. **Cross subsidisation between freight and passenger services:** here it must be understood that passenger service is a direct consumption item while freight service is an intermediate item. Cross subsidisation here has involved imputing a lower weightage to surplus generation by producers vis-à-vis

17 AITD (2000); Report of the Working Group on Railways (NTDPC).

Box 1.16

Limitations of The Present Accounting System of IR

Limitations of the Statement of Revenue and Expenditure (Profit & Loss Account):

- Inadequate disclosure in respect of the in-house manufacturing effort: IR engages in manufacturing operations through its major production units and by virtue of a large number of engineering and repair facilities where substantial production effort is carried out. The P&L Account does not disclose the value of the manufactured goods, the disposal on completion of production or internal capitalisation.
- **Depreciation Reserves:** The amounts allotted to Depreciation Reserve Fund (DRF) tend to be fixed in an ad-hoc manner and are not determined by financial principles that would withstand close scrutiny. Also, the reduction in the value of total assets post-depreciation is not shown.
- **Contribution for Pension Payments:** The procedure adopted by IR with regard to pensions is what is normally termed as 'pay as you go', a system that no commercial enterprise operating in a market environment can sustain for long. For an organisation such as IR that spends over half of its revenues on staff related expenses, the practice precludes reliable long-term financial projections and prudent financial management itself.
- **Utilisation of Net Revenue:** The residual of gross traffic receipts after meeting working expenses and allocation to the two funds (DRF and Pension Fund) is termed 'net traffic receipts'. The sum of this figure and the miscellaneous transactions is called 'net revenue'. In a manner of speaking the 'net revenue' corresponds to IR's gross profit. The 'net revenue' (in IR terminology) is allocated for - (a) Payment of the interest on loan capital to GoI, representing the servicing cost for IR's capital-at-charge (termed 'dividend' in Railway accounts); (b) anything that remains after payment of 'dividend' is transferred to other Railway funds (Capital Fund, Development Fund, Safety Fund) that are used for IR's plan expenditure.

  Though the Companies Act lays down that no dividend shall be declared until provision is made for depreciation on fixed assets of the company, IR, being governed by separate provisions, has been paying out dividend to the government on the capital-at-charge without observing this requirement.

  Further, the Capital Fund was set up in 1992 with the original objective of financing schemes like gauge conversions, doublings and route electrification which were insufficiently funded by amounts received as 'Budgetary Support'. In practice, much of this investment has gone to finance projects that are not remunerative.

Limitations of the Balance Sheet:

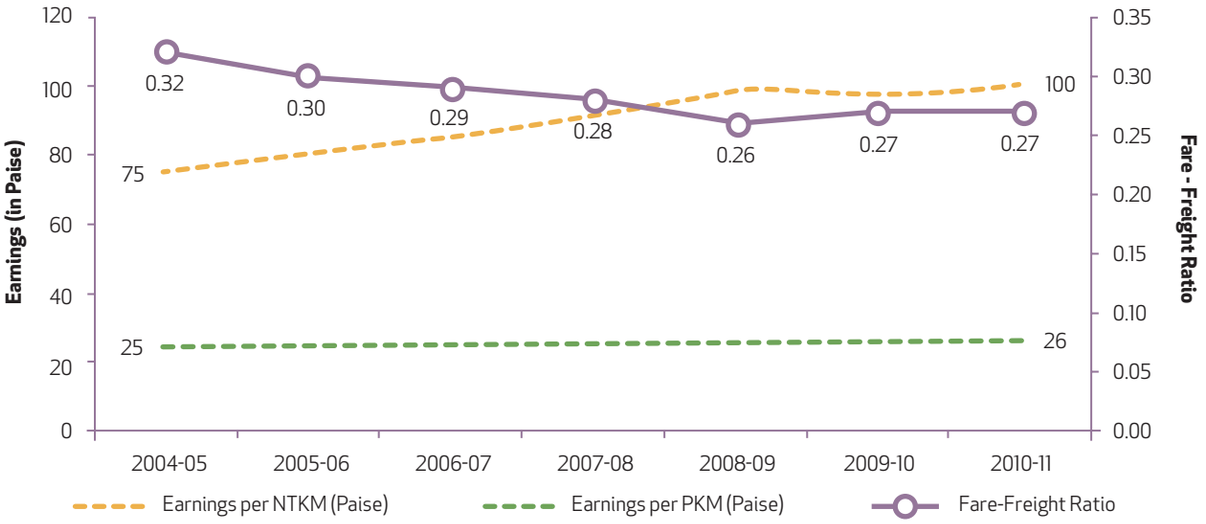
- **Unreliable estimate of capital stock: IR does not maintain a register of assets.** The balance sheet does not separately show gross block, depreciation and net block. All assets are shown at original costs, and further capital expenditure incurred from year to year is capitalised. The leased assets are not shown separately. Fixed assets are not classified in terms of opening balance and additions/deletions for the year.
- **Depreciation Reserve Fund:** The sum of the amounts that are appropriated annually to the DRF are not shown in the balance sheet but only the so called 'improvement element' is reported. Because of this, there is no depreciation provision in the application of funds and, hence, no net block. This has two implications. First, IR overstates its profit by under-provisioning for the amounts earmarked for the DRF. Second, and much more serious, IR has grossly over-capitalised itself.

Source: The Indian Railways Report 2001: Expert Group on Indian Railways.

surplus generated by consumers from a lower passengers tariff.

b. **Cross subsidisation between different classes of passenger traffic:** part of the problem is that the willingness to pay by common people is often deliberately underestimated. It should be easily possible to segment the market for the passenger services by appropriately differentiating the product and accordingly attempting to recover the cost of services. This would help delimit size of the market requiring effective subsidy.
c. **Cross subsidisation across the zones:** This is partly because of the composition of traffic. The passenger component is substantial in many of the zones, and as a result the losses

Figure 1.23
Average Realisation on Freight and Passenger and Fare-to-Freight Ratio



Source: White Paper on Indian Railways 2009, Yearbook 2010-11, Yearbook 2009-10.

cannot be compensated by profit from the freight segment.

However, cross subsidisation has resulted in high tariffs for freight and diversion of traffic to non-rail modes involving higher use of scarce resources of the society. In other words, the market response to the cross-subsidy may also lead to sub-optimal allocation of resources. The extent of effective cross-subsidy needs to be measured to determine an optimal level of cross-subsidisation.

Figure 1.23 shows some of the parameters that emphasise the cross-subsidisation on IR. The average realisation for PKM at 26 paise is one of the lowest in the world while average freight revenue per NTKM is one of the highest in the world, second only to Germany (White Paper on Indian Railways, 2009). On the passenger side, the range between the lowest charged and the highest charged classes is wide (from 13 paise per PKM to Rs 1.06 per PKM). Fare to freight ratio that roughly captures the balance between the passenger fares and freight tariffs is also one of the lowest in the world for Indian Railways (0.27) compared to France (1.3) and China (1.2). *The above clearly argues for the need for rational non-distortional prices for freight and passenger services*.

Freight Pricing: The freight rates are commodity specific and yet costs are not available at commodity level. The logic for pricing based on the ability of the commodity to bear is an age-old principle in the Railway industry. In recent times, however, most railways worldwide have moved away from a commodity based pricing mechanism to either a haulage costs based rating or individual contractual agreements based on the shipper's requirements. With the separation of the infrastructure owner and the service provider, a new market for access to paths and pricing of paths, has developed. Thus at this stage Indian Railways has to make a choice - whether to continue to rely on a regime of commodity based pricing or to move to newer methods of pricing.

There are two key aspects of commodity based pricing:

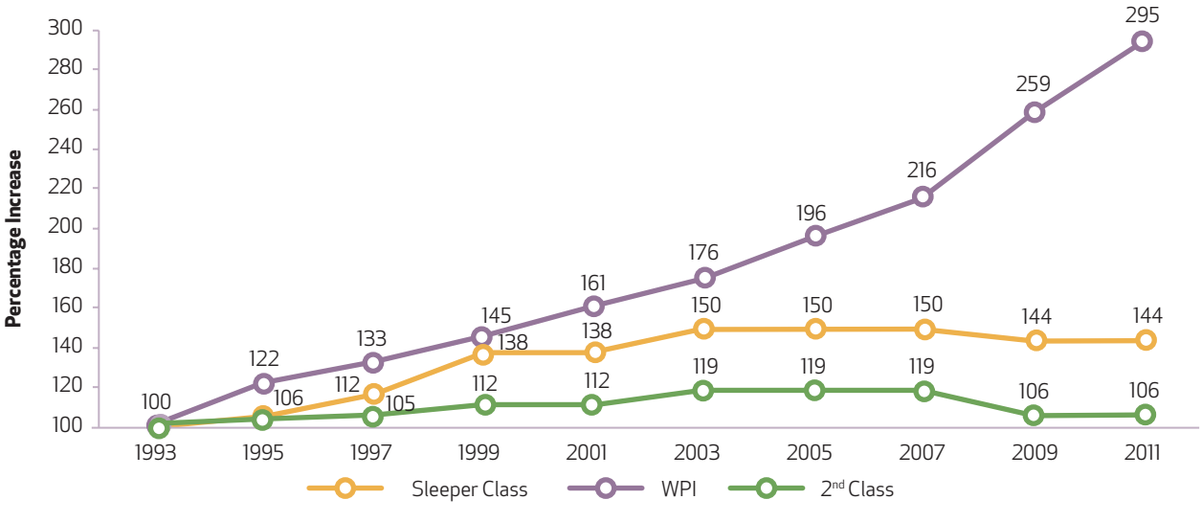
a) **The ability to correctly discern what the commodity can bear:** In recent years, in the case of iron ore for export, the railways were able to informally peg the price to the export price and thus align itself to the market. However, for other commodities there are no such readily available proxies which the IR can use to gauge the market. It would probably not be unfair to state that the IR priced itself out in the case of POL products when pipelines were being considered as an alternative.

b) **To know the cost of transportation:** As discussed above, in IR costs tend to be aggregated and averaged in a manner that does not clearly indicate the commodity specifics. Greater emphasis on disaggregated costing methodologies is important in a commodity based pricing regime.

The commodity based pricing has undergone a lot of rationalisation over the last decade or so. IR used to have a large number of classes for freight tariff. These have been compressed and the range between the lowest charged and the highest charged classes has narrowed considerably. Following are some of the recommendations for freight pricing:

- For loose bulk commodities, the current regime of pricing is a good approximation and provides the right incentives. Non-price

Figure 1.24
Increase in Wholesale Price Index and Passenger Fares (1993-2011)



Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee).

factors are critical for obtaining a better share and in the case of certain commodities the Railways should consider long-term contracts to bring about greater efficiency in investments.

- For bagged bulk commodities and non bulk commodities, the current regime is too centralised and therefore slow to respond to market changes. Service-based pricing to attract traffic in these industries would help.
- For the growing sector of containerised goods, greater research on the method of calculation of efficient haulage charges is required.

Passenger Pricing: As mentioned earlier, the Indian Railways, in addition to their commercial role as a provider of transport services, is also seen to have social/national responsibility to link people and places and facilitate rapid and low cost movement across the country. To meet this objective the Railways provide several services at prices that are below the cost of provision and this has virtually governed most of the policy decisions often away from the most economically sound ones.

The pricing of passenger services is a highly political issue and not dictated entirely by efficiency considerations. These services are heavily underpriced even though their economic costs are high. International comparison with China, Germany, Japan and Russia shows that the pricing of passenger services is a politically and socially sensitive issue not only in India, but even internationally. However, all these countries impose some statutorily-backed fare regulations on their passenger rail services (Box 1.17). All four countries also receive some form of Government financial support for passenger services (summarised in Annex 1.3).

India's average passenger yield, adjusted for parity of purchasing power, is about 11 per cent of that of Japan, 15 per cent of that of Germany and Russia and 37 per cent of that of China (Box 1.18). In India, the passenger fares have not been increased in last 10 years and their present level is ridiculously low even as compared to the bus fare (Figure 1.24). However, in the context of limited resources available to the Railways, sustainability of the existing subsidy regime needs to be seriously considered. Further, shift in the relative price of passenger rail travel vis-à-vis other modes of travel affects the modal choice of many passengers, and thus inflates demand and creates pressure to add more services.

For the year 2010-11, losses from passenger services are estimated to be around Rs 165 billion, with a total revenue of Rs 258 billion (Figure 1.25). The suburban segment incurred a loss of Rs 23 billion (roughly 125 per cent of its revenues), whereas the non-suburban segment incurred a loss of more than Rs 141 billion (roughly 60 per cent of its revenues). These losses are due to a combination of factors including non-revision of passenger fares for the last 10 years, running of poorly patronised trains, operations of trains on uneconomic loss-making branch lines and running of slow, stopping passenger trains for short distances. Ticketless travel also contributes to losses to some extent. However, train-wise disaggregated analysis is presently not available.

Looking at the financial situation of IR, with its operating ratio rising to 95 per cent over the last two years, it is imperative that IR designs a realistic

Box 1.17

Tariff Regulation: Government Control in Varying Measures

Germany, Russia, China and Japan all impose some statutorily-backed fare regulations on their passenger rail services. This clearly reflects the high social and political sensitivity of passenger transport fares in all the countries, irrespective of political system.

China lies on one extreme of the fare regulation spectrum, with *highly centralised government control of passenger railway prices*. Under the 1991 Railway Law, passenger fares proposed by the Ministry of Railways must be approved by the State Council via its macro-economic management agency. All China Rail tariffs as well as those of inter-Provincial joint venture and local railways are included in this regulation. Special pricing policies also exist for certain train categories such as high-speed train services.

In Japan, ministerial approval of Japan Rail maximum fares is required and companies are obliged to adopt co-ordinated structures that enable smooth inter-ticketing and travel across Japan. In considering fare proposals the Transport Minister must take into account the level of fares in relation to efficient costs plus 'appropriate' profits. The Minister can also order changes if the charges discriminate against certain classes of passenger or if the charges may cause 'unjust' competition against another railway. In addition to general co-ordinating mechanisms in setting and administering rail fares, when transfer between companies is required companies are obliged to set fares to take account of the total distance and to taper the fare accordingly.

In *Russia*, the Federal Tariff Service (FTS) has *strong regulatory powers but has granted much greater freedom* and now effectively only regulates non-premium tariffs. FTS is responsible for regulating charges and fees for services which involve transport of passengers by long-distance trains on Russian domestic routes, whether by RDZ or private operators.

Even in *Germany*, where there is substantial commercial freedom to set fares, *the government has formal approving authority for general fare increases* (and changes in conditions of carriage) on long-distance routes. The Bundestag (parliament) also regularly scrutinises rail fare proposals. As this is based on the principle of undistorted competition and commercial operations, in practice fares are generally approved as a commercial decision of the companies involved and the practical regulation is very light. The systems are summarised in the table below.

COUNTRY	PASSENGER FARES REGULATION
China	Heavily Regulated. State Council has complete regulatory powers, but has granted more flexibility in recent years to reflect wider range of service qualities.
Russia	Regulated. Federal Tariff Service regulates domestic long-distance fares but since 2009 has granted independence of pricing for premium travel classes and trains.
Japan	Lightly Regulated. Maximum fares must be approved by Minister of Transport, and companies must coordinate fares and ticketing systems to allow smooth transfer between companies at non discriminatory fares.
Germany	Very lightly Regulated. Federal government must approve conditions of carriage including standard fare but policy is that long-distance markets should be regulated by competition. Suburban/regional fare regulation differs by concession.

Source: Passenger Railway Institutions and Financing, Paul F. Amos, 5 September 2011.

Box 1.18

India's Unyielding Railways: International Comparisons of Passenger Revenue Yield

Within any railway there are *large variations in cost recovery between the different types of passenger service* and different routes. Unlike the transport of rail freight, the costs of a passenger train movement for which the train-consist has been determined is almost independent of the number of passengers using it. Railway management should therefore attempt to match the size of trains to the general level of demand offering. However, fluctuations in traffic by day of week and time of day mean that there is often much unused capacity even with very efficient operations. Highly peaked regional/suburban services tend to have much lower yields/carriage-km compared to costs, relative to less peaked inter-city services.

When other things are equal, *railways in developing countries face an inherently greater challenge in attaining cost recovery* in passenger rail services. The ratio of rail operating costs between efficient railways in high-income countries to those in low-income countries is relatively small, say 2:1 at most (as the cost of many of the inputs, fuel and spare parts are the same in both cases). However the equivalent ratio for income per head may be up to 10:1 and this income disparity affects the affordability of fares. *Railways in developing countries must therefore attract a healthy proportion of higher income earners within the country into their customer mix*. The economics of rail technology depend on delivering the superior travel benefits the technology can offer to those who can afford it, and pricing accordingly. The more successful a company is in providing an attractive travel product at healthy fares the more scope it has for offering cheaper fare options at the margin. As incomes (and costs) increase, positioning the main role of passenger railways as cheap transport for low income groups is a recipe for mounting financial stress.

India's average passenger yield, adjusting for parity of purchasing power, is about 11 per cent of that of Japan, 15 per cent of that of Germany and Russia and 37 per cent of that of China. When adjusted for parity of purchasing power, Japan (which receives no revenue subsidies) has the highest farebox yield, Germany and Russia have lower yields but of a mutually similar order, while China has the lowest yield of the four countries. The table below provides a comparison.

AVERAGE PASSENGER FAREBOX YIELD PER PASSENGER-KM (2010)			
COUNTRY	**YIELD/PASS-KM (LOCAL CURRENCY)**	**YIELD/PASS-KM (USD)**	**YIELD/PASS-KM (USD PPP)**
China	CNY 0.15	0.024	0.038
Germany	EUR 0.09	0.126	0.087
Japan	JNY 14.61	0.190	0.132
Russia	RUR 1.50	0.052	0.094
India	INR 0.26	0.006	0.014

Notes to table:
1. The yields are brought to a common basis of USD rates using currency exchange rates as of 30 August 2010.
2. Because of the disparity in income levels between countries, the results are also shown in USD adjusted for Purchasing Power Parity. Rates used for purchase power parity conversion are as recommended by World Bank for 2010 values.
3. German estimates are for DB long-distance and DB Regional combined but exclude non-fare income from concession contracts.
4. Japanese estimates are for JR companies and private companies combined.
5. Includes both RZD (Russian Railways Corporation) and its subsidiary Federal Passenger Company, plus jointly-owned regional/suburban passenger companies. Excludes revenue shortfall income provided by the Russian Government.

Source: Passenger Railway Institutions and Financing, Paul F. Amos, 5 September 2011.

Figure 1.25

Passenger Business: Revenue and Losses (Rs Billion) and Loss Ratio (Per cent)

Source: Ministry of Railways

programme of fare revision to reduce/eliminate the losses on passenger services. The government may subsidise up to 25 per cent of the costs of suburban railways considering that mobility is an important element in the ability of the people to access better economic opportunities and a large number of people use the suburban network on a daily basis. Box 1.19 gives a simplistic programme for fare revision in order to eliminate the losses on passenger services.

Tariff Setting: Under the provision of the Railway Act, 1989, fixation of freight and fares is the prerogative of Ministry of Railways. Railway Rates Tribunal (RRT) and Railway Claims Tribunal are the two dispute settlement bodies on IR. However, their mandates and powers are limited to complaints against Railways relating to discrimination and excess charging, etc. by the freight customers and disputes arising out of claims settlement respectively. Therefore, in the current scenario, *the Ministry of Railways plays the dual role of the provider and the regulator of these services*. In other sectors like power, telecom, major ports, etc. an independent regulator has been established to regulate tariffs.

Efficient prices or non-distortionary prices are typically the outcome of a highly competitive market or an effective regulator. Indian Railways operates in a highly competitive environment in several freight and passenger segments, but in a few others, it faces little or no competition. Further, the externality effects are not reflected in the prices. In the absence of competition, a regulator is often instituted to set prices based on true costs revealed by the monopolist or near monopolist. *The need for setting up a Rail Tariff Authority has often been stressed in this context*.

It is recommended that an independent Rail Tariff Authority (RTA) should be constituted at the earliest to fix tariffs for both passenger and freight. The Expert Group for Modernisation of Indian Railways, headed by Dr Sam Pitroda, had also recommended the need for setting up such a Rail Tariff Regulatory Authority in order to provide a level playing field to all stakeholders. Setting up of the RTA could depoliticise the process of setting the passenger fares, which were not raised for close to a decade, until recently, due to populist pressures. It would also help in expansion of the PPP programme of the Railways and could also arbitrate disputes and grievances of freight customers and PPP concessionaires.

Further, an institutional mechanism to gather, analyse and use cost data and market intelligence needs to be established. With computerisation of freight and passenger transactions, Railways now have a huge database. This needs to be used to gain insights on the behavior and preferences of passengers and freight customers. This would need expertise and it is not possible to recruit and retain such expertise within the Railway Board on a sustainable basis. This can perhaps be done through a CRIS project to design and install a decision support system for the rates directorate.

Box 1.19

A Simplistic Programme for Fare Revision

Three alternate scenarios for fare revision have been examined, based on two factors: (a) Subsidy provided for Suburban railways, and (b) timeframe.

Common Assumptions across the three scenarios:

- Revenue and loss figures for the year 2010-11 have been used as the base to calculate the required revision in fares.
- The proposed fare revision under the three scenarios has not been adjusted for inflation; i.e., it is assumed that in addition to the proposed revision under the three scenarios, the fares will also be adjusted proportionately to change in costs.

	SUBURBAN	NON-SUBURBAN
Revenue (Rs Billion)	18.7	239.2
Loss (Rs Billion)	23.2	141.7
Loss /Revenue (Per cent)	124 Per cent	59 Per cent
SCENARIO I		
Subsidy (on cost)	0 Per cent	0 Per cent
Timeframe for fare revision	10 Years	
Required increase in revenue to incur 'zero loss'*	124 Per cent	59 Per cent
Fare increase each year (per cent)	8.4 Per cent	4.8 Per cent
SCENARIO II		
Subsidy (on cost)	25 Per cent	0 Per cent
Timeframe for fare revision	10 Years	
Required increase in revenue to incur 'zero loss'*	68 Per cent	59 Per cent
Fare increase each year (per cent)	5.3 Per cent	4.8 Per cent
SCENARIO III		
Subsidy (on cost)	25 Per cent	0 Per cent
Timeframe for fare revision	15 Years	
Required increase in revenue to incur 'zero loss'*	68 Per cent	59 Per cent
Fare increase each year (per cent)	3.5 Per cent	3.1 Per cent

* The figure is adjusted based on subsidy provided.

Source: NTDPC.

With accounting reforms it should be possible for the RTA to determine the costs of operating uneconomic railway lines built on social consideration and losses on passenger services on account of subsidised tariff-setting. The government will have the option of closing operation of such lines or services or raising tariff. Alternatively, the government could decide to provide subsidy as determined by the authority.

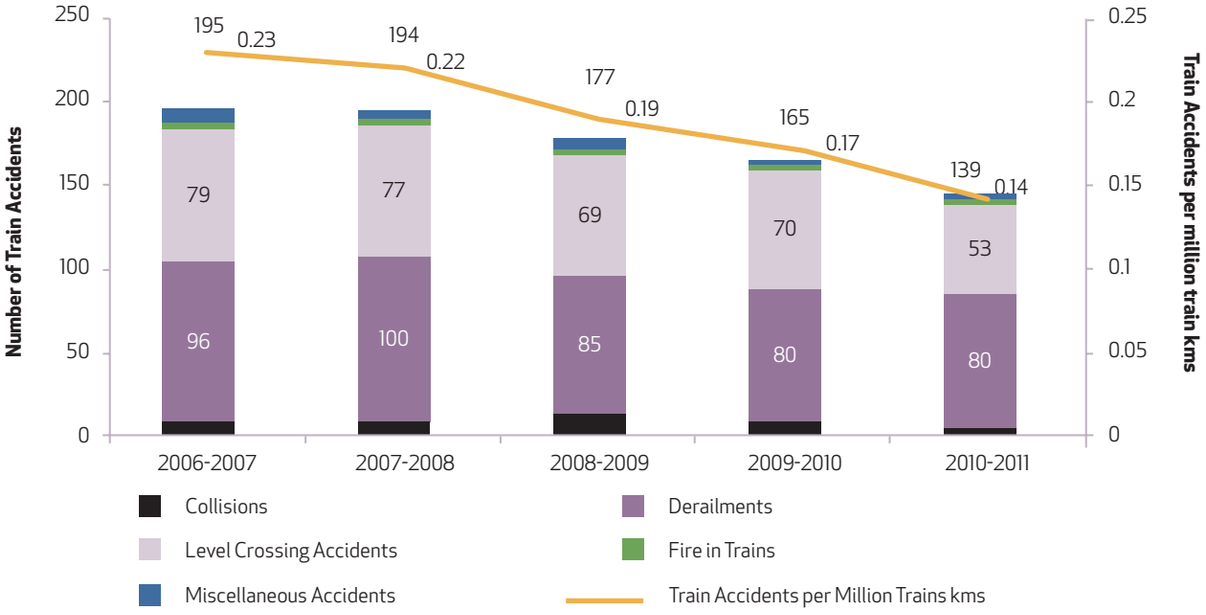
SAFETY

Safety on IR has always remained a pressing issue. Concerned with the high rate of railway accidents in India and to prepare a roadmap for improving safety on IR, the Ministry of Railways appointed a High Level Safety Review Committee[18] under the Chairmanship of Dr Anil Kakodkar. The Committee examined all technical and technology related aspects in connection with safe running of train services in the country and highlighted many discrepancies in current safety practices caused by poor maintenance of equipment and installations, lack of trained staff, and inability to adapt to new technologies. The Committee submitted its report in February 2012 and noted that:

'There is no practice of independent safety regulation by an independent agency separate from operations. The Railway Board has the unique distinction of being the rule maker, operator and the regulator,

18. HLSRC (2012).

Figure 1.26
Number of Train Accidents and Accidents per Million Train Km



Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar committee).

all wrapped into one. Commissioners of Railway Safety though considered to be the safety watchdogs have negligible role at the operational level. Compliance of safety standards set by Railways for themselves are often flouted for operational exigencies.'

The Commission of Railway Safety, working under the administrative control of the Ministry of Civil Aviation of the GoI, deals with matters pertaining to safety of rail travel and train operation and is charged with certain statutory functions as laid down in the Railways Act (1989), which are of an inspectorial, investigatory and advisory nature. The most important duty of the Commission is to ensure that any new Railway line to be opened for passenger traffic should conform to the standards and specifications prescribed by the Ministry of Railways and the new line is safe in all respects for carrying of passenger traffic. This is also applicable to other works such as gauge conversion, doubling of lines and electrification of existing lines. Commission also conducts statutory inquiry into serious train accidents occurring on the Indian Railways and makes recommendations for improving safety on the Railways in India[19].

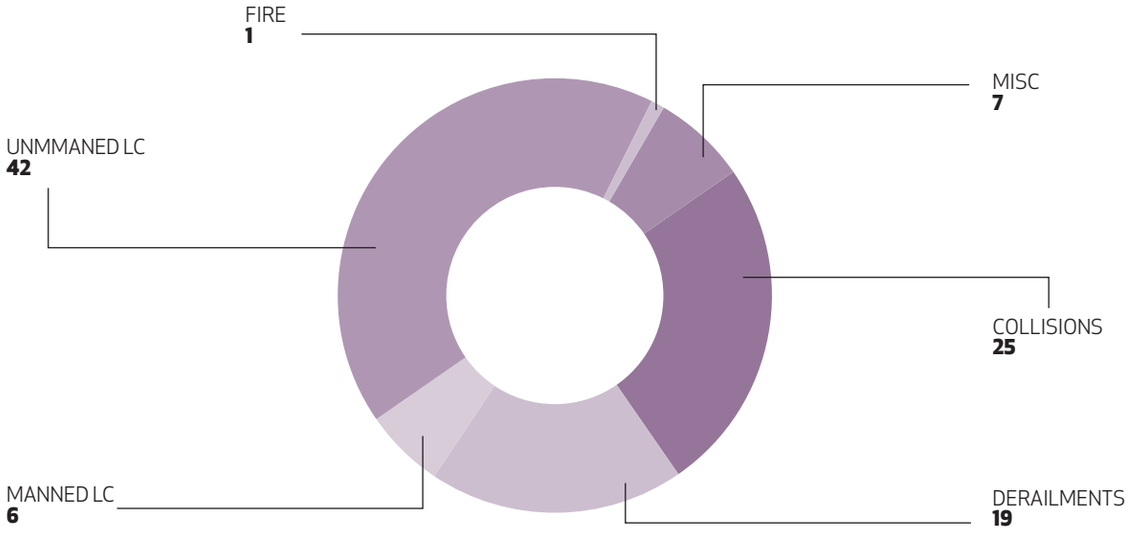
A review of the statistics for safety on Indian Railways shows a sustained reduction in number of consequential train accidents per year despite phenomenal increase in volumes of traffic, both passenger and freight. The total consequential train accidents have come down from 195 in 2006-07 to 141 in 2010-11. The consequential train accidents per million train kilometre have also shown a steady decline from 0.23 to 0.15 during this five year period (Figure 1.26). Derailments and accidents at level crossings constitute account for roughly 90 per cent of the total accidents. Moreover, roughly 85 per cent of accidents on IR are alleged to be on account of human failure[20].

Though the data of consequential train accidents over the years has been showing a declining trend despite phenomenal growth of traffic, safety on IR still remains a matter of great concern as the total casualties have increased from 610 to 844 during the same period. Further, close to 50 per cent of the casualties happen due to accidents at level crossings, while collisions account for about 25 per cent of the casualties (Figure 1.27).

The report of HLSRC also highlighted that the data maintained in the Railway Board office pertains to only those train accidents with apparent consequences. The casualties due to trespassing of railway track, or for other reasons connected with railway infrastructure and casualties of IR's own staff while on duty, though quite substantial, are not included in the statistics of train accident related casualties. Total deaths and injuries among railway passengers and others on railway property not considered as 'consequential', or due to a fault of the Indian Railways, were reported to be around 25,900 for 2011[21]. Further, during the period 2007-08 to October,

19. http://civilaviation.gov.in/CRSS/Commission%20of%20Railway%20Safety.html (accessed September 23 2012).
20. HSLRC (2012).
21. National Crimes Record Bureau (2012).

Figure 1.27
Total Casualties in Train Accidents (2006-11)
(Per cent)



Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee).

2011, about 1,600 railway staff were killed and 8,700 injured while on duty[22].

The committee also gave detailed recommendations for enhancing safety on IR, some of which are summarised in Box 1.20.

RECOMMENDATION:

- **Establish a National Board for Rail Safety** which is independent of the operational agencies to avoid conflict of interest. The CEO of the Board should be of a rank of Secretary to the GoI and should report directly to the railway Minister. The Board should be staffed by professionals who have career opportunities and working conditions similar to professionals working in IITs/CSIR laboratories. It should also have an adequate funding mechanism. The Board will also conduct statutory inquiries into train accidents occurring on the Indian Railways, presently being conducted by the Commissioner of Railway Safety. Further, with the setting up of the proposed Board, the institution of Commissioner of Railway Safety may not be necessary and it may be merged with the Board (an amendment to the Railway Act would be necessary in this regard). The terms of reference can incorporate the recommendations similar to those included in the report submitted by the Dr. Kakodkar Committee (2012) on railway safety.
- Establish/strengthen Safety Departments within operating agencies (at different levels Railway Board, Railway Regional headquarters) for ensuring day to day compliance with safety standards, studying effectiveness of existing policies and standards, conducting safety audits, collecting relevant data, etc. These departments must employ 50-60 per cent professionals with expertise in the relevant area of safety, and 40-50 per cent of the staff could be on deputation form the field.
- A railway safety policy with measurable indicators for evaluation for a five year and ten year period must be announced before the end of 2015. The policy should cover all injuries and fatalities associated with railway property.
- Reform data collection and analysis procedures for traffic accidents in consonance with international practices at different levels: National broad-based data, detailed survey systems for fatal cases, sampling systems for medical data, etc.
- Establish five to 10 multidisciplinary safety research centres at academic institutions.

INADEQUATE RESEARCH & DEVELOPMENT

Research & Development can be a significant source of competitive advantage. However, Indian Railways has not been on the frontier of developing or innovating railway technology. A comparison of the technologies employed on IR with the best that is available or in use on other railway systems shows that IR has lagged behind its peers the world over. There is a gap of a few decades between state-of-the art technology adopted (in construction, mainte-

22. HSLRC (2012).

Box 1.20

Select Recommendations of High Level Safety Review Committee

Following are some of the key measures recommended by the Committee to improve safety:

- **Independent Safety Regulation:** There is no practice of independent safety regulation by an independent agency separate from operations. A **Railway Safety Authority (RSA)** should be set up as a statutory body independent of Indian Railway Board under the Government. The Authority shall have a separate budget fully funded by the Ministry of Railways and shall be backed by a full-fledged Secretariat. The Institution of Commissioner of Railway Safety should be merged with RSA and should be strengthened and empowered. Role of Commissioner of Railway safety should be withdrawn from the routine clearance of proposals from the railways such as changes in Plans, Working Rules, etc. which consume lots of his time.
- Financial health of IR has great bearing on the safety standards. Passenger fares have not been increased in the last decade during which many passenger carrying trains were introduced on the existing overloaded infrastructure. This has strained the infrastructure way beyond its limit and all the safety margins have been eaten up pushing Indian Railways to a regime of adhocism in infrastructure maintenance. **The Committee strongly recommended to stop such practice of introduction of new trains without commensurate inputs to the infrastructure.**
- Line capacity has been severely constrained due to introduction of more and more trains over the years. No technical aid is yet available to run trains during foggy weather which adversely affect train operations during winter season of 2 to 3 months in northern India. **The Committee recommended adopting an advanced signalling system based on continuous track circuiting and cab signalling, similar to European train control system Level-II on the entire trunk routes of about 19,000 route kilometres within 5 years.**
- Casualties in accidents at level crossings are a matter of concern. Moreover, level crossings are also a drag on train operation limiting line capacity. **The Committee, therefore, has recommended total elimination of all level crossings (manned and unmanned) within 5 years.** Construction of limited height sub-ways, Road under Bridges (RUB) and Road over Bridges (ROB) should be taken up in mission mode and traffic blocks should be generously granted.
- With the introduction of long formation of trains running at moderately high speed of 110 to 120 kmph, it is recommended to stop production of ICF design coaches and completely switch over to manufacture of LHB design coaches immediately.
- There is a severe shortage of well trained staff. There are several vacancies in critical safety positions. All the vacancies of supervisors and staff in safety category should be filled up in a time bound manner say within 6 months.

Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee).

nance and operation, and different kinds of transportation solutions such as high-speed, heavy-haul operations) in the developed railway systems and Indian Railways.

At present, Research, Development and Standards Organisation (RDSO), Lucknow, is the sole R&D organisation of Indian Railways. It functions as the technical advisor to the Railway Board, zonal railways and the production units and is entrusted with:

- Development of new and improved designs;
- Development and adoption of new technologies for use on Indian Railways;
- Development of standards for materials and products specifically needed by Indian Railways;
- Technical investigation, statutory clearance, testing and provision of consulting services;
- Inspection of critical and safety items for rolling stock, locomotives, signals, telecommunications equipment and track.

Infrastructure with RDSO: Presently, RDSO has a number of laboratories equipped with research and testing facilities for development, testing and design evaluation of various railway related equipment and materials. **Although these laboratories have achieved their limited purpose, these are not state-of-the-art.** Moreover, facilities for development of model/prototype research work and workshops equipped to support such research work do not exist at RDSO.

Collaboration with Research and Academic Institutions: RDSO has also forged strategic links with premier technical institutions and organisations, such as the IIT at Kanpur, Roorkee, New Delhi and Chennai, the Defence Research and Development Organisation (DRDO), and the Central Scientific Research Organisation (CSIR). A Memorandum of Understanding (MoU) has also been signed with IIT, Kharagpur to set up a Centre for Railway Research

Table 1.12
Staffing Pattern of RDSO

STAFF	SANCTIONED STRENGTH	ACTUAL ON ROLL	MODE OF RECRUITMENT
Group 'A'	212	192	By deputation of officers from Zonal Railways/promotion from Group 'B'
Group 'B'	166	140	By promotion from Group 'C'
Group 'C'	2,101 (Tech-1,553; Non-Tech.548)	1,612 (Tech.1,141; Non-Tech.471)	RRB/Compassionate Ground
Group 'D'	870	505	RRC/NER & Compassionate Ground

Source: Report of the Working Group on Railways (NTDPC).

at Kharagpur for developing next generation railway technology for Indian Railways.

Despite existing laboratories and strategic alliances, RDSO has not been able to fully achieve its objectives and Indian Railways is mostly dependent on imported technology. RDSO's role has largely remained restricted to facilitating adoption of imported technology by Indian Railways, standardisation of design specifications and development of indigenous sources for import substitution. Some of the main factors that have impeded RDSO's emergence as the R&D spearhead of IR are:

- Bright and talented technical personnel with exposure to global technological trends are required for research. Such technical expertise is not available with RDSO. RDSO is mainly manned by railway officers and their knowledge is limited to railway operations as they exist. Railway officers are undoubtedly required to bring relevant domain knowledge and clearly define research areas but beyond that their skills are of limited use for research, development or innovation. Table 1.12 shows the current staffing pattern of RDSO. It shows that the top-echelon of RDSO is manned by officers on deputation from Zonal Railways and most of the staff of RDSO is recruited at relatively low-level.
- RDSO postings are not considered very attractive by many railway officers. Even the railway officers who are sent on deputation to RDSO stay there for short tenures. The limited expertise or exposure gained by them is also lost and no institutional capacity gets built.
- RDSO lacks research labs with state-of-the-art equipment. It is also hamstrung by the government procedures in procurement of research and testing equipment.
- Workload on account of vendor development has increased manifold in the recent past. As a result, registration and approval of vendors consumes a considerable part of the time and resources at the disposal of RDSO, adversely affecting its R&D work.

The High Level Safety Review Committee (2012) also examined the present state of functioning of RDSO and noted that:

'Research Design and Standards Organisation, which is the present apex technical wing of Indian Railways, is highly constrained due to several reasons. This has hampered the ability of the system to internalise new emerging technologies and indigenous development has not progressed consistent with today's needs.'

Box 1.21 highlights some of the observations of the HLSRC about the present research eco-system on IR. The major recommendations of the HSLRC on the proposed research eco-system on IR are summarised in Box 1.22.

Recognising the role and importance of research and technology in meeting the goals set out for IR, the **Indian Railways Vision 2020** document of Ministry of Railways noted that:

'We must establish one of the worlds' most advanced research and development capabilities for transfer and indigenisation of technology and breakthrough innovations. For meeting these objectives, the Research, Design and Standards Organisation (RDSO), CRIS and other technical bodies of the Indian Railways would be revamped to enable them to work with clear mandates and deliverables. *R&D will be integrated with the core of Railways operations*.'

It further suggested that:
'A conscious strategy to mitigate the risk of obsolescence and continuously stay ahead in technology race would be put in place. This would be achieved by fostering close linkage between RDSO, functional levels of railway administration and intellectual resources at premier technology institutes like IIT and

Box 1.21

Present Research Ecosystem (Observations of High Level Safety Review Committee)

- RDSO, in its present form, is largely discharging its role as a support organisation for operational network of Indian Railways in terms of inspection and testing, coordination between vendors / suppliers and operational units, marginal improvement of systems / sub-systems etc. RDSO also carries out the work of development of design and specifications of systems and sub systems, audit of vendors and their approval and inspection of critical items related to operation and safety. *There is, however, no semblance of any original research or technology development initiative and the general style of functioning is around customisation of designs of vendors to suit the requirements of Indian Railways*.
- *Poor empowerment of RDSO in forwarding the sanctioned area of work within the budgeted amount was also brought to the notice of the committee*. It was informed that RDSO was dependent on zonal railways in awarding the contracts for trial projects of RDSO which cause delay.
- *There is hardly any permanent cadre of scientists or officers at RDSO to carry out the R&D work*. The officers at the senior positions such as EDs, Sr EDs and Directors are drawn from the zonal railways on deputation basis. These officers go back to the zonal railways after completion of their term of 3 to 5 years or on promotion. *RDSO-specific recruitment is done only at the subordinate level on permanent basis*. After converting the status of RDSO as a zonal railway, even this recruitment has come to a halt. These subordinate employees are not able to go beyond JAG level.
- The committee had detailed presentations and interactions on Technology Mission on Indian Railways (TMRS). *It is observed that though this was a good effort on the part of RDSO and IIT Kanpur, the role of industry was very limited*. This was perhaps due to the fact that there was no incentive to the industry. Their efforts in association with IIT Kanpur and RDSO were not going to be rewarded in any way as the procurement of the product was through open tender. *IPR policy of Indian Railways was not conducive for promotion of this academia-industry-railway partnership*. This led to the unwillingness of industry partners to participate actively. *Thus, despite the best intentions and reasonable success on the development front up to trial demonstration stage, the process of technology transfer could not be carried out successfully*.
- *It must be mentioned that a certain element of ownership and independence in railway engineering is necessary in India*. If there is a tendency of over independence on suppliers and vendors and if the equipment procured is in the form of a black-box then certainly the organisation is at the mercy of vendors time and again. This is certainly not a safe scenario. The specifications of the equipment as well as the technological know-how should be owned as well as controlled firmly by Indian Railways. Development of technology as well as indigenous vendors is necessary.
- In order to improve the technology of rolling stock, motive power equipment, track system and other assets, it is essential to invest continuously in applied research and technology development. *This perspective is singularly absent in the present scenario*. In case of nuclear and space agencies, the backbone of research and development is as strong as the operational wings of these agencies. It is because of this that the country is able to achieve a level of independence and excellence in these areas.

Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee).

NITs and research laboratories of CSIR and DRDO along with targeted investments in *R&D. In 10 years' time, IR would be transformed from a net technology importer to technology exporter*.'

RECOMMENDATIONS

Establish Railway Research and Development Council: Presently, functioning of RDSO is reviewed by a Governing Council which is headed by the Minister of Railways; Chairman and Members of the Railway Board are Members of the Council. The Council is required to interact with RDSO at periodic intervals. It has been, by and large, dysfunctional and is not playing the role it was envisaged to. As suggested by the High Level Safety Review Committee, the Governing Council needs to be replaced with an apex body called 'Railway Research and Development Council' (RRDC). RRDC will be chaired by an

Box 1.22

Proposed Research Ecosystem (High Level Safety Review Committee)

The High Level Safety Review Committee proposed the establishment of a new architecture of research and development under the overall guidance of an **apex body called Railway Research and Development Council (RRDC),** which is recommended to be established for this purpose.

Apart from the RRDC, the research eco-system is conceived of the following three wings:

- **Research, Design & Standardisation Organisation (RDSO)**
- **Advanced Railway Research Institute (ARRI)**
- **A set of Railway Research Centres (RRCs)**

Following paragraphs summarise the role of each of these:

- **RRDC:** The RRDC will provide overall guidance as well as resources for the railway research eco-system in India. The council will also provide a perspective plan of research and development in view of the safety considerations on one hand and the technological solutions on the other hand. The RRDC will be chaired by an eminent technologist / scientist of the country reporting to the Railway Minister. It will have three members from the Railway Board and three members, one each from academia, research establishments, and industry associations (CII, FICCI etc). The Director General (DG) of RDSO and the Director General of the proposed ARRI shall also be members of RRDC.
- **RDSO:** Indian Railways should strengthen RDSO and make it more efficient organisation with respect to the work of design standards, inspection, testing and technical support to zonal railways. It should be restructured and empowered to perform the assigned task. It will have linkages with ARRIs and RRCs. Further, the committee recommends enhancing the powers of DG/RDSO to improve its functioning:
  - Full autonomy with financial powers to function within the sanctioned budget.
  - To award consultancy contracts of enhanced value up to Rs 10 million in each case against the present delegation of Rs 3 million in each case. Powers for awarding MOU/Consultancy Contract should also be extended to benchmarked organisations in India and abroad like AAR, TTCI, UIC, etc.
  - Full powers to award Consultancy Contract once sanctioned by the Board for values more than Rs 10 million each and there should not be any further need of sending the proposal to the Board.
  - Full powers for placement of developmental order within lump sum Budget Grant of RDSO irrespective of cost. This will expedite prototype and field validation for which RDSO is presently depending on PUs and Railway Board.
- **ARRI:** This organisation should be a high-end, research organisation focusing on engineering challenges in railway specific areas.
- **RRCs:** Indian Railways should establish a string of five or so RRCs. These centers should be co-located on the campuses of Indian technological academic institutions of national importance. Each center should specialise in specific areas like signalling, rolling stock, motive power, track and bridges, operations management, etc.
- **Financial support** up to 2 per cent of yearly revenue of Indian Railways should be available to support the entire research eco-system of railways in India.

Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee)

eminent technologist/scientist, with the Chairman and Technical Members of the Railway Board as its members. The Director General of the proposed RRDI, the Director General of RDSO and 2 Directors of the proposed Academic Centres of Excellence shall also be ex-officio members. It will also have one representative each from the academic world and research organisations. The Chairman of RRDC shall have a reasonably long tenure.

RRDC shall provide the perspective plan stretching over a reasonable period of 10 years for research and development needed for the Railways.

The budgetary provision for research and development should be adequate; 2 per cent suggested by the High Level Safety Review Committee can be a benchmark. This is a must to upgrade the research and testing facilities available presently, as also to provide the resources needed for the new RRDI, the

new Academic Centres of Excellence and the modernisation of the RDSO.

Establish **Railway Research and Development Institute (RRDI):** This will be multidisciplinary research organisation for applied research on current concerns and future technology development for Railways. This is in line with the recommendations of the Dr. Kakodkar committee to establish an ARRI. The proposed institute should formulate a Master Plan roughly every five years to articulate and lay down the major research areas and activities. The institute should look at establishing independent Research Wings for each of the major areas, e.g. Railway Track & Structure; Locomotives; Rolling Stock; Train Controls, Signalling and Communications; Information Technology; Energy Efficiency; Rail Environmental Research; Safety; Railway Transport and Logistics; Railway Economics, Statistics and Data.

The service conditions at RRDI should be similar to those at CSIR and the Director General of the institute should have rank and facilities similar to those at CSIR laboratories/ Secretary to the Government of India. The Director General will report directly to the Minister of Railways or the CRB. Terms of reference would be similar to those at the IITR (as recommended in Chapter 11 on Research and HumanResource Development), but with greater emphasis for applied work as per needs and requirements of Railways. The institute should target recruiting close to 300 researcher professionals (60-70 per cent permanent employees of the institute and 30-40 per cent on deputation) by the end of the 13th Five Year Plan, with a healthy mix of Ph.D. degree holders, engineers, architects, professors from national and international universities, etc. The institute should also look at organising joint researches in collaboration with various international organisations.

The RRDI should be supported by six or seven Regional Railways Institutes, which focus on the research requirements specific to their region. The head of the Regional Railways Institute should report to the General Manager (GM) of a zone. Each regional institute should target recruiting about 100 researchers within five years of their establishment. Apart from the research requirements specific to their region, these Regional Institutes would also compete among themselves for any Request for Proposal (RFP) floated by the **RRDI** for a research area/ project.

Establish Academic Centres of Excellence: The Ministry of Railways and the Ministry of Human Resource Development must set up academic centres of excellence, or the **Railway Research Centres (RRCs),** in at least 13 technical institutes (IITs, RECs) and at least two IIMs by 2020. It is suggested that the number of RRCs should be scaled up to 30 by 2030. These should be in the nature of full scale research centres where faculty can interact within a sizeable group. Such centres must be of interdisciplinary nature and be established based on open competition among academic institutions by inviting proposals for the same. Each centre must demonstrate its interdisciplinary nature by ensuring that the participating scientists are drawn from two or more departments and can be established in all academic institutions including medical colleges.

The RRCs should be provided grants in aid for establishment expenses, building, facilities, laboratory, equipment etc. The level of funding would be Rs 30-50 million per year per centre. In addition to equipment, supplies, travel and research funds, the funding must include 5-10 endowed permanent Chairs and 10-20 endowed post-graduate scholarships. Each centre must work in at least 3 research areas. Also each major specialisation/activity of IR should be a focus research area for 2-3 RRCs this will promote interdisciplinary research and minimise academic corruption and monopoly. In order to attract and retain the best of scientists, the RRCs should ensure that their employment and service conditions match the standards of DRDO and CSIR labs. The RRCs should embrace progressive career advancement policies for its staff and provide a platform for the scientists/researchers to rise to the highest level and head the RRCs.

Revamping RDSO: It is recommended that the functions of the RDSO are completely redefined and actions initiated to revitalise and strengthen it. RDSO should involve itself with only technology upgradation, implementation and setting of standards; it should not be responsible for the inspection function. Workload relating to vendor development can be substantially reduced by delegating it to Production Units.

The staffing policies of RDSO need a complete overhaul to induct competent technical personnel required for research. As discussed earlier, currently most of the staff of RDSO is recruited at lower level and the top-echelon of RDSO is manned by officers on deputation from Zonal Railways. In order to build the institutional capacity of RDSO it is important that most of the Group A and B officers should be permanent staff of RDSO. Lateral induction of highly qualified technical personnel at higher levels must be allowed. Further, those from the field who have flair for research should be drawn in and absorbed in RDSO; they shall help bring in domain knowledge too. The target should be to ensure that roughly 50 per cent of the staff of RDSO comprises Group A and B officers. The recruitment of technical officers directly in group 'B' should be started urgently. A well oriented policy for promoting capable and endowed officers to group 'A' on assessing their per-

Box 1.23
Chinese Academy of Railway Sciences (CARS)

CARS is the only comprehensive research institute with multi-disciplines and multi-specialties in China Railway industry. In 2002, it was transformed from a state-owned institute to an enterprise under the direct control of MOR. Grounded in the main field of railway modernization, it has tackled considerable important and critical technological problems and has made a great deal of experimental studies focusing on railway construction and transportation. Therefore, it has gained more than 2300 scientific research achievements and 825 prizes for significant fruits of scientific research. CARS has developed technological innovative ability and core competitiveness in railway transportation over its existence for 60 years, and developed into an industrial group engaging in high and new technologies of rail transport with integration of scientific research, development, production and consultation.

It has 2468 staff and workers, among whom 606 are senior research fellows, and 701 intermediate researchers. As one of the initially approved units granting master's and doctor's degree, it has now developed into a first-level doctorate degree granting institution for Traffic Engineering and Geotechnical Engineering, 2 mobile postdoctoral centers, 6 doctoral degree programmes, and 15 master's degree programmes.

It has built the national railway test center, and has been equipped with over 40 laboratories of all specialties, and 6991 test equipment. Furthermore, it has applied and established in recent years 6 state-level innovation platforms, including

- National Research Centre of System Engineering of Railway Intelligent Transport
- State Key Laboratory for Track Technology of High-Speed Railway
- National Engineering Laboratories for System Test of High-Speed Railway
- Equipment Testing Line of Urban Rail Transit
- State Key Laboratory for Traction and Control System of Locomotive and EMU
- Service Platform for Technological Innovation of High-Speed Train.

CARS is making every effort to build the academy into a first-class research institute and to contribute more to the modernization of China Railways by focusing on research and development, and motivating both experimental tests and commercialization with innovative and enterprising spirits.

Source: http://www.railway-research.org/Chinese-Academy-of-Railway accessed on 16th December, 2013.

Box 1.24
Korea Railroad Research Institute (KRRI): Korea's Railway Think Tank

KRRI was established in 1996 as a railway research body in Korea aimed at developing railway transportation and enhancing competitiveness in the industry by unfolding strategic R&D activities along with railway policies. KRRI was launched with commitment to shape the nation's railway transport systems while strengthening its competitiveness in the global railway industry. As the nation's backbone research body for the railway technology, KRRI constantly seeks innovative technologies and policies to better serve the people and nation with improved railway systems.

Over the years, KRRI has expanded its international network by signing MOU with related organisations in and outside country, and has been actively engaged in collaborative research activities with its partners. As of November 2008, KRRI had signed MOU with 25 overseas organisations from 15 countries. It is also a member organisation of International Union of Railways (UIC) and International Association of Public Transport (UITP). KRRI hosts annual seminar with Railway Technical Research Institute (RTRI) of Japan and China Academy for Railway Sciences (CARS) of China where related researchers get together to exchange their research expertise and results to develop the railway technology while forming a strong bond between the countries.

(Contd...)

The organisation of KRRI is composed of 270 regular employees, about 84 per cent out of whom consist of researchers in various technology areas. The budget of KRRI for the year 2011 was around 90 million USD.

As an internationally certified testing centre, KRRI is equipped with some 350 units of advanced railway testing facilities in 6 laboratory buildings to conduct highly sophisticated testing and assessment on railway related gears, rolling stock performance and diagnosis to ensure railway safety.

Source: KRRI website (http://www.krri.re.kr/); accessed May 03, 2013.

formance in field as well as in academics after 7-10 years should be created.

Investments should also be made to upgrade and modernise the lab facilities of RDSO.

Presently, no procedure has been specified for taking over of patent rights from the trade. Where there is design/technology the use of which has considerable importance for IR, taking over of patent rights becomes necessary, to avoid monopoly situation and from consideration of security. A procedure for taking over of patent rights from the trade should be clearly spelt. This is not applicable for rolling stock where while importing, transfer of technology with rights is automatically provided for. However, the issue assumes importance for smaller items such as for track.

Ministry of Railways should set up a Science & Technology wing/department which will act as liaison between the field staff and the Research Institutes/ RRCs, and will help in transferring knowledge to the field.

Involvement of manufacturers of railway products in R&D: The upgrade and modernisation of technology on IR can be realised by improvement of in-house R&D work and involvement of the manufacturers of railway products in R&D. Major manufacturers of railway products all over the world invest considerable resources in developing more productive, cost-effective products and systems. They need to be involved in R&D for both new technologies as well as for improvement of existing systems and products.

Setting up of new units with participation of private-sector would also be useful in ensuring technological upgrade.

Result-oriented research teams should be set up to work on specified research projects. Such teams may include participants from outside IR, including from research/academic institutions and OEMs, contracted for the duration of the project. The research projects core team must not be disturbed till the end of the project and should have strong incentives (financial as well as others) to deliver.

R&D projects need to be identified based on operational needs and potential investment returns. These need to be supported through allocation of adequate resources. Clear-cut accountability for outcome and timely completion would need to be established and monitored through annual performance audit.

An Integrated Energy Management System needs to be set up under a separate directorate in the Railway Board. This needs to be assisted by a multi-disciplinary team at RDSO. Electrification on economic justification, induction of energy-efficient rolling-stock and monitoring of non-traction energy consumption should form part of energy management plan.

HUMAN RESOURCES MANAGEMENT

Indian Railways has the second largest workforce under one government controlled institution anywhere in the world, with nearly 1.3 million employees working under 13 departments, organised in 10 different central Group A services. The current structure encourages excessive departmentalism at the management level and often leads to priorities being set not for the organisation as a whole, but on departmental considerations.

With the continuous technological upgrade, the ratio of Group 'C' to 'D' has changed from 25:75 in 1951 to 82:18 in 2010-11, indicating a shift towards induction of larger number of skilled manpower. However, a sizeable number of unskilled group 'D' staff is still being inducted into the railways. Further, IR recruits about 20,000 staff in Group 'C' & 'D' category annually on a compassionate basis. Such staff are not comparable, skill or merit wise, to those recruited by an open competition. No other department of the GoI

Table 1.13
IR Employees (as on March 2011)

CATEGORY	NUMBER (IN THOUSANDS)	PERCENTAGE
Group 'A' & 'B'	17	1
Group 'C'	1,077	81
Group 'D'	235	18
Total	**1,328**	**100**

Source: Indian Railways Yearbook 2010-11, Ministry of Railways.

does such massive appointments on compassionate grounds.

HR functions in the Indian Railways have traditionally evolved in the context of its being in the government. HR policies and practices on IR are for the most part attuned to policies of Government of India. There is no flexibility in terms of pay and rewards as these are determined by Pay Commission set up periodically by the government of India.

Recruitment of staff in Groups 'C' & 'D' is done through the Railway Service Commissions located at several centers and to which the zonal railways and production units are attached; the zonal railways and production units too recruit staff such as on compassion grounds and for Group 'D'.

The recruitment to the management cadre (Group A officers) is done through Department of Personnel & Training (DoPT) and Union Public Service Commission (UPSC). The UPSC as of now holds three different examinations for this purpose viz.:

- **Civil Service Examination** for Indian Railway Traffic Service (IRTS), Indian Railway Accounts Service (IRAS), Indian Railway Personnel Service (IRPS), and Security Service;
- **Central Engineering Services Examination** for Indian Railway Service of Engineers (IRSE), Indian Railway Service of Electrical Engineers (IRSEE), Indian Railway Service of Mechanical Engineers (IRSME), Indian Railway Service of Signal Engineers (IRSSE), and Indian Railway Stores Service (IRSS);
- **Special Class Railway Apprentices Examination** for selecting candidates to the undergraduate programme in Mechanical Engineering at the Jamalpur Institute.

The above does not include recruitment of doctors to the Indian Railway Medical Service for which a separate examination is held by the UPSC. Inclusive of this, there are 10 structured services. Ministry of Railways is the nodal ministry for the Central Engineering Services Examination and the Special Class Railway Apprentices Examination.

What are now 10 structured Group A services were originally 3 to start with in 1926; Gopal Krishna Gokhale raised the issue of Indians being given management positions in the Railways in the Imperial Legislative Assembly in 1910 and his effort fructified 14 years later with the Secretary of State giving sanction during the year 1926-27. In course of time, additional services were created for Accounts, Signal & Telecommunication, Electrical, Stores, Medical, Personnel and Security at different times, taking the total to 10.

Rail transport has two characteristics: a severely guided mode, and with controlled access. This, in turn, makes multidisciplinary inputs a must for its output. When the entire organisation is owned and managed by the GoI, proliferation of services is a natural outcome.

This is the root cause of the 'departmentalism' in the IR at the management level.

Presently, the HR function is mostly confined to the traditional role of recruitment, training and establishment matters. Though the Railway Board has the authority and power to attune recruitment and training to job requirements (in terms of skills, performance appraisal, rewards and incentives), there is hardly any effort or interest or institutional mechanism to achieve continuous improvement in HR practices, either at the Ministry's level or at the zonal level. A constant effort to review initial recruitment qualifications and upgrade training modules to reflect the changing needs for Group C staff is totally absent. And, as mentioned above, compassionate appointments done on a large scale make the situation worse. Of the multiple departments and services in IR, some manage these HR activities themselves without involving the Personnel department at Divisional/Zonal or Railway Board level. In an earlier era, Railways could attract talent by

the mere fact that it was one of the few industries in the country and railway jobs offered the security and the prestige of government service. However, to attract, nurture and retain talent in large numbers for growth in future, IR has to take a close look at its HR policies and practices.

This is particularly important in view of the large capacity expansion that is envisaged and the modernisation that is necessary in all aspects of railways' operations.

RECOMMENDATIONS

HR management would be critical to achieving the challenging goals set for IR for 2032. HR reform should proceed hand in hand with the organisational reforms. It is imperative that the 'departmental' character is rectified so as to enable the organisation to deliver on its promises and meet the expectations of the people. The focus should be on building skills and promoting and incentivising excellence at all levels. HR reforms that are carried out will need to be consistent with the proposed future corporate structure envisaged in the organisational reform of Indian Railways.

The NTDPC has discussed the HR reforms of IR extensively and at different times. There is a consensus on the need to significantly rationalise the existing multiple services and cadres of railways. However, as on some other issues, there were some differences in views with regard to how radical the HR eforms should be. The incremental view suggests that the reorganisation may be into seven cadres rather than two as recommended below. This view in favour of seven cadres is provided in full as Annex 1.4 to this chapter.

Following are the recommendations to reform the HR practices of IR:

- The recruitment to the railway cadres of officers should be totally dissociated from the Civil Services and Central Engineering Services exam. The Special Class Railway Apprentice (SCRA) exam should be upgraded to recruit candidates, who are already graduates, to two streams of Railway Service viz. Indian Railway Technical Service and Indian Railway Logistics Service. This will also facilitate the organisational reforms proposed.
- The age limit for this exam should be 21 to 25 years with three attempts at the competition (at the most).
- On selection, the candidates should be admitted to professional post-graduate level courses of two years duration, on completion of which they should be awarded suitable Masters degree in Railway Engineering, Transport logistics or other relevant disciplines including finance and management. This would help in upgrading the technical capacity of railways staff. This post-graduate training may be carried out at the proposed Railway Institute/University or other designated reputed academic institutions in India or abroad.
- The Railway Engineering degree will encompass, inter-alia, all aspects of engineering - civil, mechanical, electrical, signalling and telecom, etc. - so that the officers have a holistic approach to the railway related issues.
- The Logistics course will prepare the candidates for railway accounting, railway operations, ratings, human resource development. It could be in the form of an MBA or an MA.
- After successful completion of their course the officers will spend one year as probationers in the field applying their knowledge to actual real-time situations - in a way learning the ropes of managing the day to day working.
- The training institute where the Masters course would be imparted should get converted into a Railway University of international standard, where railway research can be undertaken and PhD degrees awarded. It should become a centre for excellence attracting talent from every nook and corner.
- Once this process of initial recruitment is put in place, we can create a superior managerial cadre of leaders at the time of granting Selection Grade i.e., in the 14th year of service. These officers can be selected by a process of assessment at the UPSC. The leaders so selected will man the posts of Additional Divisional Railway Managers, Divisional Railway Managers, Chief Vigilance Officers, General Managers, etc. In this arrangement the Managers will have long stints unlike today when the DRMs remain in the chair only for two years and the organisation suffers the consequences of frequent changes, lack of direction and cohesion at the divisional level. This will undoubtedly benefit the organisation and a sense of direction, focus will be inculcated. This process will continue for a period of 3 to 5 years, in preparation of the corporatisation and reform of Indian Railways.
- Recruitment of highly qualified PhDs from IIMs/IITs and other science and engineering institutions in India and abroad should be encouraged for specialist functions.
- Lateral recruitment from the market for jobs in R&D, marketing, finance and HR should be considered. IR needs to transform into a smart organisation through a constant process of technological upgrade and stress on customer focused growth. This requires that personnel at all levels are recruited and trained with a view to building skills and attitudes required for attainment of the organisational goals;
- Induction of unskilled staff must be reduced and eventually eliminated altogether.
- The recruitment process has to be supple-

Box 1.25
Human Resource Management

- Install and operationalise immediately modern Computerised Human Resource Management System with data base and inventory/Resume of all present employees and skills required to meet modernisation plan.
- Reduce and gradually eliminate induction of unskilled staff
- Create and impart specialised courses in partnership with academic institutions and others especially for Vocational Education, Supervisors and Management
- Launch a series of in-service training programmes immediately
- Rationalise and consolidate multiple services and cadres without sacrificing the benefit of specialisation and business capabilities
- Offer graduate programmes in Railway technology at IITs and Railway management at IIMs
- Enable lateral recruitment from market for specialist functions
- Upgrade ICT skills of present officers and employees substantially
- Review and Restructure existing training institutions for improving ecosystem and Modernisation
- Review Railway Health System separately to meet aspirations of Railway Families and Modernisation plans
- Create a system of reward for collective performance and variable pay linked to incremental surplus generated by various units

Source: Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

mented by well researched and meticulously developed induction and in service training to constantly upgrade the skills of employees. The National Academy of Indian Railways (formerly known as the Railway Staff College) should be upgraded the property and its facilities should be expanded to thrice its current size. IR needs to work closely with academic institutions to devise and impart specialised courses, curricula and diplomas. Skilled workers and supervisors, recruited and trained this way would be able to meet the challenges of absorbing new technology and business orientation as IR rapidly modernises and upgrades its systems.

Modernisation of HR practices must happen and some principles regarding necessary changes have been laid down by Expert Group for Modernisation of Indian Railways (Box 1.25).

OPTIMISATION OF LAND USE

Land is a critical and scarce resource and is getting scarcer as demands on the available land mounts due to the pressure of population and development. A proper policy framework is required to preserve the land already available with railways and to minimise the requirement of land in future.

Roughly 10 per cent of the total land under the possession of Indian Railways is vacant (estimated at approximately 4,300 hectares). These are mostly alongside the track in longitudinal strips but there are some pockets around railway stations and railway colonies also. To keep a proper account of the land resources, an exercise for identification of the vacant land and systematisation of records has been undertaken. Vacant land is primarily meant to meet developmental needs such as doubling, yard modeling, traffic facility works and manufacturing facilities (for various rolling stock and other components required by railways). If the land is not required for operational needs, it can be developed commercially by Railway Land Development Authority (RLDA) created specifically by an Act of Parliament, to generate additional non-tariff revenue for railways.

In future, railways would need to use its existing vacant land scrupulously. It would also need to acquire land for various developmental projects such dedicated freight corridors, high speed passenger corridors, new lines and doubling projects as well as for major manufacturing units and multimodal logistics hubs. In most cases, the requirement of land would be to connect places in a linear fashion and there would be little flexibility to vary the alignment due to technical constraints like the radius of curvature, gradients, soil characteristics, river crossing etc. It may always not be possible to avoid agricultural land, forest land or tribal land. However, as construction of railway lines requires only small strips of land, the hardship and physical dislocation to the land-losers can be minimised. Wherever possible, a detour could be taken or alignment changed and taken through tunnels. At some places, retaining

As construction of railway lines requires only small strips of land, the hardships and physical dislocation of the land losers can be minimised. Wherever possible, a detour could be taken or alignment changed and taken through tunnels.

walls and breast walls can also minimise the land requirements. This would also help the environment as higher earthwork fillings and deeper cuttings not only use more land, but also disturb the environment through increased earthwork by borrowing or dumping.

Acquisition of the minimum land required for railway projects would be inevitable. In order to speed up the process, Ministry of Railways had enacted Railway (Amendment) Act, 2008 through an Act of Parliament. This Act provides for speedy acquisition of land for 'special railway projects' by nominating a 'Competent Authority' by Railways without resorting to Land Acquisition Act under which acquisition is done through land acquisition officers of State Governments. Provisions of NRRP 2007 for rehabilitation and resettlement of affected persons in a fair and equitable manner have been embodied in the new Act. However, for speedier implementation of infrastructure projects, the land acquisition process has to be based on fair compensation and consent of land-losers to the maximum extent. This, however, lies in the realm of amendment to the Land Acquisition Act for the country as a whole.

RECOMMENDATIONS

Infrastructure Corridors: Several countries have followed the concept of infrastructure corridors to optimise use of land and avoid haphazard development along these corridors. In our country also, no development is permitted within 67 metres on either side of the national highways or 30 metres of the railway alignment. Similar restrictions exist for high-tension lines and petroleum pipelines also. It is suggested that suitable directives be established whereby whenever a new transport infrastructure - rail or highway - is built, the corridor must provide for segments of the infrastructure, i.e., if a new port comes up, the rail connectivity must be in a corridor that also provides for highway, power lines, combined terminals, etc.

Schedule of Dimension (SOD) and Maximum Moving Dimension (MMD) improvement: Appropriate investments in track structure and SOD/MMD improvement (by systematically identifying constraining structures and standards and improving them) can potentially enhance the carrying capacity of existing lines and obviate the need for multiple lines and thereby conserve and economise the use of land. Adequate research and cost benefit analysis need to be carried out on these aspects.

Redesign and redevelopment of suburban stations: Suburban stations provide an excellent opportunity for management of the precious land resources of Railways in urban areas. A standard template can be developed for redesign and redevelopment of the stations that maximises the comfort for commuters and create space for premium retail in station premises.

It must be ensured that the resources mobilised through commercial exploitation of land should not be utilised for non-remunerative/uneconomical social projects. These resources may be parked in a special fund to be utilised for modernisation initiatives of IR (e.g. modernisation fund as proposed by the Expert Group for Modernisation of Indian Railways, headed by Dr. Sam Pitroda).

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Indian Railways is one of the country's earliest pioneers in leveraging the power of information technology. Passenger Reservation System (PRS) is a highly successful example of use of information technology. Over the years, information technology also has been used for other passenger and customer related services such as Unreserved Ticketing System (UTS) and Freight Operations and Information System (FOIS).

However, system-wide use of IT has remained partial and incomplete. There is a sizeable amount of work needed to enable IT based solutions across business units. The development of compatible interfaces with the regional railway networks and major transport generating entities like ports, mines, etc., and the issues of uniformity of data formats, development of ICT standards and protocols also need attention. Use of information technology (IT) can play an increasingly important role in managing IR's huge network, infrastructure and assets. It will not only help improve efficiency and customer services, thereby contribute towards the goal of enhancing rail's share in the total transport, but also can play a transformative role in railways.

In order to reap the benefits of a single uniform IT solution that runs across Indian Railways, we must look at structural/organisational needs along with business processes and the currently available technology to create a holistic system. Currently, the Computer and Information Systems (C&IS) Directorate in the Railway Board plays the role of a CIO within the Railways. The Directorate is supported by a specialised institution called Centre for Railway Information Systems (CRIS) which is responsible for developing, implementing and maintain-

ing ICT applications under a dynamic operational environment. At the zonal railway level, there is an exclusive organisational arrangment for implementing and maintaining ICT applications in operational and commercial areas. There is a need to strengthen the C&I S Directorate at the Railway Board to prepare an enterprise-wide Master Plan for ICT application.

There is also room for improving the way the IT projects are conceived, prioritised and executed. Most of the IT projects are driven by the respective departments. Different IT solutions developed by different departments or divisions function as islands of information and do not interact with each other because there is no common platform or set of standards for information exchange. This is, therefore, a fragmented process without a single, strategic, and overarching roadmap driven by business objectives. Ideally, IR's business strategy should be the starting-point for identifying the focus areas to be IT-enabled. This approach would ensure that there is built-in synchronisation and cohesions among different respective project teams which function with a clearly defined purpose. Enterprise-wide integration will provide additional benefits because there will be greater uniformity in data formats which will permit greater interoperability and facilitate seamless exchange of information.

RECOMMENDATIONS

Given that there will be large benefits from introducing ICT solutions, we recommend that there be intensive implementation of ICT as soon as possible. A summary of the major recommendations for enablement of ICT in Indian Railways is provided below. These recommendations have been discussed in detail in Chapter 10 (Potential of Information and Communication Technology to Enhance Transport Effciency).

a. Institutional and Capacity Building

- Computer and Information Systems (C&IS) directorate at the Railway Board be greatly enhanced as to encompass the entire gamut of ICT applications on the network;
- Centre for Railway Information Systems (CRIS) be converted from a society to a non-profit company with much greater freedom;
- Organisation(s) for operationalising ICT applications at field level be converted into autonomous bodies;
- IR Institute of Transport Management (IRITM) be entrusted with the task of human resource development

b. ICT solutions/interventions:

- ICT solutions/interventions should be developed for Demand Forecasting, Scheduling, Procurement and Contract Handling, and Office Automation.
- A comprehensive HR management system should be developed to better manage HR processes and costs as well as to allow proper tracking of skills and to gain improved efficiencies by assigning the right people to the right jobs. Such a system should also maintain an updated record of leave and entitlements, making HR management efficient and effective.

Ideally, IR's business strategy should be the starting point for identifying the focus areas to be IT-enabled to ensure synchronisation and cohesion among project teams.

c. Long Range Decision Support System (LRDSS) Project:

- LRDSS has become obsolete and the new version has not yet been developed. CRIS has the capability to develop the required software, dovetailing the same with the operational data available with them. This tool can then be gainfully used both for long range decision making as also for operational decision support on a day-to-day basis. As such, the LRDSS project should be housed with CRIS.

d. A Comprehensive IT security framework should be developed.

INTERNATIONAL RAIL LINKAGE

Integrated transport systems at the regional level are considered crucial to facilitate regional integration and sustain the pace of economic growth in the region. Rail connectivity with neighbouring countries will foster increased economic cooperation among them and will yield not only economic but also social, political and diplomatic dividends.

In the Indian context, rail connectivity to the neighbouring countries in the SAARC region and Myanmar is important both from the economic and strategic standpoints. India is the largest member of the SAARC with 51 per cent of the surface area and 71 per cent of population. It accounts for an even bigger share of the rail network. Of the eight SAARC countries, Maldives and Afghanistan have not been considered for direct rail connectivity with India at this stage due to geographical and political reasons.

Present state of rail connectivity with neighbours: Table 1.14 summarises the current country-wise status for SAARC and Myanmar (refer Annex 1.5 for details). Historically, the rail network of the region prior to independence and partition constituted an organic system. However, in the post-inde-

Table 1.14
Summary of Present Status of Rail Connectivity

COUNTRY	STATUS OF RAIL CONNECTIVITY
Bangladesh	• At present, railway systems of India and Bangladesh are linked to each other at **five points**. • Three BG links are currently open for freight trains. The other two links, though in existence, lie dormant at present. • A bi-weekly passenger train also runs between Kolkata and Dhaka.
Pakistan	• Two BG links (Attari-Wagha and Munabao-Khokhrapar) are operational. • Attari- Wagha route is used to run both freight and passenger services. • A weekly passenger service runs through Munabao- Khokhrapar.
Nepal	• In 2004, an ICD which also serves as a rail terminal for bulk traffic was operationalised at Birgunj and connected to Raxaul on the IR network through a new 6-km long BG line. It deals with both inbound and outbound bilateral traffic from and to India and third country traffic through Kolkata and Haldia ports. • Survey for five other rail connections between the two countries has been conducted. Ministry of External Affairs has decided to fund two of these (Jaynagar- Bardibas and the Biratnagar –Jogbani lines). • These have been sanctioned and taken up by IR for execution.
Bhutan	• Bhutan does not have a railhead and is dependent on the stations on New Jalpaiguri-Guwahati BG line for its rail transportation. • GoI has commissioned studies for five connections to Bhutan. Of the five, Hasimara-Phuentsoling line which will connect Bhutan to the India Railways BG network has been proposed for construction.
Myanmar	• Myanmar constitutes the crucial missing link or land-bridge between India and South-East Asia. • Rail linkages envisaged in the Trans Asian Railway project includes connections to Moreh in Myanmar from Jiribam in Manipur via Imphal. • At present, work is progressing on the construction of a new line between Jiribam and Imphal.
Sri Lanka	• India and Sri Lanka are separated by sea and there is no physical connection between the two railway systems.

Source: Report of the Working Group on Railways (NTDPC).

pendence and post-partition period, rail systems of South Asia have developed in the national context with little consideration for cross-border connectivity and interoperability or compatibility/uniformity of standards in infrastructure and equipment.

Regional and multilateral initiatives for cross border rail connectivity: Present state of rail connectivity with neighbours: Both SAARC and United Nations Economic and Social Commission for Asia and Pacific (UNESCAP) have attempted to draw a roadmap for regional and international rail connectivity in the context of SAARC and Asian region respectively. These are summarised in Annex 1.6.

Trans-continental rail connectivity as a strategic tool is being deployed to great effect by China. It has already developed transport links to the Korean peninsula, South-east Asia, Myanmar, Pakistan and Afghanistan. It is developing extensive multi-modal connectivity in India's neighborhood which is perceived in strategic circles as an act of encirclement. It has established a presence in Pakistan with a new port at Gwadar and strategic linkages through Pakistan, Iran and Central Asia. China's initiatives in expanding its rail connectivity beyond its own geographical borders have been discussed in detail in Annex 1.7 because of its overarching strategic as well as political significance for our country. In order to secure our strategic interests in the region, looking at rail linkages beyond the country's borders is not merely an option but a compulsion. Our long-term transport policy, therefore, has to take note of and provide for solutions to the challenges posed by the Chinese initiatives in the region.

RECOMMENDATIONS

a) It is recommended that Indian Railways should give top-most priority to the projects to be taken up with Nepal and Bangladesh (Table 1.15). Annex 1.8 provides the details of the railway projects that need to be taken up with other neighboring countries. Further, India should take lead in opearationalising the southern corridor of the Trans Asian Railway (TAR) project:
   - Connection from Jiribam in Manipur to Tamu in Myanmar via Imphal and Moreh should be expedited.
   - The existing 201-km MG line from Lumding in Assam to Jiribam needs to be converted to Board Gauge at the earliest (this is a sanctioned work at a cost of Rs 41 billion; work on formation, etc. is in progress and the work is likely to be completed in 2015).
   - The line from Imphal to Jiribam (97.9 km) sanctioned at a cost of Rs 25 billion needs to be completed in a fixed time schedule. Jiribam and Moreh need to be linked to Imphal.
   - Connection from Imphal to Tamu (85 km) also needs to be taken up.
   - Mahishasan (India)-Shahbazpur (Bangladesh) rail link needs to be rehabilitated and restored.

Table 1.15
Rail Connectivity Projects to be Taken Up with Nepal and Bangladesh

COUNTRY	STATUS OF RAIL CONNECTIVITY
Bangladesh	• The old links between the two countries need to be restored for the sake of the development of India's north-eastern states as well as for the sake of better relations with our most populous neighbour. These would include: Haldibari (India) - Chilahati (Bangladesh), Gitaldaha (India)-Mughalhat (Bangladesh), Agartala (India)-Akhaura (Bangladesh) and Shahbazpur (Bangladesh)-Mahishasan (India). • Radhikapur (India) - Birol (Bangladesh) line needs to be reopened to facilitate transit trade between Bangladesh and Nepal through India. • Haldibari-Chilahati link needs to be restored for trade between Bangladesh and Bhutan through the Indian Territory. • Agartala (India)-Akhoura (Bangladesh) connection needs to be re-established to provide the much-needed direct rail link to states like Tripura, Mizoram and Manipur to Chittagong port.
Nepal	• Jaynagar–Bardibas (69.10 km) and Jogbani–Biratnagar (18.6 km) lines costing Rs 4.7 billion and Rs 2.1 billion respectively and being entirely funded by the government of India should be expedited. • Nepalganj Road-Nepalganj (12.11 km), Nautanwa-Bhairahwaha (15.30 km) and New Jalpaiguri-Kakrabitta (46.30 km), which have also been surveyed, should be taken up by the Government of India. • Rail connectivity with Nepal assumes special importance in view of the China factor discussed earlier. China is planning a rail line between Lhasa and Kathmandu. Strategically, it would be in India's interest to construct the Birganj-Kathmandu line (160 km). The cost of this line as estimated by Pipavav Rail Corporation Ltd. (PRCL) is Rs 12.85 billion (2006). This project admittedly will not be financially viable but it will be in India's strategic interest to undertake the project at its cost if it has to preserve its preeminence in Nepal.

Source: Report of the Working Group on Railways (NTDPC).

b) Improvements in rail connectivity with neighbouring countries required on diplomatic and political considerations should be fully funded by the exchequer.

c) Customs and border-crossing: Facilitation Aspects
   - In order to reap full benefits of the rail connectivity across countries, in addition to integration of physical infrastructure such as roads, railway lines, and agreed routes, etc., a mutually agreed regulatory framework for harmonisation of documentation and customs procedures and the harmonised use of electronic data interchange (EDI) is also required. Electronic data exchange under a synchronised system needs to be evolved to enable expeditious clearance at the border.
   - Inter-country connectivity for trade, transit and trans-shipment should be able to seamlessly use more than one means of transportation: air, water (sea and/or river), rail or road. Simplified procedures like through-bill-of-lading or combined-transport-bill-of-lading can be introduced to facilitate this.
   - Inter-change of rail traffic between India Pakistan, Bangladesh, and Nepal is governed under the bilateral agreements. Bilateral agreements need to be reviewed for operationalising all such intra-regional corridors that would carry third country traffic and transit across another country on its rail network. The current bilateral agreements have to be revised to a trilateral or multilateral agreement for such through intra-regional rail movements.
   - Measures like visa-free travel between countries, single-point customs and immigration checks, etc. are also required to usher in a regime that will facilitate seamless transportation across countries.

ENERGY CONSERVATION

Energy constitutes roughly 24 per cent of the working expenses of Indian Railways. IR accounts for close to 2.3 per cent of the country's total electricity consumption (for example, IR utilised more than 16 billion kilowatt-hour (kWhr) electricity in 2010-11 out of the total estimated electricity consumption of 694 billion kWhr[23]). Therefore, it is imperative that IR follows a proactive energy management and energy efficiency policy to reduce its energy consumption in both the traction and non-traction systems.

IR's energy consumption has been increasing over the years. During the period 2004-09, electricity consumption for traction and non-traction has increased by 21 per cent and 14 per cent respectively. In the same period, total GTKMs hauled by electric locomotives increased by 29 per cent. Increase in electricity consumption can be attributed to increase in traffic and general services electrical loads. Similarly, diesel consumption for traction and non-traction purposes has increased by 11 per cent and 35 per cent respectively during the same period, while the total GTKMs hauled by diesel locomotives increased by 16 per cent. The high growth rate of diesel consump-

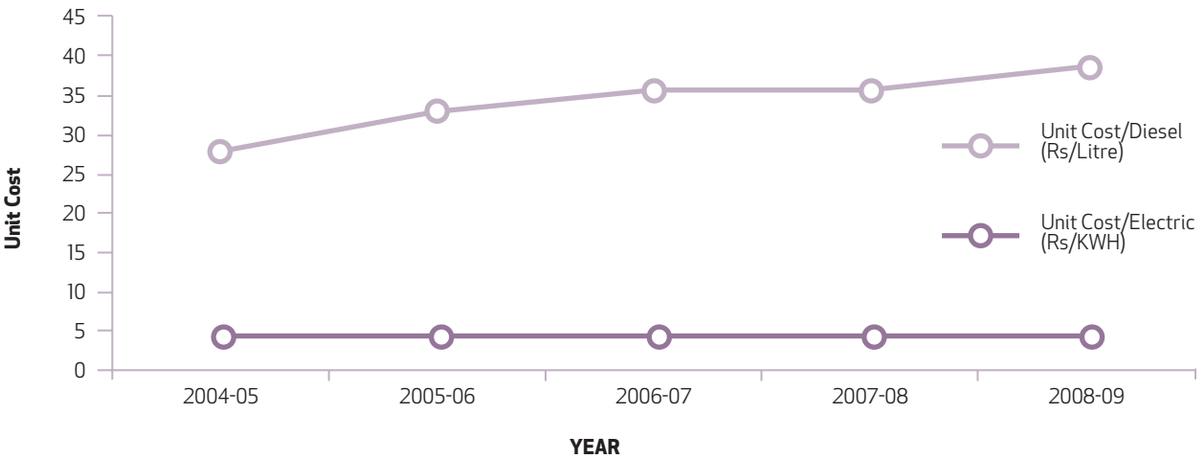
23. Ministry of Statistics and Programme Implementation (2012).

Table 1.16
Quantity of Fuel/Energy Consumed (2010-11)

	FOR TRACTION	FOR OTHER THAN TRACTION PURPOSES (INCLUDING MANUFACTURING UNITS)
Electricity (Million kWhr)	13,621	2,484
HSD Oil (Million litres)	2,523	44
Coal (Million tonnes)	0.001	0.001

Source: Indian Railways Year Book (2010-11), Ministry of Railways.

Figure 1.28
Comparison of Unit Cost for Electricity and Diesel (2004-05 to 2008-09)



Source: Ministry of Railways.

tion for non-traction purposes indicates the scope for substituting diesel generators with renewable energy sources.

Table 1.16 shows the quantity of fuel and energy consumed by IR for traction and non-traction purposes for the year 2010-11. The electricity consumption for traction and non-traction stood at 13.6 billion kWhr and 2.5 billion kWhr respectively at a total estimated cost of Rs 65 billion. The diesel oil consumption for traction and non-traction purposes was 2,523 and 44 million litres respectively.

Figure 1.28 shows the growth in unit cost of electric energy and diesel oil during the period 2004-09. While electricity prices have remained stable, the diesel prices have risen steeply. The unit cost of diesel has increased by 44 per cent and the total diesel oil bill by 61 per cent during the period. Electricity tariff, on the other hand, has remained fairly stable and increased by only 4.4 per cent during the period 2004-09. The steep rise in unit cost of diesel is expected to continue in future.

ANALYSIS OF ENERGY CONSUMPTION STATISTICS FOR TRACTION

On the IR, electric traction accounts for a larger share of freight traffic while for passenger traffic the share of diesel traction is slightly higher than electric traction. During the period 2004-09, electric locomotives hauled approximately 63 per cent of the total freight traffic and 46 per cent of the passenger traffic. During the same period, passenger and freight GTKMs carried by electric locomotives increased by 27 per cent and 29 per cent respectively, while the passenger and freight GTKMs carried by diesel locomotives increased by 17 per cent and 15 per cent respectively. The larger share of traffic movement by electric traction is on account of addition of electrified routes and a higher traffic growth rate on the existing electrified sections, which are mostly the dense traffic routes of IR. As of March 2011, more than 30 per cent of total route km and 41 per cent of total running track km, have been electrified[24]. Diesel traction covers routes with relatively lighter density of traffic.

24. Ministry of Railways (2010–11).

Table 1.17
Average Energy Consumption (in Kilowatt-hour) per 1,000 GTKM

TYPE OF TRAFFIC	2004-05	2005-06	2006-07	2007-08	2008-09
Passenger	19.2	18.6	19.2	18.9	19.4
Freight	8.5	8.2	7.9	7.7	7.3
Suburban	37.4	37.7	37.9	38.1	36.9
Kolkata Metro	74.1	75.3	74.0	73.5	73.5

Source: ASS (2004-09); Indian Railways Year Book (2004-09)

Table 1.18
Average Diesel Fuel Consumed (in Litres) per 1,000 GTKM

TYPE OF TRAFFIC	2004-05	2005-06	2006-07	2007-08	2008-09
Passenger	4.5	4.3	4.2	4.0	4.0
Freight	2.6	2.6	2.6	2.5	2.4
Suburban	5.4	5.4	5.3	4.9	5.0

Source: Indian Railways Year Book (2004-09).

TRENDS IN TRACTION ENERGY EFFICIENCY

Energy efficiency of electric and diesel traction has been summarised in Tables 1.17 and 1.18. Energy efficiency in traction is expressed as: (a) electric energy consumed per 1,000 GTKM for electric traction, i.e., specific energy consumption (SEC); and (b) quantity of diesel consumed per 1,000 GTKM for diesel traction, i.e. specific fuel consumption (SFC). The noteworthy trends are a 14 per cent cumulative SEC reduction in freight and 11 per cent cumulative SFC reduction in passenger operations during 2004-09. Table 1.16 shows the need for upgrading the coaches of the Kolkata Metro to the technology level obtained elsewhere.

Figure 1.29 shows a comparison of cost of electric energy with fuel cost (per 1,000 freight GTKM), by integrating the energy/fuel tariff data and the SEC/SFC data.

STEPS UNDERTAKEN FOR ENERGY CONSERVATION

IR has constantly endeavoured to improve the energy and environment aspects of rail transport and has undertaken various energy conservation measures over the years which have helped bring down its carbon footprint. Some of the energy saving measures implemented by IR are detailed below:

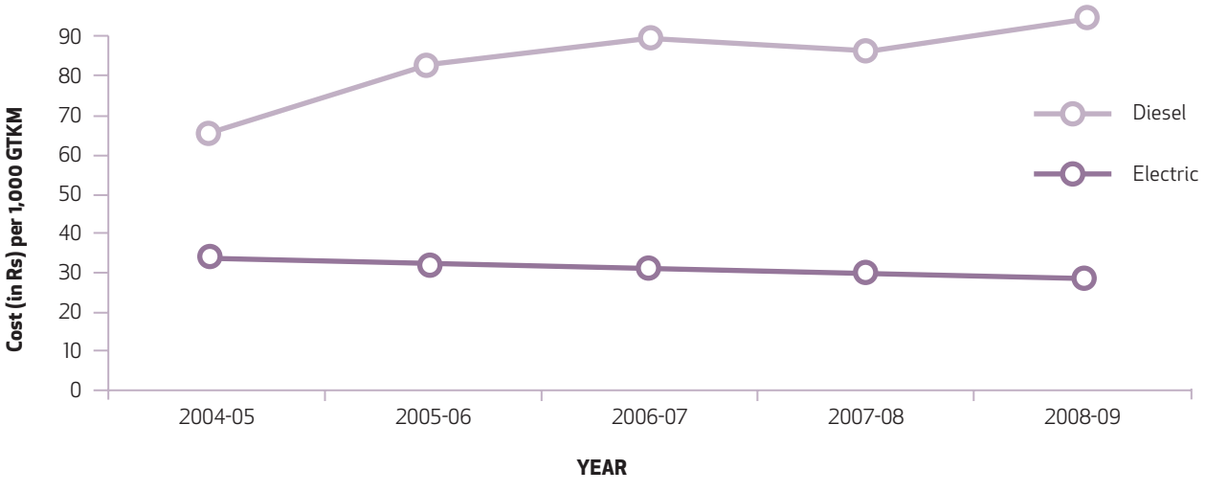
a. Energy saving measures in traction

- **Energy efficient EMUs:** The new three-phase EMUs provided on Mumbai suburban sections are capable of regenerative braking and have an aerodynamic profile. **Regenerative braking has enabled energy savings in the range of 35-40 per cent.** The project is expected to result in annual reduction of approximately 100,000 tonnes of CO_2 emissions and has been developed in association with World Bank for registration under Clean Development Mechanism (CDM) to claim carbon credits.

- **Energy efficient electric locos:** The production of three-phase electric locomotives is being stepped up progressively and all electric locomotives to be manufactured from 2012-13 onwards will be three-phase. These locomotives operate at near unity power factor and are capable of regenerative braking which enables an energy saving of 15 per cent in freight and 20 per cent in passenger operations. Besides, WAP7 locos are being provided with 2 x 500 KVA hotel load converter to take care of train power supply. This system, referred to as Head On Generation (HOG), offers 92 per cent efficiency and is superior to the 60 per cent efficiency in self-generation and 81 per cent in end-on-generation. The HOG system will eliminate the need for power cars and their replacement by passenger carrying coaches. Further, several improvements have been implemented on conventional electric locomotives for achieving reliability as well as energy conservation.

- **Adoption of 2x25kV system for heavy traffic density routes:** 2x25kV system was implemented on the South Eastern and West Cen-

Figure 1.29
Energy/ Fuel Cost per 1,000 GTKM for Freight Services



Source: Ministry of Railways.

tral Railway as a pilot project. This technology has now been accepted as the only option for hauling heavier trailing loads at higher speeds. It offers several advantages, such as increased Traction Sub Station spacing and reduced EMI. The cost of rail transportation is reduced due to the economy afforded by the system in railway electrification. The reduction in number of TSSs also results in lowering of cumulative maximum demand charges.

- **Fuel efficient diesel locos:** In order to reduce the consumption of fuel in diesel traction several new projects have been taken up, e.g. distributed power system to eliminate the need for reversal; HOG; CNG powered DEMUs; and use of B10 blend of bio-diesel on diesel locos. IR has also taken a number of direct measures to reduce the SFC. Through continuous design improvements, SFC of locomotives has been brought down from the initial value of 3.3 to 2.5, i.e., a reduction of 25 per cent (it is expected to be brought down to 2.25 by 2015). Further, new features such as intelligent low idle, automatic engine start-stop (AESS) and auxiliary power unit (APU) are being tried out. Besides, the production of fuel-efficient EMD locomotives has been stepped up with plans for a complete switchover to this class of locomotive in the near future.

- **Energy efficient wagons and coaches:** IR has improved the payload-to-tare weight ratio of wagons by using lighter weight materials such as stainless steel and aluminum. Lightweight stainless steel coaches with enhanced passenger carrying capacity have been inducted. Further, the use of the maximum moving dimensions is being studied to permit the introduction of larger-sized wagons and coaches. This involves a study of the kinematic profile and adoption of best available know-how so that maximum usable dimensions in terms of double-decker coaches or optimally designed wagons can be pressed into service, with minimum investment on infrastructure.

- **Energy-efficient practices in operations and maintenance:** Introduction of improved operation and maintenance policies/practices has helped to conserve energy and fuel. Some of the notable steps in this regard include: increased interval of schedule inspections of locos; centralised monitoring of light engine working; enforcement of instructions that locos which are idling or are expected to idle for more than 30 minutes to be shut down; near elimination of movement of dead electric locomotives; loco pilots being provided with detailed guidance on energy/fuel efficient driving as the potential for energy saving in this area is 5-8 per cent; reduction of empty wagon movements; extension of the maintenance interval of freight stock; movement of double stack containers on the western corridor; and popular passenger services with high demand augmented to 24 coaches after upgrading the requisite facilities at platforms and terminals en-route. In addition, there are plans to make feeder routes of DFCs and other identified routes on the network fit for 25-tonne axle load. This would improve the load per train from the existing level of less than 5,000 tonnes to 6,000 tonnes in future.

b. Energy saving measures in non-traction

- **Introduction of energy efficient luminaires such as CFL, T-5, etc.:** IR is about to complete a project which will achieve an annual reduction of 0.14 million tonnes of CO_2 emissions through the free distribution of 26 million CFLs to railway employees (four

CFLs per family), in replacement of energy inefficient incandescent lamps. The project is entirely financed with the carbon credits earned under the CDM framework. Besides, railways are installing T-5 lamps and LED luminaires to save energy.

- **Use of renewable energy in electrical general services:** As per the Vision 2020 document, 10 per cent of IR's energy needs are to be sourced from renewable energy sources. IR is in various stages of implementing projects that aim to harness solar energy. It has also successfully commissioned a 10.5 MW wind power plant at ICF and more are under consideration.

RECOMMENDATIONS

Set up a Special Directorate: It is recommended that IR sets up a separate directorate to deal with all aspects of energy consumption and management. The directorate will be multi-disciplinary and will coordinate with other directorates, apart from monitoring implementation of works/projects that result in reduction in energy consumption or enhancement of efficiency. A concomitant need is for an institutional arrangement to provide adequate funding in the annual budgets by a policy directive - to implement approved projects/works that reduce energy consumption and bring in efficiencies, some of which have been discussed above.

Update system of monitoring and reporting energy consumption: IR should update the present system of monitoring and reporting energy consumption. It is important to note that SEC/SFC data is not maintained on the basis of type of rolling stock, passenger service or class of locomotive. The Annual Statistical Statements (ASS), Annual Report & Accounts (ARA), and the Year Book (YB) provide consumption of electricity and diesel figures in absolute terms and in terms of 1,000 GTKM. This is not a very satisfactory situation.

All electric locomotives/EMUs are now fitted with energy meters, but the consumption data is not yet used for calculation of SEC. It is possible to transmit electric consumption data from the electric locomotives/EMUs to a central server which can then accurately compute the SEC for each passenger/freight train operated and/or for any class of locomotive or service at desired periodicity. It is noted from literature that German Railways has already implemented such a system and Norwegian Railways (NSB) is in the process of implementing a similar system. NSB expects that the web-based energy management system will enable 6 per cent energy savings. IR should also, on a priority basis set up a nation-wide Internet-based Electric Energy Management System. This will make key electric energy data of IR available on real-time basis and enable approximately 6 per cent energy savings, i.e., nearly Rs 4 billion per annum. Computerisation of diesel sheds can similarly help considerably in the processing, retrieval and monitoring of SFC data (service wise).

Electrification as a means to reduce fuel consumption: Railway electrification should be taken up on a priority basis. Bottlenecks in progress of electrification projects should be tackled systematically. Electrification should be viewed as a means of making rail transport independent of imported fossil energy, while also providing a choice in sourcing energy. Moreover, electric traction allows regeneration of power while braking/coasting and feeding the network, thereby reducing overall consumption of energy and carbon emissions. This is not possible with diesel traction.

Setting up of captive power plants: As mentioned earlier, cost of diesel fuel for transportation is much higher than the corresponding energy cost incurred in electric traction. IR incurs more expenditure on diesel than on electric energy. For 2008-09, the ratio of expenditure on diesel vs. electricity was 55:45. With progressive electrification and increasing traffic on the existing electrified sections, the requirement of electric energy will continue to increase. At present, IR is primarily dependent on SEBs, though at some locations energy is being purchased directly from National Thermal Power Corporation (NTPC).

For availing electric power at lower tariff, IR has set up a 1,000 MW power plant at Nabi Nagar through a JV with NTPC. This plant will supply 90 per cent of generated power to 164 substations of IR located in Eastern and Western regions and will result in a saving of Rs 4-6 billion per year to the Railways due to lower tariff. Another 1,000 MW captive power plant is being set up at Adra through a JV with NTPC (12th Five Year Plan, Volume II, Planning Commission).

In view of the increasing energy requirement for traction, IR will need to set up more such power plants at strategic locations and wheel the power to its distributed network with the help of Power Grid Corporation as a long-term policy.

Greater use of renewable energy sources: As per Vision 2020 document of IR, 10 per cent energy needs are to be met from renewable sources of energy. It is important that IR monitors the consumption of diesel for non-traction purposes, given its upward trend. IR must encourage greater use of renewable energy sources, particularly for production units

Box 1.26
New Generation Locomotives

Ministry of Railways (MoR) is planning to set up a factory with a foreign partner selected through international competitive bidding for supply of 12000 HP Electric Locomotives. This will be a major jump over the current 6000 HP locomotives. During the ten-year period of supply programme, the proposed factory at Madhepura will supply 800 electric locomotives with performance guarantees based on international best practices. **This locomotive will have very high energy efficiency and will constitute a part of India's response towards mitigation of the emission of green-house gases.** Successful execution of this project by the JV route will usher Indian Railways into a new era of reforms and will provide impetus to PPP funding of railway projects.

MoR is also procuring 200 number, 9000 HP electric locomotives under the JICA loan for Western DFC. These locomotives would be mainly used for container train operations on the Western DFC.

A factory is also planned at Marowhra for manufacture of diesel locomotives with a capacity of 5000 HP as against current usage of 4000–4500 HP by the Indian Railways. The Madhepura and Marowhra factories are likely to be awarded during 2012-13.

Source: Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

and workshops, which are at one location and not spread out and thus well-suited for this changeover. These units must annually report energy consumption per unit of production/performance, as is the case for companies. Further, the government may consider grant of special financial incentives to IR for adopting renewable energy in large measure. It may also initiate a policy for supporting the introduction of CO_2 free passenger and freight transportation in a phased manner.

New generation locomotives: IR must switch to new generation locomotives/EMUs/coaches within an agreed time frame and assured funding. In this regard, the replacement of Kolkata Metro coaches merits attention due to high energy consumption in metro operation and the planned expansion of the network. Development of energy efficient wagons and their introduction should be a priority area. Box 1.26 provides an overview of some of the initiatives planned by Ministry of Railways to introduce higher horsepower and more fuel efficient locomotives.

Linking tariff to the actual energy consumed in transportation: A wagon's payload- to-tare ratio is an important factor in energy consumption. Additionally, the shape of the wagon is also important as it determines the air resistance (this aspect is equally applicable for EMUs and coaches). The results of a simulation to evaluate the energy consumption with different types of wagons show that hauling of BTPN is more energy intensive as compared to BOXN. And yet, IR levies a higher tariff on coal, than on POL. Therefore, it is important that IR links tariffs to the actual energy consumed in transportation of a commodity. The same principle applies for passenger fares. It must be stated here that rationalising the tariffs for coal and POL would remove the distortion inherent in pricing of electric energy. This would bring down the cost of electric energy to its true level, thereby significantly benefiting IR and other intensive users of electricity.

Diesel traction in electrified sections: After implementation of the Railway Safety Committee's recommendation that in an electrified section, 20 per cent of the total holding of locomotives should be diesel, it is now quite normal to see diesel locomotives hauling trains under OHE. The cases of diesel under wire have further increased in order to avoid traction change and the detention involved in traction change. Since diesel operation under OHE results in higher energy costs, it is worthwhile to review this order and modify/fine tune the instructions, taking into account the experience gained.

Government of India should set up a department in a selected institution to take up strategic studies on environmental, energy and energy security issues related to railway and other modes of transportation.

IR representatives should be included in national energy policy committees.

INTERNATIONAL EXPERIENCE IN RAILWAY REFORM: LESSONS FOR INDIAN RAILWAYS

The reform measures undertaken in major railway systems such as Japan National Railways, Russian Railways, Chinese Railways, British Railways and German Railways have been reviewed to draw lessons for Indian Railways. Though the factors and circumstances leading to reforms in different railway systems vary, however, key drivers for reforms may be summarised as follows:

- Financial crisis and over-indebtedness brought about by rapid expansion of network, operation of non-remunerative lines, and inflexible organisational structure exacerbated by powerful trade unions and erosion of market share;
- Need for rapid expansion and improvement of operational performance;
- Control of public subsidy;
- Need to usher in competition and attract private investment; and
- Ideological inclination of the government.

The railway reforms carried out in Japan, Germany, Russia, China and Britain have been summarised at Annex 1.9.

Key elements of reforms: Broadly, the reforms comprised one or more of the following elements:

a. Separation of public policy and rail provider roles
b. Separation of infrastructure and operation: including institutional and regulatory reforms covering rationalisation of tariff determination, investment decisions, freedom of operating companies and establishment of independent regulators.
c. Labour reforms

Separation of public policy and rail provider roles: Most of the countries reviewed, have implemented the principle that public policy roles should be separate from the role of service provider (for both rail freight and passenger transport). For example, in Germany, Japan and Russia, Ministries of Transport determine national public interest policies in passenger rail transport, supplemented in all three countries by significant roles for the relevant local government transport administrations for specific suburban/regional systems. China has also recently (March 2013) decided to restructure its railway sector by dissolving the Ministry of Railways and separating railway policy and regulation from commercial operations (Box 1.27). Most of the countries have also separated the public policy roles of the Ministry in transport integration and sub-sectoral policy making from either the economic regulation and/or safety regulation roles (Box 1.28).

In view of the increasing energy requirements for traction, IR will need to set up more power plants at strategic locations and wheel the power to its network with the help of Power Grid Corporation as a long-term policy.

SEPARATION OF INFRASTRUCTURE AND OPERATION

The degree of separation between infrastructure and operation has varied across railway systems where reforms have been carried out. Traditionally, railway systems have been **vertically integrated** (single entity controls both infrastructure and services and performs policy and regulatory roles). The objective of reform has been to bring about either **a vertical separation** (ownership of facilities being separate from entities controlling operations: accounting separation or through organisational unbundling) or a system to allow **competitive access** (a single entity may control infrastructure and operation but the usage of infrastructure by other operators is allowed on payment of transparently determined access charges). Some examples of the countries following the three systems are shown below (Figure 1.30).

Once the railway systems moved away from vertical integration to either vertical separation or competitive access, the focus of further reforms has been to reorganise infrastructure and operation. The re-organisation is generally based on the following principles:

- Core and non-core business,
- Geographical separation,
- Line of business separation (freight, urban, long distance, etc),
- Functional separation (creation of profit centres and use of transfer pricing), and
- Traffic density (light density vs. high density to identify to commercial services and social service obligations

Administrative separation (separate administrative set-up) under an umbrella organisation allows individual accounting, evaluation of units as separate profit or cost centres and charging for usage of assets by another unit on the principle of transfer pricing. Functional division also allows for bidding out of some of the core activities like maintenance of tracks and locomotives on a competitive basis. Alternatively, the reorganisation may take the form of separate geographical organisations (e.g. Japan) or unbundling the current organisation and privatisation of several activities (e.g. U.K.). As summarised in Annex 1.9, extreme unbundling also led to coordination failure and cost of managing the same increased drastically.

Box 1.27
Reform of Railway Sector in China

China has been restructuring and reforming various sectors of the economy for several years now. The objective was to enable them to respond effectively to market economy and rapid economic growth and function effectively in the best national interest. These initiatives included reform of several Ministries of the Government in Beijing.

In March 2013, China decided to restructure its railway sector by dissolving the Ministry of Railways (MoR) and separating railway policy and regulation from commercial operations. As a result, MoR's railway planning and policy making functions have been assigned to the Ministry of Transport (MoT), while its other administrative functions such as establishing and monitoring technical standards, safety standards and service quality have been assigned to a new organisation, the State Railways Administration (SRA). In future, MoT would also establish policy for railways. It would develop a unified policy for all transport modes aiming at modal integration and optimal use of resources. It is expected that only a handful of MoR staff would move to MoT. **The responsibility for the enterprise (commercial operations of railways) has been assigned to the newly formed China Railway Corporation (CRC) that is manned virtually by all the staff and managers of MoR except a few that will move to MoT.**

CRC is fully owned by Ministry of Finance (MoF) and will have its own Board of Directors. **The Minister of Railways has been appointed as the CEO of CRC. The mandate of CRC is to operate the railway on commercial lines. It is understood that in line with this policy, CRC would be compensated financially if it is required to provide services that are financially not viable.** There is no change, for the present, in the organisation structure and the existing railway administrations will continue to function as before. This ensures that there is no disruption in railway services as a result of restructuring of MoR. However, it is suggested that competition will be introduced and the private sector will be encouraged to invest in commercial railways in the future.

Broad objectives of recent changes include:

- Coordinated development of policy, macro level planning and allocation of resources for the transport sector
- Independent supervision of the performance of CRC
- Independent safety regulation of rail sector
- Regulation of technical standards for railways
- Improving efficiency of railway management and operations i.e. CRC
- Create competition in railway sector
- Encourage non-government investment in rail sector

Source: NTDPC.

Box 1.28
Main Responsibility for Public Interest Roles

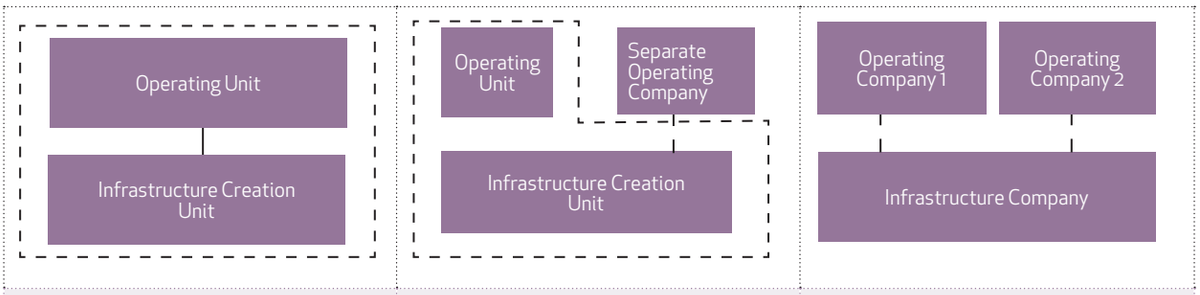
Australia, Brazil, Canada, China, Germany, Japan, Russia and the United States, all have unitary transport ministries at the central government level whose role is to develop and administer policies to protect and promote public interests across the transport sector. This is to establish integrated national transport policies that transcend or augment individual modal interests. China was a partial exception, although it has recently enhanced the role of Ministry of Transport to establish policy for railways along with national highways, ports and waterways, shipping, airports, aviation and transport integration.

(Contd...)

COUNTRIES	MAIN RESPONSIBILITY FOR PUBLIC INTEREST ROLES			
	INTEGRATED TRANSPORT POLICIES	RAILWAY SECTOR STRATEGY/ POLICIES	ECONOMIC REGULATION	SAFETY REGULATION
Australia	Department of Transport		Australian Competition Commission	Departments of Transport or Independent regulators varies by State)
Brazil	Ministry of Transport		National Agency for Land Transport	
Canada	Department of transport		Canadian Transportation Agency	Transportation Safety Board
Germany	Ministry of Transport		Federal Cartel Office	Federal Rail Agency
Japan	Ministry of Transport			Japan Transport Safety Board
Russia	Ministry of Transport		MOT & Ministry of Economic Development and Trade (MEDT)	Ministry of Transport
USA	Department of Transport (DOT)		DOT-Surface Transportation Board	National Transport Safety Board/ DOT-FRA

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 9, Paul Amos, July 2011.

Figure 1.30
Separation of Infrastructure and Operation



VERTICAL INTEGRATION	COMPETITIVE ACCESS	VERTICAL SEPARATION
India, New Zealand, Austria, Belgium, Greece, Ireland, Italy, Luxembourg, Latvia, Lithuania, Hungary, Poland, Switzerland	Japan, Europe (rolling stock), Sweden, Japan, Czech Republic, Finland, France, Slovenia	UK, Sweden, Bulgaria, Denmark, Norway, Netherlands, Portugal, Romania, Spain, Slovakia

Source: Report of the Working Group on Railways (NTDPC).

Once the asset restructuring is completed, the operation of the railway can be governed through haulage agreement, exclusive or multiple access agreements, reciprocal operating agreement, as the case may be. In the case of haulage agreement, track owner may allow any operator to use the track based on fixed haulage charges. American President Line (APL), and CSX Corp are examples for these. In the case of access agreement with one or multiple operators, operator pays for the tonnage it carries e.g. Canadian National (CN) operating over CSX. Annex 1.10 summarises the track access tariff principles and/ or formulae used in three countries (Australia, US and Canada).

LABOUR REFORMS

Labour reform is another important dimension of reforms as railways are traditionally one of the largest employers and therefore, the impact of any structural change on labour needs to be taken into account. For example, in Sweden, high level of unionisation existed among both blue-collar and white-collar employees and management was obliged to share strategic information with the employees and allow employee representation on the company board. Railway reorganisation entailed negotiation with the unions on productivity issues through productivity incentivisation, multi-task assignment, and performance compensation. The restructuring had to work within the existing framework.

Japan grappled with labour issues through reactivation of railway management consultation system. This enabled direct discussion on issues such as work conditions and organisational needs. Japan National Railway (JNR) also had to deal with issues of seniority versus skill-based wages, determination of retirement and social benefits. After restructuring, the labour cost as a percentage of revenue showed a

substantial improvement in Japan and Sweden from 70 per cent and 83 per cent to 33 per cent and 70 per cent respectively.

LESSONS FOR INDIAN RAILWAYS

A review of the reform measures undertaken in major railway systems shows that most of the countries have separated the public policy role from the role of service provider (for both rail freight and passenger transport). The Chinese example is of particular relevance to India, as the railway sector in China until recently was supervised by the Ministry of Railways (MOR), a body which was responsible for strategy, policy and regulatory functions as well as administration of operational entities that delivered the Chinese Railways network and rail transport services (similar to India).

However, as discussed earlier, in March 2013, China also decided to restructure its railway sector by dissolving the Ministry of Railways and separating railway policy and regulation from commercial operations. The big decision to dismantle MOR in China has only started the process of reform of railway sector and it will be fully effective in a few years. The aim is that this major step does not cause any disruption in railway services in the near future and planned expansion of railways materialises. It is expected that several well-considered steps shall be taken over a period of two to three years in order to achieve the long-term benefits of the reform process. Some of the important issues that need to be addressed are discussed in Box 1.29. In the Indian context too, any profound change in the organisational structure may actually distract the railways from the enormous task of building infrastructure and improving services. Some of the key elements of the reform would be accounting reform, reform in investment planning, regulatory structure, reorganisation on business lines, hiving off of activities.

ORGANISATIONAL REFORMS

CURRENT ORGANISATIONAL STRUCTURE AND ISSUES

The highest level of management in the Ministry of Railways, headed by the Hon'ble Minister of Railways and one or two Hon'ble Ministers of State, is the Indian Railway Board. The Railway Board is headed by a Chairman and comprises six other members from specific departmental areas. Indian Railways is divided into 17 zones, each headed by its own General Manager (GM) and assisted by Principal Heads drawn on departmental lines. As a result, the entire organisation gets divided into departmental lines based on different specialisations. This organisational structure of the railways results in over-differentiation and there is a lack of a coherent vision to guide the Indian Railways.

Some of the problems afflicting the IR's organisations at present are:

a. Centralisation of decision making on many operational issues at the level of members of Railway Board - as the roles of policy making, regulation and operations are today combined in the Railway Board. It leaves little time for strategic thinking and interferes with policy-making role of the Board.
b. Duality of role— commercial as well social, without any clear demarcation.
c. Overly differentiated and departmental organisation structure and lack of a coherent vision to guide the organisation.
d. Production-centric approach to business and lack of commercial and customer- orientation.
e. Bureaucratic decision- making processes and procedures.
f. Inadequate empowerment at Zonal Railway level coupled with absence or diffusion of accountability.
g. Short tenure at the top.
h. Politicisation of tariff-setting and investment planning.
i. Poor project management and inadequacies in project delivery system resulting in enormous time and cost overrun.
j. Lack of capacity and policy for attracting private investment.
k. Accounting system inconsistent with business accounting, which does not help as a decision making tool for management.
l. Absence of a system to track trends in technological developments, induct new technology and develop indigenous technology.

NEED FOR REFORMS

This report has emphasised the need to reverse the shift that has been taking place of both freight and passenger transport from the railways to other modes, especially to roads. This is essential to ensure the kind of high growth that is envisaged for the economy as a whole. The kind of investment that is being projected in the Indian Railways over the next 20 years is unprecedented in the history of the railways. For this kind of change to take place, it is essential that the Indian Railways must reinvent itself and expand so that it can play the kind of strategic role envisaged for it to meet the expanding transport requirements of the country. It must rapidly expand its network, augment capacity, modernise and improve services so as to meet the goal of carrying 50 per cent of the freight transport by 2032 and meet the passenger demand in full. By 2032, railways will have to carry close to 6,500 billion tonnes km in freight compared to 626 billion tonnes km in 2011 while it must keep pace with growing passenger demand due to GDP growth.

Box 1.29

Reform of Railway Sector in China: Impact and Issues

Railway sector in China is very large and plays a vital role in supporting its economic performance. The changes that impact railway operations would be implemented over time so that there is no disruption in rail services. Since China's economy shall continue to grow fairly rapidly, it is also imperative that, over the next two decades, railways develop sufficient capacity to service increase in demand for passenger as well as freight railway transport. It also needs to respond to demands for superior services as average incomes increase and more sophisticated commodities are transported.

The important issues that would need to be addressed are discussed below:

- **Debt:** For the present all the debt of MoR (RMB 2.6 trillion-USD 400 billion) has been transferred to CRC. This is likely to increase to about USD 600 billion as all the planned railway projects are implemented over the next few years. It is accepted that investments made in High Speed Railway network are not likely to be profitable for several years. A decision will need to be taken in respect of debt. It is possible that some of it would be transferred to the Central government to enable CRC to operate as a viable financial entity.
- **Planned investments in railways:** It is expected that the recent reform will not slow down the investment programme of railways and CRC would implement all planned projects included in the Medium Term Plan till 2020.
- **Pricing:** A clear policy needs to be articulated in respect of the authority of CRC for pricing of services. It is possible that CRC may not be given total freedom in pricing.
- **Financial Management System for CRC:** CRC will need to develop a financial management system that is aligned to commercial accounting standards. This system should be able to segregate costs by business and service so that informed decisions about pricing and cost control could be taken.
- **Salary structure for CRC staff:** Decision on staff salaries will need to be taken since company salary structure is significantly higher than that for Ministry employees.
- **Criteria for Monitoring Performance of CRC:** Developing criteria for monitoring performance of CRC and defining improvement in productivity of CRC assets and staff and financial performance for the next five years or so.
- **Encouraging PPP:** Long term aim is to encourage investment in railway sector by private sector and non-government entities. Policy initiatives that promote such investment would need to be identified and implemented.

Source: NTDPC.

The technology gap must be bridged and rail speed must be increased to 160-200 kmph along with a zero accident and failure rate. The railways must also change its perception to a more customer-oriented proposition offering best value against competition. The currently existing capacity constraints will require the railways to carry out major capacity augmentation - close to 10,000 km of DFCs, 40,000 km of doubling/quadrupling/multiple lines etc.

It is clear that the task being attempted is stupendous by any measure, especially judged against the pace of capacity augmentation and growth achieved in the past. For example, the doubling/multiple lines being attempted (at the rate of 1,500-2,000 km per annum), is four times as large as the best that has been achieved by railways in the Five Year Plans in the past. Achievement of such targets will not be possible given the current organisation structure and there is need for organisational reforms to address the above lacunae.

RECOMMENDATIONS FOR RAILWAY REFORMS IN PAST STUDIES

A common feature of most railway reforms in countries we have studied is the separation of the policy making apparatus from the operation of the railways themselves. Most countries have now set up their operating railway systems in some kind of corporate form, although in most countries, government ownership of the railway systems remains the norm, except in the United States. Policy making is of course retained in a government Ministry, usually a unified Ministry of Transport, but sometimes a dedicated Ministry of Railways. The organisational structure of Indian Railways is not very different from the kind of structure that existed prior to these reforms in countries such as Russia and China. Unlike Indian Railways, however, these countries have undertaken wide ranging reforms in recent times where they have also separated out policy making functions from operation of their respective railways.

Box 1.30
Recommendations of the Prakash Tandon Committee (1994)

- Restructure the Railway Board with Members responsible for:
  i. Bulk freight, passenger and inter-modal services;
  ii. Infrastructure;
  iii. Moving assets;
  iv. Finance and Planning;
  v. HR, R&D, Quality.
- Railway Board to focus on policy, planning, performance evaluation, major projects and appointments and not day-to-day supervision/sanction/control.
- Similar restructuring at Zonal Railways with six AGMs.
- Minimum tenure of 3 years for Board Members and GMs.
- Unified cadre for railways through cross-disciplinary rotation and selection for general management positions.
- Recruitment of qualified finance professionals.
- Shedding of off-line activities-corporatisation of Production Units.
- Induction of specialists as advisers.
- JV with state governments and private entities.
- Decision support system for investment planning.

Source: Report of the Working Group on Railways (NTDPC).

Thus, the key issue to be addressed in reform of Indian Railways is the institutional separation of roles into policy, regulatory and management functions. Currently, these roles are blurred with the Railway Board essentially performing all the three roles put together. This causes confusion about the underlying vision and mission of the Indian Railways.

If such an institutional separation of roles takes place, it would mean that policy makers are limited to setting policies; regulators to fix competition rules in general and pricing in particular; and the railways operations are done by a corporate or corporate like entity or entities.

Within India, many committees have reviewed the organisational structure of the Indian Railways and have recommended the need to undertake reforms. Key recommendations of some of the Committees are summarised below (Figure 1.31 and Boxes 1.30 to 1.32).

This section provides a review of the recommendations made by these various committees over the last 20 years. While the Prakash Tandon Committee of 1994 and the Expert Group for Modernisation of Indian Railways (2012) suggested organisational reforms while keeping the Railways within a government setup, the Expert Group on Indian Railways 2001 visualised the setting up of an Indian Railways Corporation governed by an Indian Railways Executive Board (IREB). In the proposal of the 2001 Expert Group, the Indian Railways Corporation would thus work under the Government of India like any other corporate body with the government laying down vision, objective and policy directives. This is not very different from the kind of reforms that have been undertaken in other infrastructure sectors. The 2001 Expert Group also suggested the setting up of a Railways Regulatory Authority whose functions would relate to the setting of freight tariffs and passenger fares as also resolution of disputes. These functions would then be delinked from the Ministry by setting up a Railways Regulatory Authority.

The suggested Railways Regulatory Authority would be guided by the vision and policies laid down by the Government, and not the Railway Ministry alone. It would thus deal with issues relating to subsidies and cross subsidies, as broadly laid down by the government, and help reduce the duality of role syndrome commercial as well as social now afflicting the railways. The Regulator's basic duty would be the protection of consumer interests, providing a level playing field and also ensuring fairness in dealings between Indian Railways and PPP participants in projects. Once such a Railways Regulatory Authority is set up, it would become possible to separate out the commercial operations of the Indian Railways from those operations that are done for socio-objectives at the behest of the government. We note that the Government has already approved the setting up of a Rail Tariff Authority, but which is yet to be implemented.

For this to become possible, the implementation of accounting reforms is an essential feature of the overall reforms that is envisaged. As mentioned in Section 5, the accounting system of the Indian Railways is still organised in a governmental accounting framework and does not follow the accounting standards as prescribed in the Companies Act. Any reform of the railway system, so that it is run

Figure 1.31

Roadmap for Railway Restructuring as Recommended by The Expert Group on Indian Railways (2001)

	PHASE 1	PHASE 2	PHASE 3	PHASE 4
TIME FRAME	• Upto 1 year	• 1 year to 3 years	• 3 to 5 years	• Beyond 5 years
FOCUS AREAS	• Set-up Indian Railway Regulatory Authority • Make changes to legislation • Delineate social and commercial objectives • Initiate intensive communication with stakeholders	• Set-up Indian Railway Executive Board • Prepare ground for changing structure • Commence non-core' restructuring'	• Corporatise • Restructure core businesses • Complete non-core restructuring • Revamp regional organisation • Introduce Competition	• Evaluate ownership options • Refine restructuring process

Source: The Indian Railways Report 2001: Expert Group on Indian Railways.

Box 1.31

The Expert Group on Indian Railways (2001): Key Recommendations

The Report of the Expert Group on Indian Railways (2001), noted that 'Indian Railways is an institution embedded with contradictions. Management knows that the combination of unremunerative investments coupled to massive under pricing of passenger fares is the path to financial catastrophe, yet it is not able to take any effective action to reverse the situation'. The Expert Group recommended that three areas in particular will need to be fundamentally redesigned: Governance, Structure and Portfolio.

(a) *Governance: Separate Institutions for Separate Roles: Policy, Regulatory and Management*
Governance defines the roles and institutional relationships associated with policy, regulation and management. These roles are currently blurred and need to be clarified and institutionalised. *Indian Railways must aim to be corporatised into the 'Indian Railways Corporation' (IRC) or Bharat Rail Nigam (BRaiN). The Government of India should be in charge of defining the key thrusts of policy direction*. It would also need to set up an **Indian Rail Regulatory Authority (IRRA),** which would be necessary to regulate IRC's activities as a monopoly supplier of rail services to begin with, particularly related to tariff setting. *The Indian Railways Corporation (IRC) would be governed by a reconstituted Indian Railways Executive Board (IREB)*.

(b) Structure: Structure relates to the internal organisational design of IR. *The underlying design principle is to create an outward looking, business oriented, customer driven institution. This will involve reorganising the core transportation network into its key component parts*: freight, passenger, suburban, shared infrastructure: fixed, and shared infrastructure: others. These business units will operate with a large degree of autonomy yet be held accountable for a balanced scorecard of commercial performance measures. Further, adopting commercial systems is an essential pre-requisite for a modern railway. The corporatisation of IR into IRC will **necessitate the recasting of IR's accounts into company format.** The Government will therefore need to initiate the process of restructuring the financial accounts of IR in accordance with the Company's Act 1956.

(c) Portfolio: Portfolio relates to the breadth of business IRC will incorporate under its umbrella of holdings. The view of the Expert Group is that less is more. In other words, IRC should be engaged in only those businesses directly related to its core activity of rail based logistics and passenger transport. Non-core businesses should be spun off on an arms length basis. The eventual ownership of these entities is not an issue that concerned the Expert Group. Difficult though it may be, *the Expert Group anticipates that priority candidates for accelerated spin off would be all the manufacturing units which should be done within a specified time limit*.

Source: The Indian Railways Report 2001: Expert Group on Indian Railways.

Box 1.32

Recommendations of the Expert Group for Modernisation of Indian Railways (2012)

- Re-organise Railway Board along business discipline to reflect Chairman as Chief Executive Officer and Members for the following:
  - Safety
  - Business development/ Commercial
  - Technology/ ICT & Signalling
  - Freight
  - Passenger Services
  - Infrastructure
  - Finance
  - HR and PPP
- Create commodity-wise Key Account Directors under Member Freight for major commodities like coal, iron ore, steel, food grain, fertiliser etc. Coal is 45 per cent for total freight traffic and needs special attention.
- Create Key Account Directors of suburban, long distance passenger etc. under Member Passenger.
- Ensure autonomy, flexibility and accountability at all levels with clear P&L responsibilities
- Make provisions for handling of all parliamentary functions (liaison functions with government, including handling of Parliament questions) by a Joint Secretary level officer in the Ministry, which would set the RB free to focus exclusively on business issues.
- Empower Zonal Railways along with accountability:
  - The present system of seeking sanction for Capital investment to be included in the Works and Rolling Stock Programmes of railways from the Railway Board/ Ministry should give way to a more decentralised decision-making in critical areas like safety, traffic facility, passenger amenity and other areas, by delegation of powers at the zonal level.
  - GMs of Zonal Railways to be empowered to take decisions, within a framework of rules and investment limits. The Zonal Railways should also be made accountable for return on capital, transport output, profitability and safety.
- Review the existing PPP policy framework in the light of hitherto poor response and PPP experience.
- Establish a separate Authority/SPV/Organisation for implementation of Major Projects such as development of high speed corridors, redevelopment of railway stations etc.
- Build capacity for the officers at the Zonal railways to manage PPP projects. A PPP cell should be constituted in each zone to identify, develop, implement and monitor projects at the zonal level.

Source: Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

on business line in the future, will be difficult to achieve unless accounting reform is undertaken. Adopting commercial systems is an essential prerequisite for a modern railway system. The financial accounts of Indian Railways therefore need to restructured in accordance with the Companies Act. The objective is to develop financial statements that can be understood by the financial community and the public at large. Unless this is done, it is difficult to comprehend and assess the financial performance of Indian Railways and to separate out its commercial functions from social functions.

PROPOSED ORGANISATIONAL REFORMS

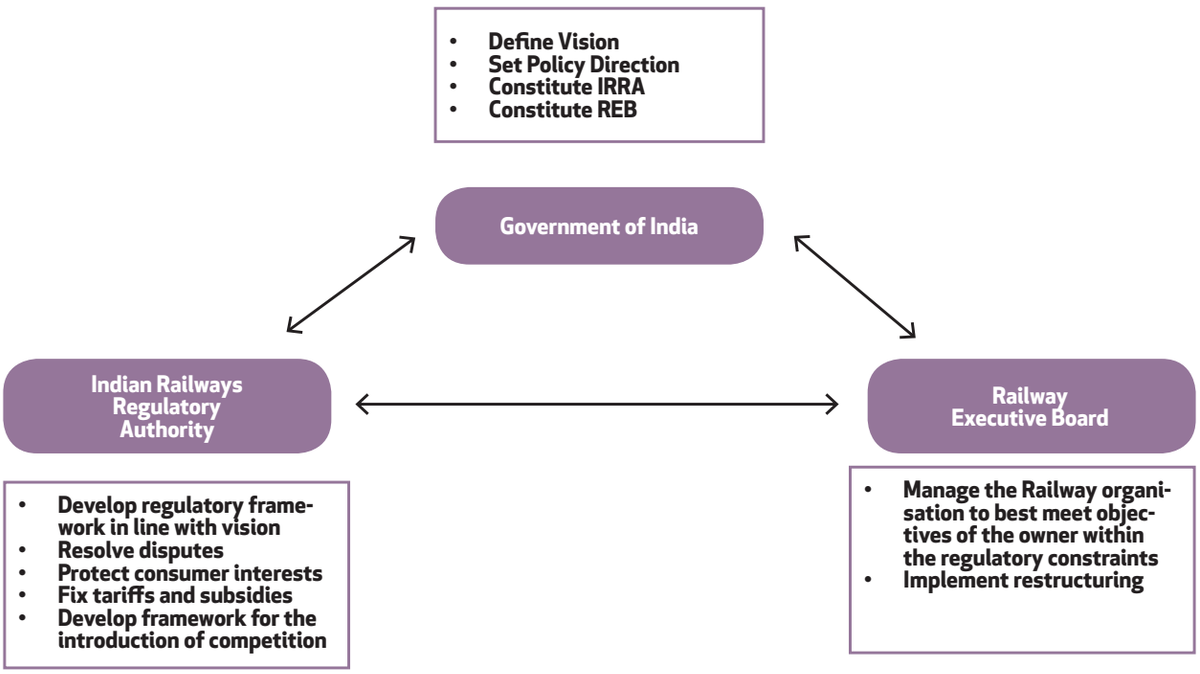
SEPARATION OF POLICY MAKING AND OPERATIONAL RESPONSIBILITIES AT THE RAILWAY BOARD LEVEL

The High Level Safety Review Committee, chaired by Dr. Kakodkar noted in its report that: 'Ever since Railway Board was first constituted in 1905, its size, functions and responsibilities have gone on widening. Today Railway Board presents itself as all encompassing monolithic structure where it has become all in one - policy framer, operator of train services and regulator'. Similar observations have been made by other committees in the past.

As discussed earlier, the Report of the Expert Group on Indian Railways, recommended a complete separation of roles of policy making, legislation and management of operations with the GoI being responsible for setting the broad parameters in which policy is to be formulated, as well as constituting the Indian Railway Regulatory Authority (IRRA) and the Indian Railways Executive Board (IREB) (Figure 1.32). It recommended that the existing Railway Board should be phased out and the

Figure 1.32

Separate Institutions for Separate Roles: The Expert Group on Indian Railways (2001)



Source: The Indian Railways Report 2001: Expert Group on Indian Railways.

Indian Railways Corporation (IRC) should be governed by the newly constituted IREB.

The Pitroda Committee (the Expert Group for Modernisation of Indian Railways, 2012) also recommended reorganising the Railway Board along business disciplines. Table 1.19 shows the recommendations of the two committees regarding reconstituting the Railway Board.

The reform of the railway sector in China, announced in March 2013 is on the similar lines and proposes to separate railway policy and regulation from commercial operations (Box 1.27).

ORGANISATIONAL REFORMS: KEY RECOMMENDATIONS

Both the 2001 & 2012 Expert Groups have suggested the re-organisation of the Indian Railways into business lines such as freight, passenger services, infrastructure, finance and the like as illustrated in Table 1.19. The difference between the 2001 Expert Group and most of the other committees lies in their recommendation to corporatise the operations of the Indian Railways as has been done with other sectors in India, subsequent to economic reforms. Other committees including the 2012 Expert Group have gone along with the retention of the current framework of railways being run as a Government department, while reorganising the Railway Board along business discipline lines. The objective of making the Railways more commercially oriented is common to all the Committees. There is also relative unanimity in setting up a Rail Tariff Regulatory Authority.

The NTDPC has debated this issue at different times. It is clear that the Indian Railways is now an outlier in being run as government department, and the kind of strategic change needed in its operations and magnitude of investments required over the next 20 years would suggest that a more radical reform be carried out as suggested in the 2001 Expert Group report. While recognising the lack of consensus on this issue in the Government, in the Railways, and in the country at large, the NTDPC feels that we have now an opportunity to draw up a vision for the Indian Railways in 2030 and that it is incumbent on us to suggest a structure that would provide for the most efficient and sustainable delivery of rail transport.

We are therefore proposing that it is now time for the government to reconsider the recommendations of the 2001 Expert Group to set up an Indian Railways Corporation in a manner that it is able to meet the challenges for overall transport strategy as it evolves over the next 20 years.

It may be noted that in other infrastructure sectors, such a reform has already been carried out. In the power sector, for example, the Minsitry of Power sets overall policies and priorities; the regulation

Table 1.19
Reorganising the Railway Board

THE EXPERT GROUP ON INDIAN RAILWAYS (2001)	THE EXPERT GROUP FOR MODERNISATION OF INDIAN RAILWAYS (2012)
• Existing Railway Board to be phased out and the Indian Railway Executive Board to be constituted by the Government.	• **Re-organise Railway Board along business discipline to reflect Chairman as Chief Executive Officer and Members for the following:** - Safety - Business Development/ Commercial - Technology/ ICT & Signalling - Freight - Passenger Services - Infrastructure - Finance - HR and PPP
• **Executive Board to have 15 members:** **Operations Office (On-going management)** - Permanent position to have a minimum tenure of 5 years - Chairperson - COO freight - COO passenger - COO suburban - COO Infrastructure - fixed - COO Infrastructure - other - VP Finance and Planning - VP HR **External office for Strategy (transition management)** - Temporary positions - initial tenure of 3 years to be extended if necessary - COOs— non-core businesses (2) - Executive Directors (5) (Traffic -3, Infrastructure -2)	

Source: The Indian Railways Report 2001: Expert Group on Indian Railways; Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

is done by the Central Electricity Regulatory Commission along with a network of State level regulatory commissions; the delivery of power is overseen by the central Ministry of Power, but implemented through large public sector corporations, such as National Thermal Power Corporation (NTPC), the National Hydro-electric Power Corporation (NHPC), Power Grid Corporation, Power Finance Corporation and others at the state level. Within the same framework, there are also now an increasing number of private sector corporations that generate and distribute power. Similarly, in the telecom sector, the Ministry of Communications oversees policies and priorities in the sector, the Telecom Regulatory Authority of India (TRAI) does overall regulation including that of tariff, while both public sector corporations, such as Bharat Sanchar Nigam Ltd (BSNL), and Mahanagar Telecom Nigam Ltd (MTNL), a plethora of private sector corporations deliver the services. Thus, the kind of reform proposed by the 2001 Expert Group for Railways, and implemented by most of the countries, is similar to what has already been done in other infrastructure sectors in India.

Therefore, the NTDPC recommends that it is time that a similar reform be carried out in the railways. There is a clear need to separate the different roles. Policy should be with the government, regulation including tariff regulation should be with a regulatory authority, and operations should be run by a corporate entity or entities. The Railways already operate a number of corporations, such as the Container Corporation of India Ltd (CONCOR), the new DFCCIL, Konkan Railway Corporation (KRC), the Indian Railways Finance Corporation (IRFC) among others. With the increasing resort to public-private-partnership, it is likely that there will be a continuing creation of other railways corporations, public or private, to undertake railways operations. It is therefore desirable that the railway system itself as a whole be corporatised in a more organised manner now.

The NTDPC is not providing detailed recommendations in this regard, since it recognises that this requires further discussion and detailed study on what may be the best form of corporate reorganisation that would be in the interest of the Indian Railways. Furthermore, such a reform will also entail amendment of the Railways Act, 1989, and the Indian Railways Board Act, 1905. Once an in principle decision is taken to undertake such a reform, a more detailed process of transformation will have to be designed. However, there would appear to be near unanimity among various committees that Indian Railways be reorganised into business lines. We can envisage an Indian Railways Corporation (IRC) to be headed by an Indian Railways Executive Board (IREB) with the Chairman as Chief Executive Officer (CEO) and Members in charge of different business lines. Decisions will also have to be taken on the relationship between this apex Indian Railways Corporation and other Railways companies that currently exist and those that may come up in the future. One possibility is that such corporations could all be subsidiaries of the IRC or joint ventures of the IRC with other private or public entities.

It is recommended that the IREB itself would limit its involvement to strategic planning, policy-making and the usual functions of the Board of such an entity. It should function like the board of a com-

pany with clear focus on business, bottom-line and other clearly defined objectives. Day-to-day operations, monitoring and decision making could be delegated to the Zonal Railways and project organisations or companies. The IREB would, however, continue to monitor the performance periodically to ensure that the strategic plans and the policies are implemented.

Governmental functions affecting the Railways would, as is done in other parts of the Government, be carried out by a compact Ministry of Railways in the first instance, and perhaps move later to the unified Ministry of Transport, as is recommended elsewhere in this report. Such a phased reform has also been carried out in similar fashion in other countries that have undertaken similar transformation of their respective Railways. The Railways Regulatory Authority and the IRC would then be responsible to the Ministry as other similar entities are to their respective Ministries. The staffing of the Ministry of Railways should be done by the assignment of Railways officers from the existing set up and from IRC and other Railways entities in the future. Careful consideration would have to be given to the delineation of functions that remain with the Government, and those to be exercised by the IRC.

We may note that the IRC should not be set up under the Companies Act. In fact, it would be advisable to set it up as a statutory Railways Corporation for which a new Act would have to be legislated providing clearly the functions and powers of such an entity. It is important that the IRC be set up as a statutory corporation since the current Railways Act endows Indian Railways with many quasi-governmental powers which will have to be retained by the IRC. However, it would need to be ensured that such a statutory corporation is essentially run on business lines, while exercising other functions of a social and strategic nature which are essential to the functioning of Railways in India.

The NTDPC is fully aware that the kind of transformation proposed above is contentious and does need further discussion among the main stakeholders in the country, including Railways staff and the unions. It is essential that a full understanding is reached that such a transformation would be undertaken in order to empower the Indian Railways system to modernise, to expand, to become more efficient, and serve the needs of the people of the country at large and the country's overall transport strategic needs. As has been made clear in the earlier sections, what is envisaged is an unprecedented significant expansion of the Railways system in India to meet the transport needs of the future in India. It would perhaps be correct to say that if such an expansion in Railways was not needed in the country, there would then, perhaps, be little need for such a transformation as has been proposed.

There is a clear need to separate the different roles involved in running the railways. Policy should be with the government, regulation including tariff regulation should be with a regulatory authority, and operations should be run by a corporate entity or entities

Corporatisation, as envisaged, will not only allow better use of Railway assets along with higher quality of service and greater emphasis on profitability but also be able to compensate the Railway employees adequately for the increased profits that they are able to bring for the organisation, as noted by the Sixth Central Pay Commission in its report (Box 1.33). Moreover, as a corporate entity IRC would be able to access capital from external sources for funding its significant expansion plan, thereby reducing the stress on government borrowings and facilitating the attainment of fiscal defict targets set under FRBMA.

The 2001 Expert Group had given a more detailed timeline for Railways reforms; in that timeline, it was suggested that it will take at least five years of preparation for the formation of an Indian Railways Corporation and associated other changes in the system. In the meantime, it would be essential to begin the process of change within the current organisational framework.

There is already in-principle agreement in the Indian Railways that accounting reform be undertaken so that Railways accounting is done in a business oriented fashion. This must be implemented forthwith. Second, the Government has already approved the formation of a new Rail Tariff Authority. Hence, this Authority should be set up as soon as possible in order to provide rationality in the setting of both passenger and freight tariffs. Third, a reorganisation of the Railway Board may be undertaken on the lines of the recommendations of the 2012 Expert Group (Chairman: Sam Pitroda) so that it is organised into the kind of business lines proposed. If these interim reforms are undertaken, it would then become much easier to transform the current system into a corporatised system as proposed. The recommendations in the rest of this section may be seen as the short term reforms that are needed to make the Indian Railways commercially oriented that would ultimately result in the kind of corporate structure as proposed.

SHORT- TO MEDIUM-TERM REFORMS

Reorganisation on business lines: Indan Railways is presently organised in terms of several functional

Box 1.33

Corporatisation of Indian Railways: Sixth Central Pay Commission Report (Excerpts)

Various Railway Federations have demanded a special dispensation for Railway employees keeping in view the profitability of their organisation. The demand is not without substance especially as employees have to be rewarded for efficient performance of the entire organisation that has yielded continuous profits without resorting to any substantial increase in the passenger/freight fares in the recent years. A separate dispensation in terms of pay scales and allowances is not, however, possible, as long as the organisation continues to be a Ministry in the Central Government because it will then need to be governed by the common pay scales and allowances for the entire Central Government. In such a scenario, the optimal solution would be corporatisation of Indian Railways as a Public Sector Enterprise. This would allow the Railways flexibility in determining its own compensation package. While privatization of Railways cannot be an option as Railways is and will continue to be a public utility service providing crucial infrastructure support for balanced economic growth of the country, corporatisation of Railways as a Central Government PSE is a viable option that will not only allow better use of Railway assets along with higher quality of service and greater emphasis on profitability but also be able to compensate the Railway employees adequately for the increased profits that they are able to bring for the organisation.

The only argument that can be used against corporatization is that it may lead the Railways to go for profitability as its primary object without catering to the benefit of the general public. Another negative point of such corporatisation usually projected is that in times of national Emergency like external aggression etc. the Government may no longer be assured of full cooperation from Railways in case it is corporatised. There is not much substance in these arguments because even as a public sector undertaking, the railways would still belong to the public domain with the only difference that the Government then would need to provide upfront compensation to Railways for any social project taken up by Railways in advancement of Governmental policies.

Corporatisation would raise the productivity of services provided by the Railways as it would then be relatively free from governmental control. The Workers, Managers and Executives in Railway organization would then be free to raise the productivity of their organisation and participate in its increased profitability. The Commission, accordingly, recommends that corporatisation of Railways as a Central Public Sector Enterprise should be considered in right earnest by the Government. This will not only benefit the employees in Railways but also the common citizens as increased productivity of Railways will ensure better services to the common citizen.

Source: Report of the Sixth Central Pay Commission.

departments like Civil Engineering, Mechanical Engineering, Electrical Engineering, Signal and Telecom, etc. While in theory, such a structure promotes functional specialisation, each department being manned by separate cadres has led to lack of unity and strategic coherence. From recruitment to retirement, officers spend their service years almost entirely in the department getting deeply steeped in departmental thinking. A great deal of organisational energy is expended in inter-departmental competition for resources.

The Report of the Expert Group on Indian Railways (2001) noted that:

'Indian Railways remains an integrated, functionally oriented institution that is organised around its cadres instead of around its businesses or customers.'

'Historically, IR was forced to be an integrator of activities in order to be successful it had both to provide cradle-to-grave care for its employees, and also to produce everything from meals to wheels in order to operate. Indian Railways today is a complex conglomerate. It runs major businesses as diverse as hospitals, schools, catering, manufacturing, real estate and maintenance. To manage these diverse businesses, however, it has created a monolithic organisational structure based on function first and geography second. This makes life more complex than it should be. It makes it hard to answer important questions and it makes unimportant issues very important.'

Table 1.20 summarises the major recommendations of the Expert Group of 2001 (Dr Rakesh Mohan) and Dr Pitroda committee (2012) regarding reorganisation on business lines. Several railways internationally have reorganised their operations in terms of

Table 1.20
Reorganisation on Business Lines

THE EXPERT GROUP ON INDIAN RAILWAYS (2001)	THE EXPERT GROUP FOR MODERNISATION OF INDIAN RAILWAYS (2012)
• The core transportation business of Indian Railways should be organised into **five strategic business units (SBUs)** comprising: - Freight transportation - Passenger transportation - Suburban transportation - Fixed infrastructure - Other infrastructure • The Freight, Passenger and Suburban divisions will be organised as **profit centres**. All sub-divisions to be treated as profit centres. • The two infrastructure divisions— Fixed and other will be organised as **cost centres.** • All non-core businesses will need to be separated into a sixth division. • A Board headed by a Chief Operating Officer (COO) will manage each of the SBUs. The COO will also represent the division on the IREB.	• Create commodity wise Key Account Directors under Member Freight for major commodities like coal, iron ore, steel, food grain, fertiliser etc. Coal is 45 per cent for total freight traffic and needs special attention. • Create Key Account Directors of suburban, long distance passenger, etc. under Member Passenger. • Ensure autonomy, flexibility and accountability at all levels with clear P&L responsibilities. • Make provisions for handling of all parliamentary functions (liaison functions with government, including handling of Parliament questions) by a Joint Secretary level officer in the Ministry, which would set the RB free to focus exclusively on business issues.

Source: The Indian Railways Report 2001: Expert Group on Indian Railways; Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

business lines (Box 1.34). Annex 1.11 shows several different forms of Line of business management structures.

RECOMMENDATIONS

Infrastructure management, freight transportation, passenger transportation and miscellaneous activities should similarly be organised as separate profit-centres by the new IRC. These businesses could be further subdivided in terms of different activities. For instance, freight transportation could be reorganised in terms of bulk transport and non-bulk transport comprising of parcels and containers; and passenger transport in terms of high-speed, intercity, suburban and regional services. IR should concentrate on providing cost-efficient solutions in each activity by doing its part efficiently and taking the assistance of private partners or special created SPVs for other activities such as for movement of containers and parcels, development and management of terminals, marketing, road bridging, etc. In the suburban passenger transport, the attempt should be to achieve physical separation of the long-distance network and the suburban network, and its organisational separation later. Modern accounting practices would ensure that infrastructure and rolling-stock resources used by these lines of business can be properly charged after appropriate and correct costing.

It is important to mention here that addressing the capacity constraint on IR (discussed in Section 5) is a concomitant need, in the absence of which the proposed accounting reforms and the reorganisation on business lines will not yield the desired results.

Non-transportation tasks: Production Units: A review of the railway restructuring experience across the globe shows that in order to become more focused, the Railways in most countries decided to spin off their non-core activities and concentrate on the core business (Box 1.35). For example, railways in Europe and Japan have long outsourced activities like rolling stock manufacturing. Even the Chinese Railways has reorganised its rolling stock manufacturing operations into separate companies - China South Locomotive and Rolling Stock (CSR) and China North Locomotive and Rolling Stock (CNR) (established in 2001 from the former China National Railway Locomotive & Rolling Stock Industry Corporation (LORIC)). Considering the serious competition faced by IR in the core transportation business (and the resulting decline in rail modal share of freight), it is imperative that IR critically reviews its presence in all the areas falling outside the core transportation operations. As mentioned earlier, the Expert Group on Indian Railways (2001) had also made a similar recommendation in its report and noted that:

'*To provide adequate focus on the core business as well as improve flexibility and cost competitiveness, the non-core activities of the railways will be fully divested over time, say five years.*'

Box 1.34

Freight as a Business Distinct from Passenger Transport

In seven of the eight countries below, rail freight is treated as a separate business from passenger transport. It was not always so; in most countries, the major railway companies once had common business management of passenger and freight business. Because freight trains and passenger trains run on the same tracks, railways historically treated them as different parts of the same business, which they conceived as the business of running trains. Traditional management structures reflected the functional divisions that underpin a 'train' business (e.g. track, signaling, locomotives, traffic operations etc.) and (in larger countries) regional management divisions, similarly organised, as well.

COUNTRY	FREIGHT AS A DISTINCT BUSINESS ACTIVITY	BUSINESS SEPARATION
Australia	Both in federal and all state contexts (other than in Queensland) the operation of rail freight is managed by entities that do not operate passenger services. In Queensland freight is managed as separate division of Queensland Railways.	Mainly 1990s.
Brazil	Freight Concessions predominate (passenger services are mainly in city areas and are run by separate concessions)	1990_s
Canada	Freight companies and passenger company (Via Rail) are separately owned. Via Rail is a publicly-owned passenger TOC that pays the freight private freight companies for access	1978
China	Still combined: Regional Railway Administrations deliver both freight and passenger services	N/A
Germany	The main freight rail operator, DB Schenker is a separate company within the State-owned DB holding structure and purchases network access from DB Netz, also in the group.	1991
Japan	The Japanese Freight railway Company is a free-standing freight TOC separate from the 6 passenger companies from whom it hires track access.	1987
Russia	The Russian Railways Corporation has progressively split Intercity Rail away from freight. Passenger Branch established 2006. Currently accounting separation only, but Passenger Brach structured to permit it being split into 5-7 regionally based passenger companies. Within the freight sector several private freight-only companies have been established, mainly with trains hauled by RZD.	2006
United States	Freight companies and passenger company (Amtrak) are separately managed and owned. Amtrak is a publicly-owned passenger TOC and pays the private freight companies for access (at regulated charges).	1970

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Paul Amos, July 2011.

The Expert Group further recommended that:
'*...that priority candidates for accelerated spin off would be all the manufacturing units which should be done within a specified time limit.*'

Given the massive investment requirement for rolling stock, it is imperative that IR should encourage participation of private players (both domestic and international) in setting up manufacturing facilities for rolling stock and components. Despite the recommendations available on this issue for quite some now, IR continues to set up new departmental production units, as also attempt setting them up under the PPP model. Leasing of rolling stock, especially wagons, under the PPP format is another policy enunciated. Joint ventures are also being planned. There is thus no coherent unified approach. Developing the private rail equipment ownership and leasing market can help in bringing substantial private investment to the railway sector (Box 1.37). Private equipment operators in Russia have invested over US$20 billion in railway freight equipment[20]. As a result, the Russian railway no longer has to finance these investments, old rolling stock is replaced promptly, and new equipment technologies have been introduced that reduce maintenance costs and out-of-service time.

Globally, there has been a trend towards consolidation through mergers and acquisitions. Since the 1990s, a series of mergers and restructurings in Europe and North America led to the emergence of three dominant global manufacturers: Bombardier of Canada, Alstom of France, and Siemens of Germany. However, over the last decade, while Bombardier and Alstom have maintained their leading positions, the two Chinese manufacturers, CSR and CNR, have moved into third and fourth place in the list of leading global rail equipment manufacturers (by sales in 2009)[21].

Recommendations on Production Units: The magnitude of the capacity expansion that is being

20. World Bank (2011).
21. Rennor, Michael and Gardner (2010).

Box 1.35
Focus on Core Business

In all eight countries—Australia, Brazil, Canada, China, Germany, Japan, Russia, and the United States, the major railway operators have withdrawn from most non-core activities. 'Core' is generally taken to mean the market focus that differentiates a business from its competitors. For freight railways the core business is delivering competitive transport services through efficient use of railway technology. In all the countries in the group, railways, both public and private, once encompassed a range of activities from which they have now withdrawn.

Three main types were social and recreational services for employees (e.g. housing, schools and hospitals); materials supply and manufacturing (e.g. loco and wagon manufacture, quarries and forests for track materials); and business support services (e.g. vehicle cleaning, printing, building maintenance). The imperatives of transport competition in the motor age have led the railways to devolve social services to specialist organisations and ministries and concentrate on sourcing and procuring railway equipment and support services in the way that will best support the core transport business, that is, by competitive tendering among suppliers. North American railways are 'leanest' in this regard. China's railway still retains ownership of various ancillary companies, though it has divested most of its social services and major construction and manufacturing activities.

China's refocusing on core business began in 1998 with reorganisation of several engineering and rolling stock manufacturing units to create limited liability companies. This was then followed in 2000 by the establishment of six major non-rail companies as independent enterprises, and their transfer to the supervision of the State Large Enterprises Working Committee. Also in 2000, MOR began transferring the schools, colleges and universities run by Regional Railway Administrations to local governments and to the Ministry of Education, although it still retained railway management institutes and colleges to provide occupational qualifications and training for railway staff. This process was completed in about 2005 when nearly 900 schools, 400 hospitals as well as kindergartens had been transferred. In 2004, the China Railway Communications Co. Ltd. (CRCC) (which had been established in 2000 and is responsible for providing railway telecommunications) and China Rail Materials and Supplies Co. Ltd. (CRMSC) (established in 1988 as the supply and trading agency for the RRAs) were transferred from MOR to the supervision of the State-owned Assets Supervision and Administration Commission (SASAC).

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Paul Amos, July 2011.

Box 1.36
Restructuring the Production Units (PUs)

IR's production units (PUs) were set up at a time when it had become necessary to develop indigenous manufacturing capacity. In order to meet the twin objectives that of developing indigenous capabilities and conserving scarce foreign exchange the IR were entrusted with task of setting up and managing their own production facilities. Five production units (PUs) were set up during the period 1950-90: Chittaranjan Locomotive Works (CLW), Chittaranjan, 1950; Integral Coach Factory (ICF), Perambur, 1955; Diesel Locomotive Works (DLW), Varanasi, 1961; Wheel & Axle Plant, Bangalore, 1984; Rail Coach Factory (RCF), Kapurthala, 1985. These units are managed as departmental undertakings of the Ministry of Railways (MoR), unlike public sector undertakings, which, though owned by the government, are autonomous corporate entities. The MoR provides the funds through the railway budget and the accounts are audited by the Comptroller and Auditor General of India.

The units have to follow the policies laid down by the Railway Board (RB) in the matter of procurement of materials, plant and machinery leaving them with no autonomy in decision making. The RB also decides on the number and types of locomotives, coaches and wheels & axles to be manufactured each year, and the PUs formulate their production programmes accordingly. The products manufactured at

(Contd...)

PUs are supplied to the Indian railways at, what is termed as the 'transfer price'. This price is worked out on actual cost basis. It, however, does not include the cost of capital, the profit element and share of administrative charges.

At present, both IR and its production units are at the crossroads. Because of its weak financial position, IR has not been able to make even essential investments in plant and machinery. No wonder, 49 per cent of the ICF's plant and machinery has outlived its economic life; 16 per cent of the machinery is over 40 years old. Overage and obsolete equipment require frequent maintenance and additional staff. Similarly, at the Weel & Axle Plant, most of the machines have outlived their economic life, causing heavy down time and low quality output.

Over the years, the production units have also developed their own types of vertical integration. For example, the older plants continue to produce components, which could be easily outsourced and that too at competitive rates. The result is high cost of production and low levels of productivity. **The availability of capital without a price tag has blurred the PUs' cost consciousness and financial accountability.** In addition, the sheltered market for their products and absence of competition do not provide them any motivation for improving quality and upgrading technology, which is way behind international standards. The production units, by and large, have continued with the technology and designs initially procured only with some incremental improvements. **In the bargain, they have suffered from technology stagnation for prolonged periods which affected their export potential.**

The world over, major industries including rail equipment industry have been undergoing structural changes as a result of domestic market developments and globalisation. **The process has been largely driven by three factors: technology, capital and competitive pressure.** The structural changes have resulted in the rationalisation and consolidation of the manufacturing activities. All national railways have hived off their production units into independent enterprises. The initial binds, which were the raison d'etre for setting up these units, have since lost their validity. The industrial base in the country has acquired the capability for producing high quality equipment. The ancillary industry has significantly developed to produce quality products at competitive prices. The private sector that was earlier reluctant to invest in capital-intensive industries is now willing to do so. It has also developed managerial and entrepreneurial skills. **Time is both ripe and opportune to hive them off into independent enterprises under a corporate structure. Here it may be clarified that corporatisation of PUs would just be an interim phase.** It would subsequently lead to disinvestment and adoption of some suitable model for restructuring in the follow-up phase. Indeed, there are several models that have been adopted in different countries.

Source: Improvement of Railway Finances, Hiving off non-core activities, P.K. Malik for ADB.

recommended by the NTDPC and the modernisation required in all forms of Railways rolling stock suggests that there needs to be a corresponding enhancement and modernisation of the production units producing such rolling stock in the country. As Indian incomes increase and there is a continuing change in the composition of demand towards more comfortable passenger coaches, there will be need for widespread replacement of the existing passenger coaches in the Indian Railways. In addition, with the kind of passenger shift toward Railways that is envisaged, there will be enhancement in demand for new coaches. On the freight side, as Dedicated Freight Corridors are rolled out, there will be new demand for freight rolling stock on a continuing basis. Furthermore, as freight transport becomes more specialised, greater integration takes place in freight transportation. As suggested in Chapter 4 (Integrated Transport: Strategy and Logistics), there will also be much increased demand for modern and specialised freight wagons, which make intermodal transfers easier and more efficient. As mentioned above, we are witnessing the emergence of a few dominant global manufacturers in the advanced economies along with the rise of couple of Chinese manufacturers of railways rolling stock. In view of the expansion expected, India should also envisage the emergence of competitive Indian manufacturers for the railways sector.

The first step in this regard should be the corporatisation of the existing public sector railways production units. One possibility could be the setting up of a holding company like the Steel Authority of India Ltd (SAIL) with each of the production units as they currently exist as subsidiaries of this holding company. In order to modernise and expand these production units, an organised programme should be designed through a PPP framework to transform them into possible joint ventures in the

Box 1.37
Equipment Ownership and Leasing

Railway rolling stock comprises a major proportion of most railways' investment portfolio. Reforms that permit or encourage private investors to purchase railway equipment and lease it to users can bring substantial private investment to the railway sector. If the railway has insufficient equipment to meet customer needs, shippers can benefit from purchasing their own freight cars, especially if owning specialised equipment reduces costs or gains a market advantage. Usually, railways offer discounts on tariffs or transport charges for shippers that invest in rolling stock. The discount level is a determining factor in shippers' incentives to invest in rolling stock.

Equipment leasing is a natural extension of private equipment ownership. For railways, equipment leasing is normally a short-term - between one and seven years - exclusive-use agreement between equipment investors and customers. Usually longer-term leases, referred to as 'financial leases,' are a mechanism to finance rolling stock. With financial leases, international accounting standards require that the equipment value is accounted for on the shippers' books rather than the investors' books.

To grow and flourish, leasing requires a market ecosystem. Railway tariffs or transport price discounts must be sufficient to provide investors and shippers with incentives to purchase or lease rolling stock. Private owner-investors must be able to spread equipment ownership risk across multiple potential customers - shippers, rail operators or forwarders, or other railways – not just the state owned railway.

The railway benefits from private investment in equipment since it need not secure financing for rolling stock. . This frees scarce railway capital for use in other areas, such as infrastructure improvement, where it may be harder to attract private investors. Privately owned equipment reduces the need for railway rolling stock maintenance facilities, and all the cost and capital they require to operate and renew. Privately owned equipment can yield more transport volume for the railway because it tends to lock shippers to rail transport and private equipment usually has higher utilisation. Moreover, the equipment may be newer, more reliable, and provide a better net: tare ratio and suitability for shipper needs than railway-provided equipment, which is likely more generic.

Shippers benefit from private investment in equipment because the equipment better suits their needs and its supply is more reliable. The equipment may reduce their overall logistics costs – either because it is easier to load and unload, or because it has higher capacity than generic railway equipment. Shippers may also benefit from the ability to assemble enough equipment to ship entire train loads in dedicated service. This not only improves equipment utilisation but also may make the shipper eligible for even more economical pricing.

Investors benefit from owning equipment by earning good returns. In a market of multiple shipper/customers, investors can spread their risks. Moreover, higher equipment productivity permits shippers to move higher volumes, which reduces overall costs for equipment investment - compared to full railway pricing or to equipment-lease payments.

Source: Railway Reform: Toolkit for improving rail sector performance, The World Bank, 2011.

first instance. As expertise is developed in these production units, we can expect a trend of consolidation through mergers and acquisitions of these joint sector units or public sector units along with any other private sector companies that may emerge in this area. Given the size of Indian Railways system and its envisaged expansion, there is no reason why Indian production of railways rolling stock should not be among the most competitive in the world.

In summary, the NTDPC recommends that all the production units of the Railways be corporatised within a holding company structure, such as SAIL, and the plans drawn up for their expansion and modernisation to emerge as globally competitive players.

Recommendations on Other Service Activities: All activities falling outside the core transportation and manufacturing operations should be critically reviewed from the perspective of either retention or outsourcing. Outsourcing would be a solution for the activities that are required for transportation service but can be done by another agency more

efficiently and at lesser cost (e.g. cleaning of coaches, provision of linen in trains, etc.).

There are also activities that are amenable and eminently suited to commercialisation and yet suffer from loss of focus being confined to a small part of the railway's operations at present. In the past, railways have benefited from corporatisation of such activities as project/technical consultancy, construction, container transportation, telecom services, etc. Going forward, parcel service management would be an ideal candidate for corporatisation. Other activities of similar nature could also be considered. In several railways, for instance Chinese Railways and Japanese Railways, transportation of special cargo (container, special freight and parcel), construction of railway infrastructure and management of stations have been successfully implemented to facilitate quick upgrade of technology, independent R&D and sharpen focus on upgrade of passenger facilities and revenue generation.

Railways have been experimenting with outsourcing a number of activities. Examples are: onboard cleaning, supply of linen in trains, station cleaning, etc. The results have not always been satisfactory. In fact, some of the outsourcing activities have given rise to a large number of complaints from customers. This, however, does not make a case against outsourcing. However, it demonstrates the need for seeking professional help and guidance in designing outsourcing modules and monitoring performance post-outsourcing.

Chapter 4, Volume II (Integrated Transport: Strategy and Logistics) details the kind of logistics systems that we can expect in the transport sector. The outsourcing activities mentioned above need to take cognizance of the emergence of these integrated logistics companies and take advantage of the kind of services that they provide.

Empowerment of Zonal Railways: It is essential that the organisational reforms be extended to the Regional/Zonal level. The recommendations of the Expert Group on Railways (2001) and the HLSRC (2012), with respect to empowerment at working level have been summarised below (Boxes 1.38 and 1.39).

Recommendations for Zonal Railways: GMs of Zonal Railways could be empowered to take decisions that enhance the revenue, reduce costs or build platforms for higher growth in future. For example, if a freight bye-pass or traffic facility work or a signalling change can increase capacity or remove a bottleneck, GMs could have the power to take such decisions without reference to Railway Board within a framework of rules and investment limits. The present system of seeking sanction for investment to be included in the Works and Rolling Stock Programmes irrespective of the size of investment should give way to a more decentralised decision making at the zonal level. Simultaneously, the Zonal Railways would be made accountable for return on capital, transport output, profitability and safety. An enabling framework can be created to stimulate internal competition among Zonal Railways with incentives and bonuses for high performers. Box 1.40 shows the improvement in financial performance achieved as a result of managerial decentralisation undertaken in China.

The proposals above on the empowerment of Zonal Railways should be implemented as preparation for their functioning within an overall corporate framework is carried out as proposed above for Railways re-organisation.

Public Private Partnership (PPP): Investment in infrastructure in India is increasingly being done through public private partnerships (PPP). The concept is now also being extended to railways infrastructural investments. As noted earlier, most railways in the world are run as government owned corporations, with the exception of the United States. Thus, extension of the PPP concept to the railways while desirable, has to be done carefully.

A thorough review of the experience of PPP projects so far needs to be undertaken. Organisational and institutional deficiencies inhibiting PPP need to be identified and addressed. Clear-cut empowerment and accountability for PPP projects need to be established. Decision-making for PPP projects needs to be streamlined. Capacity building for officers handling PPP projects both at the ministry and the field level needs to be taken up with help of professional bodies. Standardised documents balancing risks and interests of private partners must be prepared in advance to avoid delay in decision making in the course of the bidding/award process. The existing PPP policy framework should be reviewed in the light of hitherto poor response and PPP experience.

The recommendations of the Dr. Pitroda Committee with regard to improving the environment for PPPs should be implemented (Box 1.41).

SUMMARY OF RECOMMENDATIONS

The Indian Railways, with its network of about 65,000 route km, plays a crucial role in integrating the social, political and economic life of the country. IR forms the backbone of India's transport infrastructure; facilitating industrial and economic development by transporting about 33 per cent of the total freight traffic (NTKMs), while simultaneously meeting the transportation

Box 1.38
Revamp Regions/Zones: The Expert Group on Indian Railways (2001)

The restructuring process will be extended to the Regional/Zonal level. A Zonal Management Committee comprising 4 General Managers (GMs) one each from the Freight, Passenger and Infrastructure Fixed and Infrastructure other Strategic Business Units (SBUs), will have the responsibility of managing the zone. The Zonal GM will report directly to the COO of their respective SBUs. Greater powers will be given to the Zonal GMs to allow them to take independent decisions regarding their own SBUs. Decisions regarding sharing of common facilities, infrastructure will be taken jointly by the Zonal Management Committee. Guidelines to facilitate decision making by the Zonal Management Committee will be laid down in line with the principles established by the Railway Executive Board.

Source: The Indian Railways Report 2001: Expert Group on Indian Railways

Box 1.39
Recommendations of HLSRC Regarding Empowerment at Working Level

Enhanced powers should be delegated to GMs and DRMs in regard to safety matters as under:

- Powers of General Managers to be enhanced to 3 times for sanction of works under all Plan Heads except New Lines and M & P items. These should also be applicable under out-of-turn basis, depending on the urgency. Powers of DRMs also to be accordingly enhanced to 3 times.
- General Managers to be given full powers for re-appropriation of funds from one work to another under the same Plan Head and source of funds under all the Plan Heads, except New Lines.
- General Managers to have full powers to re-appropriate funds under Revenue under the same Demand from one PU to another within the overall budget allotment.
- DRMs to be fully empowered to decide the process/procedure such as Spot Purchase Committee, Single/Limited Tenders, etc.
- DRMs to have full powers:
  - To accept tenders floated by the division
  - To enter into repair or Annual Maintenance Contracts through OEM or otherwise
  - To purchase stock items in case of shortages and non-stock items upto Rs 0.3 million per case but without any monthly ceiling
- DRMs to be empowered to award works of essential nature related to operation and maintenance assets on quotation basis for 3 months as a stop gap arrangement.
- DRMs to have full powers for hiring of resources including utility vehicles.
- DRMs to have full powers to sanction construction of RUBs, limited height subways and ROB under Road Safety works.
- Powers those vested with DRMs of the Division to be enjoyed by the Chief Workshop Managers in respect of their workshops.
- Powers to sanction cash awards for good performance in safety related matters should be enhanced to three times.
- Enhanced delegation of powers to the divisions should be directly mandated by the Railway Board as a onetime measure.

Source: Report of High Level Safety Review Committee, Ministry of Railways, 2012 (Kakodkar Committee).

needs of the people across the length and breadth of the country.

However, Indian Railways has suffered from the absence of a comprehensive framework for capacity expansion over the last 60 years. Consequently, only incremental changes have taken place through gauge conversion, doubling of lines, some modernisation of signalling, etc.; along with continuous addition of new lines on uneconomic routes. Presently, the network of IR is plagued by infrastructure and carrying capacity constraints and most of the routes on the high density network (HDN) have already reached saturation in line capacity utilisation. *The expenditure on railways as a percentage of total transport sector expenditure has declined considerably over the last two decades*. Moreover, while IR has been suffering from severe capacity con-

Box 1.40
Managerial Decentralisation in China

China has increasingly tried to commercialise its Regional Railway Authorities but without establishing them as corporations. The introduction of Assets Operation Liability System (AOLS) in 1999 was a key step in managerial decentralisation by making Regional Railway Administration managements responsible for managing and increasing the value of the assets assigned to them. AOLS sets bonuses in relation to three targets and two commitments. The three targets are: to increase the net worth of the RRA; to make profits, expressed as a percentage of the RRA's gross operating assets; and to return dividends to MOR, expressed as a percentage of MOR's capital investment. The two commitments made by RRAs are: to operate safely; and to achieve a specified minimum increase in RRA profits or reduction in RRA losses. Under AOLS, each member of RRA management (as far down as stationmaster) puts up an incentive deposit, the size of which depends on rank. The deposit is forfeited if the targets and commitments are not met. For target-beating performance, the manager gets the deposit back, plus a bonus equal to up to twice the deposit. During the eight years that ALOS has been in place, there has been a steady improvement in the financial performance of the RRAs (and of CR as a whole) as well as a significant improvement in safety, with the number of accidents reducing. Most RRAs now achieve the higher levels of bonus.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 13, Paul Amos, July 2011.

Box 1.41
Organisation for PPP: Recommendations of the Expert Group for Modernisation of Indian Railways (2012)

- Create a post of Member (PPP) responsible for project development and processing of all PPP projects to facilitate their speedy sanction by the Government and award of concession. The Member should have a multi disciplinary team of officers, including finance, to deal with various railway projects.
- Establish a Committee for approval of PPP projects to be headed by Chairman Railway Board with Financial Commissioner, Member (PPP) and the concerned member to whose area of responsibility the project belongs. The process and procedure followed should be similar to that of PPPAC followed in Government of India. The Board should decide and approve the projects and they should not be examined or referred back by the members to their respective directorates. The projects thereafter should follow the normal procedure of approval by PPPAC and CCI.
- Appoint a 'PPP Ombudsman' to resolve any disputes that may arise between the private sector and the government in interpretation and enforcement of provisions of the agreements. The Ombudsman should be a quasi judicial authority and should have the authority to give directions which are binding on all parties.
- Constitute a Railways Tariff Regulatory Authority in order to provide a level playing field to all stakeholders.
- Build capacity for the officers at the Zonal railways to manage PPP projects. A PPP cell should be constituted in each zone to identify, develop, implement and monitor projects at the zonal level.

Source: Report of the Expert Group for Modernisation of Indian Railways, Ministry of Railways, 2012.

straints and remains underinvested, the road sector has witnessed a surge in investments (both public and private). The launch of the ambitious National Highways Development Project (NHDP) brought about a phenomenal improvement in the national highways.

As a result of the severe capacity constraints and distortions in relative allocation of resources, IR has seen a fall in the share of both passengers and goods transported over the last 60 years. *The non-optimal intermodal distribution is estimated to cause a loss of about 4.5 per cent of GDP to the nation's economy. It is essential that an attempt is made to reverse this declining trend in railway's share or, at a minimum, to arrest it*. If this is not done, the progressive achievements of the NHDP will only accelerate the loss in the railways' transport share leading to greater pollution and environmental degradation.

Thus, the key issue facing the country relates to the desired strategy for capacity expansion of the railways over the next 20 years. All projections for the growth in demand for both freight and long distance passenger services suggest that overall economic growth could be stymied if appropriate strategic choices are not made now to facilitate significant capacity expansion of the railways. If consistent economic growth of 7-10 per cent per annum is to be achieved over the next 20 years, there is a pressing need for unprecedented capacity expansion of the railways for both freight and passenger traffic in a manner that has not taken place since independence.

The massive capacity expansion, as envisaged, will not take place in a business as usual scenario. Hence it is of the utmost importance that a vision similar to that of NHDP is laid down for railways so that we may expect a transformed railway network by 2032. This will have to be supported by *(a) the required organisational changes, and (b) certain strategic decisions in terms of the relative allocation of resources between rail and road*.

Choices will need to be made on the priorities to be placed on different investments. This implies some judgment on the normative modal shares that are desired for rail, road, air, shipping, and inland waterway traffic. At present, this prioritisation and decision-making are disjointed. A coordinated approach needs to be taken focusing on significant augmentation of technical capacity, investments in capacity building and R&D, executing the required organisational reforms and accounting reforms, setting up of the rail tariff authority, among other things. The important recommendations for each of these areas are summarised below:

ORGANISATIONAL REFORMS

The key issue to be addressed in the reform of Indian Railways is the institutional separation of roles into policy, regulatory and management functions. Currently, these roles are blurred with the Railway Board essentially performing all the three roles put together. This causes confusion about the underlying vision and mission of the Indian Railways. Consistent with Railways reforms in other major countries and with those in other infrastructure sectors in India, the NTDPC recommends the separation of Railways management and operations from the Government. The Ministry of Railways (or the unified Ministry of Transport) in the future should be limited to setting policies; a new Railways Regulatory Authority would be responsible for overall regulation, including the setting of tariffs; and the management and operations should be carried out by a corporatised entity, the Indian Railways Corporation (IRC) to be set up as a statutory corporation, which would retain many of the quasi governmental powers endowed to the Railways under the current Act. Existing railways corporations such as CONCOR, DFCCIL, and the like will become subsidiaries or joint ventures of the IRC.

For these reforms to be implemented, the Railways Act, 1989, and the Indian Railway Board Act, 1905, will have to be amended accordingly.

These reforms will be very complex and the NTDPC recommends widespread consultation with major stakeholders including the staff and unions of the railways system. This process may take upto 5 years. During this period, the Railway Board should be reorganised along business lines consistent with the recommendations of the 2001 Expert Group on Indian Railways and those of the 2012 Expert Group for Modernisation of Indian Railways.

The NTDPC also recommends the corporatisation of the existing public sector Railways Production Units. Each of the production units could be set up as a corporate subsidiary of a holding company that oversees all the production units. Plan should be drawn for their expansion and modernisation to emerge as globally competitive players.

To facilitate these reforms, the NTDPC recommends that the Railways should undertake recasting of its accounts in a company account format consistent with accounting norms under the Indian GAAP. This is feasible to do since it has already been on a pilot basis twice: first by the Railways Capital Restructuring Committee of 1994 and the Expert Group of 2001.

Furthermore, in preparation of the overall corporatisation of the railways system, the existing organisation of the Railways needs to be reorganised on business lines. Indian Railways is presently organised in terms of several functional departments like Civil Engineering, Mechanical Engineering, Electrical Engineering, Signal and Telecom. It should be reorganised in terms of business lines such as infrastructure management, freight transportation, passenger transportation, parcel and miscellaneous activities should similarly be organised as separate profit-centres by IR.

All activities falling outside the core transportation operations should be critically reviewed from the perspective of either retention or outsourcing.

GMs of Zonal Railways to be empowered to take decisions that enhance revenue, reduce costs or build platform for higher growth in future. GMs should have the power to take such decisions without reference to Railway Board within a framework of rules and investment limits. Simultaneously, the Zonal

The existing Railways Production Units should be corporatised. Each could be set up as a corporate subsidiary of a holding company that oversees all the units.

Railways would be made accountable for return on capital, transport output, profitability and safety.

Organisational and institutional deficiencies inhibiting PPP need to be identified and addressed. Decision-making for PPP projects needs to be streamlined. Capacity building for officers handling PPP projects both at the ministry and the field level needs to be taken up with help of professional bodies. The existing PPP policy framework should be reviewed in the light of hitherto poor response and PPP experience

GOALS FOR 2032, STRATEGIC PLAN AND BUSINESS STRATEGY

Optimal market share in freight: Aim to attain 50 per cent market share in inter-regional freight traffic by 2032, up from the current level of about 33 per cent.

Indian Railways to satisfy passenger service demand in full.

A shift of long-distance (500 km and above) transport of parcels - essentially non-bulk packaged items - to rail is a must.

Indian Railways to institutionalise a strategic planning process taking a forward view over the next 20 years. The strategic plan has to be necessarily prepared involving the Zonal Railways and key stakeholders and will clearly lay down the goals to be aimed at and attained and the path to be traversed. A multi-year investment plan fully supported by a credible funding plan will form the bedrock of the strategic plan.

FREIGHT AND PARCEL BUSINESS STRATEGY

- Indian Railways to capture a significant share of the fast-growing FMCG, Consumer Durable and Information Technology (CDIT), containerised cargo and other segments like automobiles, etc., where its presence is negligible. In this regard an organised intermodal transport system which will combine the advantages of rail with that of road is needed.
- Setting up of a focused business organisation for multimodal transport of non-bulk commodities (e.g. parcels) under the PPP mode, combining the efficiency and advantages of rail and road.
- Development of a few selected corridors for heavy-haul operations.
- Development of last mile connectivity on PPP in a time-bound manner
- Running of freight trains at 100 km per hour.
- Running of premium freight services with differential pricing and assured deliveries.
- Supply of rakes on demand with differential pricing for different demand lead times.
- Running of trains on schedule with guaranteed transit time.
- Running of automobile, hazardous material trains, movement of bulk cement, etc by private train operators.
- Reduction in cargo parcel size to 1,000 tonnes and aggregation mechanism for even smaller parcel-sizes.
- Indian Railways to work closely with state and city authorities to set up rail-based multimodal logistics parks to attract increasing volumes of miscellaneous cargo to rail.

PASSENGER BUSINESS STRATEGY

- Upgrade speed to 160-200 kmph on select corridors.
- Shift of focus to long-distance and inter-city transport and suburban corridors involving dense passenger movements.
- Redevelopment of stations for smooth flow and comfortable experience of passengers as also to ensure clean and hygienic environment.
- Redesign of coaches to enhance travel comfort.
- Conversion of all stopping passenger trains to EMUs/DMUs or railcars; invitation to state governments to manage uneconomic and unpatronised services.
- Augmentation of supply (more trains and longer trains) to ensure full satisfaction of demand.

CAPACITY CREATION

Construction of 6 Dedicated Freight Corridors on top priority. The Eastern DFC must be given the highest priority among the DFCs, and should be completed within the 12th Five Year Plan. Further, construction of Eastern, East-West and East Coast DFCs must start from the eastern end. Private sector participation should be encouraged for development and operations of the DFCs.

Eight critical feeder routes for coal with a combined length of about 600 km and several other critical links for the steel industry with a combined length of about 2,340 km must be completed on the highest priority within the 12th FYP.

Improved connectivity to industry clusters as well as significant ports (major and non-major), based on

their current and projected traffic volumes. Development of last-mile connectivity should be encouraged through PPPs.

Development of 15 to 20 logistics parks as the main network hubs viz. Mumbai Bangalore, Cochin, Hyderabad, Kolkata, Delhi NCR, Ahmedabad, Nagpur, Vishakhapatnam, Siliguri, etc.

Given the massive investment requirement for rolling stock, the capacity for manufacturing rolling stock and components must be increased substantially.

Upgrade wagons and track to 25-tonne axle load.

Upgrade rail wagons (higher axle load , better tare-to-payload by shifting away from carbon steel to stainless steel and aluminium/ other light-weight bodies, increased payload of covered wagons (BCN) through use of well wagons, better maintenance cycles, etc).

Expand partnership with private sector to facilitate development of private freight terminals, operation of container, automobile and special freight trains and third-party leasing of wagons.

IR should achieve physical separation of the long distance network and the suburban network. The segregation of suburban and long distance passenger/freight traffic is necessary for efficient provision of commuter service. A separate organisation should be created for suburban services with freedom to coordinate with state governments for connectivity/integration.

Development of select High Speed Corridors (speed potential 350 Kmph) on a pilot basis, if and when deemed to be economically viable.

INVESTMENT PLANNING

IR needs to shift to a programme approach from the current project-oriented approach.

Quick pay-off projects that can ease the capacity constraint the fastest should be prioritised.

Investment should be focused on total capacity creation including rolling stock, asset renewal, technology induction, information technology, identified investments in modernisation, etc.

A more integrated approach is required to be taken of transport as a whole and choices will need to be made on the priorities to be placed on different investments. Priority should be given to projects such as DFCs which are self financing and critical to achieve the target of 50 per cent share of railways in freight transport, as compared to projects such as HSR network which require continuous fiscal support.

IR should physically separate the long-distance and suburban networks. A separate organisation should be created for suburban services with freedom to coordinate with state governments for connectivity/integration.

A programme for raising speed to 160-200 kmph on selected existing routes should be undertaken, till the time the HSR projects are found commercially justified or operationally required to cater to the country's growth and mobility needs.

IR should encourage participation of private players (both domestic and international) in setting up manufacturing facilities for rolling stock and components. This would facilitate induction of world-class technology, besides being a source of capital for the resource constrained IR.

Replacement and renewal of assets should be ensured. The ad hoc approach presently followed in respect of appropriation to Depreciation Reserve Fund needs to be overhauled and a rule-based approach needs to be put in place.

PROJECT EXECUTION

Considering the need for massive capacity augmentation over the next 20 years, a separate body/ organisation, partially independent of the Ministry of Railways should be set up to expedite the delivery of projects. All works having a budget outlay of more than Rs 5 billion (or may be Rs 10 billion) should be entrusted to an 'Authority', which may be called the 'National Railway Construction Authority' (NRCA). The NRCA would be an umbrella organisation having a national level presence, fully autonomous, and having extensive powers for award of works. It will award contracts for construction, supervise quality of construction and would ensure smooth flow of funds for the works to continue unimpeded. Repayment of loans, tax-free bonds, etc. would be channelised through it.

All capacity enhancement projects should be taken up after ensuring that funding is earmarked for each project. The concept of financial close may be introduced for each project.

Project teams to be held accountable for timely completion of the projects. Project managers to continue in their positions till project completion. Performance-linked incentives should be provided and penalties for failure should also be imposed.

A comprehensive railway safety policy with measurable indicators for evaluation for a five-year and 10-year period must be announced before the end of 2015

TARIFF

As has already been approved by the Government, independent Rail Tariff Authority should be set up with the mandate of fixation of rates and fares.

As the overall railways reform proceeds, this Authority can be changed into an overall Railways Regulatory Authority which would encompass tariff setting, along with other regulatory functions.
Service-based pricing to attract traffic for bagged bulk commodities and non-bulk commodities.

A realistic programme of fare revision should be designed to reduce/eliminate the losses on passenger services. The government may subsidise up to 25 per cent of the costs of Suburban railways and no subsidy should be provided for non-suburban railways.

SAFETY

Establish a National Board for Rail Safety which is independent of the operational agencies to avoid conflict of interest. The CEO of the Board should be of a rank of Secretary to the government of India and should report directly to the Railway Minister. The Board will also conduct statutory inquiries into train accidents occurring on the Indian Railways, presently being conducted by the Commissioner of Railway Safety.

Establish/strengthen Safety Department within operating agencies (at different levels—Railway Board, Railway Regional headquarters) for ensuring day-to-day compliance with safety standards, studying effectiveness of existing policies and standards, conducting safety audits, collecting relevant data, etc.

A railway safety policy with measurable indicators for evaluation for a five-year and 10-year period must be announced before the end of 2015.

Reform data collection and analysis procedures for traffic accidents in consonance with international practices at different levels: National broad-based data, detailed survey systems for fatal cases, sampling systems for medical data, etc.

RESEARCH AND DEVELOPMENT (R&D)

Establish **Railway Research and Development Council (RRDC),** an apex body that will replace the Governing Council and will be chaired by an eminent technologist/scientist, with the Chairman and Technical Members of the Railway Board as its members. RRDC shall provide the perspective plan stretching over a reasonable period of 10 years for research and development needed for the Railways. The Director General of the proposed RRDI, the Director General of RDSO and 2 Directors of the proposed Academic Centres of Excellence shall also be ex-officio members. It will also have one representative each from the academic world and research organisations.

Establish **Railway Research and Development Institute (RRDI),** a multidisciplinary research organisation for applied research on current concerns and future technology development for Railways. The RRDI should be supported by six or seven Regional Railways Institutes, which focus on the research requirements specific to their region. The head of the RRDI should report directly to the Minister of Railways or the CRB. It should target recruiting close to 300 researcher professionals by the end of the 13th Plan, with a healthy mix of Ph.D. degree holders, engineers, architects, professors from national and international universities etc.

Establish **Academic Centres of Excellence or Railway Research Centres (RRCs)** in at least 13 technical institutes and at least two IIMs by 2020. These should be in the nature of full scale research centres where faculty can interact within a sizeable group. The RRCs should be provided grants in aid for establishment expenses, building, facilities, laboratory, equipment etc. In addition to equipment, supplies, travel and research funds, the funding must include 5-10 endowed permanent Chairs and 10-20 endowed post-graduate scholarships.

The functions of the RDSO should be completely redefined and actions should be initiated to revitalise and strengthen it. RDSO should involve itself with only technology upgradation, implementation and setting of standards; it should not be responsible for inspection.

Manufacturers of railway products to be involved in R&D for both new technologies as well as for improvement of existing systems and products. Setting up of new units with participation of private sector would also be useful in ensuring technological upgradation.

Result-oriented research teams should be set up to work on specified research projects. Such teams may include participants from outside IR, including from research/academic institutions and OEMs, contracted for the duration of the project.

An Integrated Energy Management System (IEMS) need to be set up under a separate directorate in the Railway Board.

INTERNATIONAL RAIL LINKAGE

IR should exhibit greater urgency and expedite the execution and operationalisation of identified inter-country connectivity projects as well as the execution of bilateral agreements, for smooth and seamless movement of intra-regional traffic among neighbouring countries. It is recommended that IR should give top-most priority to the projects to be taken up with Nepal and Bangladesh

Improvements in rail connectivity with neighbouring countries required on diplomatic and political considerations should be fully funded by the exchequer.

OPTIMISATION OF LAND USE

Infrastructure Corridors: Suitable directives to be established whereby whenever a new transport infrastructure—rail or highway—is built, the corridor must provide for segments of the infrastructure, i.e. if a new port comes up, the rail connectivity must be in a corridor that also provides for highway, power lines, combined terminals, etc.

Schedule of Dimension (SOD) and Maximum Moving Dimension (MMD) improvement should be undertaken.

A standard template can be developed for redesign and redevelopment of the stations that maximises comfort for commuters and create space for premium retail in station premises.

INFORMATION TECHNOLOGY

Computer and Information Systems (C&IS) directorate at the Railway Board should be greatly enhanced as to encompass the entire gamut of ICT applications on the network.

Centre for Railway Information Systems (CRIS) should be converted from a society to a non-profit company with much greater freedom.

Organisation(s) for operationalising ICT applications at field level should be converted into autonomous bodies.

IR Institute of Transport Management (IRITM) should be entrusted with the task of human resource development.

HUMAN RESOURCES

Multiple services and cadres of Railways at the management level need to be rationalised and coalesced into fewer services in preparation of and to be consistent with the overall railways reform being proposed. The recruitment to the railway cadres of officers should be totally dissociated from the Civil Services and Central Engineering Services exams. The SCRA exam should be upgraded to recruit candidates, who are already graduates, to two streams of Railway Service viz. Indian Railway Technical Service and Indian Railway Logistics Service, while overall reform is undertaken.

Induction of unskilled staff to be reduced and gradually done away with.

The recruitment processes to be supplemented by well researched and meticulously developed induction and in service training to constantly upgrade the skills of employees.

Recruitment of highly qualified PhDs from IIMs/IITs and lateral recruitment from market would be considered for specialist functions with suitable compensation.

A system of reward for collective performance and variable pay linked to incremental surplus generated by various units to be implemented.

Annex 1.1

International Comparison of Modal Share of Domestic Freight

The modal share of rail freight ranges from only 3 per cent in Japan to around 65 per cent in Russia. Although the range of traffic types carried by railways in each country is similar, the overall contribution to the domestic freight task differs in each country. The proportion is influenced by management performance and also by (a) the actual freight markets offering and whether they are suited to railways; and (b) the existence and extent of domestic waterborne transport (coastal shipping and/or inland waterways). Since railways and these waterway services target many of the same market segments a large commercial waterway sector will significantly constrain railway modal share. The table below summarises some of the country specific factors involved:

COUNTRY	MODAL SHARE* OF DOMESTIC FREIGHT (EXCLUDING PIPELINES)
Australia	Railways carry about 44 per cent of domestic freight. Because of concentration of population and industry around the coast, the coastal shipping industry carries a substantial 20 per cent.
Canada	Railways carry about 66 per cent of domestic freight. The high market share is influenced by Canada's long east-west distances, but water transport (coastal shipping and St Lawrence/ Lakes transport) is significant with about 12 per cent modal share.
China	Railways carry about 51 per cent of domestic freight. Waterways (including both coastal shipping and over 24,000km of commercially significant inland waterways) perform a very large role in China carrying about 27 per cent of traffic.
Germany	Railways carry about 19 per cent of domestic freight. Germany has little bulk traffic and faces rather short rail distances; it also has an extensive inland waterway network consisting of the Rhine River and its tributaries, and a solid canal network, which together carry about 18 per cent of freight.
Japan	Railways carry about 3 per cent of domestic freight; because of its island geography, coastal shipping is the overwhelmingly dominant carrier with 58 per cent modal share.
Russia	Railways carry about 65 per cent of total freight. Russia's main waterways are south-north (which is contrary to main traffic flows); also the long east-west distances and relatively poor east-west road system contribute to the very high railway modal share.
United States	Railways carry about 44 per cent of total domestic freight. The USA has important coastal shipping links and about 12,000 km of commercially significant inland waterways (dominated by the Mississippi-Missouri river systems), which together carry about 25 per cent of freight.

China, Germany, Japan and Russia are, like India, mixed-use railways with significant freight volume but also heavy passenger train use of the network. By contrast, Australia, Brazil, Canada and the USA have only marginal passenger train activity outside the cities. Not having to share the network with a substantial passenger rail service affords both institutional and operational freedom on rail freight service. Nevertheless, the freight railways in those countries contain some of the most efficient land-based freight operations in the world and much of this experience is equally valid for mixed-use rail systems.

Note: Modal share does not equate to market share. Different modes can only 'share' markets where they exist as viable alternatives in those markets. The market reach of road networks is much greater than of railway systems, and that of rail systems exceeds that of waterway networks.
Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Paul Amos, July 2011.

Annex 1.2

Routes Suggested for Increasing Maximum Permissible Speed to 160-200 kmph

Source: Report of the Working Group on Railways (NTDPC).

Annex 1.3

Forms of Government Financial Support of Railway Passenger Services

TYPE	CHINA	GERMANY	JAPAN	RUSSIA
Compensation for carriage of specific user groups	No	Minor (less than 2 per cent of second class revenue on long-distance services)	No	Yes
Specific operating subsidies	No	Contract payments from regional administrations for public service contracts	No	Contributions towards regional companies from corresponding regional administrations
General operating subsidies	No	No	No	Deficit support of passenger revenue shortfalls during reform process.
Specific capital support	Grants for building new lines to remote areas	Replacement infrastructure investments, set out in a performance agreement with govt. Interest free loans and grants towards projects included in the federal transport infrastructure plan	The fees for rail company use of many high speed lines are set at less than full commercial rates on some lines.	For projects contained in the federal target programme. For 'special' projects (currently dominated by Olympic projects)
General capital support	No	No	No	Equity injections for maintenance repair and rehab.
Support from freight services	Freight services pay disproportionate share network costs	No	No	Freight services pay disproportionate share of network costs

Source: Passenger Railway Institutions and Financing: China, Germany, Japan and the Russian Federation, Paul F. Amos, 5 September 2011.

Japan's Funding System

Japan's passenger railway sector is operated by private companies according to commercial principles. The three major, privately-owned, JR companies must fully cover the train operating and network infrastructure costs of their operations with commercial revenues, and finance their own capital programmes. They receive no revenue subsidies from the Japanese Government and must finance their own infrastructure development programmes, though special provisions apply to the development of the Shinkansen Network.

Most of the companies have diversified into a wider range of non-railway (and non-transport) businesses. These include businesses based on use of railway property and air-rights. The many non-JR companies generally earn an even greater share of revenue from non-transport businesses. The financial performance of the largest JR passenger company, the East Japan Railway Company (EJRC), is illustrative of the financial structure of the passenger railway industry in Japan. Of its operating income around two-thirds is earned from transport (mainly railways but including bus services and the Tokyo monorail), 9 percent from commercial exploitation of its own stations, 18 percent from other shopping and office centres, and 9 percent from various ancillary businesses. The company has 75 subsidiaries in all (each of its 25 shopping malls is managed by a separate subsidiary).

Although commercially independent, the Japanese Government imposes a number of general obligations on the JR passenger railway companies, including appropriate setting of passenger fares and rates structure; facilitation of smooth inter-company transfers by passengers; maintenance of the currently operated railway routes with due notification and process if line closure is envisaged or stations and other railway facilities are to be developed; and consideration of the impact of company diversification plans on small and medium-sized enterprises engaged in similar business in the same areas to avoid unfair impact.

The government is involved in financing the Shinkansen (bullet train) network. The Tokaido Shinkansen, a 515 km high-speed passenger-dedicated line opened in 1964. **This first route was a financial success** and by 1967 revenue exceeded operating costs, including interest and depreciation. The succeeding Shinkansen lines, while generally earning sufficient to cover operating and mainte

(Contd...)

nance costs, were less heavily used and able to contribute little towards capital recovery. Shinkansen-related debt was JPY 5.7 trillion by 1987 and Japanese National Railways were wound up with a significant portion of this debt relieved.

The capital cost of new Shinkansen railway construction projects is now shared by the national government (two-thirds) and local governments (one-third) along the railway lines. The railways are constructed and owned by a government corporation but managed and operated by the companies. Passenger railway companies pay a levy for the use of this infrastructure. The maximum charge is equal to the profits from the new Shinkansen operations. Therefore decisions to build new lines involve a detailed appraisal of the impact on the profitability of the railway company. A little more than half of the national government funding comes from the payments received from companies for use of existing Shinkansen lines while the remainder comes from Japan's General Account.

Source: Passenger Railway Institutions and Financing: China, Germany, Japan and the Russian Federation, Paul F. Amos, 5 September 2011.

Russia's Funding Structures

The Russian passenger railway sector has undergone reforms over a period of 10 years from 2001 to convert the railway sector from the wholly vertically and horizontally integrated structure inherited from the Soviet Union to one based on commercial, corporatised structures focused on specific business activities and private sector participation in train operations. Prior to the 2010 reforms, passenger services were run directly by Joint Stock Company Russian Railways (RZD – a defined 'strategic' company whose shares were owned by the Russian Federation). As part of reforms RZD transferred staff and assets to the newly formed Federal Passenger Company, which manages long-distance rail passenger services. Their aim is **transparency of financial performance, eventual elimination of cross-subsidies, and the ability to set locally economically justified tariffs.**

RZD passenger services receive several forms of financial support from the Russian Federal Government and modest contributions from regional administrations. Revenue support of various kinds appears to have been about RUR 41 billion (US$1.3 billion as of November 2012) or just over 15 percent of the total income of the RZD companies and subsidiaries. There is also capital support of passenger railway links in preparation for the 2014 Sochi Winter Olympics and for a new airport link in Vladivostok (these categories of support are clearly of a special and short-term nature). Passenger services have also benefited from federal support of around RUR 39 billion to rail network infrastructure in 2010, although rail freight, which constitutes around 90 percent of traffic-kms in Russia, is likely to have been the main beneficiary.

RZD raises debt for its own funded investments through loans and bonds. As at the end of 2010 total debt is reported as RUR 297.6 billion consisting of RUR denominated bonds (63 percent), Euro-denominated bonds (15 percent), project finance (11 percent), syndicated loans (8 percent) and bilateral loans (3 percent).

Russian passenger services earned accounting losses in 2011, but long-distance services as a whole probably contributed positively to network infrastructure costs. Long-distance services cover about 80 percent of their fully allocated expenses and suburban/regional services about 56 percent of fully allocated expenses. This implies that long-distance services cover their train operating costs (which are expected to be less than 80 percent of the total costs) and make a modest positive contribution to infrastructure network costs, while suburban services as a group do not even cover train operating costs.

Source: Passenger Railway Institutions and Financing: China, Germany, Japan and the Russian Federation, Paul F. Amos, 5 September 2011.

Germany's Funding System

Germany's two main state-owned rail passenger service providers, DB Long-distance and DB Regional, both benefit significantly from government financial support from two main sources. DB and its subsidiary passenger and infrastructure companies are responsible for financing their operations, management and maintenance expenses entirely from revenues.

However, a major portion of the revenue earned from regional passenger services (whether run by DB Regional or private contractors) is from government funded **passenger public service contracts between the regional company and the administrations** on whose behalf specific services are run at agreed fare schedules and structures. This support represents about 56 percent of DB Regional's total revenue.

Moreover, while track access charges paid by operators to DB Netz are sufficient to cover the expenses of track operation and maintenance, access income only finances a small part of the capital costs of renewal, upgrading or of new rail infrastructure. **Most of the capital cost is funded by government grants and non-interest bearing loans,** which partly come from petroleum taxes and the EU. DB contributes funds of its own towards such projects insofar as they are in its own business interests (it has contributed around 15-20 per cent of the total). Over the last few years, the Federal government has contributed an average of EUR 1.2 billion/year to new-build and upgrading projects.

A third, source of federal government funding is **payment to providers for trips made by certain community groups** such as severely disabled passengers, and military (or alternative) national service travellers. This constitutes a minor portion of passenger revenue (less than 2 percent of second class revenue on long-distance services).

The German model of concessioning of suburban/regional networks through competitive tender has provided good value for money. According to DB, the Federal Länder (states) now have to spend less public funds to obtain a far higher level of traffic performance in regional rail service than at the start of the rail reform (According to the DB Annual Competition Report 2011, after adjustment for inflation, the Länder received 37 percent more performance for each euro in 2009 than they did in 1996).

Additional government support to DB companies is also given through borrowing guarantees. This includes explicit sovereign guarantees for loans from Eurofima, a company set up by a number of European railways to finance purchase of railway rolling stock. Because DB is 100 percent owned by the German Federal Government, the raising of capital by the DB Group is also assisted by market perception of an implicit government guarantee on bonds issued by the DB Group's financing company, DB Finance.

Source: Passenger Railway Institutions and Financing: China, Germany, Japan and the Russian Federation, Paul F. Amos, 5 September 2011.

ANNEX 1.4
REORGANISATION INTO 7 CADRES

[ALTERNATIVE VIEW ON HUMAN RESOURCE MANAGEMENT]

- While the recruitment to the Indian Railway Medical Service, the Security Service and the Indian Railway Stores Service can continue as hitherto, the balance 7 railway cadres may be reduced to 4 as under:
  i. Indian Railway Traffic Service, recruitment done through the Civil Services Examination as now.
  ii. Indian Railway Service of Engineers, recruitment done through the Combined Engineering Services. This service will be responsible for the maintenance of fixed infrastructure (track, formation including bridges, buildings, signaling, over head electrical traction system etc). The initial qualification may be prescribed as a graduate in Civil or Electrical Engineering and no other branch. It may be mentioned that till the 1950s, Signaling Cadre was a part of the Indian Railway Service of Engineers.
  iii. Indian Railway Service of Mechanical & Electrical Engineers, recruitment done

through the Combined Engineering Services. This service shall be responsible for the 'rolling' infrastructure, that is, locomotives, coaches, wagons etc. The initial qualification will be a graduate in mechanical or electrical engineering.

The SCRA exam would be done away with; it is a historical legacy of 1926; and when graduate engineers are available, the need for SCRA does not exist. In fact, the Ministry had stopped recruitment for two years due to the reluctance of UPSC to conduct such a recruitment and it was restarted more for sentimental reasons. Qualifications as now prescribed by UPSC do not prohibit an electrical engineer joining the IRSE cadre or a mechanical engineer joining the IRSEE cadre. And, the Railways have had such examples.

iv. Indian Railway Accounts Service, recruitment done through the Civil Services Examination as now.

- Recruitment to the Indian Railway Personnel Service, now done through the Civil Services Examination, may be discontinued. This service was the last to be added in the 1970s. While it is not anybody's argument that a specialised service dealing with human resources is not required- all corporate organisations have this distinctive group to assist- the situation in IR is different. Being a part of the GoI, the role a HR manager plays is limited. All establishment policies and emoluments are uniform for the civil services. The posts of 'personnel officers' can be filled by officers from the four services mentioned above, as was the case earlier, if necessary after a short course on HR and establishment at Vadodra.
- On selection to the Indian Railway Service of Engineers, the candidates should be admitted to a preselected Institute of Technology such as an IIT or NIT for professional training of one year's duration. This training will enable a graduate in one discipline of engineering to learn basic aspects of engineering in other disciplines; thus one with civil engineering qualification will have adequate coverage of basic electrical engineering subjects and vice versa so that the officers have a holistic approach to the railway related issues. The training modules will thus be specific for graduates of any one specific discipline. Similarly, candidates selected for the Indian Railway Mechanical & Electrical Service will undergo a year's course in each other's discipline for a good grounding of the basics of the discipline.

  After successful completion of their course, the officers of these two services will spend their further probationary period as now, except that they will also be trained in the Institutes at Nasik, Secunderabd and Jamalapur as the case may be. The impact of combining the existing services is a prolongation of the probationary period by one year. However, we would have initiated a process of reducing the number of services and thereby limit the problem of departmentalism in the organisation and attuned with the organisational reforms proposed.
- Officers of the two cadres— Indian Railway Service of Engineers and the Indian Railway Service of Mechanical & Electrical Service should be put through cross-disciplinary rotation; one concomitant requirement would be to increase the proportion of Group B officers in the cadre and reduce Group A cadre correspondingly. A better qualified and trained Group C cadre— the supervisory cadre - is a sin qua non for this proposal as it is this cadre that deals with day to day operations and management. Cross disciplinary rotation was a recommendation of the Prakash Tandon Committee too.
- The candidates selected for the Indian Railway Accounts Service and Indian Railway Stores Service will undergo training as hitherto and of the same duration. Similar will be the case with the Indian Railway Traffic Service. The Prakash Tandon Committee had recommended that those joining the Indian Railway Accounts Service should have a financial background; this can be achieved either by prescribing an initial qualification while applying to the UPSC or suitably including the subject in the training modules.
- Once this process of change in the initial recruitment is put in place, we can create a superior managerial cadre of leaders after 14 to 16 years of service from out of three services IRTS, IRSE and IRSM&E. These officers can be selected by a process of assessment by a Committee of Members of the Board and with participation by UPSC. The present practice of basing the selection only on annual confidential reports would be given up. The process of selection will have well developed criteria such as leadership quality, decision making capacity, proven performance, ability to work with a diverse group, analytical ability etc. A batch so chosen will be relatively small in number and with their inter-se seniority fixed. The batch will receive training in a management institute which will include logistics, supply chain management, multimodal transport, PPP, finance as relevant for a corporate body including issues related to investment and its appraisal, etc. They will man the posts of Additional Divisional Railway Managers, Divisional Railway Managers, Chief Vigilance Officers, Chief Personnel Officers, General Managers etc. In this arrangement, the Managers will have long stints unlike today

when the DRMs remain in the chair only for 2 years and the organisation suffers the consequences of frequent changes, lack of direction and cohesion at the divisional level. This will undoubtedly benefit the organisation and a sense of direction, focus will be inculcated.

- Further, recruitment of highly qualified PhDs from IIMs/IITs and other science and engineering institutions in India and abroad should be encouraged for specialist technical functions such as for structures, signaling and telecommunication, etc. Such recruits can either be on a contract basis or on regular employment with attractive compensation packages.
- Lateral recruitment from the market for jobs in R&D and marketing should also be considered. IR needs to transform into a smart organisation through a constant process of technological upgrade and stress on customer focused growth. This requires that personnel at all levels are recruited and trained with a view to building skills and attitudes required for attainment of the organisational goals.

ANNEX 1.5
RAIL CONNECTIVITY WITH NEIGHBOURS: THE PRESENT STATE[22]

Historically, the rail network of the region prior to independence and partition constituted an organic system. However, in the post- independence and post -partition period, rail systems of South Asia have developed in the national context with little consideration for cross-border connectivity and interoperability or compatibility/uniformity of standards in infrastructure and equipment. The current country-wise status is presented below.

Bangladesh: A number of connections existed between India and East Pakistan (now Bangladesh) at the time of independence. These include: Haldibari (India) - Chilahati (Bangladesh), Gitaldaha (India) –Mughalhat (Bangladesh), Agartala (India) - Akhaura (Bangladesh) and Shahbazpur (Bangladesh) –Mahishasan (India). Many of these, however, fell into disuse over the years. At present, railway systems of India and Bangladesh are linked to each other at five points. Of these, three BG links, namely, Gede (India)-Darshana (Bangladesh), Singhabad (India) - Rohanpur (Bangladesh) and Petrapole (India)-Benapole (Bangladesh) are currently open for freight trains. A bi-weekly passenger train, 'Maitree Express' introduced on 14 April 2008 also runs between Kolkata and Dhaka Cantt. via Gede-Darsana route. The other two links, though in existence, lie dormant at present. These are:

1.	Radhikapur(IR)-Birol (BR)	BG on Indian side, MG on Bangladesh side. Inoperative since 1 April 2005
2.	Mahishasan(IR)-Shahbazpur (BR)	MG. Extensive damage by floods. Not functional since December 1996. Track on BR side needs strengthening

Over the years, the gap between BR and IR in regard to the loading capacities of rolling stock, length of passing loops, size of trains, braking systems, etc has widened. Difference in ground infrastructure and technology platforms has adversely affected interoperability. On the positive side, construction of a rail-cum-road bridge over the Ganga (Jamuna) with provision of dual -gauge rail tracks suitable for both MG and BG operation has connected the previously isolated east and west rail networks.

Akhaura, which was the rail-head for Agartala during the British colonial rule in undivided India, served as a major link between Chittagong port and Tripura. IR have now extended the MG rail network up to Agartala and are extending it further south to Sabroom located on Tripura's border with Bangladesh. India has offered assistance to construct the MG Akhaura-Agartala rail link.

Pakistan: As with Bangladesh, there used to be several rail connections between India and Pakistan at the time of independence. Many of these connections fell into disuse over time. At present Attari-Wagha and Munabao-Khokhrapar links (both on BG) are operational. Attari-Wagha route is used to run both freight and passenger services, while a weekly passenger service runs through Munabao-Khokhrapar. Other links which are no longer in use are: Sialkot (Pakistan) - Jammu (India), Dera Baba Nanak (India) - Jassar (Pakistan), Hindumalkote (India) - Mandi Sadiq Ganj Jn.(Pakistan), Fazilka (India) - Mandi Sadiq Ganj Jn. (Pakistan), Hussainiwala (India) - Ganda Singhwala (Pakistan) and Khemkaran (India) - Kasur Tehsil (Pakistan). Uneasy relations between the two countries have prevented any serious efforts to re-establish these connections.

Nepal: Nepal had a small narrow-gauge network. In 2004, an ICD which also serves as a rail terminal for bulk traffic was operationalised at Birgunj and connected to Raxaul on the Indian Railway network through a new 6-km long broad- gauge line. It deals with both inbound and outbound bilateral traffic from and to India and third country traffic through Kolkata

22. Report of the Working Group on Railways (NTDPC).

Rail Routes Surveyed for Nepal

PROJECT	LENGTH (KM)	ESTIMATED COST (RS BILLION)	RATE OF RETURN: PER CENT
Jaynagar-Bijalpura-Bardibas	69	4.7	-5.7
Nepalganj Road-Nepalganj	12	1.5	Negative
Nautanwa-Bhairahawa	15	1.8	-4.14
Jogbani-Biratnagar	18.6	2.1	-3.6
New Jalpaiguri-Kakarbitta	70	3.4	-3.6

Rail Routes Surveyed for Bhutan

PROJECT	LENGTH (KM)	ESTIMATED COST (RS BILLION)	RATE OF RETURN: PER CENT
Banarhat-Samtse	23	2.05	-4.6
Hasimara-Phuentsholing	18	1.68	6
Kokrajhar-Gelephu	58	2.94	-9.7
Pathsala-Nanglam	51	6.69	4.7
Rangia-Sandrupjongkhar via Darranga	41	6.07	-8.2

and Haldia ports. Survey for five other rail connections between the two countries has been conducted:

Of the above, Ministry of External Affairs has decided to fund the Jaynagar- Bardibas and the Biratnagar-Jogbani lines. These have been sanctioned and taken up by Indian Railways for execution. In addition, Ministry of Physical Planning and Works, Nepal got a techno-economic survey carried out in 2006 for a rail line to connect Birgunj with Kathmandu. The survey estimated the cost of the 160 km long BG electrified rail line along Kathmandu-Thingari-Kaveri-Hetuada-Pyramidi-Amlekgunj-Pathlauja-Birgunj alignment at Rs 30 billion.

Bhutan: Bhutan does not have a railhead and is dependent on the stations on New Jalpaiguri-Guwahati Broad Gauge line in North East Frontier Railway for its rail transportation. Government of India commissioned studies for the following five connections to Bhutan:

Of the above, the Hasimara-Phuentsoling line which will connect Bhutan to the Indian Railway BG network has been proposed for construction.

Myanmar: Myanmar constitutes the crucial missing link or land-bridge between India and South-east Asia. Adequate connectivity with Myanmar would be an essential first step towards the integration of India's North-east region with South-east Asian economies.

Rail linkages envisaged in the Trans Asian Railway project includes connections to Moreh in Myanmar from Jiribam in Manipur via Imphal. At present, work is progressing on the construction of a new line between Jiribam and Imphal.

In 2008, India signed the Indo-Myanmar cooperation agreement on the Kaladan multi-modal transport project. Although this project envisages use of riverine and road transport to connect Sittwe with Mizoram and Manipur, a railway line from Silchar longitudinally through Mizoram connecting Sittwe port will provide access to the land -locked regions of North Eastern India, in particular, states of Mizoram, Manipur, South Assam and Nagaland .

Sri Lanka: India and Sri Lanka are separated by sea and there is no physical connection between the two railway systems of Sri Lanka and India. In the past, railway line existed upto Dhanushkoti near Rameshwaram in Tamil Nadu from where there was a ferry service to Talaimannar in northern Sir Lanka. This link was destroyed in a cyclone in December, 1964. Since then railway link to Rameshwaram has been restored and upgraded to BG, but the link to Dhanushkoti remains disrupted. A ferry service remained operational between Rameshwaram rail- head to Talaimannar till 1984 when it was discontinued owing to the militancy plaguing North and East Sri Lanka in the subsequent years.

ANNEX 1.6
REGIONAL AND MULTILATERAL INITIATIVES FOR CROSS-BORDER RAIL CONNECTIVITY[23]

Both SAARC and United Nations Economic and Social Commission for Asia and Pacific (UN-ESCAP) have attempted to draw a roadmap for regional and international rail connectivity in the context of SAARC and Asian region respectively.

A multi-modal transport study carried out at the instance of SAARC Secretariat suggested the following potential rail corridors:-

Corridor 1: The SAARC Rail Corridor 1 (2,800 kms) is on BG from Lahore in Pakistan to Dhaka in Bangladesh and thereafter on MG on its eastern side. It is an almost continuous rail link and has the potential of moving intra-regional cargo via the shortest and the fastest mode. Lahore–Dhaka containerised cargo currently moving by a much longer rail-sea-road network (Lahore–Karachi–Chittagong–Dhaka) could move on this shorter and faster corridor, saving transportation cost and transit time significantly. This route would also facilitate traffic moving from destinations in India to its North-Eastern states, drastically reducing transportation costs and transit time (Kolkata–Badarpur via Guwahati is 1,356 km on the existing rail route against 682 km via Gede–Akhaura–Shahbazpur on this identified corridor).

The port at Karachi could provide a shorter route for international inward and outward cargo especially from North India, compared to the distance it has to travel to and from JNPT. **In fact, this corridor commands immense potential of carrying inter-continental containerised cargo, say, between Dhaka in the east and Europe in the west via a BG rail network through India and Pakistan onwards to Zahedan in Iran with only one transhipment at Zahedan to SG for further movement through Iran and Turkey on standard-gauge Network.**

Corridor 2: This 707 km rail corridor, re-commissioned on 15 February 2006, connects Karachi (Pakistan) and Jodhpur (India) and thus provides connectivity to the entire IR network. Currently, a passenger train 'Thar Express'/'Link Express' operates between Mirpur Khas (Pakistan) and Munabao.

Corridor 3: This 700 km BG rail corridor provides the shortest and the fastest access for traffic to and from land-locked Nepal. The 704 km Birgunj-Kolkata port via Naihati and 832 km Birgunj-Haldia via Howrah corridor has been extended by a 30 km BG line link along Sugauli-Raxaul-Birgunj with a 6 km extension inside Nepal connected directly to ICD at Birgunj.

Corridor 4: The 1,146 km Birgunj-Katihar-Chittagong port corridor also starts at Birgunj in Nepal and connects the Indian rail network at Raxaul and runs South-east through Barauni-Katihar-Malda Town-Singhabad to the Bangladesh, border- crossing at Rohanpur. In Bangladesh the corridor then extends to the port of Chittagong via Rohanpur, Abdulpur, Ishurdi, Tungi and Akhaura. The existing rail link from Jogbani to Katihar has been identified as part of this corridor. Proposed connectivity to Biratnagar in Nepal with Jogbani (last station on IR) would provide a second rail route connecting Nepal with India and Bangladesh.

This corridor can potentially connect Akhaura in Bangladesh with Agartala in India and shorten the link between Kolkata and Agartala. Howrah-Agartala via Guwahati is 1,561 kms against 502 kms from Howrah to Agartala via Joydebpur and Akhaura.

Corridor 5: This 1,025 km Colombo-Chennai corridor has the potential of further connectivity with other SAARC member states through the IR network. It could also be utilised for the movement of containerised traffic with transhipment to sea vessels for movement across the channel connecting to the Indian mainland. The 35 km ferry link from Talaimannar Pier in Sri Lanka to Rameshwaram in India would provide connectivity with Chennai, 653 km away, through the IR network.

TRANS ASIAN RAILWAY

UN-ESCAP under its Asian Land Transportation Infrastructure Development (ALTID) project identified three Trans-Asian Railway (TAR) routes. These are: (i) Northern Corridor which passes through Russian Federation, Kazakhistan, Mongolia, China and Korean Peninsula, (ii) TAR in the Indo-China and ASIAN sub- region starting from the Chinese border through Lao People's Democratic Republic and Thailand up to Malaysia (with linkages connecting Myanmar, Cambodia and Vietnam) and (iii) The Southern Corridor comprising Turkey, Iran, Pakistan, India, Nepal, Sri Lanka and Bangladesh. Inter-governmental agreement on TAR has been negotiated under UN-ESCAP.

The Southern Corridor commences from Kunming in China and Bangkok in Thailand and ends in Kapikule in Bulgaria. The total length of this route between Bangkok and Kapikule is 11,460 kms and it provides Trans Continental rail connectivity to the countries of China, Thailand, Myanmar, Bangladesh, Pakistan, India, Iran and Turkey. The route, as proposed, would enter India at Tamu, bordering Myanmar, pass into Bangladesh at Mahisasan/Shabajpur and re-enter India from Bangladesh at Gede. On the West side, this route was proposed to enter Pakistan at Attari-Wagah. This route has a missing link of 180 kms between Jiribam and Tamu in India.

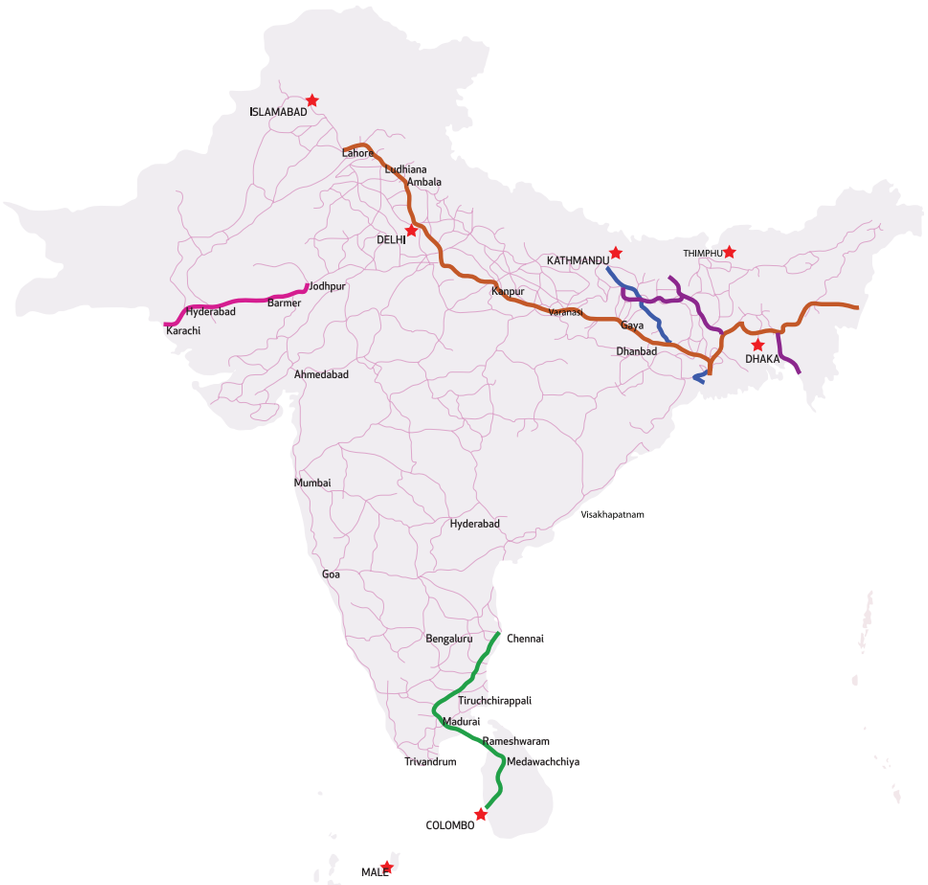
The Trans Asian Railway network is intended to provide connectivity between (i) capitals of member countries, (ii) main industrial and agricultural centers, (iii) major sea and river ports, (iv) major container terminals and depots, and (v) places of major tourist attractions.

23. Report of the Working Group on Railways (NTDPC).

SAARC Corridors

	CORRIDOR	COUNTRIES SERVED	BASIS FOR SELECTION
SRC 1.	Lahore (Pakistan)-Delhi/ Kolkata (India)-Dhaka (Bangladesh)-Mahishasan-Imphal (India)	Pakistan, India & Bangladesh	Potential growth of intraregional traffic. Reduced distance and shorter transit time.
SRC 2.	Karachi (Pakistan)-Hyderabad-Khokrapar-Munabao-Barmer-Jodhpur (India).	Pakistan & India	Shorter route for intra-regional traffic. Access to Karachi port and potential third country traffic.
SRC 3.	Birgunj (Nepal)-Raxaul-Haldia/Kolkata (India)	Nepal & India	Access to the landlocked Nepal. Potential corridor for third country and bilateral traffic (Already functional).
SRC 4.	Birgunj (Nepal)-Raxaul-Katihar (India)-Rohanpur-Chittagong (Bangladesh) with links to Jogbani (Nepal) and Agartala (India)	Nepal, India & Bangladesh	Access to Chittagong port for Indian and Nepalese traffic. Shorter route for North Eastern States of India through Bangladesh
SRC 5.	Colombo (Sri Lanka)-Chennai (India)	Sri Lanka & India	Restoration of old rail ferry link to provide passenger and goods access from Sri Lanka to mainland South Asia

SAARC RAIL CORRIDORS



LEGEND

- SR1: Lahore - Delhi - Kolkata - Dhaka - Imphal
- SR2: Karachi - Hyderabad - Barmer - Jodhpur
- SR3: Birganj - Haldia
- SR4: Birganj - Raxaul - Kathihar - Chittagong
- SR5: Colombo - Chennai
- National Railway Lines

Source: Report of the Working Group on Railways (NTDPC).

ANNEX 1.7
THE CHINA FACTOR[24]

Trans-continental rail connectivity as a strategic tool is being deployed to great effect by China. It has already developed transport links to the Korean peninsula, South-east Asia, Myanmar, Pakistan and Afghanistan. It is busy developing extensive multi-modal connectivity in India's neighbourhood which is perceived in strategic circles as an act of encirclement. It has established a presence in Pakistan with a new port at Gwadar and strategic linkages through Pakistan, Iran and Central Asia.

China Metallurgical Group Corporation, involved in the development of the Aynak copper mines, has signed an MoU with Afghan government on 22 September 2010 to undertake a feasibility study for a 700 km rail-line connecting the Aynak copper mines in northern Afghanistan with Kabul and the two neighbouring countries, with connectivity to ports in Iran and Pakistan (estimated cost- $5 billion). China is also actively working to incorporate the Gilgit-Baltistan tract into Xinjiang's logistics grid by widening the highway and laying a Pakistan-China rail link, through an MoU between Beijing and Islamabad for a trans-Karakoram rail line through the Gilgit-Baltistan region. Pakistan plans, with active Chinese involvement, a 900 km rail line from Gwadar port in Balochistan on Pakistan's south-west coast close to the Straits of Hormuz to join the Quetta-Zahedan line and via Dalbandin along Koh-i-Taftan (on Iranian border)- Spezand-Quetta-Chaman (on Afghan border) onwards through Khunjerab Pass in the Karakoram to Kashgar (Kashi) connected to Xigaze in China. It has planned a railway and pipeline from Gwadar port to western China along the Karakoram Highway route.

China has also plans to build a new rail corridor to link it to the Mediterranean Sea through Central Asia, Afghanistan, Pakistan and Iran. It has proposed 580 km rail-line from Tehran through Hamadan, Malayer and Kermanshah to Khosravi on the border with Iraq, which will also provide a link between Arak and Malayer. The line will offer onward linkages via Iraq to the Mediterranean port of Latakia in Syria, thereby facilitating a southern route from China to Europe. Yet another transit route being considered is through Afghanistan and Pakistan along Askabad-Torghundi-Herat-Kandahar-Chaman-Quetta.

In the east, China has long -term plans to link up with the Bay of Bengal port of Sittwe (Akyab) through Mandalay and the Irrawady River. China is also planning to build a 232-km Lashio-Muse/Ruili rail line that would provide a strategic link through an extensive rail network across Myanmar. From Kunming in its Yunnan province, a network of road, rail and river links fork out to Sittwe in western Myanmar and Thilawa near Yangon on the Bay of Bengal. Mynamar would thus emerge as a possible land-bridge connecting South Asia and South-west China.

Besides the Irrawady corridor through Myanmar into the Bay of Bengal, China extends significant development assistance to Bangladesh by way of grant, credit, and interest-free or concessional loans for important bridge works, natural gas, etc. Plans are on the anvil, among other projects, for constructing the second Padma Bridge and a 130 km rail line from Chittagong to Gundum on Myanmar-Bangladesh border. A Myanmar-Bangladesh rail link will help connect Kunming to Chittagong as well.

In the north, China is busy extending the world's highest 1,142 km Golmud-Lhasa rail line, that was opened in July 2006, to Xigaze, Tibet's second largest city, 253 km apart from its capital city, with plans to take it further towards Nepal, first to Nyalam, 400 km from Xigaze, on the China-Nepal border and finally a 120-km extension to Kathmandu.

In the south, a part of its 'string of pearls' strategy of links with regional maritime nations, China is now Sri Lanka's biggest investor as well as aid donor. The Economist (10 July 2010) reported that China is financing nearly all of Sri Lanka's biggest infrastructure projects, e.g., a new sea port at Hambantota, an oil storage facility, a new airport, a thermal power plant, an expressway, besides a special economic zone at Mirigama near Colombo. China is also rebuilding the main roads in the war-shattered north and east, and also a performance arts centre.

Chinese road and rail connectivity projects to speedily knit the South-east Asian land mass include the ambitious 5,380 km ASEAN flagship Kunming-Singapore rail line venture, a crucial corridor critical to the Trans Asian Railway project. China has been keen on connectivity of its rail network across those of the ASEAN region, even though there is no rail linkage between China and Myanmar, China and Laos, Myanmar and Thailand, Thailand and Cambodia, Cambodia and Vietnam, and Vietnam and Laos.

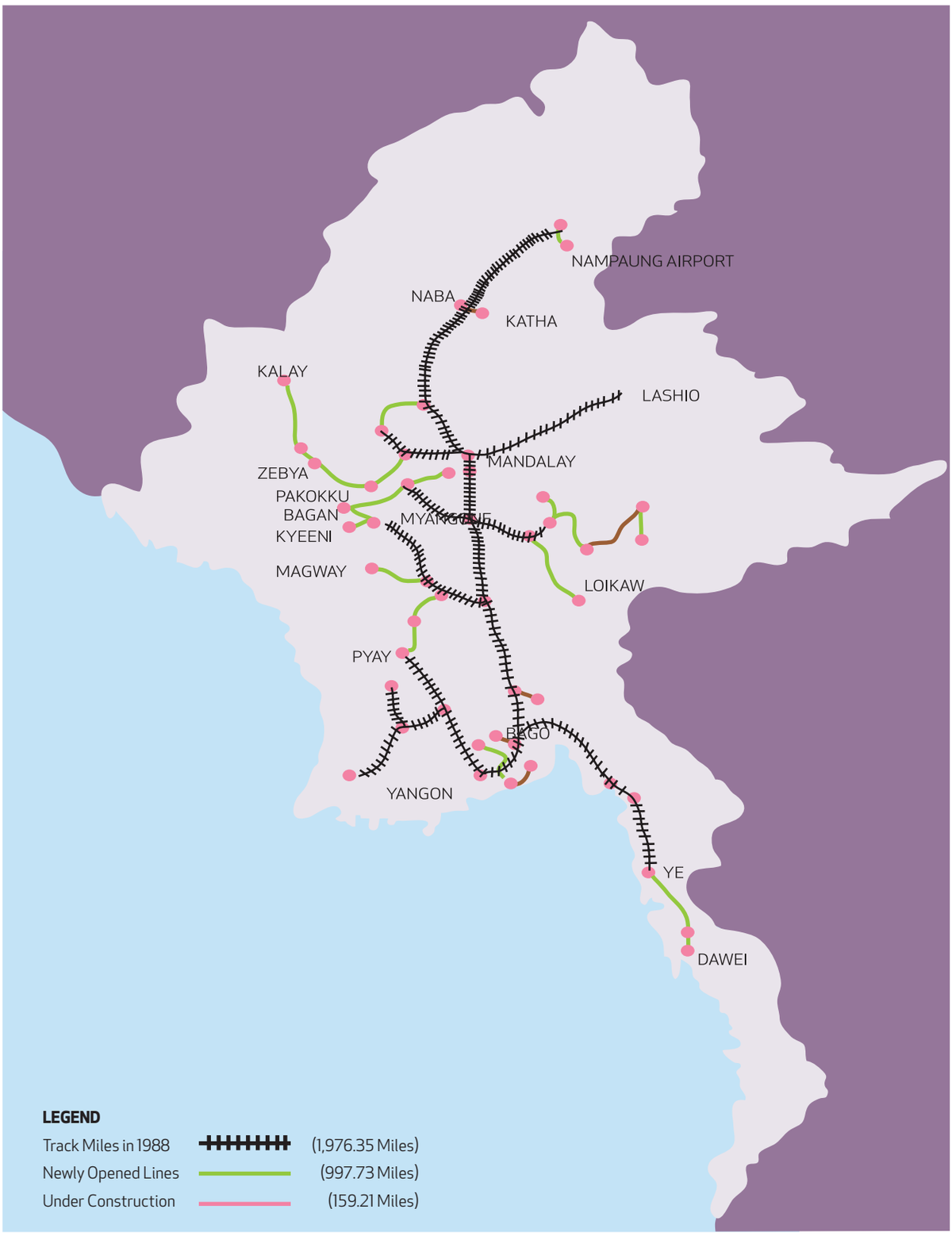
China's initiatives in expanding its rail connectivities beyond its own geographical borders has been dealt with in some detail because of its overarching strategic as well as political significance for our country. There are very important implications of Chinese advances in the neighbouring countries. In order to secure our strategic interests in the region, looking at rail linkages beyond the country's borders is not an option but a compulsion. Our long-term transport policy, therefore, has to take note of and provide for solutions to the challenges posed by the Chinese initiatives in the region.

24. Report of the Working Group on Railways (NTDPC).

Annex 1.8

Railway Projects That Need to be Taken Up with Neighbouring Countries[25]

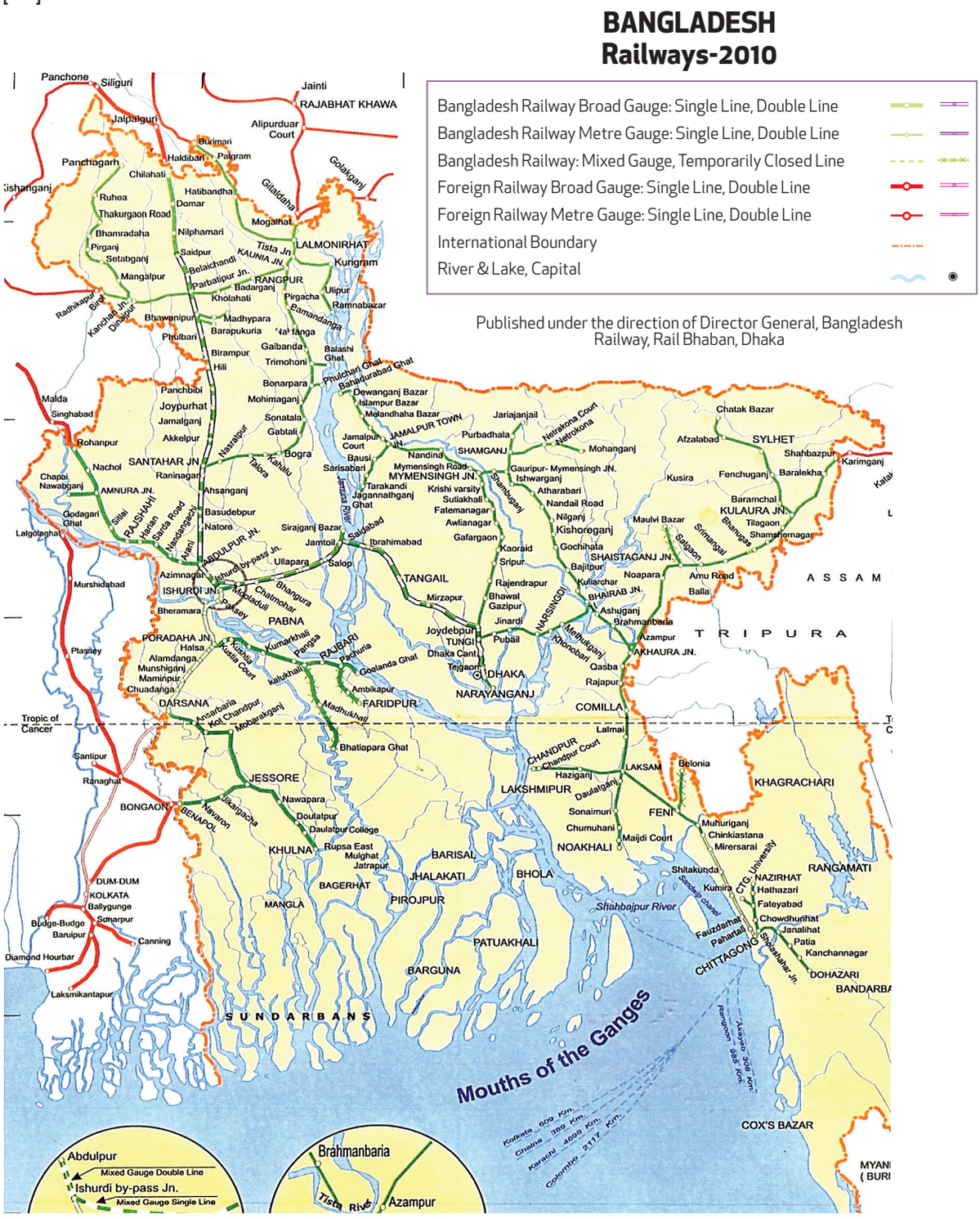
[A] MYANMAR



i. A study should be commissioned to work out the costs and other details of the Kaladan project.
ii. Jiribam-More and Seggi-Chaungh-Myohaunes lines should be constructed.
iii. Yangore Mandalay rail-link needs to be upgraded.

25. Report of the Working Group on Railways (NTDPC).

[B] BANGLADESH



i. The old links between the two countries need to be restored for the sake of the development of India's North Eastern states as well as for the sake of better relations with our most populous neighbour. These would include: Haldibari (India)-Chilahati (Bangladesh), Gitaldaha (India)-Mughalhat (Bangladesh), Agartala (India)-Akhaura (Bangladesh) and Shahbazpur(Bangladesh)-Mahishasan(India).

ii. Radhikapur (India)-Birol (Bangladesh) line needs to be reopened to facilitate transit trade between Bangladesh and Nepal through India.

iii. Haldibari-Chilahati link needs to be restored for trade between Bangladesh and Bhutan through the Indian Territory.

iv. Agartala (India)-Akhoura (Bangladesh) connection needs to be re-established to provide the much-needed direct rail link to states like Tripura, Mizoram and Manipur to Chittagong port.

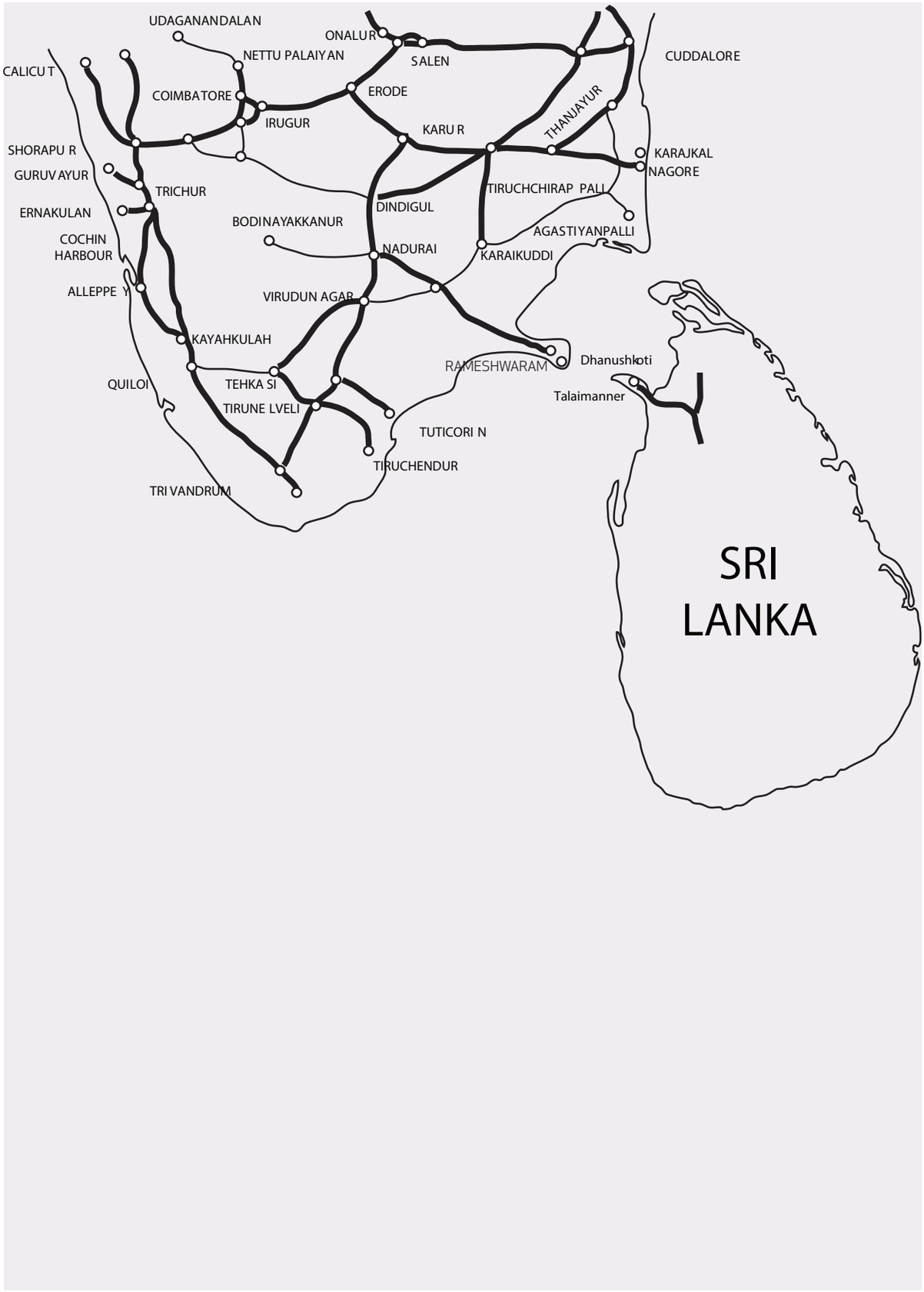
[C] BHUTAN

i. The 17.5 km long Hasimara (India)-Phuentsholing (Bhutan) which has been identified for execution should be constructed. Issues relating to land acquisition need to be addressed by the State and the Union Government.

[D] NEPAL

i. Jaynagar-Bardibas (69.10 kms) and Jogbani-Biratnagar(18.60 km) lines costing Rs 4.7 billion and Rs 2.1 billion respectively and being entirely funded by the Government of India should be expedited.
ii. Nepalganj Road-Nepalganj (12.11 km), Nautanwa-Bhairahwaha (15.30 km) and New Jalpaiguri-Kakrabitta (46.30 km), which have also been surveyed, should be taken up by the Government of India.
iii. Rail connectivity with Nepal assumes special importance in view of the China factor discussed earlier. China is planning a rail line between Lhasa and Kathmandu. Strategically, it would be in India's interest to construct the Birganj-Kathmandu line (160 km). The cost of this line as estimated by Pipavav Rail Corporation Ltd. (PRCL) is Rs 12.85 billion (2006). This project admittedly will not be financially viable but it will be in India's strategic interest to undertake the project at its cost if it has to preserve its preeminence in Nepal.

[E] SRI LANKA



i. Rameshwaram-Dhanushkoti (17km) railway link and Dhanushkoti-Talaimanner ferry service should be revived for faster, easier and convenient communication between India and Sir Lanka.

'INDIA - PAKISTAN RAIL LINKS'

1. EXISTING RLY LINKS — A
2. RLY LINKS FOR CONSIDERATION 1 - 6

*SIALKOT (PK)	-	JAMMU IN)	1
*KHEMKARAN (IN)	-	KASUR (PK)	2
*HUSAINIWALA (IN)	-	GANDA SINGHWALA (PK)	3
*FAZILKA (IN)	-	MANDI SADIQ GANJ (PK)	4
*HINDUMALKOTE (IN)	-	MANDI SADIQ GANJ (PK)	5
*DERA BABA NANAK (IN)	-	JASSAR (PK)	6

i. The following links should be revived and rebuilt: Sialkot (Pakistan)-Jammu(India), Dera Baba Nanak (India)- Jassar (Pakistan), Hindumalkote (India)- Mandi Sadiq Ganj Jn.(Pakistan), Fazilka (India)- Mandi Sadiq Ganj Jn. (Pakistan), Hussainiwala (India)-Ganda Singhwala(Pakistan) and Khemkaran(India)- Kasur Tehsil(Pakistan).

Annex 1.9
International Experience in Railway Reforms

	JAPAN NATIONAL RAILWAY	RUSSIAN RAILWAYS	GERMAN RAILWAY REFORM	BRITISH RAILWAY	CHINESE RAILWAYS
Problems of Railway and Aims of Reform	Erosion of market share Heavy debt burden	Rapid fall in traffic Efficiency of the system Inadequate investments	Poor performance Loss of market share High amount of government subsidy/debt EU directive to open up infrastructure	Shrinking market share Poor financial health	Requirements of transport capacity and quality of service Separating state control from economic activities Orienting railway institutions towards transport market
Institutional and Regulatory Framework prior to reform	JNR's management reported to a board of directors. The governor of the board was appointed by the Cabinet and s/he in turn appointed other directors with the approval of the Minister of Transportation. As public corporation JNR was not subject to same civil and commercial laws of private companies. Its employees and officers where public servants, they had right to organise into unions and negotiate labour contracts, but did not have right to strike. It had obligations beyond profit making objective. It also had to operate in low density lines that were not economically viable under the political directions.	Russian federation has a monopoly and carries half of the freight ton as compared to 8 percent in the European union. The road network is comparatively weaker and is not able to provide competition. Under the federal rail transport law, railways were unified under the direct management of Russian federation. The infrastructure and operations were not accounted for separately. There was no open access for other operators either for freight or passenger transport.	The West German system was referred To as Deutsche Bundesbahn (DB). The Governance of Deutsche Bundesbahn was heavily centralised and had several public service obligations. The workforce enjoyed the status of being civil servants. It was speculated that it under reported deficit. The state owned railway carrier of East Germany, i.e. 'Deutsche Reichsbahn' (DR). The infrastructure of DR was in poor state. It was state owned monopolist undertaking and the socialist nature of political system meant that there was no objective of earning profit from the business. In 1975 an attempt to focus on high ridership routes was made, however it was stalled by the federal states, town halls, and unions due to the fear of closing of various routes. The railway had to compete with a well developed road network and a population with high car ownership rate.	British railways was operating as a single integrated entity including track maintenance, train operations, and supporting activities. It functioned under British railways board. Around 1980, ancillary activities (hotels, ferry service, rail vehicle manufacturing business) were sold to private player. The service was organised on business service lines including intercity operations, network south east, regional railways, euro passenger service, train load freight and rail freight distribution.	Chinese railways functions under the ministry of railways and has 14 regional administrations. The government is involved in planning, operation, and regulation of Chinese railways. There are no separate suburban railway operations. New operators do not have access to infrastructure.
Reform	Restructuring of JNR involved the reorganisation and reassignment of core businesses, assets and operations, organisational structure, work force, management, liabilities, and commercial orientation among the successor companies. JNR operation was divided into six separate passenger and a freight companies. The passenger rail companies were organised into three contiguous regions on the main island and one region on each of the three islands of Hokkaido, Shikoku, and Kyushu. The main reason for this division was the fact that 95 percent of all the trips originated and terminated within one of these services territories.	The first stage was corporatisation of Russian Railways Limited (RAO RR) and creation of subdivisions for Freight Infrastructure maintenance and development Locomotive traction Long-distance passenger service 17 regional suburban railways Maintenance of carriage and locomotives Construction Research and development	In 1980, the accounting method of Deutsche Bundesbahn was changed to introduce higher degree of detail, in order to identify the origins of the deficit, particularly in local and regional passenger transport. Three cost centres were identified: Public service obligations, i.e. local and regional passenger transport The remainder of the transport Infrastructure as a public obligation However, the accounting did not separate the profits between infrastructure and operation and ended up as becoming a means to justify public subsidy.	The reform process was an extreme case which involved fragmented structure in order to introduce competition. Infrastructure was separated and privatised in 1995. By 2001, it was considered as failed move due to poor maintenance. The renewal contracts were found to be badly designed. It was bought back.	Asset Operation Liability System, which was started in 1999, has made managers of regional railways administrations (RRA) accountable for returns on capital, output, profitability and safety. RRAs are accountable for capital expenditure. Individual managers also receive financial incentives for better performance. It has focused on improving its employ productivity and reducing staff costs. Chinese railway has also done away with below cost provision of passenger services. It has separated non-core activities such as enterprises dealing with construction, manufacture, telecom, design, education and social activities. Many of these enterprises

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	JAPAN NATIONAL RAILWAY	RUSSIAN RAILWAYS	GERMAN RAILWAY REFORM	BRITISH RAILWAY	CHINESE RAILWAYS
Reform	Freight operations were organised into a separate company with a nationwide service territory. This freight operation company had no ownership of tracks but would get the access to the rail network through track usage contract with other newly formed regional rail companies. All non-core assets and liabilities of the former JNR in excess of those assigned to the individual companies were conveyed to a new entity i.e. JNR Settlement Corporation, a government agency. The Settlement Corporation, which held the shares of each of the seven operating companies that emerged from the restructuring, was intended to liquidate the assets it held, including the most important i.e. excess real estate, to pay back as much as possible of its outstanding liabilities with the proceeds of this liquidation. The new regional companies were transformed as joint stock companies, each with its own board of directors and management. The organisational structure was similar in JNR and the regional companies, except that in the regional companies departments related to railway operation were put together within the new Railway Administration unit, so that operation-related decisions can be taken in a more coordinated way. Since the regional departments of regional companies were smaller than that of JNR, meeting local needs was manageable because of smaller size. The Supervisory Committee estimated that JNR had approximately 93,000 excess employees. The restructuring plan made specific provisions for surplus employees: 1. A special fund was set up for early voluntary retirement of 20,000 employees 2. Provisions were made to transfer 32,000 employees of the newly formed regional passenger companies to other parts of JNR 3. Remaining 41,000 excess employees were assigned to the Settlement Corporation In spite of these, JNR restructuring faced union oppositions from the employees and were dragged to the court of law. JNR Settlement Tribunal failed to manage the debt was later dissolved. Its assets and liabilities were inherited by Japan National Railways Construction Cooperation, a government entity.	In the second stage, private sector was encouraged to involve into freight traffic movement and maintenance activities. Increasing passenger and suburban operation competition is also on the anvil.	Another round of reform started with merger of DB and DR in January 1994. It also attempted to separate commercial activities from liabilities. DB AG, the commercial division, was formed as a joint stock company under private law. BEV, the public division, administered by the Federal Transport Ministry and the Federal Finance Ministry, was created to take the liabilities. Infrastructure was separated from operations. Subsequently, the rail was also opened up of the rail network for third parties against the payment of track charges. The federal railway agency was founded as a regulatory agency, while the financial and contract responsibilities for regional services were transferred to states. In 1999, five joint stock companies were created: DB Reise und Touristik AG (long distance passenger transport); DB Regio AG (local and regional passenger transport); DB Cargo AG (freight transport); DB Netz AG (infrastructure); DB Station and Service AG (passenger stations) DB Reise & Touristik AG and DB Regio AG, the companies responsible for long-distance and regional passenger transport respectively were merged for better control on passenger transport. In December 2007, DB AG reorganised again bringing all passenger services under DB Bahn, freight and logistics services under DB Schenker, Infrastructure and operations under DB Netz. In June 2008, passenger and logistic services were brought under a new company DB ML AG. In 2008, Federal Government and the parliament agreed to the partial privatisation (24. 9 percent) of the DB ML AG. IPO of DB Mobility Logistics AG was planned in October 2008 but was deferred due to economic recession in the market.	The passenger operation was split into 25 companies later consolidated into 19. Three passenger rolling stock leasing companies were established for leasing rolling stock and were ultimately sold. Freight operation was sold with open access. Network Rail was named as the infrastructure company. The government sets the expectations for Network Rail and specifies the passenger service requirement. The regulator determines the efficiency targets and decides on the competition issues.	now provide services to China Railways on a competitively tendered basis. In the area of rolling stock, this has resulted in very rapid modernisation of products as a result of several joint ventures with foreign firms that became possible due to separation of production units. Chinese railways also removed a whole layer of management by eliminating the 44 sub-regional administrations. Management was consolidated at the level of the 18 regional administrations and some 60,000 staff positions were removed. All stations and depots now report directly to RRAs and train control centers were also consolidated at RRA level. This was made possible by advances in communication and information technologies. This change brought together management responsibility and accountability at the regional level. It also facilitated and encouraged higher utilisation of locomotives and crews, which had normally been changed at sub-regional boundaries. Recently, in March 2013, China has decided to dissolve the Ministry of Railways (MoR) and separate railway policy and regulation from commercial operations. As a result the functions of railway sector policy and regulation, particularly in respect of safety in construction and operation of railways, were assigned to the Ministry of Transport (MOT). In future, MoT would also establish policy for railways. It would develop a unified policy for all transport modes aiming at modal integration and optimal use of resources. The responsibility for the enterprise (commercial operations of railways) has been assigned to the newly formed China Railway Corporation (CRC) that is manned virtually by all the staff and managers of MOR except a few that will move to MoT.

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	JAPAN NATIONAL RAILWAY	RUSSIAN RAILWAYS	GERMAN RAILWAY REFORM	BRITISH RAILWAY	CHINESE RAILWAYS
Improvement in finances of railways	The market share of railways both in passenger and freight transport increased substantially after the reform process. The financial health of the privatised firms improved. The market share of the high speed railway was as high as 65 percent to 80 percent on various routes.	The performance has improved and better accountability has been achieved.	The reforms were able to arrest decline in modal share. Major traffic growth in overall passenger and freight market was observed. The freight share also increased. The open access operations, primarily run by private sector also grew over the years.	Some aspects of reform have been successful: Privatisation of freight operators Privatisation of passenger rolling stock leasing companies After privatisation, both passenger and freight traffic have increased. Along with the traffic, costs have also increased. One aspect of reform which has not been very successful is managing the interface between infrastructure and operations, both for investment decision making and operations.	The Chinese railway has performed well with these changes. It adopts a market culture and tries to match its services with customer requirements. It has been able to progress on creating one of the largest networks in a very short span.

Source: NTDPC Research.

Annex 1.10

International Experience in Setting Track Access Charges

[A] Australia: Interstate Freight

The Australian Rail Track Corporation (ARTC) publishes a list of Reference Tariffs for track access on each of its routes. The Reference Tariffs are based on a fixed component (referred to as a 'flagfall') per train for each route, plus a variable element that depends on the gross tonne-km of the train. The fixed element itself is actually fixed for different routes reflecting the length of route, so is basically distance-related rather than a true 'flagfall'. This distance-based component is affected by the speed of train and whether the train path is peak or off-peak.

The different train types are listed in Table below. The current Reference Tariffs for the different train types on different routes is publicly available and can be reviewed on line. The pricing formula is the same for each route and the tariffs are shown separately by route for convenience of customers.

FLAGFALL	TRAIN TYPE AND DESCRIPTION	TRAINS
Super Premium	Max train speed 130 km/h Max axle-load up to 20 tonnes	XPT (fast passenger train)
Premium	Max train speed 115km Max axle-load up to 20 tonnes	Passenger, Bi-modal
High	Max train speed 110km/h Max axle-load up to 21 tonnes Length up to corridor standard max	Superfreighters
Standard	Max train speed 80km/h Max axle load up to 23T Length up to corridor standard max	Express goods
Low	Off -peak train paths	Metro shunts/work trains

The Reference Tariffs relate to a particular (standard) service performance specification. There can be negotiation with individual customers for specific needs or service characteristics that vary from the reference assumptions; for example, with respect to axle loads, speed, train length, origin and destination, stops and operating timetable. However, ARTC has undertaken to the Australian Competition and Consumer Commission that it will not charge different prices to different clients where the characteristics of the service are alike; and where the applicants are operating within the same end market. ARTC also specifically undertakes not to discriminate pricing on the basis of whether the Train Operating Company is privately owned or owned by a state or federal government. All negotiated tariffs are also published.

The fixed component is paid for the right to reserve a train path and is payable by the customer whether they use the train path or not. The ARTC has also undertaken to the Australian Competition and Consumer Commission to limit the increase in the Reference Tariffs to a rate below the inflation rate, as its own efficiency incentive.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 38-39, Paul Amos, July 2011.

[B] Canada: Interswitching

Canada has many examples of what are referred to as 'voluntary running rights' which are commercial agreements between two railway companies (usually between Canadian National and Canadian Pacific companies) to allow one to run its trains on the track of the other. There are also some broader access provisions administered by the Canadian Transportation Agency (CTA) which administers interswitching rights (a form of limited- distance track access rights) and sets the access tariffs. CTA can also impose more general running rights, where one railway seeks to operate on the lines of another. Interswitching rights allow freight customers with access to a federal (inter-province) railway (basically Canadian National or

(Contd...)

Canadian Pacific) to have cars transferred (interswitched) onto another federal railway if the point of origin or destination is within 30km of the interchange point. This provision basically avoids the need to transfer wagons from one train to another for short distances at the beginning and/or end of journeys. The tariffs for this form of track access are set by the CTA because it is not convinced that market forces could otherwise protect shippers from the market dominance of one railway service provider. The CTA's Regulations establish four distance zones within the 30-kilometre radius and prescribe rates per car for interswitching traffic to or from each zone. The rates are based on the estimated costs of interswitching traffic borne by the Canadian National Railway Company and the Canadian Pacific Railway Company.

Lower per-car rates are prescribed for the interswitching of blocks of 60 or more cars as a unit. The Canadian Transportation Act requires that the Canadian Transportation Agency examine railway costs in its determination of the rates and stipulates that the resulting rates shall not be less than the average variable cost of moving the traffic. The interswitching rates are also subject to section 112 of the Act, which requires that rates established by the Agency be 'commercially fair and reasonable to all parties'.

As noted, imposed running rights can also be mandated by the CTA on a federal railway, if it decides this in the public interest. In practice, the CTA's power to approve such applications (and so confer wider track access rights) has rarely been used and most examples of running rights in Canada have been by private agreement (voluntary running rights). If the CTA does grant an application for running rights, the two railways have the opportunity to negotiate the tariff for track access. If the negotiations fail, the Agency may determine the financial compensation to be paid.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 39-40, Paul Amos, July 2011.

[C] United States of America: Track Access Agreements

Privately negotiated track access agreements have a history as long as railways themselves. Early railway companies in most continents were regionally rather than nationally based. In the boundary areas in particular they had a strong incentive to come to agreement to use each other's tracks to reach major business origins and destinations that lay over their own company's boundaries.

Access by private contract is the predominant form in the World's biggest single freight railway market, the USA. In 2010 for example there were over 550 common carrier freight railways operating in the USA. They include seven major (Class 1) railways, 31 regional railways 314 local railways, 204 switching (shunting) and terminal railways, plus 2 Canadian railways operating in the USA. All the Class 1 railways and around 90 percent of the rest are privately-owned. United States Law does not give any legal rights of access of one freight railway company over the tracks of another freight railway company.

However, under US Competition Law, railways have 'common carrier' obligations to freight customers. They must provide to customers routes and tariffs to move traffic from any origin to any destination on the railway network. If it is necessary for more than one railway to participate to complete the traffic movement the railways must interchange the traffic and establish a tariff for the total movement. However, as an alternative to interchanging the traffic, a railway can complete the movement with its own trains by entering into track access agreement with one or more other railway(s). Around 37,000 km of route operated by US railways is on track owned by another railway. That is equivalent to around a quarter of the total route-length of the network.

Agreements that set out the conditions and prices for use of another railway's infrastructure are known generically as 'trackage agreements.' They exist in many different forms. They can include agreements to use specifically defined sections of track, to use terminals, to use shunting yards, or to use 'haulage' (i.e. the locomotives and crews) of another railway entity. The agreements vary but will typically set out the services to be performed and the performance level agreed, (which will generally be an undertaking to provide the same level of service as the host railway provides to its own trains of the same type or volume - i.e. without discrimination). Any additional expenses borne by the host railway such as fueling costs, rolling stock repairs etc. are charged back to the guest train operator at agreed rates.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 39-40, Paul Amos, July 2011.

Annex 1.11
Line-of-Business Management Structures

The managements of most major freight railways in the countries reviewed have adopted lines-of-business (LOB) structures. This has been partly to better tailor products and customer care to the target markets, because each market has different customers with different needs. Equally importantly (and like the split of freight and passenger services) it has also been to devolve management of specific segments to line managers, thereby making a complex freight business more manageable. Most freight is consigned by relatively few corporate customers who employ a small number of logistics decision makers. It is both desirable and feasible for LOB managers and marketing staff to get close to these customers, understand their businesses, assess their needs, determine whether railways can meet these needs economically, and try to match product to commodity or customer.

LOB structures are applied in several different forms. LOB structures can be implemented through Product Managers responsible for client relationships for defined markets or products and who 'transact' internally in the railway to plan and monitor delivery of the services sought; with agreed internal 'cost rates' or 'prices' for those services, management accounting systems can also segment financial performance according to LOB and so devolve 'bottom-line' accountability to product managers. LOB for larger traffic segments (say, coal or intermodal business) can be divisions of the company with management responsibility for dedicated rollingstock, terminals and other assets. Ultimately, LOB may be established as separate or subsidiary companies, particularly if services are so specialised that the required market profile and/or skill-set needs to be differentiated from that of the railway itself. Freight railways in the countries reviewed display elements of all these LOB models, sometimes within the same railway. There is no best approach. It all depends what the management thinks will work best in the context of its corporate aims and the nature of markets on offer.

It is not possible to create an effective LOB organisation simply by creating segmented accounting systems or appointing segment marketing managers. Accounting and Marketing structures are tools of LOB, not the other way around. Finance departments need to adapt their accounting procedures to an authentic and agreed LOB structure, otherwise there will be no constituency of support for the accounting structures required and no market for the information they can provide. Similarly, marketing managers can discern client needs but if they have little influence and no control over product design and delivery, the implementation of LOB will probably fail. LOB management must be structured to suit the business and be holistically applied in the sense of linking market need, service response, and accountability for outcome.

Nevertheless, LOB management has led to the transformation of railway freight marketing. Those railways organised by LOB tend to have individual marketing teams specialising in the industry or customer group concerned. When railways still had monopoly power in freight, the main function of the Marketing Department (if there was one) was taking wagon orders, completing waybills and handling complaints; they employed clerical skills appropriate to clerical tasks. Rail freight providers today need marketing groups who can manage client relationships and not just client paperwork.

Source: Freight Railways Governance Organisation and Management: An International Round-up, World Bank, Page 19, Paul Amos, July 2011.

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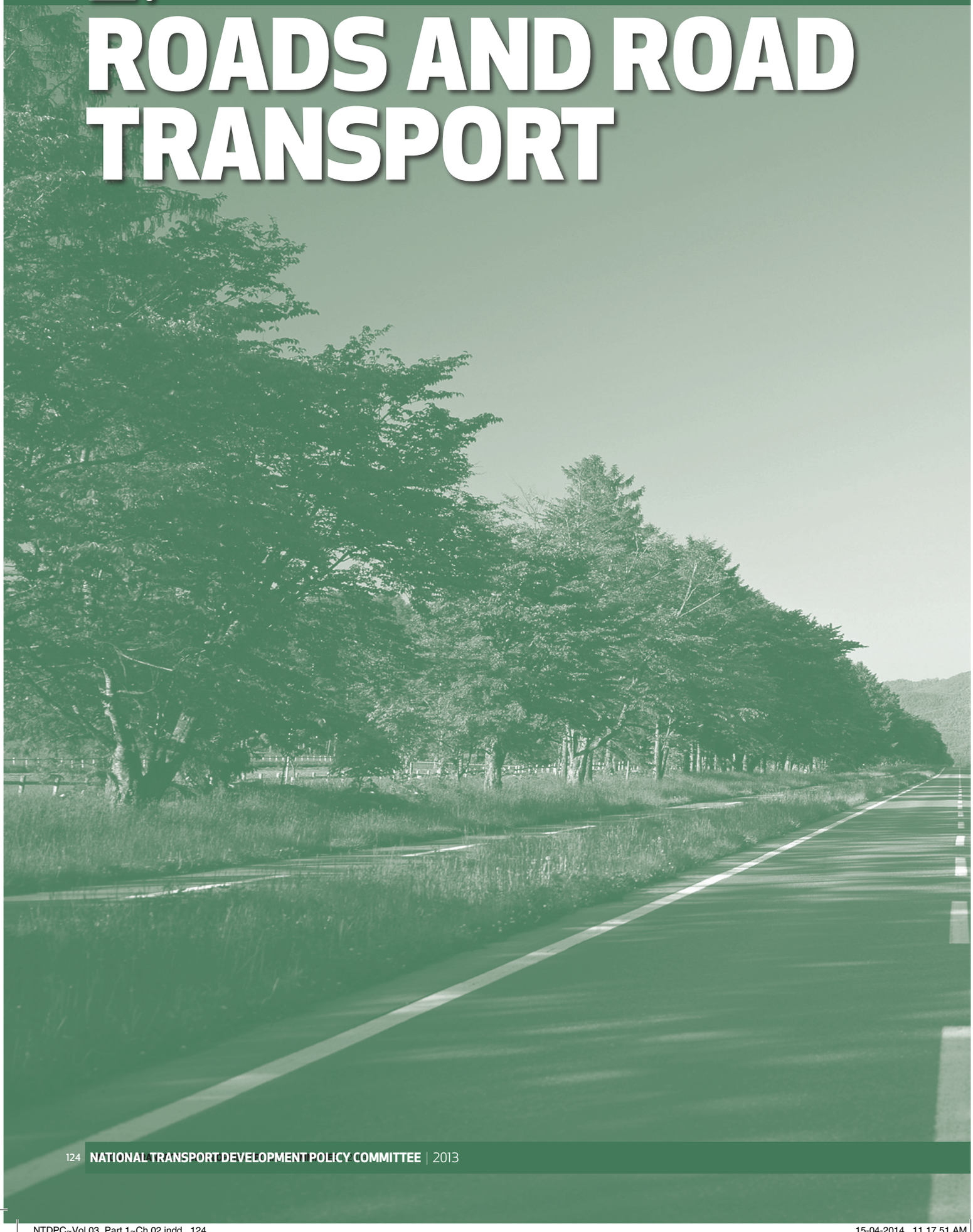
2. ROADS AND ROAD TRANSPORT



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2. ROADS AND ROAD TRANSPORT

It is a matter of some pride that India boasts of the world's second-largest road network, and the densest amongst countries of similar size. Over the years, both accessibility and mobility have improved through construction of new roads and development of existing roads.

INTRODUCTION

However, as a very broad characterisation, our roads still suffer from a litany of ills. They are capacity-constrained, slow, unsafe, environmentally unfriendly, not maintained or non-maintainable and patchily administered. Meanwhile, efforts to improve the situation are hampered by delayed clearances, multiple overlapping authorities and jurisdictions, frequently changing rules of engagement with the private sector, unyielding land laws, and skill shortages.

Over the next 20 years, India's roads must address these issues to accommodate an economy that will both be substantially larger, and structurally different in economic, social and demographic terms.

ROADS AS PART OF INTEGRATED MULTIMODAL TRANSPORT

Roads should not be looked at in isolation, but as part of an integrated multimodal system of transport (Chapter 4, Volume II). The planning and development of the primary road network must tie up with planning of the railways' dedicated freight corridors and other segments of the rail network, connectivity with ports, airports, special economic zones, logistic hubs, major tourist centres and linkage with neighbouring countries. Similarly, advantages of lower emissions and fuel consumption in movement of bulk cargo through inland water transport and coastal shipping should be fully harnessed to reduce avoidable burden on road and rail. Further, there is need to promote multimodal transport operators who provide seamless movement between the consignor and the consignee and they use each mode depending upon its inherent strength and efficiency.

CAPACITY ENHANCEMENT

Various construction programmes for different classes of roads over the past two decades have yielded a significant expansion in network size. With the notable exception of the National Highways Development Project (NHDP), the major focus of this network expansion has been to improve connectivity rather than to increase network capacity. Under the NHDP, much has been accomplished to build better trunk routes with various phases of the programme aiming for capacity upgradation, and minimum standards for wider and faster roads, though progress has been somewhat slower than anticipated. The bigger hurdles on this front are timeliness in awarding contracts, difficulties in acquiring land, and securing environmental clearances, and the persistent shortages in construction capacity. Increased focus is required in provision of service roads along high capacity corridors to cater for local motorised and non-motorised traffic and social requirements of pedestrian/cattle underpasses. At the other end of the spectrum, rural areas have benefited enormously from the PMGSY which emphasises new connectivity and upgradation of rural roads to meet the growth in traffic demand. In a major shortcoming, however, there is no resolute effort that is dedicated to bringing existing rural roads upto standards of all-weather connectivity.

While National Highway development has been motivated by the necessity of urgently improving trunk capacity, and rural road development by the basic

Existing land laws in India make it difficult and time-consuming to acquire the land required to complete infrastructure projects. The major fault lines lie along issues related to valuation and compensation, acquisition of agricultural, forested, hereditary and tribal lands, and government right to eminent domain.

goal of ensuring universal connectivity, there has been no fundamental stimulus for state highways and district roads. A transport network is only as strong as its weakest links. Consequently, these much neglected roads that connect with newly expanded National Highways create bottlenecks with congestion repercussions across the wider network and pose a deeper problem than is immediately apparent. In similar fashion, inefficient junctions, bridges, and other choke points moderate capacity enhancements from new and improved National Highways.

MAINTENANCE

At all levels, roads are often found in a state of disrepair, with potholes, poor drainage, weak bridges, substandard pavement and so on. For all the attention given to new construction and upgradation, much less funding and effort is expended on preserving the existing asset base. Regular preventive maintenance has yet to form an integral element of thinking on road investment. Much maintenance occurs when things fall apart rather than as a preventive measure. Rehabilitation requires far more substantial financial resources than preventive measures do. Importantly, rehabilitation imposes higher indirect and opportunity costs since the citizenry and government are more likely to have to contend with catastrophic failure, or with the decommissioning of important links in the network for long periods.

As compared with construction projects, there are fewer institutional incentives to perform, monitor and enforce maintenance. In the case of PPP projects, construction and maintenance contracts are often awarded to the same agency or private enterprise; but monitoring is less rigorous, and the penalties for missed or poor maintenance are smaller than for delayed or incomplete construction. Maintenance earns less political goodwill than the fanfare associated with the opening of a new road.

HUMAN RESOURCES

As with other sectors, the construction and ongoing maintenance of Indian roads is severely limited by a shortage of skilled professionals. Upon graduation, civil engineers are poached by other disciplines with higher pay scales and better career prospects. At the graduate level, few institutions offer courses or degrees in road network planning, design and construction. Agencies responsible for the roads must consequently make do with a bureaucracy whose core skills may not run deep enough to contend with the difficult issues posed by modern design practices and construction methods. The paucity of good jobs at these agencies also serves to signal promising engineers away from the road sector. Then, there is huge deficit in availability of skilled construction workers in the road sector. There is hardly any ITI or training centre that imparts training to workers, equipment operators and work supervisors (Chapter 11, Volume II on Research and Human Resource Development).

SAFETY

Indian roads are grossly unsafe. This statement is made even gloomier as it is closer to being likely conjecture rather than established fact. We simply do not have a good quantitative understanding of the nature and extent of safety-related problems on the roads. Acute under-reporting, poor accident recording, and limitations of the data that are actually collected make it difficult to form an objective view on the severity of the problem. As a qualitative characterisation, consider these everyday observations: over-loaded goods and passenger vehicles, unregistered and uncertified vehicles, unlicensed drivers, and poor compliance and enforcement of road rules. Narrow, poorly maintained roads do not conform to common safety-related design principles such as traffic segregation, divided carriageways, lane markings, and demarcated intersections amongst others. Road design favours motorised vehicles at the expense of vulnerable pedestrians and cyclists. The latter also tend to number amongst the less financially capable, and bear an unequal burden of traffic-related injuries and fatalities. Emergency medical response at accident sites is rarely guaranteed and often delayed, providing the major reason for why disproportionately more injuries on Indian roads end up with fatalities (Chapter 12, Volume II on Safety).

LAND ACQUISITION

Existing land laws in India make it difficult and time-consuming to acquire the land required to complete infrastructure projects. The major fault lines lie along issues related to valuation and compensation, acquisition of agricultural, forested, hereditary and tribal lands, and government right to eminent domain. The land acquirers' responsibilities with respect to the resettlement and rehabilitation of project affected persons are complex and inconsistent. The new The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act may have clarified some of these issues, but will also make land acquisition more expensive.

With respect to road construction, timely land acquisition is commonly cited as the dominant reason for

delayed project completion. Small changes in alignment can have very large implications for overall project costs, as well as for road safety and the environment. Land acquisition issues are especially pertinent for the several projects seeking to build new roads in tribal lands. Besides providing much-needed connectivity to hitherto neglected populations, these roads are essential for national security and integration. However, acquisition is especially fraught in these areas and must be addressed by sound policy and judicious administration. Road upgrading also suffers from want of land. It is natural for economic enterprise—whether sanctioned or otherwise—to spring up at the edge of existing roadways. This makes it difficult to enforce claims over existing, but unused rights of way or to purchase new land for widening of roads.

INSTITUTIONAL ARRANGEMENTS

Roads perform a large variety of functions from providing both basic and trunk connectivity to serving as the fulcrum in inter-modal exchanges of passengers and freight. With the road network's distributed nature and role, it is not surprising that an exceptionally large number of institutions and agencies are responsible for design, construction, operation and maintenance at all levels of government. The network's extent, complexity and varying characteristics mean that this model of distributed governance is desirable; no single institution should be expected to successfully negotiate the multitude of responsibilities and functions associated with all classes of roads. However, the current institutional arrangements leave much to be desired and need considerable capacity building for implementation of the government mandate. This is all the more critical now that a good deal of network expansion has taken place and we need to consolidate these gains by focusing on achieving higher levels of quality and imbibing international standards and practices.

INTER-AGENCY COORDINATION

Successful distributed governance of the roads requires that its various elements be bound together in a common vision of what India's roads should deliver to its citizens. It further requires that there is clear administrative responsibility for the construction and maintenance of each class of road. Horizontal and vertical inter-agency cooperation is lacking. Roads are not always built in harmony with existing or planned land use, to ensure inter-modal connectivity, and to connect well with other parts of the network to boost overall capacity. It is crucially important that professionals and agencies in charge of developing roads also co-ordinate with other agencies and authorities that are responsible for other transport modes, urban planning, village governance, and so on.

FUNDING

No other piece of transport infrastructure can replace the street outside one's home in its role as the instrument of basic connectivity. Consequently, it is sensible that sources for road funding are principally commitments from gross budgetary outlays, though these may stem from earmarked revenue streams, taxes and cesses, dedicated road funds, or special development programmes such as the Pradhan Mantri Gram Sadak Yojana (PMGSY: Prime Minister's Rural Roads Plan). The desirability of universal accessibility on developmental and nation-building grounds motivates budgetary funding for roads as a redistributive tool.

However, to a significant degree, the benefits from road use accrue to private agents, be it from the transport of goods to market or the movement of people for work or leisure. As such, after accounting for all positive consumption externalities and correcting for all other market failures, this offers good economic support for more direct financing of road infrastructure from user charges including fuel taxes, vehicle registration fees, tolls, etc.

PRICING

Fuel is subsidised, ostensibly for agricultural relief, but has many unintended beneficiaries. More vehicle-kilometres are driven than would be if fuel were priced at market. Demand has increased significantly for diesel vehicles, with severe environmental implications, given the generally high-sulphur diesel fuel available in India. Further, the method and practice of setting the subsidy is such that required adjustments are delayed until the fiscal implications become untenable, at which point they are made in large jumps causing more pain at the pump as consumers struggle to adjust to hugely increased fuel outlays. Meanwhile, vehicle registration and parking fees and taxes on cars are disconnected from the economic value of the public resources that are used up. The current programme for recalibration of diesel prices to approach consistency with international prices is a welcome move.

Successful distributed governance of roads requires that its various elements be bound together in a common vision of what India's roads should deliver to its citizens.

ROADS AND THE ENVIRONMENT

This report echoes the major economic and environmental concerns of the increasing share of road-based transport in the carriage of both passengers and freight. Roads also affect the environment more directly. The new roads that India requires must

Independent India inherited about 21,000 km of National Highways. Though expansion was slow over the next 50 years, the period from 1997 has seen more concerted road building than at any other time in India's history

often be cut through sensitive geographies either in terms of the local terrain that will mandate large-scale destructive re-engineering of the landscape, or in terms of disturbing the habitat of local flora and fauna. Current environmental laws seek to address both of these concerns, but the unwavering stringency of their application leads to delayed execution, costly realignments, and curiosities like trees in the middle of an urban road, an outcome of obvious disadvantage to both tree and commuter. More rational solutions to the competing demands between road construction and the preservation of the natural environment are essential.

India's lax fuel and vehicle efficiency standards present more immediate and substantially more dangerous environmental concerns. These loosely enforced norms already lag those in other parts of the world, contributing in no small measure to some of the most polluted air on the planet, and the consequential health effects. The partial rolling out of new standards in certain cities is unhelpful, and only seeks to undermine the credibility and usefulness of the standard-setting process. India already exports vehicles that conform to more stringent overseas standards, but which cannot be sold domestically on account of the incompatibly poor fuel available (Chapter 7, Volume II on Energy and Environment).

INDIA'S ROAD NETWORK TODAY

In opening the Indian Road Congress, 15 January 1950, Mr Lal emphasised the urgent need to complete the Nagpur plan. The plan has a target of building or improving 68,000 miles of hard crust roads and 90,000 miles of earth roads. Mr Lal stressed the need for improving the education of road engineers. He gave a detailed account of how technical committees of the IRC established standards, studied economics of highway types, etc. He pleaded for the establishment of a powerful independent Road Board capable of smoothing differences between the Central Government and the provinces.

—**UNESCAP Transport Bulletin,** Volume. I, No. 1 September 1950

Eleven days before India declared itself a republic, the Indian Roads Congress—a 'semi-official' society of highway engineers and other road-development professionals—met for its 14th annual meeting in Mumbai[1]. The concerns addressed were as familiar then as now: the urgent need for rapid expansion of the network, dismay at missed deadlines, funding shortfalls, lamentable inter-agency co-operation, capacity limitations, the necessity of building technical expertise and so forth. The major agenda item was discussion on the progress of the Nagpur Plan of 1943, the first attempt at devising a long-term road development plan. The discussions were fruitful enough for the new republic to provide a fillip to the Plan for its remaining 13 years: the originally promised 200,000 km of road network were delivered on schedule by 1963. Recognising the long-lived nature and enormous cost of road networks, the Nagpur Plan was devised to be implemented over a 20-year period, and road transport policies for individual Five-Year plans have since been hewn from subsequent 20-year plans.

The other enduring outcome of the Nagpur meetings was to lay the genesis for the familiar modern hierarchical division of the road network as determined by certain objective criteria. According to the Nagpur Plan, National Highways would pass through the states, and places having national importance for strategic or administrative purposes. State highways would link state capitals with other large cities in the state, and district roads would take traffic from the main roads into the interior of the district. Road statistics from the Nagpur Plan period aggregate these two types of road into 'state highways'. Finally, rural roads would connect villages with major roads. Hence, the classification of the road network was largely defined by the settlements that a road linked.

Even as the Nagpur Plan period was nearing completion, it was apparent that the quality of the recently enlarged network left much to be desired. Consequently, in 1961, a new 20-year plan—the Bombay Plan of 1961-81–for Indian roads was adopted. This plan made rural accessibility its defining objective and sought to construct rural roads on better technical foundations. It also first outlined a case for the construction of access-controlled expressways. Many of the individual initiatives for network expansion were stillborn, though progress was made in widening roads and in tarring previously unsealed roads. It was during this period that the state highway classification was refined, and district roads—both 'major' and 'other'—were identified separately.

The Lucknow Road Congress of 1984, as part of the third 20-year plan (1981-2001), proposed, for the first time, 'softer' considerations such as energy conservation, environmental impact and road safety as integral elements in the design of road policy and infrastructure together with the usual ambitious goals for expanding the network, raising capacity and improving accessibility.

Then the Ministry of Road Transport and Highways formulated Road Development Plan Vision: 2021

1. 1950 also saw the inception of the Central Road Research Institute, India's nodal road research and development agency.

Table 2.1
India's Road Network since 1951
('000 Km)

ROAD NETWORK	1951	1961	1971	1981	1991	2001	2011
(i) Total Length	400	524	915	1,485	2,327	3,374	4,690
(ii) Of which National Highways	22	24	24	32	34	58	71
(iii) Of which State Highways	-	-	57	94	127	132	164
Surfaced Roads	157	263	398	684	1,113	1,602	2,525

Source: Various issues of Basic Road Statistics of India, Transport Research Wing, Ministry of Road Transport & Highways, Government of India.

for roads by entrusting the task to IRC. The major thrust areas covered related to mobility in respect of main roads and accessibility in respect of rural roads to connect all villages in a time-bound manner. Strategies for capacity augmentation and preservation of assets were brought out together with measures to mobilise resources and capacity building in road organisations, consultants and contractors. Soon, thereafter, the Ministry of Rural Development embarked upon a dedicated Rural Road Development Plan: Vision 2025 with the support of IRC. Building up from the current PMGSY, it laid a road map for achieving universal connectivity to all habitations above population 100 with all weather rural roads.

Independent India inherited about 21,000 km of National Highways. Fifty years later, India celebrated its golden jubilee with 34,298 km of National Highways, having added just over one per cent to the network for each year of independence. However, early road-building priorities lay in other areas, and, happily, there was substantially more progress in building district and rural roads (Table 2.1). By the standards of the first 50 years, the period from 1997—corresponding directly with the 9th, 10th and 11th Five Year Plans—has seen more concerted road building than at any other time in India's history. This is reflected in the significantly increased investment in roads (Chapter 2, Volume II).

NATIONAL HIGHWAYS

National highways constitute the primary system of road transportation in India, Figure 2.1 gives at a glance the growth of National Highways over the years. These are main highways running through the length and breadth of the country connecting major ports, highways in neighbouring countries, capitals of states and union territories and large industrial and tourist centres, and include roads required for strategic considerations. These highways are under the administrative and financial purview of the Union Government, which exercises jurisdiction through the Ministry of Road Transport and Highways (MoRTH). The Central Government retains powers to designate any road as a National Highway. The Ministry follows an agency model. There are three agencies for implementation viz. the National Highways Authority of India (NHAI), the Border Roads Organisation (BRO), and the Public Works Departments (PWDs) in the states.

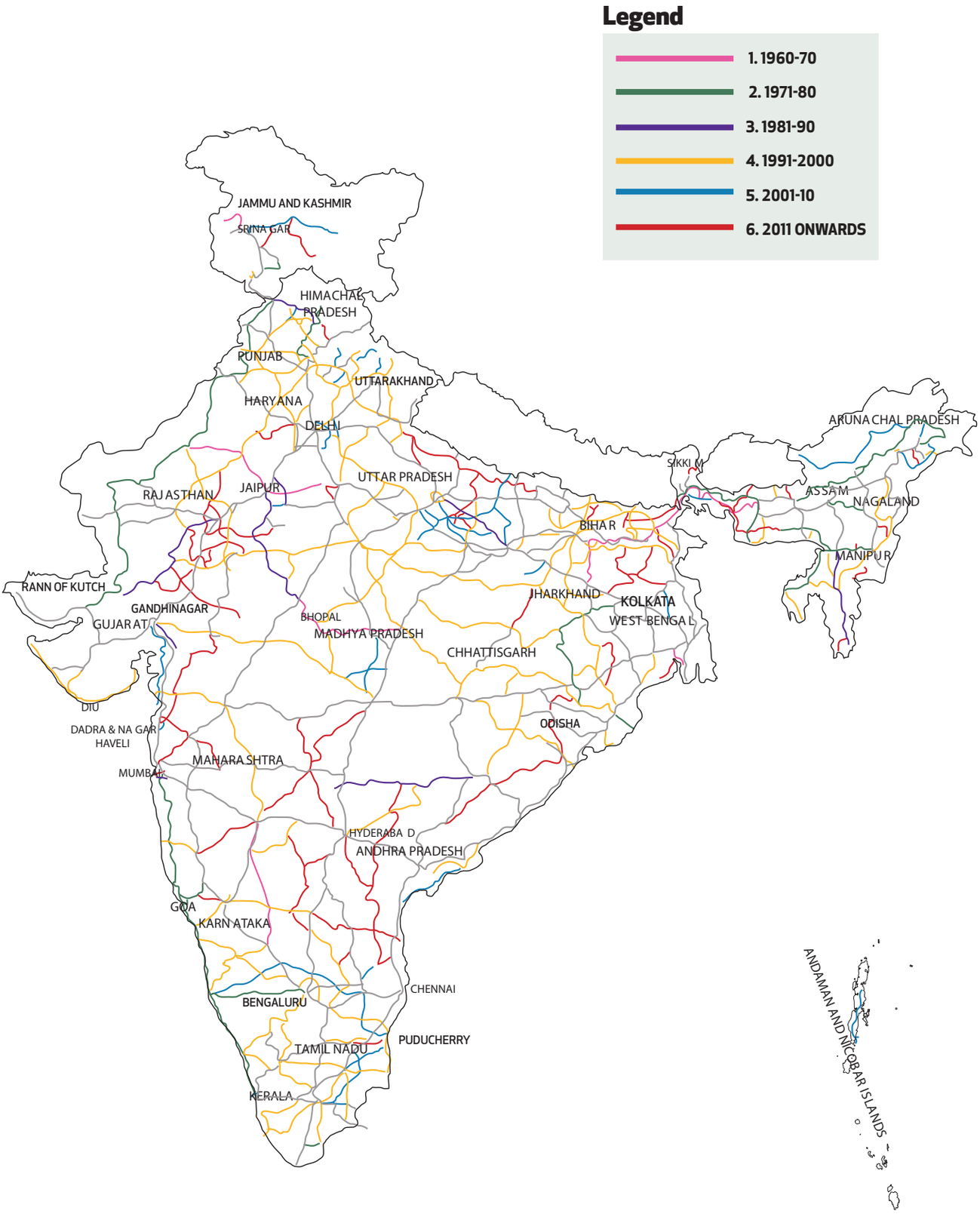
Totalling 76,818 km or 1.9 per cent of the total road network as of March 2012, about 40 per cent of road traffic plies on the National Highways; a figure that is comparable with that of other countries. That the highways constitute a very small share of the overall network is understandable, given the vast rural road network required to connect to India's widely distributed villages and habitations. Better international measures of the adequacy of the size of the network are assessments of the highways relative to land area, population and GDP. International comparisons must be treated with caution since road statistics are not quality-adjusted: one nation's National Highway may well be another's minor road.

Box 2.1 gives a snapshot of the socio-economic impact of development of National Highways on the rural communities, captured by a seminal work undertaken by the Asian Institute of Transport Development.

The construction, improvement, maintenance and general administration of selected current and planned stretches of the National Highway network are carried out under various phases of the National Highway Development Project (NHDP). The project is executed by the NHAI, an autonomous statutory government agency serviced by MoRTH. Other sections of National Highways are administered directly by MoRTH under various smaller programmes, and are collectively demarcated as NH (Original), or NH (O).

Under the first two phases of the NHDP, four-lane highways have been constructed linking Delhi, Mumbai, Chennai and Kolkata (the Golden Quadrilateral), and spanning the length and breadth of the

Figure 2.1
National Highway Network of India



Source: Ministry of Road Transport and Highways.

Box 2.1
Highways of Socio-Economic Change

Contrary to the traditional view that a National Highway mainly facilitates intercity travel and transport of goods, it is also an integral part of the road network serving the rural areas. This is borne out by the fact that almost 50 per cent of the total trips originating from the selected villages involve the use of the National Highway.

Proximity to a highway and its upgrading has significant beneficial influence on major aspects of socio-economic well-being of the rural population. Greater opportunities of employment and earnings in non-farm activities are generated. Access to education and health facilities improves. Household incomes rise and so do asset holdings.

The immediate net benefits of an upgraded highway mostly relate to improvement in access to work and educational opportunities: three-fold increase in the share of income from non-agricultural activities; 85 per cent increase in female labour participation; two-fold increase in per capita trip rate for education; and about 50 per cent increase in school enrolment.

The temporal shifts in the related parameters have brought about a distinct structural shift in the rural economy. A development of considerable importance is the noticeable increase in female participation in the workforce as also the school enrolment of girls. These welcome changes would help in the much-desired empowerment of women.

The benefits of the highway mostly extend up to a distance of 5 km on its either side, which may be treated as the influence zone. This approach distance can be covered in 30 minutes on a cycle and an hour on foot. Beyond this distance, the influence of the highway falls off sharply.

The density of population in the nearby villages is generally higher mainly due to the poor staying closer to the highway because of better non-farm job prospects. They are relatively better off in terms of various indicators of well-being vis-à-vis comparative households living away from the influence zone.

The extensive use of the National Highway by the rural population for their social and work-related trips brings out the need for building service roads along the highway to cater to the slow moving traffic comprising pedestrians, cyclists, bullock carts, etc. Equally important is the safe design of road crossings between highways and village roads.

Among other interventions, large-scale public investments in road infrastructure development can also be an effective and viable policy measure for improvement in the well-being and quality of life of the rural population.

Source: Asian Institute of Transport Development (2011).

country through the North-South and East-West corridors. Later, NHDP was expanded and it now covers seven phases. Table 2.2 gives a broad break up of various phases together with current status.

Though admirable progress was made in the early years of the NHDP, especially under Phases I and II, there has been recent cause for concern at the slowdown of implementation. There have been hold-ups in commissioning detailed project reports, in the award of contracts, and in the timely completion of construction activity. The problems besetting the NHAI in ensuring timely delivery of completed projects are:

i. **Funding** issues including the adequacy of budgetary supply and commercial borrowing;
ii. **Commercial** issues including shortages of eligible bid concessionaires, restrictive model concession agreements;
iii. **Shortages of skilled staff** in NHAI as well as at concessionaire and construction firms;
iv. **Land acquisition** including issues related to the shifting of existing utilities along the right of way, and resettlement and rehabilitation of affected persons;
v. **Delays in obtaining railway and environmental clearances.**

Figure 2.2
The Golden Quadrilateral, and North-South and East-West Corridors

Source: NTDPC (2012).

Table 2. 2
National Highway Development Project

PHASE	PROJECT DETAILS	LENGTH (KM)	APPROVED	INITIAL SCHEDULED COMPLETION	CURRENT SCHEDULED COMPLETION	APPROVED COST (RS BILLION)	EXPENDITURE (30 SEP 2013) (RS BILLION)	LENGTH COMPLETED (IN KM)	LENGTH UNDER IMPLEMENTATION (IN KM)	NO. OF CONTRACTS UNDER IMPLEMENTATION (IN KM)	TO BE AWARDED (IN KM)
I	4-laning of Golden Quadrilateral (5846 km), 981km of NS-EW corridors, 356km Port connectivity, 315km other NHs	7,522*	DEC 2000	DEC 2003	Declared complete Jan 2012	303	401	7,514	8	10	-
II	4/6-laning of 6161 km of NS-EW corridors, 486 km other NHs	6,647	DEC 2003	DEC 2007		344	631	5,657	600	52	390
III	4/6-laning of other NHs	12,109	MAR 2005	DEC 2012		806	717	5,692	4,732	89	1,685
IV	2-laning with paved shoulders of selected NHs	20,000	MAR 2005	DEC 2015		278	37	304	4,179	33	10,316
V	6-laning of selected stretches of NHs	6,500	OCT 2006	DEC 2015		412	225	1,634	2,446	28	2,420
VI	Development of expressways	1,000	NOV 2006	DEC 2015	DEC 2015	167	0.2	NIL	NIL	-	1,000
VII	Construction of ring roads, flyovers, bypasses, tunnels, over-bridges	700	DEC 2007	DEC 2014		167	16	21	20	2	659
	Total	**54,478**				**2,476**	**2,027**	**20,822**	**9,539**	**214**	**16,470**

Source: NTDPC Research.
* Chennai – Ennore port connectivity two projects (24 km) have been re-awarded, these two projects were merged with other projects (6 km) under Phase – I. Total length increased by 24 km! 14,799 km was assigned to NHAI remaining 5,201 km with MoRTH.

Table 2.3
Physical Achievements under Non-NHDP [NH(O)]

CATEGORY	10TH PLAN (2002-07)	11TH PLAN (2007-12)
Two-Laning	4,177 km	5,161 km
Four-Laning	157 km	341 km
Strengthening Weak Pavement	3,510 km	4,625 km
Improvement of Riding Quality	16,250 km	11,831 km
Bypasses	16 Nos.	16 Nos
Bridges	604 Nos.	480 Nos

Source: NTDPC (2012).

At present, a few short stretches of National Highways are designated expressways: limited access motorways of four or more lanes with grade-separated interchanges, and restricted to motorised transport. With their purposefully limited accessibility, expressways are often built as greenfield projects that run parallel to existing roads. Phase VI of the project, approved in 2006, provides funds for the completion of 1,000 km of expressways along certain very highly trafficked corridors emanating from the nation's largest cities, such as from Mumbai to Vadodara, and Bengaluru to Chennai. This phase is scheduled for completion by the end of 2015. Though seven years have elapsed, a detailed programme of implementation and investment decisions has yet to be finalised.

In recognition of the view that overall network capacity and movement efficiency depend crucially on provision of interchanges and bypasses, Phase VII of the project directs explicit attention to this infrastructure. Progress on this phase needs to be accelerated.

NON-NHDP NATIONAL HIGHWAYS: NH (ORIGINAL)

MoRTH is also responsible for the upgrade and upkeep of several National Highways that are not accounted for by the NHDP. Lumped together under the moniker NH (O), these NHs are typically lightly trafficked, mostly less than two lanes, and so are lower priorities for capacity-enhancing investment. However, many of these run through economically less developed regions of the country, and assume greater significance. Management of these roads is delegated to state PWDs and the BRO for the most part, and activities include widening, strengthening of pavement, improvement of ride quality, and the construction of bridges and bypasses. Table 2.3 gives a broad picture of physical progress during the 10th and 11th Plan in respect of NH (O) works. Table 2.4 gives a broad break of expenditure on central sector roads administered by the MoRTH during the 10th and 11th Plans.

STATE HIGHWAYS

State highways (SH), together with Major District Roads (MDR), constitute the secondary system of road transportation in the country, and are administered and financed by state governments. SHs provide links with NHs, district headquarters of states and important towns, tourist centres and minor ports. The total length of SHs at present is about 166,000 km. Their length is about 4 per cent of the total road network and they carry 25 to 30 per cent of the total road traffic. About 60 per cent of these route-kilometres have carriageways of less than the minimum desired two-lane standards. The SH network is compromised by weak and narrow bridges and culverts, at-grade railway crossings, and poor upkeep and maintenance. Several roads have failed to keep up with changing traffic patterns and have become hopelessly ill-equipped to accommodate increasingly large vehicle volumes.

Table 2.5 gives a broad idea of capacity of state highways by the end of 11th Five Year Plan.

An expenditure of Rs 628 billion was incurred on state sector roads during the 10th Plan. This got increased to Rs 1,656 billion during the 11th Plan.

State governments fund state highways and there is a general shortage of available funding for the maintenance and upgrading of these roads. SHs are important roads. However, a slow-burning campaign exists on the part of many state governments to have these roads declared as National Highways instead. In this event, the Central Government assumes financial and administrative responsibility over these roads, while the states benefit from better roads that deliver localised connectivity and accessibility. Some states

Table 2. 4

Expenditure on Central Sector Roads (excluding PMGSY) During the 10th and 11th Five Year Plans

[Rs billion]

PARTICULARS/SCHEME	10TH PLAN (2002-07)	11TH PLAN (2007-12)
NHDP (NHAI) (of which Private Sector Investment)	383	1,278 (653)
NH (O) (of which Private Sector Investment)	91	220 (4)
SARDP-NE including Arunachal Pradesh package	6	50
Left Wing Extremism, Tribal Areas, etc.	--	20
Roads of Economic and Interstate Importance (E&I)	4	8
Strategic Roads	2	4
Miscellaneous Including Research, Training, IT, etc.	0.90	0.37
Total	**486**	**1,581**

Source: NTDPC (2012).

have benefited from the Central Government scheme of providing viability gap funding upto 20 per cent of the project cost for PPP road projects.

MAJOR DISTRICT ROADS

MDRs run within districts connecting areas of production with markets, and rural areas with district headquarters and with SHs and NHs. Serving as links between rural and urban areas, SHs and MDRs contribute significantly to the rural economy and to the country's industrial development by enabling movement of raw materials and products from and to regional India. The development and maintenance of MDRs is the responsibility of state governments. The total length of MDRs is about 266,000 km with more than 90 per cent of the network length not meeting two-lane standards.

RURAL ROADS

Rural roads cover Other District Roads and Village Roads and constitute the tertiary road network. They are a key component of rural development since they provide access to economic and social infrastructure and services, thereby generating increased agricultural income and productive employment opportunity in rural areas. Rural roads are used as an entry point for poverty alleviation. There is growing empirical evidence that links transport investments to the improved well-being of the poor. A study carried out by the International Food Policy Research Institute on linkages between government expenditure and poverty in rural India has revealed that an investment of Rs 100 million in roads lifts 16,500 poor persons above the poverty line[2]. A joint study by the Asian Institute of Transport Development (AITD) and UN:ESCAP also confirmed close link between accessibility and incidence of poverty and advocated provision of access as an entitlement (Box 2.2).

The Bombay Plan (1961-81) had laid down that all villages be brought reasonably close to a planned system of all-weather roads so that no village is more than 2.5 km from a road in an agricultural area and 8 km from a road in a non-agricultural area. The Lucknow Plan (1981-2001) had envisaged that all villages with population above 500 be brought within 1.6 km of an all-weather road.

The thrust to the development of rural roads was given at the beginning of the 5th Plan in 1974 when it was made part of the Minimum Needs Programme (MNP) along with electricity, health care, primary

2. Study on Linkages between Government Expenditure and Poverty in Rural India by Fan, Hazell and Thorat (1999).

Table 2. 5
Capacity of State Highways
(Km)

LANE WIDTH	AT THE END OF 10TH PLAN (UPTO YEAR 2007)	AT THE END OF 11TH PLAN (UPTO YEAR 2012)
Single Lane or Intermediate Lane	111,995	101,049
Two-Lane	36,405	60,811
Four-Lane (or more)	2,313	4,269
Total	**150,713**	**166,129**

Table 2. 6
Connectivity of Villages with Roads Achieved upto Year 2000

POPULATION CATEGORY	TOTAL NUMBER OF VILLAGES	NUMBER OF VILLAGES CONNECTED BY 1980	NUMBER OF VILLAGES CONNECTED BY 1990	NUMBER OF VILLAGES CONNECTED BY 2000
1,500 & above	71,623	37,950 (53)	59,722 (83)	70,000 (98)
1,000-1,500	58,229	21,970 (38)	35,362 (61)	50,000 (86)
Less than 1,000	459,465	107,324 (23)	166,311 (36)	200,000 (43)
Total	**589,317**	**167,244 (28)**	**261,395 (44)**	**320,000 (54)**

Note: Figures within brackets give the percentage of villages in each population category to the total number of villages in that category. The basis for population is 1981 census. For balance unconnected habitations not eligible under PMGSY.
Source: IRC (2001).

Box 2. 2
Access as an Entitlement

A joint study by AITD and UN: ESCAP has brought out that wherever there is better access, there is less poverty. Hence, the 'public good' aspect of transport assumes an added significance. Fixed transport infrastructure, such as roads, constitutes such a 'public good' and this raises the issue of entitlement. An entitlement is another name for a right. It is necessary that a new perspective on transport—one deriving from the idea of access as an entitlement—is adopted. The study concluded that most of the benefits that flow from rural access projects are likely to be indirect and intangible, generating significant beneficial externalities. Although these benefits pose measurement problems, it is these very benefits which are likely to be of paramount importance in projects like rural roads, irrigation, education, health and housing.

Source: Study on Evaluation of infrastructural interventions for rural poverty alleviation by AITD and UN: ESCAP.

Table 2.7
Physical and Financial Progress of PMGSY (as on 31 March 2012)

PARTICULARS	UNIT	TOTAL ELIGIBLE	ACHIEVEMENT DURING 10TH PLAN	ACHIEVEMENT DURING 11TH PLAN (2007-12)	ACHIEVEMENT AS ON 31 MARCH 2012
Habitations	Number	178,181*	36,694	47,809	84,503
Length (a) New Connectivity (b) Upgradation (c) Total	 Km Km Km	 367,673 374,844 742,517	 86,716 33,861 120,577	 122,130 107,726 229,856	 208,846 141,587 350,433
Expenditure Incurred	Rs billion		210	705	915

Source: NTDPC Research.
* There are in all 849,315 habitations in the country. Of these, number of habitations remaining to be connected at the time of PMGSY launch was 346,607. Against this unconnected habitations, eligible habitations under PMGSY are 178,181.

school and dwelling unit. Funds were provided by the states. However, there were several states that could not achieve the intended targets. Table 2.6 gives the connectivity of villages of various population groups achieved upto the year 2000.

THE PRADHAN MANTRI GRAM SADAK YOJANA (PMGSY)

In order to give a boost to rural connectivity and to promote balanced development of all districts and states, a rural roads programme known as Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched in December 2000. This programme shifted the focus from the village to the habitation since it was realised that a village may consist of several clusters separated by considerable distance, often mirroring socio-economic stratification. As against 589,000 villages (Table 2.6), there are about 850,000 habitations and the programme envisages connecting all habitations with a population in excess of 500 people in the plains, and 250 people in hill, tribal and desert areas, to the road network. It is a fully funded scheme sponsored by the Central Government to provide all-weather connectivity to previously unconnected rural areas of India. Rural road connectivity is also part of the Central Government scheme known as *Bharat Nirman*. The initial goals under *Bharat Nirman* were slightly more modest in targeting habitations with populations exceeding 1,000 in the plains and 500 in hills, deserts and tribal areas. The actual execution of PMGSY construction is delegated to state governments, but a centrally mandated standards and quality control programme is in place. The PMGSY also provides funds for upgrading rural roads in those districts where all the eligible habitations had been provided with new connectivity. Funds for maintenance are to be provided by the states. The physical and financial progress of PMGSY upto the end of the 11th Five Year Plan is given in Table 2.7.

ROAD SECTOR INVESTMENTS IN THE PAST DECADE

The road sector has seen an unprecedented increase in investments during the last one decade (Table 2.8). It would be seen that investments to the tune of Rs 5,600 billion have been made during the period 2002 to 2012. It is essential therefore to consolidate these investments and ensure they provide quality service to the road users.

THE ROAD NETWORK ASSET BASE

It is, of course, extremely difficult to quantify how much a given kilometre of road is worth. Even the broadest estimates, however, may be useful if they also permit quantification of the annual loss in the asset base from want of maintenance and other factors. Amongst the many variables that will influence the replacement value of a kilometre, the more important are: the number of lanes, the difficulty of terrain traversed, the date of construction and quality of material used, the degree of periodic upkeep and current condition of roads and bridges. Of course, the true economic cost will also depend on the availability of transport alternatives, and the time- and rupee-value of transport services executed on the road. Table 2.9 presents a broad ballpark assessment of the current replacement value of the road network for taking a policy view on maintenance. The unit replacement cost assumed here are the average costs for constructing or upgrading the road to a particular capacity under each category of road network. These unit costs are on the lower side than is the current experience.

Table 2.8
Investments (Expenditure) on Roads
(Rs billion)

PARTICULARS	10TH FY PLAN (2002-07)			11TH FY PLAN (2007-12)		
	PUBLIC SECTOR	PRIVATE SECTOR	TOTAL	PUBLIC SECTOR	PRIVATE SECTOR	TOTAL
Central Sector	486	NA	486	924	657	1,581
National Highways	474	NA	474	842	657	1,498
E&I, LWE, Tribal, etc.	7	NA	7	33	NA	33
SARDP-NE	6	NA	6	50	NA	50
PMGSY	125	-	125	915	NA	915
Sub Total (I)	**611**	**-**	**611**	**1,839**	**657**	**2,496**
State Sector	683	NA	683	1,800	NA	1,800
Sub Total (II)	**683**	**NA**	**683**	**1,800**	**NA**	**1,800**
Total Roads (I+II)	**1,294**	**NA**	**1,294**	**3,640**	**657**	**4,297**
Say	1,300	NA	1,300	3,640	660	4,300

Source: NTDPC Research.

VEHICLE FLEET AND TRAFFIC FLOWS

The number of vehicles per 1,000 people has more than doubled from 53 to 117 between 2001 and 2011, suggesting large increases in ownership penetration, and the rise of multiple-vehicle ownership within households. Meanwhile, relative to the size of the road network, the vehicle fleet has exhibited more moderate increases: in 2001, there were 328 vehicles per 100 km of road; by 2011, this had increased to 388. With a focus on road widening rather than on new construction, it is possible that *aggregate* network congestion has eased, though no certain data on this is available. The caveat to this suggestion is that network congestion is a complex phenomenon, depending on many factors other than the number of vehicles in use.

The number of registered vehicles is not an accurate guide to the number that are actually in-use. Unregistered vehicles ply on the roads, especially in rural areas, and decommissioned vehicles are often not deregistered. Accurate data on the distribution of vehicles by age is not available. Vehicle counts 7-day, 24 hours are available only on National Highways and selected State Highways. These data are important for understanding the overall fuel efficiency and emissions of the vehicle fleet, and for a better picture on traffic flow patterns.

There is a perceptible shift in rural areas from non-motorised rural transport (camel/bullock carts) used in the movement of passenger and agricultural produce to tractor-trailers, improvised vehicles like juggads; and this has implications on energy, environment and safety.

Indeed, in the absence of detailed nationwide traffic and vehicle use surveys, it is extremely difficult to gain a deeper understanding of geographically disaggregated trip length and routes, travel times, origin-destination pairs, congestion, fuel emissions and vehicle efficiency. These factors are critical to effective long-term network planning by enabling realistic and consistent traffic assessments and preparation of DPRs for new projects.

INSTITUTIONS

A number of organisations are responsible for the administration of the road network at various levels of government. With the exception of PMGSY roads, MoRTH is the overseeing central agency for the nation's road network. National highways and roads constructed under special development programmes for Left-Wing Extremism (LWE) affected states, Jammu and Kashmir, and the North-East are under its direct mandate. The new MoRTH programmes must have the approval of the Cabinet or the Empowered Group of Ministers. Actual execution of MoRTH

Table 2. 9
The Replacement Value of India's Road Network, January 2013 Estimates

		KM ('000)	ROUGH REPLACEMENT COSTS (RS MILLION/ KM)	ESTIMATED REPLACEMENT VALUE (RS BILLION)
A	**National Highways**			
	4-Lane or more	19,000	70	1,330
	2-lane	40,000	20	800
	Single-Lane	19,000	8	152
	Total	78,000		2,282
B	**State Highways**			
	4-Lane or more	4,000	65	260
	2-Lane	61,000	18	1,098
	Single-Lane	101,000	7	707
	Total	166,000		2,065
C	**Major District Roads**			
	Mostly single lane	266,000	5	1,330
D	**Rural Roads**			
	PMGSY	400,000	4	1,600
	Non-PMGSY	2,500,000	1.2	3,000
	Total	2,900,000		4,600
	Grand Total			**10,277**

Note: This excludes urban roads, project roads and other special roads.
Source: NTDPC estimates prepared by DP Gupta, former D.G. (Roads) MoRTH.

programme roads is delegated to the NHAI, the BRO or state PWDs. MoRTH is also the central agency for classifying National Highways and defining standards across the entire road network, and for compiling network statistics.

State Highways and Major District Roads are administered by the State Public Works Departments. Projects on these roads are executed by state PWDs.

The Ministry of Rural Development oversees the PMGSY programme through its arm National Rural Roads Development Agency (NRRDA). From the bottom-up, Panchayati Raj and state institutions assist in the formulation of district- and block-level rural roads plan for each district. The district Panchayat is considered the competent authority to prioritise the construction of various roads in the plans. State-level agencies such as the PWDs or Rural Engineering Organisations or Rural Works Departments function as the executing agencies. There may be multiple executing agencies within a state, but execution of the plan for a given district is entrusted to only one agency at a time. State technical agencies (academic institutions) provide technical support to the executing agencies, scrutinise design plans and cost estimates. State Rural Roads Development Agencies have been gazetted within each state to disburse PMGSY funds to the agencies, and to monitor implementation. The NRRDA provides operational and management support to the programme, including standardisation of design specifications, bidding documents and procurement procedures, quality control during execution and monitoring of progress.

At the state level, the Public Works Departments and the Rural Works Departments are the key institutions for bulk of the road network and their capacity and performance need to be enhanced for efficient delivery of government mandate.

FUNDING

Investment in road infrastructure has a long gestation period, and returns are typically not seen until several years after construction. This, coupled with

Indian road funding agencies cannot access international equity or debt capital markets directly. As no agency has been corporatised or privatised, access to domestic equity funding is also not feasible. The only option that remains is the domestic debt market

the lumpy and large nature of infrastructure investment, and the public goods nature of roads, has meant that the road network was historically funded mostly from government outlay.

Today, the Indian road network is funded through both government and private sources and from multi-lateral agencies. Government sources consist of funding commitments derived from gross budgetary outlays, though these may stem from earmarked revenue streams, taxes and cesses, or from dedicated road funds. Depending on the classification of the road, funding is available from central government, state governments, or both.

Private funding essentially refers to investments made for building a road asset for which the financial return is the right to levy an agreed toll from the users for an agreed period of time. Ownership of the asset usually returns to the government upon expiry of the contracted period. During this period, the concessionaire is also responsible for maintaining the road to a defined performance standard. Agreements between government and private agencies that determine the precise contours of the latter's funding of road infrastructure come in a very wide variety of flavours. For example, they may or may not include viability gap funding, government revenue or traffic guarantees, and may provide annuities instead of tolling rights and so forth. It is an ongoing challenge to ensure that negotiated agreements are fair to all parties, represent value for money for the government, and do not actually increase the government's risk exposure, and provide for proper allocation of risks between the government and the entrepreneur.

Finally, multi-lateral agencies, foreign governments, and non-governmental organisations provide funding to build roads in order to supplement government funds. Over time, this has become a proportionately less important source. In assessing and contributing to road infrastructure investments, these agencies frequently, though not always, combine economic criteria with other development goals such as poverty alleviation, and access to social infrastructure. The institutional strengthening of road agencies, contractors and consultants are also a part of their financial assistance strategy. The entry of international agencies like the World Bank and the Asian Development Bank did help in enhancing the delivery of road development projects and increased capacity of contractors and consultants.

GOVERNMENT FUNDING

THE CENTRAL ROAD FUND (CRF)

Apart from other budgetary resources, this is the principal mechanism by which roads are funded in India, and is legislated in the Central Road Fund Act of 2000. The Central Government is responsible for the general administration, management and allocation of the fund, and for monitoring the outcomes to which disbursements are applied. The CRF is funded from a two-rupee cess on each litre of high-speed diesel (HSD) and motor spirit (petrol) sold in the country. Table 2.10 gives the allocation of the current CRF accruals. The cess was fixed at this level in March 2005.

The CRF is at present an accounting mechanism, under the Ministry of Finance, without any capacity of its own to negotiate work programmes with road agencies, scrutinise disbursement applications, or commission financial or technical audits of expenditure[3].

With the increase in fuel prices in recent years, the proportional share of the cess in the fuel value retailed has decreased. Expenditure on fuel and fuel-derived products such as bitumen can account for up to 30 per cent of the actual construction cost of a highway, excluding pre-construction activity such as land acquisition.

STATE AND OTHER ROAD FUNDS

Some states have also established road funds for state road network development and maintenance. Amongst the states to have already done so are Assam, Kerala, Maharashtra, Rajasthan and Uttar Pradesh, and similar initiatives are under active consideration by Tamil Nadu and Karnataka governments. These state road funds are financed from multiple resources: budgetary support from the Central Government and state government, direct road user charges, additional sales tax on fuel, motor vehicle taxes, fees and tolls, indirect road user charges and taxes. Some states like Haryana, Madhya Pradesh, Punjab levy fee on agriculture products for part deployment in rural roads construction and maintenance. Similar to the CRF, the state road funds are used for both development and maintenance of road network. The UP road fund, however, is dedicated to road maintenance[4].

PRIVATE FUNDING

INTERNAL AND EXTRA-BUDGETARY RESOURCES

Agencies such as the NHAI and state road development authorities also raise extra-budgetary funds by appropriating surplus toll revenues, and from lines of credit from banks and the LIC. The PMGSY, NHDP, and the various states also receive supplementary funding from multi-lateral agencies such as the World Bank and the Asian Development Bank. These funds are usually supplied on concessional terms including repayment moratoria, long terms that are

3. 'Road Fund Knowledge Base', World Bank, 2010, http://go.worldbank.org/G0UXMX7XD0 (accessed 12 March 2014).
4. Ibid.

Table 2.10
Allocation of Current CRF Accruals
[Rate of Cess: Rs 2.00 per litre on Diesel and Petrol]

CATEGORY	ALLOCATION	PETROL	DIESEL
National Highways (Administered by MoRTH)	(a) 50 paise per litre on diesel and petrol (b) of the remaining 150 paise per litre, distribution is as under: (i) 57.5 per cent of 150 paise per litre on petrol (ii) 57.5 per cent of 75 paise per litre on diesel	136.25 paise per litre	93.125 paise per litre
State Highways and Major District Roads (Administered by MoRTH)	(i) 30.0 per cent of 150 paise per litre on petrol (ii) 30.0 per cent of 75 paise per litre on diesel	45.00 paise per litre	22.50 paise per litre
Rural Roads (PMGSY) (Administered by MoRD)	50.0 per cent of 150 paise per litre on diesel	Nil	75.00 paise per litre
Railway over/under bridges and manning of unmanned railway crossings (Administered by Ministry of Railways)	(i) 12.5 per cent of 150 paise per litre on petrol (ii) 12.5 per cent of 75 paise per litre on diesel	18.75 paise per litre	9.375 paise per litre

Source: NTDPC Research.

commensurate with the life of the asset created, and below-market interest rates. Separately, multi-lateral agencies have also assisted with implementing new PPP funding mechanisms by providing technical assistance on an appropriate enabling environment that is transparent, competitive, and has clear guidelines for dispute resolution.

CAPITAL MARKET FUNDING

In line with usual restrictions on Indian corporate entities, road-funding agencies cannot access international equity or debt capital markets directly. As no road funding agency has been corporatised or privatised, access to domestic equity funding is also not feasible. Consequently, the only option that remains is the domestic debt markets. The NHAI has successfully issued bonds that are deductible on capital gains for many years. More recently, new 10- and 15-year bonds that are fully deductible on interest income and capital gains have proved to be overwhelmingly popular. Long-term infrastructure bonds issued by other entities such as IDFC and IIFCL are also directed towards PPP investment.

Commercial borrowing plays a large, but perhaps sub-optimal, role in the debt component of PPP finance given maturity mismatches. Bank funding is typically available only for shorter maturities. Given the long construction and payback periods of infrastructure assets, the maturity mismatch results in increase of the interest rate at which bank funding for infrastructure can be raised.

PPP AGREEMENTS

Together with the revamped CRF, the major innovation in the capacity augmentation of main roads over the previous two decades has been the use of private enterprise to design, build finance and operate road projects See Box 2.3 for PPP policy arrangements for roads in India.

These PPP arrangements are partnerships in the sense that risk is shared between government and private enterprise, and that both must execute certain tasks for project delivery. The government completes pre-construction activity such as the acquisition of land, conducts feasibility studies, tenders contracts, and supplies any necessary funding for a project to become viable. Private enterprise must supply the bulk of the funding and execute the project for which it is compensated by revenues from the resulting infrastructure.

THE BOT-TOLL MODEL

Two versions of the PPP model are commonly employed in India. Under the Build-Operate-Transfer (BOT) toll agreements, the concessionaire is responsible for designing, building, operating and financing the infrastructure to be developed, though the government can supply up to 40 per cent of the project's cost as viability gap funding. The concessionaire is permitted to collect and retain an agreed toll. All risks, including construction, finance, operational, maintenance and commercial risks, are borne by the concessionaire. The concessionaire must deliver the project to an assured quality, including on-time construction. BOT toll agreements are generally better suited to highly trafficked routes in soundly administered jurisdictions where there is little scope for revenue seepage to alternative roads.

This provides a cap on the commercial risk that is borne by the private enterprise. In some instances, the government can choose to provide non-VGF

Box 2.3
PPP Policy Arrangements for Roads in India

Incentives

Over the past 20 years, several new policy initiatives have assisted in making PPP a viable funding mechanism for India's highways. These policy incentives include:

1. Grants and viability gap funding of up to 40 per cent of project cost for marginal projects
2. 100 per cent automatic FDI for all road development projects
3. A 100 per cent income tax exemption for a period of ten consecutive years within a period of twenty years following the completion of a project
4. Agreements to avoid double taxation
5. Provision of encumbrance-free land for road construction
6. Traffic guarantees in some instances
7. Protection for private investors against force majeure type situations including political, non-political and legislative changes
8. Equity participation of up to 30 per cent by the NHAI in a special purpose vehicle (SPV) set up for road development

Model concession agreements

In order to specify the policy and regulatory framework on a fair and transparent basis, a Model Concession Agreement (MCA) for PPPs in National Highways has been introduced. The government also approved a new Model Concession Agreement (MCA), which is considered by some 'a very attractive document as far as lenders are concerned', as it allows for grant funding and government guarantees, is high on transparency, and addresses principal concerns of lenders, such as land acquisition and protection in the event of default.

Source: http://morth.nic.in/index2.asp?slid=17&sublinkid=9&lang=1 (accessed 12 March 2014).

grants, traffic guarantees to limit the commercial risk of the project, and to also prescribe revenue sharing agreements to participate in any revenue earnings upside. To maximise return on equity, the private concessionaire for BOT contracts will typically aim to contribute about 30 per cent equity to their share of project funding. With the complex nature of risks borne by the developer, and the absence of any feasibility of a lien on the underlying asset, the debt component is typically raised with recourse that is limited to the equity contribution of the developer.

THE BOT-ANNUITY MODEL

For several projects, especially in roads that are relatively lightly trafficked, viability gap funding at 40 per cent is not enough at which the project becomes feasible. In this situation, the government may choose to supply either a lump-sum payment, or more commonly an annuity in exchange for the private financing of construction and operation of a project. The toll collected accrues to the government, and the private operator is remunerated via a fixed, periodical payment from the government. Under these contracts, the private operator is responsible both for constructing the road, as well as for operating and maintaining it for a fixed period of time (typically 15 years). Because the break-even point for the private operator does not occur until late in the contract, this form of PPP transfers both responsibilities for bridge financing and performance risks to the private sector. In addition, because the annuity payment is not indexed, the private sector retains any risk associated with higher than anticipated operations and maintenance costs. Annuity concessions are only paid once the road is constructed to agreed quality standards, thereby rewarding early completion and incentives for quality construction that requires less by way of maintenance. However, the Annuity Model is not a sustainable model for development of road infrastructure due to its heavy burden of contingent liability on the government.

PPP FUNDING IN THE 10TH AND 11TH PLANS

During the 11th Five-Year Plan, about 50 per cent of the 10,600 km of National Highways completed under the NHDP were funded through the BOT-Toll model. Around 10 per cent of completed length was paid for through a system of annuities to the concessionaire, with the balance largely in the form of traditional EPC contracts. This is in marked contrast with the 10th plan wherein the corresponding figures for 5,445 km built under the BOT toll, annuity, and EPC models were around 10, 10 and 80 per cent respectively. This illustrates the huge impact that toll-based private contracts have had on accelerating capacity augmentation of National Highways.

SAFETY

According to official statistics, 138,258 people were killed in road traffic crashes in India in 2012[5]. The situation in India has worsened in recent years. Traffic fatalities increased by about 5 per cent per year from 1980 to 2000, and since then have increased by about 6-8 per cent per year for the years for which statistics are available. This is attributable partly to an increase in the number of vehicles on the road, and partly to the absence of a coordinated official policy to control the problem. The fatality rate has increased from 36 fatalities per million persons in 1980 to 115 fatalities per million persons in 2012. There is vast under-reporting of road accidents and resultant minor injuries. Given this under-reporting, fatalities which are much more widely reported—may prove to be a better indicator of road safety. Despite the flaws in the data, there is no denying that road traffic injuries are one of the leading causes of deaths, disabilities, and hospitalisations, with severe socio-economic consequences[6].

It is possible that about three times that number (~400,000) were permanently disabled and 20 times that number (~ 2.5 million) hospitalised. With vehicle numbers, network size, and accessibility to motorised transport, it can be difficult to uncover the true nature of the severity of the safety problem. From the admittedly patchy data, the following facts hold. First, the absolute number of accidents has increased with time. Safety improvements in cars like seat belt, air bags may have been responsible for making car passenger safer. However, these may not have improved safety for other users. Meanwhile, the roads themselves continue to do users few favours, killing and injuring (on a per kilometer basis) with nearly unchanged intensity over the past twenty years. Finally, the effects of increased motorisation are most apparent when we consider per-capita incident rates which have continued to increase over the years.

Roads in India are being designed primarily for motor vehicles exposing vulnerable road users to greater accident risks. The absence or paucity of footpaths, cycle tracks, and traffic calming measures to reduce speed where non-motorised modes of transport blend with motorised traffic, increases the risk of accidents and their severity.

Of the total road network, national and state highways accounted for 55 per cent of road accidents and 65 per cent of fatalities in 2011, reflecting the larger, faster, traffic flows on these networks. 'Driver error', principally in the form of excessive speed, is alleged to be one of the single most important factors in road accidents, injuries and fatalities. A more modern view is that road design should correct driver behaviour towards safer alternatives; that is, by default, badly designed roads should be held responsible for accidents rather than bad drivers. Beyond this, however, the absence of reliable data and analysis restricts our ability to identify the causes and factors that characterize road accidents.

If the current safety paradigm persists unchanged, road fatalities and injuries are projected to increase inexorably. By 2030, road crash deaths and injuries in low and middle-income countries are projected to be the 4th largest cause of healthy life years lost for the total population compared with malaria (15th) and tuberculosis (26th), and the leading cause of health losses for children (aged 5-14) and the 2nd largest cause for men. Low and middle-income countries already bear around 90 percent of this burden, especially among their vulnerable road users. Unless scaled-up and sustained safety measures are undertaken, escalating health and associated economic losses from road crashes are very likely. Over the next 20 years, India must meet the challenge of bringing its road trauma sustainably under control, if it is to avoid the fatalistic pathway taken by high-income countries during the 20th century, where, for far too long, road deaths and injuries were accepted as an inevitable price of economic growth and traded off for mobility gains[7].

INTERNATIONAL EXPERIENCES AND LESSONS THEREFROM

CONTEXT

India's road network compares favourably internationally (see Tables 2.11 and 2.12) in terms of the overall route length and density relative both to population and to land area. However, there remains much to be accomplished on several other fronts such as the design standards, quality of the road network, safety, operation and management, interstate movement, energy efficiency, control on overloading, capacity and performance of road agencies in efficient delivery of road programmes.

Road traffic injuries are one of the leading causes of death and disablity in India, with severe socio-economic consequences

CHINA

China has seen one of the fastest growths in road construction recently, driven by the National Trunk Highway System (NTHS) designed to connect all major cities and provincial capitals with population greater than 500,000 through the construction of 12 major highways. This has now been expanded by the 7-9-18 Highway Network which is intended to link all cities with population above 200,000 to those connected by the NTHS.

5. NCRB (2013).
6 Bliss and Breen (2011), Improving Road Safety Performance: Lessons from International Experience. World Bank Resource Paper, prepared for the NTDPC. NTDPC Research.
7. Ibid.

Table 2.11
International Comparison—Road Network 2004-09 (Km)

COUNTRY	EXPRESSWAYS	HIGHWAYS	SECONDARY ROADS	OTHERS	TOTAL ROADS
Argentina					231,374
Brazil	0	93,071	276,776	1,382,021	1,751,868
China	65,055	59,462	300,686	3,435,620	3,860,823
India		**66,754**	**1,017,763**	**3,025,275**	**4,109,592**
Mexico	7,056	40,509	78,267	240,975	366,807
Pakistan					258,350
Russia					982,000
South Africa	239	2,887	60,027	300,978	364,131
Thailand	450	51,405	44,000	84,198	180,053
Turkey	2,036	31,271	30,948	298,405	362,660
France	11,240	9,020	381,000	550,000	951,260
Germany	12,813	39,887	178,269	413,000	643,969
Japan	7,642	54,790	129,377	1,016,058	1,207,867
New Zealand	183	10,909	83,209		94,301
Spain	13,014	12,832	140,165	501,053	667,064
UK	3,674	49,032	122,543	244,416	419,665
USA	75,643	19,857	1,930,104	4,520,235	6,545,839

Source: International Road Federation, World Road Statistics, 2011.
Expressways are access controlled primary roads, highways and primary roads with partial or no control of access.

MALAYSIA

The Malaysia Highway Authority was established in 1980 to facilitate the construction of a toll expressway from north to south of the peninsular link to all main towns. Most highways are tolled. As part of an overall master economic development plan called Vision 2020, the government plans to widen the implementation of the Private Finance Initiative (PFI) based projects during the Plan period to increase opportunities for the private sector (Box 2.4).

For the National Highway Development Project (NHDP) of India, the World Bank has studied the impact of the multi-laning of the Golden Quadrilateral on the performance of organised manufacturing. Box 2.5 provides a summary of the impact.

Main lessons emerging from this are:

i. Each country would have its own planning and policy strategy for development of the road network. NHDP in India has given a good boost to the economy. This project should continue. Similar projects should be undertaken for state highways as well.
ii. Due to land acquisition constraints, greenfield development is considered advantageous both in terms of speed and least social problems. This strategy would need to be pursued for the India's expressway network development.

Table 2.12
International Comparison—Road Network Ratios

	TOTAL		
COUNTRY	**KM/100,000 POPULATION**	**KM/1000KM² LAND AREA**	**KM/$ 1BN GDP**
Argentina	573	84	627
Brazil	899	207	839
China	288	403	651
India	**336**	**1,382**	**2,379**
Mexico	323	188	354
Pakistan	149	335	1,461
Russia	693	60	663
South Africa	728	300	1,000
Thailand	260	352	565
Turkey	498	471	494
France	1,466	1,485	371
Germany	787	1,847	196
Japan	948	3,314	221
New Zealand	2,159	359	744
Spain	1,448	1,337	474
UK	674	1,734	185
USA	2,116	714	449

Source: International Road Federation, World Road Statistics, 2011.

iii. Delegation of powers to field level functionaries helps avoid delays in project implementation. Simultaneously, they need to be made responsible and accountable for their performance.

DESIGN AND OPERATIONAL STANDARDS

DESIGN TRAFFIC VOLUME AND LEVEL OF SERVICE

A road is designed to cater to the traffic expected on it. Average daily traffic projected to some future design year, typically 15 to 20 years into the future, is an important criterion for determining the number of lanes and even characteristics of a highway. At the planning stage of a proposed highway, the design traffic volume is determined. If this volume exceeds a certain threshold, then the highway is designed for the functional class consistent with that level. The thresholds for China, South Africa and New Zealand are given in Table 2.13. In some cases, there is an overlap between traffic volume threshold ranges for two functional classes. Other factors besides traffic volume are then considered, such as economic development, and environmental, social and political considerations.

Level of service, LOS, is another factor that influences the decision as to when an arterial road should be expanded or upgraded. Traffic volumes associated with expected levels of service can be considered

Box 2. 4

Summarising Road-Building Programmes in China and Malaysia

	China	Malaysia
Planning	Develop a good effective master plan for an integrated highway network and link it through regular economic plans	Develop a good, integrated master highway plan
Policy	Implement policies to facilitate desired plan outcomes	Implement policies to facilitate desired plan outcomes
Planning Accountability	Plan formulated mainly by provincial governments; they are responsible for administering construction and loan repayments	Plan developed and projects managed by federal highway authority
Land Acquisition	Greenfield development considered fastest and most productive due to lack of interference from existing networks	Greenfield development considered most advantageous with least social problems
Highway Industry Capacity	International contracts bring advanced technology and better management methods; supply chain improved through institutional reform and privatisation	Early network expansion relied on international contractors for expertise and to build domestic capacity; large projects divided into smaller chunks to allow competition from domestic firms
Regulation and Legislation	Aim to develop regulations, and legislation that supports the overall policy	Separate government department to devise and administer regulations; highway authority solely manages the program
Trade Associations	Support the growth of trade associations; ensure open dialogue with government; promote self-regulation; establish a single apex organisation as 'voice of industry'	Maintain the view that trade associations help build much needed capacity
BOT	The privatisation experiment has been unhappy; government aiming to buy back concessionaires to reduce tolls	Extensive use of PPP; some criticism on speed of transfer to privatised arrangements; dissatisfaction with level and extent of tolling
Alternative Contract Arrangements	Preferring to experiment with pure private funding rather than BOT	Preferring to experiment with pure private funding rather than BOT
Operation and Maintenance Contracts	Used for about 40 per cent of toll expressways	
Building National asset base	Considered vital to complete projects with minimal delay; site staff has decision-making authority	Project level staff to make on-site decisions to avoid delay in project addition to asset base
Dispute Resolution	Typically, there are no disputes.	A new adjudication act is under consideration

Source: NTDPC Secretariat and papers received from the World Bank on Cost Effective Standards for Roads and Traffic Based Benchmarks for Widening of Highways versus Construction of Expressways.

Box 2.5
Impact of Golden Quadrilateral NHDP for Location and Performance of Manufacturing Sector

The Golden Quadrilateral National Highway project sought to improve the connection of four major cities: Delhi, Mumbai, Chennai and Kolkata. It comprises 5846 km connecting several industrial, agricultural and cultural centres of India. The study on the impact of the GQ highway upgrades on the performance of the organised manufacturing revealed that the GQ upgrades have increased new entry the most in high- and medium-density districts that lie 0-10 km from the GQ network. For instance, moderate-density districts, like Surat in Gujarat or Srikakulam in Andhra Pradesh, that lie on the GQ highway registered more than 100 per cent increase in new output and new establishment counts after GQ upgrades. On the other hand, the GQ upgrades are not linked to heightened entry or performance in low-density areas. One interpretation of these results is that the improved connectivity enables manufacturing establishments to efficiently locate in intermediate cities, but that localization economies prevalent for the sector continue to preclude entry in low-density places.

The project improved the connectivity and market accessibility of districts lying close to the highway compared to those more removed. Non-nodal districts located within 0-10 km from the GQ network experienced substantial increases in entry levels and higher productivity. These patterns are absent in districts 10-50 km away. The data suggest that there might have even been declines in entry rates in districts farther away. Dynamic specifications and comparisons to the NS-EW highway system mostly confirm these conclusions, with the most substantial caveat being that the productivity gains may be upwardly biased by a pre-period dip. The GQ upgrades also appear to have facilitated a more natural sorting of industries that are land and building intensive from the nodal districts into the periphery locations; the upgrades also appear to be encouraging decentralization by making intermediate cities more attractive for manufacturing entrants.

Source: Highway to Success in India: The impact of the Golden Quadrilateral Project for the location and performance of Manufacturing by Ejaz Ghani et al., January 2013, World Bank Policy Research Working Paper 6320.

to assess implicit benchmark volumes. The level of service reflects the operating conditions of the road in terms of traffic performance measures related to speed and travel time, freedom to manoeuver, traffic interruptions, and comfort and convenience[8]. In the United States, as well as in a number of other countries, there are six levels of service from LOS A (least congested) to LOS F (most congested) as shown in Table 2.14.

Table 2.15 shows the maximum density, volume-capacity (v/c) ratio and service flow rates for various LOS for multi-lane highways in the United States. It is seen that for each level of service, there is a maximum acceptable traffic flow for that level of service.

Typically, there is a specified design LOS for each class of highway at the planning stage. The design LOS is the minimum LOS that the highway should provide before it reaches its design year. It also indicates that when the actual LOS of a highway is worse than its design LOS, the highway should be widened or upgraded so it provides the design LOS. For arterials in rural level area, the design LOS is B, which means that if the free-flow speed of an arterial in rural level area is 50 mi/h, the maximum accepted traffic volume is 900 pcu/lane/hr. LOS performance is based largely on hourly performance.

Tables 2.16 and 2.17 present operational service levels for Freeways in China and in the United States.

For the same level of service, freeways in China and the United States are allowed to have more congestion (expressed as a higher vehicle-to-capacity ratio) than other highways. For example, for intermediate service levels of 2 and 3 for Chinese freeways, the vehicle-to-capacity ratios are 0.74 and 0.88. However, for Chinese Class I Highways, the corresponding values of vehicle-to-capacity ratios are 0.65 and 0.80.

The hourly lane capacities (corresponding to LOS E) for the United States is 2,250-2,400 passenger cars. The corresponding figure for Chinese freeways is 2,000-2,200 passenger cars. For the US Multilane Highways and Chinese Class I Highways, the hourly lane capacities are 1,900-2,200 and 1,600-2,000 respectively. United Kingdom Motorways (Freeways) have a range of hourly lane capacities (1,800-2,000) similar to that of Chinese Class I Highways. However, Single Carriageway (undivided highways) have lower hourly lane capacities.

8. TRB (2000).

Table 2.13
Traffic Thresholds

		THRESHOLD TRAFFIC VOLUME (AVERAGE DAILY TRAFFIC)		
ROAD CLASS	CARRIAGEWAY WIDTH	CHINA	SOUTH AFRICA	NEW ZEALAND
Freeway	4-lane	25,000-55,000	15,000	>8,000
	6-lane	45,000-80,000		
	8-lane	60,000-100,000		
Class I	4-lane	15,000-30,000	8,000-10,000	<12,000
	6-lane	25,000-55,000		
Class II	2-lane	5,000-15,000		
Class III	2-lane	2,000-6,000		

Source: K. C. Sinha et al. (June 2011).

Table 2.14
Highway Levels of Service in United States (AASHTO*, 2004)

LEVEL OF SERVICE	GENERAL OPERATING CONDITIONS
A	Free flow
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Source: K. C. Sinha et al. (June 2011).
Note: *American Association of State Highway and Transportation Officials.

Table 2.15

Capacity and Operational Service Levels for Multi-lane Highways in the US (AASHTO, 2004)

FREE-FLOW SPEED	CRITERIA	LEVEL OF SERVICE				
		A	B	C	D	E
	Maximum Density (pc/mi/ln)	11	18	26	35	40
50 mi/h	Average Speed (mi/h)	50	50	50	48.9	47.5
	Maximum v/c	0.28	0.45	0.65	0.86	1.00
	Maximum Service Flow Rate (pc/h/ln)	550	900	1,300	1,710	2,000
45 mi/h	Average Speed (mi/h)	45	45	45	44.4	42.2
	Maximum v/c	0.26	0.43	0.62	0.82	1.00
	Maximum Service Flow rate (pc/h/ln)	490	810	1,170	1,550	1,900

Note: pc/h/ln means passenger car per hour per lane, pcmi/ln means passenger car per mile per lane.
Source: World Bank Paper for NTDPC on Traffic-Based Benchmarks for Widening of National Highways Versus Construction of Expressways, by Kumares C. Sinha et al. (July 2011).

Table 2.16

Capacity and Operational Service Levels for Freeways in China

DESIGN SPEED	CRITERIA	LEVEL OF SERVICE				
		1	2	3	4	4
	Density (passenger cars/km/lane)	<7	<18	<25	<45	>45
Design Speed = 120 km/hr	Speed (km/hr)	>109	>90	>78	>48	<48
	Volume/ Capacity Ratio	0.34	0.74	0.88	1.00	>1.00
	Maximum Service for Transportation Volume (passenger cars/hr/lane)	750	1,600	1,950	<2,200	0-2,200
Design Speed = 100 km/hr	Speed (km/hr)	>92	>97	>71	>47	<47
	Volume/ Capacity Ratio	0.31	0.67	0.86	1.00	>1.00
	Maximum Service for Transportation Volume (passenger cars/hr/lane)	650	1,400	1,800	<2,100	0-2,100
Design Speed = 80 km/hr	Speed (km/hr)	>74	>66	>60	>45	<45
	Volume/Capacity Ratio	0.25	0.60	0.75	1.00	>1.00
	Maximum Service for Transportation Volume (passenger cars/hr/lane	500	1,200	1500	<2,000	0-2,000

Source: Ministry of Construction, China, 2004.

Table 2.17
Capacity and Operational Service Levels for Freeways in the United States

CRITERIA	LEVEL OF SERVICE				
	A	B	C	D	E
Maximum Density (passenger car/km/lane)	7	11	16	22	28
Free Flow Speed = 120 km/hr					
Minimum Speed (km/hr)	120	120	114.6	99.6	85.7
Maximum Volume/Capacity Ratio	0.35	0.55	0.77	0.92	1.00
Maximum Service Flow Rate (passenger car/hr/lane)	840	1,320	1,840	2,200	2,400
Free Flow Speed= 110 km/hr					
Minimum Speed (km/hr)	110	110	108.5	97.2	83.9
Maximum Volume/Capacity Ratio	0.33	0.51	0.74	0.91	1.00
Maximum service flow rate (passenger car/hr/lane)	770	1,210	1,740	2,135	2,350
Free Flow Speed= 100 km/hr					
Minimum Speed (km/hr)	100	100	100	93.8	82.1
Maximum Volume/Capacity Ratio	0.30	0.48	0.70	0.90	1.00
Maximum Service Flow Rate (passenger car/hr/lane)	700	1,100	1,600	2,065	2,300
Free flow Speed = 90 km/hr					
Minimum Speed (km/hr)	90	90	90	89.1	80.4
Maximum Volume/Capacity Ratio	0.28	0.44	0.64	0.87	1.00
Maximum Service Flow Rate (passenger car/hr/lane)	630	990	1,440	1,955	2,250

Source: World Bank Paper for NTDPC on Cost Effective Standards for Different Types of Roads by Kumares C. Sinha et al, USA (June 2011).

CONCEPT OF 2+1 ROAD SECTIONS

Several European countries have published standards on the design of 2+1 roads. A 2+1 road consists of two lanes dedicated to travel in opposite directions and a lane in the middle with alternating travel directions for the purpose of passing or turning. These roads involve either the new construction or the conversion of a two-lane facility (single lane in each direction) to three lane facility to defer expansion to a four-lane facility. Table 2.18 shows the longitudinal and transverse design standards implemented by Germany, Sweden, Ireland, Finland and South Korea.

The stated values for length of the passing section provide motorists a more generous opportunity for overtaking than passing sections available for US two-lane highways[9]. Such an opportunity causes drivers to execute the passing manoeuver with a more relaxed approach and consequently reduces crash frequency.

Main lessons emerging from these standards are:

i. The above capacity standards may not apply in India since there is a considerable mix of motorised and non-motorised traffic on roads in India both in urban areas and on inter-city highways. There is urgent need for development of a Highway Capacity Manual specific to India. It is understood that some research work has started in this direction by the Central Road Research Institute. This needs to be expedited and overseen by the Ministry of Road Transport and Highways.
ii. The capacity standards specified by the IRC

9. Lee et al. (2012); FHWA (2005).

Table 2.18
Design Standards for 2+1 Road Sections in Selected Countries

	SWEDEN	GERMANY	FINLAND	IRELAND	SOUTH KOREA
Diverging Area Length: Lnc (m)	100	30	50	50	90
Junction Length: Lc (m)	300	180	500	300	280
Length Of Passing Section: Lp (km)	1.00 to 1.25	1.00 to 1.40	1.50	1.00 to 2.00	1.00 to 1.50
Total Length: L (km)	1.40 to 1.65	1.21 to 1.61	2.05	1.35 to 2.35	1.37 to 1.87
Lane Width (m)					
First Traveled Lane	3.75	3.50-4.25	3.75	3.50	
Second Traveled Lane	3.25	3.25-3.50	3.50	3.50	
Passing/Turning Lane	3.25	3.25	3.25	3.50	
Shoulder Width (m)	1.00	0.25	1.25	0.50-1.00	

Source: World Bank Paper for NTDPC on Cost Effective Standards for Different Types of Roads by Kumares C. Sinha et al., USA (June 2011).

need immediate review particularly in respect of multilane highways. From Tables 2.15 to 2.17, it is observed that there is no perceptible decrease in operating speed under LOS C compared to that under LOS B and yet 40 per cent more traffic can be carried. The current Indian practice of designing roads for LOS B could be reviewed if studies in India show similar results. Adopting LOS C for design will imply more intensive use of the highway and it will also enable postponement of avoidable investment in capacity augmentation without any significant decrease in operational speeds.

iii. The 2+1 road section should not be considered at the current stage of road development in India until we have experimented with such designs and evolved specifications suitable for Indian traffic conditions on intercity roads.

ROAD ASSETS: PRESERVATION AND MANAGEMENT

In the 1980s, the growing perception of widespread failures in road maintenance led to a series of World Bank studies and these studies culminated in the publication in 1988 of Road Deterioration in Developing Countries (RDDC). The report asserted that sound road asset development and maintenance required that:

- A coalition of private and public stakeholders asserts 'ownership' of the road asset development functions.
- Road user costs and life-cycle analysis of road agency costs are both taken into account in public policy decisions concerning road development and management.
- Owners of the road network set up adequate funding mechanisms to sustain maintenance and capital renewal.
- Road maintenance and renewal works are carried out by bodies separate from the public road planning and administration bodies, contracted out in competitively tendered contracts.
- The more broadly engaged owners of the road network establish strong accountability and incentives aligned with the public interest among road administration, funding sources, planners, executing agencies and contractors. Quantitative performance measures are set and monitored regularly to support accountability.

Table 2.19 summarises the extent to which the above prescriptions have been applied in selected countries.

Main lessons emerging from these practices are:

i. Long-term (five years or more) performance-based maintenance contracts have encouraged contractors to invest in economically efficient maintenance actions and purchase of proper maintenance equipment. While PPP approaches have in-built provisions for long-term maintenance for projects undertaken through EPC mode, it is inevitable to move towards outsourcing of maintenance on a long term basis.

ii. Success of outsourcing depends upon proper

Table 2.19

Cross-Country Comparison of Adherence by Successful Countries to Key Recommendations of 'Road Deterioration in Developing Countries'

				OUTSOURCING		
COUNTRY	COALITION OF DIVERSE STAKEHOLDERS FOR GOOD ROADS	PLANNING BASED ON HOLISTIC COST ANALYSIS	SUSTAINED FUNDING MECHANISM	WORKS DESIGN & SUPERVISION OUTSOURCED TO 'ENGINEER'	EXECUTION OUTSOURCED TO 'CONTRACTOR'	QUANTITATIVE PERFORMANCE MONITORING
South Africa	Yes, sustained, but has evolved from broad stakeholder representation to more specialised board of professionals	Yes, sustained application of HDM-4	Yes, adequate funding sustained by taxes, tolls, and toll-backed borrowing, but earmarking discontinued	Yes, the engineer functions were corporatized in SANRAL, providing Full management flexibility as owner of National Roads	Yes, sustained	Yes, with sustained annual measurements of national roads condition
Rest of Sub-Saharan Africa	Extensive experimentation, with widely varying results	At least one strategic application in most countries, but mostly ad hoc, not sustained	Much improved across the region, but still major problem due to low population and low GDP per road-km	In some cases	In many cases	Extensive experimentation, but generally not well sustained
Argentina	No specific coalition, but concessionaires and contractors well incentivised for high road quality	Yes, sustained application of HDM-4	Yes, long-term contract funding sustained even through major fiscal crisis	No, the engineer functions have been retained in the government highways authority	Yes, sustained with major innovations in contracts to offset risks and incentivise contractors	Yes, sustained

Source: World Bank paper for NTDPC on Road Asset Management by Clell Harral, et al. (May 2011).

contractual framework, risk allocation mechanism and governance environment covering financial management, effective internal and external audits, accountability and responsiveness of road agencies to the needs/expectations of road users.

iii. Application of ICT measures offers promise to enhance performance. Quality of road agencies in planning, contract procurement and administration is the prime determinant of success in providing a good road infrastructure to society.

DIRECT CHARGING FOR HIGHWAY USE

Direct charging mechanisms to transfer the costs of construction, maintenance and operations to users is widely practiced in several countries. These include user fees paid to the road agency that reflects the amount of time or extent of highway use. Table 2.20 provides a summary of direct charge pricing schemes in Europe and Singapore. It would be seen that some of the general contexts of direct charging include levy of toll, congestion pricing, cordon fee, distance/weight based fees.

In some European countries (Box 2.6) such as Switzerland, Austria, Germany, Czech Republic, Slovak Republic, heavy goods vehicles (HGV) or commercial vehicles are required to pay tolls proportional to distance travelled on some, or all, major roads. None of these schemes is designed for congestion pricing although Austrian and German technologies permit some differentiation of tolls by time and location.

Several countries have studied distance-based charges for passenger vehicles (Box 2.7). Depending on the technology, the fee could be varied by time, distance, and location to price based on congestion. In the UK and the Netherlands, such schemes have not yet been implemented due to political opposition. In the United States, the use of a Vehicle Miles Travelled (VMT) fee as a long-run alternative to fuel taxes as the primary funding mechanism for roads is being considered, although the current political climate does not

Table 2. 20

Summary of Direct Charge Pricing Schemes in Europe and Singapore

	SYSTEM	PURPOSE/ OBJECTIVE	TYPE OF PRICING	MILESTONE DATES	TECHNOLOGY	MEASURED IMPACTS	ANNUAL REVENUES AND COST (IN USD)	DISTRIBUTION OF NET REVENUES
Demand Management	**Stockholm, Sweden:** Congestion Tax	Manage Congestion (primary) Promote Transit and protect Environment (secondary)	Cordon pricing in city center by time of day at SEK10 toSEK20 (about US$1.50 to US$3) per crossing of cordon line into and out of city center	Trial: January–July 2006 Referendum: September 2006 Permanently reinstated: August 2007	Automated number plate recognition (ANPR) to assess tax to vehicle owner	20 per cent reduction in traffic congestion in the city center 10-14 per cent decrease in emissions	Gross revenues (2009): SEK850 million (US$118.5 million) Net revenues (2009): SEK530 million (US$74 million) Overhead costs: SEK320 million (US$44.5 million), about 37 per cent of revenues	Collected by national government and transferred to the city of Stockholm Net revenues used to invest in transit and new roads
	London, United Kingdom: Congestion Charge	Manage Congestion (primary) Promote Transit and Protect Environment (secondary)	Area pricing in central London and its Western extension Flat daily rate of £8 (US$13)	Started in Central London: February 2003 Price increased from £5 to £8 (60 per cent increase) in July 2005 Western extension: February 2007 Repeal of western extension: planned in 2010	ANPR to track compulsory payment compliance and identify violators	Initial traffic reductions of 25 per cent and 19 per cent (central London and western extension, respectively)	Gross revenues (2008): £268million (US$435 million) Net revenues: £137 million (US$222 million) Overhead costs: £131 million(US$212 million), about 50 per cent of Revenues Capital costs for central London zone: £130 million (US$211 million)	Net revenues used for transit (80 per cent) and other transport (20 per cent) Improvements within greater London
Revenue Generation	**Singapore:** Electronic Road Pricing (ERP)	Manage congestion (primary) Promote transit (secondary)	Cordon and expressway pricing by time of day and vehicle class	Cordon pricing via manually enforced paper permit system in 1975 Transition to ERP in 1998, followed by expressway pricing	Dedicated short Range Communication (DSRC) in-vehicle units with removable stored-value smart card for payment ANPR for enforcement	Achieves free flow road speed targets of 45–65 km/h on expressways and 20–30 km/h on arterials.	Gross revenues (2008): SG$125 million (US$90 millions) Net revenues: SG$100 million (US$72 million) Overhead costs: SG$25 million (US$18 million), 20 per cent of gross revenues	Net revenues returned to vehicle owners through tax rebates – heavy investment from general fund in transit and highway systems

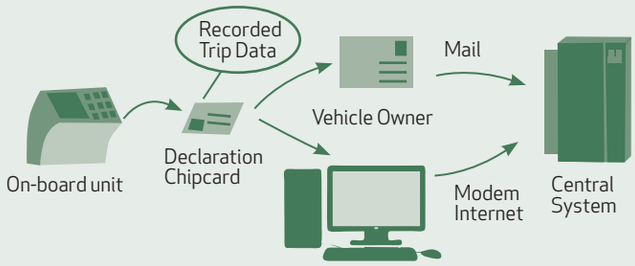
	SYSTEM	PURPOSE/ OBJECTIVE	TYPE OF PRICING	MILESTONE DATES	TECHNOLOGY	MEASURED IMPACTS	ANNUAL REVENUES AND COST (IN USD)	DISTRIBUTION OF NET REVENUES
Revenue Generation	**Germany:** Heavy Goods Vehicle (HGV) Charging on Highways	Generate revenue and promote user pays principle (primary) Protect environment and encourage mode shift to rail and water (secondary)	Truck tolls for HGVs greater than 12 metric tons on the autobahn and limited portions of other National Highways based on distance traveled, number of axles, and emissions class	Opened in January 2005	Global Positioning System (GPS) for vehicle location Global System for Mobile Communications (GSM) for data Transmission DSRC and ANPR for Enforcement Manual booking system via kiosk terminals and Internet for those without on-board units	Violations less than 2 per cent Empty truck trips declined by 7 per cent 58 Per cent shift from dirtier truck models (Euro class 1, 2, 3) to cleaner trucks (Euro class 4, 5)	Gross revenue (2008): €3 to 5 billion (US$5 billion) Overhead costs: 15 –20 per cent of gross revenues Average toll rate: €0.163 per km (US$0.378 per mi)	Net revenues for roads (50 per cent), rail (38 per cent), and Waterways (12 per cent) €560 million (US$815 million) per year for Truckers 'harmonization' programme
	Czech Republic: Truck Charging on Highways	Generate revenue and promote user pays principle (primary) Advance environmental objectives (secondary)	Truck charges on selected National Highways based on distance traveled, number of axles, and emissions class	Opening: January 2007 Originally for HGVs >12 metric tons Expansion to include trucks >3.5 metric tons in January 2010	Transponder-based DSRC system with gantries on mainline highways ANPR for enforcement	Average toll rate of US$0.35 per mi on freeways	Gross revenue (2008): CZK6 billion (US$340 millions) Overhead costs: 30 per cent of gross revenues Average toll rate: CZK4.05 per km (US$0.36 per mi) for highways; CZK1.90 per km (US$0.17 per mi) for first-class roads	Net revenues for roads and highways, railway lines, and inland transport routes
Demand Planning	**The Netherlands:** National Distance Based Tax (The plan has been dropped in 2010 due to political inaction)	Manage congestion, replace vehicle tax revenue, and promote user-pays principle (primary) Promote transit and protect environment (secondary)	National distance based road pricing of all vehicles (commercial trucks and private cars) on all roadways	Phased implementation was originally planned to begin in 2011, with all trucks covered by 2012 and all vehicles by 2018 Implementation is on hold	Under development, likely GPS for vehicle location, GSM-based data communication, and DSRC interrogation with ANPR for enforcement	2020 forecasted results: 5-10 per cent reduction in vehicle-miles traveled 40–60 per cent reduction in delays 10 per cent reduction in CO_2 6 per cent increase in public transit use	Gross revenues (2019 forecasted): €9 billion ((US$13.1 billion) Overhead costs: to be determined (capped in law at 5 per cent of gross revenues) Capital costs (estimated): €5.7 Billion (US$8.3 Billion)	Revenues intended to replace existing vehicle ownership taxes

Source: World Bank Paper for NTDPC on Direct Charging Mechanisms for Highway Use by Kumares C. Sinha et al. (July 2011).
(Adapted from FHWA 2010).

Box 2.6

Distance-based Heavy Goods Vehicle Schemes in Europe

The **Swiss** toll applies to HGVs over 3.5 metric tonnes gross vehicle weight and is paid on the entire 71,000 km national road network. It is differentiated by emissions class but not by type of road or time of day. Distance is recorded using a digital tachograph and a smart card. The unit is activated by roadside dedicated short-range communication device (DSRC) transponders when a vehicle enters the country, and it is deactivated when the vehicle exits. Charges are paid by inserting the smart card into a roadside terminal.



Billing procedure of Swiss HGV distance-based pricing scheme

In contrast to the Swiss system, HGV tolls in **Austria** are only charged on the 2,060 km primary road network and are not differentiated by emissions class. An on-board unit called a "Go Box" is used for communications. It uses DSRC microwave technology, is attached to the windscreen, and can be easily set to register the number of axles on the truck and trailer. Such pricing schemes in European countries offer interoperability or seamless travel. For instance, the Swiss on-board unit (OBU) can be used in Austria as an alternative to the "Go Box".

Germany's HGV scheme "Toll Collect" applies to federal motorways and some secondary roads (12,000 km in total). Toll differentiation is similar to Switzerland, but the technology is more advanced, using GPS to measure distance. DSRC beacons are used for backup location information. The system is scalable in that more roads can be added, and the technology allows tolls to be differentiated by road type and time of day.

Source: World Bank Paper for NTDPC on Direct Charging Mechanisms for Highway Use, Kumares C. Sinha et al. (July 2011).

favour such a scheme. Several US experiments with regional distance-based pricing have been conducted that provide evidence on the technological possibilities and challenges.

Main lessons emerging from these practices are:

i. Road toll is a good mechanism for direct charging for road use and to generate additional revenues. The current practice of levy of tolls for use of multi-lane highways in India should continue.
ii. For collection of tolls, manual toll booths are prone to revenue leakage. It is, therefore, preferable to switch over to electronic toll collection. A transparent system improves confidence of the general public. There is need to display toll collected upto date at each toll plaza.
iii. Toll charges may be dynamic, different for peak and non-peak periods.
iv. The policy of weight-distance charges being implemented for heavy goods vehicles in Europe should be introduced in India to generate additional revenues.
v. Linking the rates/charges to the benefits received by the users contributes to public acceptance. There is a strong case, therefore, for a detailed highway allocation study that should capture the costs occasioned by different class of vehicles on road construction and maintenance. Evidence-based research in this direction is of paramount importance. This would help the government in facing the occasional threats/concerns by the transporters and truckers as they do believe/perceive that benefits received by them are not commensurate with the taxes and toll charges being recovered.

Box 2.7
Experimental Distance-based Passenger Vehicle Schemes

- Oregon VMT Pricing Pilot Project (2004–06)
  - Assessed viability of distance-based charges as a replacement for fuel taxes.
  - Charges defined by zone and peak/non-peak periods
  - Test vehicles equipped with GPS devices that recorded mileage
  - Individual vehicle movements cannot be tracked
  - Distance-based charge paid automatically when vehicles refuel at participating gasoline stations
  - State fuel tax was deducted from the bill
  - Conclusion: GPS technology is reliable; privacy protection can be assured.

- Puget Sound Regional Council assessed the merits of several road-pricing schemes (2002–2008)
  - Examined driver responses to network-wide facility based tolls
  - Tolls were varied by road class, peak/non-peak period
  - Unlike Oregon, GIS used with GPS; distances travelled on freeways and arterials recorded separately

- University of Iowa Study (2005)
  - Assessed feasibility of GPS-based tolling technology, gauged driver response and public attitudes
  - GIS is used in combination with GPS to record distances within the region, to compute charges on the vehicle, and to download updates to the database
  - Only aggregate charging data is transmitted from the vehicle
  - Unlike in the Oregon and Puget Sound studies, tolls are flat

Source: World Bank Paper for NTDPC on Direct Charging Mechanisms for Highway Use, Kumares C. Sinha et al. (July 2011).

USE OF INTELLIGENT TRANSPORT SYSTEMS

ITS has been deployed by several countries to provide a number of services to enhance the operational performance of highway networks by increasing user awareness of traffic conditions and alternative routing opportunities. The deployment status of ITS services and application areas in different countries is presented in Table 2.21.

Main lessons emerging from this are:

i. The ongoing advances in information and communication continue to lower the cost of ITS deployment.
ii. ITS can be installed at the time of development of road infrastructure (to save on additional retrofitting cost later on).
iii. Low cost incident management systems (highway service patrols, call centres) are most cost-effective ITS.
iv. Electronic Toll Collection has helped reduce congestion at toll booths besides ensuring transaction security and reducing revenue leakage.
v. ITS application in Commercial Vehicle Operations is critical to the productivity and efficiency of trucking and interstate bus operations. Such applications are designed to enhance commercial vehicle safety, communication between carriers and consignors/consignees, fleet management and facilitate regulatory processes. They help in seamless movements across states.
vi. To start with, a simple ITS architecture and gradual phasing-in of ITS components is preferable.

ROAD SAFETY

Road safety is a matter of grave concern in India. Box 2.8 gives a glimpse of some of the best international practices.

A Report of the Sundar Committee on Road Safety and Traffic Management was submitted to the MoRTH in February 2007. Based on this report, the National Road Safety and Traffic Management Board Bill, 2010, was submitted to the Lok Sabha in 2010 and considered by the Standing Committee On Transport, Tourism & Culture. The Bill was referred back to the MoRTH for reconsideration and it has not yet been resubmitted to the Parliament. The

Table 2. 21
Deployment Status of Selected ITS Application Areas in Different Countries

APPLICATION AREAS OF FOCUS	SUB-AREAS I	SUB-AREAS II	SELECTED COUNTRIES WITH EXPERIENCE
Advanced Traffic Management Systems	Incident Management	Service Patrols and Call Centres	US, Europe
		Automated Systems	US, Europe, China, Malaysia, South Korea, South Africa
	Electronic Toll Collection (ETC)	ETC Systems	US, Europe, China, Malaysia, South Korea, South Africa, India, Singapore
	Arterial Management	Adaptive Traffic Control Systems	US, Europe, China, India, Thailand, South Korea, Brazil
		Automated Enforcement (red light, speed limit)	US, Europe, South Africa
	Demand Management	Ramp Metering	US, Europe, South Africa
		Managed Lanes	US, Europe
Advanced Traveller Information Systems		Variable Message Signs	US, Europe, China, Malaysia, Thailand, South Korea
		Internet/Mobile Applications	US, Europe, Malaysia, Thailand, South Korea
		Call Centres	US, Europe
Commercial Vehicle Operations		Credentials Administration	US, Europe
		Safety Assurance	US, Europe
		Electronic Screening	US, Europe
		Carrier Operations and Fleet Management	US, Europe, Brazil
		Security Operations	US, Europe

Source: Resource Paper by World Bank for NTDPC.

main recommendations of the Sundar Committee report are:

- The National Road Safety and Traffic Management Board should be established through an Act of the Parliament called the National Road Safety and Traffic Management Act.
- It should address road safety issues in respect of the National Highways and Mechanically Propelled Vehicles and make recommendations and set guidelines on road safety on other roads. It should contain enabling provisions to set up Road Safety and Traffic Management Boards in the states. It should also encompass the provisions related to road safety contained in the other relevant Acts like the Motor Vehicles Act. The Parliament is competent to legislate on Road Safety and Traffic Management in respect of National Highways and Mechanically Propelled Vehicles as they fall in List II of Schedule VII of the Constitution. This Act should be administered by the Ministry of Road Transport and Highways.
- The primary objective of this Board would be to promote road safety and improve traffic management in India. It would be responsible for the following functions:
  - Road related measures: designing, setting standards and conducting audits
  - Vehicle related measures: prescribing safety features and setting standards
  - Road safety research: institutional linkages and training
  - Traffic laws, operations and management
  - Capacity building
  - Medical care and rehabilitation: Lay down

Box 2.8
Best Practices: Systematic Road Safety

SWEDEN
In 1997, the Swedish Parliament adopted the Vision Zero, a bold new road safety policy based on four principles:

i. Ethics: Human life and health are paramount; they take priority over mobility and other objectives of the road transport system;

ii. Responsibility chain: The providers, professional organisations and professional users are responsible for the safety of the system. The users have the responsibility to follow rules and regulations. If the road users fail to follow rules and regulations, the responsibility falls back on the providers of the system;

iii. Safety philosophy: Humans make errors; road transport systems should minimise the opportunity for error and the harm done when errors occur;

iv. Driving mechanisms for change: Providers and enforcers of the road transport system must do their utmost to guarantee the safety of all citizens and each of the participants should be ready to change to achieve safety.

Who is involved?
The Swedish Road Administration (SRA) has the overall responsibility for road safety within the road transport system. According to the principles of Vision Zero, all other stakeholders in the field of road transport also have responsibilities for ensuring and improving road safety.

How effective and costly is it?
Vision Zero is estimated to achieve a possible reduction in the number of deaths by a quarter to one third over a 10-year period. The adoption of Vision Zero in Sweden helped in developing further research and implementing a new system design. It helped in the implementation of the upgrading of single carriageways to 2+1 lanes roads with central cable barriers to shield drivers from opposite traffic.

THE NETHERLANDS
A Sustainable Safe road system aims to prevent crashes and if they still occur, to minimise their consequences. It is based on the idea that people make mistakes and are physically vulnerable. There are five main principles: functionality, homogeneity, predictability, forgivingness, and state awareness. The Sustainable Safety vision has a large influence on road safety work in practice, and has led and still leads to the implementation of effective and sustainable road safety measures. For example, one of the consequences of the principle of homogeneity is that motorised traffic and vulnerable road users (pedestrians, cyclists) can only interact if speeds of motorised traffic are low. If speeds cannot be kept low, separate facilities for vulnerable road users are required.

Who is involved?
Sustainable Safety has been the leading vision in the road safety policy of the Netherlands since the early nineties. The road authorities at the different levels (national, regional and local) actually implement the Sustainable Safety measures.

How effective and costly is it?
It has been estimated that the infrastructure measures of the sustainable safety approach reduced the number of fatalities and in-patients by 6 per cent nationwide. Costs, in particular those related

to reconstruction of roads are high, but can largely be combined in the budget for regular maintenance work.

AUSTRALIA AND NEW ZEALAND

Road authorities in Australia and New Zealand have committed to the Safe System approach as a conceptual framework which guides all activities relating to the provision and operation of roads. In managing road safety, the safe system approach implies:

- Designing, constructing and maintaining a road system to reduce fatal or debilitating injury accidents.
- Improving roads and roadsides to reduce the risk of crashes and minimise harm.
- Regulating or encouraging high quality active and passive safety systems in vehicles to reduce impact forces on occupants and on struck pedestrians and cyclists.
- Managing speeds, taking into account the risks on different parts of the road system. Advising, educating and encouraging road users to obey road rules and to be unimpaired, alert and responsive to potentially high-risk situations.
- Using enforcement and penalties to deter road users from breaking the rules, including removing the privilege of road use from those who do not comply.
- Program research to identify the most cost-effective interventions for particular situations. Promoting public understanding and endorsement of the safe system approach, and public participation in achieving a safer road system.

Source: Europa Road Safety Handbook, 2009

guidelines for establishing and upgrading trauma care systems at all levels

- The Committee noted that the Committee on Infrastructure decided that one per cent of the cess accruing to the National Highways should be employed to create a National Road Safety Fund. The Committee was of the considered view that a minimum of one per cent of the total proceeds of the cess on diesel and petrol should be available to the Road Safety Fund of Centre and the states, as road safety is a matter of concern not only on National Highways but also on the state roads, village roads and railway level crossings.
- The legislation should also contain an enabling chapter for the states to set up Road Safety and Traffic Management Boards, which the states could adopt.
- The proposed structure of the Board is given as follows.

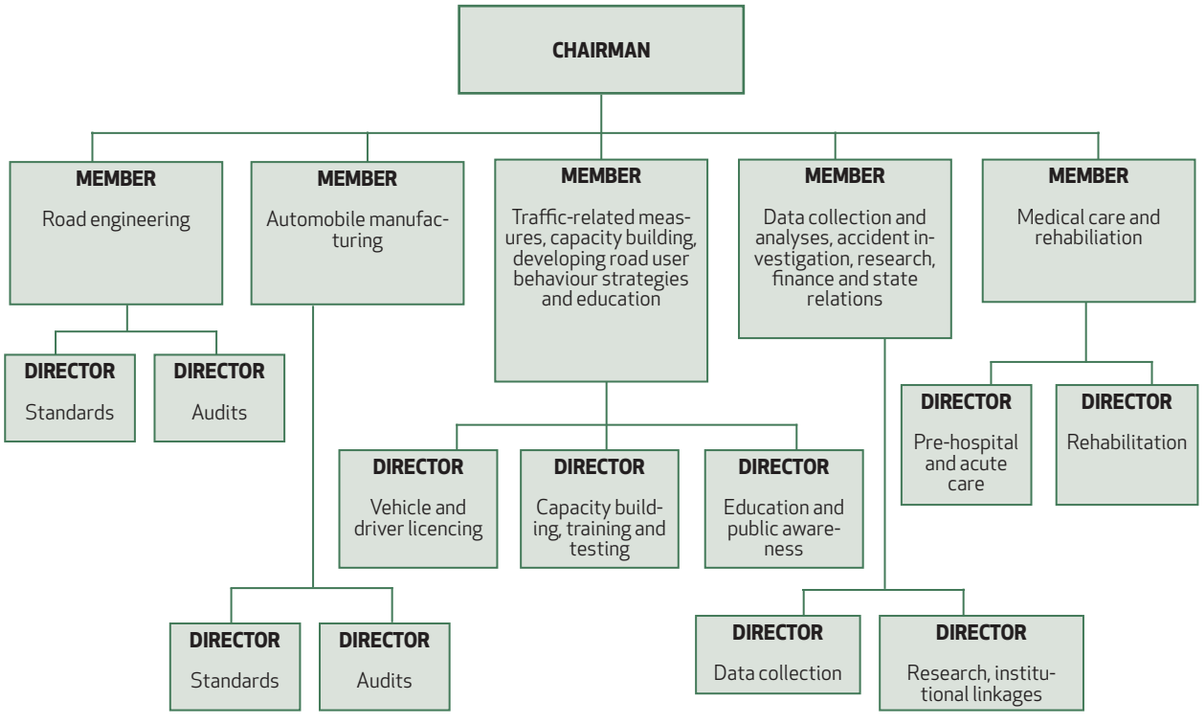
RECOMMENDATIONS IN THE 12TH FIVE YEAR PLAN

Annually, 150,000 people die in road accidents in India. To strengthen the data, there is need to set minimal road death and injury data reporting requirements in accordance with standards set by the International Accident Database Group (IRTAD) for national level data. Web-based data systems should be established and be made operational in the 12th Plan period. There is need to implement on an urgent basis the key recommendation of the Sundar Committee Report regarding the creation of National Road Safety and Traffic Management Board.

High level of awareness is required so that systemic problems get rectified. Awareness should be spread using all modes of communication: TV, newspapers and radio. ITIs need to be involved in driver training. MoRTH provides a scheme for setting up IDTR/DTI at state level. Before they start imparting driving training in driving schools, they should attend 'Trainers Training' in IDTRs/RSIs. To ensure that the needs are met, driver training schools should be encouraged to come up in the PPP mode.

At present, the introduction of new safety standards is dependent on testing facilities available in the country including those at NATRIP. Since the vehicles produced in the next few years will be present on the road for about two decades, it is essential that the provision of testing facilities and introduction of new standards should be expedited. Impact standards for vehicles should be implemented on an early basis. Since a vast majority of those injured and killed in road accidents comprise pedestrians, bicyclists, and motorcyclists, India should take the lead in introduction of pedestrian impact standards for all vehicles. India should set up an NCAP India

Figure 2.3
Road Safety and Traffic Management Board: Proposed Structure



Box 2.9
Capacity and Performance Indicator Framework for Road Agencies

Mandate, Policy and Legal Framework: The indicators under this category are intended to capture the vision/mission statement of the highways agency and to find out if a formal road policy, backed by a legal and regulatory framework, has been laid down covering development, asset management and safety.

Planning: Indicators in this category are expected to inform planning capabilities of the highway agency by assessing the existence of long- and short-term investment plans for both development and maintenance of their road network and asset management system.

Capacity: Under this category, indicators are intended to capture the highway agency's strength to deliver its mandate by knowing outputs of the budget, expenditure, projects delivery, skill development strategies, and human resource management.

Efficiency: The indicators under this category would capture the agency's ability to evolve cost effective strategies in developing the road programs and efficient contract administration to contain time and cost overruns during the implementation. Monitoring the 'asset value' of the network is one such indicator.

Quality of Road Network: The indicators under this category are intended to assess the agency's ability to provide a safer, greener, reliable and more comfortable road network. The indicators suggest the shifting of focus from a traditional input- and process-based one to outcome- and user-oriented measures, for example, capturing the degree of congestion, network quality index, and accident hazards.

Private Sector Participation: The indicators under this category intend to assess the road agency's effort to attract and promote private sector financing of the road sector.

Governance: The indicators under this category are intended to capture initiatives such as right to/freedom of information, e-procurement, website, publishing of annual reports, road user satisfaction surveys, and grievance redressal mechanisms.

Source: A Review of Highway Agencies in the South Asia Region by Rajesh Rohatgi et al. World Bank and DFID, 2011

Programme. In the first phase, cities with significant transport vehicles (Metros) should introduce a modern inspection and certification regime.

CAPACITY AND PERFORMANCE INDICATOR FRAMEWORK FOR ROAD AGENCIES

A study of road agencies in the South Asia region including India was undertaken by the World Bank with the objective to help governments and policy makers in identifying reforms required to strengthen the capacity and performance of their agencies to deliver large investment programmes. The study utilised the systems prevalent in Australia, South Africa, New Zealand and Sweden. It recognised that each country and within each country, each road agency has to identify its own capacity and performance indicator framework based on its specific mandate and vision. Keeping in view the functions required to be performed by the road agencies, the Bank has proposed a seven-category framework. These are indicated in Box 2.9.

The benefits of adopting such a framework are:

i. The agency is able to improve its performance and pride itself in doing so as the performance of its roads become verifiable.
ii. The accountability of the agency improves as it becomes easier to assign responsibilities to specific departments and engineers/managers.
iii. It brings transparency to the agency's decision-making process.
iv. It supports highway agencies in improving its efficiency and effectiveness in delivery of road programmes.

The road agencies need to move steadily and gradually to modern organisation. The basic requirement is to establish a regular data and information collection strategy in the highway agency and instituting a system of annual performance targets, capacity building and enhancing competence of staff in business practices in programme delivery and bringing in a culture of road asset management and focusing on responsiveness to needs of users. The MoRTH already has a system of RFD (Result Framework Document) for functions within its mandate. This can be reviewed to capture outcome based indicators suggested earlier.

POLICIES TO ENCOURAGE ENERGY EFFICIENT VEHICLES

Policies for enhancing energy efficiency of vehicles may be intended to improve operational efficiency of existing vehicles or to encourage purchase of fuel efficient vehicles. Fuel efficiency also leads to reduction in CO_2 emissions. There are five core areas where international experience provides examples that might be helpful to consider: financial measures; regulatory standards; inspection and maintenance programme; public outreach; and traffic management. They have been applied in various forms, in a number of countries, including the US, UK, Canada, Australia, Japan, China, Singapore, Hong Kong, and South Korea[10]. Box 2.10 gives broad details

SUMMARY AND CONCLUSIONS

For projects undertaken through the EPC mode, it is inevitable to move towards outsourcing of maintenance on long-term basis

i. The capacity standards adopted in USA, China, etc. may not apply in India since there is considerable mix of motorised and non-motorised traffic on roads in India both in urban areas and on inter-city highways. Some research work for development of a Highway Capacity Manual specific to India is in progress by the Central Road Research Institute. This needs to be expedited and overseen by the Ministry of Road Transport and Highways.

ii. The current Indian practice of designing roads for LOS B could be reviewed if studies show that there is no perceptible decrease in operating speed under LOS C compared to that under LOS B. Adopting LOS C for design will imply more intensive use of the highway and it will also enable postponement of avoidable investment in capacity augmentation without any significant decrease in operational speeds.

iii. Experience from countries like South Africa and Argentina, which succeeded in improved delivery of road maintenance has revealed that long term (five years or more) performance-based maintenance contracts have encouraged contractors to investin economically efficient maintenance actions and purchase of proper maintenance equipment. While PPP approaches in India have in-built provision for long-term maintenance, for projects being undertaken through EPC mode, it is inevitable to move towards outsourcing of maintenance on long term basis. Further, success of outsourcing depends upon proper contractual framework, risk allocation mechanism and governance environment covering financial management, effective internal and external audits, accountability and responsiveness of road agencies to the needs and expectations of road users.

10. Onoda (2008); APEC (2009); IEA (2009); Kojima and Ryan (2010).

Box 2.10

Summary of Core Areas to Achieve Energy Efficiency of Vehicles

Financial Incentives and Disincentives

Initiatives involving financial measures can be grouped under the following mechanisms:

- Differential taxes and charges based on fuel efficiency or greenhouse gas emissions (or proxies such as engine size or vehicle weight).
- 'Feebates': a set of fees (surcharges) for fuel-inefficient old vehicles and rebates for the purchase of new fuel efficient vehicles, based on fuel-efficiency, GHG emission (CO_2) performance of the vehicle.
- Internalisation of the external costs of highway energy consumption by increasing fuel taxes.
- Subsidies for purchasing alternative fuel vehicles or for converting traditional fuel vehicles to alternative fuel vehicles.
- Support to manufacturers to develop vehicles that use alternative fuels.
- Support for research and development into existing fuel enhancement and new fuel technologies.
- Mandate government agencies to purchase hybrid, alternative fuel, or efficient vehicles for agency fleets

Regulatory Standards for Vehicle Fuel Efficiency

In countries where regulatory standards for vehicle fuel efficiency have been used, it has been in the form of one or more of the following specific mechanisms:

- Foster mandatory vehicle fuel efficiency or CO_2 emission standards.
- Establishing automotive industry agreements on fuel efficiency and adaptation of efficient and innovative vehicle technology.
- Improve on-road fuel efficiency of vehicles by focusing on energy efficiency of non-engine components (generally not considered in official fuel efficiency tests), including tyres, cooling technologies, and lighting systems.
- Developing and enforcing standards on imported or used vehicles.
- Vehicle efficiency labels/ratings at point of sale/purchase.
- Implement fuel efficiency standards for heavy duty vehicles
- Provide a mandate that two- and three-wheeled vehicles, a large source of petroleum fuel consumption and air pollution, should be retrofitted with modern engine improvements and alternative fuels that enhance energy efficiency and reduce emissions.

Inspection and Maintenance Programmes

Inspection and maintenance (I/M) programmes are a common initiative in many countries to promote greater fuel efficiency and ensure that vehicles meet emissions standards. I/M programmes have been implemented through a variety of specific mechanisms such as:

- Enforcing operational efficiency of used vehicles through periodic inspection and maintenance programme.
- Mandatory vehicle emissions inspection, targeted primarily to local air quality.
- Encouraging the retirement of old vehicles through both mandatory and voluntary programme.

The enforcement of periodic inspection and maintenance requirements has been accomplished as a part of annual registration process or the use of windshield decals indicating compliance. In the US, universal I/M programs were discontinued after public complaints and are currently administered only in metropolitan areas that are not in compliance with EPA air quality standards. Some countries have experienced that I/M programs can become burdensome requirements for vehicle owners and thus can lead to evasion and attendant corruption.

Public Outreach and Awareness Programs

The mechanisms of public awareness campaigns, through billboards, television, print media, radio, and in-vehicle systems, have included the following:

- Provision of information to car purchasers on vehicle performance, e.g., fuel consumption

labelling on vehicles, including fuel consumption data in vehicle advertisements.
- Standards/labelling requirements for non-engine components, such as tyres, cooling units and lighting, etc., which impact on fuel consumption.
- Communicating the range of operational efficiency of vehicles and its monetary significance to consumers/drivers, such as in-car feedback instruments for eco-driving.
- Heavy vehicle environmental rating scheme.

Highway Traffic Management

Policy initiatives in this area are directed at minimising stop-and-go operations and frequent speed changes. Fuel efficiency can be improved if a relatively smooth traffic flow can be maintained. Many countries are in the process of pursuing the following:

- Implement intelligent transportation systems in order to minimise delay and idling.
- Rapid incident detection and clearance at low capacity highways
- Improve highway, street, and intersection design standards that foster smooth flow of traffic.
- Adopt demand management programs.
- Add physical capacity by adding lanes, bypasses, or other improvements.

Source: World Bank Paper for NTDPC on Government policies to encourage energy efficient vehicles on roads by Kumares C. Sinha et al. June 2011.

iv. Direct charging mechanism for road development practiced in Europe, Singapore, etc. provide evidence that road toll is a good instrument for direct charging of road use and to generate additional revenues. The current practice of levy of tolls for use of multi-lane highways in India should continue. For collection of tolls, it is preferable to switch over to electronic toll collection. A transparent system improves confidence of the general public. There is need to display toll collected upto date at each toll plaza. Toll charges may be dynamic, different for peak and non-peak periods.

v. The policy of weight-distance charges being implemented for heavy goods vehicles in Europe should be introduced in India to generate additional revenues.

vi. Linking the rates/charges to the benefits received by the users contributes to public acceptance. There is a strong case, therefore, for a detailed highway allocation study that should capture the costs occasioned by different class of vehicles on road construction and maintenance. Evidence-based research in this direction is of paramount importance. This would help the government in facing the occasional threats/concerns by the transporters and truckers as they do believe/perceive that benefits received by them are not commensurate with the taxes and toll charges being recovered.

vii. Intelligent transport systems have been deployed by several countries to enhance the operational performance of highway networks. The ongoing advances in information and communication technology continue to lower the cost of ITS deployment. ITS application in Commercial Vehicle Operations is critical to the productivity and efficiency of trucking and interstate bus operations. Such applications are designed to enhance commercial vehicle safety, communication between carriers and consignors/consignees, fleet management and facilitate regulatory processes. They help in seamless movements across states.

INDIA'S ROAD NETWORK OVER THE NEXT 20 YEARS

A VISION STATEMENT FOR INDIA'S ROAD NETWORK

There is value in constructing a normative vision statement for India's desired road network. It can help to ensure that the various institutions responsible for planning, providing and commissioning road infrastructure agree on the ends that the network must serve. A shared vision together with derived qualitative and quantitative goals is more likely to result in a coherent, comprehensive network that best addresses India's socio-economic needs and wants. It can serve as a valuable communication device in selling infrastructure policy and decisions to the populace. Equally, it can serve to hold to account the public and private institutions that are responsible for designing, planning, commissioning, building, operating, managing and maintaining India's road network.

By 2032, the end of the 15th Five Year Plan period, India's road network should:

Table 2.22
GDP Estimates for 12TH, 13TH, 14TH and 15TH Plans

YEARS	GDP ESTIMATES (PER CENT)
2012-17 (12TH PLAN)	6.6
2017-22 (13TH PLAN)	8.0
2022-27 (14TH PLAN)	8.5
2027-32 (15TH PLAN)	9.0

Source: NTDPC Research (Chapter 3, Volume II).

- Be of an extent and quality that is commensurate with supporting the desired pace of India's economic transition;
- Facilitate export and import trade movements;
- Provide reliable all-weather road connectivity between every village and settlement to an arterial road that in turn connects with market towns;
- Help in achieving enhanced road safety as also smooth and efficient movement of people and goods;
- Mitigate the adverse environmental costs of road transport to the furthest extent;
- Meet India's strategic and defence needs as also national and energy security goals;
- Be the product of a sensitive approach to social considerations, including through fairly compensated land acquisition, and proper resettlement and rehabilitation of affected people;
- Be sustainable, well managed and preserved commensurate with investments being made in the sector;
- Promote the integration of scheduled castes and tribes, and national integration more generally;
- Assist in providing equitable access to economic, educational and healthcare facilities for all citizens.

ESTIMATED DEMAND

The demand for both freight and passenger traffic has been growing rapidly over the years. The modal split between rail and road transport in both freight and passenger traffic is heavily inclined towards road transport. As of 2011-12, road transport is estimated to hold 69 and 90 per cent share in case of freight and passenger traffic respectively[11].

The NTDPC has estimated the growth in road freight and passenger traffic over the next 20 years (Table 2.23). The forecasts are made using the elasticity of traffic demand with respect to GDP as the underlying approach. Table 2.22 presents the GDP growth projections.

As far as freight traffic is concerned, it is estimated on the basis of historical data that the total freight traffic (rail+road) holds an elasticity of 1.2 with respect to GDP[12]. In addition, it is estimated that the share of road in total freight traffic would decline from 69 per cent in 2011-12 to 65 per cent in 2016-17 to 55 per cent in 2021-22 to 50 per cent in 2031-32.

In case of passenger traffic, the elasticity of road passenger traffic has been estimated 1.9 with respect to GDP, keeping the GDP estimates same as above, which appears reasonable given the historical trend.

Road freight traffic is estimated to grow at about 9 per cent per annum and the road passenger traffic at about 17 per cent over the next 20 years. Throughout, the growth elasticity of freight transport is held, conservatively, at 1.2 and of passenger transport at 1.9. There is substantial international evidence that as countries enter phases of sustained high growth, growth elasticities—which, like all elasticities, are linear estimates valid only at defined points—become increasingly unrepresentative. If India sustains growth rates in excess of 7 per cent, implying a doubling in the size of the economy every 10 years, the GDP-elasticities for transport demand will almost certainly be different.

POLICY AND PLANNING

TRAFFIC SURVEYS

Transport operations in the road sector being basically in private hands, there is high level of customer focus. However, at the same time, this mode is much less energy efficient and environment friendly besides being more unsafe. As such, road development should not be seen in isolation but as part of

11. NTDPC Research.
12. For more details, refer Chapter on Trends in Growth and Development of Transport (Chapter 2, Volume II).

Table 2. 23
Projected Road Freight and Passenger Traffic

YEAR	TRAFFIC	
	FREIGHT BTKM	PASSENGER BPKM
2011-12	1,385*	9,329
2016-17	1,987	17,272
2021-22	2,949	35,043
2026-27	4,321	74,079
2031-32	6,559	163,109

* Estimated
Source: NTDPC Research

an integrated modal system of transport. For facilitating such a process, it is necessary to undertake regional traffic and transport surveys on regular basis—preferably every five years (to provide inputs to formulation of Five-Year Plans and mid-course correction of policy prescriptions formulated for long-term development goals)—of freight and passenger flows, transport pricing, resource costs and identify existence of distortions in the movement from point of view of a desirable/optimal intermodal mix and investment policy for different modes of transport.

To this end, a Total Transport System Study encompassing the five modes of transport in the country—railways, roads, coastal shipping, inland waterways and airways—should be mandated, covering the following main objectives:

a. To generate and analyse inter-modal transport resource costs and traffic flows
b. To identify the factors leading to the current distribution of passengers and freight traffic and reasons for distortions observed from the perspective of national resource costs
c. To determine an optimal inter-modal mix and allocation of transport investment to assist the planners in designing a transport vision for the immediate term of five years and direction for the long-term

The exercise indicated above should be carried out under the umbrella of Office of Transport Strategy.

ROAD DATA CENTRE

Database in the road sector is virtually absent. This needs serious attention. Setting up of a dedicated road data centre managed through a high level institution does not admit of any delay. This would help in reducing the current ad hoc decision-making in the road development planning process.

CAPACITY AUGMENTATION

The entire transport system, including roads, is facing capacity constraints. The economic and environmental costs of a saturated transport system are high. Strangulation of railway capacity is unduly burdening the road sector. Railways need to regain their share. This cannot happen until their capacity is enhanced and they learn from road transporters to provide a better customer focus. It is also to be realised that the congested roads lead to lower transport productivity, increased energy consumption and pollution. Lack of road and vehicle maintenance adds to the undesirable industry competitiveness in the international market besides resulting in high inventory costs. Once the role for roads and road transport is identified within the overall transport system, it is necessary to identify and carve out road development and maintenance programmes which not only meet the expected traffic demand and improve transport productivity but also ensure that such programmes reduce in their wake the negative externalities of energy inefficiency, environment pollution and accident hazards.

RURAL CONNECTIVITY

Integrated rural development has been another area of focus by the government for considerations of social justice, national integration, economic uplift and overall higher productivity in rural areas. For this, there is all-round recognition of rural roads serving as one of the key infrastructures as they help in increasing accessibility to schools, health centres and in creating more employment opportunities. Rural roads serve as an entry point for poverty alleviation. These roads also provide

The primary roads should have uniform design standards for a given volume of traffic and service level desired, irrespective of whether they are National Highways or State Highways.

physical mobility of raw materials, farm produce, promote specialisation and increased size of market. Further, these roads influence the process of growth by facilitating dispersal of knowledge and reduction of inequalities. The states have already prepared district level Core Road Network master plans in due consultation with the Panchayati Raj institutions and local MLAs and MPs. These plans could be reviewed every five years to account for both agricultural and industrial growth in each district. The current programme of PMGSY needs to be expanded to achieve universal connectivity to all habitations on a time-bound basis and upgradation of existing roads based on traffic and condition assessment. In remote hill areas, provision of ropeway bridges across streams/rivulets need also to be considered to enhance access. Priority for upgradation of existing roads would need to be given to roads linking rural growth centres.

SOCIAL ASPECTS

Another area of concern is finding ways and means of reducing the burden of land acquisition where it affects the communities. Road design standards should account for this social factor as well. The rehabilitation and resettlement (R&R) of persons whose livelihoods or habitations are affected by road development projects varies widely, depending on whether projects are implemented through external aid or loan assistance, or through publicly funded projects or PPP projects. It is also dependent on the nature of the project and the area through which it passes. There is further variance in R&R policies between state and central governments who are each responsible for constructing, improving and maintaining different kinds of roads. A uniform R&R policy is desirable to ensure that compensations are equitably rationalised for similar kinds of utility losses across state and central government projects.

REVISITING THE ROAD HIERARCHY

The current system of road hierarchy and classification dates back to 1943 when the Indian Roads Congress formulated the first Long Term Road Development Plan. The road network is divided into five classes—National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. Many countries classify their road network into three broad groups—primary, secondary and tertiary. Primary roads offer a high degree of mobility at the cost of reduced accessibility in the sense that longer distances must be travelled to access the primary network. In direct contrast, tertiary roads feature high levels of accessibility together with low mobility that is characterised by local rural traffic, lower speeds and shorter trips. Bridging the gap, secondary roads have medium mobility and medium accessibility, and they basically serve as the collection and distribution system, providing links with higher and lower order roads in the total journey.

A simplification of the five-step Indian road hierarchy into a tripartite system of primary, secondary and tertiary roads would serve to bring greater strategic clarity to the goals of road investment planning and the resulting outcomes. It is recommended that an independent Road Classification Commission (RCC) comprising of administrators, economists, geographers and road engineers under the umbrella of the Office of Transport Strategy proposed by the NTDPC should be set up for this purpose. This Commission should set down clear, objective criteria keeping in view holistic network planning perspective that maximizes the efficiency of each class. There is also a need to introduce systematic numbering of different classes of roads as per international practice.

Under a reworked hierarchy, both national and state highways could be classified as part of the primary network. For declaration of any road as a primary road, there should be well laid down criteria, for example connectivity to state capitals, district headquarters, ports, important industrial hubs and tourist destinations and linkages with highways in neighbouring countries. Road alignments that provide direct connection between important origin/destination points and result in cutting down journey distance could also be considered good candidates.

The primary roads should have uniform design standards for a given volume of traffic irrespective of whether they are National Highways or State Highways. Their development should be undertaken commensurate with the level of traffic and level of service desired and be independent of the actual designation. State Highways are a state subject and their financing is the responsibility of the concerned state government. The nomenclature National Highways and State Highways may therefore continue but the latter should be treated as part of primary road network. It may be added that, the Central Government provides financial support by way of certain component of CRF for state roads and roads/ bridges of interstate and economic importance. In addition, central funds are also provided towards viability gap funding for PPP road projects being undertaken by the states. States should formulate programmes of development of state highways on the lines of NHDP. This programme could be labelled SHDP and projects undertaken through various phases on the lines of NHDP.

Box 2.11
Financing Expressways Around the World

Expressways are access-controlled roads with grade-separated intersections that are limited to motorised traffic that is capable of travelling above a certain minimum speed. These are known by different names around the world: interstates in the US, motorways in the UK and in New Zealand, autoroutes in France, autobahns in Germany, autostrades in Italy, or simply as highways. Mechanisms that have been used to finance these are equally varied.

- In the US, the interstate highway system is funded through the Highway Trust Fund, which is sourced from a tax on fuel and tyres. These tax rates have varied over time, and state governments levy their own taxes. There is very limited tolling, only a few roads and bridges.
- Motorways in the UK are developed through taxes on fuel and on vehicles. There is no direct tolling. Shadow tolling is adopted for some stretches of motorways that are built or upgraded under the scheme of Private Financing Initiative. A shadow toll is paid directly by the government to the entrepreneur, without a direct user charge.
- Australian and New Zealand expressways are generally free of tolls, though for certain bypasses and bridges, nominal user fees are levied.
- In Japan, all expressways were constructed through government funding and investments recovered through tolls. Toll rates are amongst the highest in the world. It is only lately that the government has awarded some operational and maintenance contracts to private agencies.
- The French autoroute system was built by several public and private companies. A length of around 1,500 to 2,500 km was entrusted to each agency. These agencies were permitted to recover costs by levying tolls governed by an agreed schedule.
- Over the past 15 years, China has developed a huge network of expressways through the state enterprise system. Though users pay tolls, initial funding is through several sources of taxes and user fees at the district level.
- Malaysia constructed about 250 km of expressway to partially link Kuala Lumpur to Singapore from its own budgetary resources. Thereafter, tolling rights were offered to private entrepreneurs who also had to build the remaining length (about 500 km). The government guaranteed a minimum level of traffic, and the project was successfully completed by the entrepreneur.
- In India, the Government of Uttar Pradesh commissioned the Yamuna Expressway linking Greater Noida with Agra through a private agency. Apart from tolls from users, the private agency has been given real estate rights (capturing incremental land values).
- In India, the Government of Maharashtra built an expressway between Mumbai and Pune by setting up a public sector road corporation and raising bank loans. After a few years of operation, the project was offered to a private concessionaire for operations and management, for the consideration of a lump-sum rights payment to the corporation. The concessionaire has right to retain toll collected from users.

Source: NTDPC Research and World Bank Papers for NTDPC

Expressways need not be a separate class; they may be considered as part of primary road network since they are highways with features of access control and limited to movement of fast motorised traffic.

Similarly, Major District Roads may be classified as the secondary network with concomitant changes to design standards. And finally, Other District Roads and the Village Roads could be grouped as Rural Roads, as they already are informally.

EXPRESSWAYS

Access-controlled expressways feature heavily in plans for future highway development. The other defining features of these roads are grade-separated interchanges and divided carriageways. They are typically intended for use by fast-moving motorised traffic. However, investments in expressways are of an order of magnitude much higher than those in four- and six-lane highways that are not access-controlled, and should therefore be based on well-defined economic criteria for resource allocation. Further, all access-controlled roads foster faster traffic and divide villages and other communities. This makes local transit more difficult and longer, especially for non-motorised vehicles and pedestrians, and for livestock and agricultural produce. Alternative routes and crossings should be made available in conjunction with access-controlled roads. Wherever expressways provide the sole route within a defined area with no viable alternatives for slow-moving, non-motorised, or

For capacity augmentation of National Highways, the current programme of NHDP in seven phases is well conceived and its implementation may continue in the immediate term, i.e., the 12th Five Year Plan.

local traffic, it is essential that they are augmented with service lanes.

Expressways are likely to form the backbone of India's land transport network along with railways insofar as they will swiftly carry the large volumes of traffic along busy corridors. Box 2.11 gives a glimpse of financing modalities for provision of expressways around the world. Given that expressways are often greenfield developments that duplicate existing routes, they may not be straightaway attractive to private investors and developers.

It may be noted that most expressways in the world have been constructed by the government or public sector undertakings/authorities. There is mixed experience in the use of tolls to help recover costs. The use of fuel and vehicle taxes is common.
Based on international practices and experience, there appears to be a number of different options that could be considered for development of an expressway network in the country:

a. The government could choose to develop these expressways from its own budget, albeit seek to recover costs through user charges and tolls. In doing so, it may also explore the feasibility of obtaining external loan assistance including technology transfer. Private entrepreneurs could be involved after initial construction of say 2,000 to 3,000 km of expressways by the government. These stretches could be handed over to private entrepreneurs for their O&M and leveraging the revenue earned to expand the network of expressways in a phased manner.
b. The entire expressway network be divided into eight to 10 packages of 1,500-2,000 km each on the lines of French autoroute development strategy. Each package could be entrusted to major private developers. For this purpose, a dialogue with industry leaders is critical to formulate a strategy for their financing, construction and operation. Some seed money can be infused by the government as a start-up. Costs are to be recovered through user charges and tolls. Each package could be bid out to private developers for financing, construction and operations, if feasible and found to be economic. In the light of international experience, to accomplish this, it will be necessary to make a clear assessment of the private sector to undertake projects of this magnitude

A target of 18,637 km of expressways has been approved in principle by the Government of India, and is intended to be achieved by 2031. However, there is inadequate information on characteristics of road links, traffic volumes and traffic patterns. This network should be subjected to a consultation process with the states. Ideally, industry should also be taken into confidence in freezing the broad contours of such a network. There should be a minimum threshold traffic to consider provision of an expressway, say 40,000 PCUs per day. Access control highways effectively divide the countryside, necessitating provision of flyovers and interchanges to permit cross movement. This involves high capital investments. Priorities should be determined based on the needs of economy and progress of railway network capacity augmentation. Some of the existing four- and six-lane roads under the NHDP may be considered for converting them into access control facilities by providing service lanes all through for local and non-motorised traffic as an immediate step.

STRATEGIES FOR DEVELOPMENT OF PRIMARY ROADS (NATIONAL HIGHWAYS AND STATE HIGHWAYS)

NATIONAL HIGHWAYS

A strategic plan (1981-2001) for India's roads envisaged that India's national and state highways should together connect all towns with population greater than 5,000. The Road Development Plan: Vision 2021 pegged the length of National Highways to 80,000 km and of State Highways to 160,000 km. MoRTH's preferred strategy for identifying desired lengths is to partition the country into a square grid, with each gridline representing a road of a designated standard. For NHs, a grid size of 60 km has been suggested for being achieved by 2031. Of course, the practical realities of geography, topography and demographics will guide deviation from this ideal. The 60 km grid size is a rough average of several considerations: states with high traffic densities and throughput require more immediate access to the NH network, and topography in hill states and demography in sparsely populated states motivate a much larger grid size in these regions. With this reasoning, 80,000 km of National Highway are proposed by 2021, with an increase to 100,000 km by 2031. A large share of this will be accomplished by promoting existing state highways to NH status, and by upgrading these to the required standards.

Since the main function of the primary system is mobility and enhanced productivity of transport, stress should be laid on consolidation of National Highways in terms of capacity augmentation through multi-laning of existing highways and provision of access controlled expressway facilities.

Within these phases, the programme relating to widening of single lane roads to two lanes deserve to

be accelerated for reasons of enhancing safety and energy efficiency. Six-laning of existing roads without access control has the potential of being more accident prone. As such, the programme relating to six-laning of existing four-lane stretches needs to be stopped and where traffic volumes are beyond four-lane capacity, consideration given to provision of expressway network. In order to improve transport efficiency and enhance safety, all existing four-lane and six-lane roads need to have service lanes to cater to the requirements of local (both motorised and non-motorised) traffic so as to bring in an element of partial access control on such facilities. Provision of wayside amenities along the highways is becoming an integral part of the road projects. Such facilities should be provided by the private sector.

STATE HIGHWAYS

At 166,000 km, the state highway network is already more extensive than was envisaged in the Road Development Plan: Vision 2021. For NH and SH put together, an average grid size of 20 km is reckoned adequate for network purposes. This will imply that the length of the national and state highways together may be about 300,000 km. Since 100,000 of these kilometres are already intended as NHs, the required extent of the SH network is 200,000 km. For these roads also, the focus should be on consolidating the existing network, with minimal expansion as needed, due to economic and geographic considerations.

When developing state highways, priority ought to be given to:

- Providing links to minor ports, special economic zones, industrial towns, and pilgrimage and tourist centres
- Connecting remaining towns with population exceeding 5,000
- Connecting remaining district headquarters with state capitals
- Construction of missing bridges and reconstruction/widening of existing weak and narrow bridges and replacement of semi-permanent timber bridges with regular bridges in the North-East region.

Under the present system, state governments lobby the Central Government to declare certain SHs as NHs, thereby removing the SH from its administrative purview. About 64,000 km of SH are reported to be candidates for reclassification as NH. The present arrangements are inefficient in that they create incentives for state governments to delay maintenance and upgrades of key SHs. These sub-standard roads have ramifications for the entire primary network, and the Central Government becomes more amenable to reclassify these as NHs. States that ensure on their own that the SH network is upgraded and maintained may stand to get penalised for their diligence since MoRTH could be reluctant to reclassify such good SHs which require little rehabilitation as it places pressure on exhausting the budget allocation. It is important to reconsider the institutional, policy and budgetary mechanisms that encourage this unhelpful lobbying and punish diligence. As mentioned earlier, there is need for setting down objective criteria for classification of roads.

Provision of wayside amenities along the highways is an integral part of road projects, and should be provided by the private sector

For capacity augmentation of state highways, every state should formulate programmes on the lines of NHDP and undertake implementation as per priorities identified through traffic surveys, economic and financial analysis of individual project stretches on the SH network. Each state should formulate its own State Highway Development Project (SHDP). The SHDP may comprise schemes of capacity augmentation by two laning, four laning, construction and rehabilitation of bridges, bypasses, replacement of railway crossings and works of riding quality improvements and safety engineering measures. Constitutionally, these roads are to be funded by the states. Central assistance is currently made available from the viability gap funding for projects being implemented under the PPP scheme and some funds for state roads out of CRF. There is a case for enhanced central assistance to make up for the past neglect.

OTHER ASPECTS

Financing of Primary Roads: Financing of the primary roads should continue with the existing Central Road Fund through additional levies on petrol and diesel. The accruals to the CRF may be enhanced by making levy of cess on fuel on ad valorem basis rather than the current system of a fixed amount of Rs 2 per litre, which was fixed in 2005. At that time, the price for petrol was around Rs 40 per litre and diesel was around Rs 30 per litre. The existing policy of levy of toll on two lane roads needs to be done away with. A two-lane highway on the primary network should be viewed as a basic minimum facility and provided through government budget including CRF. For four-lane highways and expressways, the user charge principle should be relied on. The levy of appropriate tolls would help in cost recovery.

Bypasses: While preparing projects for capacity augmentation, the need arises for planning of bypasses around towns to ensure smooth movement of through traffic. In most cases, these bypasses also serve as vehicle for development of the town along or on the other side of the bypass. Therefore, the alignment for such bypasses should be planned jointly by the road agency and the urban development agency. Further, these bypasses should be planned and provided as access-controlled expressway type facilities with entry/exit at predetermined locations. For large size cities (population above one million), bypasses could also be provided in the form of peripheral

The efficacy of airports, and especially ports, is greatly diminished when the quality of the connecting road network is poor. Special needs of connectivity to ports, airports, mining areas and development of power plants should be factored in when planning road programmes

expressways. The intersection points of bypasses with main highways may also serve as freight logistics parks on case to case basis. The bypasses may preferably be elevated.

Dilapidated and Weak Bridges: Another critical requirement for development of national highways and state highways relates to the strengthening and widening or reconstruction of several existing bridges that are showing signs of distress. As per the Report of the Working Group on Roads, there are as many as 1,650 bridges on national highways which are in dilapidated condition which require reconstruction. Similarly, there would be several weak bridges on state highways and major district roads crying for replacement especially semi-permanent timber bridges in the North East region. It is to be recognised that a weak bridge on the section of the corridor can become the bottleneck for efficient movement of heavy loads thus impairing the transport efficiency. It is necessary to put in place a system of regular inspection of all bridge structures, diagnosis of their ill-health and formulation of remedial measures and strategies required for implementation on a defined time-frame. A system of maintaining and updating database on bridge inventory and their condition surveys need to be instituted to enable decision-making regarding their maintenance. For the purposes of expeditious reconstruction of these bridges, consideration may be given to initiating a special plan scheme with associated earmarked funding. There are also missing bridges on several large rivers flowing across different areas. It is necessary to identify critical locations that are posing an impediment in opening up of the area. A phased programme of construction of missing bridges should also be undertaken.

Tunnels: In the recent past, tunnel technology has been promoted for both rail and road network. In hill areas, provision of tunnels on selected alignments can help in cutting down not only the distance of travel but also the potential for landslides in cases of hairpin bends requirements as an alternative. Another advantage can be that the road facility is available to the users for a much longer period during winter months.

Special Areas: Besides the programmes noted above, various ministries undertake road construction and development with a mandate to ensure more equitable access to economic opportunities for areas and peoples that have been historically under-served by prior road-building efforts. This may have come about for any number of reasons such as exceptionally difficult terrain, distance or disconnect from the broader Indian economy, historic marginalisation and so on. These special programmes can include road development of all standards from National Highway to village road. Under these programmes, funds are made available for widening and strengthening roads, constructing missing links, building and rehabilitating bridges, culverts and bypasses, and other measures aimed at improving ride quality.

North East: Under Phase A of the Special Accelerated Road Development Programme for North-East region (SARDP-NE) and Special Arunachal Pradesh packages, about 6,400 km of roads will be improved in the North-East states by the end of the 12th Plan period. Projects have been and will be commissioned with private participation when possible.

Tribal and Left Wing Extremism Areas: The Government has also taken up a programme for the development of about 1,120 km of NH and 4,352 km of state roads in Left Wing Extremism (LWE) affected areas as a special project, with the aim of completing all works by March 2015. Some relaxations are also accorded in guidelines for PMGSY roads in such areas by including all habitations with population exceeding 250. On similar grounds, a special programme for funding road development in Jammu and Kashmir has also been approved.

Industrial Corridors: Several investment regions and areas are proposed along the new Delhi-Mumbai Industrial Corridor, and along future such industrial corridors. These regions and areas will require road connectivity both within the various lands they are developed over, and also to the rail and road network more generally. These greenfield roads must necessarily be built well in advance of actual demand.

Connectivity to ports, airports, power plants, etc.: The efficacy of airports, and especially of ports, is greatly diminished when the quality of the connecting road network is poor. Development programmes exist to address this need. The aim is to ensure that each major port has at least four-lane road connectivity. Further, roads to non-major ports can now also be designated as National Highways on a case-by-case basis. Special needs of connectivity to ports, airports, mining areas and development of power plants should be factored in development of the road programmes. In certain cases of power plants, movement of Over Dimensioned Cargos (ODCs) will be involved and this will require advance planning particularly for strengthening of bridges involved and improvement of curves in hilly areas.

Container Freight Stations and Railway Stations: Similarly, there is a need to ensure good connectivity by road to railway stations and container

Table 2. 24
Investment Requirements for Expressways (at 2011-12 prices)

PARTICULARS	PERIOD				TOTAL
	2012-17	2017-22	2022-27	2027-32	2012-32
Physical Targets (km)	500	2,000	4,000	6,000	12,500
Total Investments (Rs billion) including land acquisition	200	600	1,200	1,800	3,800
Of which Private Investment	NIL	100	300	1,000	1,400

freight stations while formulating plans for development of road network in cities and towns.

Inland Waterways and Water Fronts: Another area that requires attention would be the road connectivity to identified water fronts on the inland waterway network to facilitate smooth cargo entry to and evacuation from the IWT terminal stations.

Highway Facilities: A well-developed road network is also one that is easy and comfortable to use. Depending on traffic volumes, roads should variously offer opportunities for rest breaks, refuelling and meal purchase. Each of these can also be expected to contribute to the overall safety of the network by preventing driver fatigue and timely assistance to vehicle breakdowns. Facilities like parking lots, drinking water stations, snack bars and restaurants, rest rooms, kiosks, information facilities, petrol pumps with service and repair facilities and communication systems should be developed. As several of these facilities are revenue generating enterprises, the private sector may be encouraged and supported to provide for such amenities. The provision of these amenities must form an integral element of the design for both new projects as well as for major widening and upgrading of roads. Provision must be made for concomitant land acquisition. For PPP projects, the construction and operation of a specified list of amenities and other project facilities can be attached to the concession agreement. On road stretches constructed directly by the government, wayside amenities should be set up and managed by private enterprises on commercial terms. The provision of such facilities must be commensurate with the buying power of truck and bus drivers along with passengers. (In recent times, some of the facilities built are not affordable for the common trucker.)

INVESTMENT REQUIREMENTS

It is difficult to hazard a precise estimation of physical and financial requirements for development of primary roads without a detailed study of traffic forecasts. However, a broad assessment is presented based on the exercise undertaken by the NTDPC Working Group on Roads and taking into consideration the likely lower levels of private sector financing expected in future and constraints of budgetary support. An investment of Rs 21,400 billion for National Highways and Rs 11,600 billion for state highways at 2011-12 prices, spread over 20 years upto the year 2032 could be required. See Tables 2.24 to 2.29 for National Highways (including special programmes and expressways) and Table 2.30 for state highways. Targets for private sector financing are also indicated.

STRATEGIES FOR DEVELOPMENT OF MAJOR DISTRICT ROADS

These roads run within the districts connecting areas of production with markets and serve as connecting links between rural roads and the primary road network and are thus equally vital for agricultural and industrial development of the landscape. However, these roads have not received the desired level of attention and investments in the past. This gap has to be filled to ensure balanced development of all classes of roads and in all regions of the country. An overall length of 400,000 km as proposed by the Working Group on Roads is recommended as a target network of MDRs. Here too, the strategy should be on consolidation of the road network. Currently, these roads are mostly single-lane with weak road pavement and bridges that are in need of immediate strengthening. A large percentage of these roads are reported to be in bad shape. This is posing a threat to even optimal use of PMGSY roads which are in much better condition. The situation is further aggravated due to movement of overloaded vehicles. Presence of railway level crossings causes undue delay to traffic movement on one side and lowering of speeds to the rail movement on the other. Therefore, the stress should be to accelerate the programme of widening of these roads to regular two lanes, including bridges, and provision of rail over/under bridges on heavily trafficked stretches. Priorities

Table 2. 25
NHDP Proposed Expansion/Improvement: 12th Plan and Beyond (2012-32)

PHASES	TOTAL LENGTH (KM)	LENGTH COMPLETED (KM) END MARCH 2012	LENGTH TO BE COMPLETED (KM) BEYOND MARCH 2012
NHDP-I GQ,EW-NS corridors, Port connectivity, etc.	7,522	7,484	38
NHDP-II 4/6-laning N-S,E-W corridors etc	6,647	5,499	1,148
NHDP-III Upgradation, 4/6-laning	12,109	3,643	8,466
NHDP-IV 2- laning with paved shoulders	20,000	0	20,000
NHDP-V 6-laning of GQ and High density corridor	6,500	913	5,587
NHDP-VI Expressways	1,000	0	1,400
NHDP-VII Ring roads, bypasses, flyovers, etc.	700 km of ring roads / bypasses + flyovers	11	689

Source: NTDPC (2012).

Table 2. 26
Investment Requirements for NHDP
(Rs billion)

MODE OF INVESTMENT	2012-17	2017-22	2022-27	2027-32	TOTAL (2012-32)
Public Sector	1,100	1,650	2,000	2,750	**7,500**
Private Sector	550	700	1,000	1,250	**3,500**
Total	1,650	2,350	3,000	4,000	**11,000**

Source: NTDPC (2012).

Table 2. 27
Investment Required for Special Schemes
(Rs billion)

SCHEME	2012-17	2017-22	2022-27	2027-32	TOTAL (2012-32)
SARDP-NE including Arunachal Pradesh	250	400	500	600	**1,750**
Of which Private Sector	NIL	NIL	50	50	**100**
Left wing extremism tribal special package for J&K connectivity to ports, airports, E&I	100	150	200	200	**650**
Of which Private Sector	NIL	NIL	NIL	NIL	**NIL**
Total	350	550	700	800	**2,400**
Of which Private Sector	NIL	NIL	50	50	**100**

Source: NTDPC (2012).

Table 2. 28
Investments Required for Non-NHDP National Highways
(Rs billion)

SCHEME	2012-17	2017-22	2022-27	2027-32	TOTAL (2012-32)
Four-Laning	30	100	300	600	**1,030**
Two-Laning with Paved Shoulders	270	450	600	700	**2,020**
Strengthening Weak Pavements	40	50	50	100	**240**
Reconstruction of Weak Bridges	80	100	100	100	**380**
Safety Engineering Works	40	50	100	100	**290**
Miscellaneous Works (bypasses, railway overbridges, etc.)	40	50	50	100	**240**
Total	500	800	1,200	1,700	**4,200**
Of which budgetary support including toll and external assistance	450	700	1,050	1,500	**3,700**
Private Sector	50	100	150	200	**500**

Source: NTDPC (2012).

Table 2. 29
Abstract of Projected Investments for Central Sector National Highways including Expressways and Special Programmes
(Rs billion)

SCHEME	2012-17		2017-22		2022-27		2027-32		2012-32	
	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR
NHDP (NHs)	1,650	550	2,350	700	3,000	1,000	4,000	1,250	11,000	**3,500**
Non-NHDP (NHs)	500	50	800	100	1,200	150	1,700	200	4,200	**500**
SARDP-NE	250	NIL	400	NIL	500	50	600	50	1,750	**100**
Other Special Schemes	100	NIL	150	NIL	200	NIL	200	NIL	650	**NIL**
Expressways	200	NIL	600	100	1,200	300	1,800	1,000	3,800	**1,000**
Total	2,700	600	4,300	900	6,100	1,500	8,300	2,500	21,400	**5,500**

Source: NTDPC (2012).

Table 2.30
Proposed Investment for State Highways in the State Sector
(Rs billion)

SCHEME	2012-17		2017-22		2022-27		2027-32		2012-32	
	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR
SHDP for State Highways	1,500	100	2,000	200	2,300	250	2,600	300	**8,400**	**850**
Reconstruction of Weak and Narrow Bridges	400	50	500	50	700	100	800	100	**2,400**	**300**
Safety Engineering Works	100	NIL	100	NIL	100	NIL	100	NIL	**400**	**NIL**
Additions to The SH Network	100	NIL	100	NIL	100	NIL	100	NIL	**400**	**NIL**
Total	2,100	150	2,700	250	3,200	350	3,600	400	**11,600**	**1,150**

Source: NTDPC (2012).

Table 2.31
Proposed Investments for Major District Roads in the State Sector
(Rs billion)

SCHEME	2012-17		2017-22		2022-27		2027-32		2012-32	
	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR
SHDP for Major District Roads	800	NIL	1,000	NIL	1,200	NIL	1,700	NIL	**4,700**	**NIL**
Reconstruction of Weak and Narrow Bridges	100	NIL	200	NIL	300	NIL	300	NIL	**900**	**NIL**
Safety Engineering Works	50	NIL	50	NIL	50	NIL	50	NIL	**200**	**NIL**
Additions to The MDR Network	50	NIL	50	NIL	50	NIL	50	NIL	**200**	**NIL**
Total	1,000	NIL	1,300	NIL	1,600	NIL	2,100	NIL	**6,000**	**NIL**

Source: NTDPC (2012).

Table 2.32
Funding Requirement for Completion of PMGSY
(Rs billion)

Funds Required for Completion of Works Already Sanctioned	342
Funds Required for Works Not Yet Sanctioned	1,814
Total Funds Needed	2,157
Funds Available in 2011-12	200
Net Funding Requirement in the 12th Plan and Beyond	1,957
(rounded off)	1,960

Source: NTDPC (2012).

may be governed by the traffic—current and projected. Some limited stretches may requiring four-laning also in later years depending upon the traffic growth witnessed.

Besides two-laning, attention would also be required for strengthening of pavement of existing single lane and provision of hard shoulders to enable safe movement of vehicles and preventing such stretches from getting damaged beyond repair and rehabilitation. Programmes of improvement in riding quality with partial strengthening need to be planned and implemented. Several isolated bridges on the MDR network which show signs of distress would also require reconstruction as standalone works.

An investment of Rs 6,000 billion, at 2011-12 prices, spread over the next 20 years is envisaged. See Table 2.31 for broad details.

Currently, the Central Government is providing some funds for these roads out of the CRF but funding needs a quantum increase in order to make up for the continued neglect by the states.

DEVELOPMENT OF RURAL ROADS

The design of rural roads must begin by acknowledging the all-or-nothing nature of the village road, and the attendant harsh realities of construction and maintenance. For the vast majority of Indian villages, the village road is the only avenue in and out for people, animals and goods. Contrast this with cities connected together with urban roads or with towns linked by highways, where there are not just alternative roads for transport between points A and B, but also alternatives offered by rail and possibly air. By connecting the village with a district road or highway, the rural road provides faster and better access to markets for the agricultural output of the hinterland, and provides access to social infrastructure including a wider array of education, employment and healthcare opportunities. Often, the absence of a road can mean miles spent traipsing across muddy fields and gullies, enormously raising the costs of engagement with the rest of the world. Indeed, as far as re-distributive policies go, the village road may well offer better value-for-money than any other alternative.

The challenges associated with delivering safe and reliable all-weather rural roads are manifold. First, construction must often take place in remote locales over unyielding terrain. Road design must safely accommodate pedestrians, cyclists, animals, carts, small vehicular traffic, large trucks, and perhaps even heavy machinery (such as for mining) on relatively narrow roads. The opportunity cost of appropriating farmland for wider roads in the face of limited traffic may be prohibitive. However, the relatively lower traffic carried does not justify lethargic maintenance. Where roads are not sealed, they are prone to being washed away in the annual monsoon. All roads contend with the potholes and obstructions wrought by floods and landslides. If routine maintenance like the upkeep of drainage, clearance of vegetation, and repair of potholes is neglected, it is much more likely that major, more expensive, rehabilitation work will be required sooner than otherwise necessary.

Considerable progress has been made and is continuing under the current PMGSY. The National Rural Roads Development Agency (NRRDA) has developed a common set of engineering standards, contract documents and operating and financing procedures that are applied in respect of rural roads nationwide through the state implementing agencies. For the first time, well-engineered roads are being provided in rural areas. Funding for construction is provided 100 per cent by the Centre, while states are responsible for subsequent maintenance. The programme covers rural roads required for new connectivity

Table 2.33
Cost estimates for Universal Connectivity

1. LEFT-WING EXTREMISM/INTEGRATED ACTION PLAN DISTRICTS (LWE/IAP)*	NUMBER	LENGTH (KM)	AMOUNT (RS BILLION)
i. Habitations with Population Above 250	800	3,200	160
ii. Habitations with Population Between 100 and 249	9,000	38,680	193
iii. Additional Funds for Bridges and Drainage			149
Total for LWE/IAP districts			**502**
2. OTHER HABITATIONS			
Total Unconnected Habitations**	120,000	250,000	1,250
Total for Universal Connectivity			**1,752**

Estimates by MORD ** Quick estimates based on MORD-Rural Road Development Plan: Vision 2025

(one basic access to unconnected habitation) and upgradation of existing roads (requiring improvement to provide all-weather access). Some dispensations have been given to accelerate the pace of implementation of PMGSY roads in Left Wing Extremism (LWE) affected areas and Integrated Action Plan (IAP) districts and in NE states. This programme is being implemented for the last over 10 years. Investments over Rs 100 billion have been made. This programme is well conceived and its implementation may continue. Main areas of concern emerging relate to assured maintenance, safety and upgradation in areas that have witnessed high agricultural and other economic growth. These aspects need special attention.

The Central Government has recently approved a scheme of PMGSY-II which envisages consolidation of the existing rural road network and cost sharing by the states. The selection of roads would be with the objective of identification of rural growth centres and other critical rural hubs.

The state governments have also been undertaking their own investments in provision of rural roads to connect other villages/habitations not eligible under the PMGSY or Bharat Nirman. This has helped in accelerated development of rural areas. The implementation needs to continue as per the district level core road network plans of the state governments. There is a need for expansion of the current mandate of PMGSY to achieve universal connectivity as these roads serve as entry point for poverty alleviation and provision of access to social infrastructure such as education and health, besides market. In order to estimate the overall requirements of rural connectivity, proper GIS maps should be generated covering habitations of various population sizes in terms of new road links and those requiring upgradation.

These roads can stay as single-lane roads in view of low volume of traffic likely to prevail. However, some roads under this category could witness volumes that may justify widening to intermediate or two lanes. Some states like Punjab and Haryana are providing such facilities. Provision should be made accordingly in other states as well.

Fiscal federalism would suggest that since rural roads serve as a prime redistributive tool in the government's armoury, they should continue to be funded by grants from the Centre. It is proposed that for financing of these roads, the current CRF accruals and RIDF window of NABARD may need to be augmented. The strategy of some states to raise funds through market committee fees on agricultural produce is commended for being emulated by other states as well. Some funds for earth work for example may be leveraged from MGNREGA schemes.

For completion of the PMGSY programme remaining at the end of 11th Five Year Plan, an investment of Rs 1,957 billion is estimated to be required (see Table 2.32). An amount of Rs 1,265 billion has been allocated for the 12th Plan (2012-17). Obviously, the programme would spill over to the 13th Plan.

As mentioned earlier, the programme needs to be extended to cover LWE/IAP districts and universal connectivity to habitations above population 100. This would require investments to the tune of another Rs 1,752 billion (Table 2.33).

Table 2.34
Investments Requirements for Rural Roads (2012-32) (Budgetary Allocations)
(Rs billion)

PROGRAMME/PROJECT	2012-17	2017-22	2022-27	2027-32	TOTAL
Balance of PMGSY	1,090	860	--	--	**1,950**
LWE/IAP Districts	175	200	125	--	**500**
Other Lower Size Habitations	185	290	675	100	**1,250**
Upgradation	--	500	500	1,000	**2,000**
Total	1,450	1,850	1,300	1,100	**5,700**

In addition, need will arise for upgradation of the core road network which is not covered under the PMGSY and strengthening of pavement of PMGSY roads at the end of their design life. As per District Rural Roads Plans finalised by the states, the length of core network of rural roads is 1,134,114 km. Of this, a length of 374,844 km is covered under PMGSY. This leaves a length of about 750,000 km that is not covered under the PMGSY scheme. The estimated cost of upgrading and strengthening of pavement would be Rs 2,000 billion.

From the above, it will be seen that an investment of Rs 5,700 billion, at 2011-12 prices would be required over the next 20 years for development of rural roads. Table 2.34 gives the broad phasing. These are to be budgetary allocations only as no private sector financing is envisaged.

OVERALL INVESTMENTS REQUIRED

An abstract of the overall investments required for the road infrastructure in the next 20 years is provided in Table 2.35. Broad assessment of private sector financing is also shown. Annual investments of the order of Rs 1,450 billion in the 12th Five Year Plan to increase to Rs 3,000 billion in the 15th Five Year Plan are envisaged. Of these, private sector financing may be of the order of 10 to 15 per cent as only part of the road network can be taken up on PPP basis.

MANAGEMENT AND PRESERVATION OF ROAD ASSETS

The absolute and opportunity costs of providing and maintaining roads for society at an acceptable serviceability level is high: for every km of district road we might instead choose to provide primary education for several children; for every km of expressway we may instead bring power to several villages. It is therefore essential to ensure that road assets do indeed supply a quality of transportation that is commensurate with the funds applied, and that this is not compromised over time for want of maintenance and repair.

The current replacement value of the existing road network defies precise estimation, given that there is no sustainable system of updating inventory and condition assessment of roads and bridges at present. A ballpark figure of Rs 10,300 billion is claimed by some experts as a broad asset base of the road network. Even if such an assessment would be and could be debatable, for a policy dialogue, there can be no two opinions that to ensure continuity of benefits of the road infrastructure being developed at huge cost to the economy, the road agencies must preserve, operate and maintain the assets.

The vicious cycle of build, neglect and rebuild has to be broken. While PPP approaches have helped in taking care of operation and maintenance needs of roads built during the concession period which extends to 15-20 years, this addresses the issue for only part of the overall road network.

Timely and adequate maintenance of the existing road network does not admit of any laxity. It is an economic necessity as otherwise, erosion of asset base will get accelerated. Challenges will grow as the road network ages and traffic increases occur. Box 2.12 provides an example of Asset Management core

Table 2.35
Projected Investments for Road Infrastructure
(Rs billion)

SCHEME	2012-17		2017-22		2022-27		2027-32		2012-32	
	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR	TOTAL	PRIVATE SECTOR
Expressways	200	NIL	600	100	1,200	300	1,800	1,000	**3,800**	**1,400**
National Highways	2,150	600	3,150	800	4,200	1,150	5,700	1,450	**15,200**	**4,000**
Special Schemes SARDP-NE+ Arunachal Package (Central Sector)	250	NIL	400	NIL	500	50	600	50	**1,750**	**100**
Other special schemes (Central sector)	100	NIL	150	NIL	200	NIL	200	NIL	**650**	**NIL**
State Highways	2,100	150	2,700	250	3,200	350	3,600	400	**11,600**	**1,150**
Major District Roads	1,000	NIL	1,300	NIL	1,600	NIL	2,100	NIL	**6,000**	**NIL**
Rural Roads including PMGSY	1,450	NIL	1,850	NIL	1,300	NIL	1,100	NIL	**5,700**	**NIL**
Total	7,250	750	10,150	1,150	12,200	1,850	15,100	2,900	**44,700**	**6,650**

principles of national highway network in South Africa.

It will be advisable for the road agencies to institute road network asset management systems. This will involve specifying asset performance indicators for each road class, scientific condition assessment and determination of priorities for maintenance interventions on rational basis.

Information pertaining to the consolidated inventory of road assets needs to be maintained and updated at regular intervals. At present, very limited information is available regarding the road inventory, available Right of Way (ROW), etc. A proper system shall have to be developed for creating the database based on actual ownership details supported by legally acceptable documentation and with support for periodic updating of the database. Formats should be developed to compile the information starting from Panchayat and block levels, and compiled for each state on GIS platform. The data should be available in electronic form with facility for real-time updating as and when land is acquired to augment the existing ROW. Further, there should be facility to add to the inventory in case of newly declared NH or Expressways, etc.

Various Finance Commissions also laid stress on maintenance management of the road network and recommended central grants for state roads besides budgetary allocations by the state governments under the Non-Plan Head.

The road agencies are not the users of the road network. That might partially explain why there is weak planning and implementation of road maintenance operations. It is necessary to change this laissez faire attitude. Every road agency should prepare an Annual Asset Management Plan for roads within its jurisdiction, which as a minimum should include:

Box 2.12

Commercial Management of a National Road Network: The Case of South Africa

Management of South Africa's national road network exemplifies successful implementation of asset management core prescriptions.

Ownership of all national roads is vested in a commercial company, SANRAL, which is wholly state-owned and accountable to the national government for the satisfactory performance of the assets (provincial and municipal roads are managed separately). The agency is governed by an 8-member board that comprises 2 government officials appointed by the Minister of Finance and Minister of Transport, 5 private members appointed by the Minister of Transport, and SANRAL's chief executive.

Spending is prioritised and justified by holistic economic life-cycle costing, using the HDM-4 model. Management of assets is financed by a blend of the national budget (13,050 km of network), and user toll revenues and borrowing (3,120 km of network), mostly secured by road assets and sovereign guarantees.

SANRAL is run as a semi-private company, operating under a shareholder agreement and a performance agreement to manage the national roads. It must adhere to the Public Financial Management Act (PFMA) because it is executing public funds, and must follow financial reporting requirements under the Companies Act. However, as a company it may operate with its own procurement rules that comply with PFMA, and human resource policies which permit performance incentives and market-based remuneration.

Government requires all agencies—SANRAL, provinces and municipalities—to prepare a multi-year business plan as the basis of their multi-year budget submission, and to manage their roads under a network management system, which includes regular monitoring and reporting of road conditions. SANRAL, with its clear business model and a comprehensive asset management system, has been consistently successful in achieving its performance targets.

Developed over twelve years, this institutional model has reached a maturity that enables it now not only to fund and manage existing national road assets, but also to sustainably finance major investment in expansion of the network to meet surging economic growth in the country. The South Africa National Road Agency Limited (SANRAL) was established in 1998 as a limited liability company, wholly owned by the government. This board reports to the Government through the Minister of Transport SANRAL's functions and operations were defined in an act of parliament, which provides some protection from political pressures.

Source: World Bank paper for NTDPC on Road Asset Management by Clell Harral et al. (May, 2011).

- Inventory of assets (pavements, bridges, safety appurtenances, etc.)
- Network condition, pavement serviceability index, bridge structural index
- Assessment of maintenance treatment required for each road link based on condition, traffic, importance of road
- Annual maintenance plan based on available/allocated budget
- Impact on deterioration and performance of the road network for which funds are not allocated.

For primary roads, there is need for non-engineering aspects as well. This would include land management by way of prevention of encroachment, control on ribbon development, regulation of access on existing highways and use of ROW by utility agencies. Incident management and highway police patrol are other activities that should become integral part of O&M provisions. The Control of NHs (Land & Traffic) Act, 2002 was promulgated giving quasi-judiciary powers to Highway Administrations. The provisions under this Act inter-alia delegates authority to remove encroachments, prevent occupation of or damage to NH land and control access on NH land. The Act stipulates punitive measures for the offences committed (which are deemed as cognizable) in violation of its stipulations. However, there is lack of enforcement of the provisions of the Act, partly due to want of appropriate management and monitoring systems. Adequate support from state governments and law enforcement agencies is critical. It is of paramount importance that proactive support and assistance is available to the Highway Administrations from the District Administrations so that the provisions of these legislations can be effectively

Box 2.13

Performance-Based Contracts for Road Rehabilitation and Maintenance: Argentina's Experience

At the start of the 1990s, Argentina had the lowest share of roads in good condition among upper-middle-income countries. Due to previous neglect and mismanagement, more than a third of the national paved network was in poor or even critical condition. Today, informed observers consider Argentina one of the best performers in Latin America in implementing sustainable maintenance and rehabilitation of a large part of the national road network.

To achieve this transformation, over the past 15 years, the national roads department has put in place several effective policies aimed at this goal. A central instrument is the award of long-term contracts for rehabilitation and maintenance of main roads, with maintenance being paid for on the basis of performance standards met, rather than on the basis of inputs employed Argentina's experience with this innovative approach, known as a 'rehabilitation and maintenance concession' (in Spanish 'concesión de rehabilitación y mantenimiento' or CREMA) has been very successful. It illustrates the following core prescriptions:

- Expenditure priorities determined by life-cycle analysis of road agency costs
- Sustained funding
- Outsourcing the execution of works to access the flexibility and incentives for efficiency of the private sector under contractual structures that closely align incentives with the public interest
- Clear accountability supported by quantitative performance measurements.

The concept underpinning CREMA was to contract out packages consisting of road rehabilitation followed by routine maintenance over a period of five years, to be paid for on a lump-sum basis against indicators of road condition. This concept was generated locally, from within the national roads department (known in Spanish as 'Vialidad'). This packaging of routine maintenance with rehabilitation followed a trial period, starting in 1994, of contracting out only routine maintenance. It embodied three principles: (i) long-term contract for routine maintenance; (ii) pay against results; and (iii) the basis for paying would reflect the road users' view of road condition.

The contracts specify several indicators, with penalties for non-performance. After the first three years, 600 certificates for non-compliance had been issued over the 60 contracts awarded, and penalties amounting to 1 per cent of the total amount of the contracts had been withheld from payments.

CREMA contracts now cover over 90 per cent of the whole national paved network, about 19,000 km, at a rate of about $20,000 per km, for a total of about $380 million per year. The total budget allocation for national roads in 2006 was about $1.0 billion (0.5 per cent of GDP).

Source: World Bank paper for NTDPC on Road Asset Management by Clell Harral et al. (May, 2011)

implemented. Similar frameworks may be evolved for all categories of roads on the lines of the Control of NHs (Land & Traffic) Act, 2002.

The government may also consider not to treat maintenance of roads as a non-Plan activity so that it does not suffer ad-hoc cuts as is the current experience. Plan funds should be used for maintenance of existing road assets to the extent necessary to bridge the gap between maintenance requirements and allocation.
The states have been steadily reducing their gang labour and increasing maintenance works through private contractors. This has been the right approach. While existence of some gang labour may be useful particularly for emergency situations and disaster management under conditions of earthquakes, landslides, cyclones, etc., there is a need to move to standalone long-term performance-based maintenance contracts where capacity augmentation may not be required in immediate future. Box 2.13 gives an example of Argentina's experience on such contracts.

Currently, there is weak enforcement of maintenance performance standards on the roads particularly the primary road network being managed by the concessionaires. Enforcement of performance standards by the government through a well laid down mechanism is essential and road agencies responsible for execution of maintenance works made accountable. The road agencies need to borrow a leaf out of the railway book with responsibility assigned to an Executive/Assistant Engineer for the upkeep of the road segment assigned to him. For enabling him to do so, sufficient funds should be made available to him together with supervision facilities.

Box 2.14

Maintaining Rural Roads: Lessons from Around The World

Rural Road Co-operatives for Maintenance: The Finnish Experience

The Government of Finland has promoted rural road maintenance using road co-operatives. A road-co-operative is a rural road maintenance organisation whereby people living along a road accept responsibility for its maintenance. The Finnish Government has provided a legal framework which stipulates the right-of-way, cooperative ownership, and the formula for distribution of maintenance costs amongst the road users and property holders along the road. Participation in the road co-operative is compulsory for property owners who use the road. The cost of road maintenance is shared amongst the members of the co-operative depending on the benefits to each member in the form of the size of the holding and the created traffic. Each co-operative holds an annual general meeting to decide the fees, to accept new members and to audit the previous year's accounts.

Routine maintenance by Community Based Micro-enterprises in Peru

In Peru, the Rural Roads Project (RRP) has set up a cost-effective routine maintenance system based on contracting out labour-intensive maintenance works to micro-enterprises, local co-operatives and other community based organisations. The composition of these entities varies according to the size of the road. Their average size is about 13 people and the average length of the road covered is about 36 km. Priority is given to unemployed people with prior experience in construction works.

The micro-enterprises are engaged through performance based contracts with the Peru Roads Department and paid on a monthly basis. The micro-enterprises are self-governing, and determine how the monthly payment is allocated to the various uses: wages, tools, rentals, transportation, savings and other investments.

Micro-enterprises carry out simple works continuously throughout the year, to clean the ditches and culverts, control vegetation, fill potholes and ruts, maintain the surface camber, remove small landslides, and undertake other emergency works. They have also demonstrated capacity to build retaining walls and small bridges and handle El Nino emergency works under the guidance of the highway authority.

Source: IDFC Infrastructure Report 2007

The states should encourage citizen and user oversight through undertaking road user satisfaction surveys. To start with, structured questionnaire and analysis of response can bring out road user satisfaction index on various stretches of the primary road network. This should include the projects awarded to BOT concessionaires as well. This will strengthen the government oversight on enforcing performance standards from the private sector.

There is a case for a dialogue with the contracting industry to support them in creating a dedicated band of contractors who specialise in undertaking O&M works on the road network. This will improve maintenance delivery on the ground and also act as a good resource partner of the BOT concessionaires during the operation period. For rural roads, local small contractors may be utilised in area-based contracts and gradually involve local community with technical support from road agencies. Box 2.14 gives examples from Finland and Peru.

SUMMARY AND CONCLUSIONS

i. Road development should not be seen in isolation but as part of an integrated modal system of transport. For facilitating such a process, it is necessary to undertake regional traffic and transport surveys on regular basis—preferably every five years (to provide inputs to formulation of Five Year Plans and mid-course correction of policy prescriptions formulated for long-term development goals) of the freight and passenger flows, transport pricing, resource costs and identify existence of distortions in the movement from point of view of a desirable/optimal intermodal mix and investment policy for different modes of transport. Database in the road sector is virtually

The existing policy of levy on two-lane roads needs to be done away with. A two-lane highway on the primary network should be viewed as a basic minimum facility and provided through the government budget.

absent. This needs serious attention. Setting up of a dedicated road data centre managed through a high level institution does not admit of any delay. This would help in reducing the current ad hoc decision-making in the road development planning process.

ii. Current system of road hierarchy and classification dates back to 1943 when the Indian Roads Congress formulated the first Long Term Road Development Plan. The road network is divided into five classes—National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. It is recommended that the division of the network may be confined to three categories—primary, secondary and tertiary. Primary roads may encompass both national and state highways. Secondary roads may include current major district roads. Tertiary roads could be termed rural roads and comprise of both other district roads and village roads. Expressways need not be a separate class but these may be considered as part of primary road network since they are highways with features of full access control and limited to movement of motorised traffic. An independent road classification commission comprising of administrators, economists, geographers and road engineers under the umbrella of proposed Office of Transport Strategy should be set up. It should lay down clear, objective criteria for which authority holds the administrative mandate over a particular class of road. It should do so from a holistic network planning perspective that maximises the efficiency of each class. There is also need for introducing systematic numbering of different classes of roads as per international practice. For each class of road and traffic groupings, the standards should be uniform both in design and translation on ground.

iii. The existing network of national highways and state highways may be expanded in tune with the economic growth and development of industrial hubs, special economic zones, ports, tourist centres and connectivity to international routes—linkage with Asian Highways and European Road Network. At the same time, since the main function of the primary system is mobility and enhanced productivity of road transport, stress should be laid on consolidation of this network in terms of capacity augmentation through multi-laning of existing highways and provision of access controlled expressway facilities. An overall length of 100,000 km of NHs and 200,000 km of SHs should be largely adequate for the country. This may also include about 20,000 km of access controlled expressways.

iv. For capacity augmentation of national highways, the current programme of NHDP in seven phases is well conceived and its implementation may continue in the immediate term, i.e., the 12th Five Year Plan. Within these phases, the programme relating to widening of single lane roads to two lanes deserves to be accelerated for reasons of enhancing safety and energy efficiency. Six-laning of existing roads without access control has potential of being more accident prone. As such, the programme relating to six-laning of existing four-lane stretches needs to be stopped and where traffic volumes are beyond four-lane capacity, consideration given to provision of expressway network. In order to improve transport efficiency and enhance safety, all four-lane and six-lane existing roads need to have service lanes to cater to the requirements of local (both motorised and non-motorised) traffic so as to bring in an element of partial access control on such facilities. Provision of wayside amenities along the highways is becoming an integral part of the road projects. Such facilities should be provided by the private sector.

v. For capacity augmentation of state highways, every state should formulate programmes on the lines of NHDP and undertake implementation as per priorities identified through traffic surveys, economic and financial analysis of individual project stretches on the SH network.

vi. Financing of these roads should rely on user charge principle in the form of tolls as direct beneficiaries and continuing with the existing Central Road Fund through additional levies on petrol and diesel. The existing policy of levy of toll on two-lane roads needs to be done away with. A two lane highway on the primary network should be viewed as a basic minimum facility and provided through government budget including CRF. The accruals to the CRF may be enhanced by making levy of cess on fuel on ad valorem basis rather than the current system of a fixed amount of Rs 2.0 per litre, which was fixed in the year 2005. This may be enhanced to Rs 4 per litre to enhance the accruals to meet the project investment requirements. Some states have constituted

state road funds to provide assured funding for the state sector road projects. This is a good strategy and worthy of upscale by other states as well.

vii. While preparing projects for capacity augmentation, the need arises for planning of bypasses around towns to ensure smooth movement of through traffic. In most cases, these bypasses also serve as a vehicle for development of the town along or on the other side of the bypass. Therefore, the alignment for such bypasses should be planned jointly by the road agency and the urban development agency. Further, these bypasses should be planned and provided as access controlled expressway type facilities with entry/exit at predetermined locations. For large size cities (population above one million), bypasses could also be provided in the form of peripheral expressways. The intersection points of bypasses with main highways may also serve as freight logistics parks on case to case basis.

viii. Another requirement relates to reconstruction of dilapidated and weak bridges which are showing signs of distress and crying for replacement. There are also missing bridges on large rivers needed for opening of the area.

ix. Special needs of connectivity to ports, airports, mining areas and development of power plants should be factored in development of the road programmes. In certain cases of power plants, movement of ODCs (Over Dimensioned Cargo) will be involved and this will require advance planning particularly for strengthening of bridges involved and improvement of curves in hilly areas.

x. It is difficult to hazard a precise estimation of physical and financial requirements for development of primary roads without a detailed study of traffic forecasts and inventory of existing road network. However, a broad assessment is presented based on projections by the Working Group on Roads and deliberations within the Committee.

xi. The Major District Roads run within the districts connecting areas of production with markets and serve as connecting link between the rural roads and the primary road network and are thus equally vital for agricultural and industrial development of the landscape. Somehow, these roads have not been receiving the desired level of attention and investments in the past. This gap has to be filled to ensure balanced development of all classes of roads and in all regions of the country. An overall length of 400,000 km as proposed by the Working Group on Roads is recommended as a target network of MDRs. The stress should be to accelerate the programme of widening of these roads to regular two lanes including bridges and provision of rail over/under bridges on heavy trafficked stretches. Priorities may be governed by the traffic—current and projected. Some limited stretches may require four-laning also in later years depending upon the traffic growth witnessed.

The cess on fuel ahould be on ad valorem basis rather than the current system of Rs 2 per litre, which was fixed in the year 2005.

xii. Considerable progress has been made and is continuing under the current Pradhan Mantri Gram Sadak Yojana for providing connectivity to villages with all-weather roads. This programme is being implemented by the states with good managerial and technical support by the Centre. For the first time, well-engineered roads are being provided in rural areas. Hundred per cent fund for construction is by the Centre. The states are responsible for subsequent maintenance. The programme covers rural roads required for new connectivity (one basic access to unconnected habitation) and upgradation of existing roads (requiring improvement to provide all-weather access). This programme is well-conceived and its implementation may continue. The main areas of concern emerging relate to assured maintenance and upgradation in areas that have witnessed high agricultural and other economic growth. These aspects need special attention. The Government of India has recently approved a scheme of PMGSY-II which envisages upgradation of existing major rural links to rural growth centres where cost of upgradation will be shared by states also. There is a need for expansion of the current mandate of PMGSY to achieve universal connectivity as these roads serve as entry point for poverty alleviation and provision of access to social infrastructure such as education and health besides market.

xiii. The overall investments required for the road infrastructure in the next 20 years is given in Table 2.35. Broad assessment of private sector financing is also shown. Annual investments of the order of Rs 1,450 billion in the 12th Five Year Plan to increase to Rs 3,000 billion in the 15th Five Year Plan are envisaged. Of these, private sector financing may be of the order of 10 to 15 per cent as only part of the road network can be taken up on PPP basis.

xiv. The road agencies are not the users of the road network. That might partially explain why there is weak planning and implementation of

States should encourage citizen and user oversight through undertaking road user satisfaction surveys. This should include the projects awarded to BOT concessionaires as well. This will strengthen government oversight on enforcing performance standards from the private sector.

road maintenance operations. It is necessary to change this *laissez faire* attitude. Both the Central and state governments should declare as a policy that the roads would receive dependable and adequate allocation of funds on a continuous basis. A system of working out the replacement value of the road assets at the end of each financial year should be established by every road agency for roads under its jurisdiction. The information relating to road asset value should be put on a website in public domain. The government may also consider not to treat maintenance of roads as a non-Plan activity so that it does not suffer ad hoc cuts as is the current experience.

xv. There is need to move to long-term performance-based maintenance contracts where capacity augmentation may not be immediately required. Projects under the PPP mode have in-built provision for maintenance and operation during the concession period. Enforcement of performance standards by the road agencies through a well laid down mechanism is essential and field engineers responsible for execution of maintenance works made accountable.

xvi. The states should encourage citizen and user oversight through undertaking road user satisfaction surveys. This should include the projects awarded to BOT concessionaires as well. This will strengthen the government oversight on enforcing performance standards from the private sector.

xvii. There is a case for a dialogue with the contracting industry to support them in creating a dedicated band of contractors who specialises in undertaking O&M works on the road network. This will improve maintenance delivery on the ground and also act as a good resource partner of the BOT concessionaires during the operation period.

xviii. Technology for maintenance also needs a quantum jump particularly in respect of primary and secondary roads.

xix. For primary roads, non-engineering aspects should include land management by way of prevention of encroachment, control on ribbon development, regulation of access on existing highways and use of ROW by utility agencies. Incident management and highway police patrol are other activities that should become integral part of O&M provisions.

xx. The state transport authorities also need to support the road agencies in enforcing axle load limits of vehicles particularly trucks as overloading is seen to damage the roads prematurely.

xxi. Annual allocations required for maintenance should be worked out by each road agency for the roads under its jurisdiction based on asset management principles and traffic and road condition observed on the system. This should be a first charge on the available resources.

IMPLEMENTATION CHALLENGE

In evaluating the desired contours of India's road network, there are two basic questions that demand answers. First, is it possible to transport oneself or one's goods from points A and B within India? For the most part, the answer to this is, undoubtedly, yes. There will invariably be the extremely remote villages and settlements where the local terrain make it difficult for such habitations to be formally connected with the road network. Leaving these special cases aside, it does seem that India's road network in 20 years time will allow seamless transit between any two given points on the map. A more pertinent question that arises is how to enhance cost effectiveness and efficiency of delivery of the road development programmes without compromise on safety, quality and sustainability of assets. This would call for capacity building of the road agencies and the private sector, revisiting of road standards and sensitising road engineers so that road safety and environment mitigation measures become integral part of road design.

REVISITING THE MoRTH

Currently, the Ministry of Road Transport and Highways is responsible for development and maintenance of National Highways on behalf of the central government. For implementation of works on the ground, there are three agencies: National Highways Authority of India (NHAI), Border Roads Organisation (BRO) and state Public Works departments (PWDS).

The NHAI is the arm of the MoRTH for execution of NHDP. Works on National Highway stretches in the border areas of the country are entrusted to the BRO. The works on all other National Highways are executed by the Public Works departments in the states for the stretches within their respective juris-

diction. The designs and preparation of projects is handled by the state PWDs and their technical and financial sanction as per plan programmes and budget earmarked are issued by the MoRTH. Thereafter, awarding of contracts and implementation are undertaken by the state PWDs on agency basis.

With the NHAI having become operational through successful implementation of the NHDP, there is need to review the current structure of the MoRTH and expand the mandate of the NHAI. The objective should be for the MoRTH to entrust all National Highways and National Expressways to NHAI with proper restructuring of NHAI and only planning, policy and budget functions should remain with the MoRTH.

HUMAN RESOURCE DEVELOPMENT

At present, there is an acute shortage of skills at all levels and in all spheres of activity related to road infrastructure development. Indeed, this paucity of skilled manpower is emerging as the weakest link in ensuring that India can efficiently deliver on the road network it needs. It is imperative that central and state governments attach high priority to building capacity in the highways sector.

TRAINING NEEDS ASSESSMENT

As a first step, a comprehensive survey of the training needs of all road agencies responsible for the delivery of various programmes is required. While undertaking this exercise, attention should also be focused on training of supervisors and junior engineers who have so far largely been neglected by formal skills enhancement programmes. Associations and federations of contractors also need to provide a similar assessment of the skills gaps extant in their areas of operation. The assessments should be undertaken both in headcount as well as in qualitative terms.

PLANNING FOR EDUCATION AND TRAINING

On induction to an organisation, every new staff member should be given a comprehensive orientation course on various responsibilities and duties expected. A specified proportion of mid level officers (at least 5-10 per cent every year) in road agencies of the states and the central governments should be encouraged to go in for M.Tech/Ph.D courses in various disciplines of highway engineering and construction management. We must target that at least 3,000 engineers belonging to road agencies in the Centre and the states have a minimum of M.Tech/Ph.D. qualifications. In order to utilize their talents, new positions will have to be created in the various departments which allow them to use their knowledge.

The Indian Academy of Highway Engineers (formerly known as the National Institute for the Training of Highway Engineers) is currently the apex institution for training of highway engineers, functioning under the aegis of the Ministry of Road Transport and Highways. Besides providing training to engineers of central and state governments, it imparts training to engineers of consultants and contractors (see Box 2.15). It also organises site visits to marquee construction sites and built projects. There is need for considerable investment in IAHE for enabling them to effectively discharge its mandate. A minimum of 20 to 30 full time faculty and commensurate support technical and secretariat staff should be in place. The faculty should comprise both educationists and practising engineers. IAHE should also tie-up with business schools in the country and abroad so that our engineers may also be exposed to tailor-made management courses. The state governments should also strengthen their state level training centres with support of local academic institutions.

Attention should be paid to training needs of supervisors and junior engineers who have so far been neglected by skills programmes.

To prevent ossification of skills in the face of continuously changing technologies and design principles, continuing education must form an essential part of every highway engineer's career. The requirement for specialisation and skill development of officers of the road agencies in core processes of planning, design, preparation of sound feasibility reports and detailed project reports, project development and financial appraisal for BOT projects, social and environment concerns, traffic studies, contract management, etc., should receive regular attention. The training plans should also include study tours of projects in India and abroad by a group of officers from different states and the central government; and post-graduation in various disciplines of highways from prestigious universities in the UK, US, Australia, etc.

It is very important that all road agencies of the states and the central governments make provision for lateral entry of professionals mid-career and senior levels through open competition. Relevant rules and procedures will have to be devised for this. In addition officers may be admitted on deputation from industry and academic institutions for periods of one to three years. It is possible that some of these professionals may opt for lateral entry into these departments eventually if they find the work more rewarding than at their parent institution. Similarly, officers from state and central road agencies should be encouraged to take up short-term deputations in academic institutions and the private sector.

Box 2.15

Indian Academy of Highway Engineers (IAHE)

An apex institution of excellence for training of highway engineers in road sector—both at entry level and during the service.

Mission: Bring in efficiency and value for money in planning, design, construction and maintenance of roads in the country and inculcate leadership quality, professionalism and commitment to excellence among the highway engineers.

Initiative of Ministry of Road Transport and Highways. Established in 1983. Campus in NOIDA. Collaborative institute of the Central and State Governments. Organises training for government, contractors and consultants at both national and state levels, also conducts programmes in various states (inset). Also imparts training to highway engineers from SAARC and African countries. Has an excellent infrastructure: lecture halls, seminar halls, auditorium, hostel, Board room, office block, canteen, recreation facilities, library, computer lab, soil testing lab, staff quarters (spread over an area of around 10 acres)

Types of Training Courses

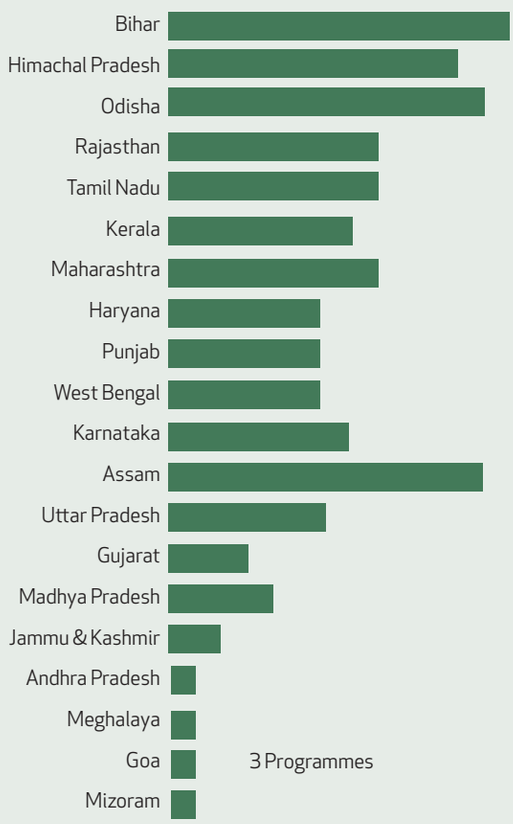
- Foundation Courses (for newly recruited Engineers)
- Refresher Courses
- Orientation Courses
- Specialised Areas of Highway Engineering
- Contract Management
- Highway Management and Administration Programmes
- Management Development Programmes

Mode of Training

- Lectures
- Case Studies
- Group Discussions

- Multimedia Presentations
- Site Visits & Field Attachments
- Laboratory Practice
- Software Packages
- Video Films

Programmes conducted in various states



Source: Indian Academy of Highway Engineers, www.nithe.org (accessed 1 July 2013).

Box 2.16

National Academy of Construction (Hyderabad)

(A Model Agency for Training in Construction)

Initiative: Government of Andhra Pradesh set up the Academy in 1998 as a Society; managed by Board of Governors chaired by the Chief Minister, Andhra Pradesh.

Mission: Improving efficiency and productivity of the Indian Construction Industry

Core Activity: Training of workmen, supervisors, managers, contractors and engineers in the field of construction.

Funding: 0.25 per cent (recently reduced to 0.10 percent) deduction from the bill payments of contractors in the state.

Example of competencies provided to works supervisors

Surveying; marking out; estimating; costing and quantity surveying, roads and cross drainage works with quality control as per IRC/MORTH/MORD specifications, on-job experience with leading construction companies.

Certificate of Competency is awarded by NAC under authorisation by the Ministry of Labour & Employment, Government of India

Objectives:

i. Basic skill training for general/specialized construction trades
ii. Upgradation of skills in contract management practices of government, corporate and contractors managers.
iii. Quality supervision, stores management and surveying.
iv. Training of Trainers

Methodology:

i. Structured courses for training (theory and practice)
ii. Group discussions
iii. Workshops, seminars, conferences, symposia
iv. On-job experience, visit to project-sites

Faculty: Both core and guest faculty

Infrastructure: Spread over an area of 167 acres (land allotted by the state government), the campus has a very good infrastructure consisting of classrooms, workshops, auditorium, seminar halls, office block, board room, hostel, canteen, recreation facilities, shopping centre, exhibition halls, etc.

Training efforts directed at contractors' staff must be an essential part of the agreement signed between the contractor/concessionaire and commissioning agency. The government should support the construction industry in strengthening existing training centres and ITIs. For skill upgradation of construction workers, equipment operators and supervisors, an initiative was taken by the state government of Andhra Pradesh to set up National Academy of Construction in Hyderabad. Box 2.16 gives a snapshot of its activities. Such an example needs to be replicated in each state.

Some of the leading construction contractors like Larsen & Toubro have set up their own institutes and centres throughout the country (Box 2.17).

Once a critical mass of skilled engineers, construction workers, and equipment operators is assured, the construction industry should be encouraged to adopt a formal system of apprenticing to provide a practical supplement to more academic training efforts. Box 2.18 brings out the skills development strategy for construction workers in the road sector that can be adopted.

FUNDING OF TRAINING PROGRAMMES

Sufficient funds must be budgeted by the various stakeholders—government, contractors and consultants—for training. Government road agencies should make a provision of 0.25 per cent of the project cost in each estimate towards staff training to cover course fees, travel to training centres, per diem allowances, and expenses of institutions in imparting training. In consultation with the Ministries of Finance and Labour & Employment, 0.25 per cent of the cess collected under the Construction Workers Welfare Cess Act, 1996, should be earmarked for training of construction workers.

Box 2.17
L&T Construction Skills Training Institute

Mission: Empowering and building careers for rural youth through skill training.
Enhance productivity of men and machines in construction projects.

Objectives:
1. Train construction workforce to meet demand for construction skills in terms of safety and quality of workmanship.
2. Identify training needs and set standards for occupational competencies.
3. Testing and certification to validate competency levels.
4. Facilitate training by setting up modular training schools.
5. Serve social objective of channelising the potential and strength of rural youth for producing employable construction workforce.

Courses offered: Formwork, carpentry, bar bending, masonry, electrical, scaffolding, pre-stressing

Training period: 200 hours to 600 hours (one month to three months)

Methodology:
1. Preparation of skill standards, training modules
2. Trade Testing
3. Three distinct levels (level III basic, level II intermediate and level I high)
4. Coverage is 80 per cent practical and 20 per cent classroom

Mainstreaming: Via certification through approved National Certifying Authorities

Spread: Chennai, Mumbai, Ahmedabad, Bengaluru, Delhi, Kolkata, Hyderabad and Cuttack

Source: L&T Limited, ECC Division

This will usefully benefit other construction-reliant industries as well.

SKILLS INVENTORY

There are several areas for training in the highway sector to which the stakeholders in the road sector should be exposed. An indicative list of possible areas for skill enhancement in the highway sector is given in Box 2.19.

TRAINING STRATEGY

MoRTH in consultation with the Ministry of Rural Development and state governments may take the lead in formulating a training strategy for the road sector in India. Such a strategy may cover:

- All stakeholders: Road agencies, contractors, consultants.
- Different aspects: Project management, quality assurance, legal, contract administration, dispute resolution, public private partnership approaches, social and environment aspects, safety.
- System of incentives: Weightage in construction contracts to workers and site engineers who hold competency certificate from accredited training institutions.
- Financing strategies: Both government budget and private sector.
- Institutional framework: Strengthening and networking of existing training and academic institutions, collaboration with international agencies.

INDIAN ROADS CONGRESS

Currently, the IRC mandate is to evolve standards, specifications, manuals, guidelines for planning, design, construction and maintenance of different categories of roads. There are several similar professional bodies across the world like American Association of State Highway and Transportation Officials in the US; Permanent International Association of Road Congresses in Paris; National Association of State Roads in Australia; Japan Roads Association in Tokyo; International Road Federation in Geneva, etc., which are engaged in various activities connected with planning, design, construction, maintenance and operation of highways and development of codes, standards and specification. The Indian Roads Congress is already in touch with some of these organisations. The IRC should take advantage of such agencies in continuously keeping abreast of latest practices. There is a need to review design standards on a regular basis so that these are in line with international practices duly taking into account our own milieu.

Box 2.18
Skills Development Strategy

For the 12th Plan (2012-17), preliminary exercises suggest an investment level of Rs 45,000 billion in infrastructure. As a modest estimate, about 40 per cent of these investments would directly contribute to construction activities. This includes a significant component of roads. For construction workers in the road sector, there is huge demand for trades like surveyor, excavator operator, grader operator, stone crusher operator, laboratory technician, road roller operator, skilled, semi-skilled and unskilled workers. Very few opportunities for skill development are currently available for these trades as most ITIs and polytechnics have bypassed them. There are hardly any organised training providers to train the construction equipment operators or quality assurance technicians. The Government of Andhra Pradesh took the initiative of setting up National Academy of Construction in Hyderabad for training of construction workers a few years back. This is a joint effort of the state government and contractors associations. This is an excellent example for being replicated in several regions of the country with due focus on road sector demands.

The framework for skill development of workers of workers in the road sector should include the following key features:

- Demand driven short-term training courses based on modular employable skills to be decided in consultation with the construction industry, viz., contractors and consultants;
- Testing and certification of prior learning (skills of persons acquired informally);
- Flexible delivery mechanism (part time, weekends and full time);
- Different levels of programmes (foundation level as well as skill upgradation) to meet demands of various target groups;
- Optimum utilization and enhancement of existing training infrastructure to make training cost effective and purposeful;
- Testing of skills of trainees by independent assessing bodies who would not be involved in delivery of the training programmes.

Source: Road Sector: Skills Development Strategy by Mukesh C. Gupta, International Labour Organisation, New Delhi. IRC Discussion Paper No. 565, October 2010.

The current system of formulating design codes and manuals needs a total overhaul.

Eventually the standards should have statutory standing and become the responsibility of the Standards Departments of the proposed Indian Institute for Intercity Road Transport, Indian Institute for Urban Transport, and National Road Safety and Traffic Management Board (see chapters on Safety and Research and Human Resource Development). The Standards Departments in these institutions will have the authority to propose, evaluate and establish relevant standards that will have statutory status. The procedure followed will have to similar to those established by Bureau of Standards in India and abroad with domain experts in charge of specific standards.

ROAD DESIGN INSTITUTE

Except for a few technical officers in the road agencies who staff design cells in the states and the Centre, there is no dedicated institute for undertaking designs for the various components of the road projects. There is a compelling need for a dedicated Indian Institute for Intercity Road Transport and Indian Institute for Urban Transport for the road sector that should function under the umbrella of MoRTH. It should have around 400 to 500 professionals at various levels covering various disciplines such as transport planning, traffic and safety engineering, transport economics, pavement design, bridge structure design, maintenance technology, geo-technical engineering, material engineering, IT related interventions, tunnel engineering, social and environment engineering, etc. Similar institutes should be set up in each state PWD and Rural Roads Agencies. Every state should have at least 40 to 50 professionals covering various disciplines.

RESEARCH, DEVELOPMENT AND TECHNOLOGY INITIATIVES

The basic purpose of research in the highway sector is incorporation of technology innovations for:

- Achieving cost efficiencies, speed in construction, increased durability and performance,
- Providing technical underpinning to evolving standards, and
- Developing a pool of scientists and engineers having knowledge of latest developments around the globe.

Box 2.19

Highways-Related Skills Inventory

- **Introductory issues**
  1. Current issues in highway development, financing and administration

- **Project design and evaluation**
  1. Undertaking best-practice feasibility and detailed project reports
  2. Cost-benefit and commercial analysis of highway projects; quantifying project benefit; selecting between construction alternatives
  3. Traffic forecasting
  4. Financing methods: standard PPP models, road user charges, Road Funds, tolls and tolling methodology
  5. Environment management plans
  6. Land law and acquisition schemes; resettlement and rehabilitation policy
  7. Highway legislation including NH Act, NHAI Act, Control of National Highways (Land & Traffic) Act, CRF Act, States Highways Act, Motor Vehicles Act
  8. World Bank and ADB guidelines for construction projects

- **Project management**
  1. Procurement planning and preparing bid documents
  2. Contract management
  3. Tailoring MCAs and drafting standard bidding documents
  4. Evaluating bid proposals and awarding tenders
  5. Liaising with supervising and monitoring concessionaires
  6. Managing construction consortia
  7. Managing construction site safety
  8. Dispute resolution and negotiation

- **Highway design and regulations**
  1. Road safety measures including use of signs, markings, crash barriers
  2. Pavement design: flexible and rigid pavement; international practice
  3. Geotechnical investigations and landslide protection measures
  4. Road geometry and alignments
  5. Bridge design
  6. Hill road design—special considerations

- **Highway construction and engineering**
  1. Pavement construction
  2. Design and construction of high embankments, ground improvement methods, soil reinforcement structures
  3. Bridge construction including foundations, sub-structures, superstructures, aesthetics
  4. Construction of flyovers and interchanges

- **Maintenance**
  1. Designing and monitoring road performance measures; pavement evaluation techniques; road maintenance management systems
  2. Planning, norms, financial and institutional issues
  3. Maintenance of road asset inventory and condition history
  4. Bridge inspection and distress diagnosis; bridge management system

- **Expressways**
  1. Planning and alignment
  2. Design of pavement, bridges and interchanges
  3. Construction and operations and management

- **Highway management**
  1. Monitoring axle weights, traffic data, origin-destination surveys, traffic forecasting
  2. New materials and construction technologies

Box 2. 20

Central Road Research Institute, New Delhi: A Snapshot

Established: 1952 as National Laboratory under CSIR
Mandate: Explore emerging areas in road sector, provide guidance to highway profession, support development of cost effective standards and specifications of roads of various categories

Research Areas

- Road Development Planning and Management
- Traffic Engineering Safety and Environment
- Pavement Engineering and Materials
- Geotechnical and Natural Hazards
- Bridge Engineering and Management
- Instrumentation

Beneficiaries

- Government Road Organisations
- Indian Roads Congress (IRC)
- Contracting and Consultancy Sector
- Oil Companies, Cement Manufacturers
- Testing Equipment Manufacturers

Landmark Achievements

- Road user cost study (input to World Bank HDM-III, HDM-4)
- Landslide mitigation strategies (hill regions)
- Consolidation of marine clay (coastal belts)
- Soil stabilisation techniques
- Pavement deterioration prediction models
- Use of flash and other industrial waste in roads
- Road Safety Audits, Traffic Management Measures
- Non-destructive testing of bridges
- Road Condition Evaluation Devices, Bump Integrator
- CC block pavement in deserts and mountains
- Training Highway Engineers (10,000 so far)

Current Activities

- Road Information System
- Slope protection strategies in hills
- Maximising use of marginal/waste material
- Engineering safety measures
- Highway Capacity Manual for Indian Conditions
- Refining pavement condition prediction models
- Diagnostics of distressed bridges
- Pilot testing of innovative materials
- Skill enhancement of highway professionals

Spectrum of Activities

- Basic Research
- Applied Research
  - Sponsored
  - Collaborative
- Technical Services
- Principal Technical Agency, PMGSY
- Testing, Calibration
- Skill Enhancement
- Think Tank of IRC

International Collaboration

- Transportation Research Board, USA
- Transport Research Laboratory, UK
- Australian Road Research Board, Australia
- LCPC, France
- PIARC (World Roads Congress), Paris
- International Road Federation (IRF), Geneva
- CSIR, South Africa

Support Infrastructure

- Good Size Campus
- Wide pool of talented Scientists and Engineers
- Support Staff
- World Class Testing Equipment and Labs
- Test Tracks
- Library
- Computer/Data Centre
- Software Packages (in-house and international)
- Seminar Halls
- Hostel

Box 2.21
Thrust Areas for Research, Development and Technology Innovations

A. Areas relevant to PPP and government funded projects on main highways

1. Blending/stabilisation techniques to maximise use of locally available and marginal materials. (Pilot projects be undertaken throughout the country).
2. Determining design service volumes at various levels of service for 2-lane, 4-lane and 6-lane roads.
   - with/without paved shoulders
   - with/without service roads in both urban and non-urban areas.
3. Accelerated bridge construction technologies to achieve faster construction (precasting techniques, concrete-steel superstructures, etc.). Also evolve standard designs.
4. Condition assessment of existing bridges and distress diagnostics of superstructures, substructures and foundations of bridges
5. Evolving pavement performance predication models for determining rate of deterioration of road pavements and riding quality with time, traffic and weather (including rural roads). Develop non-destructive evaluation and inspection techniques (quick results possible as CRRI has acquired an APT facility)
6. Evolving bio-engineering and other measures for improving slope stability in hills (including rural roads)
7. Recycling techniques (hot/cold) of bituminous pavements. Evolve guidelines for promoting their use as it would ease the burden on use of aggregates and reduce carbon footprint

B. Areas relevant to rural roads

1. Identification of locally available materials at district level and determining their strength characteristics and promoting stabilisation techniques
2. Use of soil cement, cement blended granular material, brick ballast and other marginal materials
3. Use of bituminous emulsions, chip sealing and surface dressing
4. Evolve low cost water crossing structure designs
5. Evolve low cost drainage and erosion control measures
6. Evolve designs for fabricating low-end technology equipment for construction and maintenance

Source: Report of the Working Group on Roads for the NTDPC – May 2012.

The early development planners of the country had clearly recognised the need for national research and development in all branches of science and technology. The establishment of the chain of National Laboratories under the Council of Scientific and Industrial Research (CSIR) was a major step in this direction. The Central Road Research Institute (CRRI) was one such Laboratory set up for the road sector in the early 1950s in New Delhi. The CRRI has been doing pioneering service to the highway engineering profession (Box 2.20).

The MoRTH and IRC have created a mechanism for accreditation of innovative materials and technologies for the road sector to promote their utilisation on ground. However, despite these measures, there is a time lag between research findings and application on ground. Moreover, the level of R&D in the highway sector is currently low in relation to the investments on road development being made by the Central and state governments. We need to provide opportunities to the road construction industry to introduce cost effective materials, specifications and technologies to satisfy requirements of performance and durability and achieve fast construction and reduced carbon footprint.

Thrust areas for knowledge development are given in Box 2.21.

In order to give further push to the technology initiatives, centres of excellence should be set up in the existing IITs, IIMs, NITs and other academic institutions on various topics related to road sector viz. PPP, safety, highway administration and management, trucking operations, construction management, pavement design, environment concerns, energy conservation, urban transport, bridges, tunnels, disaster management, expressways, low volume roads.

Box 2. 22

Technology Initiatives under PMGSY: Lab to Land

1. **Main Drivers of Technology**
   - Political: Awareness and commitment
   - Bureaucracy: Appreciation and encouragement to scientists
   - Scientists/professionals: Innovation effort
   - Practitioners: Pilot/experiments on ground
2. **Advantages**
   - Enhanced durability and performance
   - Reduced initial or life cycle cost
   - Reduced environment degradation
3. **Strategies Adopted**
   - All India Workshop of Stakeholders
   - Group of scientists, academia, technocrats constituted by Ministry
   - Guidelines proposed by Group deliberated among SRRDAs, STAs, PTAs
   - Guidelines considered and approved by Ministry
   - Guidelines issued to state governments for implementation
   - Oversight on implementation through regional reviews
4. **Salient Features of Guidelines**

   A. For proven technologies
   - Field officers, academic institutions capacity building
   - Contractors to be guided during execution
   - CRRI + IITs + NITs to map the availability of marginal materials and their strength characteristics
   - Minimum 15 per cent projects to use these technologies
   - No sub-contracting till critical mass of contractors created in execution of such technologies
   - Defects Liability Period: Six months, thereafter employer, contractor not held responsible. Checks and balance with respect to strict quality control during execution.

   B. For potential technologies
   - Pilot projects on ground
   - Obtain warranty for performance and cost-containment from Technology Provider
   - MoU with Technology Provider for providing material and technology guidance and support during execution
   - On successful performance, treat them as Proven Technology

Focus
- Marginal Materials
- Industrial Wastes
- New Materials
- Green Technologies

Source: Prepared from the Ministry of Rural Development, National Rural Roads Development Agency Guidelines on Technology Initiatives issued to States in May, 2013.

The government should promote transfer of proven R&D technologies from lab to land through well considered pilots for implementation by BRO, NHAI, NRRDA, state PWDs and SRRDAs, etc. At pilot stage of testing performance, a liberal view would need to be taken of some unintended non-performance or failure of such pilots, with of course a laid down mechanism for supervision and monitoring during execution. See Box 2.22 for the recent initiative taken by the Ministry of Rural Development in mainstreaming technology initiatives under PMGSY.

QUALITY AUDIT

The National Rural Roads Development Agency, an arm of the Ministry of Rural Development, has instituted a three-tier quality monitoring system for construction of PMGSY rural roads. The first tier is at the Project Implementation Unit level where the Junior Engineer, Assistant Engineer and Executive Engineer have been made responsible for exercising quality control checks during execution and before authorising payments to contractors for the work carried out. Second tier is the system of State Quality Monitor (SQM). At the state headquarter level, one Chief Engineer or Superintending Engineer is designated to exercise sample checks and oversight on the quality at various predefined stages. At the third tier is the system of National Quality Monitors (NQM) whereby the retired CE/SE with high credentials, based on recommendation of the state government are empanelled by the NRRDA (Ministry of Rural Development, Government of India). These NQMs visit the states as per the direction of the NRRDA and provide independent report on quality of construction of PMGSY road to both NRRDA and the State Implementing Agencies.

The NHAI and some of the state PWDs also undertake third party independent technical audit of their projects through reputed private sector and academ-

The MoRTH should entrust all National Highways and Expressways to the NHAI and only planning, policy and budget functions should remain with the ministry.

ic/research agencies. However, there is no well laid down system in place except for the quality control checks exercised by the 'Engineer' of road agencies or of the Construction Supervision Consultant engaged for contract administration. Road agencies need to institute a credible system of third party audit to enhance quality in execution of projects in the road sector on the lines of NRRDA.

SUMMARY AND CONCLUSIONS

i. The current system of formulating design codes and manuals by the Indian Roads Congress needs an overhaul. There is need to reduce the delays currently experienced in finalisation and updating of design codes, etc. Funds for such purposes should be provided by the government out of R&D budget. Eventually, the standards should have statutory standing and become the responsibility of the Standards Departments of the proposed institute for Intercity Road Transport, Institute for Urban Transport and Traffic Management Board.

ii. Except for a few technical officers in the road agencies who are manning design cells in the states and the Centre, there is no dedicated institute for undertaking designs for the various components of the road projects. There is compelling need for a dedicated institute for the road sector that should function under the umbrella of MoRTH. It should have around 400 to 500 professionals. Similar institutes should be set in each state PWD and Rural Roads Agencies. Every state should have at least 40 to 50 professionals covering various disciplines.

iii. With the NHAI having become operational through successful implementation of the NHDP, there is need to review the current structure of MoRTH and expand the mandate of the NHAI. The objective should be for the MoRTH to entrust all National Highways and National Expressways to NHAI with proper restructuring of NHAI and only planning, policy and budget functions should remain with the MoRTH.

iv. The existing road agencies in the Centre and the states are gearing themselves to the needs of accelerated road sector programmes. However, capacity and performance of these agencies need further enhancement depending upon the current weaknesses in each agency. The Government of India has instituted a system of Results Framework Document for various sectoral ministries and are also encouraging the state governments for similar initiatives. The road agencies may consider self-evaluation or undertake capacity analysis through domain management expert agencies to identify enhancement measures required to improve their capacity and performance.

v. Staff at various levels should receive regular training in various aspects of the road projects. Each road agency should have its training plan and calendar for both short-term and long-term. Such a plan should cover sponsoring officers for undertaking M.Tech. programmes in various branches of highways, bridges and tunnels.

vi. There is a huge backlog of training at the cutting edge level of supervisors, junior engineers and assistant engineers for which special programmes need to be evolved and provided. A few states have set up their own training institutes for this purpose. These institutions need strengthening and provision of state-of-art training infrastructure. Such training institutions should come up in all states.

vii. The government also needs to support Indian Academy of Highway Engineers (IAHE), other training institutes at state level and academic institutions to improve their infrastructure for training of road agencies.

viii. Consultancy in the road sector has played a significant role in supporting the road agencies. However, due to quantum jump in the volume of work, weaknesses in their output become evident in some cases. There is need for a system of internal quality audit by the consulting firms before they submit their outputs to the road agencies. The government should also tighten the current performance evaluation system to bring in more accountability of the consultants.

ix. With the push given by the World Bank and the Asian Development Bank since the mid 1980s, the contracting industry in the road sector has come up reasonably well in terms of mechanisation and acquisition of professional site engineers and project managers. However, the sheer increase in volume and size of projects bring offered by the government in the road sector has created several challenges and constraints in this industry. Major constraints relate to poor productivity and substandard quality due to non-availability of skilled construction workers, and equipment

operators and site supervisors. Both the government and the construction industry need to address this concern. Advantage should be taken of the skill development initiatives being launched by the Government of India to assess the magnitude of requirements of the road sector and consider a three pronged strategy, viz. at the vocational level through industrial training institutes, at the diploma level through polytechnics and at the state level through setting up construction academies.

x. There is an urgent need for quantum jump in the R&D and technology upgradation effort in the road sector covering pavements, bridges, tunnels, safety and traffic management for knowledge acquisition and knowledge development in our own context and situation.

xi. The R&D schemes having immediate practical relevance in the context of the initiatives of the government to develop the road sector in the country needs to be taken up on priority. In this context, consideration needs to be given to evolving country specific highway capacity manual, models for prediction of pavement performance with traffic, distress diagnostics of bridges and strategies for maximising use of locally available marginal materials including recycling of existing pavements and promoting use of industrial waste materials and by-products where found useful.

xii. Centres of Excellence should be created on different aspects of roads and road transport including safety in IITs, NITs, other engineering institutes and IIMs to accelerate the research and capacity building activities.

xiii. The government should promote transfer of proven R&D technologies from lab to land through well considered pilots for implementation by BRO, NHAI, NRRDA, State PWDs and SRRDAs, etc. At pilot stage of testing performance, liberal view would need to be taken of some unintended non-performance or failure of such pilots, with of course a laid down mechanism for supervision and monitoring during execution.

xiv. A provision of one per cent of the total road investments should be earmarked for capacity building of the stakeholders involved and technology innovations in the road sector.

ROAD TRANSPORT

NEED FOR TRANSHIPMENT FACILITIES

Freight transport is the backbone of the economy. For reoptimisation of modal mix, a critical infrastructure need is transhipment facilities, both rail and road transhipment and the use of 'transport *nagar*s'. Such *nagar*s can be positioned on suitable locations on the periphery of large cities and pick-up and delivery services on the hub-and-spoke model.

Other integration that is needed is synchronisation of short haul movement by road and long haul movement by rail for both export/import cargo through containers and long haul freight movement to/from destinations in remote areas not connected with rail network.

MODERNISING THE TRUCKING INDUSTRY

The trucking industry can be broadly characterised as being highly fragmented and unorganised. According to statistics provided by Transport Corporation of India, 90 per cent of the industry consists of entities that have less than five trucks, contributing 80 per cent of gross revenues. The remaining 10 per cent that comprises the organised sector, consists of small numbers of fleet operators who have the flexibility to operate trucks of varying payloads over a distributed network, and are primarily employed in supply chain management and for other formal logistics purposes. However, the bulk of the unorganised fleet is used for general goods transportation with operators working on a 'hub and spoke' model. With transportation companies that run big fleets gradually moving from asset-based to contractual models, it is widely recognised that the dependence of small fleet operators and small operators on brokers will continue to have impact on the physical as well as the financial performance of the sector. There is a case for regulating trucking firms for suitable incentive structures (Box 2.23).

One per cent of the of the total road investments should be earmarked for capacity building and technology innovations.

The approach of government departments to the trucking industry has been to regard it as a source of revenue at every stage: excise duties; sales tax on purchase of vehicles; road tax on owning and using; licence fees and permits for operating; octroi or entry tax by local authorities; not to speak of taxes and duties on petrol, lubricants and spares. As a result, over 30 per cent of the initial cost and about 50 per cent of the operating costs are due to these multiple burdens[13]. So there is little incentive to invest in better vehicles, improved maintenance or well-trained and well-paid operating crew. The industry is characterised by very low levels of technology. The main reason for this situation is market failure—the market is not transmitting the signals required for technology upgradation. There is a multiplicity of taxes, variations both in the basis and

13. Asian Institute of Transport Development: Journal on Trucking Industry, 2000.

Box 2. 23
Regulating for Suitable Incentive Structures

Single truck owners make up as much as 50 per cent of the trucking firms; economists will consider the prevailing situation as one which comes close to perfect competition. That is, there is a large number of producers of trucking services and none of them is big enough to influence the price line. As a result, the industry today is essentially controlled by intermediaries, because a large number of truck owners themselves are too small as firms to acquire critical market information.

The inability of poorly capitalised firms to gather information about cargo has resulted in the growing domination of brokers who need to be brought under the purview of regulation keeping in mind the fact that while trucking firms will have to pay for information about consignments, this asymmetry must not be allowed to become the fulcrum around which the industry revolves.

Usually, it is possible to strike a balance between the demand and the supply side of any activity. But in trucking, the fiduciary nature of the activity has to be kept in mind. This suggests an important approach to regulating trucking, namely, that the thrust of regulation has to be on the seller of trucking services.

The creation of an efficient marketplace, similar to a stock exchange or a commodity exchange, to bring together customers and transport vendors in this largely unorganised sector could bring about the desired change in the trucking landscape.

Source: Asian Institute of Transport Development: Journal on Trucking Industry, 2000.

rates at which these are levied, high incidence of these taxes and the absence of guidelines for the tax authorities. An ideal tax system is one which is neutral, efficient in allocation of resources, administratively expedient and avoids cascading effect in the economy.

There is a relatively high percentage of light trucks on Indian roads when compared internationally. Indian trucks largely consist of a chassis that is supplied by a truck manufacturer. Specialist after-market 'body' carpenters and other constructors then build a complementary cab and a tray or hold according to the purpose for which the truck will be used. There is considerable variation in the final versions of the trucks and buses turned out by these constructors, guided as they are by regional preferences and individual idiosyncrasies. Unlike elsewhere, there is comparatively little use of the tractor-trailer model wherein a tractor may be hitched to various trailers as dictated by demand. This means that Indian trucks often carry goods in generic trays and boxes which may not be expressly suited to the job at hand. This jerry-built nature of Indian trucks is perhaps understandable given that road surface conditions mandate robust, easy-to-fix trucks. Lately, however, multi-axle vehicles have grown in significant numbers on the back of growth in NHDP-funded highways that encourage their use.

The Indian trucking industry is characterised by low levels of technology[14]. This is in spite of the fact that both truck manufacturers and trucking firms are in the private sector. This suggests that the main reason for the low level of technology is market failure: the market is not transmitting the signals required for technology upgradation. The duopoly on the supply side and the peculiarities of the cost structure on the demand side seem responsible for this. Unless these distortions are rectified, it may not be possible to speedily raise the level of technology in this industry. Overall, it will be necessary for policy-makers to forge a stronger link between profitability and technology because at present this link is quite weak. The thrust of the policy should be to alter the structure of costs so that fixed costs play a less important role in determining the profitability of trucking operations. This can be done by making available finance more liberally.

The profitability of truck operations depends on the following factors: capacity utilisation; freight trips; fuel prices and fuel efficiencies; and other operating costs. In order to maximise profitability from their inefficient vehicle fleet, truck operators will increase revenue by overloading vehicles, resulting in excessive road wear and tear, a reduction in the economic life of the vehicle itself, and a higher propensity for road accidents.

14. Asian Institute of Transport Development: Journal on Trucking Industry, 2000.

Table 2. 36
Role of CVO in Seamless Interstate Freight Movement in the United States

CVISN	APPLICATION	IMPACTS CAPABILITY
Safety Assurance	Safety Information Exchange	Has provided inspectors with electronic access to carrier and vehicle safety information from previous inspections.
	Automated Inspection	Identifying of faulty equipment on carriers facilitated by remote testing.
Electronic Screening	Safety Screening	In-vehicle transponders are used to facilitate communications with inspection stations to pre-screen trucks for safety records.
	Border Clearance	By applying in-vehicle transponders, truckers are able to communicate with customs checkpoints to pre -screen their trucks for safety records, border clearance and proper credentials.
	Weight Screening	Weigh stations and in-vehicle transponders are able to communicate to pre-screen trucks for compliance with weight regulations. Weigh-in-motion (WIM) scales and Automatic Vehicle Classification (AVC) systems have reduced delay at checkpoints by allowing carriers to pass inspection without stopping.
	Credential Checking	Weigh stations and customs check-points are able to communicate with in-vehicle transponders, to pre-screen trucks for proper administrative credentials.
Credentials Administration	Electronic Payments	Facilitates electronic business and transfer of registration fees between carriers and the revenue collection agency.
	Electronic Registration/Permitting	The internet applications and other electronic means facilitate the exchange of credential data between licensing/permitting agencies and the carriers. This reduces time taken for permit approval.
Security Operations	Asset Tracking	The location and condition of fleets can be monitored for security purposes by using surveillance and detection technologies.
	Remote Disabling Systems	Theft and unauthorised use of commercial vehicles can be prevented by employing ITS technologies.

Source: World Bank Paper for NTDPC on Institutional and Regulatory Frameworks for Free Movement of Commercial Highway Vehicles Across States/Provinces by Kumares C. Sinha et al. (June, 2011)

The major policy issues with respect to modernising the trucking industry then have to do with industrial organisation and market consolidation; modernising the trucking fleet by encouraging the use of modern tractor-trailers; encouraging fuel efficiencies through the supply of cleaner fuels and advanced engine technologies. The first of these depends as much on labour laws, increasing educational standards, emergence of alternative investments and on labour and capital market deepening as anything else. It will also depend on increasing levels of supply chain sophistication, such as the requirement for specialist automobile delivery lorries and refrigerated trucks. These must also function alongside rail haulage facilities and services. These advanced logistics will naturally become the preserve of more complex entities that are capable of managing larger, more technologically advanced fleets. (See Chapter 4, Volume II on Integrated Transport: Strategy and Logistics)

ENHANCING PRODUCTIVITY OF COMMERCIAL VEHICLES

Cumbersome documentation, detention at check posts and bureaucratic hassles have adversely affected the productivity of the trucking industry. As a result, a truck on a highway is able to clock only 300 to 500 km per day. Trucks in the developed countries are able to cover double this distance.

Due to cumbersome documentation, detention at check posts and bureaucratic hassles, a truck on an Indian highway clocks only 300-500 km per day. Trucks in developed countries cover double this distance.

Commercial vehicles should be treated as rolling stock of the road transport infrastructure as they are carrying the economy on wheels. All efforts must therefore be made to improve productivity of precious assets. The use of intelligent transportation systems (ITS) in commercial vehicle operations can significantly enhance regulatory processes and this can make interstate truck movement seamless. Electronic registration and issue of permits by state agencies allows carriers to register online, decreasing the turnaround time associated with permit approval. Electronic processing of driver and vehicle safety information can eliminate or minimise inspection and enforcement requests at state borders. At check stations, enforcement personnel can use the national database clearing houses to confirm carrier regulatory compliance data and cross check safety assurance information. A commercial vehicle can thus travel seamlessly through state boundaries, once it is inspected and cleared at the origin state and the information is electronically transmitted to other states along the proposed trip. In this context, reference is invited to the Commercial Vehicle Information System And Networks (CVISN) as a component of the Commercial Vehicle Operations (CVO), designed by the US Federal Motor Carrier Safety Administration. Table 2.36 captures the role of CVO in seamless interstate freight movement.

The following measures need to be introduced to achieve seamless movement of commercial vehicles in the country:

i. Promote use of ITS in commercial vehicle operations to enhance regulating processes making interstate truck/bus movement seamless. Electronic screening promotes safety and efficiency since trucks or buses equipped with low-cost in-vehicle transponders can communicate with check stations. Communication equipment at the roadside can automatically query regulatory data as they approach these stations and issue a red or green light on in-vehicle transponders, so drivers know whether to continue or report to the check stations for inspection.
ii. Electronic processing of driver and vehicle safety information can eliminate or minimisse inspection and enforcement requests at state borders. Once a vehicle is inspected and cleared at the origin state and the information is electronically transmitted to other states along the intended trip, the travel can be seamless. The US Federal Motor Carrier Safety Administration have designed the commercial vehicle information system and networks (CVISN) as a component of the commercial vehicle operation. The information systems, therein, are owned and operated by the state governments, motor carriers and other parties. Similar system can be easily evolved and adopted in the country.
iii. Apart from cooperation of respective state governments, it will be advisable for the MoRTH to undertake outreach programmes and facilitate development of such ITS backed commercial vehicle operations and information networks to enable full advantage of NHDP being reaped by the industry.

INSPECTION AND MAINTENANCE OF VEHICLES

Even though the new technology vehicles meet the emission and safety standards, there are a lot of old vehicles (cars, buses and trucks) operating on the roads. The MV Act obligates the motor vehicle users to carry out periodic checks and maintenance to ensure that they are both road worthy and non-polluting. Presently, only commercial vehicles are required to undergo fitness test for road worthiness. Private vehicles are required to undergo pollution under control checks at periodic intervals. For ensuring safety, road worthiness and emission performance, all motor vehicles should be covered. The inspection and certification regime practised by the State Transport Departments need to be modernised and strengthened with automated test equipments as per international practices. These aspects have been elaborated in Chapter 7, Volume II, on Energy and Environment.

BUS TRANSPORT SERVICES IN RURAL AREAS

The share of passenger traffic by road continues to be high. However, despite that rural areas are still poorly served by bus transport. As per an assessment by the MoRTH, about 70 per cent of villages are not connected by organised public transport. These villages are currently served by autos, jeeps, jugads and private buses which may not be reliable and affordable. The government is likely to undertake a pilot project where buses will be owned and operated by private enterprises with predefined service levels and government financial support will be provided as Viability Gap Funding (VGF). The bidding parameter is proposed to be net cost VGF. The outcome of this pilot needs to be watched.

END OF LIFE VEHICLES (ELV)

End of Life Motor Vehicles (ELV) are a significant contributor to waste volumes. The number of

ELVs arising each year is likely to increase with the expanding automobile sector. The recycling of recoverable materials at end-of-life of vehicles would lead to considerable energy savings. It will be necessary to establish collection centres so that the last owner of the end-of-life vehicle hands it over to the centre. The issue is discussed in more detail in the Chapter 7, Volume III on Energy and Environment.

ICT FOR ROAD TRANSPORT

ICT in road transport will help in:

- Increasing safety
- Enhancing uniformity and interoperability
- Improving operational performance
- Enhancing mobility
- Delivering environmental benefits
- Boosting productivity and economic growth

In order to ensure uniformity and interoperability throughout the country, the Government has sanctioned a project for creation of National Register and State Registers of Driving Licences (DL) of Drivers and Registration Certificates (RC) of Motor Vehicles. The objective is to capture the functionalities as mandated by Central Motor Vehicles Act, 1988 as well as state motor vehicle rules. Along with the National Register, a National Transport Portal has also been launched. This is a very good initiative as this would help not only in interoperability between states but will also improve enforcement and instant verification of Driving Licences and Registration Certificates.

The Regional Transport Officer is the 'aam aadmi's' interface with the road transport administration. Sharing of data by the RTOs with each other, traffic police and insurance agencies would help in dealing with defaulting drivers. Further, computerisation of check posts would help in cutting down delays and revenue leakage.

Other areas for ITS applications proposed are:

i. Advanced Traffic Management Centres
ii. Electronic toll collection along with Central Toll Clearing House
iii. Advanced Public Transport System
iv. Fully integrated vehicle to infrastructure and vehicle to vehicle communication, vehicle tracking mechanism, commercial vehicle operations
v. Weigh-in-motion systems for control on overloading

ENHANCING FUEL EFFICIENCY AND FUEL QUALITY

Policies for energy efficiency in road transport should be targeted to both new vehicles and in-use

The recycling of recoverable materials at the end of life of motor vehicles would lead to considerable energy savings.

on-road vehicles. Based on current national practices and international experience (refer Box 2.10), there are five core policy areas where practicable strategies need to be evolved. The following measures merit consideration:

i. Financial Measures
   - Differential taxes and charges based on fuel efficiency and greenhouse gas emissions
   - Internalisation of external costs of highway energy consumption by increasing fuel taxes
   - Support to automotive industry for development of vehicles that use alternative fuels
   - Support for Research and Development for fuel technologies
ii. Fuel Efficiency Standards
   - Foster mandatory vehicle fuel efficiency and CO_2 emission standards
   - Establish automotive industry agreements on fuel efficiency and emission norms
   - Fuel efficiency labels/ratings at point of sale/purchase
iii. Inspection and Maintenance Programmes
   - Enforce operational efficiency of on-road vehicles through periodic inspection and maintenance programmes
   - Encourage retirement of old vehicles and establish age limits for retirement
iv. Enhancing Awareness
   - Fuel consumption labelling and data in vehicle advertisements
   - Communicating range of operational efficiency of vehicles
v. Traffic Management
   - Advanced Traffic Management Centres on high traffic corridors
   - Adopt demand management strategies and programmes
   - Provide minimum two lanes to reduce use of earth shoulders for passing and overtaking
   - Encourage highway and intersection designs that foster smooth flow of traffic

OPTIMISATION OF AXLE LOADS OF COMMERCIAL VEHICLES

There has been demand from the trucking industry to permit higher axle loads to increase their productivity and earning capacity. This would, however, result in accelerated deterioration of road pavement and require heavy investments in road infrastructure for construction, maintenance and rehabilitation. A study on optimum axle loads for commercial vehicles was undertaken by the Asian Institute of Trans-

Box 2. 24

Optimisation of Axle Loads of Commercial Vehicles

- There is a strong correlation between pavement design standards and carrying capacity of vehicles due to static and dynamic forces generated in the course of the movement of the vehicles. It is because of this correlation that countries prescribe maximum permissible gross vehicle weight and maximum allowable axle loads.

- The notified axle loads in India are: front single axle load of 6 tonnes with single tyres and a rear single axle load of 10.2 tonnes with twin-mounted tyres, although most roads have been designed for an axle load of 8.16 tonnes. Tandem and multiple axles fitted with additional tyres are allowed higher tonnage. Restrictions on the front axle load apply primarily because the vehicle has to meet the requirements of steering torque.

- The Indian standards do not differentiate between a driven and non-driven or steered axle. European standards, however, make such a distinction. Thus, in their case, the permissible axle load is 11.5 tonnes for single-driven axle and 10 tonnes for single non-driven axle, irrespective of the number of tyres. An additional tonne per axle is permitted if the same is fitted with pneumatic or equivalent suspension.

- The total transport costs (road user costs plus the road agency costs of construction, maintenance and rehabilitation) are minimised at an axle load of 11 tonnes, as against the prescribed limit of 10.2 tonnes. This limit of 11 tonnes may be taken as the optimal axle weight for purposes of pavement design.

- Higher dynamic loads cause higher rates of pavement deterioration. For example, increase in designed axle load of 8.16 tonnes to 12 tonnes for a two-axle truck results in a four-fold increase in the vehicle damage factor (VDF). In the case of a multi-axle truck, the increase in VDF is much less for the same tonnage.

- Reduced rates of pavement deterioration lead to significant reductions in total costs, arising mainly from vehicle operating costs, while increased rates of deterioration lead to significantly increased costs, arising from the same source.

- The road network suffers from a host of deficiencies in terms of pavement thickness, distressed bridges, etc. Approximately 80-90 per cent of the national and state highways are not suitable for the permissible axle loads of 10.2 tonnes.

- Massive investments are needed to strengthen the network for the currently prescribed axle loads. It is, therefore, premature to revise upwards the axle load limit for commercial vehicles. However, after the network is strengthened, consideration should be given to increasing the axle load limits to 11 tonnes.

- The use of improved vehicle technology offers great potential for reducing pavements costs. It is well known that Indian trucks are a product of an outdated technology—two-axle rigid trucks fitted with steel leaf-spring suspension. There is need for research in various aspects of interaction between vehicle design and road surface, an area that has so far been neglected.

Source: Optimisation of Axle Loads of Commercial Vehicles, World Bank sponsored study conducted by the Asian Institute of Transport Development, New Delhi, 2004.

port Development sometime back. The study concluded (Box 2.24) that the total transport costs—road user costs plus road agency costs of construction, maintenance and rehabilitation are minimised at an axle load of 11 tonnes. However, about 90 per cent of the road network is not suitable for the permissible axle load of 10.2 tonnes and massive investments are needed to strengthen the network for even the currently prescribed loads. It is, therefore, premature to revise upwards the axle load limits for commercial vehicles.

CONTROL ON OVERLOADING

Various studies conducted on the effect of axle loads on road pavements have established that damage to road pavement occurs in proportion to the fourth power law; e.g., an axle load of 16.32 tonnes (which is two times the equivalent standard axle load of 8.16 tonnes) causes 2^4, i.e., 16, times more damage to a road. Axle load surveys are conducted for assessing vehicle damage factors (VDF) when designing a new pavement[15]. As an alternative to axle load surveys, indicative values are available from IRC guidelines, though these should be updated to reflect changes in trucking technology and the business environment[16].

Axle load surveys conducted on various stretches of National Highways have revealed that a VDF in the range as high as 10-15 for multi-axle vehicles is not uncommon. This implies that there are rampant violations of the legally permissible axle and gross vehicle weight limits by the commercial carriers of goods.

Thus, overloading of trucks is causing premature death of roads resulting in loss of investments and undue burden on rehabilitation of roads. Besides, overloading is resulting in deaths of vulnerable road users—pedestrians and cyclists as they share the same carriageway. The wilful overloading observed on roads suggests that the imposed fine does not discourage owners and operators. Both the private sector and public sector agencies as consignors indulge in pushing the transporters in overloading of trucks. It will require strong political and bureaucratic will for enforcement.

Buses and light vans frequently carry passengers in greater numbers than they are designed to safely accommodate. It is a matter of some concern that many of these vehicles are either owned by or ply on behalf of the state transportation authorities.

A far stricter regime needs to be put in place for control on overloading. The following measures need to be adopted to exercise control on overloading:

a. The main road corridors should be dotted with Weigh-In-Motion (WIN) stations along with static weigh stations and space for off-loading of excess cargo. Excess load must necessarily be offloaded before allowing the vehicle to proceed further. The infrastructure—WIM stations, static weigh scales, hardware, software, etc.—can be provided even under public-private partnership mode and legal procedures of weight check, penalties and off-loading taken care of by the enforcement staff.
b. The consigner should be held guilty of violation.
c. Awareness campaigns be held to improve self-discipline by the truck owners and drivers. They should themselves decline (refuse) to drive the vehicle in case it is overloaded.
d. The policy of weight-distance charges being implemented for HGVs in Europe should be introduced in the country (see Box 2.6).
e. In respect of buses and light vans, the state transport authorities must exercise due care and concern on their own part, and greater vigilance over contracted firms.

MOTOR VEHICLE WORKSHOPS

For ensuring effective maintenance of vehicles, motor vehicle repair workshops must have trained mechanics, proper equipment and procedure, and quality assurance checks. Therefore, there is an urgent need for the upgradation of workshops. The authorised agents of dealers of vehicles—cars, buses and trucks—should set up workshops and also be responsible for certification of workshops. The certification will enable individual vehicle owners and vehicle fleet owners to make informed choices in engaging workshops for the maintenance of their vehicles to ensure vehicles working in good condition with respect to emission and safety.

DRIVING TRAINING INSTITUTIONS

It has been estimated that about 500,000 commercial vehicles are being added every year, resulting in an annual requirement of the same number of commercial vehicle drivers. Assuming that one training establishment can turn out 25 trainees every month, 1,660 drivers' training schools are needed for commercial vehicles alone. Meeting this requirement will be quite a challenge. While the licensing of training institutions for driving may continue to be with the state governments, the law may be amended to require them compulsorily to adhere to an accreditation and quality assurance system. An important element in the strengthened regulation of training institutions for transport vehicle drivers will be to ensure that these institutions have adequately trained staff. For this purpose adequate facilities need to exist for training of trainers. MoRTH should

15 VDF multipliers convert the number of commercial vehicles of different axle loads and axle configuration to the number of equivalent standard axle load repetitions.
16. A capacity constrained business environment is likely to see more trucks taking to the roads with heavier loads than normal.

Road signs have to be legible and understood in time to permit a proper response. The current situation in India on this is dismal.

carry forward the scheme for establishing model driver training institutes across the country for addressing the training needs of driving motor vehicles. The central task of these institutes should be to produce training instructors.

HUMAN DIMENSION

The employment generated by the trucking industry is quite substantial—4,500,000 or so in direct operation and many times more in all the up-and-downstream activities. Yet, the human element in the industry is often overlooked. Take the case of a truck driver, who is perhaps the most critical link in the road transport chain. But in terms of infrastructural support, social status and compensation package, he is way behind his counterparts in other modes of transport. Overall, his quality of life is poor. A survey conducted sometime ago showed[17] that more than 25 per cent of the drivers could return to their base only after eight days of duty. About 40 per cent of the drivers returned to base between five and eight days, 20 per cent between three and four days, while only 10 per cent returned in less than two days. The incidence of HIV and other such diseases is known to be high among professional truckers. Clearly, the most effective way to make the job more attractive is to reduce the length of trips to 400-500 km so that drivers can spend more time with their families. There is a need to set up terminals at these distances so that he can hand over to another driver, Pony Express style. Containerisation of goods will facilitate this much desired operational practice.

STANDARD ROAD SIGNS

The basic requirement for road signs is that they are legible and understood in time to permit a proper response. The current situation in the country is dismal in the matter of road signs on the road network. Apart from being inadequate, the existing signs are not in conformity with the existing Code of Practice. It hardly needs emphasis that uniformity of application is as important as standardisation with respect to design and placement of road signs. The decision to use a particular sign at a particular location should be based on proper traffic engineering study by knowledgeable professionals.

A standard signage system should be introduced across all highways in the country for intercity roads, roads in urban areas and for rural roads serving the villages and connecting markets, agriculture mandis, etc. The Indian Roads Congress is understood to have recently updated its old Code of Practice on road signs and revised it in line with international standards and in conformance with the Vienna Convention on international signs. As recommended by the Sundar Committee on amendments of Motor Vehicles Act, 1988, this Code should be regularly updated by the IRC so that it is kept in line with developments taking place round the globe. Side by side, a mechanism for enforcement needs to be in place. This is a serious gap at present.

SUMMARY AND CONCLUSIONS

i. The Motor Vehicles Act is in need of amendment to respond to the demand of road transport for the current century. The Sundar Committee has suggested the needed amendments. These need to be carried out.

ii. Freight transport being the backbone of the economy, apart from reoptimisation of the modal mix between road and rail, transhipment facilities by way of transport nagars and synchronisation of short haul movement by road and long haul movement by rail for both import and export cargo through containers would be required.

iii. For modernisation of trucking industry, continued emphasis is needed for higher energy efficiency and lower emission levels with suitable incentive structure for multi-axle vehicles. Further, the industry is controlled heavily by intermediaries who need to be brought under the purview of regulation. The thrust has to be on the seller of services. The trucking industry is also characterised by low levels of technology. A strong link needs to be forged between profitability and technology. Financing for acquisition of modern trucks should be more liberal.

iv. Use of Intelligent Transport Systems can significantly enhance regulatory processes and streamline seamless movement in inter-state movement of commercial vehicles. Advantage should therefore be taken of such technologies so that once a vehicle is inspected and cleared at the origin state and the information is electronically transmitted to other states along the proposed trip, there is seamless travel. The commercial vehicle should be treated as mobile infrastructure since they are carrying the economy on wheels. All efforts should be made to improve the productivity of these precious assets.

v. The Inspection and Certification regime practised by the State Transport Departments should be modernised to reduce human inter-

17. Asian Institute of Transport Development: Journal on Trucking Industry, 2000.

vention and it should gradually cover all motorised vehicles, not just commercial vehicles alone.

vi. There is need to establish collection centres for end-of-life vehicles to retrieve scrappage material as this would ultimately help in considerable energy savings.

vii. Passenger transport services in rural areas are still lacking and this requires a special focus of the state transport departments. Possibility of public-private partnership needs to be explored by providing viability gap funding to the private operators for such services.

viii. Information and communication technology needs to be used to improve operational performance of road transport including traffic management, electronic toll collection, vehicle tracking, overloading control and 'aam aadmi' interface with the transport administration.

ix. Policies for energy efficiency in road transport should be targeted for both new and in-use on-road vehicles. There are five core policy areas—financial measures, fuel efficiency standards, inspection and maintenance regime, awareness raising and traffic management—for which practicable strategies need to be evolved and implemented.

x. There is need for uniform applicability of road signs as per international standards across highways throughout the country.

SUSTAINABILITY

A well-designed road network must convey goods and passengers in reasonable time between desired locations. However, it must also ensure that transportation is safe, mitigates environmental harm, socially responsible, and minimises other externalities. All of these considerations may be broadly captured under measures that promote the 'sustainability' of the network. In turn, 'sustainability' can be taken to mean a composite of:

- Buy-in from citizens, both those directly affected by road construction and improvement, those who will benefit from the eventuating infrastructure, and those who pay direct and indirect costs;
- Putting in place processes and procedures that address the issues arising from land acquisition, utility shifting/relocation, adverse environment impact, risks of accidents, etc.

Road alignments need to be finalised early from environmental and social perspectives to avoid land acquisition problems.

LAND ACQUISITION

A major reason for delays in executing projects is the time taken to ensure that the necessary land is acquired and made free from encumbrances. For PPP projects, the current practice that 80 per cent of the required land should be available at the time of award of the projects should continue. Further, it should also be ensured that the remaining 20 per cent is made available to the concessionaire within a period reasonable enough so as not to delay the implementation of the projects as per the stipulations of the contract and concession agreements.

It is necessary to go in for land acquisition proceedings well in advance. For this, the first requisite is the finalisation of the road alignment for each project from technical, environment and social perspectives. Whenever the road alignment happens to pass through protected forests, it is essential for the road agencies to interact with the concerned environment authorities for jointly finalising the road alignment.

The Government has taken up the initiative for amendment of the Land Acquisition Act, 1894, and this is in advanced stages of finalisation. It needs to be ensured that the land acquisition clauses as per the provisions of the NH Act, 1956 are also amended accordingly. There may be need to move towards acquiring land for roads through the system of negotiated rates to accelerate the process. Further, the concept of land bank may also be explored.

The given land resources of the country have to meet myriad requirements of its large population. Ever-increasing economic activities are putting greater pressure on this scarce resource. Hence, there is an imperative need to have a closer look at the requirements of land for transport projects. Expressways, particularly greenfield projects, consume large swathes of land. Rail corridors use much less land and provide much greater capacity. Intermodal choices need to factor in this also, besides inherent characteristics of each mode.

In the foreseeable future, the acquisition of land would become a difficult and time consuming process. It would therefore be prudent to build land banks. Time lags can thus be minimised.

Utility agencies are not the owners of Right of Way. For any operation, they should enter into an agreement with the concerned road agency for use of the stretch of road in question, and pay a reasonable rent for this.

REHABILITATION AND RESETTLEMENT

The rehabilitation and resettlement (R&R) of persons whose livelihoods or habitations are affected by road development projects varies widely, depending on whether projects are implemented through external aid or loan assistance, or whether they are publicly funded or PPP projects. It is also dependent on the nature of the project and the area through which it passes.

There is further variance in R&R policies between state and Central governments, who are each responsible for constructing, improving and maintaining different kinds of roads. A uniform R&R policy is desirable to ensure that compensations for project affected persons (or families) are equitably rationalised.

UTILITY SHIFTING

It is often the case that various utility networks piggyback on existing road networks. This includes electric and telephonic cables, water mains, gas and other pipelines. The rationale is obvious. There is an existing right of way, the localised terrain is already made manageable by the road, and there are no costs associated with further land acquisition. Further, the roads themselves provide easy access to the utility agencies for construction, repair and maintenance. On the whole, this piggybacking is desirable as it can help manage construction costs of both road and utility, and also does not require duplication in land that is reserved as right of way. However, these utility networks that skirt the margins of the roads are problematic when roads need to be widened or improved. A complex set of permissions and sign-offs are needed from any number of concerned authorities. Further, specialist technicians must undertake the work of relocating the utility network along the margins of the new, wider, road. Overall, seeking the necessary permissions and arranging for temporary alternatives during the construction period and then for permanent realignments once works are complete is a slow and onerous task, and one that often contributes to delayed road infrastructure projects.

There is a more general argument to be made with respect to roads and utilities. Land acquisition and creating usable rights of way is a central issue to the planning of any kind of network, though is undoubtedly most crucial for road infrastructure.

Utility agencies need to recognise that they are not the owners of the Right of Way. As such, for any operation, they need to seek prior permission of the road agency within whose jurisdiction the particular stretch lies. They should enter into an agreement with the concerned road agency for use of the ROW of the road stretch in question. Where such utilities need to cross the road, this should be at mutually agreed locations. For use of the right of way, a reasonable rent should be payable by the utility agency to the road agency to compensate the latter for the cost incurred in acquiring the ROW. The agreement should also stipulate obligations on the part of the utility agencies for laying and thereafter restoring the road embankment, etc., in its original condition and with least delay. The entire cost of relocation of existing utilities should be borne by the utility agency irrespective of whether this is due to road upgradation or due to requirement of utility agency itself. For any new locations, the utility agencies should acquire their own right of way.

ROAD SAFETY

It is essential that a new paradigm for road safety is adopted in India wherein all stakeholders and participants, from legislators through to regulators, administrators, engineers, contractors, constructors and ultimately, road users acknowledge the role that they must play in ensuring road safety, and execute actions to achieve this. Based on the report of the Sundar Committee on Road Safety, the MoRTH has already introduced a Bill in Parliament to create a Road Safety and Traffic Management Board as an umbrella agency in this regard. The major areas of attention can be grouped into: engineering measures on roads and vehicle design incorporating safety features; education and awareness; enforcement; and emergency medical care. There are several financing options for funding road safety such as the road fund; surcharges on fuel or vehicle licences; corporate social responsibility initiatives on the part of public and private agencies; and automobile industry contributions.

SUNDAR COMMITTEE ON ROAD SAFETY AND TRAFFIC MANAGEMENT

The wide-ranging recommendations of the Sundar Committee on Road Safety and Traffic Management should be adopted. The centrepiece of the Committee's recommendations was to set up a Road Safety and Traffic Management Board together with a National Road Safety Fund. In consultation with the government, which will also retain powers to issue directions, the Board will have wide-ranging powers to promote road safety and improve traffic management in India. The Board should consist of a chairperson and three to five experts in road engi-

neering, traffic engineering, vehicle engineering, traffic laws and enforcement, and accident-related healthcare. A summary of the functions of the Board is provided in Box 2.25.

POST-ACCIDENT EMERGENCY MEDICAL CARE

An area of critical concern is the post-accident emergency medical care. A new safety initiative (post-accident initiative) called 'Golden Care' is recommended to reduce fatalities in the event of an accident on National or State Highways. The golden hour is a term used in emergency medicine and refers to the time immediately following a traumatic injury, when prompt medical attention is most likely to prevent death. Under the Golden Care Initiative, when an accident occurs, medical care should be provided to the victims within the golden hour. Administrators should ensure that whenever an emergency situation occurs in the highways, the victims are rushed to a nearby medical centre within 10 minutes of accident (Figure 2.3).

The administrators can get the relevant details of the vehicle and driver through an online database (blood group, medical history if needed etc.). Meanwhile nearby ambulances (using GPS technology etc) can be called to transport victims to the nearby medical centre. Automation technologies and communication technologies can be used to provide right-of-way to ambulances while transporting passengers during emergency situations. This can be linked with the existing system that uses the phone number 108 for emergencies.

ROADS AND THE ENVIRONMENT

As described on several occasions in this report, trucks on roads account for the vast bulk of freight carted across India. Rising mode-share for road, vis-à-vis rail-based freight transport, is undesirable on several counts and a central theme of this report has been to argue in favour of reversing this trend. Be that as it may, road transport will remain a central element of both freight and passenger transportation for the period under consideration, and it remains essential that its environmental impact is evaluated and mitigated to the furthest possible extent.

ENERGY USE

The transport sector derives nearly all of its energy requirements from petroleum products, using about 27 per cent of total oil and oil products available in India in 2006-07. Of the total energy employed by transport, roads account for the lion's share at 78 per cent, a figure which is only projected to increase over the next 20 years (see Figure 2.4). With India importing most of its petroleum products, any efficiencies in energy use that may be wrung from the road transport sector will be enormously beneficial.

The singlemost influential measure to constrain energy use is to maintain or even increase the share of public transportation.

Given the relative efficiencies of public over private transportation modes for passenger traffic (Table 2.37), the single most influential measure at constraining the road transport sector's energy use is to ensure that public transportation shares are maintained or even increased.

For each mode, proper economic incentives should price passenger-kilometres at the true inherent marginal social costs. The implications of this are profound, including an unravelling of fuel subsidies, at least on the basis of their justification today. Better quality fuels are usually more expensive to refine but offer better energy efficiencies in turn.

Newer engines offer technologies such as variable valve timing, variable compression ratios, friction reductions etc that improve fuel economies. Appropriate incentives should be in place to encourage faster migration to the use of these engines. The quality of road pavement and the generally free-flow of traffic—which can be aided by two-laning and the provision of earth shoulders—also impact fuel efficiencies. In summary, better fuels, better engines, and better roads can all contribute to dampening the incessant increase in demand for energy from the road transport sector.

EMISSIONS

Emissions of greenhouse gases are directly related to the quality and quantity of petroleum products used in the sector. These gases contribute to the warming of the climate. The important gases in this regard are carbon monoxide, nitrogen oxide, nitrogen dioxide, and sulphur dioxide and methane. Emissions also take the form of unburned hydrocarbons, which are collectively called PM10 (particulate matter that is less than 10 microns in diameter). This particulate matter greatly affects the air quality and, at excessive levels, poses severe health complications.

The quantity of emissions drastically increases with reductions in motor speeds, therefore measures aimed at easing congestion will not only result in reduced journey time but also in reduced emission of pollutants into the atmosphere.

The standard methodology for managing emissions is through the use of vehicle emissions standards. Implemented with varying stringencies worldwide, these standards have become progressively tighter over time as technologies and fuel qualities have improved. The standards relate to both the quality of fuels and vehicles made available for sale in relevant jurisdictions. Once, Indian standards were

Box 2. 24
Functions of Road Safety and Traffic Management Board

Road-related measures
- Set safety standards in conjunction with the IRC for the design, construction and operation of National Highways
- Conduct or commission road safety audits of National Highway projects through all phases to monitor adherence to prescribed standards and issue directions, and where necessary, to take corrective action
- Recommend minimum safety standards for the design, construction and operation for roads other than National Highways
- Recommend traffic calming and other similar measures

Vehicle-related measures
- Set standards for safety features for all mechanically propelled vehicles
- Conduct or commission audits to monitor adherence to standards
- Set minimum conditions for the safe usage of mechanically propelled vehicles and safety standards for vehicular traffic on various types of roads
- Recommend minimum safety features for non-mechanically propelled vehicles and promote safe carriageways for such transport and vulnerable road users

Road safety research
- Identify subjects and institutions for research in different areas of road safety
- Establish centres of excellence in road safety research and education
- Create links between research centres at central, state and local levels
- Maintain a comprehensive database on safety-related matters
- Establish a procedure and methodology for data collection, storage and dissemination

Traffic law
- Recommend guidelines to state governments for computerizing information regarding vehicle and driver licensing
- Recommend guidelines for training, testing and licensing of drivers

Public awareness
- Promote best practices in road safety and traffic management
- Identify and recognise NGOs working towards road safety and assist where possible

Medical care
- Lay down guidelines for establishing and upgrading trauma care systems
- Create a grid of medical, allied medical and rehabilitation facilities to provide first aid, care during transportation, emergency care

Other functions
- Advise the central government on administration of provisions under Central Motor Vehicles Act, 1988
- Provide technical assistance to state boards and other agencies engaged in road safety
- Liaise with international agencies and organisations
- Liaise with other agencies like education and health boards, healthcare providers

Source: Report of the Sundar Committee on Road Safety and Traffic Management – February, 2007.

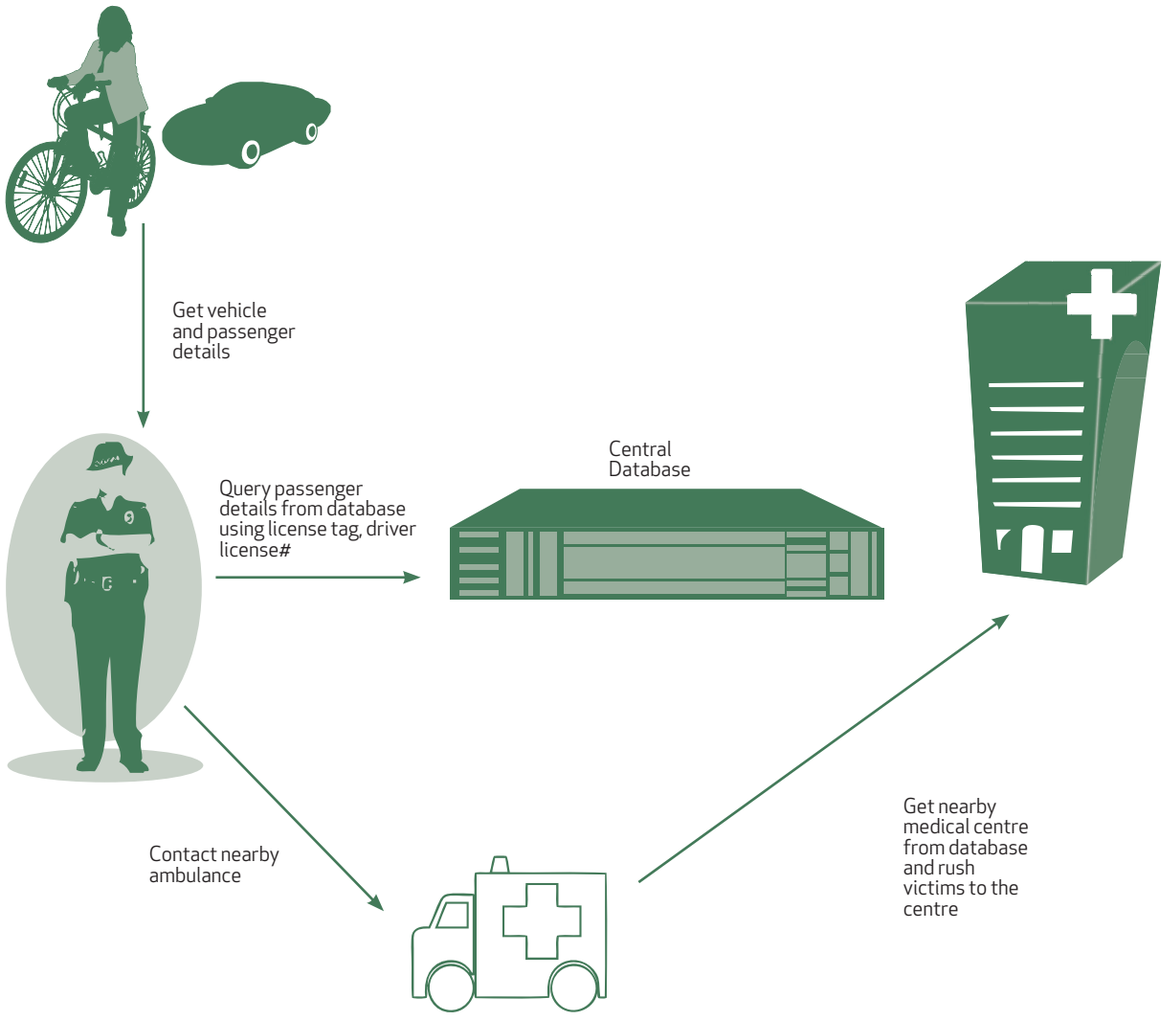
nearly 15 years behind emissions norms in Europe; today, much progress has been made and this lag is now only five years. However, there is some disparity in that different norms apply in metropolitan urban areas and in the rest of the country. This is at least partially connected with the difficulties of ensuring adequate quantities of better quality fuels, e.g., low-sulphur diesel. Over the next five years, India must introduce uniform fuel quality and emissions standards throughout the country and make emissions monitoring a key component of the vehicle inspection and certification process.

This issue has been dealt with in detail in Chapter 7, Volume II, on Energy and Environment.

INTER-AGENCY COORDINATION

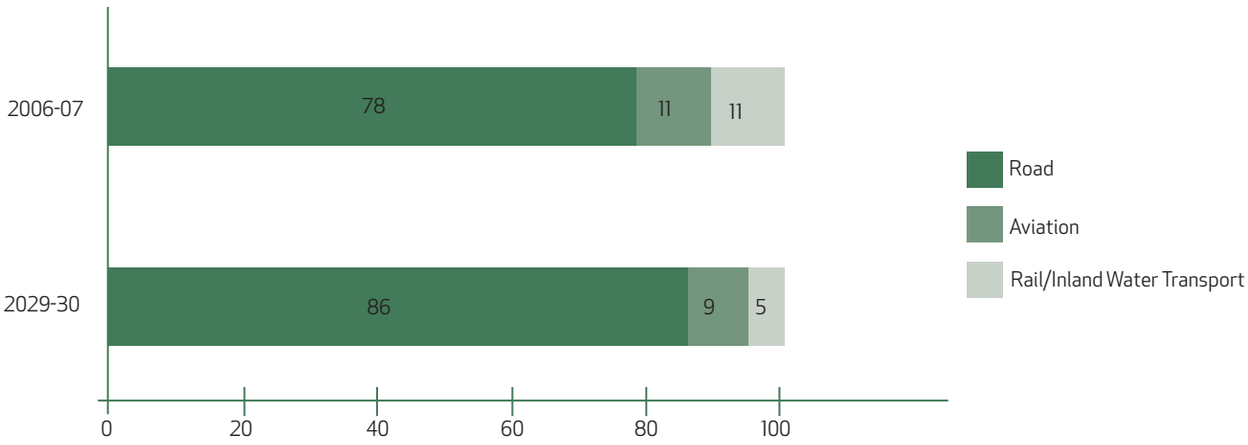
There are multiple agencies both in the Centre and the states for the development of the road transport sector. In such a situation, more often than not, each agency formulates and implements its own plan for development without any regard to the plans of other agencies. This leads to sub-optimal network development and results in higher resource cost of transportation. In Chapter 5, Volume II, Institutions for Transport System Governance, setting up of the Office of Transport Strategy (OTS) has been recommended. This organisation would develop a larger coordinated plan for all modes of trans-

Figure 2.3
Golden Care



Source: Infosys Research

Figure 2.4
Mode-Wise Energy Shares in the Transport Sector
[Per cent]



Source: Report of the Working Group on Roads for NTDPC, May 2012

Table 2.37
Relative Fuel Efficiencies of Various Road Transport Modes

MODE	FUEL TYPE	FUEL EFFICIENCY (KM/L)	ENERGY INTENSITY (L/PKM)	RELATIVE ENERGY INTENSITY
Bus	Diesel	4.3	0.006	1.0
Two-wheeler	Petrol	44.0	0.015	2.5
Three-wheeler	Petrol	20.0	0.028	4.7
Car	Petrol	10.9	0.038	6.3

Note: pkm = passenger kilometre, l = litre
Source: Report of the Working Group on Roads for NTDPC, May 2012

portation including road transport. Within the framework of this plan, each organisation may formulate plans and policies. If necessary, OTS may issue suitable guidelines and assist the agencies in this regard.

SUMMARY AND CONCLUSIONS

i. Delays in land acquisition affect the implementation of road projects. It is necessary to go in for land acquisition proceedings well in advance. There may be need to move towards acquiring land for roads through the system of negotiated rates to accelerate the process.

ii. Ever-increasing economic activities are putting greater pressure on the scarce resource of land. Hence, there is an imperative need to have a closer look at the requirements of land for transport projects. Expressways, particularly greenfield projects, consume large swathes of land. Rail corridors use much less land and provide much greater capacity. Intermodal choices need to factor this in also, besides inherent characteristics of each mode.

iii. A uniform policy for rehabilitation and resettlement of project affected persons is desirable so as to ensure equitable compensation across state and Central government agencies.

iv. Utility agencies need to seek prior permission of the road agencies for their operations and should be required to pay a reasonable rent for use of the right of way. The entire cost of relocation of existing utilities should be borne by the utility agency irrespective of whether this is due to road upgradation or due to requirement of the utility agency itself.

v. The wide-ranging recommendations of the Sundar Committee on Road Safety and Traffic Management should be adopted. A Road Safety and Traffic Management Board should be set up, together with a National Road Safety Fund. In consultation with the government, which will also retain powers to issue directions, the Board will have wide-ranging powers to promote road safety and improve traffic management in India. The Board should consist of a chairperson and three to five experts in road engineering, traffic engineering, vehicle engineering, traffic laws and enforcement, and accident-related healthcare.

vi. Given the relative energy efficiencies of personalised vehicles and public transport, it is necessary to enhance the share for the latter. Apart from this, better fuels, better engines and better roads would also help contain the incessant increase in demand for energy for road transport. This would also help in containing the emission levels to acceptable norms.

FINANCING ROADS

As seen earlier, the projected investments for roads in the next 20 years covering the 12th, 13th, 14th and 15th Five Year Plans are huge. To recapitulate, Table 2.38 shows the requirements of funds to respond to the traffic demand and providing universal connectivity to our villages.

FINANCING STRATEGIES

It is not too far into the past, when the sole method available for financing road infrastructure was the government budgetary allocation of each year, made according to a five-year investment plan. Some of

the budgetary allocation would be directly funnelled from revenue sources such as fuel taxes, vehicle and passenger taxes, other road taxes, and named cesses. Recent attempts at private sector involvement in provision of road infrastructure have brought enormous changes, and made possible greater quantities of better new roads available faster than they otherwise might have. However, these partnerships between the public and private sectors have not proved to be uniformly successful. Even so, there can be no escaping the conclusion that private sector involvement is essential over the next 20 years. Hence, government focus must also be on lessons learnt from the current concession projects and incorporate the same in designing mode of delivery of road infrastructure so as to ensure value for money invested.

ROAD TAX AND FUEL CESS REFORM

Taxes on petroleum and high speed diesel oil are earmarked for road construction programmes. For the Central Road Fund, the current policy is to charge a fixed cess of Rs 2 per litre. In an environment of rapidly increasing oil prices (which it must be recalled, immediately influence road construction costs), these cesses comprise decreasingly lower shares of fuel retail prices. This policy should be replaced with fuel taxation on an ad valorem basis. As noted earlier, the cess was fixed at Rs 2 per litre on petrol and diesel in 2005. At that time, the price of petrol was around Rs 40/per litre and that of diesel around Rs 30/per litre. Current prices are Rs 70 and around Rs 50 (highly subsidised). The cess can be enhanced to Rs 4 per litre now and be increased with time. The CRF accruals would get enhanced to about Rs 400 billion a year. Apart from this fund, several states have created state road funds for development and maintenance of state roads. Such initiatives can be adopted by other states as well.

Furthermore, road taxes are inconsistent and seemingly disconnected from the desired economic outcomes they ought to relate to. Myriad taxes at varying rates on varying tax bases apply on vehicle purchase, on the operation of motor vehicles, and on parts and tyres. There are fees associated with registration and transfer and on permits for commercial vehicles to ply on interstate routes. Finally, there are periodic vehicle taxes, and operational fees payable, such as lease taxes, and passenger and goods taxes. The idiosyncrasies of the taxation regimes across the states mean that it is difficult to account for how these revenues are actually used. There is need for rationalisation of road taxes on motor vehicles (Chapter 9, Volume II on Fiscal Issues, for details).

These differing taxation regimes also act as a deterrent to the free movement of freight, hampering economic productivity and growth. The uncertainty and confusion caused by the taxation policies of the states must be rationalised with the guiding principle being a clear mapping between the economic rationale for the tax, the tax itself, and how the resulting revenues are deployed.

A uniform policy for rehabilitation and resettlement of project-affected persons is desirable so as to ensure equitable compensation.

There is a case for significant increase in taxes on personalised vehicles so that they can be ploughed back to generate resources for strengthening public transport.

In addition to road taxes and tolls, some states have also been generating financial resources through market committee fees on agriculture produce and share out of royalties from mining.

PPP IMPLEMENTATION

With limited public funds and a pressing need to rapidly develop India's infrastructure, the government has, in recent years, sought private participation in major infrastructure projects. Typically, the government (at the central or state or joint levels) negotiates terms with a consortium of private enterprises under which each contributes a certain amount towards the construction of the project. The terms also govern how the project is to be operated and maintained over a defined period, how risks and revenues are shared, what guarantees are supplied by both parties to each other, and what happens to the asset at the end of the defined period.

The current policy framework for undertaking road infrastructure projects through the PPP mode has been well laid down and needs to continue. The standard documents prepared by the Planning Commission and the Indian Roads Congress are world class. While implementing projects through the PPP, a few problems have, however, arisen. Box 2.26 brings out issues and experiences in implementation of three projects as case examples.

The initial exuberance that private enterprise would prove to be a bedrock on which the road network of the future could be built seems to have dampened to some extent in recent months. Much of the low-hanging fruit in the form of the most profitable, i.e., highly trafficked, highways has been picked. Projects that are less attractive to the private sector, but no less important for the nation, have struggled to find suitors. Several PPP-funded projects have suffered from want of pre-construction preparation in the form of securing land, permissions, and adequate provisions for resettlement and rehabilitation. More generally, the balancing of risks between government and private enterprise remains desirous of a consistent framework that is fair, rational, and sustainable.

Table 2. 38
Projected Investments for Road Infrastructure
(Rs billion)

SCHEME	2012-17	2017-22	2022-27	2027-32	2012-32
Expressways	200	600	1,200	1,800	3,800
National Highways	2,150	3,150	4,200	5,700	15,200
Special Schemes SARDP-NE + Arunachal Package (Central Sector)	250	400	500	600	1,750
Other Special Schemes (Central Sector)	100	150	200	200	650
State Highways	2,100	2,700	3,200	3,600	11,600
Major District Roads	1,000	1,300	1,600	2,100	6,000
Rural Roads Including PMGSY	1,450	1,850	1,300	1,100	5,700
Total	7,250	10,150	12,200	15,100	44,700

While it is necessary to design agreements that are flexible enough to accommodate the concerns of the entrepreneurs, it is equally incumbent on the road agencies to exercise due diligence in conceptualising the scope of work for the PPP projects. See Box 2.27.

The following suggestions merit consideration for provision of road infrastructure through PPP.

i. Undertake studies of several PPP road projects with a view to distilling good practices and problems faced and how they were resolved. The reports based on such studies should be put on the web and discussed with road agencies to improve delivery of future projects.

ii. Continue with the current strategy of phased development for capacity augmentation—neither too much too early nor too little too late. Provide capacity for a minimum of 10-12 years initially. Land width should of course be planned and provided initially itself. It is necessary to ensure that land acquisition conforms to the letter of the law and institutional arrangements are made to address grievances and adequate provisions are made for rehabilitation and resettlement of project affected persons.

iii. The road agency must provide a value-for-money analysis for each project not only at the time of procurement but also post construction. The post construction value-for-money analysis should also capture time and cost overruns, variations in revenue realised compared to initial forecasts and quality of service achieved.

iv. It is also to be appreciated that PPP projects are vulnerable to both the financial and the real impact of the economic downturn. Drop in GDP growth rate in the recent past has directly affected the traffic growth rate and thereby revenue potential of road projects. Due to the lower revenue potential, viability of highway projects took a hit. The lenders found that the original revenue projections

given by the project developers were not being met and debt servicing was not upto the levels originally projected. Due to this, lenders reduced their interest and exposure towards road sector projects. Effects of down turn on PPP projects are evident. There is need for the government to invest in knowledge acquisition, especially in respect of traffic forecasting, pavement performance and deterioration prediction and highway capacity norms. This would help both the government and the concessionaire in more informed financial appraisal, transparency in PPP finances and reduced risks arising from uncertain outcomes. Even the current risk sharing mechanism may need review to provide reasonable comfort to the concessionaire and the lender.

v. The Annuity Model is nothing but a deferred budget form of delivery and has the potential of casting a heavy burden on contingent liability of the government. It is clearly unsustainable in the long run as the entire traffic risk is transferred to the government. The government would do well to stop this mode of delivery in its present form. Where this mode of delivery is proposed, there should be a cap, say no more than 15 per cent of the annual road budget to defray year-by-year contingent liability by way of annuity payments. Further, such projects, being prohibitively expensive, should be subjected to a more rigorous value-for-money analysis and compared with the public sector delivery option. Another modification that has potential to soothen contingent liability in the future would be for the government to provide 40 per cent of the construction cost upfront and the balance cost of construction plus maintenance to be paid back through annuity payments. There is also need for stricter scrutiny of annuity payments demanded by the bidders on the parameter of reasonableness of demand. Otherwise, it would be more cost-effective to undertake projects instead as EPC contracts.

vi. Given that for some projects in the past, the concessionaires did not evince interest in BOT (Toll) and preferred BOT (Annuity), it is evident that there is less appetite for bearing full traffic risk by private players. It would be advisable to revisit the strategy for traffic risk sharing in BOT (Toll) model. The government needs to share both the upside and downside of a predecided/predetermined traffic band and address the concern of competing facility so as to provide the requisite comfort to the private sector.

vii. The government is already aware of the problems arising due to lack of progress on pre-construction activities covering land acquisition, shifting of utilities and environmental clearances. Arrangements should be made for bringing these activities under control before project award and streamlining the system of various clearances and State support in facilitation of these clearances as also in law and order and toll operations.

viii. The level of service and riding quality are seen to be poor on several projects. There is need for a stricter regime for enforcement of performance standards during operation and management of projects by the concessionaires. The agencies should be held accountable for any deficiency in performance of the concessionaires.

ix. PPP projects necessarily involve a user-pays element. In several parts of the country, the local population has balked at the idea of paying to use a road that is constructed on land that is considered their own. Occasionally, it has proved sound politics to stoke this civil disobedience. Wider acceptance of this model is required to reduce the social and political risks associated with PPP-funded projects. This can be done by ensuring that land acquisition conforms to the letter of the law, setting up institutions to address grievances, providing for adequate resettlement and rehabilitation efforts, and by demonstrating direct benefit and value for money. This last factor depends on timely construction, assured maintenance, smooth toll collection, and predictable toll escalation.

THE WAY FORWARD

PPP has introduced much-needed private funding for provision of public infrastructure. Amongst the various sectors, the influence of PPP on roads has been especially strong. This can be attributed to strong political leadership for promoting user charge principle, a supportive institutional environment and sound legal framework with fair risk sharing mechanisms, a clear mandate, a capable champion and enabler in the road agencies, and an incentive structure that welcomes private investment. However, for PPP funding to continue to contribute to the development of the Indian road network, there is a strong case for learning from the achievements made so far and undertake further reforms to enhance the level of private financing.

REVIEW OF TOLL POLICY

There is need for review of the current policy of user fees (tolls) on National Highways. A two-lane road should be considered a minimum facility to be provided out of government budget in respect of primary roads (National Highways and State High-

Box 2. 26

Issues and Experiences in Implementation of PPP Road Projects

Delhi-Gurgaon Project on Golden Quadrilateral: Better Project Preparation

The project was conceptualised in 1999 as a part of the Golden Quadrilateral project. It was awarded to the consortium of Jaypee Industries and DS Constructions Ltd in 2002. It was also the first project to be awarded on negative grant basis. The project could be opened to traffic only in 2007 after five years of its award.

In between, following issues were observed:

1. NHAI relied on old traffic data which resulted in a situation with high traffic levels causing heavy queuing at the toll plaza.
2. The project required various approvals from 15 government/civic bodies, which was a complex and time consuming process. Such delays can be avoided through a single window clearance mechanism or a clearer approval process that should be standardised across states and agencies.
3. The original project cost envisaged was Rs 548 crore. However, actual cost to the concessionaire turned out to be more than Rs 1,000 crore. There were substantial changes in the original design to provide for future requirements and the convenience of commuters. Out of a total of 11 structures, nine had significant design modifications. Also, various government agencies demanded changes in the project alignment and design resulting in change in scope, project cost and consequent delay.
4. The project also faced issues in land acquisition. There were certain small parcels of land which were difficult to acquire.

Experience in this project highlights the importance of reliable and up to date traffic data, single window clearance for large projects, deeper stakeholder consultations for design finalisation during project preparation, especially in urban areas, and the need to closely monitor project performance as well as to ensure that audited results reflect the true performance of the project.

Ahmedabad-Vadodara (NH-8) 6-laning project combined with Ahmedabad-Vadodara Expressway: Innovative Structuring

Ahmedabad-Vadodara Expressway (NE-1) was constructed by NHAI and was operated under an SPV owned by NHAI. Recently, when the need for six-laning of the Ahmedabad-Vadodara NH-8 section was realised, its project structuring faced issues relating to a competing facility in the form of the existing Expressway. Also, there was an issue of correct estimation of traffic on the NH-8 section and thus there was risk of developers allocating high risk premium in their bids.

Consequently, the Expressway and the NH-8 sections were clubbed under one project for bidding out. This reduced the risk perception and also improved viability of the project.

This experience highlights the importance of innovative project structuring leading to win-win situations.

Mumbai-Pune Expressway: Importance of Establishing Revenue Streams for PPP Projects on Toll Basis

This project, developed by the Government of Maharashtra, involved a full new alignment with attendant traffic risk and significant uncertainty in initial years. The Government of Maharashtra allowed the project to first establish a definite revenue stream over a few years and then awarded the project on operations and maintenance contract with tolling rights. This experience highlights the need of a reliable and established revenue stream for PPP projects to be successful on toll basis.

Source: Report of the Working Group on Roads for NTDPC-May 2012.

Box 2. 27
Sub-Prime Highways

- Banks have been lending far in excess of the duly approved TPC (Total Project Cost) in case of several PPP highway projects under the NHDP, leading to a situation where the concessionaire may not only spend beyond reasonable costs, but also siphon out funds at public expense. A question arises as to whether these are in the nature of sub-prime loans that can expose public finances to undue risk.

- Disproportionate grants by the government for construction of PPP road projects combined with permitting the concessionaire to sell its equity and exit from the project after two years of completing the construction reduces its incentive to build a project that would last longer and can leave government with low-quality assets. Need to identify and eliminate potential risks to public interest.

- Bids received for some of the annuity projects also seem to be very high and unjustified. This arrangement does not seem to represent value for money from the perspective of the exchequer.

- There seems inadequate appreciation of the fact that annuity payments are essentially a form of deferred budgetary payments which will pre-empt future development by committing the expected cess revenues for 15 to 18 years. This is not only unprecedented but also unsustainable.

- The standards laid down in the IRC Manuals are being routinely exceeded and excessive costs continue to be incurred by adding elements that lack justification.

Source: Sub-prime Highways: An Issues Paper by Gajendra Haldea, June 2010.

ways) with no direct user charge. Toll should be levied on multi-lane highways, both access-controlled and non-access controlled, as also spot improvement projects such as bridges, tunnels, flyovers, bypasses.

The government is already considering reduction in user fees after recovery of capital costs and dispense with charging of toll when the project is under construction. This would be a step in the right direction. In addition, the government may also consider incentivising toll rates for multi-axle vehicles as they carry more tonne km per litre of fuel.

Due to multiplicity of vehicle taxes being paid by the commercial vehicles (buses and trucks), there have been occasional threats and concerns expressed in the past by the road transport industry for linking the rates of tolls with the savings in time, fuel consumption and vehicle operating costs. It is necessary to immediately launch a highway allocation study to decipher the costs occasioned by cars, buses and trucks in use of roads covering both construction and maintenance costs and benefits occurring due to capacity augmentation in terms of savings in road user costs. This will provide the much-needed rationale for review of the current toll rates.

While the open system of toll collection needs to continue in respect of non-access controlled multi-lane roads, there is need to move to closed system of toll collection on expressways so that users are charged based on the length of road utilised for the journey. In the open system also, there have been cases where the users have been required to pay much heavier toll amount in relation to the use of the highway because of irrational location of toll plazas. This requires a more reasonable approach in deciding location of toll plazas.

There is need to adopt the electronic toll collection system as per recommendations of the Nandan Nilekani Committee. To enhance transparency, each toll plaza should display cost of project, and amount of toll collected up-to-date.

PUBLIC SECTOR FINANCING

Private sector financing in the highways would remain confined to the commercially viable and high traffic density stretches. Rural roads are being built with the government financing utilising the CRF and

The government is considering reduction in user fees after recovery of capital costs and dispense with tolls when the project is under construction. In addition, it should also consider incentivising toll rates for multi-axle vehicles as they carry more tonne-km per litre of fuel.

RIDF window of the NABARD funding. While the private sector would continue to serve an important segment of the road network, sizeable investments in the road sector are required to develop the balance road network of even primary and secondary roads. It will be prudent, therefore, to enhance the availability of public sector funding sources to bridge the current gap between the availability of funds and the road development requirements. Further, public sector delivery also is in need of enhanced efficiency and value engineering.

SUMMARY AND CONCLUSIONS

i. The current policy framework for public-private partnership in roads has been well laid down and should continue. However, the government must focus on lessons learnt from the current concession projects and ensure value for money invested.

ii. Recently, there has been somewhat poor response from the private sector. There is need for the government to invest in knowledge acquisition, especially in respect of traffic forecasting, pavement performance and deterioration prediction and highway capacity norms. This would help both the government and the concessionaire in more informed financial appraisal and reduced risks arising from uncertain outcomes. Even the current risk sharing mechanism may need review to provide reasonable comfort to the concessionaire and the lender.

iii. The Annuity Model is nothing but a deferred budget form of delivery and has potential of casting a heavy burden on contingent liability of the government. It is clearly unsustainable in the long run as the entire traffic risk is transferred to the government. The government would do well to stop this mode of delivery in its present form. Where this mode is proposed, there should be a cap, say no more than 15 per cent of the annual road budget to defray year-by-year contingent liability by way of annuity payments. Further, such projects should be subjected to a more rigorous value-for-money analysis and compared with the public sector delivery option. Another modification that has potential to soothen contingent liability in future would be for the government to provide, 40 per cent of the construction cost upfront and the balance cost of construction plus maintenance to be paid back through annuity payments. There is also need for stricter scrutiny of annuity payments demanded by the bidders on the parameter of reasonableness of demand. Otherwise, it would be more cost-effective to undertake projects instead as EPC contracts.

iv. Given that for some projects in the past, the concessionaires did not evince interest in BOT (Toll) and preferred BOT (Annuity), it is evident that there is less appetite for bearing full traffic risk by private players. It would be advisable to revisit the strategy for traffic risk sharing in BOT (Toll) model. The government needs to share both the upside and downside of a predecided/predetermined traffic band and address the concern of competing facility so as to provide the requisite comfort to the private sector.

v. The government is already aware of the problems arising due to lack of progress on preconstruction activities covering land acquisition, shifting of utilities and environmental clearances. Arrangements should be made for bringing these activities under control before project award and streamlining the system of various clearances.

vi. The level of service and riding quality are seen to be poor on several projects. There is need for a stricter regime for enforcement of performance standards during operation and management of projects by the concessionaires. The road agencies should be held accountable for any deficiency in performance of the concessionaires.

vii. PPP projects necessarily involve a user-pays element. In several parts of the country, the local population has balked at the idea of paying to use a road that is constructed on land that is considered their own. Occasionally, it has proved sound politics to stoke this civil disobedience. Wider acceptance of this model is required to reduce the social and political risks associated with PPP-funded projects. This can be done by ensuring that land acquisition conforms to the letter of the law, setting up institutions to address grievances, providing for adequate resettlement and rehabilitation efforts, and by demonstrating direct benefit and value for money. This last factor depends on timely construction, assured maintenance, smooth toll collection, and predictable toll escalation.

viii. It is to be realised that the private sector financing in the highways would remain confined to the commercially viable and high traffic density stretches. Rural roads are being built with the government financing utilising the CRF and RIDF window of the NABARD funding. While the private sector would continue to serve an important segment of the road network, sizeable investments in the road sector are required to develop the balance network of even primary and secondary roads. It will be prudent, therefore, to enhance the availability of public sector funding sources to bridge the current gap between the availability of funds and the road development requirements. Further, public sector delivery also is in need of enhanced efficiency and value engineering.

DATA AND INFORMATION TECHNOLOGY

Better decisions on road infrastructure can only stem from better understanding of the underlying structure of current and expected traffic on our roads. This understanding, which in turn is dependent on better data, can help ensure that outlays deliver infrastructure that actually addresses the core concerns of mobility and accessibility, while not being wasteful. As a simple example, consider a situation where the citizens of a medium-sized town report an access road to be perpetually congested. Solutions to this problem can range from widening the access road, constructing a bypass around the town, boosting rail capacity into the town, constructing a transport nagar on the outskirts, amending city bylaws, and many others. The point is that the most efficient and cost-effective solution hinges crucially on an in-depth understanding of why the road is congested and the pattern and characteristics of the types of traffic plying on the road. Such evidence-based decision-making and monitoring of resulting outcomes is reliant on extensive, relevant and robust data.

EXISTING DATA COLLECTION AND DISSEMINATION

The existing system of planning and management of various categories of roads involves some level of judgment and empiricism due to the lack of a fit-for-purpose database on existing condition of roads, traffic data, vehicle fleets, level of service, accidents and so on. Even for National Highways, only limited data is available on the inventory of bridges and overpasses. Traffic censuses are based only on seven-day counts carried out twice a year, falling well short of delivering a complete picture of year-round use. Much useful data collected by both Central and state governments stay unused for want of being accessible from a centralised system in a standardised format.

The government needs to share both upside and downside risks so as to provide the requisite comfort to the private sector.

PHYSICAL INFRASTRUCTURE

Data on physical infrastructure at the Central and state level is collected in Basic Road Statistics, a publication issued by MoRTH. All classes of roads are covered, though with a substantial time lag. With ambitious targets for road building that are often expressed in terms of km per day, it would be immensely useful for performance monitoring purposes if data were published regularly and frequently. This will require overhauling and streamlining of the data collection system that relies on a multiplicity of agencies and often features incomplete and inconsistent data that frustrate timely publication.

VEHICLE FLEET STATISTICS

The Road Transport Yearbook collates data on India's vehicle fleet from the governments of states and union territories. Disaggregated data is also available for many of the largest cities. The headline data item is the total of the registered motor vehicle fleet in each jurisdiction, though this is more finely distinguished by: vehicle classification, passenger load for public transport vehicles, engine size, public and private ownership of buses, and so on. However, with road transport primarily under state purview, the quality and coverage of this data is largely dependent on state-level funding and effort. A major limitation of this data is that registered vehicles are a superset of vehicles actually in use. Thus, there is considerable overestimate of the number of vehicles that are on the road. Other missing features of this data concern the vehicle km travelled by both private and public transport vehicles, the degree to which they conform to design rules and pollution controls, and whether or not they are fit for use on the road network.

OTHER STATISTICS ON ROAD TRANSPORT

The Road Transport Yearbook also includes other important data such as the applicable rates of registration fees and tax on different types of vehicles, the rates of tax on goods and passenger transport, revenues realised from motor vehicle taxes, physical and financial performance of state road transport undertakings, some road accident data and Plan outlays and expenditure in the road sector.

Other sources such as the Reserve Bank of India, and Central Excise and Customs also publish data pertaining to the roads sector. For example, in its survey of state finances, the RBI provides data of revenue raised from motor vehicles, passenger and freight taxes. Meanwhile, Customs publishes excise data on motor vehicles and parts. The

Performance and outcome-based indicators are not being captured for roads, leading to an incomplete picture of the impact of new or better roads on traffic carried, congestion alleviation, environmental effects, and quality of life. Collection of this data is essential.

Planning Commission is the central repository of data on Plan allocation and expenditure on roads under the various central and state schemes. It also brings together some data on how the road sector interacts with other transport modes, though this data is neither periodic nor standardised.

DATA REQUIREMENTS

Indicators for the road transport sector need to be identified so that data on these is compiled and analysed for benchmarking, performance monitoring within the sector, and for intermodal comparison. Good progress is being made in compiling data on physical achievements. However, performance and outcome-based indicators are not captured, leading to an incomplete picture of the impact of new or better roads on traffic carried, congestion alleviation, environmental effects, and quality of life. Data on these outcomes-focussed measures are equally essential for all categories of roads.

As noted earlier, a major limitation of the data on vehicle fleets is that it focuses on the registration rather than on vehicles actually in use. This can be addressed through a specially created Motor Insurance Database wherein all insurance companies provide details of the first insurance policy as well as for renewals for each vehicle covered.

Road accident data has already been addressed, but it is worth reiterating that more extensive data on the circumstances peculiar to each accident can help identify long-term trends and patterns which can be used to inform safer road design, improved laws and regulations, and more stringent enforcement where necessary.

Maintenance work on roads is especially hampered by lack of knowledge on the real-time condition of a road in terms of the level of service it is capable of providing. Data is needed on the pavement quality as measured by rut depth, the extent of road cracks, number of potholes, bridge condition and so on. Maintenance treatments can be prioritised by combining this information with other data that compares observed average traffic speeds with design speeds and accident histories amongst others.

There is no organised data on non-motorised transport modes. although it is known that they serve an important need in both urban and non-urban areas by catering to short trips and providing access to public transport catering to long trips.

With respect to passenger bus services in the public sector, much useful information is available on fleet utilisation, vehicle productivity, staff productivity, staff bus ratio, fuel consumption for state-owned transport companies. But there is virtually no data available on private bus operators even though they constitute a major share of total public transport. This information should be collected and should be made available in electronic form for public use.

There is no mechanism for undertaking systematic origin-destination studies for freight moved by road. It is widely acknowledged that goods vehicles face substantial delays at state borders and other check posts, and at inter-modal junctions. However, there is little data that can be used to substantiate and then address this phenomenon. In order to collect data on the movement of freight, a random survey should be conducted every five years. Figure 2.5 shows the kind of data on freight that will be required. This method can be used to track industries that contribute significantly to freight movement such as manufacturing, retail, mining, fuel, electronic shopping, etc. We expect the following industries to be included in the survey: food; petroleum products; coal; chemicals; primary metal manufacturing; machinery; wholesale dealers in fuels; and warehousing and storage.

Figure 2.6 shows the process to be used for obtaining the data. It shows the various groups of participants which should be included in the survey. After obtaining data from the surveys, a database needs to be built. Various analytical studies can then be carried out and the results shared with users to get their feedback. If there seem to be major discrepancies or gaps in the data based on the feedback, then design of the freight database will need to be modified.

In order to ensure that all the necessary data is accurately represented in the database and to facilitate data entry for the surveyors, it will be important to develop standards for the format of the various kinds of data. Figure 2.7 shows the categories of data that will be included in the database and for which data standards and formats will need to be agreed upon, and developed if not already available. There will be a wide variety of data that will need to be collected and a great deal of work will need to be done before the surveys are started to arrive at a consensus on the data formats and standards. Recent traffic surveys carried out by RITES for total transport system studies would give the basic framework for data formats which would also help in analysis of intermodal choices and needed policy corrections.

The existing programme of traffic census that is carried out to support certain studies must be urgently

supplemented by permanent traffic count stations at several hundred important locations on the network. These counts can be used to monitor the overall health of the network, to identify choke points and to direct new infrastructure spending to where it may be most beneficial. With an increasing number of projects funded through PPP arrangements, these counts would also enable more reliable traffic growth forecasts, besides helping in proper planning, design, construction and operational phases of the contract. More accurate traffic counts lead to better estimates of future road use, project revenues, and required government subsidies.

MANAGING DATA

Notwithstanding the data collection gaps identified above, an equally pressing problem is the management and dissemination of the data that is already being collected. At substantial cost to both government and private agencies, a large number of traffic censuses, feasibility studies, detailed project reports and the like have been carried out to support the construction of new road infrastructure. These reports normally include much useful information such as assessment of localised network features, soil conditions, unit costs, manpower, machinery and material requirements, traffic volumes, and the impact of a project on the network and local catchment area. However, there is currently no organised system to access the data generated from these efforts.

MoRTH has financed several studies and research and development with a view to improving the strategy and management of all categories of roads. It would be expedient to establish a Road Data Centre for the collection of data from various sources, its storage, retrieval and analysis for the use of other interested agencies. The Data Centre should ensure that the data collected and distributed conforms to standard measures of data integrity: timeliness, accuracy and coverage. Data should be periodically updated, and stored in a format that permits easy electronic access. The Data Centre should make available both raw data at the highest level of granularity possible, and also seek to construct meta-measures such as quality-adjusted or hedonic cost indices. Table 2.39 provides a listing of important statistics that should be collected, constructed and disseminated and put on the web so that it is in public domain.

PAVEMENT AND TRAFFIC MANAGEMENT SYSTEMS

A pavement preservation strategy must be devised based on statistically valid data on the performance of various types of pavement compositions under varying traffic, geographic and climatic conditions. Special care must be taken to ensure that this data accounts for the stresses that the Indian climate and topography places on road pavement.

A Pavement and Bridge Management System (PBMS) needs to be developed so that the pavement preservation strategies may be optimally implemented. This system will record detailed current inventories of road assets, thereby ensuring that road maintenance and overhaul programmes can be tailored for maximal efficiency. The PBMS ought to be part of a wider, more comprehensive database called a Road Information System that will effectively provide details not just on the 'quality' of the road at a given point in time but also on its extent, reach and possibly traffic flows (if permitted by technology).

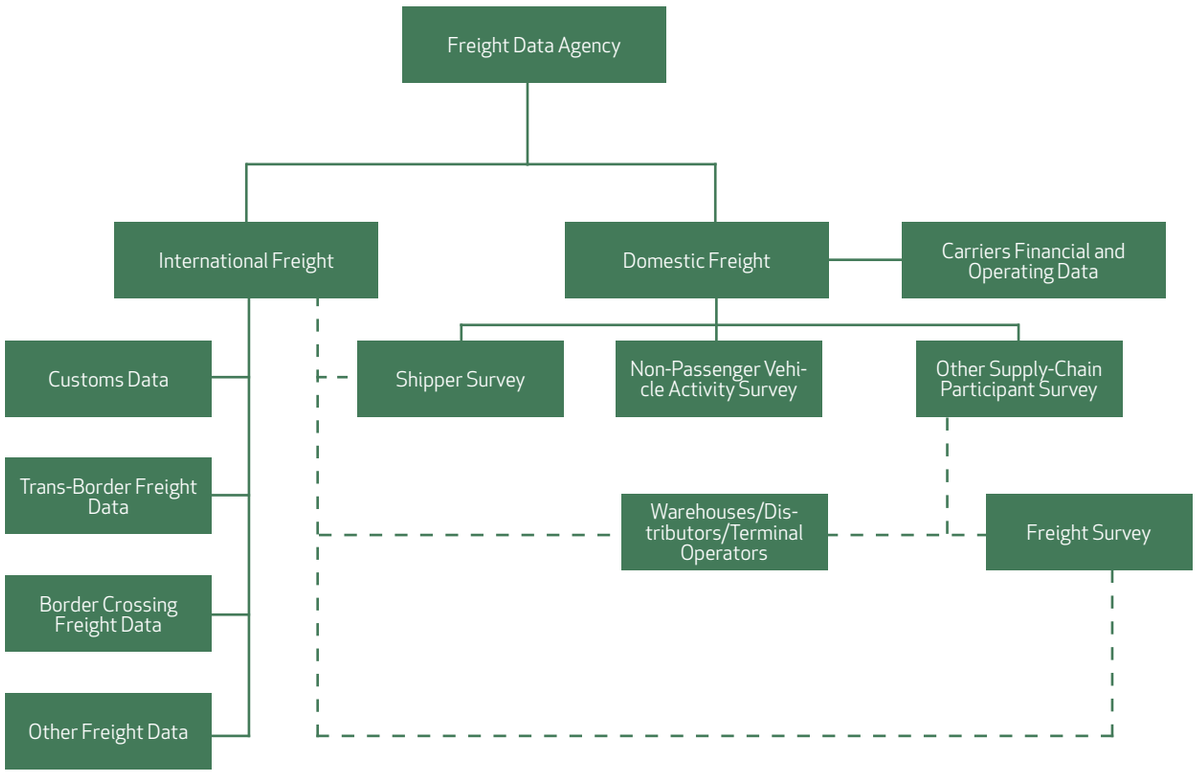
The current programme of traffic census must be urgently supplemented by permanent traffic count stations at several hundred important locations on the network.

An Advanced Traffic Management System (ATMS) should be progressively introduced especially on National Expressways and four-lane NHs. The ATMS is a broad collection of technologies that work together to ensure a better and safer traffic flow. Such systems include facility and traffic control centres, emergency call boxes, variable message signs, video surveillance and incident detection, and meteorological sensors. They may also lend support to commercial mobile communication systems. Finally, automatic traffic counting and classifying systems can aid greatly in managing traffic, and in providing ready data for several purposes such as identifying bottlenecks and future road design.

ELECTRONIC TOLLING

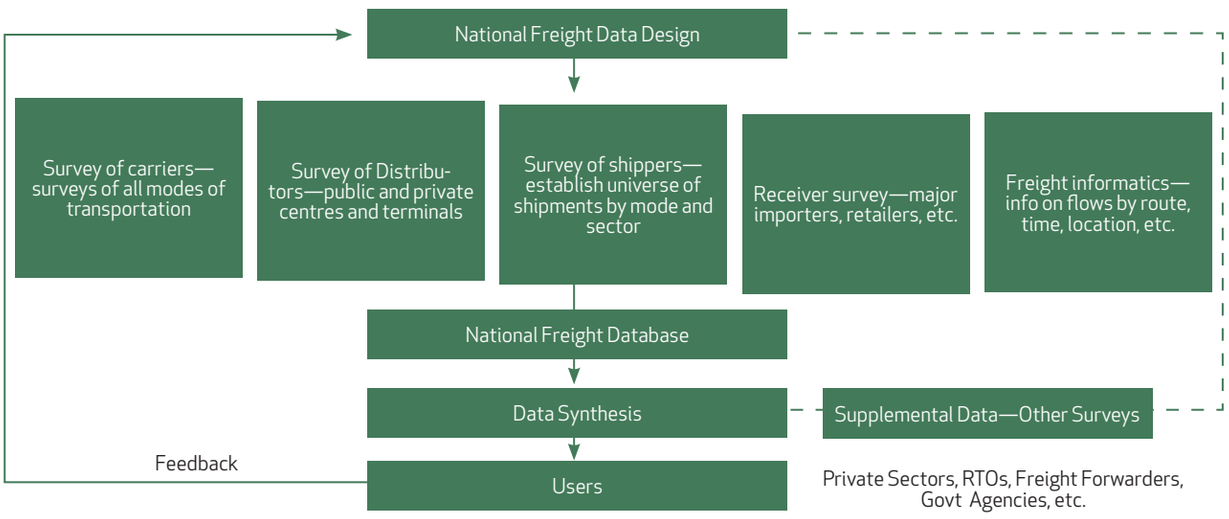
The integration and standardisation of toll collections across the country will greatly aid faster and smoother traffic flows. Collecting tolls electronically from freely moving traffic has seen good international success. The Nilekani Committee on this subject has recommended Radio Frequency Identification (RFID) technology for this purpose on the grounds that it is cheap, robust, easy to use, maintenance-free, scalable and reliable. The case is convincing. The system consists of cheap tags that, affixed to a windscreen, uniquely identify a vehicle. The tags are readable by special sensors located at toll plazas. Tolls may be pre-paid and appropriate amounts are deducted whenever the vehicle passes a toll plaza. In order to manage the financial transactions relating to toll collection, the Nilekani Committee recommends a central clearing house. Because a tag uniquely identifies a vehicle, the RFID system has additional advantages in the sense that it can be

Figure 2.5
Data Requirements on Freight Movement



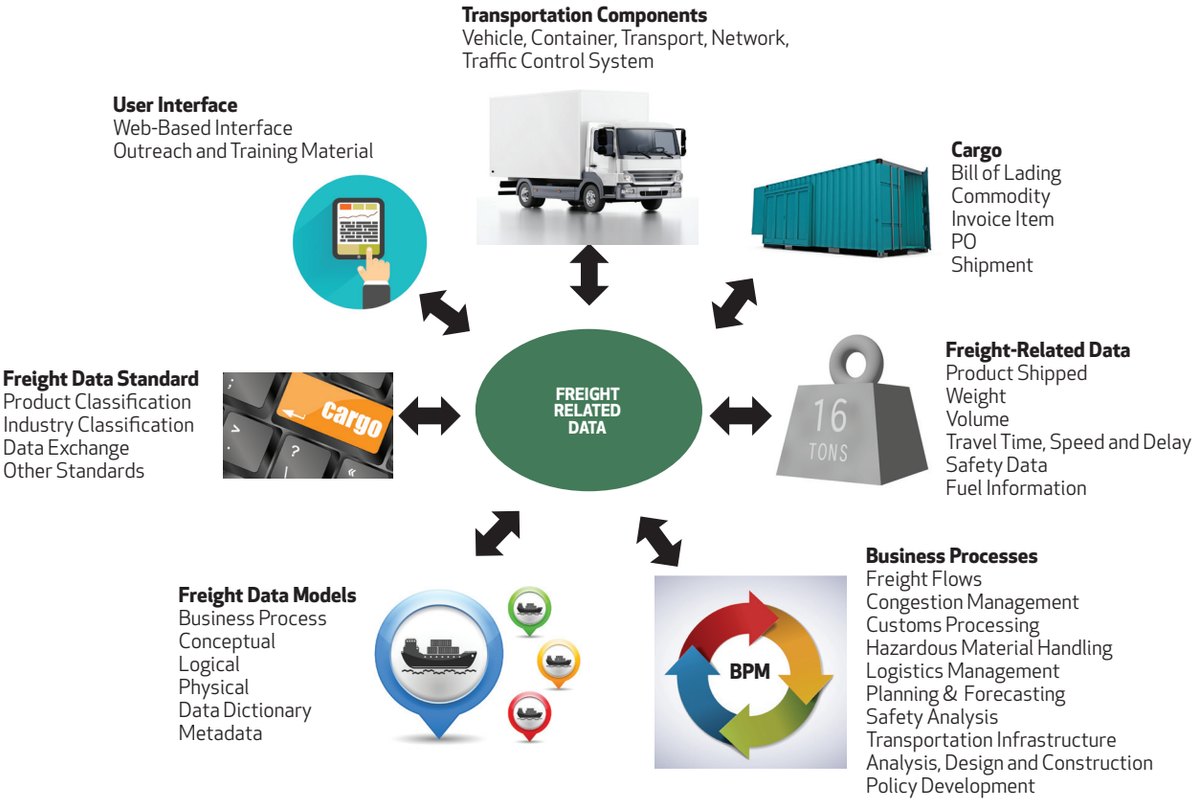
Source: Infosys Research (adapted from BTS)

Figure 2.6
Process for Developing Database



Source: Infosys Research (adapted from BTS).

Figure 2.7
Required Data Formats and Standards



Source: Infosys Research (adapted from BTS).

easily used for vehicle tracking, parking and traffic enforcement, etc. Box 2.28 gives the implementation strategy proposed by the Apex Committee constituted by the MoRTH.

GOVERNANCE

Regulation of the road sector in India, as in other countries, has been largely through contracts. The Concession Agreements that are entered into with BoT concessionaires or the EPC contracts awarded to the construction contractors spell out the rights and obligations of the two parties involved, the concessionaires and the governments/road agencies. Such contracts attempt an equitable allocation of risks. A well drafted concession agreement together with adequate contract management skills in the government/road agencies would constitute a satisfactory mechanism for regulating road development either through contract or concession agreement. In fact, as stated earlier, in most countries of the world, road development is regulated through contracts and not through a commission or a regulatory authority. There is no example of a road regulator anywhere in the world.

At best, the argument of a road regulator rests on the premise that concession agreements are for lengthy periods of time, say 20-30 years, and it is not possible to predict events that might occur and impact the project during that period; a road regulator could help in addressing such events. However, even such a contingency can be duly provided for in a binding agreement. It is essential to improve governance whereby the road agency enforces performance of the contractor/concessionaire as per the obligations set out in the contract agreement. The road agency is also to perform its own obligations set out in such agreements.

Table 2. 39
Data: Metrics and Sources

CATEGORY	PARTICULARS	POSSIBLE AGENCIES
Network	1. Total length 2. Length by classification 3. Width of carriageway 4. Ownership	• Road agencies at central and state level
Inventory and Condition	1. Width of right of way 2. Width of road formation, carriageway 3. Location and span of culverts, bridges, rail overpasses and crossings 4. Roughness 5. Rut depth 6. Area of cracks 7. Subgrade strength of soil 8. Bridge conditions and distress	• Road agencies at the central and state level • Private O&M agencies • Privately commissioned surveyors
Traffic	1. Classified traffic counts—motorised and non-motorised—by section 2. Axle load spectrum 3. Permanent traffic counts 4. Speed surveys 5. Origin-destination surveys at selected points	• Road agencies at the central and state level • Academic institutions may be funded to undertake certain delegated surveys
Vehicle Fleet	1. Number of motorised vehicles of various categories registered state-wise 2. Vehicle age and usage status	• State-level transport departments
Passenger Movement	1. Frequency 2. Purpose 3. Fare per km 4. Km per journey 5. Km per mode 6. Fleet utilisation 7. Vehicle productivity 8. Staff productivity 9. Staff-vehicle ratio 10. Fuel consumption	• ASRTU • AIMTC • Federation of Bus Owners' Associations
Freight Movement	1. Commodity-wise tonne-km 2. Freight movement by vehicle class, including non-motorised transport	• AIMTC • Federation of Truck Owners' Associations • Sample surveys through agencies like RITES, CRRI
Accidents	1. Fatalities 2. Injuries: grievous, minor 3. Property damage 4. Location of accidents	• Traffic police and state departments • Academic institutions

CATEGORY	PARTICULARS	POSSIBLE AGENCIES
Revenue: Taxes and Tolls	1. Statewise taxes on various categories of passenger and freight vehicles 2. Number of toll plazas and booths 3. Collection of tolls from each plaza	• Transport departments • Regional Transport Authorities at state levels • Road agencies in the centre and states • Concessionaires
Financial	1. Investments in various categories of roads with public-private sector breakdowns, and disaggregation by schemes: capacity augmentation, bypasses, bridges, etc. 2. Expenditure on maintenance of various categories of roads 3. Unit construction and maintenance costs 4. Cost indices	• Road agencies in the Centre and the states
Connectivity	1. Number of habitations connected by all-weather roads 2. Number that remain to be connected	• NRRDA • SRRDAs
Material	1. Bitumen use per km 2. Steel use per km 3. Aggregates use per km 4. Cement use per km (Disaggregated for various construction categories and maintenance)	• Contractors • Consultants • Road agencies at central and state levels
Manpower	1. Technical staff by level and agency 2. Non-technical staff by level and agency 3. Educational qualifications of staff	• Road agencies at central and state levels

Recent experience in respect of PPP projects in the road sector by the NHAI has shown that contract negotiations become necessary not only since eventualities occur after a long period of time but because of lack of clarity on the rights and obligations of the parties in the concession agreements. A number of disputes appears to have arisen between road concessionaires and NHAI because of unsatisfactory contract or poor contract management. The clamour for the road regulator seems to have arisen because of these disputes. It now appears that government is now considering a mechanism to resolve contractual disputes in PPP project across all sectors. Once this mechanism is established and PPP disputes are addressed, there would be no need for the road regulator to resolve disputes between PPP developers in the road sector. The Model Concession Agreements, standard construction bidding and EPC contracts should be live documents, amenable of being modified based on feedback or learnings from projects being implemented.

Ultimately, drafting appropriate contract agreements, managing contracts, resolving disputes, etc., are all part of good governance. There is considerable scope for improving governance in the road sector and good governance is possible only when there is adequate capacity to provide the necessary support. Road engineers, as a tribe, are not thorough with contractual terms, negotiations and management. Capacity building amongst road engineers should be given high priority. There is also a tendency in the NHAI/government to be more concerned and focused on awarding contracts without bringing under control preconstruction activities such as acquisition of land, resettlement and rehabilitation of project

Box 2.28

Electronic Toll Collection: Implementation Strategy

- The Committee headed by Nandan Nilekani recommended adoption of passive RFID technology for electronic toll collection (ETC) at toll plazas in India, considering user convenience, rate of acceptance and ease of implementation. The system involves a self adhesive tag on the windshield of the vehicle which is read by transreceivers installed at the toll plaza.
- A key component for implementation of nationwide RFID based ETC is interoperability, which requires that the tag on the vehicle can be read by all the transreceivers and at the same time all tags can be read by a particular transreceiver. This implies that both the tags and the transreceivers together with Automatic Vehicle Identification should have certain common specifications. This has to be a mandatory requirement of the ETC system.
- The main functions of the ETC system are:
  - Tag distribution
  - Toll road user registration and recharge
  - Toll transaction

  For managing these functions, a virtual hub called the Central ETC system (CES) is proposed to be created.
- ETC being a relatively new concept in the country, at least for the initial phase, services of domain expertise would need to be procured from the international market.
- Simultaneously, it will be essential to identify possible violations and enforcement elements against the same. Some countries use a video system to track violations.

Source: Report by Apex Committee for ETC Implementation, Government of India, September 2011.

affected persons, shifting of utilities, tree cutting and other environmental clearance. Government should consider taking a more market-oriented approach both in awarding contracts and resolving disputes so that road construction and development can take place rapidly without getting caught in a quagmire of disputes and time/cost overruns. Periodic user surveys should be carried out on the NH and SH corridors to capture the concerns of users, which should be duly considered for corrective measures and an instrument of feedback on road agency performance.

RECOMMENDATIONS

POLICY AND PLANNING

TRAFFIC SURVEYS AND DATA CENTRE

Transport operations in the road sector being basically in private hands, there is a high level of customer focus. However, at the same time, this mode is much less energy efficient and environment friendly besides being more unsafe and requiring more land. As such, road development should not be seen in isolation but as part of an integrated modal system of transport. For facilitating such a process, it is necessary to undertake regional traffic and transport surveys on regular basis—preferably every five years (to provide inputs to formulation of Five-Year Plans and mid-course correction of policy prescriptions formulated for long-term development goals) of freight and passenger flows, transport pricing, resource costs and to identify existence of distortions in the movement from point of view of a desirable/optimal intermodal mix and investment policy for different modes of transport. Database for the road sector is virtually absent. This needs serious attention. Setting up of a dedicated Road Data Centre managed through a high level institution does not admit of any delay. This will help in reducing the current adhoc decision making in the road development planning process.

CAPACITY AUGMENTATION

The entire transport system, including roads, is facing capacity constraints. The economic and environmental costs of a saturated transport system are high. Strangulation of railway capacity is unduly burdening the road sector. Railways need to regain their share. This cannot happen until their capacity is enhanced and they learn from road transporters to provide a better customer focus. It is to be realised that congested roads lead to lower transport productivity, increased energy consumption and pollution. Lack of road and vehicle maintenance adds to undesirable industry competitiveness in the international market besides resulting in high inventory costs. Once the role for roads and road transport is identified within the overall transport system, it is nec-

essary to identify and carve out road development and maintenance programmes which not only meet the expected traffic demand and improve transport productivity but also ensure that such programmes reduce in their wake the negative externalities of energy inefficiency, environment pollution and accident hazards.

Government should take a more market-oriented approach, both in awarding contracts and resolving disputes so that road development does not get caught in a quagmire of time/cost overruns.

RURAL CONNECTIVITY

Integrated rural development has been another area of focus by the Government for considerations of social justice, national integration and economic uplift. For this, there is all-round recognition of rural roads serving as one of the key elements of rural infrastructure as they help in increasing accessibility to schools, health centres and in creating more employment opportunities. Rural roads serve as an entry point for poverty alleviation. These roads also provide physical mobility of raw materials, farm produce, promote specialisation and increased size of market. Further, these roads influence the process of growth by facilitating dispersal of knowledge and reduction of inequalities. The states have already prepared district level Core Road Network master plans in due consultation with the Panchayati Raj Institutions and local MLAs and MPs. These plans could be reviewed every five years to account for both agricultural and industrial growth in each district. The current programme of PMGSY needs to be expanded to achieve universal connectivity to all habitations on a time-bound basis.

SOCIAL ASPECTS

Another area of concern is finding ways and means of reducing the burden of land acquisition where it affects the communities. Ever increasing economic activities are putting greater pressure on the scarce land resources. There is an imperative need to have a closer look at the requirements of land for transport projects including roads. Road design standards should account for this social factor as well.

ROAD CLASSIFICATION

Current system of road hierarchy and classification dates back to 1943 when the Indian Roads Congress formulated the first Long Term Road Development Plan. The road network is divided into five classes—National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. It is recommended that the division of the network may be confined to three categories—primary, secondary and tertiary. Primary roads may encompass both national and state highways. Secondary roads may include current major district roads. Tertiary roads could be termed rural roads and comprise both other district roads and village roads. Expressways need not be a separate class but these may be considered as part of primary road network since they are highways with features of full access control and limited to movement of motorised traffic. An independent road classification commission comprising administrators, economists, geographers and road engineers under the umbrella of proposed Office of Transport Strategy should be set up. It should lay down clear, objective criteria for which authority holds the administrative mandate over a particular class of road. It should do so from a holistic network planning perspective that maximises the efficiency of each class. There is also need to introduce systematic numbering of different classes of roads as per international practice. For each class of road and traffic groupings, the standards should be uniform both in design and translation on ground.

EXPRESSWAYS

Facilities like expressways are highly capital intensive and need a long lead time for planning of alignment, acquisition of land, rehabilitation and resettlement of people affected and other pre-construction activities including environment clearances. The Central Government has identified a network of about 18,000 km. However, there is inadequate information on characteristics of road links, traffic volumes and traffic patterns. This network should be subjected to a consultation process with the states as well. There should be a minimum threshold traffic to consider provision of an expressway: 40,000 PCUs per day is recommended. Access-controlled highways effectively divide the countryside, necessitating provision of flyovers and interchanges to permit cross movement. This involves high capital investments. Priorities should be determined based on the needs of the economy and progress of railway network capacity augmentation. Some of the existing four-lane roads under the NHDP may be considered for conversion into access control facilities by providing service lanes all through for local and non-motorised traffic as an immediate step. User charge principle would be amply justified in provision of such facilities. Strategy of constructing 2,000 to 3,000 km initially through the government budget and borrowings, and thereafter handing over such stretches to the private sector for its O&M and leveraging the revenue earned to expand the network could be another promising option.

SPECIAL NEEDS OF NE REGION

The government has been focusing special attention to the transport development needs of the North-East Region and other isolated areas. It is necessary to formulate and implement a comprehensive master plan for the NE region covering all modes of

Access-controlled highways involve high capital investments. Therefore, priorities for these should be determined based on the needs of the economy and progress of railway network capacity augmentation.

transport including roads. Chapter 6, Volume III is devoted to this issue.

AUTO INDUSTRY

The vehicle-manufacturing sector has shown some improvement in technology upgradation to bring in efficiency in fuel consumption and reduction in environment pollution. There is steady increase in production and operation of multi-axle vehicles for movement of freight. Such developments do help in increasing tonne-km per litre of fuel. Bus design is in need of overhaul to improve boarding and riding comfort. There is need for continuous upgradation of technology in the auto industry, especially the commercial vehicle sector, to meet the objectives of better comfort, productivity, energy efficiency, safety and emission standards in line with international practices and standards.

ROAD DEVELOPMENT

CURRENT INITIATIVES

The two decades covering the period 8th to 11th Five Year Plans (1992-2012) proved momentous for the road sector as it was marked by a heavy dose of road investments by the government and its strategy of promoting PPP in development of National Highways, state highways and revamping of road fund through additional excise duty to serve as a window for viability gap funding. International agencies like the World Bank and the Asian Development Bank also supplemented the resources. A part of the Central Road Fund and NABARD ensured availability of dedicated funds for rural roads under the PMGSY. The entry of international lending agencies helped in enhancing the capacity of contractors and consultants in the delivery of the development programmes and road projects. Private sector entry in financing got facilitated through introduction of direct user charge in the form of tolls, liberalised economic policies, increased transparency, open competition and reasonable apportionment of risks between the various stakeholders—government, concessionaire and lenders. It will be advisable to continue multiple strategies for development of the road network during the next two decades upto 2032, building on the current focus during the 12th Five Year Plan (2012-17). Private sector financing in the highways would remain confined to the commercially viable and high traffic density stretches. It will be prudent, therefore, to enhance the availability of public sector funding.

STRATEGIES FOR PRIMARY ROADS (NATIONAL HIGHWAYS AND STATE HIGHWAYS)

i. The existing network of National Highways and state highways may be expanded in tune with the economic growth and development of industrial hubs, special economic zones, ports, tourist centres and connectivity to international routes—Asian Highways and the European Road Network. At the same time, since the main function of the primary system is mobility and enhanced productivity of road transport, stress should be laid on consolidation of this network in terms of capacity augmentation through multi-laning of existing highways and provision of access-controlled expressway facilities. For projects of four-laning through PPP mode, a phased development approach can be adopted by initially reserving the full land width for 20 to 25 years' traffic needs, but providing number of lanes to meet demand for 10 years in the first instance and further widening in the second phase. An overall length of 100,000 km of NHs and 200,000 km of SHs should be largely adequate for the country. This may also include about 20,000 km of access-controlled expressways.

ii. For capacity augmentation of National Highways, the current programme of NHDP in seven phases is well-conceived and its implementation may continue in the immediate term, i.e., the 12th Five Year Plan. Within these phases, the programme relating to widening of single lane roads to two lanes deserve to be accelerated for reasons of enhancing safety and energy efficiency. Six-laning of existing roads without access control has potential to be more accident-prone. As such, the programme relating to six-laning of existing four-lane stretches needs to be stopped and where traffic volumes are beyond four-lane capacity, consideration given to provision of expressway network. In order to improve transport efficiency and enhance safety, all existing four-lane and six-lane roads need to have service lanes to cater to the requirements of local (both motorised and non-motorised) traffic so as to bring in an element of partial access control on such facilities. Provision of wayside amenities along the highways is becoming an integral part of the road projects. Such facilities should be provided by the private sector.

iii. For capacity augmentation of state highways, every state should formulate programmes on the lines of NHDP and undertake implementation as per priorities identified through traffic surveys, and economic and financial analysis of individual project stretches on the SH

network.

iv Financing of these roads should rely on the user charge principle in the form of tolls as direct beneficiaries and continuing with the existing Central Road Fund through additional levies on petrol and diesel. The existing policy of levy of toll on two-lane roads needs to be done away with. A two-lane highway on the primary network should be viewed as a basic minimum facility and provided through government budget including CRF. The accruals to the CRF may be enhanced by making levy of cess on fuel on *ad valorem* basis rather than the current system of a fixed amount of Rs 2 per litre., which was fixed in the year 2005. This may be enhanced to Rs 4 per litre to enhance the accruals to meet project investment requirements. Some states have constituted state road funds to provide assured funding for the state sector road projects. This is a good strategy and worthy of upscale by other states as well.

v. While preparing projects for capacity augmentation, the need arises for planning of bypasses around towns to ensure smooth movement of through traffic. In most cases, these bypasses also serve as a vehicle for development of the town along or on the other side of the bypass. Therefore, the alignment for such bypasses should be planned jointly by the road agency and the urban development agency. Further, these bypasses should be planned and provided as access-controlled expressway type facilities with entry/exit at predetermined locations. For large-sized cities (population above one million), bypasses could also be provided in the form of peripheral expressways. The intersection points of bypasses with main highways may also serve as freight logistics parks on case to case basis.

vi. Another requirement relates to reconstruction of dilapidated and weak bridges which are showing signs of distress and crying for replacement. There are also missing bridges on large rivers needed for opening up of the area.

vii. Special needs of connectivity to ports, airports, mining areas and development of power plants should be factored in development of the road programmes. In certain cases of power plants, movement of Over Dimensioned Cargo (ODCs) will be involved and this will require advance planning, particularly for strengthening of bridges involved and improvement of curves in hilly areas.

viii. It is difficult to hazard a precise estimation of physical and financial requirements for development of primary roads without a detailed study of traffic forecasts and inventory of existing road network. However, a broad assessment is presented based on projections by the Working Group on Roads and deliberations within the Committee. An investment of Rs 21,400 billion for National Highways and Rs 11,600 billion for state highways, at current prices, spread over 20 years upto the year 2032 could be required. Targets for private sector financing are also proposed.

Private sector financing in the highways would remain confined to the commercially viable and high traffic stretches. Thus, it will be prudent to enhance availability of public sector funding.

STRATEGIES FOR SECONDARY ROADS (MAJOR DISTRICT ROADS)

i. These roads run within the districts connecting areas of production with markets and serve as a connecting link between the rural roads and the primary road network and are thus equally vital for agricultural and industrial development of the landscape. These roads have not been receiving the desired level of attention and investments. This gap has to be filled to ensure balanced development of all classes of roads and in all regions of the country. An overall length of 400,000 km as proposed by the Working Group on Roads is recommended as a target network of MDRs. Currently, these roads are mostly single-lane with weak road pavement and bridges in need of immediate strengthening. A large percentage of these roads is reported to be in bad shape. This is posing a threat to even optimal use of PMGSY roads which are often in much better condition. The situation is further aggravated due to movement of overloaded vehicles. Presence of railway level crossings causes undue delay to traffic movement on one side and lowering of speeds to the rail movement on the other. Therefore, the stress should be to accelerate the programme of widening of these roads to regular two lanes including bridges and provision of rail over/under bridges on heavy trafficked stretches. Priorities may be governed by the traffic—current and projected. Some limited stretches may require four-laning also in later years depending upon the traffic growth witnessed.

ii. Besides two-laning, attention would also be required for strengthening of pavement of existing single-lane roads and provision of

Attention must be paid to strengthening of pavement and provision of hard shoulders to enable safe movement and preventing road damage beyond repair and rehabilitation.

hard shoulders to enable safe movement of vehicles and preventing such stretches from getting damaged beyond repair and rehabilitation. Programmes of improvement in riding quality with partial strengthening need to be planned and implemented.

iii. Some isolated bridges on the MDR network which show signs of distress would also require reconstruction as standalone works.

iv. As per a broad assessment, an investment of Rs 6,000 billion, at current prices, spread over the next 20 years, is envisaged.

v. Currently, the Central Government is providing some funds for these roads out of the CRF but it needs a quantum increase in order to make up for the continued neglect by the states.

STRATEGIES FOR RURAL ROADS (OTHER DISTRICT ROADS AND VILLAGE ROADS)

i. Considerable progress has been made and is continuing under the current PMGSY. This programme is being implemented by the states with good managerial and technical support from the Centre. For the first time, well engineered roads are being provided in rural areas. The entire funds for construction come from the Centre. The states are responsible for subsequent maintenance. The programme covers rural roads required for new connectivity (one basic access to unconnected habitation) and upgradation of existing roads (requiring improvement to provide all-weather access). The programmem being implemented for the last over 10 years, is well conceived and its implementation may continue. The main areas of concern emerging relate to assured maintenance and upgradation in areas that have witnessed high agricultural and other economic growth. These aspects need special attention. The Government of India has recently approved a scheme of PMGSY-II which envisages upgradation of existing major rural links to rural growth centres where cost of upgradation will be shared by states also.

ii. The state governments have also been making their own investments in provision of rural roads to connect other villages/habitations not eligible under the PMGSY or Bharat Nirman. This has helped in accelerated development of rural areas served by such roads. The implementation of rural roads programmes need to continue as per the district level core road network plans of the state governments. The current mandate of PMGSY should be expanded to achieve universal connectivity as these roads serve as the entry point for poverty alleviation and provision of access to social infrastructure such as education and health besides market.

iii. Basically, these roads can stay as single-lane roads in view of the low volume of traffic likely to prevail. However, some roads under this category could witness traffic volumes that may justify widening to intermediate or two-lane. Provisions should be made accordingly.

iv. Fiscal federalism theory would suggest that since rural roads serve as a prime redistributive tool in the government's armoury, they should continue to be funded by grants from the Centre. It is proposed that for financing of these roads, the current CRF accruals and RIDF window of NABARD may need to be augmented. The strategy of some states to raise funds through market committee fees on agricultural produce is commended for being emulated by other states as well. Some funds for earth work for example can be leveraged from MGNREGA schemes.

v. An investment of Rs 5,700 billion, at current prices, spread over the next 20 years, is envisaged.

MAINTENANCE AND ASSET MANAGEMENT

The current replacement value of the existing road network defies precise estimation, given that there is no sustainable system of condition assessment of roads and bridges at present. A ballpark figure of Rs 10,300 billion is claimed by some experts as a broad asset base of the road network. Even if such an assessment would be and could be debatable, for a policy dialogue, there can be no two opinions that the current assets are huge and justify both preservation and maintenance.

The vicious cycle of build, neglect and rebuild has to be broken. While PPP approaches have helped in taking care of operation and maintenance needs during the concession period which extends to 15 to 20 years, this addresses the issue for only part of the road network. The various finance commissions have also laid stress on maintenance management of the road network and recommended central grants for state roads besides budgetary allocations by the state governments under the non-Plan head. Timely and adequate maintenance of the existing road network does not admit of any laxity. It is an economic

necessity as otherwise, erosion of asset base will get accelerated. It will be advisable for the states to institute road network asset management systems so that there is scientific condition assessment and priorities for maintenance interventions are fixed on a rational basis.

Both the Central and state governments should declare as a policy that roads would receive dependable and adequate allocation of funds on a continuous basis. A system of working out the replacement value of the road assets at the end of each financial year should be established by every agency for roads under its jurisdiction. The information relating to road asset value should be put on the web in public domain.

The government may also consider not to treat maintenance of roads as a non-Plan activity so that it does not suffer ad hoc cuts as is the current experience.

The states have been steadily reducing their gang labour and increasing maintenance works through private contractors. This has been the right approach. While existence of some gang labour may be useful, particularly for emergency situations and disaster management under conditions of earthquakes, landslides, cyclones, etc., there is a need to move to standalone long-term performance-based maintenance contracts where capacity augmentation may not be required in the immediate future. Enforcement of performance standards by the government through a well laid down mechanism is essential and field engineers responsible for execution of maintenance works made accountable.

States should encourage citizen and user oversight through undertaking road user satisfaction surveys. To start with, structured questionnaires and analyses of response can bring out road user satisfaction index on various stretches of the primary road network. This should include the projects awarded to BOT concessionaires as well. This will strengthen the government oversight on enforcing performance standards from the private sector.

There is a case for a dialogue with the contracting industry to support them in creating a dedicated band of contractors that specialises in undertaking O&M works on the road network. This will improve maintenance delivery on the ground and also act as a good resource partner of the BOT concessionaires during the operation period. For rural roads, local small contractors may be utilised in area-based contracts and gradually involve the local community with technical support from road agencies.

The vicious cycle of build, neglect, rebuild has to be broken. While PPP approaches have helped in taking care of operation and maintenance needs during the long concession periods, this addresses the issue for only part of the road network.

Technology for maintenance also needs a quantum jump, particularly in respect of primary and secondary roads. There is a need to evolve long-lasting pavements which can help in increasing the current four-five year renewal cycle to a 12-15 year cycle. Mobile maintenance units need to become a normal practice.

Non-engineering aspects need to be focused on as well. This would include land management by way of prevention of encroachment, control on ribbon development, regulation of access on existing highways and use of ROW by utility agencies. Incident management and highway police patrol are other activities that should become integral part of O&M provisions.

The state transport authorities also need to support the road agencies in enforcing axle load limits of vehicles, particularly trucks, as overloading is seen to damage the roads prematurely.

Annual allocations required for maintenance should be worked out by each road agency for the roads under its jurisdiction based on asset management principles and traffic and road condition observed on the system. This should be a first charge on the available resources.

CAPACITY BUILDING FOR ENHANCING DELIVERY EFFICIENCY

INDIAN ROADS CONGRESS

i. Currently, the IRC mandate is to evolve standards, specifications, manuals, guidelines for planning, design, construction and maintenance of different categories of roads. Many of the standards are outdated. Design standards need to be reviewed on a regular basis so that these are in line with international practices duly taking into account our own milieu.

ii. The current system of formulating design codes and manuals needs an overhaul. Base papers for each topic need to be prepared through identified academic, research or professional agencies or even international domain experts. These outputs should then be subjected to peer review by domain experts and thereafter by the members of the committee. This would considerably reduce the delays currently experienced in finalisation

Annual allocations required for maintenance should be worked out by each road agency based on asset management principles and traffic and road condition. This should be a first charge on the available resources.

and updating of design codes, etc. Funds for such purposes should be provided by the government out of R&D budget. Eventually, the standards should have statutory standing and become the responsibility of the Standards Departments of the proposed institute for Intercity Road Transport, Institute for Urban Transport and Traffic Management Board.

iii. The IRC needs to expand its mandate to cover a systematic assessment of road transport operations and their impact on the road network with a view to reviewing the existing standards and guidelines so that the roads serve the intended purpose.

iv. The IRC can draw lessons from international bodies like American Association of State Highway and Transportation Officials (AASHTO), Permanent International Association of Road Congresses (PIARC), National Association of State Roads of Australia (NASRA), Japanese Road Association (JRA), International Road Federation (IRF) to further enhance its capacity.

ROAD DESIGN INSTITUTE

Except for a few technical officers in the road agencies who are manning design cells in the states and at the Centre, there is no dedicated institute for undertaking designs for the various components of the road projects. While some capability is available in the academic institutions and the private consulting firms, there is no system of adequate oversight on their output. The current experience of time and cost overruns on major road projects is indicative of the weaknesses in the preparation of DPRs and lack of proper design focus in the first instance. There is a compelling need for a dedicated road design institute for the road sector that should function under the umbrella of MoRTH. It should have around 400 to 500 professionals at various levels covering various disciplines such as transport planning, traffic and safety engineering, transport economics, pavement design, bridge structure design, maintenance technology, geotechnical engineering, material engineering, IT-related interventions, tunnel engineering, social and environment engineering, etc. Similar institutes should be set in each state PWD and Rural Roads Agency. Every state should have at least 40 to 50 professionals covering various disciplines.

ROAD AGENCIES

i. With the NHAI having become operational through successful implementation of the NHDP, there is need to review the current structure of MoRTH and expand the mandate of the NHAI. The objective should be for the MoRTH to entrust all National Highways and National Expressways to NHAI with proper restructuring of NHAI and only planning, policy and budget functions should remain with the MoRTH.

ii. The existing road agencies in the Centre and the states are gearing themselves to the needs of accelerated road sector programmes. However, capacity and performance of these agencies need further enhancement. The Government of India has instituted a system of Results Framework Document for various sectoral ministries and is also encouraging state governments for similar initiatives. The road agencies may consider self-evaluation or undertake capacity analysis through domain management expert agencies to identify enhancement measures required to improve their capacity and performance. A set of suggestive indicators have been given in the Report based on a recent study of the highway agencies in the South Asia Region by the World Bank. At a minimum, the road agencies must have core competence in monitoring output of consultants, public private partnership models, contract procurement and administration, quality control and monitoring, adherence to design standards, safety engineering, maintenance planning, social and environment impact assessment, etc. Some selected officers need be encouraged to go in for graduate programmes in various disciplines of highway engineering.

iii. Staff at various levels should receive regular training in different aspects of road projects. Each road agency should have its training plan and calendar for both short-term and long-term. Such a plan should cover sponsoring officers for undertaking M.Tech. programmes in various branches of highways, bridges and tunnels.

iv. There is a huge backlog of training at the cutting edge level of supervisors, junior engineers and assistant engineers for which special programmes need to be evolved and provided. A few states have set up their own training institutes for this purpose. These institutions need strengthening and provision of state of art training infrastructure. Such training institutions should come up in all states.

v. The government also needs to support the Indian Academy of Highway Engineers (IAHE), other training institutes at state level, and academic institutions to improve their infrastructure for training of road agencies.

vi. Study tours should be undertaken both within the country and abroad for raising awareness among road agencies staff about good national/international practices in implementation of road projects.

CONSULTANTS

i. Consultancy in the road sector has played a significant role in supporting the road agencies in various stages of road development projects and programmes—be it feasibility studies, preparation of DPRs, bidding documents for procurement of construction contracts and BOT projects, supervision of works during construction or review of designs or quality audits as third party. With the entry of multinational firms and their setting up India-specific subsidiaries, domestic firms have also graduated to international stature. Larger firms have not only experienced professionals on their roster but also they are equipped with state-of-art instruments and software. However, due to the quantum jump in the volume of work, weaknesses in their output become evident in some cases. One area of deep concern is the poor quality of DPR and bid documents being prepared by the firms. This results not only in avoidable variations in design and scope-of-work changes during execution but also in time and cost overruns. A number of disputes raised by the contractors also emanate from poor bid documentation. There is a need for a system of internal quality audit by the consulting firms before they submit their outputs to the road agencies. The government should also tighten the current performance evaluation system to bring in more accountability of the consultants.

ii. The personnel of the consulting firms can also avail of the training facilities and infrastructure available in the IAHE, CRRI and other engineering and management institutes in the country for keeping abreast of the latest national/international practices.

iii. For complex projects, the current practice of third party review of consultants' design may continue, but such a role should ideally be performed by the Road Design Institute referred to earlier. We should also utilise the academic institutions depending upon the special expertise residing therein. For this, the government may permit entrustment of such assignments on negotiated basis.

CONTRACTORS AND CONCESSIONAIRES

i. Thanks to the push given by the World Bank and the Asian Development Bank since the mid-1980s, the contracting industry in the road sector has responded reasonably well in terms of mechanisation and acquisition of professional site engineers and project managers. However, the sheer increase in volume and size of projects being offered by the government in the road sector has created several challenges and constraints in this industry. Major constraints relate to poor productivity and substandard quality due to non-availability of skilled construction workers, and equipment operators and site supervisors. Both the government and the construction industry need to address this concern. Advantage should be taken of the skill development initiatives being launched by the Government of India to assess the magnitude of requirements of the road sector and consider a three-pronged strategy—at the vocational level through industrial training institutes, at the diploma level through polytechnics, and at the state level through setting up construction academies. For the latter, an excellent initiative has been taken by the government of Andhra Pradesh. The National Academy of Construction set up in Hyderabad is a joint effort of the state government and the contractors' association. For financing the academy, an amount of 0.25 per cent is deducted from the bill of every contractor in the state and earmarked for the functioning of the academy. The contractors' association has developed the campus and road agencies depute their senior level officers in managing the affairs of the academy. Such an example needs to be multiplied in other states.

Study tours should be undertaken both within the country and abroad to raise awareness among staff about good national/ international practices.

ii. Another area that holds promise is promoting the concept of equipment bank. Private entrepreneurs could venture into this arena and provide equipment to small and medium-sized contractors on lease/hire.

iii. There is need to recognise that contractors and concessionaires are partners in progress. The road agencies also need to provide proper environment for their performance. Various approvals/decisions are required at various stages of the project. A healthy deci-

An area that holds promise is promoting the concept of equipment banks. Private entrepreneurs could venture into this arena and provide equipment to small and medium-sized contractors on lease/ hire.

sion support system and dispute resolution mechanism would contribute a great deal in improving the performance of the contractors and the concessionaires.

iv. The senior and middle level staff of the contractors should also avail of the training facilities of the central and state government for enhancing their capacity and capability.

FINANCING FOR CAPACITY BUILDING

A provision of one per cent of the total road investments should be earmarked for capacity building of the stakeholders involved and technology innovations in the road sector.

RESEARCH, DEVELOPMENT AND TECHNOLOGY INITIATIVES

There is an urgent need for a quantum jump in the R&D and technology upgradation effort in the road sector covering pavements, bridges, tunnels, safety and traffic management for knowledge acquisition and knowledge development in our own context and situation. R&D vision and strategy need to be developed for the next 20 years by the Highway Research Board with support of MoRTH, MoRD, MoUD, CRRI, NHAI, NRRDA, BRO, state governments, academia and regional research centres.

The R&D schemes having immediate practical relevance in the context of the initiatives of the government to develop the road sector in the country needs to be taken up on priority. In this context, consideration needs to be given to evolving country-specific highway capacity manual, models for prediction of pavement performance with traffic, distress diagnostics of bridges and strategies for maximising use of locally available marginal materials including recycling of existing pavements and promoting use of industrial waste materials and by-products where found useful.

The equipment industry should sponsor and support research in development of technologies for accelerated construction of bridges, tunnels, flyovers, etc., and increased mechanisation in maintenance operations.

Centres of Excellence should be created on different aspects of roads and road transport including safety in IITs, NITs, other engineering institutes and IIMs to accelerate the research and capacity building activities.

The government should promote transfer of proven R&D technologies from lab to land through well-considered pilot projects for implementation by BRO, NHAI, NRRDA, state PWDs and SRRDAs, etc. At pilot stage of testing performance, a liberal view would need to be taken of some unintended non-performance or failure of such pilots, with of course a laid down mechanism for supervision and monitoring during execution.

PRIVATE FINANCING INITIATIVES

The Government has put in place a sound policy, institutional and legal framework to deliver the NHDP and state highways upgradation projects. This includes a menu of fiscal and financial incentives to enhance commercial viability of road projects. However, it is time to undertake case studies of a few PPP projects on a random sample basis to draw lessons for future projects. Such a study should include dialogue with the concessionaires, contractors, consultants, financing institutions and road agencies.

The government would do well to stop the policy of undertaking projects through BOT (Annuity) Model as it is not a sustainable option. Where this mode of delivery is proposed, these should be a cap say 15 per cent of the annual budget to defray contingent liability year by year. Further, such projects should be subjected to rigorous value-for-money analysis and compared with public sector delivery option.

One area of concern that the Committee noted relates to the undue haste in award of such projects without bringing under control the pre-construction activities covering land acquisition, rehabilitation and resettlement of people affected, environment clearances, shifting of utilities.

Support of state governments would be needed for effective control on ribbon development along the high-density corridors.

ROAD TRANSPORT

The Motor Vehicles Act is in need of amendment to respond to the demand of road transport for the current century. The Sundar Committee has suggested the needed amendments. These need to be carried out.

Freight transport being the backbone of the economy, apart from reoptimisation of the modal mix between road and rail, transhipment facilities by way of transport nagars and synchronisation of short haul movement by road and long haul movement by rail for both import and export cargo through containers would be required.

For modernisation of trucking industry, continued emphasis is needed for higher energy efficiency and lower emission levels with suitable incentive structure for multi-axle vehicles. Further, the industry is controlled heavily by intermediaries who need to be brought under the purview of regulation. The thrust has to be on the seller of services. The trucking industry is also characterised by low levels of technology. A strong link needs to be forged between profitability and technology. Financing for acquisition of modern trucks should be more liberal.

Use of Intelligent Transport Systems can significantly enhance regulatory processes and streamline seamless movement in inter-state movement of commercial vehicles. Advantage should therefore be taken of such technologies so that once a vehicle is inspected and cleared at the origin state and the information is electronically transmitted to other states along the proposed trip, there is seamless travel. The commercial vehicle should be treated as mobile infrastructure since they are carrying the economy on wheels. All efforts should be made to improve the productivity of these precious assets.

The Inspection and Certification regime practised by the State Transport Departments should be modernised to reduce human intervention and it should gradually cover all motorised vehicles, not just commercial vehicles.

There is need to establish collection centres for end-of-life vehicles to retrieve scrappage material as this would ultimately help in considerable energy savings.

Passenger transport services in rural areas are still lacking and this requires a special focus of the State Transport Departments. Possibility of PPP needs to be explored by providing viability gap funding to the private operators for such services.

The Motor Vehicles Act is in urgent need of amendment to respond to demands of road transport for the 21st century. The suggested amendments are with the Government.

Information and communication technology needs to be used to improve operational performance of road transport including traffic management, electronic toll collection, vehicle tracking, overloading control and 'aam aadmi' interface with the transport administration.

ROAD SAFETY

It is essential that a new paradigm for road safety is adopted wherein all stakeholders—legislators, administrators, engineers, contractors, police, transport department, road users acknowledge the role they must play in ensuring road safety. Safety engineering measures should become an integral part of road design and construction.

The wide-ranging recommendations of the Sundar Committee on road safety and traffic management should be implemented by the government on a priority basis to contain the accident situation which is going from bad to worse.

GOVERNANCE

There is need for enhanced governance to improve quality of contract agreements and contract administration to achieve higher performance levels in delivery of road programmes and projects rather than a separate regulatory body. Nowhere in the world is there a regulator for the road sector. However, the Model Concession Agreement, construction and EPC contracts should not be static documents. Rather, they should be live documents, being modified based on feedback or learnings from projects being implemented.

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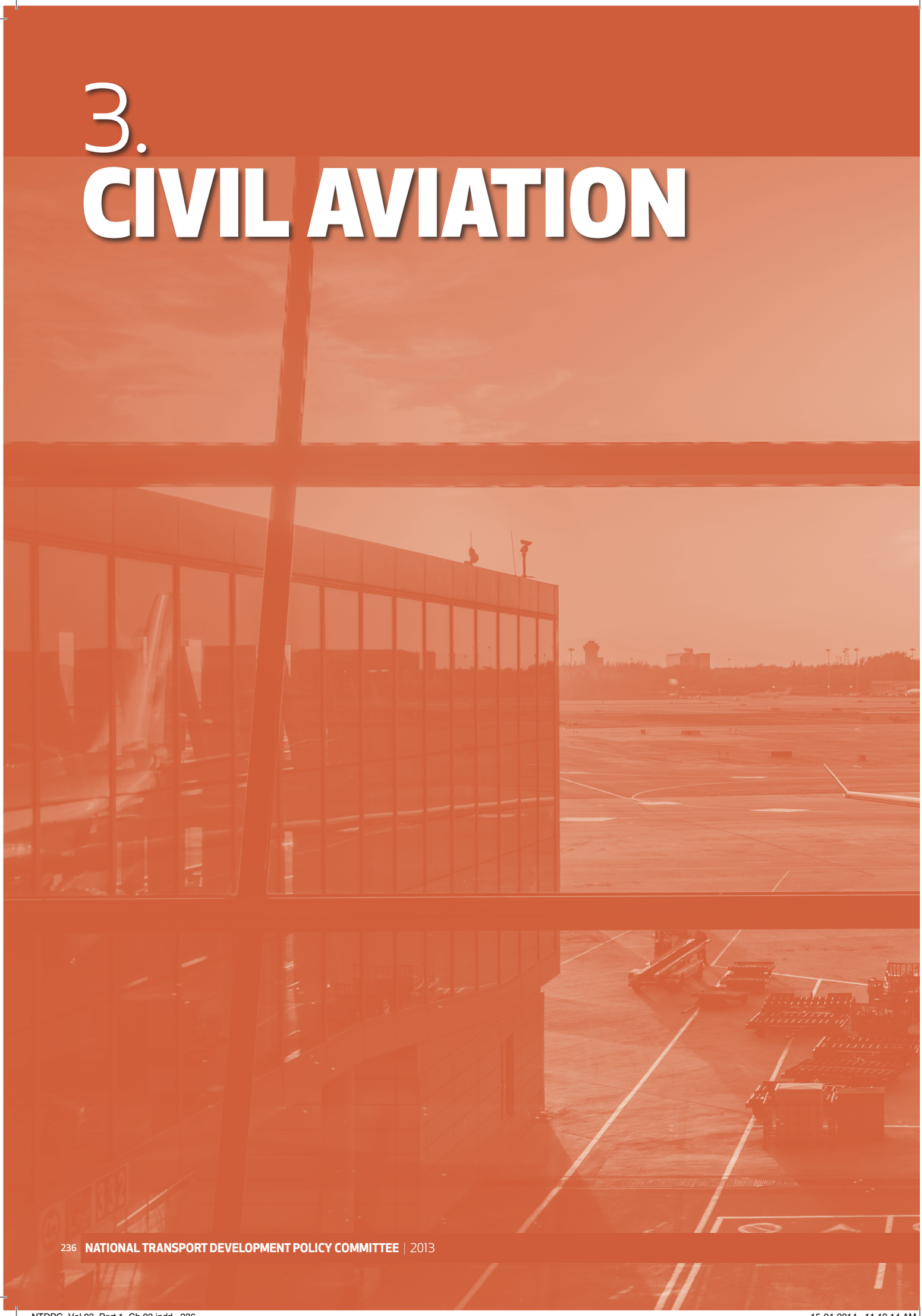
3. CIVIL AVIATION



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3. CIVIL AVIATION

If the path outside one's home provides the basic means of accessibility to the outside world, then aviation services are, for the most part, at the other end of the connectivity spectrum: they allow faster travel to more locations than any other transport mode.

Via an aircraft, Indians of certain means access leisure, education and business opportunities across the country and around the world. Destinations that were only diversions for the daydreaming mind a generation ago are now within ready reach of millions of urban Indians. The aircraft continues to moderate the financial, physical and emotional transaction costs of studying at a foreign university, or of spending several years employed overseas. Inbound tourism, reliant almost entirely on civil aviation, has brought a great fillip to the travel industry, served as an important source of foreign exchange, and provided much needed impetus for the preservation of country's natural and cultural heritage.

Domestically, the idea of the 'day trip' has entered the vernacular: managers and officials routinely access nearly every part of India in under three hours for a meeting. Closer ties between hinterland factories and mines, and urban head offices allow for greater business efficiencies. Aviation makes possible the shipment of fresh flowers from the Himachal and fresh fish from Kerala to wherever they will command the highest price. It allows firms to rationalise production and storage costs by sourcing intermediate components as required. Aviation has come to form the cornerstone element of time-sensitive logistics services.

Even so, air travel is not simply a means for going further, faster. The aircraft opens up the world at a more fundamental level. It allows wider first-hand exposure to and dissemination of new ideas. Where forbidding terrain or sparse populations cause certain regions to be un-served or underserved by road and rail, the aircraft can prove to be the most financially judicious and perhaps environmentally-friendly means of providing basic connectivity.

In short, by compressing the time between origin and destination, the aircraft is the basic engine of the modern globalised world. It has expanded the world by shrinking it. As India seeks to grow its economy at the desired rates over the next 20 years, the careful nurturing and expansion of the aviation sector will be of the utmost consequence.

In 2012, more than 2.9 billion passengers travelled by air worldwide, a figure that was 5 per cent higher than the previous year[1]. At one end, passengers took flights that hopped across islands in no more than five minutes. At the other, they stayed aloft in giant airliners for the better part of a day before arriving at destinations on the other side of the world. They flew on low-cost carriers that offer ever more innovative revenue generation and pricing mechanisms, allowing more people to make their very first flights. They also flew on legacy full-service carriers with the promise of the traditional courtesies and pleasures of a baggage allowance, a hot lunch, and a movie. Passengers were offered more choices of destinations on more airlines than ever before. Against this, they had to contend with crowded and inefficient airports, sub-optimal routings, increasingly stringent security arrangements, and airfares bloated with fuel surcharges and a laundry list of taxes.

Air travel is not simply a means for going further, faster. Where forbidding terrain or sparse populations cause certain regions to be unserved or underserved by road or rail, air travel can be the most financially judicious means of providing connectivity.

Meanwhile, the 51 million tonnes of cargo transported by air in 2012 were a small decline on the volumes of previous years, a reflection of recent anaemic growth in the world economy. That said, facilities for processing airfreight have continued to be designed and implemented at rapid rates. Logistics firms and freight forwarders have built dedicated hubs at

1. ICAO (2012).

major world airports to process cargo. Governments have lent a hand by installing dedicated customs and clearance facilities for both exports and imports, and by minimising the times required to remove cargo for onward transhipment. The net result of these movements of passengers and freight is an aviation business that directly supports over 8.4 million jobs and generates $539 billion in worldwide GDP[2].

Over time, the aviation sector has continued to restructure and consolidate, with a number of mergers taking place. The aftershocks of the government's directive for Air India and Indian Airlines to merge are still being experienced.

In 2011-12, the Indian civil aviation sector provided the means for transporting 122 million domestic and 40 million international passengers as well as 807 million metric tonnes of domestic cargo[3] and 1,460 million metric tonnes of international cargo. Over the 11th Plan period, domestic passenger movements have grown at 11.5 per cent per annum, and international passenger movements at 9.5 per cent. International freight traffic has grown at 7.5 per cent, somewhat slower than the domestic freight growth rates of 8.8 per cent. (All multi-year growth rates are compounded annual rates.) These strong growth rates have occurred during a period of relative weakness for the Indian economy, at least when compared with the previous Plan period. As the economy returns to growth rates of more than 7 per cent, as expected over the long term, the demand for passenger and freight aviation services will climb at rates in excess of those noted here. These growth rates mandate renewed emphasis on encouraging public and private investment in airport infrastructure, and in creating sensible policies that promote the growth of a competitive but stable aviation network.

INDIAN AVIATION: A SHORT HISTORY

Less than eight years after the Wright brothers' 12-second airborne adventure in 1903 on a wood-and-cloth contrivance at Kitty Hawk in the United States (US), the first aircraft was flying over Indian airspace[4]. Many of these early airplanes were recreational, the preserve of interested, wealthy and often ingenious amateurs. Mail services and ad hoc passenger air services quickly followed. By 1932, the serially enterprising firm of Tata Sons had set up an airline to deliver mail under a government contract. The government would eventually become an equity partner in the airline in 1946, with a rebranding to Air India the same year. Air India's first international service, from Mumbai to London, followed in 1948. At the time, nine operational airlines provided a simple patchwork of scheduled and charter air services.

With the passing of the 1953 Air Corporation Act, the assets of each of these were subsumed into the creation of two new state-owned enterprises: Air India International and the Indian Airlines Corporation. The Act, which prohibited any party other than these two corporations from operating scheduled air transport services to, from or within India, effectively gave monopoly rights to Air India and Indian Airlines. Monopoly outcomes being what they are, air services remained undersupplied and overpriced for much of the post-Independence period. Apart from the US, many countries followed the state-owned flag-carrier model for their airlines, for security and diplomatic reasons as much as any others. This eventually led to the complex system of bilateral landing rights negotiations that persists to this day.

For the next several decades, the history of Indian aviation is synonymous with that of Air India and Indian Airlines. Between the two, Air India fared substantially the better, cautiously expanding its route network to South-East Asia, the Middle East and Africa, Europe and the US. An aggressive programme of fleet modernisation resulted in it being one of the first airlines to enter the jet age. New equipment combined with a distinctly Indian emphasis on warm hospitality delivered a stellar reputation for Air India.

Meanwhile, Indian Airlines, being the slightly uncomfortable melange of eight parent post-Independence airlines, never quite bedded operations down into an efficient and profitable domestic network. It was hindered in this task by a government mandate that required it to provide service to unprofitable destinations, poor airport infrastructure outside the major metropolitan centres, an unfortunate selection of aircraft in the fleet that were variously susceptible to malfunctions or unsuited to the demands of the network, and complications arising from various regional security skirmishes.

The Indian airlines did not prove immune to the oil shocks of the 1970s. Elsewhere, the massive losses sustained by the sector paved the way for deregulation and private competition from the late 1970s onwards. In India, the airlines were rescued through a series of capital injections and soft loans intended to stave off bankruptcy. Problems were compounded by several waves of labour unrest and strike action.

2. ATAG (2012). The same study calculates the total impact of aviation, including indirect and catalytic effects, at $1.4tn with the support of 22m jobs.
3. AAI Traffic News, March 2012.
4. The Ministry of Civil Aviation commemorated the centenary of aviation in India on 18 February 2011. A hundred years earlier, Henri Piquet had purportedly carried 6,500 pieces of mail 13 km from Ahmedabad to Naini on a Humber biplane.

In 1986, the government began to allow private airlines to operate charter and non-scheduled services under the Air Taxi Scheme, according to which private carriers could transport passengers but were not permitted to publish time schedules or issue physical tickets to passengers. Nonetheless, the introduction of the Air Taxi Scheme was intended to enhance domestic air services, thereby providing a boost to (largely domestic) tourism and a small measure of competition within the existing monopoly market. The result was that a number of private players—many of which would ultimately become full private airlines—began operations as air taxi operators. Among these were Air Sahara, Jet Airways, Modiluft and East-West Airlines.

In March 1994, the Government of India repealed the Air Corporation Act and opened the air transport sector to private players, subject to the fulfilment of certain statutory requirements. And in 1997, additional measures were taken to further remove barriers to entry and exit in the domestic aviation sector, as the government relaxed requirements placed upon prospective entrants and began to leave more decision making authority (e.g., choice of aircrafts and fleet size) to individual operators. By 1997, four airlines that had begun taxi operations following the 1986 deregulation were in business as full-service scheduled carriers.

The entry of low-cost carriers into the market marked a watershed moment that dramatically altered India's aviation sector. In 2003, Air Deccan, India's first low-cost carrier, entered the domestic market, creating a new form of competition within what was, at the time, a highly-concentrated industry comprised mainly of Indian Airlines, Air Sahara and Jet Airways.

Following that initial shake-up of the competitive landscape, other carriers appeared. In 2005, Kingfisher launched its business together with three low-cost carriers in Go Air, Paramount and SpiceJet. The following year, IndiGo entered the market, going on to become the largest domestic airline in India. In short, these changes have significantly altered the market structure and made air travel gradually more affordable. This phenomenon, coupled with India's growing middle class and economic successes in the decade to 2011, led to significant passenger traffic growth. Moreover, market changes have brought with them other customer-friendly developments, including the Advance Purchase Fare pricing strategy, which has resulted in discounted fares, promotional offers and the steady introduction of flights to new domestic and international destinations. The co-existence of full-service and low-cost carriers has provided greater choice and made air travel more affordable to a broader section of India's population.

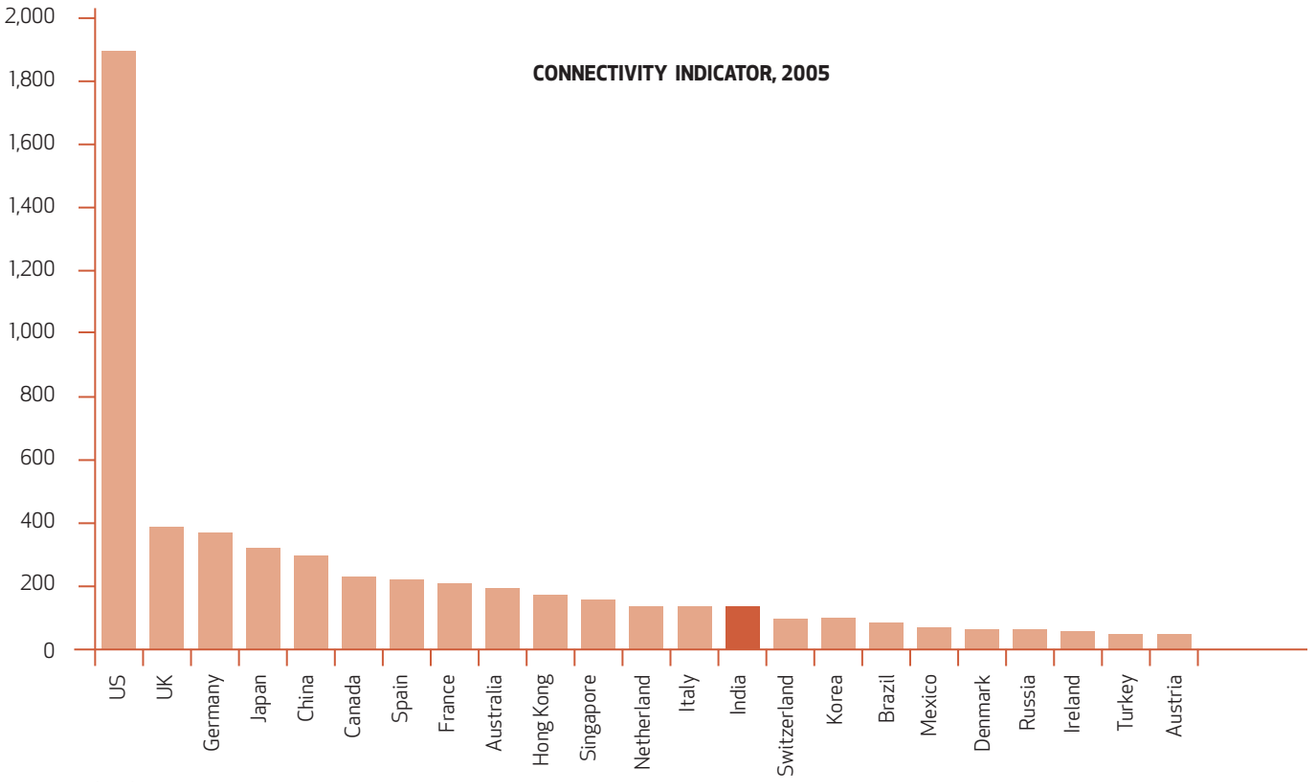
Under the Air Cargo Open Sky Policy, airlines, foreign and domestic, were allowed to operate cargo services to or from any Indian airport with customs facilities. The existing regulatory regime over cargo rates for major export commodities was also abolished.

Over time, the sector has continued to restructure and consolidate, with a number of mergers taking place. The aftershocks of the government's directive for Air India and Indian Airlines to merge are still being experienced, with the combined entity lurching from one precarious debt position to another. Meanwhile, the full-service airline Kingfisher's ill-considered merger with the low-cost Air Deccan seems only to have resulted in an airline uncertain of its position and strategy, and for which it appears to have paid the ultimate price. For a while, the most successful of the mergers was that of Jet Airways with Air Sahara. By mid 2012, however, the new Jet Airways also found itself struggling to compete in a difficult market.

In the 1980s, the Indian economy grew at over 5 per cent annually but suffered from continual shortages of international air cargo capacity, which quickly became a key obstacle hindering the industry's ability to enhance export and foreign currency exchange earnings. Following the announcement of the government's industry-wise 'economic disengagement' policy in 1990, the Air Cargo Open Sky Policy was adopted initially for three years and thereafter permanently. Under this policy, any airline, foreign or domestic, that met certain operational and safety requirements, was allowed to operate scheduled and unscheduled cargo services to or from any Indian airport with customs facilities. Additionally, the Air Cargo Open Sky Policy abolished the existing regulatory regime over cargo rates for major export commodities, enabling carriers to begin setting their own rates. The government also relaxed restrictions on foreign airlines operating mixed passenger and freight aircraft, allowing additional passenger flights into India, and further liberalised domestic air taxi operations and the rules on international tourist charters. To make these changes, the government did not require reciprocity from bilateral partners for Indian carriers.

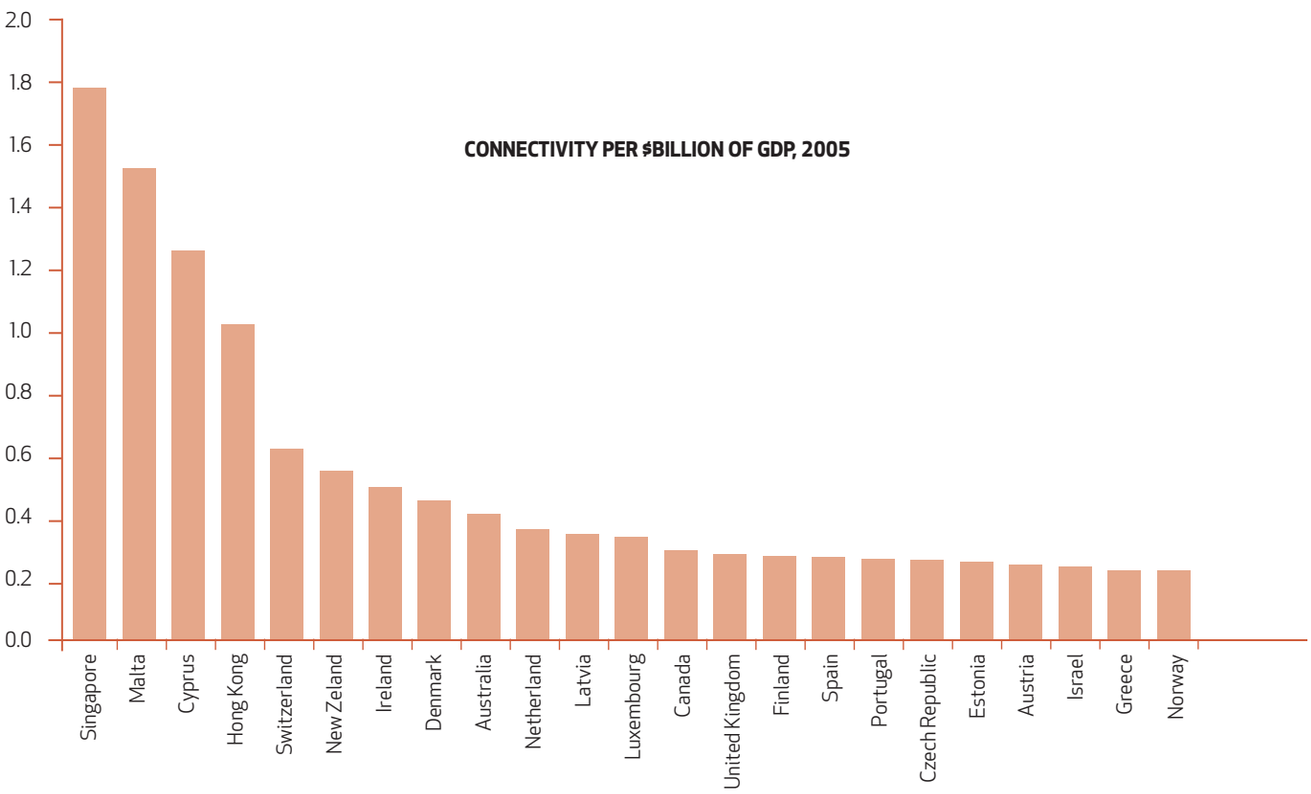
In the 1990s, when sector deregulation permitted private carriers to begin flying domestic routes—initially as air taxis and thereafter, as scheduled airlines—the government initially permitted up to 40 per cent foreign direct investment in scheduled air carriers, including by foreign airlines. For example, Gulf Air and Kuwait Airways held a 20 per cent stake each in Jet Airways, providing the young airline with much-needed access to both managerial

Figure 3.1
IATA Index of Air Connectivity (2005)

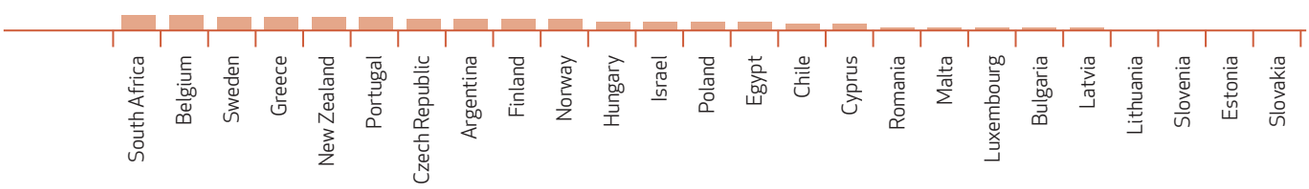


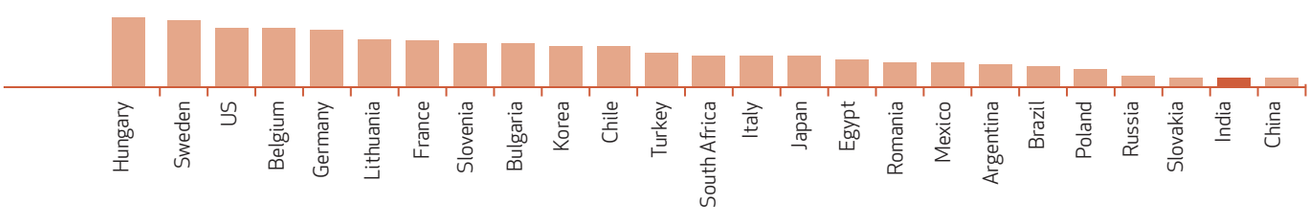
Source: IATA (2007).

Figure 3.2
IATA Index of Air Connectivity, Adjusted for GDP (PPP), (2005)



Source: IATA (2007).





It is fair to claim that the deregulation, liberalisation and eventual democratisation of civil aviation have made a seat on an aircraft accessible to more global citizens, and latterly to Indians, than ever before.

and technical expertise as well as international passenger feed.

However, these benefits were short-lived: in 1996, the Government of India announced that foreign airline shareholdings were not in the best interest of Indian carriers and would thus no longer be permitted. At the time, the government's stated primary concern was that local private carriers were still very small and thus, there was a significant risk that foreign airlines would control these domestic carriers' development so as to feed their own offshore hubs, thereby relegating Indian airlines to the status of regional carriers and thwarting healthy development of the domestic civil aviation sector. Jet Airways thus had to buy back its shares from Gulf Air and Kuwait Airways, and the government reasoned that foreign airline investment restrictions would ultimately be lifted when domestic carriers were robust enough to negotiate as equals with potential investors. But over time, a combination of factors—poor economic conditions, looming security concerns and the ever-present question of how relaxed foreign airline investment restrictions would affect Air India—kept the restriction intact, until it was finally lifted in September 2012. A detailed analysis of this recent regulatory revision follows in a later section.

INDIA'S AIR CONNECTEDNESS

Around the world, air travel was the preserve of the wealthy and an elite few only a generation or two ago. Until the dawn of jet age, any necessary intercontinental journeys were made by ship or not at all. Ocean-going liners did not give up their domination of transatlantic passenger traffic to airlines until the early 1960s. And passengers who chose to board an aircraft, paid handsomely for the privilege of dramatically shorter transit times. Various estimates suggest that real airfares have declined by well over two-thirds since the first waves of deregulation of the airlines in the 1970s. For example, in 2012 dollars, the heavily trafficked and competitive New York-London route was around $3,200 in 1970 and $800 in 2012[5]. Leaving aside any hedonic adjustments for the changing quality of service over the ages (in either direction), the relative affordability of modern-day air travel is made starker by considering airfares as shares of income: the same New York-London airfare was 14 per cent of US per capita GDP in 1970. By 2012, this had declined to less than 2 per cent. A similar story can be told in the Indian context. Civil aviation was very much considered a 'luxury for the few' (and taxed as such) with rail being the de facto choice for domestic long-distance passenger travel.

It is fair to claim that the deregulation, liberalisation and eventual democratisation of civil aviation have made a seat on an aircraft accessible to more global citizens, and latterly to Indians, than ever before. The impact of civil aviation on general economic activity is well-documented. An expansive and efficient aviation sector contributes significantly to a nation's economic development, generating both direct and indirect employment opportunities and simultaneously facilitating better productivity and efficiency in the manufacture and movement of goods and services. Since many of these benefits derive from the connectivity of an economy with its trading partners, it is useful to begin an examination of the economic impacts with an assessment of the present state of connectedness.

Aviation has improved India's internal and external connectivity by providing cheaper, more frequent, more reliable, and otherwise better transport service between many cities. According to the International Air Transport Association (IATA), the slightly nebulous concept of aviation connectivity is defined as a measure of both the number and the economic importance of the destinations served from a country's airports, the frequency of the service to each destination, and the number of onward connections available from each destination[6]. As such, this indicator is qualitative, measuring the relative importance of the destinations served rather than being purely monotonic with the number of destinations served, and the frequency of service[7]. Though the index is somewhat dated, the important point drawn from a comparison of Figure 3.1 with Figure 3.2 is that though India may be seemingly well-connected in terms of the number and importance of destinations served (a fact that will have only gained further credence in the ensuing years), connectivity is still relatively low when this is adjusted for the size of the Indian economy[8].

Arvis and Shepherd deployed a technique derived from gravity models of trade to create an Air Connectivity Index for the World Bank[9]. These models

5. NTDPC calculation based on official CPI series and historical data from OAG.
6. IATA (2007, p. 16).
7. The relative importance of a destination is defined in terms of the economic influence it exerts on the rest of the world, i.e., in terms of its GDP.
8. A 2009 update of the index (with a UK-centric focus) shows that India's air connectivity relative to GDP on a PPP basis improved between 2005 and 2009, with a higher rank than Venezuela, Poland and Russia. Over the same period, China improved its ranking from the bottom-of-the-table to nearly mid-table, with a ranking superior to that Brazil, South Korea, France and Turkey.
9. Arvis and Shepherd (2011).

Table 3.1
International Air Connectivity Index, Calculated for 201 Countries

RANK	COUNTRY	INDEX
1	United States	22.7
2	Canada	13.4
3	Germany	12.1
7	France	11.6
8	United Kingdom	11.6
44	Australia	5.9
46	China	5.7
88	India	3.8
125	Brazil	2.7

Source: Arvis and Shepherd (2011).

directly address the networked nature of the air transport industry. They defined a country's connectivity to be synonymous with its importance as a node within the global air network, thereby better capturing the hub-and-spoke nature of modern air networks. As they write, 'when a country is considered to be better connected, the stronger is the overall "pull" it exerts on the rest of the network. A country's connectivity score is higher if the cost of moving to other countries in the network is relatively low. It is considered to be less well-connected if the dispersion of these costs is high'[10]. In short, the greater the number of direct links that a country will have to other countries, and the higher the frequency of those links, the better the country's connectivity score. Their approach also uses realistic cost functions that accurately model the cost, technology and policy environments that airline managers face in planning route networks. The limitation is that the index only measures international connectivity. Arvis and Shepherd calculated the Air Connectivity Index for 201 countries in 2011; Table 3.1 presents results for a select sample.

The comparisons of the top two ranked countries offer an illustrative example in understanding air connectivity. The US, with roughly 10 times the population of Canada, has proportionately more international traffic. However, the assessment of Canada's connectivity is boosted by the fact that most cities have extremely strong air links with several major US hub airports, from where these cities can access the world. In similar fashion, India's connectivity is boosted by the high frequency of its links with the largest international hub airports (such as Singapore, Hong Kong, London, and the Gulf airports of Dubai, Doha and Abu Dhabi), which then provide it with one-stop access to a substantial majority of the world's important cities.

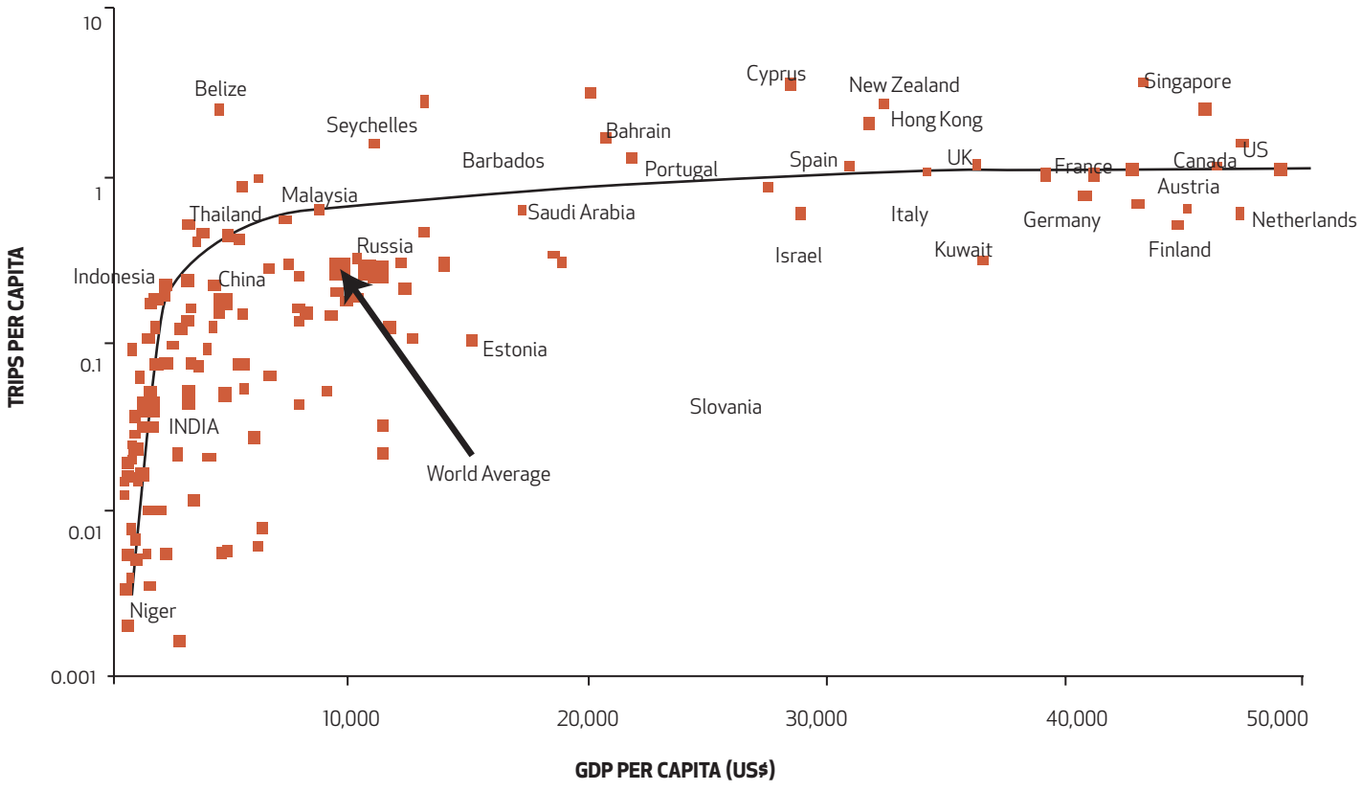
To sum up, India's connections with the world rely primarily on the strength of excellent links with regional hubs—and therefore, exhibit a marked dependence on overseas infrastructure and service providers. Connectivity is low by international standards, relative to the PPP-adjusted size of the economy. Finally, there has been little formal analysis on the changes in internal connectivity that have been achieved over the years.

THE ECONOMIC IMPACT OF AVIATION

The overall effects of this connectivity can be measured in terms of the easier access provided to more markets, efficiency improvements, and greater domestic and international competitiveness (see Figure 3.4). By connecting businesses with a wider

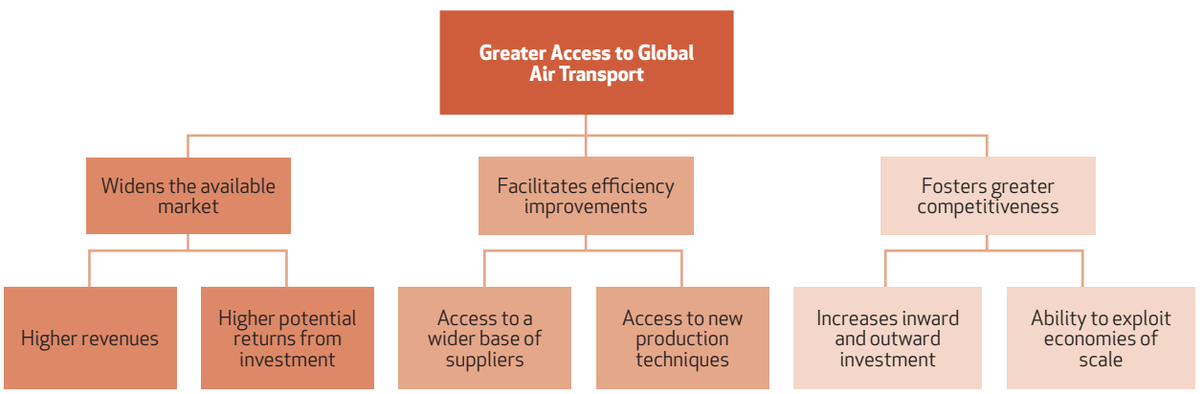
10. Ibid. (p. 3). These results mean that a spoke country with a strong connection to another country cannot be considered to be well-connected. A regional hub with strong connections to a moderate number of destinations receives an intermediate connectivity score, since the costs are relatively dispersed across the remainder of a network. Finally, a global hub with strong connections to many countries in the network receives a relatively high score.

Figure 3. 3
Travel Markets at Different Stages of Development



Source: IATA (2011).

Figure 3. 4
The Wider Economic Impact of Connectivity



Source: IATA (2009).

range of global markets, and expanding the customer base, air transport allows for higher revenues and higher returns from capital deployed. These benefits are particularly relevant for sectors that manufacture products with high values-to-weight, and for those shipping time-sensitive goods. By expanding the customer base, air transport allows companies to exploit economies of scale and to reduce unit costs. By exposing domestic companies to increased foreign competition, it also helps to drive efficiency improvements among domestic firms in order to remain competitive.

Several industries rely on air transport to operate their just-in-time production operations, providing greater flexibility within their supply chains. Costs are controlled from a reduced need to hold stocks of supplies. Extensive air transport links facilitate effective networking and collaboration within and between firms located in India and abroad. Access to a greater number of markets also encourages greater spending on research and development by companies, given the increased size of the potential market for future sales.

'Improved connectivity gives Indian businesses greater access to foreign markets, encouraging exports, and also increases competition and choice in the home market from foreign producers. It encourages firms to specialise in areas where they possess a comparative advantage. Where firms enjoy a comparative advantage, international trade provides the opportunity to better exploit economies of scale, driving down their costs and prices, benefiting domestic consumers in the process. Opening domestic markets to foreign competitors can also help reduce unit production costs, either by forcing domestic firms to adopt best international practices in production and management methods or by encouraging innovation. Competition can also benefit domestic customers by reducing the mark-up over cost that firms charge their customers, especially where domestic firms have hitherto enjoyed some shelter from competition'[11].

PRODUCTIVITY IN THE AVIATION SECTOR AND GENERAL IMPACT

Relative to other spheres of economic activity, the sector exhibits relatively high levels of labour and multi-factor productivity. The productivity increases have come from the use of better technology in the form of more efficient airframes and engines, better regulatory policy that allows more airlines to use more innovative pricing regimes, better operating practice that results in faster turnaround times at airports, and so forth. In short, as in other industries, all productivity improvements can be traced to changes in technology, worker skills, institutional factors, capital utilisation and economies of scale.

Moreover, the international and relatively fungible nature of the business, personnel, and equipment—compare planes with trains and automobiles—means that productivity gains quickly filter across national boundaries. For example, better engine technologies developed offshore are quickly made available for export. (The same handful of manufacturing companies provide the aircraft deployed throughout the world.) Best practice standards or regulations set for one jurisdiction are necessarily or voluntarily adopted by the entire industry and by other jurisdictions. Safety protocols set by the Federal Aviation Administration of the United States or environmental restrictions placed by European authorities may indeed only apply to aircraft and airlines flying into and out of these regions. However, their influence, which derives from the size of their markets, means that these protocols quickly become de facto global standards. Meanwhile, improvements in the competitiveness of foreign airlines force local carriers to improve their practices, at least in the markets that they compete directly with these foreign airlines. These improvements then naturally filter into domestic markets. In summary, the aviation sector is productive, and is also a sector where several types of productivity differentials cannot be expected to persist for long. (Of course, the efficient migration of productivity improvements across borders also depends on a prevailing regulatory environment that must be receptive to these improvements.)

Improvements in aviation productivity have raised productivity in almost every sector of the economy, from manufacturing to retail, tourism to agriculture.

The improvements in aviation productivity have also served to improve productivity in almost every other sector of the economy, from manufacturing to retail, from tourism to agriculture. This improvement in productivity in firms outside the aviation sector comes through two main channels: through the effects on domestic firms of increased access to foreign markets, and increased foreign competition in the home market, and through the freer movement of investment capital and workers between countries.

This last point is an important, though less visible, avenue by which aviation and the industry's productivity influences economic productivity more generally, through the marginal productivity of capital. Access to extensive air transport links allows domestic firms to identify and manage investments in foreign assets and encourages foreign firms to invest in the domestic economy. Firms can make better investment decisions in offshore locales by undertaking first-hand due diligence and by monitoring their investments in physical plant and equipment more

11. Oxford Economics (2011, p. 10).

easily. In essence, the liberalisation of aviation enables the full flowering of the benefits of financial liberalisation. Capital can be more easily directed to its best use. For India, this will prove ever more important in the decades to come as it seeks to attract increasing amounts of foreign capital and as more Indian companies attempt to expand their operations overseas.

More than a whiff of precariousness prevails in the sector, with most airline balance sheets failing to register profits over multi-year periods.

OVERALL EFFECTS

Improved air transport has contributed to rapid growth in India's international trade in recent decades by offering a faster and more reliable method by which to transport products and personnel across long distances. In particular, high-growth sectors are heavily dependent on aviation, and it is essential that India's aviation industry continue to expand if the economy hopes to reap the full benefits of future foreign trade and investment expansion.

Air transport has contributed to rapid growth in international trade, offering rapid and reliable transportation to move products and individuals across long distances. Civil aviation has also played a vital role in tourism: in 2012, approximately 90 per cent of the 6.6 million foreign visitors to India arrived via air[12]. According to Oxford Economics in a study for the IATA, in 2009 the aviation sector directly contributed approximately 0.5 per cent to India's GDP and 1.5 per cent if the indirect effects are included[13]. The direct impact stems from the output of the aviation sector itself—airlines, airports, ground services and fees accruing to the government for the management of India's airspace. The indirect contributions to GDP arise from the aviation sector's supply chain and from the spending of those employed directly and indirectly by the industry[14]. The same study also reckons that in excess of 1.7 million high-productivity jobs are supported by the aviation sector, with 276,000 directly engaged in the provision of aviation services.

In the last 20 years, India's air cargo traffic has witnessed an average annual growth of 8.6 per cent. The entry of leading private air cargo companies into the Indian market has brought with it a wave of increased automation, mechanisation and process improvement initiatives at major air cargo terminals. That said, there is still a great deal of work to be done. The average weight load factor of air cargo over the previous five years was approximately 62 per cent, reflecting significant unused capacity. Generally speaking, air cargo has not been able to grow at the same pace as other cargo transport modes (notably marine cargo). The five-year CAGR for air cargo (approximately 11 per cent) is lower than the growth rate of India's overall exports and imports, which grew by approximately 15 per cent and 18 per cent respectively over the same period[15].

Similarly, India's current proportion of air cargo (relative to cargo overall) is low versus other developing nations, and total air cargo volume for all Indian airports still pales in comparison to a number of individual airports, both within the region and globally (e.g., Hong Kong, Incheon, Shanghai, Paris and Anchorage). That these individual airports handle more cargo annually than all Indian airports in aggregate reflects tremendous growth potential for India's air cargo sector, particularly in light of strong projected economic growth and rising exports.

THE MAJOR ISSUES

The past 20 years have brought dramatic changes to Indian aviation. More passengers are flying more often than ever before. New airlines are inaugurating new routes, both domestically and internationally. Prices have declined in both nominal and real terms generally, and a wide range of products is available at all service classes. Competition is rife, possibly even excessively so. Service frequency on the most popular metropolitan routes is in excess of 30 flights per day. Airports are being modernised and expanded with funding from both public and private sources. Safety standards at Indian airports and airlines are broadly at par with prevailing international practice.

Against this, the sector remains beset with problems and more than a whiff of precariousness prevails. Airline balance sheets and income statements are rickety, with most failing to register profits over multi-year periods. At various times, airfares have been considered to be unsustainably low or unjustifiably high, though the appropriate regulatory response is unclear. Passed under industry duress, new policies have reversed the long-standing injunction against foreign equity in domestic airlines. The cyclical wringing of hands over government subsidies to Air India, and the consequent effects on the industry, often results in little more than a fresh capital injection. Some issues have arisen regarding perceived high charges in some of the new private airports Amidst all this, the industry is hamstrung by a tortuous system of taxes, cesses, rules and regulatory

12. Ministry of Tourism (2012).
13. Oxford Economics (2011, p. 4).
14. The aviation sector's supply chain can be decomposed into the fuel, catering, repair and maintenance, ticketing and distribution, freight forwarding and aircraft financing activities sought by domestic airlines; into mineral products and composite hardware, and financial, technical and technological services sought by aerospace firms; and into the general requirements for finance and facilities management sought by firms that provide ground-based infrastructure.
15. NTDPC (2012, p. 53).

restrictions that are at odds with a sector that must necessarily be nimble and dynamic. This subsection provides summary snapshots of the most pressing issues confronting the aviation sector.

AVIATION AS PART OF A MULTI-MODAL TRANSPORT NETWORK

A fundamental recommendation of this report is that every decision on transport infrastructure should, ultimately, be able to be traced back to a sense of place and purpose within the wider transport network that is inclusive of all modes. Elsewhere, the report has argued for network-centric thinking in planning transport infrastructure. Relative to road, rail and other land-based transport modes, aviation is unique in that the network comprises only nodes—the airports. The arcs or paths between these nodes are typically just the shortest point-to-point distances subject to operational limitations.

Two major considerations apply towards ensuring aviation's place in the wider transport system. First, as with other modes, the efficiency of aviation and its contribution to social and economic welfare will be influenced by any policy that changes its cost or revenue structures. Second, at a more practical level, airports will function best as terminals if good land transport networks are available to quickly distribute passenger and cargo traffic to and from the region served by the airport. Depending on the size of the airport and the economic and demographic characteristics of the passenger traffic, these transport links may also include mass rapid transit options. The great advantages of air travel in terms of the savings in time that it offers will be muted if the air network does not cohere well with land-based transport. This is especially true for time-sensitive cargo.

CAPACITY ENHANCEMENT

As with other modes, the capacity of the air transport network depends on each of the component elements: the capacity of airport terminals to process arriving and departing passengers, and to provide gates for aircraft; the ability of airlines to deploy more or larger aircraft at higher frequencies; and the efficiency of support provided by other transport networks, importantly roads. In turn these are dependent on more fundamental factors, including the productivity of the capital invested and of human resources, and on new technologies such as radar or navigation systems that permit aircraft to fly with narrower separations or in difficult weather conditions.

At present, a major limiting factor is the capacity of airports. Several of India's existing airports are already running at levels near full utilisation. There is a shortage of landing gates and areas for processing passengers are crowded. The crowding extends to the immediate airspace at peak times as aircraft circle awaiting a landing spot. Even some of the airports that have been recently expanded are projected to run into capacity issues within the next five years, necessitating further enlargement of terminal buildings or new secondary airports.

In spite of rapid growth, airport capacities remain constrained. The financial viability of the entire airline sector is in question. Adequate numbers of trained staff cannot be introduced to the sector. The economic regulation of airports has conspired to leave both airlines and airports dissatisfied with airport charges despite record traffic.

INSTITUTIONAL ARRANGEMENTS

The Ministry of Civil Aviation is the central authority for the regulation of aviation in India. The oversight of Air India is also ultimately the ministry's responsibility. Under the ministry, the Directorate General of Civil Aviation manages the day-to-day tasks of ensuring that airline operators deliver safe and reliable service. It is responsible for making, implementing and monitoring compliance with the rules of civil aviation, and for the certification of pilots, engineers and other staff. The Airports Authority of India (AAI) constructs, maintains and operates the bulk of India's airports. More recently, it is a minority partner in six airports that have been modernised and are now operated as joint venture partnerships with private companies. A separate Airports Economic Regulatory Authority (AERA) is responsible for regulating airport charges.

With many of the decisions being made at the central level, and with the bulk of funding for new infrastructure arriving from the central fund, aviation should present fewer complications relating to the institutional arrangements that govern the sector. However, problems are present on several fronts. Airport capacities remain constrained, as noted above. The financial viability of the entire airline sector is in question. Adequate numbers of trained staff cannot be introduced to the sector. The economic regulation of airports has conspired to leave both airlines and airports dissatisfied with airport charges despite record traffic.

Reforms required for the future should emphasise the streamlining of decisions taken by these authorities aided by clarifications as to their agenda, remit and powers. The institutions will need to be strengthened with the addition of substantial numbers of staff skilled in network economics and regulation, certification, safety, setting and implementing standards, finance, and law. Greater cooperation between the

The 'airport-as-hub' debate must carefully piece through the costs and benefits of developing global hubs versus focusing on developing the domestic market, or on developing regional and national hubs.

authorities, civic agencies, and the administrators of other transport modes should also be mandated.

MANAGING COMPETITIVENESS

In recent years, there have been severe doubts about the viability of many of India's operating airlines. Kingfisher has ceased operations, Air India has required equity injections from the government, and many of the others have failed to establish stable long-term financial outlooks. A number of causes can be attributed to this: the ultra-competitive environment that has forced fares lower and delivered compressed operating margins, the pricing of aviation turbine fuel, the lack of availability of skilled staff which has driven up salary bills, inflexible cost structures with respect to maintenance, a high and growing overhang of debt that was used to fuel recent growth, rupee depreciation, and challenging global and domestic economic conditions.

In this environment, regulatory agencies must walk a fine line between continuing to encourage industrial competitiveness to maximise consumer surpluses and ensuring that the competitiveness is not achieved at the price of unsustainable or irresponsible actions on the part of the airlines. It is important to ensure that the barriers to entry are not insurmountable for firms that clearly qualify on account of their financial standing or industry experience and expertise. It is equally important to manage the exit of airlines from the market with grace and efficiency so as to not impose negative externalities of these exits on the remaining airlines.

DEVELOPMENT OF INDIAN AIRPORTS AS NATIONAL, REGIONAL AND GLOBAL HUBS

The hub-and-spoke model is an established result from efforts at optimising airline networks. (That said, it is certainly not optimal under all circumstances.) Discounting speed and any technological restrictions, the fundamental advantage that air travel holds over other modes of transport is the capacity to connect any two points on a map directly. However, traffic between these two points may not be sufficient to warrant scheduling a flight between them. If, however, passengers originating from several other airports can be assembled at a third point, then enough concentrated traffic may evolve to justify air service between this third point (the hub), and the first two. By collecting traffic, hubs afford viable air service to more locations than if every route was strictly between origin and destination.

It is obvious that metropolitan cities serve as natural hubs. Their large populations and concentrations of economic activity serve to attract people and cargo shipments. In India, Delhi and Mumbai serve as national hubs, accepting passengers and freight from abroad and other parts of India, and then forwarding these elsewhere within the country. Regional aviation—that is, travel between two non-metro cities—has yet to fully blossom in India on account of insufficient demand, though this may shortly change on some sectors. Consequently, there are few regional hubs, though Kolkata may be reasonably considered as the gateway to the North East region.

The astonishing growth of the airlines and airports of the Middle East in recent years has been predicated on their favourable geographic location, with hundreds of destinations within reach of their home airports by modern aircraft. A major plan mooted to provide further impetus to Indian aviation is the promotion of an Indian airport as just such a global hub. The hub will serve to concentrate passengers from countries West of India, distributing them onto flights headed East and vice versa. This is considered especially enticing at a time that the balance of air traffic is expected to swing decidedly East, towards Asia.

However, there are fundamental differences between India and the entrepot airports of the Middle East and South East Asia that weaken the case for an Indian airport as a global hub. Chief amongst these is the massive latent home market for both domestic and international travel which stakes deserved claim to be the premier development priority. Hubs also require a dominant airline with an extensive international network; these airlines often require implicit or explicit state support. The debate must therefore carefully piece through the costs and benefits of developing global hubs versus focusing on developing the domestic market, or on developing regional and national hubs.

FUNDING

There are three issues on the funding of Indian airlines that immediately present themselves. With respect to Air India, it is necessary to frame a decisive policy of ownership on the government's part, and then setting a clear agenda for the airline. As with other State-owned enterprises, this agenda must not distort the market for privately owned competitors. Meanwhile, for these airlines, new rules on foreign ownership and operation of domestic airlines must be implemented. It must also develop careful regulations for assessing the stability of private equity and debt funding of domestic airlines, with a view towards promoting the overall financial health of the sector. Recent policy changes have made substantial headway in this regard (see section on foreign investment in Indian airlines).

Though most Indian airports remain under the government's direct funding and administrative purview through the AAI, a handful of the very largest airports—Mumbai, Delhi, Hyderabad, Bengaluru, Cochin and Nagpur—are now joint-venture enterprises with private sector partners. For the AAI-controlled airports, the challenge remains to operate airports in the public economic and social interest, but with due regard for commercial principles in general, and at a minimum, to be self-sustaining. To this end, each airport should be endowed with a set of operations goals and a development plan, have measurable targets by which performance can be gauged, and be encouraged to adopt transparent reporting processes. For joint-venture airports, the task before regulators and administrators is to devise proposals that attract participants with both financial resources and technical and expertise such that stable long-term ventures can be successfully negotiated.

PRICING

The newly competitive landscape of Indian civil aviation has resulted in periodic bouts of cuthroat pricing of airfares. This competition is to be welcomed from a consumer's perspective. Regulators, however, have found cause to pause in the suggestion that the pricing is unsustainable, and the losses sustained will drive some participants out of the market, leading to higher airfares in the long run. At other times, there is considerable evidence of pricing that is unjustifiably high at times of increased passenger demand, such as during the festival season. As in many oligopolistic situations, the regulatory burden is in encouraging competition, permitting sensible and efficient market entry and exit, while building up a sector that is robust to short-term shocks. As discussed in a later section, the regulatory rules on the pricing of airfares require substantial overhaul.

Meanwhile, there is scope for authorities to ensure that airport pricing regimes for landing charges, passenger services, cargo, parking and hangar space, and other items like security and noise-related charges, are fairly determined and transparently applied. At all airports, possibilities exist to raise revenues from non-aeronautical activities, including from restaurants and food service, car parking, and rentals for concessions, retail, banking and other services. For the joint-venture airports, the regulatory challenge remains to decide on a tariff schedule that begins with recognition of the monopolistic nature of airports, accurately reflects the cost base of the airport, and places an equitable cost incidence on all users of the airport.

The bills for aviation turbine fuel (ATF) represent around 40 to 50 per cent of a domestic airline's operating cost. With several state and central surcharges ranging from customs duties to central excise to service tax and VAT levied on ATF, prices for this fuel are some of the highest in the world. Prices for ATF retailed to airlines at Indian airports are between 50 to 70 per cent higher than in other regional hubs. Indian airlines have regularly cited this as the biggest cost disadvantage they face. The rationale for pricing fuel in the manner that it is needs to be revisited.

MANAGING THE ENVIRONMENTAL IMPACT

Compared with other modes of transport, the impact of aviation on the environment is relatively moderate in aggregate terms. However, this observation must be tempered by the fact that, proportional to the passenger- or tonne-kilometres (for freight) travelled, an aircraft is potentially the most environmentally-unfriendly mode of transport. The impact is compounded by the fact that the bulk of the greenhouse gas emissions from jet engines take place in the upper reaches of the atmosphere where they may have the greatest potential to cause the most environmental damage. It is important to note that the science establishing the net or relative marginal environmental impact is far from unequivocal: 'Air travel has the highest specific impact on short-term (global) warming, while on long-term warming, car travel has an equal or higher impact per passenger-kilometre'[16].

All airports can raise revenues from non-aeronautical activities–restaurants, car parking, rentals for retail, banking and so on.

The aviation industry has set itself challenging goals to dampen this impact, even in the face of global growth that is forecast to exceed 4 per cent per annum over the next few decades. These goals include the Air Transport Action Group's targets of reaching carbon-neutral growth by 2020 and that of reducing aviation's overall carbon dioxide emissions by half between 2005 and 2050.

The main greenhouse gas emissions generated by air transport are carbon dioxide (CO_2), nitrogen oxides (NO_x), water vapour (H_2O) and particulate matter (PM). The bulk of these emissions are at source—that is, from the aircraft engines themselves—with the remainder made up of on-the-ground contributions from aviation support services. The environmental and human costs of these emissions have been discussed elsewhere in this report, and it is urgently incumbent on all participants to devise solutions to mitigate emissions and their environmental impact.

The other major source of environmental pollution from aircraft is noise. The principle sources of air-

16. Borken-Kleefeld et al. (2010, p. 5700).

craft noise are the aircraft's engines and, particularly during approach, the aircraft's flaps and landing gear. Aircraft noise levels are today typically around 20 decibels lower than they were 40 years ago. This represents a significant reduction in the acoustic energy at source and consequently, for an individual event, the noise level perceived by the listener. However, over this period, the number of air traffic movements has significantly increased, and will continue to grow. As a result, aircraft noise continues to have a very significant environmental impact around airports and is a source of disturbance to the public. Many airports in other countries have implemented noise-related charging schemes, quotas on night flights or even night curfews. As cities and airports both expand, increasing shares of India's urban populations will lie under a flight path, and will expect reasonable efforts on the part of authorities to shield them from the worst excesses of engine noise.

HUMAN RESOURCES

The desired growth in Indian aviation will require the country's technical colleges and flying schools to churn out engineers, pilots, air traffic controllers and other key staff in substantially greater numbers than at present. No less important is the requirement for an improved, larger cadre of airline administrators and managers, regulatory economists and planning professionals. The internationally fungible nature of aviation service professionals means that India faces stiff competition for skilled employees. Students trained in India are lured to the rapidly expanding regional hubs by better salaries. Meanwhile, there is a shortage of pilots with sufficient experience in India. This will need to be addressed by short-term contracts with foreign pilots. These skill shortages are especially limiting to the incipient ambitions of India as a global hub for civil aviation and mechanical, repair and overhaul (MRO) work.

AIR CONNECTIVITY TO REMOTE AREAS

Remoteness is a function of both geography and topography. The North East region of India is far from India's largest centres of economic activity, but the problem is compounded by relatively poor road and rail access. In turn, the poor road and rail networks in the region are at least partially a function of the difficult terrain and climatic conditions that prevail, and the expense of surmounting these. Remoteness is at least partially self-fulfilling as well. Land transport links tend to be difficult within these regions, thereby making them 'remote'. The somewhat obvious point here is that when robust transport links are extended to regions previously considered remote, they are no longer so.

Some of the insidious effects of remoteness are well-known: a lack of accessibility to education and employment opportunities, a lack of engagement with the nation's zeitgeist, and disaffection and disinterest on the part of both the remote peoples and the rest of the country. Air travel can be the quickest, cheapest, and most environmentally-friendly class of transport links that can be extended to these regions. The challenging topography places less of a barrier to the construction of an airport than to the laying of a railway line. Arguably, the airport presents less of an environmental threat than the cutting of a new road that requires the acquisition of vastly more land and its subsequent clearance. The scattered nature of the communities can be easily accommodated within a standard hub-and-spoke framework. Connectivity within the region improves from low-cost hopping flights. The environmental costs and safety implications of a five-minute flight can be more favourable than those of an equivalent five-hour car ride over a treacherous mountain pass or riverboat journey.

The remote regions of India—the North East, Jammu and Kashmir, the Andaman and Nicobar Islands, Lakshadweep, and parts of central India—are amongst the most impoverished of the land. They stand to gain enormous economic and social benefits from being better connected with the rest of the country, and civil aviation makes a promising case for being the preferred mode to accomplish this needed connectivity.

At present, mandated Route Dispersal Guidelines (RDG) require airlines to provide service to certain remote locations as a condition of licenses to operate the more heavily-trafficked routes. The guidelines aim at 'ensuring that all players in the liberalised era deploy capacity to destinations in remote areas and participate equitably in providing air transportation to remote areas'[17]. By dividing the air routes into three different categories depending on their economic profitability and viability, the guidelines essentially mandate a system of internal cross-subsidisation from the profitable routes (generally, those connecting metropolitan cities), to less profitable ones. The present sentiment is that the RDGs cast a burden on the commercial health of airlines in India[18]. Further, there are concerns that RDGs do not achieve the intended outcomes with air connectivity largely concentrated on routes connecting state capitals, and more generally, to a very limited number of airports in remote areas. Island airports, too, remain underserved. Consequently, there is a need to devise an alternative mechanism that better serves the goals of remote-area connectivity.

INDIAN AVIATION TODAY

The reforms of the 1980s and 1990s have resulted in a civil aviation landscape that is vastly different

17. NTDPC (2012, p. 115).
18. Ibid. (p. 92), citing MoCA (2011).

Table 3.2
Estimated Gross Revenue Earned by Various Participating Sub-Sectors
(Rs billion)

SUB-SECTORS	GROSS INCOME 2012-13
Airlines	**547**
Scheduled	532
Non-Scheduled	15
Airports	**111**
AAI	69
Private	42
Maintenance, Repair and Overhaul (MRO)*	**40**
Air Cargo Express Industry*	**190**
Ground Handling*	**20**
Aviation Academies*	**3**
Total	**911**

Source: Respective Annual Reports, Industry Sources, Analysis: Ministry of Civil Aviation.
Note: * The income of FY 2009-10 is presented. Data for non-scheduled airlines is for 2010-11; For Air India and Alliance Air, data pertains to 2011-12.

from the anaemic State-controlled system of the post-Independence period. However, the reforms are incomplete, growing pains pervade every element of the sector, and for all of the strong fundamentals that will drive growth, substantial and uncertain headwinds remain.

Table 3.2 sets the industry in context. Scheduled airlines contribute over half the gross product of the civil aviation sector. This is only representative of the domestic and international operations of domestically incorporated airlines. The revenues earned by international airlines from their Indian operations are estimated to be around Rs 200 billion for 2010-11 but are not included in this table.

SERVICE DELIVERY: PERFORMANCE AND RECENT TRENDS

PASSENGER SERVICES

Since India's economic liberalisation began in 1991, domestic air traffic has grown at an annual average rate of 10.4 per cent, and in 2011-12, Indian carriers transported 60.8 million domestic and 14.3 million international passengers[19]. Over the last two decades, India's overall air traffic has grown 10.5 per cent domestically, 4.0 per cent internationally and 8.4 per cent overall. Not surprisingly, the most rapid period of growth has been post-sector liberalisation: from 2005-06 to 2011-12 passenger traffic grew 15.5 per cent overall, with domestic passenger CAGR of 15.8 per cent and international passenger CAGR of 14 per cent[20] (see Table 3.3).

Over the last two decades, domestic passenger traffic has generally grown more rapidly than international passenger traffic. This can perhaps be partially attributed to stagnating foreign tourist arrivals into India: only 6.6 million visitors in 2012 (less than 10 per cent the figure for China in that year)[21]. Urbanisation, pent-up demand from previously underserved cities, the entry of low-cost carriers, the expansion of the middle class, internal migration are only some of the factors that are good candidates for explaining why domestic traffic has grown faster than international traffic.

Moreover, Indian carriers have been unable to make substantial inroads into the international market for air traffic in spite of rapid economic growth (and rising foreign tourism and investment) since market liberalisation began. Indeed, in 2009-10, Indian scheduled carriers transported 34.6 per cent of international passengers to and from India, versus 31.7

19. Directorate General of Civil Aviation and Airports Authority of India.
20. NTDPC (2012, p.15), citing Directorate General of Civil Aviation, Airport Authority of India and Ministry of Civil Aviation.
21. World Bank and Ministry of Civil Aviation.

Table 3.3
Passengers Carried by Scheduled Carriers

YEAR	DOMESTIC	INTERNATIONAL	TOTAL
	Passengers Carried (millions)		
1990-91	7.5	6.3	13.8
2005-06	25.2	6.5	31.7
2011-12	60.8	14.3	75.2
	CAGR (per cent)		
1990-91 TO 2011-12	10.5	4.0	8.4
2005-06 TO 2011-12	15.8	14.0	15.5

Source: DGCA, AAI; Analysis: Ministry of Civil Aviation.

per cent two decades ago[22]. A number of factors are often cited to explain why Indian carriers transport only a third of international traffic to or from India. These include: their low utilisation of international traffic rights, entry restrictions, inherent cost disadvantages, and the foreign airlines'[23] expansive hub airports that provide onward connections to a wider array of international destinations.

A final reason lies in the ability of foreign airlines to add or remove capacity on Indian routes more easily than domestic carriers can. The former's extensive networks allow them to rebalance capacity across the network with comparative nimbleness. Meanwhile, Indian airlines are hamstrung, because the equipment used for domestic or short-haul international travel (narrow-body jets), cannot be easily repurposed for service to destinations further afield.

This observed lack of dominance of Indian airlines in the market for international travel often prompts concern that foreign exchange is frittered away on international travel, and that carefully negotiated bilateral rights and expensive landing slots lie redundant. There are further concerns that Indian air travel could be held hostage to fickle route decisions by the foreign airlines, as well as national security implications. However, primary importance should certainly be placed on noting that all who want to travel to or from India can do so. Though not unimportant, the home of the carrier airline is a second-order concern.

There is reason to believe that Indian airlines will gain market share in coming years. Unused rights under the bilateral negotiations will be used up as the new domestic airlines of the past decade expand and become eligible under current rules for scheduling international flights. With no overnight domestic flights in India, it makes sense for the airlines to use idle planes to fly offshore even if their primary focus is the domestic market. New equipment such as the more fuel-efficient wide body aircraft, the Airbus A350 and the Boeing B787, are ideally suited to long-haul travel direct from origin to destination. With substantial domestically sourced traffic for a large variety of destinations, and in the absence of international hubs, these new aircraft could be just the ticket to boost domestic airlines' international market share. Air India has already announced plans to expand its international network to Australian airports, and to Birmingham and Moscow using the B787[24].

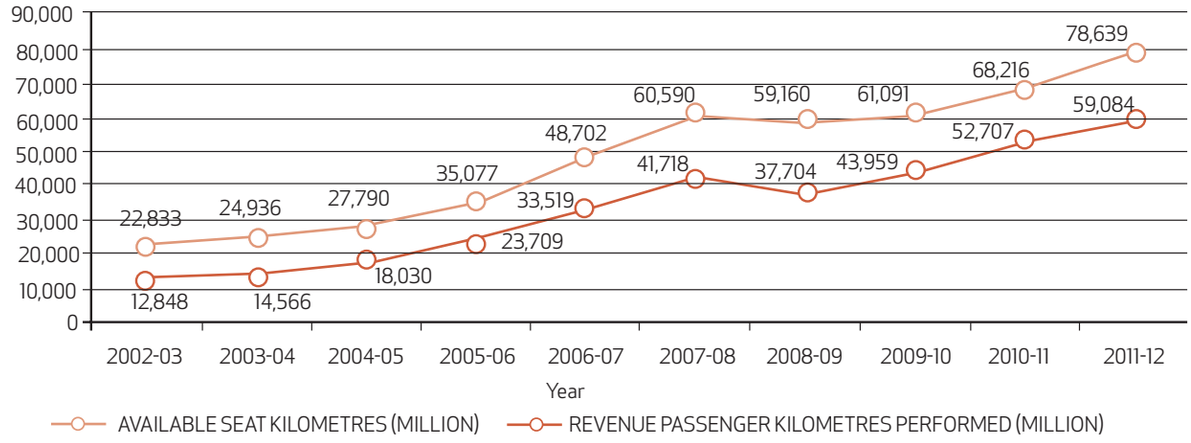
Further liberalisation and market access reform will also help to balance market share. For example, Indian low-cost carriers' enhanced ability to fly between India and the Middle East or South and South East Asia could provide a valuable boost to international air traffic. More convenient and less expensive travel within the region, at a time when disposable incomes in India are rising quickly, will enhance international passenger flows.

22. Directorate General of Civil Aviation; Ministry of Civil Aviation.
23. As examples from the past two years: American Airlines has withdrawn its service between Delhi and Chicago; Qantas no longer flies between Mumbai and Sydney (Boeing 2012).
24. Hitherto, nearly all traffic between India and Australia was carried on the airlines of Eastern Asia via hub airports in their home countries.

Figure 3.5

Revenue Passenger Kms (RPK) and Available Seat Kms (ASK) for Scheduled Domestic Carriers

LONG-TERM GROWTH IN ASK AND RPK PERFORMED ON SCHEDULED DOMESTIC SERVICES BY ALL SCHEDULED INDIAN CARRIERS FOR THE LAST 10 YEARS



Source: DGCA.

THE DOMESTIC MARKET

The domestic market is served by two full-service carriers: Air India (19.1 per cent share as of April 2013), and Jet Airways (17.1 per cent) which also has a low-cost subsidiary Jet Lite (5.4 per cent). Three low-cost carriers comprise the lion's share of the market: IndiGo (29.5 per cent), Go Air (9.0 per cent) and SpiceJet (19.8 per cent). In addition, there are some regional carriers.

Aviation capacity and its utilisation (see Figure 3.8) is a function of both the number and size of aircraft deployed as well as the distance travelled, which is representative of their availability for use in commercial service. So, Available Seat Kilometres (ASK) refers to the available capacity deployed by scheduled carriers across their network, and is a measure of the supply of aviation services[25]. On the demand side, Revenue Passenger Kilometres (RPK) refers to the number of seat-kilometres for which the carrier has earned revenue[26].

Figure 3.5 indicates that capacity in the domestic market has grown steadily. Both ASK and RPK moved in tandem for most of the post-liberalisation period from 1993-94, indicating that latent demand justifiably motivated capacity increases and that the new capacity was priced sensibly so that the latent demand could be actualised.

The ratio of RPK to ASK yields the passenger load factor, the most widely used measure of capacity utilisation (See Table 3.4). Load factors had increased even as new private carriers added substantial capacity from 2005-06 onwards. However, in the aftermath of the global financial crises of 2008, demand declined precipitously and load factors dropped. This illustrates the difficulties that airlines face in cutting capacity in the short term, and also the importance of creating an industry that is resilient enough to weather these storms. More recently, with Kingfisher's withdrawal from the market, resurgent demand, and more cautious expansions to the network, load factors have increased. They stand at as high as 90 per cent for IndiGo, down to 75 per cent for Jet Airways.

THE INTERNATIONAL MARKET

The market for international air travel again features Air India and Jet Airways as full-service carriers over long-haul distances. More recently, as the new private carriers IndiGo and SpiceJet have acquired experience, equipment and credibility, they have begun international service to short-haul destinations in South Asia, South East Asia and China, and to the Middle East. The international market is fragmented, with no one carrier boasting a dominant market share. The largest airline serving the international market is Jet Airways, followed by Emirates and then Air India. The top 13 carriers account for only 70 per cent of passenger traffic, as seen in Table 3.5, with around 60 carriers accounting for the remaining 30 per cent. Though it is not uncommon for as many carriers to operate to large

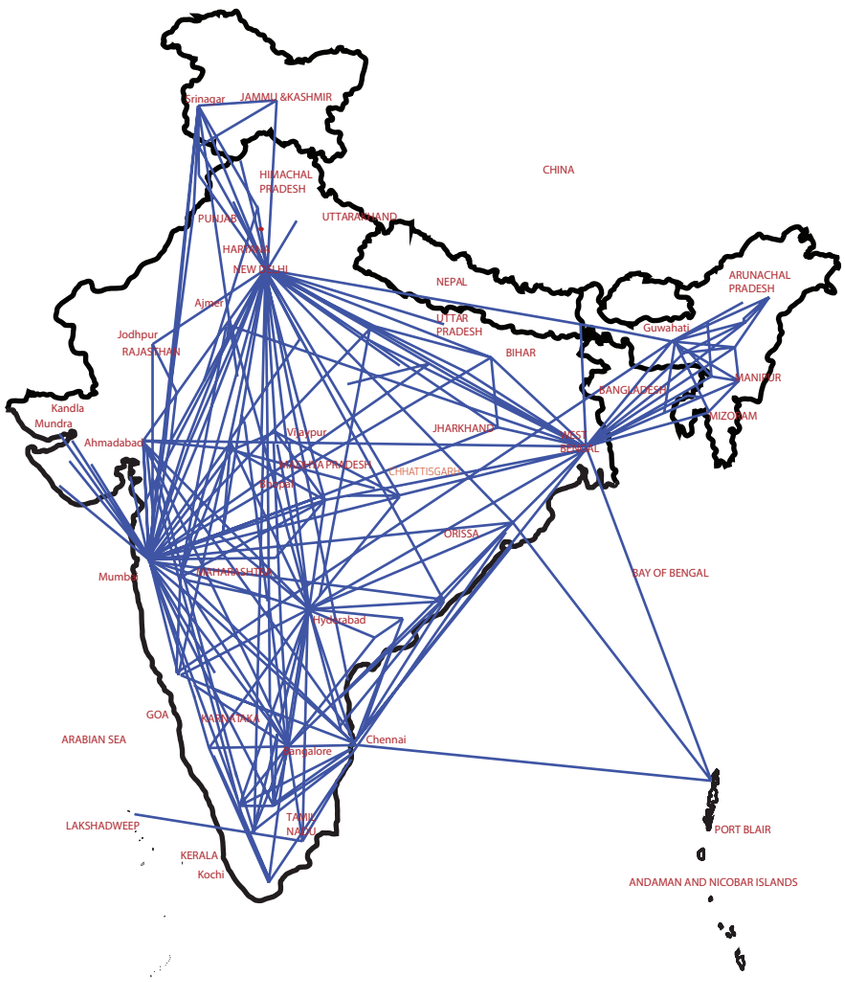
25. 'Available Seat Kilometer' (ASK) stands for the sum of the product obtained by multiplying the total number of seats that are available in each flight by the flight stage distance.
26. RPK is calculated as the sum of the product obtained by multiplying the number of revenue passengers carried on each flight stage by the stage distance, which gives the number of kilometers travelled by all passengers.

Table 3.4
RPK and ASK of Scheduled Domestic Carriers

YEAR	RPK (MILLION)	ASK (MILLION)	LOAD FACTOR
1993-94	6,779	10,821	62.6
1999-00	11,420	19,089	59.8
2004-05	18,030	27,790	64.8
2005-06	23,709	35,077	67.6
2006-07	33,519	48,702	68.8
2007-08	41,718	60,590	68.8
2008-09	37,704	59,160	63.7
2009-10	43,959	61,091	71.9
2010-11	52,707	68,216	77.2
2011-12	59,084	78,639	75.1

Source: DGCA.

Figure 3.6
India's Domestic Air Network



Source: NTDPC.

Table 3.5
Indian Operations of International Airlines, 2011-12

AIRLINE	PASSENGERS (M)	SHARE(PER CENT)	NUMBER OF INDIAN AIRPORTS WITH INTERNATIONAL SERVICE	NUMBER OF FOREIGN DESTINATIONS[b]	NUMBER OF ONWARD FOREIGN DESTINATIONS[c]
Jet Airways	5.45	15.7	10	20	0
Emirates	4.65	13.4	10	1	120
Air India	4.23	12.2	13	27	0
Qatar Airways	1.53	4.41	12	1	
Air Arabia	1.49	4.31	13	1	>40
Lufthansa	1.18	3.42	4	2	
Oman Air	0.95	2.75	10	1	
British Airways	0.93	2.70	5	1	
Air Lanka	0.85	2.45	7	1	45
Cathay Pacific	0.74	2.14	4	1	
Etihad	0.67	1.95	9	1	
Kingfisher[a]	1.18	3.42		8	0
Indigo	0.41	1.19	7	4	0
SpiceJet	0.29	0.86		7	0
Others	10.09	29.10			
Total	**34.80**	**100.00**			

Source: NTDPC.
Note: (a) Kingfisher ceased operations in the second half of 2012. (b) The number of foreign destinations served refers to non-stop or direct flights from Indian airports to a foreign airport. A direct flight can be a halt within or outside India en route to the final destination, but there is no change of aircraft. (c) The number of onward foreign destinations refers excludes all destinations within India.

countries with many airports, it is unusual in the international context to not have a domestic airline that dominates international traffic at any one airport or at all airports within a country.

The rights to operate international service to and from India by domestic or foreign airlines are set out in bilateral air services agreements (BASA). In the absence of open-skies agreements, where any airline from a defined region or group of countries is free to establish the characteristics of air services offered of its own accord, a BASA identifies maximal allowances between any two countries. India has negotiated bilateral agreements with over 120 countries with many having been signed or renewed in the last wave of liberalisation of 2005-06. These agreements are negotiated on the basis of reciprocity, and specify some permutation of the number of flights, number of airports, frequency of service, and type of aircraft that can be allocated to international air

service by airlines domiciled in either of the entreating parties.

Many of the bilateral agreements lie dormant, with the rights remaining unexercised by airlines from other countries. Of these, there is little prospect of any uptake of rights on the vast majority of dormant agreements. The major critique levelled on the others is that they are overly generous in granting access to foreign airlines at a time that the domestic ones are uninterested or incapable of exercising their rights, face Indian regulatory barriers, or find it uneconomical to do so. Indeed, it is estimated that around 65 per cent of the rights allocated to foreign airlines are exercised, and only around 30 per cent of rights allocated to Indian airlines are used[27].

In a review of these bilateral agreements, the Comptroller and Attorney General of India (CAG) found that though the liberalised policy towards bilateral entitlements benefited the Indian traveller considerably in terms of choice and lower tariffs, the timing of the liberalisation left much to be desired. The merger of Air India and Indian Airlines was relatively new, and many aircraft purchased by these airlines that would allow them to make full use of the bilateral rights would only be delivered several years hence. Further, the major airports of India that would serve as natural gateways to expanded international traffic were in the process of being modernised. The CAG also took issue with the spirit of the agreements being violated by international regulators and carriers. The agreements are intended to serve demand for bilateral point-to-point travel. But the CAG concluded that much of the rights were being used to soak up demand for onward travel from offshore hubs, the so-called 6th freedom of the air. (Box 3.1).

A BASA can have a substantial effect on the patterns of air traffic. For example, the expansion of capacities between India and certain hub airports, together with the easing of foreign ownership rules, could result in realignment of direct traffic from Indian cities to such hubs, making use of the foreign airlines' extensive onward network. As a result, traffic that may have been aggregated at Indian hubs like Delhi and Mumbai from the regional cities for onward service on international routes could then shift to the foreign hub.

Indian airlines that seek to expand overseas must also contend with the so-called '20-5 rule'. Under this rule, scheduled domestic carriers must amass a minimum fleet of 20 aircraft and have completed five years of domestic flight services, before being eligible for licenses to provide international service. Foreign airlines servicing Indian cities are generally not subject to similar requirements. As explained above, these airlines must idle aircraft when they cannot be deployed on domestic routes, cannot take advantage of market opportunities, and must give up any possible first-mover advantages to foreign airlines[28]. There does not appear to be a strong justification for the persistence of this rule.

GENERAL AVIATION

General aviation refers to the non-scheduled domestic and international flights of approved operators, charter operations, business and private jet travel, helicopter services and the non-scheduled travel of scheduled operators. According to the Directorate General of Civil Aviation (DGCA), the general aviation fleet in India comprises around 800 small aircraft and 300 helicopters. Around 20 per cent of this fleet is likely to be more than 25 years old and may not be operational. The number of approved non-scheduled operators is now in excess of 220, a substantial increase over the 36 registered in the year 2000.

The drivers of the demand for general aviation are diverse. Helicopters perform a multitude of services where airborne versatility is required. This includes the provision of emergency medical treatment and evacuation, city-to-airport transfers, airborne law enforcement, aerial photography, relief and rescue operations, news reporting, and agricultural activities like spraying. As the economy grows and as technologies and incomes advance, demand for each of these value-added services provided by the helicopter industry is likely to increase.

Charter services play an increasingly central role in ferrying tourists to India. As appreciation of India's offerings increases, and as the tourism industry itself becomes regularised, the country is more likely to attract the package tourist, the one who is more content to leave the organisation of a vacation up to the professionals. A steady stream of charter flights from Eastern Europe already plies routes to the beaches of Goa and Kerala every winter. It is anticipated that international charter flights will increase, and the itineraries will become more complex with time by the inclusion of multiple domestic stops. Finally, with corporate growth and in the ranks of the very rich, it is easy to foreshadow increased demand for travel by private aircraft.

FREIGHT AND CARGO SERVICES

The demand for air cargo transportation has increased significantly in recent years, growing at approximately 8.6 per cent CAGR since 1990-91. Today, air cargo represents approximately 10 per

27. See MoCA (2011, p. 51).
28. The rule may also prompt perverse outcomes in other ways. The two-year old Kingfisher's purchase of a 26 per cent stake in Air Deccan in 2007 at what now seems to be an excessively high price was prompted in large part by the former's desire to take advantage of the latter's more extensive operational experience to circumvent the 20-5 rule.

Box 3.1
Freedoms of the Air

Bilateral and multilateral agreements on commercial aviation between countries are negotiated on the basis of freedoms of the air. Similar to concepts in marine shipping, these freedoms refer to rights to transport passengers and goods under a variety of circumstances. The first two freedoms concern the right of an airline to use airspace and air facilities in countries other than where the airline is registered without actually providing any service. Specifically, the first freedom allows an airline to overfly a country, and also permits the country to charge for this right. Airlines use rights under the second freedom to make technical halts, such as for refuelling or maintenance, at airports outside their home country without providing any services for passenger or goods to or from these airports.

Freedoms 3 and 4 allow an airline to transport goods and passengers from its home country to others and vice versa. The fifth freedom allows an airline to provide service between two foreign countries as part of the normal course of service to and from its home country. For example, Jet Airways exercises the rights available under this freedom to service the Brussels-New York market, as these flights arise in the normal course of its international services from Indian cities. The first five freedoms are enshrined in the Convention on International Civil Aviation of 1944.

The remaining four freedoms are 'unofficial' insofar as they are not subjects of the Convention. They have gained prominence in recent times as newer route and scheduling patterns have emerged. The sixth freedom is behind the rise of the entrepot hub airports of Asia such as Singapore, Dubai and Abu Dhabi. Under the rights conferred by this freedom, airlines may provide service between two foreign countries by directing traffic through their home countries. The seventh freedom is similar, except that it waives the requirement of a home-country halt while permitting an airline to offer service between two foreign countries. This freedom is rarely exercised except by airlines in countries that are signatory to open-skies agreements. For example, low-cost carriers link many international city pairs in Europe without heed for halts in home country hubs.

'Cabotage' is a shipping term that refers to service provided between two ports in a country by a vessel flag-registered in another country. The eighth and ninth freedoms extend this concept to air travel. The eight freedom permits an airline to offer service between two airports in a foreign country as part of continuing service to its home country. The ninth freedom waives the continuing service requirement.

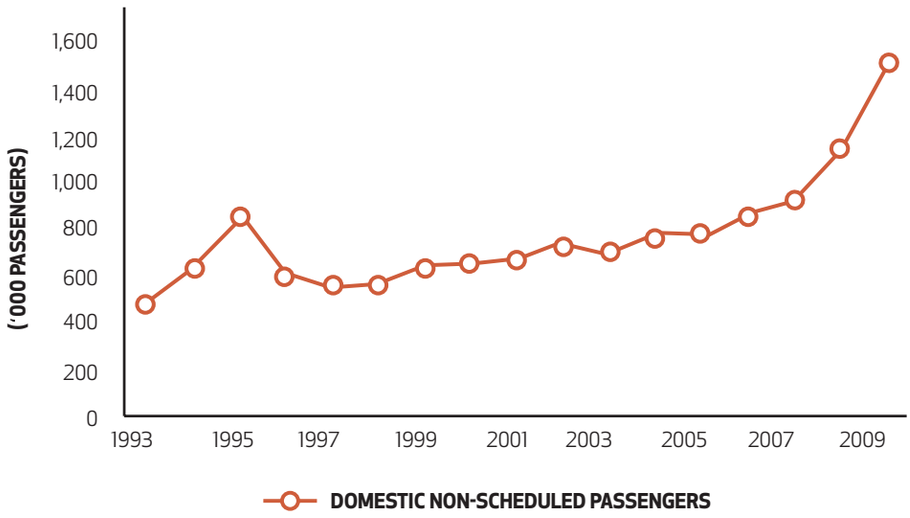
cent of the Indian airline industry's revenues and 35 per cent of the value of goods traded internationally. Scheduled Indian carriers have lost significant international freight market share in the last 20 years. When the liberalisation of the markets began in 1990-91, Indian carriers held 36.9 per cent market share in total cargo carried. Unfortunately, in 2009-2010, domestic carriers transported only 16.1 per cent total cargo while foreign carriers were responsible for 83.9 per cent total cargo carried to and from India that same year[29].

Indian cargo carriers' paltry market share is largely due to foreign carriers' rapid entry into the sector after the launch of India's Air Cargo Open Sky policy in 1990, at which time Air India was the only major domestic airline equipped to handle cargo. Sensing a longer-term growth opportunity and capitalising upon their own economies of scale and scope, international carriers were aggressive at filling India's domestic market gap. Consequently, international carriers now enjoy a stronghold over India's cargo sector.

Long-term growth rates for international and domestic cargo are largely similar. That said—and in a trend that parallels recent passenger growth rates—recent trends suggest that domestic air cargo is growing at a faster rate than international cargo to and from India. Not surprisingly, air cargo growth rates are generally susceptible to fluctuations in India's GDP growth rate (and in fact sometimes seem to foreshadow an economic slowdown).

29. Directorate General of Civil Aviation; Ministry of Civil Aviation.

Figure 3.7
Domestic Passenger Traffic Carried by Non-Scheduled Operators



Source: NTDPC (2012).
Note: More recently, there has been a substantial decline in passengers carried by non-scheduled operators. In 2010, only 660,000 domestic passengers were carried by non-scheduled operators, rising to 890,000 in 2011.

Since 2003-04, the share of international air cargo that passes through Delhi and Mumbai has declined from 66 per cent to 57 per cent, while a greater proportion of cargo now passes through Chennai (20 per cent, up from 17 per cent in 2003-04) and Bengaluru (9 per cent, up from 7 per cent previously). The total volumes of cargo shipped stood at around 1.2 million metric tonnes for 2010-11, with imports accounting for about 60 per cent of this. Imports and exports forwarded via air have exhibited remarkably similar annual growth rates over the past 20 years, being around 7.5 per cent for imports and 11 per cent for exports. Thus, if trends persist, we may expect the volume disparity between inbound and outbound freight to disappear with time, providing greater efficiencies.

With respect to domestic movements of freight, the interesting trend is the slow but steady decline in the use of passenger aircraft to transport cargo, and the rise of the dedicated freight service[30]. This can be attributed to the time-sensitive demands of the logistics industry which requires extreme efficiency in processing air freight.

AIRPORT PERFORMANCE

At present, there are a total of 125 airports in India, of which 84 are currently operational. Six of these airports—Delhi, Mumbai, Bengaluru, Nagpur, Hyderabad and Cochin—are run via a PPP model and currently handle approximately 60 per cent of India's total air traffic. AAI is responsible for the remaining airports, 84 of which are operational. Additionally, there are eight airports that are either completely privately owned or owned by their respective state governments[31]. Fifteen airports are designated as *major*; the AERA-determined criterion for this designation is an airport with an annual throughput in excess of 1.5 million passengers[32]. Of these 15, the six largest airports associated with India's six largest cities—Delhi, Mumbai, Kolkata, Chennai, Hyderabad, Bengaluru—are called metro airports.

Together, the six metro airports have the capacity to process 171 million passengers annually. This is equivalent to 78 per cent of the total capacity of all Indian airports, which is 214 million passengers.

30. Over the past 10 years, the share of cargo transported in the belly of passenger service aircraft has declined from 89 to 83 per cent.
31. Jamshedpur, Latur, Lengpui, Mundra, Nanded, Baramati, Puttaparthy and Vidyanagar.
32. Currently, these airports are declared major: Delhi, Mumbai, Chennai, Bengaluru, Kolkata, Hyderabad, Cochin, Ahmedabad, Goa, Thiruvananthapuram, Guwahati, Jaipur, Kozikhode, Lucknow and Pune.

Table 3.6
Cargo Carried on Scheduled Flights

YEAR	CARGO CARRIED (IN '000 MT)		
	INTERNATIONAL	DOMESTIC	TOTAL
1990-91	231	97	328
1995-96	348	113	461
2003-04	617	227	844
2010-11	1,244	476	1,720
	CAGR (per cent)		
(1995-96 TO 2003-04)	7.4	9.1	7.8
(2004-05 TO 2010-11)	9.1	8.9	9.0
(1995-96 TO 2010-11)	8.9	10.0	9.2
(1990-91 TO 2010-11)	8.8	8.3	8.6

Source: DGCA, Analysis: Ministry of Civil Aviation.

And as a final decomposition, note that the two airports of Delhi and Mumbai together account for 41 per cent of the total passenger throughput of Indian airports. This highlights both the importance of the two airports in the current network schema, but also the potential for rebalancing away from these airports as growth becomes more widespread[33].

Currently, only seven out of AAI's 89 operational airports are profitable, in spite of the government's aggressive Rs 124 billion capital investment programme under the 11th Five Year Plan (2007-12), which was intended to upgrade and modernise India's non-metro airports by improving the technology and manpower at these airports, so as to enhance efficiency and reduce costs over time.

PASSENGER MOVEMENT AT AIRPORTS

In 2011-12, including arrivals and departures, approximately 163 million passengers were carried by air, either domestically or internationally. Greater numbers of passengers were processed by airports on domestic routes, and this has been growing more rapidly than international passenger traffic: the percentage of domestic passengers as a proportion of total passengers processed has increased from 68 per cent in 2004-05 to 74 per cent in 2010-11. Similarly, domestic CAGR has grown at approximately 18 per cent over the last six years versus approximately 12 per cent international CAGR during that same period[34]. Table 3.7 provides additional information regarding passenger traffic growth over the last 15 years[35].

CARGO MOVEMENT AT AIRPORTS

Cargo handled at Indian airports reached 2.28 million metric tonnes (MMT) in 2011-12 after growing at approximately 11 per cent CAGR over the previous years, though this comprised a small decline over the previous fiscal year. Of this, nearly 90 per cent was processed at one of the six metro airports. On the back of an expansion in domestic trade, domestic cargo has grown at a relatively more rapid pace versus international cargo during that period[36]. International cargo, accounting for two-thirds of total cargo handled, passes primarily through India's the major metropolitan airports. The airports in Delhi and Mumbai alone handle approximately 50 per cent of India's total cargo. Some airports, such as Pune, have become more important as regional hubs for cargo than for the passengers processed there.

Table 3.9 provides additional information regarding cargo traffic growth over the last 15 years[37].

The average weight load factor of air cargo over the last five years was approximately 62 per cent, reflecting significant unused capacity. Air cargo has not grown at the same rapid clip as certain other transport modes (e.g., marine cargo), with five-year air

33. This will not necessarily apply if either or both of the Delhi and Mumbai airports become true international hubs.
34. NTDPC (2012, p. 49).
35. Airport Authority of India and Ministry of Civil Aviation.
36. NTDPC (2012, p. 51).
37. Airport Authority of India and Ministry of Civil Aviation.

Table 3.7
Passengers Throughput
(Millions)

YEAR	DOMESTIC	INTERNATIONAL	TOTAL
1995-96	26	11	37
2004-05	40	19	59
2010-11	106	38	144
2011-12	122	41	163
	CAGR (per cent)		
1995-96 TO 2004-05	4.9	6.3	5.3
2004-05 TO 2011-12	17.2	11.5	15.6
1995-96 TO 2010-11	10.1	8.5	9.7

Table 3.8
Annual Terminal Capacity and Passenger Movement at Major Airports, 2010-11

MAJOR AIRPORTS	ANNUAL CAPACITY (MILLION)	PASSENGER TRAFFIC HANDLED (MILLION)	CAPACITY UTILISATION (PER CENT)
Mumbai	29.07	29.00	100
Delhi	60.00	29.94	50
Chennai	23.00	12.05	52
Bengaluru	11.50	11.59	101
Kolkata	24.10	9.63	40
Hyderabad	12.00	7.60	63
Cochin	5.00	4.34	87
Ahmedabad	4.02	4.04	101
Goa	3.23	3.08	95
Thiruvananthapuram	1.79	2.53	141
Guwahati	1.15	1.93	168
Jaipur	1.16	1.66	143
Calicut	1.85	2.06	111
Lucknow	1.21	1.58	130
Pune	1.12	2.81	251

Source: NTDPC (2012).

Table 3.9
Cargo Handled at Indian Airports
('000 metric tonnes)

YEAR	DOMESTIC	INTERNATIONAL	TOTAL
	Cargo Handled ('000 MMT)		
1995-96	222	458	680
2004-05	490	831	1,321
2010-11	888	1,504	2,391
2011-12	812	1,468	2,280
	CAGR (per cent)		
1995-96 TO 2004-05	9.2	6.8	7.7
2004-05 TO 2010-11	7.3	8.8	6.1
1995-96 TO 2010-11	8.3	7.3	7.0

Source: NTDPC (2012).

cargo CAGR standing at approximately 11 per cent, substantially lower than India's overall export and import growth rates (approximately 15.1 per cent and 17.3 per cent over the same time horizon). Additionally, as mentioned earlier, the amount of air cargo volume that all Indian airports handle is less than that handled by a number of individual airports around the world, including Hong Kong, Memphis, Shanghai, Incheon, Anchorage and Paris. These facts, coupled with forecasted trade and economic expansion, suggest that significant growth opportunities exist for India's cargo sector. The need for attention to improving infrastructure and policies around the sector is thus critical.

CIVIL AVIATION IN INDIA OVER THE NEXT 20 YEARS

What should India's civil aviation sector look like by 2032, the end of the 15th Five Year Plan period? What outcomes does the country require such that aviation supports its growth agenda, and which policies will deliver these outcomes? As with chapters detailing the discussion on infrastructure investment in other transport modes, it is helpful to begin with a vision for the ideal civil aviation milieu of 2032. A shared vision together with derived qualitative and quantitative goals is more likely to result in a coherent, comprehensive network that best addresses India's socio-economic needs and wants. It can serve as a valuable communication device in selling infrastructure policy and decisions to the populace. Equally, it can serve to hold to account the public and private institutions that are responsible for designing, planning, commissioning, building, operating, managing and maintaining India's civil aviation network.'

GROWTH DRIVERS FOR INDIAN AVIATION

This subsection only considers the fundamental drivers, the long-term secular trends that will underpin demand for aviation services, and will be responsible for catapulting the Indian civil aviation sector from the ninth- to the third-largest market worldwide over the next decade. The size of the market will obviously depend on the supply response as well. Conditional on the needed infrastructure and on accommodative policy, it is assumed that the private sector will respond to market forces and supply the requisite additional capacities for passenger and freight transport.

Growing economic activity will result in more business and leisure travel. The GDP-elasticity of demand for passenger aviation services has been usually estimated at between 1.3 and 1.8 in several international studies[38]. At a 7 per cent growth rate (implying a doubling of GDP in 10 years), the demand for passenger aviation could increase nearly threefold. Further, with the bulk of GDP growth being fueled by growth in industry and services, the flow-on demand for aviation will be direct. In the longer term, as India becomes a middle-income country, the growth decompositions will undoubtedly be different from today. Even so, as gross trade increases, the demand for aviation services can be expected to remain strong.

38. NTDPC (2012, p. 37, Table 12).

By 2020-21, the average Indian will undertake 0.12 domestic air trips per year. This is less than what the annual trip rate today for the average Chinese (0.15), the average Brazilian (0.25), and the average Malaysian (0.54).

India's middle class—160 million strong as of 2010—is expected to rise to 547 million, or 37 per cent India's total population, by 2025[39]. This middle class, with higher disposable incomes, can be expected to express the same preferences for domestic and international travel for leisure, education and business that today's middle classes do. Further, as incomes rise, airfares will constitute a smaller share of disposable income, increasing demand. The new middle classes are likely to substitute away from road and rail in favour of air travel, whenever the latter presents a viable advantage in terms of cost and time. Meanwhile, as India's young population continues to mature and reaches working age, increasing numbers of youth will seek to take advantage of employment and education opportunities elsewhere, expanding the domestic passenger base.

The McKinsey Global Institute projects that India's urban population will reach 590 million by 2030. By this time, it is estimated that India will have 68 cities with population of greater than one million, and six cities of more than 10 million[40]. Even if the economic and demographic factors noted above apply in reduced strength than envisaged, the greater concentration of the nation's population in cities will make air travel naturally more attractive. As populations become concentrated, demand for point-to-point travel increases, thereby boosting demand for air travel relative to that for road and rail transport that are better suited to distributed populations.

Tourism is another important growth factor. The sector continues to grow on the back of recent economic growth, and better air transport will continue to increase both domestic and international tourism in India. Domestic tourist visits within India grew to over 1 billion for the first time in 2012, and the number of foreign tourist arrivals to India has grown to 6.6 million from 2.3 million in 2002[41].

The Indian government's stated goal of enhancing connectivity in remote, inaccessible regions of the country has created the potential for growing demand from these new regions. Finally, there is significant untapped market potential generally. Air traffic density in India remains very low versus developed nations as well as for India's emerging-market peers (e.g., Brazil and China, where densities are three and four times higher respectively), signalling a key opportunity for sector development.

Finally, some other factors that will support growing future demand for aviation include:

- **Global Integration of Business.** Greater economic activity and the subsequent greater integration of businesses globally will lead to increasing cross-border business travel over time and in turn, growth in civil aviation.

- **Shifting Traffic Patterns.** In line with global economic forecasts, air traffic will continue to shift away from North America and Europe and toward Asia-Pacific over time. By 2030-31, Airbus forecasts that 25.2 per cent of global RPK will be from Asia-Pacific (versus 19.0 per cent today)[42].

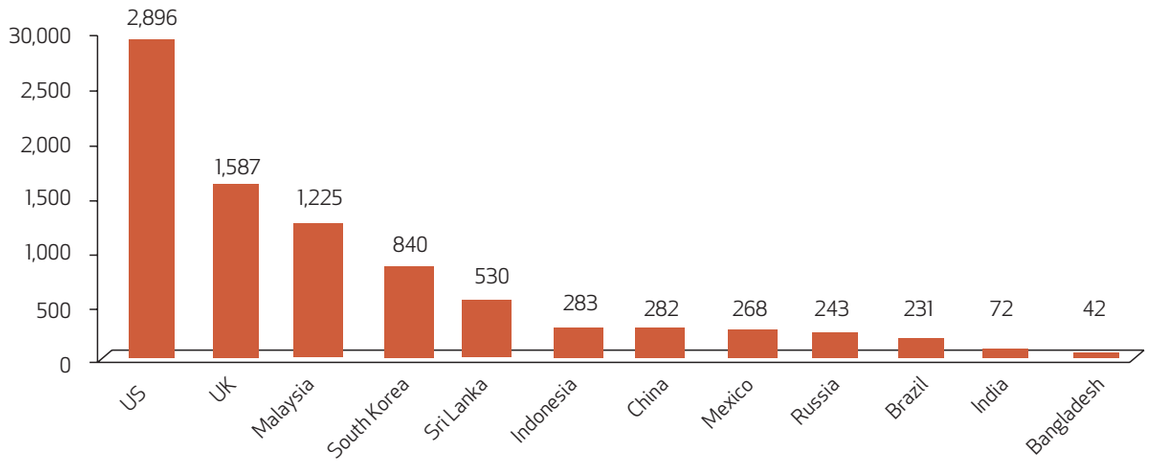
- **International Market Access.** While Open Sky Agreements have increased competition in international air travel, so too have they increased the size and scope of the market itself. Similarly, further deregulation and market opening should help to enhance international passenger and cargo growth for Indian carriers.

On the supply side, growth in India's low-cost sector since 2004 has made air travel accessible to a broader swathe of the population, stimulating new demand. Low-cost carriers (including the LCC brands of full-cost operators) constituted over 65 per cent of the total market share in 2012, as domestic traffic continues to rapidly shift toward LCCs. As certain low-cost operators (such as IndiGo) achieve financial success, we believe that this trend should continue over time. Indeed, the only airline to have evinced interest and made formal forays to enter the Indian market at this time is Air Asia, a subsidiary of an established low-cost Malaysian carrier[43]. Low-cost carriers are especially attracted to serving non-metropolitan cities, the so-called Tier-II or Tier-III towns. While there may be already some connectivity between these towns and the metros, there is a lack of competition relative to traffic between a metro city-pair. This, and the government's new commitment to expand airport capacity or develop new airports in these towns, will only serve to make them more attractive to LCCs.

Further on the supply side, private-sector participation in India's airports—Rs 300 billion invested in the last five years alone—has expanded airport capacity and allowed airlines to schedule more

39. Shukla (2010).
40. NTDPC (2012, p. 29).
41. Ministry of Tourism (2013).
42. Airbus Global Market Forecast 2011-2030.
43. Air Asia is a joint venture between a Malaysian LCC of the same name, Tata Sons, and a Delhi-based conglomerate, Telstra Tradeplace, which owns Hindustan Aerosystems, a manufacturer of aviation-related hardware and other products.

Figure 3.8
Air Passengers Per Million Urban Population ('000)



Source: NTDPC (2012), based on McKinsey & Co., and World Bank data. Data for India is from 2010; for other markets from 2008-09.

flights to these airports. The government has cited India's rapidly expanding air transport network, together with massive investments in airport infrastructure, as key reasons for the surge in air passenger traffic in India.

TRAFFIC FORECAST FOR INDIAN AVIATION

The first task of an infrastructure planning exercise is to forecast the likely passenger demand that the aviation infrastructure of the future must service[44]. The airline industry will rely on the forecast to prepare a fleet acquisition plan. Efforts at training the appropriate numbers of skilled staff are contingent on the forecast, as is the planning for the provision of ancillary services like MRO, ground handling services, and others. The Working Group's forecast is based on an econometric model that relates GDP to the demand for the carriage of passenger and freight traffic. These exercises yield GDP-growth elasticities for passenger and freight traffic, thus providing a simple linear relationship between expected future GDP and the expected future demand for domestic and international travel[45]. These elasticities were measured at 1.7 and 3.1 for domestic and international passenger travel, and at 1.4 and 1.3 for domestic and international cargo movement respectively. The results were shown to be robust to several choices of the measure of demand, and also in broad agreement with eight other planning exercises conducted by various airports or countries.

To forecast traffic, assumptions are made on the growth path of future GDP. The Working Group chose to assume growth rates for domestic GDP that ranged between 8.5 per cent in the near term, to 6.0 per cent in the long term. This yields the results summarised in Table 3.10.

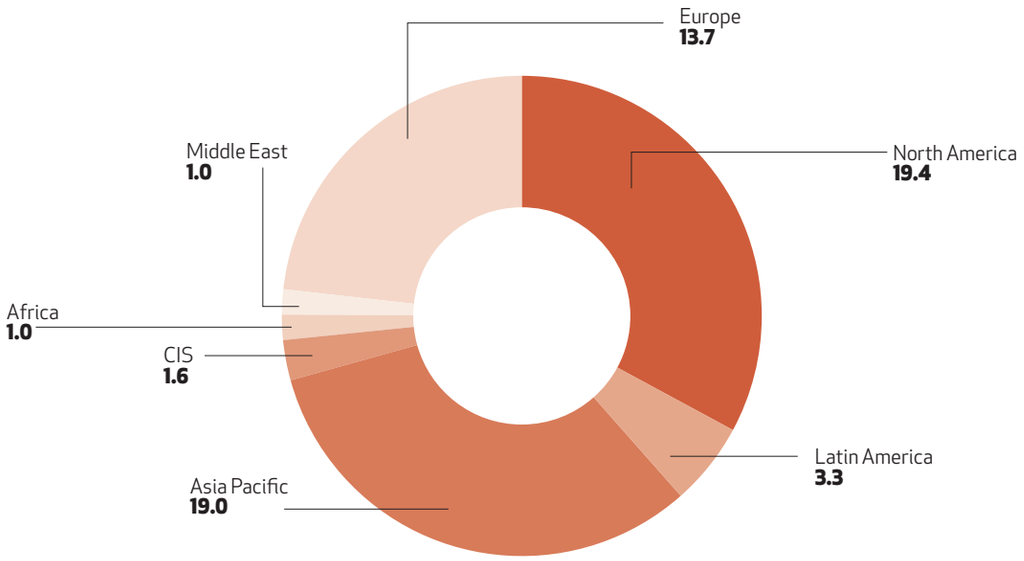
The domestic air traffic carried by scheduled airlines is projected to be about 164 million passengers in 2020-21, about three times more than the 54 million carried in 2010-11. This is less than the growth in traffic achieved in the 10 years to 2010-11. Similarly, international passenger traffic is anticipated to be around 92 million in 2020-21. This too is a smaller multiple than what the rise in traffic was between 2000-01 and 2010-11. With aviation yet to become truly accessible to the Indian masses, these comparisons would suggest that the forecasts are suitably conservative. They also agree comfortably with forecasts produced by other agencies as seen in Figure 3.10. (However, traffic levels forecast by MoCA for 2030-31 are around one-third higher than those estimated by other agencies.) A final reality check on the forecast is from the observation that by 2020-21, the average Indian will undertake 0.12 domestic air trips per year. This is less than what the annual trip rate today for the average Chinese (0.15), the average Brazilian (0.25), and the average Malaysian (0.54).

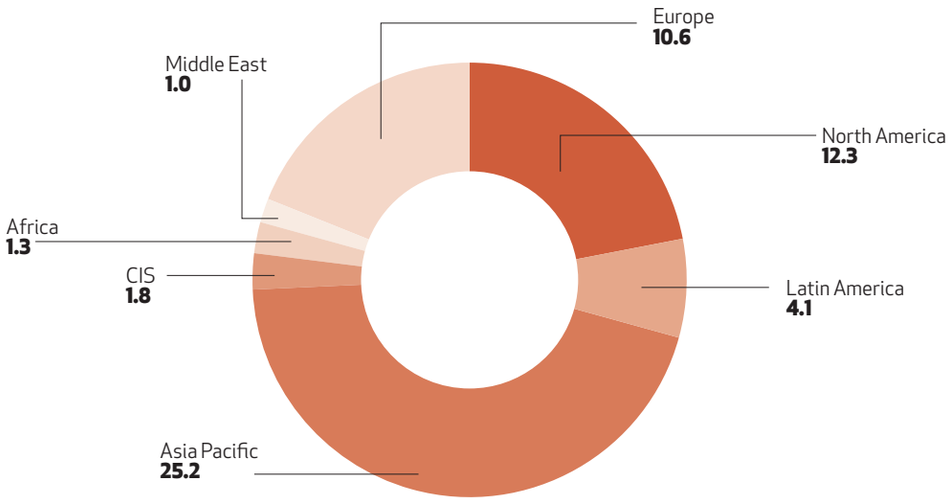
Table 3.12 highlights forecasts for cargo traffic, with both domestic and international volumes growing by around 11 per cent per annum. Again, these are

44. This subsection summarises the results of a forecasting exercise conducted by the Working Group of the NTDPC (2012) on Civil Aviation. Full details are available in Chapter 4 of the report of the Working Group.
45. The defining relationship for domestic passenger travel, and domestic and international cargo movement was with domestic GDP. The defining relationship for international passenger travel, was with international GDP.

Figure 3. 9
Expected Changes in Demand for Passenger Travel, by Region
[Per cent}

Figures are per cent share of global RPK and are for 2010-11 (top panel), and 2030-31 (bottom panel).





Source: NTDPC (2012).

Box 3.2
Secondary Airports

Most Indian cities have one operational airport or airfield that can accommodate scheduled, commercial air services. This is in stark contrast to the situation in other countries, where cities often have two or more airports. For example, London boasts of five airports and New York four. Paris, Chicago, Frankfurt, Shanghai, Beijing, Tokyo, Rome, Stockholm, Melbourne, and many other global cities of note have two or more airports. Several substantially smaller cities and cities in developing economies are home to two or more airports: Phoenix, Dallas, Sao Paulo, Johannesburg, Rio de Janeiro, Istanbul and others.

In some instances, the need for multiple airports to serve the same urban agglomerations has arisen from capacity constraints. (Civil aviation has grown so rapidly in China over the past decade that both Beijing and Shanghai have commissioned new airports only a few years after completing major airport projects in the same cities.) In others, the urban agglomeration has steadily grown to encompass several airfields that lay outside historical city boundaries.

The major advantage of multiple airports is choice. Where airports ownership is privatised and deregulated, the airports compete amongst each other to attract airlines. For example, each of the five airports of London has developed distinct characters and offers a distinct service profile. Heathrow serves as the major regional and long-distance hub for international travel, with Gatwick rapidly rising in prominence as Heathrow reaches capacity limits. London City airport, located only a few miles away from the centres of financial and political activity, serves as a convenient short-haul option for business passengers. Meanwhile, Stansted and Luton are at considerable distances from the city centre, and have less stringent noise abatement restrictions allowing greater operational freedom. These airports have aggressively pursued business from low-cost carriers.

In fact, the rapid rise of low cost aviation owes much to the presence of secondary airports in cities. When Ryanair, one of the pioneer European low-cost carriers, flies from London to Stockholm, it does so from Stansted (50 km from London city centre) to Västerås (100 km from Stockholm city centre).

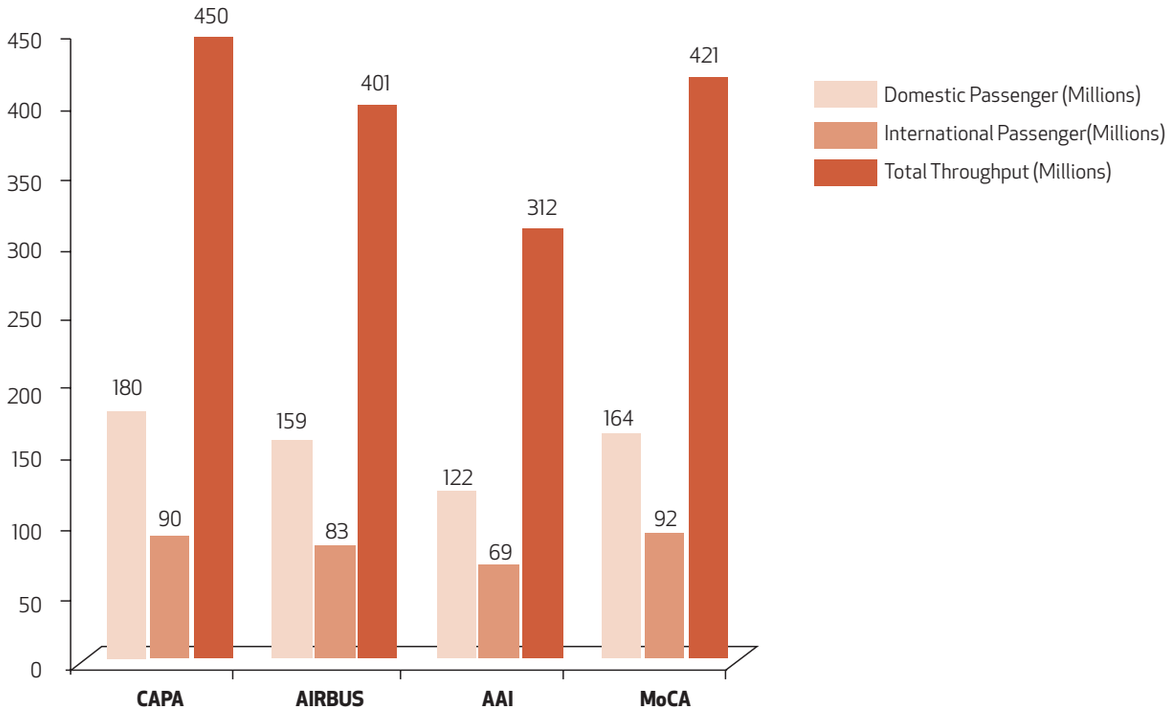
As urban agglomerations grow, it is not just airlines that benefit from choice. A four-hour door-to-door trip via air from a Delhi address to a Mumbai address can easily double in duration if the origin is somewhere in the expanses of Greater Noida and the destination in Thane or Vasai. The presence of a secondary airport affords passengers much in the way of time saving choices.

Table 3.10
Forecast of Passenger Traffic

YEAR	DOMESTIC (MILLIONS)	RESULTANT CAGR (PER CENT)	INTERNATIONAL (MILLIONS)	RESULTANT CAGR (PER CENT)	TOTAL (MILLIONS)	CAGR (PER CENT)
2010-11 (Actual)	53.9	-	37.9	-	91.8	-
2015-16	94.1	11.8	59.4	9.4	153.5	10.8
2020-21	164.4	11.8	91.9	9.3	256.3	10.8
2030-31	437.9	11.0	217	9.1	654.9	10.3

Source: DGCA and MoCA estimates.

Figure 3.10
A Comparison of Passenger Traffic Forecasts for 2020-21



Source: NTDPC (2012), from CAPA, Airbus, AAI and MoCA estimates, p. 43.

broadly in line with estimates produced by other agencies[46].

TRAFFIC IMPLICATIONS FOR AIRPORT CAPACITY

Every passenger travelling by air must journey through two airports, with the possibility of more if several sectors are on the itinerary. The traffic increases forecast above must essentially be doubled to arrive at estimates of passenger throughput at domestic Indian airport terminals. For international travel, only one terminal will be located in India, but a five per cent adjustment is made to traffic figures to account for passengers transiting to other airports. If a strategy to develop Indian airports as global hubs is desired and successful, the throughput estimates for these airports must obviously be adjusted to account for a substantial bulk of transit passengers. The same considerations noted here also apply to the movement of cargo traffic. Consequently, the airport throughput noted in Tables 3.13 and 3.14 should be considered a conservative estimate conditional on the traffic forecast.

Total passenger movement at Indian airports is expected to be three times present levels by 2020-21, and seven times larger by 2030-31. Growth is expected to be driven marginally more by domestic passenger traffic, on account of the untapped market potential noted above. Similar growth multiples are expected for cargo throughput over the next 10 and 20 years.

REQUIRED INVESTMENT IN AVIATION INFRASTRUCTURE

The previous section noted a set of traffic forecasts for domestic and international air transport of passengers and cargo. This section describes the preferred supply response in the form of infrastructure spending required to expand capacity. The investment for aviation infrastructure consists of the development and expansion works at new and existing airports, and of the acquisition of aircraft to make use of the extra capacity at airport terminals. The assumption in this report is that, given a policy environment conducive to investment, the private sector will increase aircraft numbers and service delivery capacity as required to meet demand. Thus planning for the future consists of identifying the likely airport development required, and the creation of a sensible, market-friendly, policy environment.

AIRPORTS

Airports in India are largely under the administrative purview of the Airports Authority of India. The AAI implements long-term government policy and

46. NTDPC (2012) also presents these forecasts.

Table 3.11
Forecast of Non-Scheduled Domestic Passenger Traffic

YEAR	DOMESTIC (MILLION)	CAGR (PER CENT)
2009-10 (Actual)	1.49	-
2015-16	1.98	4.8
2020-21	2.52	4.9
2030-31	3.89	4.7

Source: NTDPC (2012).

Table 3.12
Forecast of Cargo Traffic

YEAR	DOMESTIC ('000 MT)	CAGR (PER CENT)	INTERNATIONAL ('000 MT)	RESULTANT CAGR (PER CENT)	TOTAL ('000 MT)	CAGR (PER CENT)
2010-11 (Actual)	475.5	-	1,243.9	-	1,719.4	-
2015-16	835.3	11.9	2,113.0	11.2	2,948.3	11.4
2020-21	1,436.0	11.7	3,500.0	10.9	4,936.0	11.1
2030-31	3,622.8	10.7	8,238.4	9.9	11,861.2	10.1

Source: NTDPC (2012).

Table 3.13
Expected Passenger Throughput at Indian Airports

YEAR	DOMESTIC (MILLION)	RESULTANT CAGR (PER CENT)	INTERNATIONAL (MILLION)	RESULTANT CAGR (PER CENT)	TOTAL (MILLION)	CAGR (PER CENT)
2010-11 (Actual)	106		38		144	
2015-16	188	12.1	62	10.3	250	11.7
2020-21	329	12.0	97	9.8	426	11.5
2025-26	546	11.5	147	9.4	693	11.0
2030-31	876	11.1	228	9.4	1,104	10.7

Source: Ministry of Civil Aviation Estimates.

Table 3.14
Expected Cargo Throughput at Indian Airports

YEAR	DOMESTIC ('000 MT)	CAGR (PER CENT)	INTERNATIONAL ('000 MT)	RESULTANT CAGR (PER CENT)	TOTAL ('000 MT)	CAGR (PER CENT)
2010-11 (Actual)	888	-	1,504	-	2,392	-
2015-16	1,671	13.5	2,133	7.0	3,784	11.4
2020-21	2,872	12.5	3,500	9.0	6,372	11.1
2025-26	4,652	11.7	5,472	9.0	10,124	10.6
2030-31	7,246	11.1	8,239	8.9	15,485	10.1

Source: Airports Authority of India/Ministry of Civil Aviation Estimates.

direction on the development of airports. In recent years, six of the largest and systemically important airports in urgent need of expansion or redevelopment have had their ownership transferred into public-private joint-venture enterprises, under Operation, Maintenance and Development agreements. The private partners in these enterprises have supplied much-needed financing in exchange for a majority equity holding. The AAI has retained a minority stake in the joint venture companies and shares in the revenue generated. It also continues to supply air navigation at these, and all other airports. The tariff structure of these airports is regulated by AERA. A plan for developing airport infrastructure must therefore identify the location of any new development or expansion, the size of this exercise, and must also identify clear criteria for how the development works are to be funded and administered, whether through the AAI, or through a PPP joint venture.

The Ministry of Civil Aviation has established that the unit cost of creating additional new terminal capacity that is capable of processing 1 million passengers per annum is in the range of Rs 2.75 to 3 billion at 2011 prices. Where this capacity is to be created by enlarging existing infrastructure, i.e., as brownfield development, the unit costs are somewhat larger at Rs 4 billion. Though the land acquisition costs for greenfield developments should indicate a higher unit cost, the received wisdom is that capacity expansions at existing busy airports are made difficult by the need to plan around everyday operations.

According to Table 3.7, Indian airports processed 106 million domestic passengers and 38 million international passengers in 2010-11. This is expected to grow to 329 million and 97 million by 2020-21, and to 876 and 228 million by 2030-31 respectively. As standard international practice, a 30 per cent increment on these forecasts is applied for infrastructure planning to future-proof investments by ensuring sufficient slack in the added capacity: mid-course correction of design and development on account of changes in traffic forecasts will only result in higher outlays.

These facts lead to a straightforward assessment of the required capacity and investment in airport infrastructure as summarised in Table 3.15. For each Plan period through to 15th Five Year Plan concluding in 2032, the analytical framework apportions traffic between greenfield and other airports. This is then translated into a capacity requirement as described above, together with the 30 per cent margin, and by applying the unit costs, a total anticipated outlay for each plan is acquired.

A total investment of Rs 5,900 billion is estimated to be required for airport infrastructure development by 2030-31. This investment will result in creation of additional capacity of around 1,700 million passengers per annum (mmpa), out of which 383 mppa capacity will come up in greenfield airports alone. This additional capacity will help in catering to the forecasted passenger traffic of 1177 mppa by 2030-31 in a seamless and safe manner.

Unlike with roads or rail networks where investment output can be measured in so many kilometres of roads cut or rails laid of a certain type, investment in aviation is lumpier. Some airports will be larger than others by several orders of magnitude, and the unit costs of construction will be idiosyncratic. We may be able to differentiate between the unit cost of an expressway with that of a village road; however, it is an altogether different matter to compare unit costs of capacity expansion at airports in Delhi

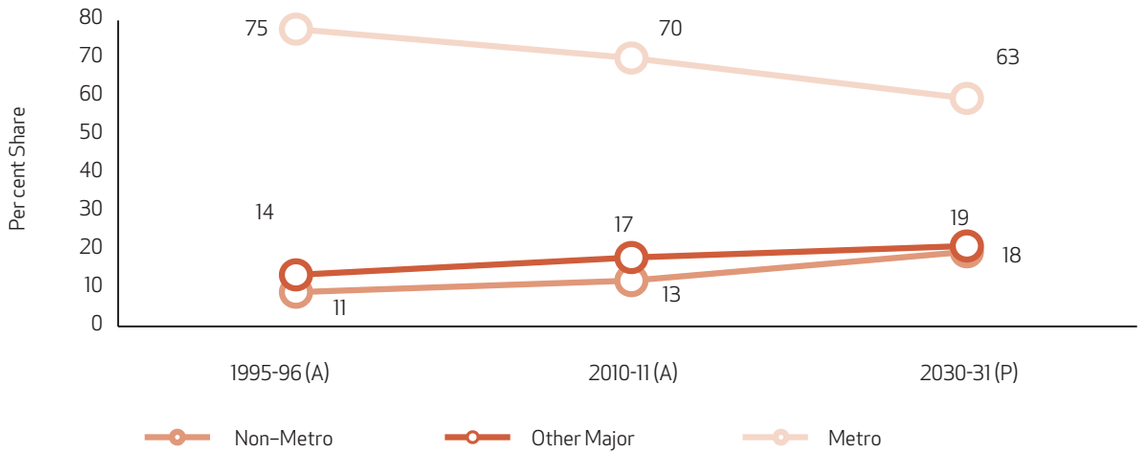
Table 3.15

Investment Requirement in India for Airport-Related Infrastructure by 2031-32 (Passenger Services)

PLAN PERIOD	PLAN PERIOD ENDING AT FINANCIAL YEAR	TOTAL PAX THROUGH-PUT FORE-CASTED (MILLIONS)	TRAFFIC APPORTIONED AMONG AIRPORTS			ESTIMATED CAPACITY REQUIREMENT AT AIRPORTS			ADDITIONAL CAPACITY REQUIRED AT AIRPORTS			INVESTMENT REQUIRED (RS BILLION)		
			GREEN-FIELD	OTHER THAN GREEN-FIELD	TOTAL	GREEN-FIELD	OTHER THAN GREEN-FIELD	TOTAL	GREEN-FIELD	OTHER THAN GREEN-FIELD	TOTAL	GREEN-FIELD	OTHER THAN GREEN-FIELD	TOTAL
11th FIVE YEAR PLAN	2011-12	162	23	139	162	29	181	211	6	(16)		18		**18**
12TH FIVE YEAR PLAN	2016-17	281	39	242	281	51	314	365	22	101	123	60	369	**429**
13TH FIVE YEAR PLAN	2021-22	473	95	378	473	123	492	615	78	194	272	215	707	**923**
14TH FIVE YEAR PLAN	2026-27	764	153	611	764	199	795	993	97	404	501	268	1,474	**1,741**
15TH FIVE YEAR PLAN	2031-32	1,177	235	942	1,177	306	1,224	1,530	186	623	809	511	2,275	**2,786**
TOTAL									**383**	**1,322**	**1,705**	**1,071**	**4,825**	**5,896**

Source: NTDPC.

Figure 3.11
Throughput at Major, Non-Major and Metro Airports



Source: NTDPC (2012), from MoCA analysis of AAI data.
Note: (A) refers to Actual and (P) refers to Projected.

versus Patna, or Mumbai versus Aizawl. Nonetheless, the preceding analysis has lumped together all the different types of capacity expansion to arrive at a net figure for infrastructure investment. However, it is crucially important to determine which cities and airports should benefit in which manner from the global pool of spending. Further, there is endogeneity in the process: decisions made on airports today will influence the airline route maps of the future; equally, the expected airline route maps should, by rights, determine the distribution of today's investment.

With 130 airports in the country and many more envisaged, it is specious to map out an investment plan for each. As a mirror to the point made here, these airport-specific plans should be dynamic in their response to changing traffic patterns and demand, and yet proactive, by building airport capacity in advance of the period when constraints start to bite. It is a difficult but essential balance, and one that will require substantial skill and strength of expert judgment.

That said, a rebalancing of traffic shares away from the metro airports is anticipated. At present, these airports process around 70 per cent of passenger traffic. With the rise of low-cost airlines, a preference for point-to-point travel whenever possible, a strategy that emphasises regional aviation, congestion at major airports and the general economic rise of the hinterland towns, the metro airports can be expected to yield traffic share to other major and non-major airports. These metro airports will remain systemically important, however, both as international gateways to the country, as national hubs for both full-service and low-cost carriers.

There is an urgent need to build airport capacity to process cargo. Congestion and delays in air cargo terminals in some of the major metro airports have become chronic. The limitations spring from several sources: limited apron space for freighter aircraft, mixing of passenger luggage and cargo, delays in customs processing and clearances, poor connectivity with the road network delaying removal of cargo from airport facilities, and so forth.

At the larger airports, capacity can be done through dedicated cargo terminals with land-side facilities let out to freight forwarders and logistics providers. Consideration should also be given to building airports that are entirely dedicated to freight. These may be public airports sited at locations that have other excellent transport facilities or are proximate to metropolitan cities and other final destinations for cargo. These may also be private airports that are operated by a provider of logistics services. For example, two of the biggest package delivery services in the world, FedEx and UPS, each maintain dedicated hubs for their US operations at Memphis and Louisville respectively. Located centrally, the firms have built massive cargo processing facilities at these airports, to allow goods to be trans-shipped to their final locations. In India, locations like Nagpur or Pune could prove to be good choices on account of their geographic centrality, thereby minimising travel times to most metro cities in India.

Cargo that is air-freighted tends to be time-sensitive, relatively low in volume, and relatively high in val-

Table 3.16
Forecast of Passenger Throughput, Decomposition by Type of Airport

AIRPORTS (MPPA)				
PHASE	METRO	OTHER MAJOR	NON-METRO	TOTAL
2015-16	165	43	42	250
2020-21	276	77	7	425
2025-26	444	125	124	693
2030-31	695	210	199	1,104

Source: Ministry of Civil Aviation.

ue. Effort should be devoted to studying the decomposition of air freight in greater detail, and a database built of origins, destinations, and the nature and value of shipments. This will provide valuable information on the candidate sites for dedicated cargo facilities.

Table 3.17 presents estimates of the required investment in airport infrastructure to process cargo. Required capacities are calculated on the basis of a 30 per cent premium on the estimated cargo throughput over the next 20 years. Further, it is assumed that the unit cost of installing capacity to process an additional 1 million metric tonnes (mmt) of cargo is Rs 4.17 billion.

Combining the estimates presented in Table 3.15 and Table 3.17 yields a net required investment for passenger and cargo processing at airports of about Rs 6 trillion.

AIR NAVIGATION SERVICES

The Air Navigation Services (ANS) unit of the AAI operates communication, navigation, surveillance and traffic management systems for aircraft operating in Indian airspace. The ANS controls all air movements over India's sovereign airspace, and develops and maintains critical infrastructure and flight path systems throughout India. At airports, it manages air traffic control towers and radar centres.

In keeping with its land area, India has one of the largest sovereign airspaces in the world, and one that is projected to become even busier as domestic and international traffic in India expands. Being at the geographical crossroads of Europe and the Middle East on the one hand, and East Asia and Australasia on the other, the ANS also assume responsibility for the through traffic over India's airspace. This traffic, too, will grow substantially in the years to come.

Substantial investment will be required to ensure that the ANS can continue to deliver on an exceptional record of aviation safety. Already busy airspace over metropolitan cities will become even more crowded, and new technologies will have to evolve to allow faster processing to and from the terminal gate. This will mean a closer separation between landings and departures, and more sophisticated methods for managing traffic in the airspace proximate to airports.

The Indian air navigation system master plan includes significant investment in modernisation communication, navigation, and surveillance (CNS) equipment, and air traffic management and meteorological equipment. It also foreshadows required upgrades in the number and expertise of air traffic controllers and other skilled staff. A series of new technologies will be required to provide centralised control over air traffic, as well as allowing some dynamic variation in flight path. (These measures may also result in reduced time and fuel burn on many routes, as the commander of an aircraft can restrictively amend the flight path to best suit circumstances.) A new navigation system, the GPS-aided GEO-augmented Navigation system (GAGAN) has been developed by the AAI with the support of the Indian Space Research Organisation (ISRO). The AAI estimates the project will require a total investment of Rs 7 bil-

Table 3.17

Investment Requirement in India for Airport-Related Infrastructure by 2031-32 (Cargo Processing Services)

PLAN PERIOD	PLAN PERIOD ENDING AT FINANCIAL YEAR	TOTAL CARGO THROUGHPUT FORECASTED (MILLION TONNES)	ESTIMATED CAPACITY REQUIREMENT AT AIRPORTS (MILLION TONNES)	ADDITIONAL CAPACITY REQUIRED AT AIRPORTS (MILLION TONNES)	INVESTMENT REQUIRED (RS BILLION)
11th Five Year Plan	2011-12	2.4	3.1	0.7	3
12th Five Year Plan	2016-17	4.3	5.6	2.5	10
13th Five Year Plan	2021-22	7.4	9.6	4.8	20
14th Five Year Plan	2026-27	12.0	15.6	8.5	35
15th Five Year Plan	2031-32	18.0	23.4	12.6	52
Total				28.9	121

Source: NTDPC Research.

lion during the 12th Plan period. More generally, industry sources suggest that the investment required for ANS alone would be around Rs 37 billion for the next five years.

AIRLINES

The investment in aircraft will largely be undertaken by the private sector, though from a public regulatory perspective, the methods of finance chosen to fund these purchases will remain important. These are discussed in later in the chapter. Airbus, the aircraft manufacturing conglomerate, has prepared an estimate of the number of aircraft that will be required over the next 20 years (see Table 3.18). This includes those purchased to add capacity, and those purchased to replace existing aircraft. India can expect to add in excess of 1,000 commercial and 1,000 general aviation aircraft to its national fleet over the next 20 years.

GENERAL AVIATION

The General Aviation (GA) market in India is expected to grow at 10 per cent per annum to cross Rs 16 billion by 2016-17. Industry sources indicate that around 300 business jets, 300 small aircrafts and 250 helicopters will be added to the current fleet by this time. A total investment of more than Rs 200 billion in GA facilities is required during the next five years alone.

The development of heliports is important to support the growth of general aviation in India, especially in areas that cannot have runways for financial or terrain-related challenges. A PPP policy for the development of heliports needs to be formulated, and one that especially applies to remote area service. There is also a need to develop standardised route operating procedures for helicopters.

The supporting infrastructure for GA at airports in Tier-II and Tier-III cities requires development. This includes night-landing facilities, enhancement of passenger amenities and State support in statutory services (e.g., security) to boost the GA industry. GA facilities at metro airports may be better served by developing separate terminals with premium facilities, and others that are fit-for-purpose.

Non-operational airstrips should be upgraded in places of economic significance such as ports, mining areas, tourist places and industrial clusters. These should be done at the lowest possible cost without compromising on safety. The airstrip may attract a small number of GA flights initially and if it has a strong business case, it may ultimately lead to full-scale operations in future, with significant benefits to the local economy.

With the current traffic load of scheduled flights at metro airports, GA aircraft, at times, are allocated lower priority as compared to scheduled opera-

Table 3.18
Investment in Aircraft to 2031-32

TYPE OF AIRCRAFT	FORECASTED NUMBERS OF AIRCRAFT	VALUE US $ (BILLIONS)	VALUE IN RS (BILLIONS)
Passenger (> = 100 seats)	1,019	141	7,070
Freighter (Payload > 10 Tonnes)	218	110	5,500
Sub-total	1,237	251	12,570
General Aviation (Only up to 2020)	1,400	8	410
Total	2,637	259	12,980

Source: Airbus, CAPA.

tors. Delays in take-off and landing clearances may defeat the purpose of investments in GA aircraft. A joint review committee should be formed by MoCA and DGCA with representation from GA operators to review the existing regulatory and operational framework.

MAINTENANCE, REPAIR AND OVERHAUL

The Indian MRO industry is expected to triple in size from Rs 22 billion in 2010 to Rs 70 billion by 2020. However, this future size is small when compared with the present MRO industry size of countries such as the UAE (Rs 80 billion per annum) and China (Rs 100 billion per annum). With India likely to become the third largest aviation market, there is substantial reason to promote an MRO industry that is even larger than the Rs 70 billion envisaged. It is possible that, even at this size, the industry will not be large enough to accommodate MRO operations for India's expected fleet, forcing operators to despatch aircraft offshore for this purpose, much as they do today. India has strong comparative advantages to become a world-leading centre for MRO. These include a growing domestic fleet, location advantages, and the availability of a large skilled workforce. The challenges against this are in ensuring that the industry is regulated properly, and that the required skills are developed to service increasingly sophisticated aircraft.

To pave the road for India as a preferred global hub for MRO, it bears thinking carefully as to why it is not already so in light of the comparative advantages just noted. First, under the present set of taxation policies, Indian MRO service providers pay nearly 40 per cent more in taxes than their foreign competitors[47]. These are in terms of countervailing import duties, value-added and service taxes. This has led to Indian carriers taking their aircraft to other locations like Dubai, Singapore, and Malaysia for the cheaper MRO service available there, even after the transaction costs are factored in. The resultant tax revenues in India from MRO are a fraction of what they could have been. There is a need for urgent review of this taxation policy to make it consistent with international practices. The current policies place Indian airlines at a cost disadvantage, as foreign airlines are able to make use of cheaper MRO services at their home bases.

The high countervailing duties on spare parts also need to be reviewed to bring them in line with the practice at other MRO hubs. These duties prevent local MRO providers from maintaining an inventory of key spare parts, leading to wasteful delays as aircraft are grounded for long periods. The 2013-14 budget of the central government went some way in this regard. First, the time period for the consumption or installation of parts and testing equipments imported for MRO purposes was extended from three months to one year. Second, a broader class of parts

47. NTDPC (2012, p. 77).

Airlines should be encouraged to set up MRO hubs through three-way joint ventures with MRO service providers and airports. This assures a symbiotic relationship between the three most important entities in the industry.

and testing equipment was made exempt from basic customs duty. The rationale for continued imposition of countervailing duties appears weak when considering that their sustained application over the years has hardly resulted in a vibrant domestic aeronautics industry. Meanwhile, with aircraft often deployed on both domestic as well as on international routes, and the policy goal noted previously of attracting foreign-registered aircraft to Indian MRO service centres, a re-consideration of service taxes and duties on imported parts is necessary to properly account for MRO service exports.

Airlines should be offered incentives to set up dedicated MRO hubs in India through three-way joint ventures with MRO service providers and airport companies. This assures sustained business for the venture, a cost advantage for the airlines, and a symbiotic relationship between the three most important entities in the aviation industry. Many global airlines have set up their own engineering services to which other airlines outsource maintenance. Air India's engineering arm is well-regarded, and with investment in training and equipment and a sound supporting policy, it can become a regionally important MRO provider in short time. These incentives may take the form of government designating a few airports as MRO hubs while also stipulating that all planned development at these locations properly allocates suitable on-site land and hangar facilities for MRO activities, with charges regulated by AERA. Further, AERA's remit may be expanded to regulate tri-partite arrangements between airport, airline and MRO provider and the tariffs charged for services rendered.

According to industry participants, receiving approvals for the establishment of MRO service provision is extremely challenging. Currently, the licensed activity is 'ground-handling' rather than MRO which suggests that no distinction is made between these very different services. Urgent repairs of grounded aircraft may require foreign specialists at short notice, but the issuance of the necessary security clearances is cumbersome and time-consuming. This renders them ineffective since the opportunity cost of a grounded aircraft is extremely high. There is a need to streamline clearance procedures so that there is a rational balance between business exigencies and security considerations.

In summary, the anticipated growth in Indian civil aviation, the country's geographic advantages and the potential of a skilled labour force combine to offer a persuasive case for the setting up of regionally dominant MRO facilities. The enabling policies required are (a) reconsideration with a view towards reduction or elimination of customs duties and other taxes; (b) mandated provision of suitable facilities as airports are re-developed together with a regulated tariff regime for real estate and for provision of services at airports; and (c) policy support to equip a skilled labour force.

GROUND HANDLING

A huge variety of activities are clubbed under the generic term 'ground handling'. Airlines can choose to undertake some or all of these themselves, contracting out the remainder to dedicated providers of ground handling services. Airlines will often undertake their own handling services at their hub airports; the economies of scale being such that the provision of services at other airports will be contracted to specialist providers or other airlines. These services can include arranging for passenger check-in and baggage handling, aircraft servicing at turnaround, refuelling, and in-flight catering amongst others.

The market for these services is expected to double from the present Rs 20 billion to Rs 39 billion within the next five years. A number of global ground-handling service providers have aggressive expansion plans in India. Future infrastructure development in this space will be largely driven by technology. Among the technologies expected to have a significant impact on the Indian aviation sector are passenger self-service solutions (such as for check-in), radio frequency identification for faster and more reliable processing of baggage, common use terminal equipment, unit load device scanners for cargo handling, and internet and mobile technologies. The introduction of these technologies will depend significantly on supportive fiscal policies and requisite traffic at the airports to warrant their use. Again, with handling equipment deployed for service provision on both domestic and international routes, a strong case for removing or reducing customs duties may be made.

The Ministry of Civil Aviation has brought in a ground handling policy for the six metro airports, limiting the number of ground handling agencies therein in order to facilitate consolidation and promote efficiency[48]. Mechanisation and modern ground handling processes are also key to ensuring efficiency. There should be proper monitoring mechanisms to oversee and enforce service level agreements between airlines and ground handling agencies, and between custodians, airport operators and ground handling agencies. To this end, airport regulators should specify service standards on the speeds with which passenger check-ins are processed, and the

48. This has been contested by airlines. The matter is currently subjudice in the Supreme Court.

numbers of mishandled baggage, and then require service providers to file regular compliance updates and be subject to period procedural audits.

DEVELOPMENT AND MANAGEMENT OF AIRPORTS: SELECT ISSUES

INSTITUTIONAL CHANGE

In India, the AERA was inaugurated during a round of reforms in 2007, with the express purpose of regulating tariffs set by the new joint-venture airports and those under the direct control of the AAI. The AERA regulates a wide range of tariffs relating to the operation of aviation services including landing charges, passenger service charges or user development fees, cargo charges, parking and hangar charges. Airports can also collect revenue from non-aeronautical activities such as aviation fuel and oil concessions, restaurants and catering services, car parking, and other commercial activities such as leases to express cargo and freight forwarding companies. Revenues from non-aeronautical activities sometimes subsidise those that are directly related to aviation.

The JV airports can be considered a success on several levels. There has been rapid expansion in capacity and improvements in quality of service delivery. On the whole, these airports are not just fit-for-purpose but are comparable with the very highest international benchmarks on several fronts. However, these improvements have been achieved at a price that may be considered untenable. Landing and usage fees at Delhi and Mumbai airport are amongst the highest in the world, though these have been approved by AERA[49]. Airlines have periodically complained of these fees, and have cited them as major barriers to increased service provision and lower airfares. The outcry has been vociferous enough that some airlines have claimed that it is uneconomical for them to operate service to these airports entirely[50]. The increases in fees sought by airport operators have been large, ranging between 100 and 400 per cent, again provoking concern from users. An important contributing factor to the large increases which have created adjustment costs for end users has been that tariffs were held steady from 2001 onwards, necessitating larger revisions. Several other airports are currently following or will shortly follow a PPP-JV investment model for constructing new facilities or upgrading existing ones. It is hoped that future adjustments will be more timely, and transparently presented with a more detailed assessment of airport costs.

The JV airports will need to be careful to levy reasonable tariffs that are competitive with other airports in the region. Any attempt to levy high tariffs by the JV airports, which, it will be recalled, are the systemically important airports in the Indian aviation network, are not conducive to the desired expansion of the industry or to lower airfares. It is fair that the development of these airports be paid for with substantial user charges. However, the current system of large increases in end-user charges on the basis of higher-than-anticipated development or other costs which the regulator has little power to reject lest this force the venture into bankruptcy is untenable. To prevent this, future PPP-JV agreements must be subject to more careful scrutiny on development costs, with reduced tolerances for budget overruns. India's preferred model of maximal regulation of airport tariffs through AERA on the basis of cost-plus pricing is sound only if the authority has real powers to impose penalties on contracting parties to the JV for failures to hold costs in check. To this end, the permissible structure for charges should be made known at the time of the tender, so that the consortium bids accordingly and the appropriate level of investment is expended on the airport development project. This can only be achieved if there is the framework of a National Master Plan for the development of airports which identifies clear economic reasons for building new airports in generally specified locations.

Airport regulators should specify service standards like speed of check-in, and then require service providers to file regular compliance updates.

Nonetheless, private funding and management of airport operations is increasingly the international norm, and it is desirable that the Centre should progressively withdraw from airport operations where feasible and commercially sustainable. If anything, state governments should play a much more active role in the airport sector since aviation is a key enabler of local economic development and they would be the appropriate partners for investors. Therefore, MoCA should engage with and encourage the states regarding the potential benefits of establishing a more conducive environment for the aviation sector based upon their understanding of the significant economic benefits of airports on their local economies.

With respect to other airports run by the AAI, the government should clarify the future role of the agency. As a first step, the AAI should be separated into two distinct functions: Airport Operations and Air Navigation Services. Each function should initially be corporatised, preparing its own financial statements, continuing under State ownership but

49. See IATA (2012) and IATA Submission to AERA on Consultation Paper 32/2011-12, dated March 2012 for a detailed review of the airline industry's position on these charges.
50. See http://goo.gl/PH9lO4 and http://goo.gl/IW903M (accessed on 31 August 2013).

The AAI should be separated into two distinct functions: Airport Operations and Air Navigation Services. Each function should be corporatised, preparing its own financial statements, and managed independently along commercial lines.

managed independently along commercial lines. The Airport[51] Operations Division currently has no clear commercial goals and is involved in a large number of projects, of which many are economically unviable. There would be advantages to breaking these activities into smaller units, separating airport construction from airport management, in turn further breaking these down by region. Further, budget accountability is essential, considering that as the AAI enhances its prime assets and progressively privatises them, it will be left with the task of continuing to invest in airports that are initially not viable. It is also possible for the public sector authority or corporatised entity to act as a landlord while terminal operations are run by private entities.

The newly reorganised Airports Authority should then turn its attention to developing new airports together with state governments so as to stimulate their participation in the sector. However, new airport projects should be subject to review by an independent Airports Approval Committee. Such new projects should also be developed within the context of a 30- to 50-year Master Plan for Indian Airports as mentioned above, integrated with the National Transport Plan and metropolitan road and mass transit projects.

At present, the AAI's business model is highly complex as it manages the largest portfolio of airports in the world under a single operator and, in addition to the management and construction of airports, it also has the onerous task of providing air navigation services. It is for this reason that our recommendation is for a clear structural and commercial reorientation of the authority with a rolling programme of privatisation of the new assets that it creates.

SLOT MANAGEMENT

For the purposes of providing fair access to a capacity-constrained airport, 'slots' permitting planned operations are allocated to the airlines seeking to use the airport. For the purpose of slot allocation, airports are categorised according to the following levels of congestion[52]:

- Level 1: where the capacity of the airport infrastructure is generally adequate to meet the demands of the airport users at all times.
- Level 2: where there is potential for some periods of the day, week or season which can be resolved by voluntary cooperation between airlines.
- Level 3: where capacity is constrained due to lack of sufficient infrastructure.

Major revisions to India's slot allocation policy were introduced in 2007, and again in May 2013. The 2007 revisions were prompted by a need to accommodate the differential requirements of the joint-venture airports. The managers of these airports received proposed schedules either directly (from domestic airlines), or via Air India (for foreign airlines, highlighting an immediate conflict of interest). The airport managers would then liaise with the AAI in its role as the provider of air-traffic control and navigation services to determine runway capacities and usage, before communicating outcomes to the airlines. Slot allocation at all other airports remained under the purview of the AAI.

The newly-issued 2013 guidelines aim at correcting some of the shortcomings of the system which include[53]: (a) the absence of a system for objectively assessing the available slots at an airport; (b) the absence of information on available slots in the public domain; (c) no mechanism to cancel slots; (d) the blocking of slots by airlines without using them; and (e) the absence of robust appellate mechanisms. The revised policy introduced in May 2013 is intended to be transparent, fair, equitable, and amenable to course correction. To this end, it identifies streamlined procedures for assessing demand and managing capacity at airports, simplifying the process of categorisation of airports as Level 1, 2 and 3 facilities. It also sets up a coordination mechanism wherein the airport operator liaises with airlines and sets up a coordinator to allocate slots in a 'neutral, transparent, and non-discriminatory manner'. The major prioritisation principle for slot allocation is historicity in that an airline seeking slots for a forthcoming period must have used more than 80 per cent of the slots allocated to it in the previous period.

The 2013 guidelines also go some way towards ensuring that allocation considerations account for the entry of new airlines into the market, the promotion of domestic and international hubs, the promotion of season-long and year-round operations, the promotion of market competition, and ameliorating the impact of curfews at one airport on the civil aviation network. The guidelines also give the coordinating authorities more precise criteria for gauging slot misuse and powers to cancel allocated slots. As such, these guidelines are a welcome reform.

However, problems remain. Today, as per IATA principles, an incumbent airline in India is entitled to retain a group of slots based on historical precedent

51. In this context, 'operations' refers to the collective of all activities required to arrive at and depart an airport.
52. See MoCA (2013a, 2013b).
53. Ibid. (p. 7).

provided the slots in question have been allocated to a passenger air carrier and utilised at least 80 per cent of the time in the preceding season[54]. The guidelines additionally state that slots may not be withdrawn from existing carriers in order to accommodate new market entrants; rather, from a given pool of available slots, new entrants have access to only 50 per cent of these. At present, while the UK and European Union recognise and apply IATA slot allocation guidelines, the US does not, in part due to concerns regarding anti-trust law.

Not surprisingly, these slot allocation rules create artificial barriers to entry for new market participants by sharply limiting the number of free slots available to them at domestic Indian airports. IATA's grandfathering provision, to which the AAI adheres, allows existing carriers to withhold prime-time slots at airports on lucrative, popular routes, thus enabling incumbent airlines to cling to substantial market share and effectively crowd potential entry out of the market. Carriers also automatically control all slots utilised at least 80 per cent in a particular assignment season during the next season, and underutilised slots are only brought to market every six months, creating a time lag that compounds new market entrants' competitive disadvantage. Moreover, it is often the case that underutilised slots are intrinsically less desirable in the first place—at unfavourable times and otherwise unable to generate high revenues—which compounds new carriers' ability to compete on lucrative high-margin routes.

Another power imbalance resulting from India's slot allocation system occurs when domestic airlines merge. When two incumbent carriers merge, all premerger slots of both airlines will be allocated to the surviving entity. Since the number of slots that a carrier controls is positively correlated with the market power it enjoys, merged entities consequently end up in a disproportionately favourable position from which to capture greater market share from competitors. Not only does this process create an artificial scarcity of (already-scarce, in many cases) slots, so too does it raise the concern that sector consolidation will by default severely reduce competition in the domestic market, particularly if two larger industry players were to merge and thus effectively crowd out other incumbent carriers and potential new entrants alike. Here again, only if the merged entity fails to utilise individual slots are those slots returned to the 'unallocated' pool—a pool comprised primarily of non-peak, oddly-timed slots.

Unfortunately, the overall effect of the 2013 guidelines is unlikely to be conducive to a well-functioning and competitive sector. A case in point is the trading of slots among airlines, a process that is permitted as per IATA guidelines but banned within the Indian regulatory framework. It has been demonstrated globally that allowing airlines to trade slots can promote operational efficiency among carriers and maximise the utilisation of available slots. Indeed, slot trading (with financial incentives) is permitted in the UK, the European Union and the US and allows airlines in these jurisdictions to enhance overall sector efficiency by effectively creating a market in which slots can be allocated to airlines based on willingness to pay.

It has been demonstrated globally that letting airlines trade slots—not allowed in India—can promote operational efficiency among carriers and maximise the utilisation of available slots.

Having said this, the slot trading system is by no means perfect: for example, it can lead to hoarding, since there is generally a positive correlation between controlled slots at a carrier's influence within a particular market. However, on balance, allowing Indian carriers to trade a limited supply of slots would lead to more efficient outcomes versus the existing semi-annual government slot review and assignment, particularly in light of the other regulatory challenges to effective competition that have been highlighted above. Greater adherence to due process, transparent decision making by airport operators and regulators will lead to continued improvements in the slot management process. Reviewing and gradually revising India's current slot allocation system will help to reduce a key market barrier to competition and in turn create a framework of more predictable and efficient slot allocation outcomes, as it has in other markets globally.

LAND ACQUISITION AND LAND USE FOR AIRPORT DEVELOPMENT

Unlike for other transport modes, the provision of aviation services does not depend on transport corridors. Instead, what is required are reasonably sizable pieces of land in close proximity to centres of population that also conform with international standards for safety in civil aviation. Wherever possible, it should be preferable to develop brownfield airports: these will offer the greatest locational advantages. Where it is desirable to develop greenfield airports, the area required for airport development should be decided based on current and future demand and traffic patterns.

The long-term traffic forecasts indicate that the growth of our new metro cities will require second and in some cases third airports in the 20- to 30-year timeframe. Land scarcity implies that this will not only become a significant political issue but requires search for the land for second and third airports to

54. NTDPC (2012, p. 106) (citing IATA regulations). Note that in a year, there are two seasons (six months each) for slot utilisation; slots used less than 80 per cent of the time in a given season are categorised as 'underutilised'. See Procedure Manual Directorate of Regulations & Information, Government of India Office of the Director General of Civil Aviation, p. 10.

commence now with appropriate zoning for such land and reservation of such land for connecting transport corridors.

A strong regulatory framework is essential to determine the practices under which land can be acquired, the compensations paid, and the zoning of both the actual land used for airport development and that in its immediate vicinity. In many countries, land that is proximate to airports has been put to extremely productive use in the form of off-site cargo processing and shipping facilities, as warehousing space for time-sensitive cargo, and as real estate for the several industries that both rely on and support civil aviation. With many global cities boasting multiple airports, urban development master plans and plans for development of civil aviation should both give formal consideration to a handful of smaller airports in the largest metropolitan cities.

Urban Master Plans should give formal consideration to a handful of smaller airports in the largest metropolitan cities.

An 'Airport Approval Commission' may be established within MoCA to review the business plans of proposed airports prior to granting clearance[55]. The Commission would take account of airport development within the multi-modal context of transport development policy: it would consider airport development with regard to sustainable viability: it would refer to goals and objectives defined for airport in that location and, in order to attract private and PPP models, the transparent and equitable economic regulatory framework needs to be articulated in advance.

HUB AIRPORTS

In recent times, the government has declared the intention of revitalising Delhi's, and possibly Mumbai's airport, as international hubs. These ambitions are commensurate with India's expanding aviation market, and a desire to direct a greater share of aviation business originating both domestically as well as internationally to Indian economic and tax jurisdiction. However, as noted previously, these ambitions for global hubs that rival Dubai to the West and Singapore to the East, should be subservient to the pressing requirement for the development of national hubs within India, which help to transfer passengers from one part of the country to another more cost effectively than through point-to-point services. These West Asian and South East Asian hubs have, to some extent, developed because of the absence of similar-sized and efficient hubs in India.

While it seems a strategic national imperative that India should have an international hub to interchange the travellers overflying India in the global east to west and west to east air corridors, *it must be appreciated that a hub in India can only operate competitively against the West Asian and South East Asian hubs, if it has a strong national airline (or airlines) to patronise this hub in preference to hubs promoted elsewhere by national governments for the airlines of their respective countries.* Had Air India grown into an airline of scale, with significant international reach both eastwards and westwards to all five continents and, were it to be a viable airline, Delhi may evolved naturally to be a major airport hub for long-distance international travel to and through India. Unfortunately, Air India's current network and market share do not accommodate this vision and its future viability is in doubt.

It has been estimated that there are at least 30 destinations from India to Europe, North America and South East Asia that could justify daily nonstop flights departing India, in some cases multiple flights per destination. Therefore, as it is in the national interest for Indian-owned airlines to gain the revenue of long-distance travel of India-originating traffic, it would be necessary to actively support the development of such a full-service international airline or airlines, by providing the appropriate facilities at Delhi airport, support on bilateral rights, and other required government approvals, each according to a transparent regulatory framework. In summary, discussions on the development of international hubs in India must first recognise the more urgent requirements for promoting domestic hubs, and also ensure that a viable airline with sufficient reach exists to symbiotically develop the international hub.

Air India continues to possess the slots and air traffic rights that could, potentially, enable it to emerge as a dominant Indian airline that can be counted among the best in the world. That such an outcome is beyond any current expectation is obvious. It is therefore imperative that the government takes a considered view in this matter and reinvent Air India with the ambition of making it into a competitive airline comparable with peers such as Emirates, Singapore Airlines, Qatar Airways, Etihad, Lufthansa and the like. All of these airlines are under public ownership but are run completely on commercial lines. An imaginative solution will have to be found that takes a complete break from the past. Within India, very competitive commercially aggressive entities have appeared from former public ownership, such as ICICI Bank, and others. The solution may be to develop a completely new airline that takes over key Air India assets, while the liabilities are hived off, to be dealt with separately, analogous to a good bank/ bad bank strategy. The new airline could be in the public sector (if so desired), joint sector, or private. But the

55. CAPA's submission on the New Civil Aviation Policy.

important ingredient would be complete commercial and operational autonomy.

ISSUES RELATING TO REGULATION OF AIRLINES

THE AIRLINE MARKET

The government seeks to take a number of measures to prevent airlines from engaging in anti-competitive practices. One such practice common among incumbent players is to charge fares on routes at levels that are in aggregate insufficient to cover marginal costs. Airlines sometimes do this to undercut relatively inefficient competitors, or to deter the potential entry of new market players by deciding to take short-term losses, something that new market entrants may not have the balance sheet strength to do. Another such strategy is for airlines to add excessive capacity or frequent service, the deployment of which can force competitors to drop fares in order to ensure greater utilisation of their own aircraft. Here again, an incumbent airline can pressure new players effectively out of the market, by lowering fares in the short term.

Needless to say, the behaviours and institutions outlined here contribute to the power imbalance among India's new and emerging airlines that is discussed throughout this report.

PRICING STRATEGY

A number of market developments surrounding scheduled carriers' pricing mechanisms suggest the need for some form of pricing regulation. Most recently, in 2010, there were allegations that domestic carriers were setting prices artificially high, particularly during festival and holiday seasons and during periods in which airline employees were on strike. According to the Civil Aviation Working Group Report, evidence suggests that day-of-departure spot prices on certain routes were sometimes seven to eight times higher than the prices airlines had been charging only weeks previously.

Although it is common in other jurisdictions—around Thanksgiving or Christmas in the United States or Chinese New Year throughout East Asia, for example—to charge higher prices during holiday seasons, the differential by which Indian domestic carriers are alleged to have done so is notable. Moreover, a number of passengers filed complaints related to excessive pricing during peak festival seasons (e.g., Diwali) during which some airlines' pilots were striking, which thus naturally gave undue advantage to carriers whose pilots were not striking, allowing them to drive up prices even as they captured excess market demand. Preying on customers whose options are limited, particularly during periods in which domestic demand is high, is problematic.

A new airline could take over key Air India assets, while the liabilities are hived off, to be dealt with separately, analogous to a good bank/bad bank strategy. The airline could be in the public, joint, or private sector. But it must have commercial and operational autonomy.

Following these episodes, the Directorate General of Civil Aviation required that carriers become more transparent in disclosing airfares in advance to the public. Going forward, regulators should work with airlines to regulate pricing, but only loosely. The desired regulatory framework should protect consumers against episodes of predatory and discriminatory pricing as described above while simultaneously ensuring that prices are fair, reasonable and largely market-driven.

One of the key factors in determining airlines' financial outlay lies in effective utilisation of aircraft, which can have a dramatic impact upon carriers' ability to efficiently manage costs. Higher aircraft utilisation rates allow airlines to reduce overall operating costs and to rationalise capacity induction in the most financially viable manner.

Not surprisingly, within the domestic market, low-cost carriers (e.g., IndiGo and SpiceJet) are more effective than full-service carriers in aircraft capacity utilisation, in part because they tend to lease rather than own their aircraft and are thus able to respond more quickly to changing demand. According to the Civil Aviation Working Group Report, in 2010-11 SpiceJet (10.6) and IndiGo (10.2) posted aircraft utilisation rates (in block hours/day) closer to those of global industry leaders such as Singapore Airlines (11.7) than to domestic full-service peers (e.g., Jet Airways 9.7; and Air India 6.9)[56].

PROFITABILITY AND VIABILITY

CAPA estimates that India's airlines would posted a combined loss of approximately $1.65 billion for the 12 months ending March 31, 2013[57]. These losses stem from two carriers—Air India ($950 million loss) and Kingfisher ($500-520 million loss). Other airlines, except IndiGo, which fared well, made modest profits[58].

Generally speaking, Air India has struggled throughout the Indian aviation market's transition from a monopoly market into one that is increasingly competitive. Although the flagship carrier was able to break even or limit operating losses until 2005-06, the entry of four additional airlines in that year has contributed to rising losses at Air India in the period since then. Simply, Air India continues to struggle to improve efficiency and keep pace with its more innovative and agile private competitors.

Air India's performance somewhat improved in 2012-13. The net losses came down, due to increase in load factor from 67.9 in 2011-12 to 72.4. The yield (Revenue/Passenger Km) improved by 16 per cent. The financial restructuring

56. NTDPC (2012, p. 93) (citing Directorate General of Civil Aviation and airline annual reports).
57. CAPA India Aviation Outlook 2012/13.
58. Though Kingfisher has ceased operations, its exit from the market is messy, and daily losses accrue to creditors.

Based on air traffic forecasts, India's commercial fleet size is expected to more than double over the next decade. Airlines in India are expected to add approximately 370 aircraft (worth Rs 1.5 trillion) to their respective fleets in the next five years.

plan approved by the government should have also contributed towards improvement in the balance sheet. Air India should continue to improve yield and load factor and effect reduction of cost base. Finally, strong consideration must be given over the medium-term to the rationale for retaining a national airline. If the arguments are not tenable, then plans should be made to divest investment therein.

Simultaneously, Jet Airways continues to struggle financially: the airline's recent revenue growth has been surprisingly modest in spite of the fact that market conditions presented Jet with a prime opportunity to exploit the financial woes its two key full-service competitors (Air India and Kingfisher) have been facing. Although Jet Airways achieved growth in revenue and yield, the traffic in terms of passenger kilometres decreased in 2012-13 compared to the year before. The load factor also dipped marginally. Industry analysts believe that Jet Airways' inability to leverage the issues its main competitors have faced over the last year could signal structural weaknesses within the business. Specifically, CAPA India has stated that Jet's cost base may be too high and that without efforts to restructure controllable non-fuel costs—particularly in light of high ATF prices and a weak rupee—the airline will struggle to maintain viable operations[59].

IndiGo continues to lead the domestic market in performance, though India's recent higher-cost environment and the airline's entry into international services have even pressured the financials of this rising star, by all accounts the domestic aviation industry's greatest success story in recent years. In spite of these factors, CAPA India still believes IndiGo is likely on track to record its highest annual profits to date this year, provided international operations prove successful and the airline is able to successfully navigate the current challenging cost environment. Moreover, as IndiGo continues to expand rapidly, it must place heavy emphasis upon ensuring consistently strong service levels (e.g., efficiency of service, on-time arrivals and other factors that have to date differentiated IndiGo's business strategy vis-à-vis domestic peers) across all the markets it serves. While customer satisfaction remains high, these issues will become ever more challenging as the airline continues to ramp up.

Go Air, India's smallest carrier by fleet size, continues to perform better than the majority of its much larger competitors. The carrier maintains stable operations and high customer satisfaction rates, and has managed to achieve the market's highest gross fares among low-cost carriers. A targeted and strategic network, the decision to operate routes on which the airline faces little competition and higher yields have served Go Air well. As the airline matures, continued reduction of debt levels will help to ensure future financial viability.

Finally, SpiceJet's financial performance continues to suffer, in part due the airline recently beginning to operate Q400 aircraft (a move that has yet to turn profitable) and its launch of international flights. Although these decisions may have been better-timed in light of broader financial pressures on the domestic market, over time they may help the airline to build a more competitive cost base and improve efficiencies, if managed appropriately.

Overall, although the combined performance of these carriers is the best it has been over the last 18 months—yields continue to improve and the airlines are demonstrating capacity discipline as they continue to focus on profitability above market share—current market conditions place a great deal of pressure on domestic airlines. Moreover, a number of key factors (most notably fuel prices and recent, sharp depreciation of the rupee) remain beyond the control of the airlines' management teams, who continue to struggle to find ways to tackle these issues. Cost pressures have further intensified this year, as airlines expect the announcement of still-higher airport charges and passenger fees in Mumbai, Chennai and Kolkata. In short, the combination of these factors continue to pressure domestic carriers and render their potential to deliver sustained profitability somewhat unlikely over the near term.

ENHANCING PHYSICAL CAPACITY

Physical capacity in the domestic market continues to grow steadily, with both Available Seat Kilometres (ASK) and Revenue Passenger Kilometers (RPK) moving largely in tandem since the mid-1990s: in fact, the gap between the two has increased significantly since 2005-06, indicating excess supply of capacity in relation to demand growth over the last five years. This has in part been the result of the global economic downturn—given the high degree of sensitivity of passenger air travel to broader economic conditions—and consequently it is critical that capacity continue to be enhanced over time in order to keep pace with India's economic growth over the medium-to-long term.

59. CAPA India has stated that Jet Airways must focus on three key elements to create viable operations, namely: (a) introduce strategic clarity and greater definition with respect to its low-cost subsidiaries and strategy; (b) control and rationalise non-fuel costs; and (c) focus on generating ancillary revenues, in which CAPA India believes the airline has recent begun to take positive measures.

Based on air traffic forecasts, India's commercial fleet size is expected to more than double over the next decade. Airlines in India are expected to add approximately 370 aircraft (worth Rs 1.5 trillion) to their respective fleets in the next five years[60]. Similarly, India's general aviation fleet is expected to expand by roughly 2,000 (aircraft and helicopters) in the next decade[61].

There are various methods by which airlines can successfully induct new aircraft (e.g., direct purchases, finance and operating leases), each of which holds various degrees of benefits and liability. In India, while Air India chooses to follow the direct purchase model, low-cost carriers such as IndiGo and SpiceJet tend to lease their aircraft.

Although Air India owns its aircraft, industry analysts are concerned that the flagship carrier may not have the capacity to fully leverage domestic demand and engineer a turnaround of its recent financial and operational woes. Air India currently owns 55 domestic aircraft (only 45 of which are available purely for domestic routes)—an insufficient number with which to successfully meet domestic market demand. Similarly, Air India only has between 20 and 25 aircraft for international routes, and CAPA India further believes that its core aircraft (the Boeing 777) has not been optimally deployed with respect to route selection, further pressuring the airline's already-insufficient international fleet.

FUEL PRICING

Fuel is perhaps the largest input in aviation, accounting for around 50 per cent of operating costs. Prices for ATF in India are nearly 60 per cent higher than in neighbouring hubs like Dubai, Singapore and Kuala Lumpur. The high prices result from its administrative treatment, a complex system of taxes and the lack of competition in a market where other fuels are subsidised. Representations delivered to the Working Group on Civil Aviation suggest that the market for ATF is not sufficiently competitive to ensure that prices have a direct basis in costs[62]. Prices of ATF are based on International Import Parity Prices and so are unrelated to the actual cost of refining ATF in India which is a middle-distilled crude derivative. Instead, the purchase price of ATF includes a notional customs duty of 5 per cent, a customs excise duty of 8.25 per cent, service taxes on refuelling activities at 10.3 per cent, value-added taxes at around 25 per cent that are levied by most states and an Octroi or entry tax.

Despite being an input fuel (similar to coal and gas), ATF is subject to VAT, ranging in most states between 20 per cent and 30 per cent. Generally, the central excise duty paid on any input in manufacture is set off against service tax paid on output as per the service tax principles laid down by the Central Board of Excise and Customs. However, this facility of set-off is not applicable in the case of ATF although air travel itself is also subjected to service tax.

Prices for ATF in India are nearly 60 per cent higher than in neighbouring hubs like Dubai, Singapore and Kuala Lumpur.

Other recommended policy changes are (a) the inclusion of ATF in the unified GST regime, as introduced in the future; (b) the existence of a more transparent ATF regime where oil marketing companies are required to declare costs and methods used to price the end product; and (c) a switch to a specific rate of duty rather than an ad valorem structure. The last recommendation is motivated by the fact that higher base prices result in both higher duties as well as higher VAT under the present taxation regime.

AIR INDIA

The government should clarify the future role of Air India. In the present environment, reasons for government to operate an airline in a highly competitive, volatile, and capital-intensive environment must be clearly defined. The Committee has not found persuasive arguments for continued government ownership and operation of the airline. In the event that these reasons are not defined, a plan for the progressive disinvestment of the government's stake in Air India over a period of three to five years, based on a phased scheme with defined milestones should be identified. The airline will need to be recapitalised, restructured organisationally, its working capital debt burden written off and some divisions made independent and corporatised, with government retaining perhaps a 26 per cent stake. It would essentially be a new airline. As recommended earlier, this entity should start completely anew while Air India's current liabilities are separated out and dealt with.

It is apparent that with its excessive and unproductive manpower, its failure to invest in the technology required to keep it competitive and with its sub-scale operations, Air India's future prospects remain precarious. Air India must therefore be provided the opportunity to reinvent itself with new professional management, managerial and operational autonomy, while taking over all existing productive assets. If such a makeover cannot be done in a public sector or joint sector framework, it will need to be privatised. Failure to implement such a plan will

60. NTDPC (2012).
61. According to the Working Group Report, studies of mature aviation markets (e.g., the US) suggest that general aviation plays a significant role in the expansion and growth of a nation's scheduled commercial market. Consequently, it is important to take note of India's future general aviation growth, as it will in part influence commercial and overall sector growth.
62. NTDPC (2012, p. 76).

The aviation market still presents barriers to entry relating to political risk. Nor does it facilitate orderly exit with airlines having been allowed to continue operations when they fail to meet their payment obligations.

continue to drain over $1 billion per annum of tax payers' money each year over the next 10 years, which is surely unacceptable in the light of our national priorities. Meanwhile, Indian civil aviation will suffer and India will not be able to develop major hubs.

GENERAL AVIATION

General Aviation has the potential to emerge as the key driver of regional connectivity and with it, accelerated economic development. It is therefore surprising that this sector, which has such a massive growth potential and in many other countries has hundreds if not thousands of aircrafts being operated on a non-scheduled basis does not have a dedicated policy or regulatory framework or infrastructure or services in this country to support it.

The current neglect of the sector is a serious economic opportunity loss for the Indian economy. Plans for the development of national airports should incorporate steps to increase capacity of support to, and flexibility for, general aviation. This would include ensuring adequate parking and hangar space, allowing MRO activities on the airport, and developing ATC procedures capable of accommodating increased movements of small aircraft.

Along with this, serious consideration should be given to the development of disused or low-traffic secondary airports, where state governments could support their revival to stimulate air taxi operations for business and tourism.

The current regulations affecting general aviation impose restrictions on import of aircraft and in some cases do not recognise the difference between helicopters and fixed wing aircraft. The DGCA suffers from shortage of personnel to monitor this area whether there is a multiplicity of aircraft type and fragmentation of operations. The DGCA should establish a dedicated division to deal with general aviation through, for example, the appointment of a Director for General Aviation.

COMPETITIVENESS

The present aviation market, though liberalised, still presents barriers to entry relating to political uncertainty and risk, as a result of absence of an aviation policy. Nor does it facilitate orderly exit with airlines having been allowed to continue operations when they fail to meet their payment obligations. The regulatory authority must take into account (and have the expertise to do so) the financial strength and stability of airlines while permitting entry and also continuing operations. A similar approach for financial viability assessment should be put in place and applied to airlines in view of the very large numbers of passengers who can be stranded away from their homes, in India or abroad, by a cessation of an airline's operations. These important factors relating to airline stability must be gauged by more systematic and consistent criteria that agree with basic accounting and economic principles, rather than by arbitrary rules of thumb such as the 20-5 rule described here. The criteria and the resulting regulatory action can also include the very basic: for example, airlines should not be permitted to expand if they are encumbered with heavy debt obligations which remain unpaid; or if they have negative net worth; or if they have inadequate liquidity to meet their current operational obligations.

It is further recommended that new entrant airlines should be scrutinised for the strength of their business plans, for adequate capitalisation and that the airline at any point of time has the liquidity to meet liabilities for a defined period (such as one or two quarters) without any revenue inflow for that period. The aviation policy should also strictly prohibit the grant of no-objection certificates for the relaunch of any airline whose previous debts to banks or creditors remain unpaid. Elsewhere in the world, if an airline does not have cash to pay fuel bills, or airport charges, or navigation and landing fees, it is obliged to cease operations. If the same discipline is made to apply in India, inefficient airlines will quickly either recapitalise or exit, thus permitting entry of better capitalised entities.

SUSTAINABILITY AND OTHER ISSUES

EMISSIONS

Four kinds of gases make up the main emissions from aviation[63]. These are carbon dioxide (around 70 per cent of total emissions), water vapour (30 per cent), and miniscule proportions of nitrogen oxide and sulphur oxide. About two per cent of global carbon dioxide emissions can be attributed to aviation. Though the absolute quantities may be small relative to other transport modes, these are very large relative to passenger kilometres performed. The effects of the emissions are especially pernicious as the largest quantities of these take place at high altitudes where their warming potential is greatest.

The industry's collective efforts at reducing emissions are spearheaded by ICAO and IATA, though the European Union has perhaps made the largest

63. World Bank (2012).

efforts of any individual jurisdiction. The Group on International Aviation and Climate Change (operating under an ICAO mandate) was tasked with developing measures consistent with the UN Framework Convention on Climate Change for the aviation industry. The declarations emanating from meetings held to debate the findings of the Group argue for annual average fuel efficiency improvements of two per cent until 2020, with similar long-term goals from 2021 through 2050. The declarations also 'announced plans to create a market-based mechanism to lower emissions and a comprehensive reporting system to track emissions'[64]. Further, the development of alternative fuel technologies and engine efficiencies is encouraged.

Meanwhile, the European Commission's 2008 directive on extending an emissions trading scheme to aviation requires all flights operating to or from the EU to be subject to market-based measures to either reduce greenhouse gas emissions, or to compensate for them. Carriers are given allowances based on their past emissions levels, and are then set targets to reduce these by defined proportions each year. 'Carriers that exceed their allotted allowances must either purchase allowances from other ETS participants, purchase approved emissions-reduction credits, or pay a fine'[65]. Finally, IATA has proposed that the industry respond to these goals and regulatory requirements with a four-pronged approach. First, new technologies must be deployed to yield more efficient engines and aircraft, and better fuels. Second, operational practices like weight-reduction measures and more efficient flight procedures and air-traffic control should be researched and adopted widely. Third, better airport infrastructure (for example in terms of its siting, layout, and design) could result in reduced low-altitude emissions. Finally, market measures like carbon offset programmes, cap and trade programmes, and others should be developed and adopted.

Indian regulatory authorities have not agreed or subscribed to these goals for the most part. However, Indian carriers will not be immune to these measures even if they are not adopted domestically. Fungible technologies and the absence of a domestic manufacturing industry mean that over time, globally standard equipment will be the norm in domestic fleets. More importantly, Indian carriers will have to conform to rules imposed by regulatory authorities in foreign destinations. For example, the EU directive noted above applies to international airlines from all domiciles from 2012 onwards. Indian regulatory authorities and airlines are active and valued participants in institutions like the ICAO and IATA. By treating this as a matter of importance as they shape the growth of the sector, and by allocating greater priorities towards these concerns, they can both shape the global agenda as well as better prepare the domestic industry for changes in international standards. To that end, if domestic authorities deem objections to proposed international norms justifiable, then rigorous alternatives must be investigated and raised for discussion at the international forums. To do nothing would ignore a pressing problem and signal a substantial missed opportunity to shape the international agenda.

NOISE POLLUTION

Since the rise of the jet aircraft in the 1960s, concerns have been raised about the impact of generated noise on human health. Though the science assessing this impact is not universally accepted at the margin, several less controversial links have been proven to hold true. Sustained exposure to defined 'high' noise of around 85 decibels (dB) can cause hearing impairment in the medium to long term. Shorter exposures to even higher peak sounds (in excess of 120dB) can cause immediate pain, tinnitus, and immediate and permanent hearing loss. The physiological effects of noise pollution are not limited to the ears. Noise exposure has also been pinged as a causal factor in adverse cardiovascular, immunological, and pre-natal effects. Perhaps most importantly, there is general annoyance, stress and hypertension, sleep deprivation, and irritability that stems from excess noise, each of which has consequences for workplace productivity and the general enjoyment of life.

Concerted global effort has made sure that modern jet engines are almost a quarter as noisy as those in the 1960s.

In recognition of these effects, there has been concerted global effort over the years to ameliorate aircraft noise and its effects. The lion's share of the noise abatement has come from the aircraft themselves: modern jet engines are between a quarter and a third as noisy as their ancestors from the 1960s. Regulatory authorities have modified ATC and other practices to allow for quieter take-offs and landings. For example, the practice of Continuous Descent Arrival wherein an aircraft descends continuously from cruise altitude (typically around 35,000 feet) to a final approach altitude of 3,600 feet reduces the noise associated with step changes in altitude[66]. Similarly, prohibitions on the use of reverse thrusts substantially reduce noise in the immediate vicinity of the airport.

The ICAO recommends a balanced approach to limit noise from civil aircraft. The first element is a progressive tightening of noise certification standards on jet engines and airframes. These standards are published by the ICAO periodically, and referred to

64. Ibid. (p. 34).
65. Ibid. (p. 35).
66. The AAI has recently permitted this practice for landings at Delhi International Airport, with a view to extending this to other airports.

by 'Chapter' numbers. The latest noise standard, Chapter 4, was agreed to by the ICAO in 2001, and features a ceiling that is 10dB lower than the previous Chapter 3 standard. It is estimated that each new generation of jet aircraft are 15 per cent quieter than the previous generation. The second approach focuses on ensuring that the population affected by aircraft noise is minimised around the airport through better land-use planning. Third, new regulations governing operational procedures can mitigate noise. These can range from outright bans and curfews to procedures governing flight paths and technical restrictions on take-off and landing practices. Finally, as with the emissions reduction methods proposed here, the fourth pillar at containing aircraft noise seeks to implement measures that directly charge airlines on the basis of noise emitted by their fleets. For example, the UK sets noise emissions quotas and also determines the contribution that an aircraft movement of a particular type makes towards using up the quota. A gross quota is allocated to airlines which helps them better manage their fleet and operations to ensure that their cumulative noise emissions remain contained within the quota.

The challenge lies in ensuring necessary levels of supply of skilled staff, while maintaining unimpeachable safety standards.

It is recommended that all future airport developments be made with a view towards mitigating the impact of aviation noise on surrounding populations. This may be done by designating and allocating land far in advance of intended usage, and by permitting populations in the vicinity both the incentive and the opportunity to relocate. Further, the neighbouring land should be zoned for uses that are compatible with the aviation industry, thereby minimising the likelihood of objections to aviation-related noise. Such advance planning will also avoid the requirement of post hoc measures such as curfews which may prove detrimental to the growth of the industry. Should issues of noise become especially pertinent at a particular airport, consideration may be given to innovative schemes such as quotas that allow airlines to self-regulate total noise emissions in any manner consistent with market realities. Meanwhile, for the present, detailed observations should be made of the impact of noise at all airports on the surrounding community. Where the data suggest obvious health hazards, consideration should be given to stricter amelioration measures like insulated homes and windows and abatement measures like curfews. As the Indian aviation market expands and matures and remains profitable for the operating airlines, the curfews should not prove inimical to the health of the industry.

HUMAN RESOURCES

THE PRESENT SITUATION

India's civil aviation sector is at present facing acute shortages in manpower, e.g., for pilots, cabin crew, engineers, air traffic controllers, ground staff and handlers, administration and management. According to the Report of Working Group on Civil Aviation for formulation of 12th Five Year Plan (2012-17), the total manpower requirement of Indian carriers is estimated to rise from 62,000 in 2010-11 to 117,000 by 2016-17. This shortage is due primarily to a significant lack of adequate training infrastructure, including training academies, instructors and equipment. The staffing requirements at Indian airports can also be projected. The metropolitan airports, on average, employ one staff for every 65 passengers, while this ratio is around 200 in the smaller airports. Consequently, the Working Group estimates the total manpower requirement at airports to increase from 20,000 to as much as 30,000 by 2016-17. Even after accounting for improved efficiencies, this figure could grow fivefold over the period under consideration by this Committee.

The challenge lies in ensuring supply of skilled staff at a pace consistent with the expected and desired growth rates in civil aviation, while maintaining unimpeachable safety standards. India faces competition from regional aviation hubs, as well as from those further afield for these skilled staff. For example, between 30 and 40 per cent of the staff at several carriers and aviation service providers based in the Arab Gulf, are drawn from India[67]. Meanwhile, the ICAO forecasts that all regions except North America are expected to face a shortage of pilots, with the problem most severe in the Asia-Pacific region. Another independent forecast suggests that airport employees, air traffic controllers, ground handlers, catering staff, retail and security staff are estimated to triple from 90,000 at present to 270,000 within 10 years[68].

Almost no educational, research or governmental institution in the country undertakes research in civil aviation. There is also an absence of qualitative and recognised formal educational programmes in civil aviation (as opposed to engineering and aeronautics). Many public and private organisations in the field must therefore recruit generalist staff and invest considerable resources in on-the-job training. The quality of flying schools in India is not gauged to be satisfactory. Airlines and type-training organisations report serious concerns with the quality of graduating students. In the absence of sufficient high-quality domestic pilots, India continues to rely extensively on foreign pilots. Of the 42 licensed pilot-training institutes, only 17 are operational. There

67. NTDPC (2012, p. 151).
68. CAPA.

is no institute for training civil helicopter pilots in the country. India has approximately 1,900 Air Traffic Controllers compared to a sanctioned strength of 2,200. There is a need to increase the capacity of current training facilities to keep pace with growth as well as to provide recurrent training to existing controllers. It is estimated that an additional 2,500 to 3,000 ATCs will be required over the next five years. Further, the existing ATCs would also require upgraded training to keep pace with the significant investments in modernising equipment and operations under the Indian Navigation System Master Plan.

Finally, in Air India's case, the resolution of personnel issues remains the national carrier's most significant structural challenge. The imminent retirement of 13 executive directors will deplete the airline's management strength at a pivotal time in the airline's life, and it is of paramount importance that Air India use the current opportunity to induct experienced industry professionals so as to create a strong management team capable of carrying the airline through this critical phase. Simultaneously, the periodic pilots' strikes have proved extremely costly to the airline's global reputation and, according to CAPA, 'virtually sealed the decision by Star Alliance not to proceed with its membership'[69].

IMPROVEMENT MEASURES

At present, the Indira Gandhi Rashtriya Uran Akademi (IGRUA), the National Institute of Aviation Management & Research (NIAMAR, recently renamed the Indian Aviation Academy), and the Civil Aviation Training Colleges at Allahabad and Hyderabad airports provide education and training services in civil aviation. However, these institutions collectively offer only a small subset of the required skills for the modern industry. For example, IGRUA trains pilots to be eligible for commercial licenses, and this is the only regularly scheduled course it offers. Other courses such as on instrument rating and engine endorsement are only offered on an as-needed basis. Meanwhile, NIAMAR/IAA specialises in short courses such as on IATA guidelines on dangerous goods or on environmental and safety issues that meet the needs of the employees of DGCA, the AAI and BCAS.

These course offerings are not sufficient to meet the needs of a vibrant industry. The initiative taken by MoCA to set up the Rajiv Gandhi National Aviation University in Uttar Pradesh should be supported with full administrative and financial support. A separate division in the Ministry with a full contingent of staff and officers devoted exclusively for aviation education and training with appropriate budgetary support is also required. Second, the standards of curriculum and examination systems for various categories of personnel in the aviation sector should

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be completely overhauled with modernised systems of examination and evaluation. Third, the systems of accreditation of various training institutes of the aviation sector in the country by the regulator need to reviewed and restructured to ensure that the most modern systems are available with the training institutes along with adequate infrastructure for imparting training to all categories of personnel. The University should offer degree and diploma programmes in the various fields of civil aviation leading to increased professional recognition, better job-market signalling, and better-defined career paths in the industry.

The training and capacity building of ATCOs should be an immediate priority. Partnership options with international ATC training institutes should be explored. The enhanced capacity can also help ATC earn additional revenue in the long run by training foreign ATCOs and providing consultancy services to global ATC service providers. It is appropriate to consider the option of allowing private players to set up ATCO training facilities, subject to adequate supervision by AAI. This may be started in a PPP mode first and thereafter be made fully open to private sector in the long run.

Midcareer training to personnel who are already employed in the industry should be the next area of priority. The training of trainers should be the priority in all organisations in the sector and adequate funds should be made available for this purpose.

There are 77 DGCA-approved Aircraft Maintenance Engineer (AME) institutes producing around 5,000 engineers every year. AMEs and technicians need a minimum of a year's experience on heavy aircrafts and pass the DGCA examination to get type-rated license. Although India enjoys a significant cost advantage, it has a shortage of qualified MRO personnel who can carry out complicated repairs on the latest aircrafts and components. There is a strong case for establishing MRO training institutes to help develop capability of certified MRO engineers.

Cabin crew strength has increased from around 4,000 in 2001-02 to around 10,000 in 2008-09. The requirement would increase significantly as the fleet sizes of Indian and global carriers expand in the near future. On this front, the focus should be on setting standards expected of graduating students, and on

69. CAPA (2012).

The FAA has periodically placed the DGCA on notice after 'safety audits showed a lack of coordination in air-worthiness and flight operations in the country'.

setting benchmarks for testable skills. On several occasions, training establishments have proven to be sub-standard or, at their worst, fraudulent enterprises. Greater vigilance is required to register and certify these institutions, and towards ongoing monitoring.

SAFETY AND SECURITY

Safety is of paramount importance in air transportation. The safety levels that global air transport enjoys today represent an enormous improvement on the outcomes of earlier decades and an achievement built on the determination and efforts of all stakeholders. India has maintained an excellent safety record with only four accidents in scheduled commercial air operations over the decade to 2000. (Non-scheduled air operations account for 22 accidents in the same period.) The outcomes of these efforts must be preserved and new standards established to keep pace with the demands of increased traffic. It is forecast that the 1.3 million aircraft movements of 2010-11 will grow by about 13 per cent each year to reach a total of nearly 5 million by 2020-21 and 14 million by 2030-31[70].

The major regulatory issues are as follows. First, staff shortages at the DGCA render safety oversight, regular audits, and monitoring of operations difficult. The shortages make it impossible to carry out meaningful audits, surveillance of a large number of scheduled and non-scheduled operators, training institutes for pilots and engineers, maintenance organisations, and airport service providers[71]. The DGCA has further responsibilities in terms of compliance with ICAO standards, the licensing of personnel, the registration and certification of aircrafts and communication systems, and the investigation of accidents that it is not able to execute satisfactorily given the staff and skill shortages. These shortages have been severe enough that the international credibility of safety standards of Indian aviation have occasionally been under threat. For example, the FAA has periodically placed the DGCA on notice after 'safety audits showed a lack of coordination in air worthiness and flight operations in the country, which pose a risk to passenger life'. Should such downgrades in the perceived reliability of the DGCA's work eventuate, it would have a massive impact on the credibility of the entire sector and impose large costs on the airlines as they seek the offshore certification that will allow them to continue operating overseas. Recruitment processes at the DGCA are constrained by standard government practices. To these ends, the Committee is able to endorse the ICAO's recommendation that the DGCA be transformed into a Civil Aviation Authority with the necessary autonomy.

Second, infrastructural limitations cause ground- and air-space congestion with attendant implications for safety. As traffic increases, the reduced separation between aircraft movements and in holding patterns will create increased levels of stress for ATC staff, and increase the odds of accidents. Specifically, safer air travel can be achieved with less congestion or with practices and technologies that can better manage congestion. New ATC policies, hardware, and software will help in this regard, as will the expansion of airport facilities to include parallel runways. Instrument landing systems (ILS) that enable aircraft movements during times of reduced visibility will require pilots to be trained in the necessary procedures. Third, training of aviation personnel must be subject to accreditation and recognition of institutions and to in-depth and on-going certification of the standards achieved by graduating student, as described in the previous sub-section.

Fourth, regulatory powers must be clearly identified and delegated to allow effective enforcement of unambiguous rules. At present, the system requires the regulator to initiate legal proceedings under all circumstances. The enforcement mechanism should differentiate between the severity of an offence and delegate powers to the authority to investigate, prosecute and adjudicate over a limited range of procedural matters. Such a system is common in many countries, and indeed in India for the roads and railways. An appellate mechanism outside DGCA, preferably in the Ministry of Civil Aviation, should be available to operators to ensure fair enforcement of regulations. Beyond these considerations, the improvement of facilities for maintenance and MRO operations, and wider training in new technologies will both ensure continued safe outcomes in the sector.

In 2006, the ICAO carried out a comprehensive audit of the DGCA and identified technical manpower, training of personnel, legislation, and oversight capacity as the major areas of concern and redress. The DGCA has already made some progress in addressing these, such as by establishing a training institute for its staff in conjunction with the AAI (see above). Modernisation of the DGCA's operating practices is essential to keep pace with technical innovations in the operation of aircraft and management of airlines. For example, urgent implementation of a proposed comprehensive computerisation plan to maintain databases of pilot qualifications, tests, medical records, engineers' qualifications and air traffic control is required. That said, the institution and the desired goals may be better served by a fundamental reconsideration of its charter and powers

70. NTDPC Working Group Report on Civil Aviation, p. 137.
71. ibid, p. 148.

with views formed as to whether this could be better executed if the body were to be re-incorporated as an independent third-party regulator, or as a civil aviation authority.

Aviation security is in the responsibility of BCAS which ensures that air passengers, airport and airline staff, and air cargo are all fit to undertake journeys or perform functions. As with the DGCA, the BCAS is under-staffed and must rely on a mix of state police and the CISF to actually undertake the security screenings at airports. This results in wide variation in the stringency with which the clearance protocols are applied at the various airports. The enlargement of airports, new airports, and the general rise in traffic when coupled with new and emerging threats to the security of civil aviation will place increased demands for more efficient screening from the security apparatus. A revitalised BCAS should be staffed with experts in airport design, planning, information technology, human resource management and civil intelligence.

AIR SERVICES IN THE NORTH EAST

As noted in the introduction to this chapter, air travel can be an expedient, financially sound, and environmentally-friendly means of providing connectivity to remote areas, and to regions of the country that present challenging terrain for expansions of the road and rail networks. This is especially important in the eight states that comprise India's North-East: Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. At present, air services are available to or from 11 airports in the region, with most of these being the primary airports of the state capitals. Over the past five years, flights connecting the region with other parts of India have grown consistently, but at rates slower than the general pace of aviation growth. The Summer Schedule of 2007 indicated 290 flights per week to the region; the same period in 2011 saw 370 flights; and 420 flights in 2013. In addition to scheduled air services, non-scheduled shuttle service is also provided to and within the region with small aircraft.

The primary mechanism for ensuring service to the region are the Route Dispersal Guidelines (RDGs) which require scheduled airlines to necessarily allocate capacity on these often-unprofitable routes in exchange for permissions to operate the more desirable, i.e., more heavily trafficked, routes elsewhere in the country. Thus, the social obligation of providing basic connectivity to remote areas and to promote economic development is delegated to the airlines.

RDGs are set out by MoCA with a view to achieve better regulation of air transport services and take into account the need for air transport services of different regions in the country. All routes are divided into three categories: I, II and III. Category I routes are those that traditionally generate surpluses, and form the trunk civil aviation network connecting the metropolitan cities. Category II routes connect remote areas and are considered loss-making. These include those connecting airports in the North East, Jammu and Kashmir, the Andaman and Nicobar islands, and Lakshadweep. All other routes are subsumed into the third category. Category II routes are further classified into II(A) routes referring to those that exclusively connect airports within the specified regions. Capacity deployments based on historical ASKs then determined the following RDG specification:

- On Category II routes, airlines are required to deploy at least 10 per cent of the capacities allocated to Category I routes.
- On Category II(A) routes, airlines are required to deploy at least 10 per cent of the capacities allocated to Category II routes.
- On Category III routes, airlines are required to deploy at least 50 per cent of the capacities allocated to Category I routes.

The RDGs are subject to the following additional restrictions. First, a service operated on a Category I route as a part of international air service will not be reckoned for the above purpose. Second, multiple-sector flights that connect two metropolitan cities, for example, before providing onward service on a Category II or Category IIA route, capacities on the individual sectors are accounted towards RDG fulfilments. These aside, all airlines are free to operate anywhere in the country subject to compliance with the RDGs.

The major issues of concern are that the RDGs only provide a partial solution to the issue of regional productivity as even on Category II and III routes, airlines cherry-pick the routes which are comparatively more lucrative leaving the unviable sectors underserved. This internal cross-subsidisation is not sustainable in the long run given the financial stresses the airline industry is presently undergoing. There is a strong view that in order to achieve social objectives of connectivity and of economic development in these regions, more innovative mechanisms need to be introduced.

Examples of such mechanisms abound. These include direct budgetary transfers to an airline leading to a reduction in cost price of the air ticket. Alternatively, airlines can be made exempt from landing fees at remote airports reducing their costs and increasing route viability. Direct cash or voucher transfers can be made to passengers. Finally, taxes can be imposed on airlines that provide

services on financially viable routes, and then used to subsidise the unviable routes. Direct budgetary transfer can be supported through a process of minimum subsidy bidding[72].

Australia offers a pertinent example of the implementation of one mechanism. It is a large country with a population that is highly concentrated in its largest cities along the Eastern coast. Then, there are dozens of smaller towns and hundreds of communities in the continent's vast hinterland, many of which are several days' drive from their closest neighbours. In this geographic setup, the policy goal for Australian civil aviation is to maintain an open interstate domestic aviation market that maximises benefits to the Australian economy, but also provides assistance for regional and remote air services, where many routes remain vulnerable to low demand and high per-passenger costs. These remote routes are essential for economic and social well-being of the communities they serve and the Australian government aims to target assistance to these remote areas. The Remote Air Service Subsidy Scheme (RASS) in Australia 'subsidises a regular weekly air transport service for the carriage of passengers and goods such as educational materials, medicines, fresh foods and other urgent supplies to communities in remote and isolated areas of Australia'[73]. Communities apply directly to the Department of Infrastructure and Regional Development which considers the application against set criteria such as demonstrated need and sufficient 'remoteness'. Air operators are contracted with the Australian government for a fixed term and the subsidy is paid directly to the air operator.

For essential air services on routes that are strategically important but commercially unviable, the State should provide explicit subsidy support.

The essential air services programme in the US and in other countries operate on similar lines and are also often based on minimum subsidy bidding. They have many features in common: they are aimed at linking small communities with larger ones, support generally comes from central budgetary allocations, mechanisms involve transparent public competitive tender or application process for carrier selection, provision of subsidies, concession or license granted is contractual and time-limited and the regulatory elements cover frequency, capacity, levels and conditions of air fares and standard of service[74].

The Naresh Chandra Committee Report recommended an Essential Air Services Fund (EASF) for India as a replacement for the RDGs. 'As regards maintaining essential air services on routes that are strategically important but are commercially unviable, the government should provide explicit subsidy support, preferably through direct budgetary transfers or the imposition of a sector-specific cess or a combination of both. In addition, such support should be allocated through a transparent process of minimum subsidy bidding. Here it is noteworthy that competitive tendering of subsidy for maintaining essential air services is a well-established practice in several countries, as it allows such routes to survive but on the basis of fair competition and at the lowest cost possible to the tax payer'[75].

These recommendations are a worthy replacement for the current RDG system. The EASF should be non-lapsable and exclusively aimed at providing explicit and direct subsidies to airlines to make up for viability gaps on defined routes. As noted in the section on regulation, budgetary support will be required for this fund but the ministry may also consider augmenting the fund through a cess on domestic passengers chargeable through tickets issued by airlines. The EASF could also be utilised for the development of low-cost regional airports and heliports[76].

FINANCE

Insofar as transport infrastructure for aviation is concerned, in an environment in which private enterprise in providing air carriage service is encouraged, the government's major responsibility falls towards ensuring that efficient airports are available to meet demand. In recent years, the government has entered into partnerships with private entities to develop and expand airport facilities at a handful of the most important airports in the country. However, it remains responsible for the expansion of all other existing airports, and for the development of several new ones in India's smaller towns and cities[77].

PUBLIC AND PRIVATE OWNERSHIP OF AIRPORTS

In India, the management of all non-private airports is under the purview of the AAI[78]. The AAI executes its agenda with the public interest in mind rather than with profit considerations. This, however,

72. In a minimum subsidy auction, the government identifies a project and a maximum subsidy. Companies compete for the project by bidding down the value of the subsidy. The bidder requiring the lowest subsidy wins.
73. http://www.infrastructure.gov.au/aviation/regional/rass.aspx (accessed 10 February 2014).
74. NTDPC (2012).
75. MoCA (2003, p. 22).
76. About one-third of EASF could also be ear-marked for providing critical viability gap funding to regional airports in underserved areas.
77. The discussion in this section is based in part on the Convention on International Civil Aviation.
78. In other countries, public ownership and control of airports can vest with state governments or municipal authorities.

should not preclude the setting of clear objectives and the adoption of best commercial practices.

Some of the most important airports are developed as joint-venture partnerships between the AAI and private enterprises. For example, for Delhi and Mumbai airports, the AAI retains a 26 per cent equity stake, but is eligible for revenue shares that are as high as 46 per cent. The joint-venture model was intended to attract private capital to a sector undergoing rapid expansion in the 2000s and in dire need of investment funds. It was also envisaged that the JVs would bring a new standard of service to the sector eliminating the congestion, delays and poor customer experiences that had become the norm. Much of the airport development in the 11th Plan period was funded from these PPPs that resulted in funding that was well in excess of that allocated to the AAI.

Investment in airport infrastructure is capital-intensive with significant concomitant risk and long payback periods. Private promoters continue to bring in very low equity and thus the debt-to-equity ratios are extremely high, sometimes reaching 80:20 proportions. Such a debt-equity structure translates into fixed cash outflow in the form of huge interest repayments. Short-term debt servicing costs can be as high as 18 per cent per annum with longer-term returns to debt of around 12 per cent. This results into long payback periods to equity investors.

The revenue-sharing models noted here are a departure from the international norm. Operators of airports developed under joint ventures have expressed concerns that their commitments for 'high' revenue share could potentially affect their viability unless there are alternative sources of raising revenue to airports. Raising the level of non-aeronautical revenue is limited by the scope of activities for commercial exploitation under 'city side development'.

As noted earlier, it is fair to state that the PPP-model has delivered airport infrastructure that is internationally comparable. The infrastructure was built, largely on time, and largely on budget, even going by the usual benchmarks for these projects. Some of the key outcomes were recorded in the form of higher user satisfactions for passengers, increased focus on land use and real estate activities, better utilisation of fixed and variable assets with a focus on non-aeronautical revenue generation, and better coordination with local bodies and state governments. The entry of leading private air-cargo companies has brought in a wave of increasing automation, mechanisation and process improvement initiatives at major air-cargo terminals in the country.

On the other hand, contracts under PPP have also proved problematic, primarily because of the large

Operators of airports developed under joint ventures have expressed concerns that their commitments for 'high' revenue share could potentially affect their viability.

tariff increases that have eventuated. The contracts were awarded without a proper regulatory authority in place. Issues arising out of agreements already made prior to the introduction of a new tariff and performance regulator had to be resolved by AERA which resulted in uncertainty in the system. Projects incurred large cost overruns due to PPP infrastructure being based on very preliminary rough estimates. Mid-course corrections requiring revision in design and planned capacity were necessitated due to unprecedented upswing in the air traffic. A lack of clarity as regards accountability of PPP entities to public authorities like CAG, RTI, and CVC etc is also causing lot of uncertainty in the system. Operationally speaking, difficulties have been reported in performance monitoring in respect of soft performance dimensions. As the governance system matures with implementation of several projects under PPP model, it is hoped that further refinements could be made to the design of the PPP model for obtaining robust results.

FOREIGN INVESTMENT IN INDIAN CARRIERS

It may be recalled that the basic rationale of opening up of certain sectors to competition, including participation of foreign investors, has been to cater to the enormous size of investments required for a growing economy and the need to bring in cutting-edge technology and the associated best practices of the industry. There is a view that the airline industry qualifies in all these respects and therefore the need to facilitate larger capital inflow from abroad into the country. Foreign investment is not just a source of equity investment for developing economies, it also brings with it considerable benefits, viz. technology transfer, management know-how, and access to international markets. The mechanism of the relationship has been through inflow of investment funds, infrastructure and technology transfers, enhancement of human capital, improvement in the quality of the factors of production, faster growth of output and employment, increased productive efficiency, consumer benefits and access to global markets.

FOREIGN DIRECT INVESTMENT

Until recently, government policy prohibited FDI by foreign airlines in the equity of locally incorporated scheduled and non-scheduled passenger airlines. A revised policy sponsored by the Ministry of Commerce, issued late in 2012, now permits foreign airlines to invest in such airlines up to a limit of

The EU is the first region in the world to remove airline ownership restrictions. One of the best ways to access the EU market is through cross-border acquisition. Other motives for cross-border acquisition are to provide feeder traffic to a home hub and for slot acquisition.

49 per cent of their paid-up capital. The policy also permits foreign institutions other than foreign airlines to invest up to 49 per cent in scheduled carriers and, subject to government approvals, up to 74 per cent in non-scheduled carriers[79].

The issue was hotly debated, as it has been on several occasions in India's recent economic history. The major thrust of the debate is whether civil aviation is a sensitive industry—from both an economic or security perspective—and thereby deserving of protection from foreign ownership and its attendant effects. Recent turmoil in the industry and the urgent need for fresh capital injections in many airlines, prompted the government to issue this revised policy. However, Air India remains exempt from its provisions.

The policy also makes provisions for Indian carriers to undertake MRO works or to train pilots and other staff at facilities operated by the foreign carrier. That said, certain restrictions are in place that reduce the influence that foreign airlines can bring to bear on their domestic equity partners. For example, all technical equipment and staff associated with such investments require security clearances. No more than a third of the Board of Directors of an Indian airline may be sponsored by the foreign equity partner.

The policy is a welcome change and a much needed fillip for the domestic aviation sector. In the ongoing debate on whether to remove the caps on foreign investment entirely, the following observations may prove helpful: In the process of economic liberalisation, the airline industry remains an exception globally. In terms of both operations and of ownership and control, the airline industry remains restricted. In most jurisdictions, foreign ownership restrictions remain intact on fears of job losses or access issues in national emergencies if a country's commercial airlines are under foreign control, hence keeping the issues of sovereignty and national interest in consideration[80]. A majority of countries both in the developed and developing world have imposed a 49 per cent ownership limit in the airline industry, and India's new policy is in line with this. The US, otherwise a freer economy than most, is more restrictive in the airline sector, limiting the amount of foreign ownership to 25 per cent. Canada too has stayed with 25 per cent foreign ownership limit in Canadian airlines.

The EU is the first region in the world to remove airline ownership restrictions. One of the best ways to access an otherwise inaccessible EU market is through cross-border acquisition. (The lack of accessibility is due to capacity constraints at airports rather than due to government policy[81]). Other motives for cross-border acquisition are to provide feeder traffic to a home hub and for slot acquisition.

The Open Skies agreements that the US shares with 56 countries could provide a framework for the reciprocal elimination of restrictions on foreign ownership, foreign control and cabotage rights if it ever would want to take the lead on liberalising global air transport market. This attempt towards liberalisation could result in conventions wherein nations could exchange rights on a multilateral basis to form a unified, global and fully liberalised market for air transport.

OTHER INVESTMENT CONSIDERATIONS

It is noteworthy that during the initial phases of growth in a capital-intensive industry such as this, the CAPEX to sales ratios will be very high, leaving little scope for meeting the working capital requirements. The rapidly changing air transport environment dictated by global economic fortunes is forcing airlines to seek structural adjustments in order to survive. Developments in the early 1990s, including the bankruptcies and mergers of airlines with heavy debt burdens, have prompted a re-examination of the limits placed on foreign capital. Investment by foreign airlines offers an alternative to the borrowing that has undermined the financial health of some airlines. Therefore, this should result in lower costs of capital to the airline industry, particularly in developing countries where these costs are higher.

Given the high-cost debt environment prevailing in the country on account of structural issues, it would be difficult if not impossible to raise these resources at relatively easy terms. It was reported by CAPA in July 2010 that the three large airline groups in India have a combined debt of approximately $13.5 billion with an annual interest burden of over $1 billion. For the financial year 2011-12, it is estimated that this would touch $20 billion for the entire airline industry. And they will require capital raising of a further $10-12 billion over the next two to three years to finance scheduled aircraft deliveries. Because of the low equity base, raising additional capital by these enterprises will be a challenging task.

79. Non-resident Indians may wholly own both scheduled and non-scheduled airlines without seeking government approval.
80. The authority to sovereignty was first codified multilaterally in the 1919 Paris convention treaty recognising that every nation has exclusive sovereignty over its own airspace.
81. For example, the International Airlines Group is the holding company for both British Airways and Iberia (Spain's national airline). The merger was motivated on the grounds that it would give BA better access to Iberia's Latin American network.

External Commercial Borrowings (ECB) could become an important source of funds to the airline industry which is adversely affected by high cost of loans in India. Further relaxation of restrictions on ECB to the sector will provide much needed relief. This measure would be of very high relevance at this juncture when cost of debt is prohibitively high in India.

DATA AND INFORMATION TECHNOLOGY

The Committee has noted at several points in this report that good decisions axiomatically begin with good data. Extensive coverage and quality data make it possible for airlines to efficiently plan their networks and schedules to best meet extant and latent demand. Data on airlines' finances and operations assists regulators in efforts at maintaining a market that is viable, competitive and functions smoothly. Authorities that regulate airports, meanwhile, must have access to current and expected airport cost structures, and to current and expected usage. The development of new airports, capacity expansion at existing airports, and the identification of strategies for network management each requires the use of sophisticated economic models to analyse and forecast passenger and cargo traffic. This sophistication notwithstanding, the quality of the results on which these important decisions are based will only be as good as the data supplied.

By rights, the aviation sector should be particularly predisposed to the collection, management and dissemination of complete and robust data. Each of the major agencies that participate in the sector—airlines, airports, government authorities and regulators, MRO service providers, freight forwarders and logistics firms, and so on—are established and recognised, and are subject to the oversight of some combination of domestic and international governments, shareholders, customers, and specialised institutions that set safety and other operational standards. These agencies must operate robust information and technology systems to perform their activities. The closed nature of these systems means that the agencies are in complete control of all the data generated by their activities. As a simple example, airline databases maintain origin-destination records of every passenger, and every maintenance exercise undertaken on every aircraft in their fleet. Moreover, there are in-built checks and balances within the system. For international travel, government customs and immigration databases can be used to verify the origin-destination record for any given passenger. Both airlines as well as MRO service providers maintain logs of the maintenance on an aircraft. Airports and airlines must both account for passenger traffic numbers. In short, the aviation sector normatively lends itself to the collection of high-quality data. That said, there is still much that can be done to ensure the data is deployed and made widely available to best use.

CIVIL AVIATION STATISTICS

A number of domestic government departments and international organisations are responsible for collecting and disseminating data on the aviation sector. The Economic Analysis and Policy Section of ICAO collects, compiles and analyses data pertaining to global civil aviation. It is empowered to do so under the statutory provisions of the Chicago Convention of 1944, and has, over the years, expanded its remit to cover more components of the aviation sector. Presently, this includes performance data relating to airlines and the operation of airports, and important data from the management of air navigation services. The Organisation has prescribed a number of reporting forms and all contracting states, including India, are required to provide data pertaining to these. Much of the data is reported annually, though passenger traffic data is available at higher frequencies. Table 3.19 highlights the data collected and made available by the ICAO for each of its member-states. While allowing for easy cross-country comparisons, a limitation of this data is its heavier focus on the international operations of airlines. This is clearly insufficient for Indian purposes, as the growth of domestic aviation is likely to substantially outpace international passenger and freight traffic.

Investment by foreign airlines offers an alternative to the borrowing that has undermined the financial health of some Indian airlines.

The two organisations responsible for collecting and maintaining the bulk of data pertaining to civil aviation in India are the DGCA and the AAI. The Statistics Division of the DGCA, under authorities delegated from the Aircraft Rules of 1937, requires every entity to which an operational permit has been granted to submit to the DGCA (a) monthly returns regarding the operations of permitted air transport services and (b) annual returns showing the financial results of results of the services or operations during each calendar year.

Other divisions of the DGCA, such as those responsible for air safety and aircraft certification, maintain data on air accidents and the civilian aircraft register respectively. The Directorate of Air Safety maintains data on each accident, date, time and location of the accident, the type of aircraft, the damage to the aircraft, counts and extents of injuries and fatalities, and the ultimately determined causes of the accident. This data documenting the characteristics of accidents is separately available for scheduled and non-scheduled airline operations, flight training, private aircraft, and other purpose-determined categories. The Directorate on Air-Worthiness

maintains an aircraft register with details on the registration number, type and other details of the aircraft, date of registration or de-registration, details of the owner and operator, and so on. Finally, the Directorate of Licensing and Training maintains data on the number and type of licenses issued to personnel authorised to maintain and operate aircraft.

Data collected by the AAI on airport operations and air navigation services is also eventually entered into DGCA databases and disseminated thereon. At the AAI, the Department of Corporate Planning and Management Services collects, compiles, analyses and publishes data on aircraft movements (scheduled and non-scheduled, international and domestic), passenger movement (information on embarkation, disembarkation and transit for both international and domestic passengers), and on cargo and mail (loaded and unloaded, for both international domestic carriage). The DPMS also conducts surveys like normative planning surveys, airport benchmarking surveys, capacity assessment studies and customer satisfaction studies. The aim of these surveys is to assess the peak-hour and annual capacity of existing passenger and cargo terminals, the traffic potential at greenfield airports, and customer satisfaction on services delivered.

Data on aircraft movement is collected from ATC, and on passenger and freight movement from the airlines providing government oversight of this important data. ATC manages the air navigation services which has the primary responsibility for reporting on the en-route facility services.

The Air Traffic Management Unit of the AAI maintains the data on over-flying traffic from 12 airports currently. Data is also collected on various parameters such as the date and time of departure, flight identification, type of aircraft, destination, flight altitude in 100ft increments, and time and location of exit from Indian airspace. This radar-collected data is stored only for 30 days before being deleted.

Data collected by the DGCA and AAI is published in both print and electronic format at least an annual frequency. Traffic data that is summarised by airline and airport is available at monthly and quarterly frequencies.

DATA DEFICIENCIES

TIMELINESS

The usefulness of data is limited to a good degree by the timeliness of its availability. At present, the traffic data collected from Indian and foreign scheduled carriers, from non-scheduled operators and from airports is generally available soon after the end of a defined period. Some operators and airports, however, do not fulfil their data submission obligations for several months at a stretch, compromising the production and usability of aggregate traffic statistics. Deadlines for the submission of financial data are respected even less. Given the fast-changing nature of the airline industry—and especially the high elasticity of its viability to the business climate and to fuel prices—accurate monitoring of the financial health of airlines by the regulatory authorities is crucial.

Given that much of the traffic data is known in near real-time by airlines and airports, an electronic system for the collection of this by the DGCA should help in compliance with submission deadlines. The DGCA should identify data standards, and then implement these standards in internet-based software. Airlines and airports should, over time, be encouraged to update their own internal MIS systems to link directly with the DGCA's software to provide real-time data on traffic and performance.

IMPROVING TRAFFIC DATA

The quality of the data collected on several fronts, other than those relating to traffic and performance, needs to be substantially improved. The quality of the data on freight, non-scheduled operators, over-flying traffic, and other areas is compromised by ill-defined standards, incompatible competing electronic formats, and ad-hoc collection and dissemination processes. This sub-section considers several specific examples of these practices, and provides recommendations for addressing the resulting data shortcomings.

Data on traffic generated by over-flying aircraft is insufficiently collected and analysed. At present, the data is collected from radar stations at only a few airports and is discarded periodically. The data provides an up-to-date perspective on the changing patterns of flight over Indian airspace, and is therefore useful to devise long-term strategy for the development of airports and other facilities, to guide airlines in planning their route networks and schedules, and to ensure that present and planned ATC systems will be adequate for the forecast airspace congestion. The ANS Directorate should be suitably strengthened and staff skilled to collect, compile and publish this data regularly.

Freight data submitted to the DGCA should be separately identified: freight carried by dedicated cargo airlines, and freight carried by scheduled and non-scheduled passenger airlines. This is already available for domestic carriers, and it ought to be a simple step to extend the practice to foreign carriers. Further, mail is not accounted for in the data on international cargo.

The activities and the operational and financial performances of non-scheduled operators are insufficiently monitored by the DGCA, and the resulting data is inconsistently published. Non-scheduled

Table 3.19
ICAO Prescribed Forms for the Collection of Civil Aviation Statistics

FORM	SUBJECT	FREQUENCY	MAJOR PARAMETERS
A	Commercial air traffic	Monthly/ Quarterly/ Annual	Aircraft kilometres flown, aircraft hours, aircraft departures, passengers carried, Available Seats per KM, Revenue Seats per KM, Passenger load factor, Freight carried, Available Tonnes per KM, Revenue Tonne per KM, Weight Load Factor
B	International origin-destination and revenues (scheduled services)	Quarterly	Revenue traffic by city pairs, passengers carried, freight carried, mail
C	Revenue traffic by flight stage	Annual	Traffic data on number of flights and type of aircraft by airport, capacities available, revenue traffic carried
D	Fleet and personnel (commercial carriers)	Annual	Fleet statistics on number and size of aircraft, utilisation of aircraft, personnel, annual expense on each category of personnel
EF	Financial information (commercial carriers)	Annual	Income statement, Revenues and expenditures, operating results, balance sheet, assets and liabilities
G	Aircraft accidents	Annual	Details of accidents of light (less than 5700 kg MTOW) and heavy (more than 5700 kg MTOW) aircraft
H	Registered civil aircraft	Annual	Summary of all aircraft on register, No. of large aircraft by type
I	Airport traffic	Quarterly	Airport traffic data, number of aircraft movements, number of passengers embarked, number of passengers disembarked, freight loaded, freight unloaded, mail loaded, mail unloaded
J	Airport financial data	Annual	Income statements, revenues and expenses, investments
K	En-route facility financial data	Annual	
L	En-route facility traffic statistics	Annual	

Source: Economic Analysis and Policy Section, ICAO.

operators, especially those catering to the seasonal leisure and travel sectors, have steadily increased the numbers of passengers carried in recent years. As such, to better understand this industry and the role that it plays in the promotion of and access to Indian tourist facilities, non-scheduled traffic patterns beg to be studied at length. Data on these operators is clubbed together with that on the operations of helicopters, balloons, and private aircraft operators, and is less useful for this aggregation. Meanwhile, the coverage on these non-scheduled operators should also expand to account for those based offshore; at present, only the domestic operations of domestic operators are captured by the data. Package tourism has made the country accessible for many millions of foreign visitors. This tourism often relies on charter flights, and further development of such tourism will surely require better monitoring and regulation of non-scheduled operators.

Not all carriers supply data on traffic between city pairs, and those that do, do not do so in a standardised format. This data is essential for the accurate forecasting of the changing patterns of demand for air travel. For example, it can help decide on the regional hubs and spokes of the future or identify latent demand that is insufficiently or inefficiently met by existing routes or schedules.

RECOMMENDATIONS

AVIATION AS PART OF A MULTI-MODAL TRANSPORT NETWORK

a. Every decision on air transport infrastructure should, ultimately, be able to be traced back to a sense of place and purpose within the wider transport network that is inclusive of all modes.

b. Network-centric thinking should prevail in planning air transport infrastructure. Efforts should be directed at building complementary regional, national and international air networks.

c. Good land transport networks should be available to quickly distribute passenger and cargo traffic to and from the region served by an air-

port. Depending on economics, demographics and geography, this may include mass rapid transit options.

d. The great advantages of air travel in terms of the savings in time that it offers will be muted if the air network does not cohere well with land-based transport. This is especially true for time-sensitive cargo.

CAPACITY ENHANCEMENT

a. Airport capacity sufficient to process 1150 million passengers per annum (mmpa) is required by 2031-32. This will require the creation of additional capacity of around 1100 mmpa at a total cost of Rs 5,900 billion.

b. Expansions in airport capacity should be made with cognisance of systemic endogeneity: decisions made on airports today will influence the airline route maps of the future; equally, the expected airline route maps should, by rights, determine the distribution of today's investment.

c. Airport-specific investment plans should be dynamic in their response to changing traffic patterns and demand, and yet proactive, by building airport capacity in advance of the period when capacity constraints start to bite.

d. A National Master Plan should be devised and maintained which identifies clear economic reasons for building airports in generally specified locations. This Plan should address the critique that new airport projects are announced with overlapping or insufficient catchment areas, without regard for airspace issues or the potential for airlines to operate there.

e. Long-term forecasts indicate that several cities will require second and in some cases third airports in the 20- to 30-year timeframe. Land scarcity means that this will not only become a significant political issue but requires search for the land for second and third airports to commence now with appropriate zoning for such land and reservation of such land for connecting transport corridors.

f. An Airport Approval Commission should be established within MoCA to review the business plans of proposed airports prior to granting clearance.

g. There is an urgent need to build airport capacity to process cargo. At the larger airports, capacity can be added through dedicated cargo terminals with land-side facilities let out to freight forwarders and logistics providers. Consideration should also be given to building airports that are entirely dedicated to freight. These may be public airports sited at locations that have other excellent transport facilities or are proximate to metropolitan cities and other final destinations for cargo. These may also be private airports that are operated by providers of logistics services. Off-airport cargo processing facilities similar to inland ports and container depots are required to reduce congestion and delays at airports. Air cargo terminals attached to airports may be considered only as transit points if on-site processing facilities are infeasible or costly. Customs services should liberally recognise and man secure bonded facilities off-airport to facilitate the rapid sorting, handling, collection and break-bulk of air cargo.

h. Sufficient capacity to process passengers is determined by gate and apron capacity to accommodate aircraft; terminal capacity to accommodate passengers; ground traffic management and ancillary aviation processes that ensure quick aircraft turnarounds. Also helpful are improved air traffic and air space management practices, and new radar technology that allows narrower separations in the air and more closely-spaced aircraft movement, as well as movements in adverse weather. Efforts at improving capacity must thus be directed at all of these; pinch-points on any one front reduce capacities across the system.

i. Capacity is also determined by size and of aircraft deployed by carriers and by frequency of service. It is recommended that air carriers be free to determine these operational details subject to other regulations.

j. Helicopters can be enormously useful in tourism, mining, corporate travel, and in providing air ambulance services and homeland security. The development of heliports is important to support the growth of general aviation in India, especially in areas that cannot have runways for financial or terrain-related challenges. A PPP policy for the development of heliports needs to be formulated, and one that especially applies to remote area service. There is also a need to develop standardised route operating procedures for helicopters.

INSTITUTIONAL ARRANGEMENTS AND POLICY

a. Reforms in the civil aviation sector should emphasise the streamlining of decisions taken by various authorities that regulate the sector aided by clarifications as to their agenda, remit and powers.

b. The regulatory and policy functions should be clearly separated: the Ministry should focus on devising national policy, and on encouraging and guiding state governments in their efforts to develop the aviation sector.

c. Meanwhile the DGCA should be replaced with a Civil Aviation Authority responsible for the operational regulation of airlines and aircraft covering areas such as air-worthiness, safety and licensing, with separate divisions for airspace management, environment, competitiveness and consumer protection.

d. The Centre should progressively withdraw from airport operations where feasible and commercially sustainable. If anything, state governments should play a much more active role in the airport sector since aviation is a key enabler of local economic development and they would be the appropriate partners for investors. Therefore, MoCA should engage with and encourage the states regarding the potential benefits of establishing a more conducive environment for the aviation sector based upon their understanding of the significant economic benefits of airports on their local economies.

e. With respect to other airports run by the AAI, the government should clarify the future role of the agency. As a first step, the AAI should be separated into two distinct functions: Airport Operations and Air Navigation Services. Each function should initially be corporatised, preparing its own financial statements, continuing under State ownership but managed independently along commercial lines. The Airport Operations Division currently has no clear commercial goals and is involved in a large number of projects, of which many are economically unviable. There would be advantages to breaking these activities into smaller units, separating airport construction from airport management, in turn further breaking these down by region. Further, budget accountability is essential, considering that as the AAI enhances its prime assets and progressively privatises them, it will be left with the task of continuing to invest in airports that are initially not viable. It is also possible for the public sector authority or corporatised entity to act as a landlord while terminal operations are run by private entities.

f. Air accident investigation should be made independent of the DGCA (or from its proposed new replacement, a Civil Aviation Authority), and a fully autonomous Accident Investigation and Safety Board is proposed. All accident reports should be published publicly.

g. Greater cooperation between the authorities, civic agencies, and the administrators of other transport modes should also be mandated.

h. The taxation regime that applies to the entire industry from aircraft purchase to aviation turbine fuel to insurance and lease rentals should be revised in view of the distortionary nature of the present system of taxes and their unbundling from the economic tax base.

i. The present policy on slot management, and especially the ban on the trading of landing slots, is not conducive to a well-functioning and competitive sector. Reviewing and gradually revising India's current slot allocation system will help to reduce a key market barrier to competition and in turn create a framework of more predictable and efficient slot allocation outcomes, as it has in other markets globally. Despite recent changes, there is an urgent requirement for the slot allocation process to become more transparent and for strict oversight of due process as described in stated policy.

j. Stated policy on the development of international hub airports require re-visiting as no Indian airline presently has the reach to service such an airport. Further, more important priorities may lie in the development of domestic hubs in view of the huge latent domestic demand for air travel. Instead, more active consideration should be devoted to the development of a regional hub for low-cost carriers, with Chennai being a promising candidate.

k. The newly-reorganised Airports Authority should then turn its attention to developing new airports together with state governments so as to stimulate their participation in the sector.

l. At present the AAI's business model is highly complex as it manages the largest portfolio of airports in the world under a single operator and, in addition to the management and construction of airports, it also has the onerous task of providing air navigation services. Therefore, a recommendation is made for clear structural and commercial reorientation of the authority with a rolling programme of privatisation of the new assets that it creates.

AIRLINES AND MARKET COMPETITIVENESS

a. Regulatory agencies must walk a fine line between continuing to encourage industrial competitiveness to maximise consumer surpluses and ensuring that the competitiveness is not achieved at the price of unsustainable

or irresponsible actions on the part of the airlines.

b. It is important to ensure that the barriers to entry are not insurmountable for firms that clearly qualify on account of their financial standing or industry experience and expertise.

c. It is equally important to manage the exit of airlines from the market with grace and efficiency so as to not impose negative externalities of these exits on the remaining airlines.

d. Regulatory authorities must take into account (and have the expertise to do so) the financial strength and stability of airlines while permitting entry and also continuing operations. Prospective airlines seeking to enter the market should be scrutinised for the strength of their business plans, capitalisation, and liquidity.

e. The 20-5 rule should be done away with in favour of more systematic, flexible and transparent rules.

f. The National Airport Master Plan should incorporate steps to increase capacity of support to, and flexibility for, general aviation. This would include ensuring adequate parking and hangar space, allowing MRO activities on the airport, and developing ATC procedures capable of accommodating increased movements of small aircraft.

g. Consideration should be given to the development of disused or low-traffic secondary airports, where state governments could support their revival to stimulate air taxi operations for business and tourism.

h. The DGCA should establish a dedicated Division to deal with General Aviation through, for example, the appointment of a Director for General Aviation.

i. Given the distortions created in the market and the resulting financial impacts on the entire industry, the government should clarify both the role for Air India, and make a firm policy commitment towards its agenda, its budget and its finances. In a highly competitive, volatile, capital-intensive environment, there should be sound reasons for continued government involvement in airline operations. In the absence of these reasons, the government should instead outline a plan for gradual disinvestment in the airline.

AIR INDIA

a. The government should clarify the future role of Air India. In the present environment, reasons for government to operate an airline in a highly competitive, volatile, and capital-intensive environment must be clearly defined. The Committee has not found persuasive arguments for continued exclusive government ownership and operation of the airline. In the event that these reasons are not defined, a plan for the progressive disinvestment of the government's stake in Air India over a period of three to five years, based on a phased scheme with defined milestones should be identified. The airline will need to be recapitalised, restructured organisationally, its working capital debt burden written off and some divisions made independent and corporatised, with government retaining perhaps a 26 per cent stake. It would essentially be a new airline. It should start completely anew while Air India's current liabilities are separated out and dealt with. It is apparent that with its excessive and unproductive manpower, its failure to invest in the technology required to keep it competitive and with its sub-scale operations, Air India's future prospects remain precarious. Air India must therefore be provided the opportunity to reinvent itself with new professional management, managerial and operational autonomy, while taking over all existing productive assets. If such a makeover cannot be done in a public sector or joint sector framework, it will need to be privatised. Failure to implement such a plan will continue to drain over $1 billion per annum of tax payers' money each year over the next 10 years, which is surely unacceptable in the light of our national priorities. Meanwhile, Indian civil aviation will suffer and India will not be able to develop major hubs.

FUNDING

a. The government must decide clear and stable rules governing the foreign ownership and operation of domestic airlines. This foreign ownership may also be expected to bring additional benefits of access to cheaper debt finance, technology transfers, management knowhow and access to international markets.

b. Careful regulations for assessing the stability of private equity and debt funding of domestic airlines should be developed, with a view towards promoting the overall financial health of the sector.

c. The unique features of the aviation industry with the largest costs and substantial revenues determined in offshore markets mean that there is support for the relaxation of restrictions on External Commercial Borrowings by airlines.

d. Each airport funded by the AAI should be endowed with a set of operations goals and a development plan, have measurable targets by which performance can be gauged, and be encouraged to adopt transparent reporting processes.

e. For joint-venture airports, the task before regulators and administrators is to devise proposals that attract participants with both suitable financial resources and technical expertise such that stable long-term ventures can be successfully negotiated.

f. The instabilities seen in the viability of some PPP airports has been manifest in excessively high increases in landing charges sought and approved well after the project is launched. To combat this, the permissible structure for charges (and their growth structure) should be made known to all parties at time of tender. This is to allow consortia to bid accordingly, and to ensure appropriate levels of investment in the airport network.

g. Airport development under PPP has proceeded well insofar as projects have been delivered and are operated largely to the desired standard. New public-private models will be required to fund the redevelopment of airports in non-metropolitan cities with lower traffic.

h. At all airports, substantial scope exists to raise revenues from non-aeronautical activities, including from restaurants and food service, car parking, and rentals for concessions, retail, banking and other services.

PRICING

a. There is substantial scope for airports to ensure that their pricing regimes for landing charges, passenger services, cargo, parking and hangar space, and other items like security and noise-related charges, are fairly determined and transparently applied.

b. The regulation of tariffs at airports operated under the PPP model must be strengthened with more careful accounting of benefits and costs to various stakeholders, restructuring of tariff schedules, and with a view towards maintaining the dynamism of Indian civil aviation.

c. Aviation Turbine Fuel pricing should be reformed. The tax structure on the fuel should, at a minimum, be rationalised and simplified, and also more closely justified by observed market failures or tied directly to the expected future development of the aviation industry. Further, with ATF being much more expensive in India than regional airports offshore, there is also a case for reducing taxes to this baseline. Competition in the ATF market should be encouraged and any efforts at cross-subsidising (as with other fuels) should be avoided.

d. The pricing of air services should largely be subject to market considerations, and remain under the purview of airline operators on a day-to-day basis. However, substantial regulatory vigilance is required to maintain market integrity and for consumer protection. This is motivated on the grounds of ensuring pricing that is fair and reasonable, non-predatory and non-discriminatory, and transparent. To that end, clearer rules are required

MANAGING THE ENVIRONMENTAL IMPACT

a. Globally, the airline sector has set itself the goal of reaching carbon-neutral growth by 2020 and that of reducing aviation's overall carbon-dioxide emissions by half between 2005 and 2050. Relative to the expected size of the industry in 20 years' time, India is well-placed to adopt an environmentally-friendly growth path, which is preferable to post-hoc remedies to entrenched systems. With aviation equipment being internationally fungible, India is likely to automatically benefit from technological advances that improve fuel efficiency, and reduce emissions. The major domestic regulatory impetus will lie on policies that encourage more efficient flight paths, glide landings, fleet modernisations and renewals, and higher capacity utilisations.

b. As cities and airports both expand, increasing shares of India's urban populations will lie under a flight path, and will expect reasonable efforts on the part of authorities to shield them from the worst excesses of aviation-related noise.

HUMAN RESOURCES

a. Institutions that regulate civil aviation will need to be strengthened with the addition of substantial numbers of staff skilled in network economics and regulation, certification, safety, setting and implementing standards, finance, and law. Existing private institutions do not offer sufficient depth and variety in their course content, and the infrastructure facilities available to them are insufficient.

b. Thus, the desired growth in Indian aviation will require the country's technical colleges and flying schools to churn out engineers, pilots, air traffic controllers and other key staff in substantially greater numbers than at present.

c. On the management and regulatory front, there is a requirement for an improved and larger cadre of airline administrators and managers, regulatory economists and planning professionals.

d. An institute for training civilian helicopter pilots should be set up.

e. There is an absence of formally recognised educational programmes at the degree and diploma level in the field of civil aviation. Budgetary support should be provided, and industry support encouraged, for the expansion of aviation programmes at universities, especially at the graduate level. In conjunction with industry and academia, the State should also boost the value of these programmes by defining qualitative and quantitative standards for the academic programmes. More generally, the systems of accreditation of the various training institutes should be reviewed with a view towards ensuring minimal standards in educational outcomes.

f. The training of a new corps of air-traffic control officers requires immediate priority. Partnership options with international ATC training institutes and with the Indian Air Force should be explored to enhance ATC-capacity.

g. Foreign participation or investment in an Indian university for aviation management should be encouraged.

AIR CONNECTIVITY IN REMOTE AREAS

a. Air travel can be the quickest, cheapest, and most environmentally-friendly class of transport links that can be extended to remote regions with challenging geography or topography.

b. The current arrangement for ensuring essential air services is not satisfactory. Air connectivity in remote areas is largely concentrated on routes connecting state capitals. Meanwhile, the Route Disbursal Guidelines intended to ensure minimum connectivity to remote and inaccessible regions cast a burden on the commercial health of airlines in India. Essentially being a cross-subsidisation tool, several distortions arise from its implementation, and further reliance on these guidelines will be unhelpful at a time of industry-wide financial stress.

c. The RDGs create a market distortion and also a potential moral hazard for airlines to find ways to bypass the obligations. Hence, there should be a move towards a direct subsidy model with viability-gap funding.

d. The establishment of a non-lapsable exclusive fund to provide explicit and direct subsidies to airlines as a form of viability-gap funding is a preferable alternative to ensuring service to remote and inaccessible, and so financially non-profitable, areas of the country.

STATISTICS AND DATA

a. Data furnished by airline operators to the DGCA should be processed, subject to cross-verification. The DGCA should work closely with MIS personnel at the carriers to define systems for data collection, verification and dissemination.

b. A country-specific forecasting model should be developed for the Indian aviation market to aid infrastructure planning, route management and expansion, and regulation. Effort should be devoted to studying the decomposition of airfreight and passenger traffic in greater detail, and a database built of origins, destinations, and the nature and value of shipments. This will provide valuable information on the candidate sites for dedicated passenger and cargo facilities.

c. Aviation is grossly underestimated in the national accounts; the present compilation of National Account Statistics should be modified to reflect the wider array of activities that relate to the aviation sector. A system of satellite accounting for the civil aviation sector should be introduced, especially in cases where direct data collection is not possible.

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