7 INTEGRATED TRANSPORT

7.1 THE TRANSPORT SECTOR

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ESTIMATING DEMAND

The first problem in examining transport infrastructure at the macro level is that there are no reliable estimates of output. Let alone projections, even current estimates of demand for road transport are very weak and are hardly reliable. The problem is quite serious, given that road transport is the primary mode of transportation today.

With the Indian economy expected to grow at around 6 per cent per annum, the transport sector, both passenger and freight, is expected to grow at 7.5 per cent. The income elasticity of demand currently used by the Planning Commission is 1.25. Total freight and passenger traffic was 869 billion tonnes kilometres (btkm) in 1998–9. This has been projected into the future in Table 7.1.1 using the Planning Commission's estimate of elasticity with respect to real gross domestic product (GDP). With the total demand for passenger and freight so arrived at, these are split into rail and road in the ratio of 53:47 for freight and 23.77 for passenger.

Other studies, including one by the Ministry of Surface Transport (MoST), have questioned both the share and absolute figures put out by the Planning Commission, especially for road traffic, claiming that these are underestimates.

The 1991–2 figures so arrived at have been questioned by the World Bank. The World Bank's assessments have been based on demand for expressways (World Bank 1995a). The World Bank also felt that the Planning Commission's figures are underestimates. As per their extrapolation, the rail share in 1998–9 was 33 per cent and 16 per cent, respectively, for freight and passenger. The view of the Indian Railways (IR) is that the rail:road share is closer to 40:60 for freight and 20:80 for passenger today (IR 2000a).

TABLE 7.1.1
Estimates and Projections of Freight and Passenger Traffic by Rail and Road

Freight traffic

Year	GDP (1980–1 prices) (Rs crs)	Total traffic (btkm)	Rail movement (btkm)	Rail movement %	Road movement (btkm)	Road movement %
1984–5	132,367	343	182	53	161	47
1991–2	185,503	524	257	49	267	51
1998–9	281,691	869	284	33	585	67
2005–6		*1442*				

Passenger traffic

Year	GDP (1980–1 prices) (Rs crs)	Total traffic (bpkm)	Rail movement (bpkm)	Rail movement %	Road movement (bpkm)	Road movement %
1984–5	132,367	966	227	23	739	77
1991–2	185,503	1477	315	21	1162	79
1998–9	281,691	2450	404	16	2046	84
2005–6		*4065*				

Source: World Bank (1995); IR (1993 and 1999).

This difference in the share of rail in various estimates can partly be attributed to the fact that modes other than rail and road have not yet been formally recognized as being significant! The figures derived by using the multiplier would reflect the total transport demand of all modes, while micro-level studies and the perspectives

of IR and MoST are generally limited to rail and road. One way to reconcile this is to estimate the non-rail and non-road modes for freight and passenger. Coastal shipping and pipelines for freight, and airlines for passenger, have gained in significance, especially in the 1990s. The absolute quantities and modal shares for freight and passenger transport for 1998–9 based on my assessments are given in Table 7.1.2.

TABLE 7.1.2
Distribution of Internal Effort for Freight and Passengers over Various Modes

	btkm/bpkm	% share
Freight		
Road	449	51.7
Rail	284	32.7
Pipeline (max)	70	8.1
Coastal shipping	66	7.6
Total	869	100.0
Passenger		
Road	2034	83.0
Rail	404	16.5
Air	11	0.4
Coastal shipping (max)	1	–
Total	2450	100.0

Air is a maximum of 0.14 btkm.

Note: Table 7.1.2 has been derived using documented data for railways and air from CMIE, *Indian Infrastructure*, December 1999. The coastal movement was arrived at from Basic Port Statistics, 1998–9, which give originating tonnes. The lead for coastal freight was assumed as 1600 km (Raghuram 2000a), for coastal passengers towards the islands as 1000 kms, and for the remaining coastal passengers as 100 km. The 100 km is possibly an overestimate, though consequentially insignificant. For pipeline, the capacities and lengths were multiplied and added, with no utilization factor considered. The road figures were estimated to be the balance remaining, based on total transport figures from Table 7.1.1.

For freight transport, total transport effort would be 1442 btkm in 2005–6, given the figure of 869 btkm in 1998–9. For passenger transport, this would imply that the total transport effort would be 4065 billion passenger kilometres (bpkm) in 2005–6, given the figure of 2450 bpkm in 1998–9.

To have more reliable estimates of the output of the transport sector, it would be necessary to make and publish an annual scientific assessment of the road transport tonnes km and passenger km based on reliable sample surveys.

The 'Golden Quadrilateral' and Spatial Imbalance

The growth in transport has been, and is expected to be, concentrated on the Mumbai–Delhi–Calcutta–Chennai 'golden quadrilateral', the diagonals of this quadrilateral, a few spurs from the quadrilateral towards certain industrial zones, and the major ports (for both rail and road). This is in keeping with the pattern of industrialization, trade flows, and urbanization. Much industrialization is taking place along the Indian coast, which will always remain an attractive zone for development. Two per cent of road length carries 40 per cent of road traffic in India and one-sixth of the railway network, which forms the golden quadrilateral, carries over two-thirds of all rail traffic. Transport capacity along the key corridors and multimodal handling capacity at the terminals have not kept pace with demand. Traffic congestion, leading to wasteful additional time of travel and environmental pollution, has therefore increased.

The concentration and congestion of traffic also creates the opportunity to relax them. Investments in transport infrastructure can be focused, with high returns, to relaxing the congestion on segments of the quadrilateral. Development of high capacity high speed infrastructure along such corridors, and leveraging alternate corridors for high demand-origin destination links, can then be the investment strategy. This means that no great plans are called for to direct investments to the rail and road networks, at least till such time as congestion is relaxed.

TRANSPORT MYOPIA

Due to insufficient resource allocation and poor management, maintenance of transport infrastructure is poor. This leads to additional wear and tear of transport equipment and further damage to the carriageway. Together they increase pollution unnecessarily and result in avoidable delays in journeys. In addition to the above, due to poor controls or monitoring, safety levels are far below what is desirable.

Fig. 7.1.1 brings out the interlinkages and the feedback effects of this 'transport myopia'.

Safety

Safety is adversely affected by the transport myopia. Table 7.1.3 gives a picture of the road deaths in India as compared to developed countries. *India is at least six times worse than the worst of the European countries.*

The true picture of safety on Indian roads may be much worse than what the comparison in Table 7.1.3 would seem to indicate! This is because: (i) many accidents go unreported in India; (ii) nearly 69 per cent of the vehicle population is motorized two wheelers (MTWs), with relatively lower passenger occupancy; and (iii) Indian roads have among the lowest ratio of vehicles to kilometres of roads!

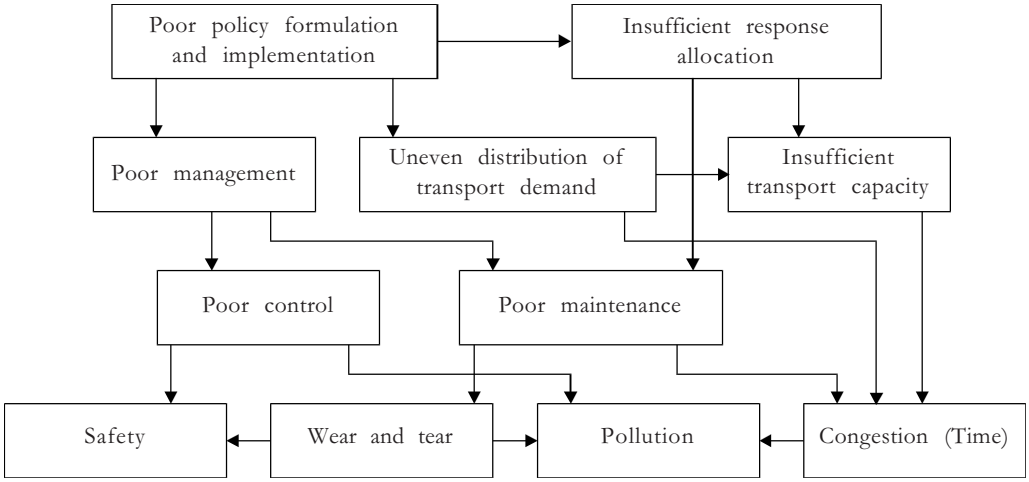

Fig. 7.1.1: Transport myopia.

TABLE 7.1.3
Road Deaths and Vehicles in India and in Certain Other Countries 1996

Country	Vehicles/km of road	Road deaths/10,000 vehicles each year
Britain	67	1.5
Netherlands	65	1.7
Germany	62	2.1
France	36	3.2
Belgium	32	3.2
India	10	20.8

Source: Bamford (1998); MoST (1998).

The effect of the vehicle profile and increasing indiscipline comes through dramatically if we compare road deaths per bpkm between 1961 and 1996 (Table 7.1.4). The figure for road deaths per 10,000 vehicles was 83.5 in 1961, when the MTW population was 13 per cent, coming down to 20.8 in 1996. This does not mean improved safety on the road. On the contrary, road deaths per bpkm have increased over the same period from 30.6 to 51.0. Based on a study (Mohan 2000) of eleven locations, amongst the fatalities, over 50 per cent are pedestrians (non-vehicle users) in urban areas, while on the highways 32 per cent are pedestrians, followed by MTW occupants at 24 per cent!

TABLE 7.1.4
Road Deaths in India in 1961 and 1996

	1961	1996
Road deaths (no.)	5547	69,800
Vehicles ('0000)	66.4	3355.7
Road deaths/10,000 vehicles	83.5	20.8
Motorized two-wheelers (MTWs) ('0000)	8.8	2311.1
Percentage of MTWs	13	69
Passenger km travelled (bpkm)	181	1368
Road deaths/bpkm	30.6	51.0

Source: Mohan (2000); Central Institute of Road Transport (2000).
Note: The road passenger kilometres have been arrived at using the rail passenger kilometres for 1960–1 and 1995–6, with rail:road modal shares of 30:70 and 20:80 respectively.

Safety is also a matter of concern for the IR. Compared to the 1960s, IR has improved in safety record. Train accidents per million train km have fallen from 2.7 in 1965–6 to 0.56 in 1998–9 (IR Year Books 1979 and 2000). During the same period, the number of deaths per bpkm fluctuated between 0.0 and 1.2, depending on the number of deaths in a year, which fluctuated between 3 and 406. (It should be noted that the IR only reports the deaths for which it was responsible. There are deaths which occur because of other causes.) Comparing road and rail, it is quite clear that on the parameter of deaths per bpkm, rail is a distinctly safer mode than road.

Air and sea safety are also matters of concern, often critically appraised as 'lesser than desirable' by international bodies such as ICAO and IMO. Apart from deaths in fatal accidents, most accidents result in injuries, damage to vehicles, and loss of cargo. In freight carriage, accidents leading to losses not only happen during transportation, but also during handling and storage necessitated by multimodal movements. The impact of such losses as a proportion of total logistics cost has been estimated for India at 14 per cent (for the year 1987) and is amongst the highest in the world (Raghuram 1992)! (The total logistics cost constitutes 10–12 per cent of GDP). A more recent study by the Ministry of Food and Civil Supplies in 1999 estimated such losses for foodgrains and fruit and vegetables at 10 per cent and 30 per cent of total production, respectively. While 'human failure' is the single largest cause of accidents,

the systems and engineering behind the human being are actually responsible in a more meaningful sense.[1]

Wear and Tear

The wear and tear on vehicles and goods is particularly acute in the road sector. The expert group on commercialization of infrastructure projects estimated the economic losses due to the bad condition of main roads as being of the order of Rs 200 to 300 billion per annum during the late 1990s (Mohan 1996). This is nearly 2 per cent of the GDP! Another way of looking at it is that it is at least about Rs 7000 per road using vehicle per year. Such high wear and tear is also a major cause of pollution and poor safety.

Boxes 7.1.1 and 7.1.2 provides two examples of how poor roads affect vehicle operating costs. One is based on interviews of truckers in Zambia and the other is a more recent statement on Bombay (now Brihanmumbai) Electric Supply and Transport Undertaking (BEST).

Pollution and Environmental Impact

Pollution is significant on Indian roads, especially in urban areas. Similarly, land acquisition is a problem during, or prior to, construction of transport projects.

BOX 7.1.1

How Potholes Affect Vehicle Operating Costs

Potholes cause immense damage to vehicles. To better understand the additional costs associated with potholes, the Federation of Zambian Road Hauliers interviewed truckers to compare the running costs of a truck and trailer combination on a road with potholes with those on a road without potholes. The vehicle considered was a lorry and trailer with twenty-two wheels, weighing between 44 and 50 tonnes. The costs estimated are those over and above normal running costs. This excess is equivalent to $ 0.20 per vehicle km.

On a road with bad potholes a driver can either pursue a defensive strategy or ignore the potholes and carry on as usual. If he follows a defensive strategy, he first slows down and changes gears. He then has to negotiate the vehicle through the potholes. This causes extra stress on the tyres, wheel bearings, spring assemblies, spring hangers, chassis, cross members, engine mountings, gear box mountings, brakes, steering assemblies, and shock absorbers. Having negotiated the potholes, he will drive through them at his regular speed, resulting in more damage to the vehicle and tyres and increasing the risk of accidents. The axle pressure on the road now increases by at least three times.

The survey resulted in the following annual expenditures over and above normal running expenditures. It ignores extra fuel consumption, damage to goods, down time of trucks under repair, and accidents caused by potholes and sharp pavement edges.

Quantity	Item	Unit price ($)	Annual cost ($)
10	Extra tyre and tubes	595	5952
1	Extra clutch and pressure plate	1071	1071
4	Extra wheel bearing	201	803
1	Extra set of brake shoes	1050	1050
1	Extra set of springs	1667	1667
4	Extra spring hangers and bushes	113	452
–	Welding electrodes/oxyacetylene: for body chassis and cross member damage, engine and cabin mountings (repair cost)	952	952
1	Extra steering assembly	1874	1874
4	Extra shock absorbers	128	510
	Total annual costs attributable to potholes		14,331

Sources: (i) Federation of Zambian Road Hauliers Ltd. (1992).
(ii) Heggie (1995).

Road traffic causes air pollution, which is high by international standards, especially in urban areas (Table 7.1.5). The annual premature deaths, due to ambient air pollution levels exceeding the World Health Organization (WHO) standards, are as high as 7491 in Delhi and

[1] Poor systems and engineering tax pedestrians and vehicles users alike, increasing the probability of an accident when attention lapses for even a moment. Improper systems, when in place for long, result in a culture of aggressive behaviour. Equally importantly it is systems and engineering that can be improved and leveraged upon.

BOX 7.1.2

Deluge, BMC Punch Holes in BEST's Coffers

They are built for the rough and tumble of Mumbai's asphalted lunar surface. Both the two punishing bouts of rain this year, in quiet collusion with the civic authorities, have left the BEST's lumbering behemoths battered and bruised. Apart from injured chassis, officials emphasize the ground-level is particularly grisly.

Against average 200 punctures per day, sustained by its 3430-strong fleet during the monsoon, the figure has climbed to an alarming 550 since the July 12 deluge. At a cost of Rs 9600 per tyre, officials say the cost of repair and replacement has become prohibitive.

'Potholes have been erupting with unusual enthusiasm this year. May be [sic] it has something to do with the quality of asphalt and tar used by the civic authorities. Besides, the roads near the flyovers under construction are in such bad shape that driving has become hazardous', remarks a senior official of the Brihanmumbai Electric Supply and Transport (BEST) undertaking.

According to V. K. Katdare, deputy chief engineer (traffic), the BEST spends Rs 11.52 crore on the purchase of 12,000 tyres every year. Of these, 8000 are scrapped during the four monsoon months alone. However, this year, the figure is expected to be far higher. Though punctures account for most of the damage, heavy scarring and large tears also necessitate replacement. Outside the monsoon months, the average number of punctures is as small as 50 per day.

According to S. H. Bhatte, chief engineer (traffic), 80 per cent of punctures is caused by cratered roads. The rest is inflicted by sharp objects like nails.

'If the penetration is more than four inches, the tyre is rendered useless.

But if the Island City has turned into a veritable obstacle course in some areas, drivers cringe at the thought of negotiating the distant western suburbs. Identifying four depots as being particularly treacherous, officials say the number of punctures sustained by buses with the Gorai (Borivili-W), Magathane (Borivili-E), Dindoshi (Goregaon) and Mazas (Jogeshwari) depots has trebled, to a staggering 30 per day. The main culprits: the Jogeshwari–Powai Link Road, Sakinaka–Powai Road and roads in Chakala.

In some instances, officials' here say, new tyres sustain punctures after traversing a mere 100 feet!

BEST officials say that they have written to the civic authorities, urging them to improve road conditions but to no avail.

While agreeing that the road conditions generally worsen during the monsoon, A. V. Burute, chief engineer (roads), with the Brihanmumbai Municipal Corporation [BMC] rebuts the allegation that 'most' punctures are due to abysmal road conditions. 'There is no concrete study which shows this. There are many other reasons why tyres are damaged', he says.

Asked to explain why the corporation does not monitor the contractors who undertake the work, he replies: 'When the Civic Roads Department awards a contract, it takes a guarantee of one to five years from the contractor depending on the nature of work. If the road is damaged, the contractor is asked to repair the stretch. A close watch is maintained on arterial and major roads'. He adds: 'Mumbai's traffic is far more than in other cities, making the roads more susceptible to damage'.

'This is worsened by heavy vehicles, especially when traffic congestion makes them brake abruptly and frequently.' He denied, however, that substandard material is used.

Source: Kalpana Verma, *Indian Express*, 21 July 2000.

2979 in Ahmedabad. The number of workdays lost per capita annually on account of air pollution is five. MTWs are responsible for 46 per cent of air pollution near the roads.

Congestion

Average vehicular speeds on Indian roads are amongst the lowest in the world. This is relatively more acute on the highways than in urban areas. A truck in India averages 250 km per day, while in the developed countries the average is closer to 600 kms per day (Mohan 1996).

For the railways, during 1998–9, the average turnaround was 8.2 days, of which only 28 hours was the

TABLE 7.1.5
Premature Deaths Due to Ambient Air Pollution Exceeding WHO Standard c. 1995 in Some Indian Cities

City	No of deaths per year
Delhi	7941
Calcutta	5726
Mumbai	4477
Ahmedabad	2979
Kanpur	1894
Varanasi	1851
Chennai	863
Bangalore	254

Source: World Bank (1995b).

revenue-earning run over an average lead of 669 km (IR 2000a). This reflects congestion and lack of coordination at terminals for multimodal handling. While the maximum speeds for mail/express and freight trains are 100 kmph and 75 kmph respectively, the average speeds achieved are typically 50 kmph and 24 kmph. The average is significantly lower than the maximum, which is indicative of route congestion.

The principal problem with ports is the very large average turnaround time of 5.9 days (MoST Basic Port Statistic 1999). The average comparable turnaround time in ports inter-nationally is only two days. Given the 14,676 port calls during 1998–9 (Indian Ports Association 2000) in major ports in India, at an average ship standing charge of $ 8000 per day, the net cost of the additional 3.9 days spent at ports by ships works out to $ 457.9 million, that is Rs 1623 crore.

Why is There This 'Transport Myopia'?

The transport myopia outlined above debilitates the economy. A variety of problems underlie this myopia.

There are problems that arise because of the cadre-based and bureaucratic mindset in the management of organizations which have to create, maintain, or deliver infrastructure. Apart from the deep-rooted hierarchy orientation (which is a complete antithesis to the much required customer orientation), there are additional tensions due to administrative cadres often occupying senior positions in competition with the technical cadres. Examples of such dysfunctional organizations are ports and road transport corporations.

Abdication of authority, or lack of authority at the top, significantly inhibit infrastructure organizations from being responsive to market opportunities, formulating projects appropriately, or managing projects in time and delivering the service effectively. Archetypical of such organizations is the Indian Railways.

Parliamentarians too consider many of the public enterprises providing infrastructure as their fiefdom. For example, the *Times of India* of 8 August 2000 reported that the civil aviation minister was pulled up by the Lok Sabha for the delay of a flight in which the speaker and a few other Members of Parliament from Andhra Pradesh were travelling. The minister assured the Chair that he would take steps to see that no such inconveniences would in future have to be suffered by VIPs (very important persons). This incident brings into focus once again the 'feudal' outlook of governance, which is an anathema to a citizen-oriented infrastructure. It is unfortunate that the plight of 'lesser mortals', the common consumer, did not figure in the discussions. Those affected by VIPs' movements better suffer in silence is the message. The minister himself thought his first responsibility was to serve the VIPs, even to the neglect of the consumer.

What Next?

Systems of public management (and governance) in India, though employing some of the best minds and brains in the country, unfortunately do not have the right kind of stakeholding and accountability, nor even the requisite autonomy. There is mismatch between task performance and the criteria for evaluation of managers and officers. There are almost no incentives for performance, or task orientation, or innovations at any level of management. Even the incentives for workers are related merely to hours of work, and never to efficiency or output.

A market-based and customer-oriented approach could change transport infrastructure services and development, removing the 'transport myopia' to result in better service. The crucial challenge then is how to develop structures and systems that would ensure this. The three dimensions of performance are: (1) asset-creation efficiency—nobody wants an expressway that was supposed to have opened in 1988 and is still languishing; (2) asset-management efficiency—an asset, once created, needs to be maintained, but without proper maintenance, roads and most transport infrastructure would deteriorate very rapidly; (3) service delivery effectiveness and efficiency—should an accident on a road hold up traffic for half a day, only because the police is not at the site on time, or the cranes to remove the vehicles are not available?

Segmenting the Market

While it is usual to study the transport sector on the basis of administrative categories, it is more fruitful to look at it from a market segment perspective. One obvious split, which is already recognized, is between freight and passenger. Within each of these divisions, the key geographic segments would be intra-urban, intra-rural and rural to urban, and inter-urban. Urban transportation as well as intra-rural and rural to urban are typically short haul. Inter-urban is typically long haul. Another dimension for segmentation would be the time value of the freight unit or passenger, which could be categorized into low and high. For freight transportation, the segmentation is also influenced by the nature of the user, since freight transportation is part of the supply chain logistics of the user. Fig. 7.1.2 outlines a framework to segment the users as bulk, industrial, and consumer durables and consumer goods manufacturers.[2]

[2] Much of the discussion on the market environment is excerpted from Raghuram (2000c).

	Bulk	Industrial durable	Consumer	Consumer goods
Value addition (VA)	Low	←	→	High
Consumer type	Intermediary	←	→	Final consumer
Per cent of logistics costs as proportion of VA	High	←	→	Low
Customer sensitivity to availability	Low	←	→	High

Fig. 7.1.2: A framework to segment users.

Bulk goods are typically transported in large shipment sizes. Therefore dedicated vehicles, specialized modes of transport, and handling are important. Industrial goods have high value and are often critical. Therefore the need is for speedier transport. Some items require specialized transportation and handling. For consumer durable goods, inventory costs are significant. Appropriate distribution networks that minimize in-transit inventory costs play an important role for such goods. For consumer goods, availability is an important factor. Logistics choices here are governed by better service levels as much as by costs. Appropriate distribution networks and warehouse locations play an important role in both improving service levels and reducing costs, direct and indirect. The users are often willing to pay a premium for superior service.

I consider four key attributes by which these segments can be distinguished. They are value addition (VA), consumer type, percentage of logistics costs as proportion to VA, and customer sensitivity to availability.

The percentage of logistics cost to the total value added signifies the importance of logistics-related activities in the cost of production and sales. It is high for bulk goods manufacturers, while it is low for consumer goods manufacturers. For bulk goods, total logistics cost as a proportion of value addition is about 70 per cent, out of which transportation costs constitute nearly two-third. Such customers are very sensitive to the price of transportation. For consumer goods and durables, total logistics costs as a proportion of value addition do not exceed 10 per cent, out of which transportation costs constitute less than a third. Such customers tend to be sensitive to service. Customer sensitivity to availability would determine the propensity to switching. Such attributes of market segments are most useful and need to be brought into the management of public transportation systems. Policy making too greatly benefits from the logistics orientation, since that should immediately lead to an integrated perspective with regard to transportation modes and support facilities. And an integrated perspective is the need of the hour.[3]

Thus perishable commodities or hazardous commodities require specialized infrastructure support. Understanding geographic (origin–destination) requirements would enable a focus on appropriate infrastructure investments, especially from the perspective of economies of scale. Segmentation by use would enable an assessment of value addition provided to the customer and the consequent requirements of infrastructural services.

Transportation of hazardous goods assumes great importance for a variety of industries such as petrochemicals, textiles, and dyes and chemicals. Logistics problems arise due to handling requirements and safety aspects. Underregulation, especially with regard to safety and implementation of standard, often leads to accidents with consequential damages and inadequate post-accident measures. On the other hand, overregulation, and adherence merely to the letter of regulations, leads to delays and high costs of transportation.

Similarly segmentation is possible for passenger transportation. The purpose of travel would be a key attribute in the segmentation.

The choice of mode, willingness to pay, and service expectations are governed by the segments. Consequently, transport infrastructure and services need to recognize these parameters while planning service concepts, routing, and scheduling, determining capacity, and in pricing.

[3] De-bottlenecking, reducing consumer side costs, increasing capacity from a multimodal optimality are all constrained today by a lack of the multimodal perspective in transport policy making.

STRUCTURE OF THE TRANSPORT SECTOR[4]

Defining Sector Components

While many activities in the transport sector in India are strictly state controlled, there are other significant segments which are almost entirely in the private sector. It would be useful to broadly classify the transport sector into three primary segments, namely infrastructure (hardware), services, and regulation. There are broadly three components of infrastructure with increasing possibility of being attached to the specific services provided: (a) right of way, (b) terminals, and (c) rolling stock and equipment. Services too can be broadly categorized into three types with increasing closeness to the customer: (a) maintenance, (b) operations, and (c) customer services. Both maintenance and operations can be further classified as being for the right of way, or for terminals, or rolling stock. Customer services can be classified into basic and special (value-added) services. Thus, the distinct activities may be seen as under:

INFRASTRUCTURE

1. Ownership and asset creation
   - Right of way
   - Terminals
   - Rolling stock and equipment

SERVICES

1. Maintenance
   - Right of way
   - Terminals
   - Rolling stock and equipment
2. Operations
   - Right of way
   - Terminals
   - Rolling stock and equipment
3. Customer services
   - Basic services
   - Special services

REGULATION

1. Licensing
2. Environmental impact
3. Safety
4. Pricing
5. Service levels

[4] This section is based on Pangotra and Raghuram (1999).

The relative importance of the state and the current structure of provisioning of each of the above activities for all the transport modes are brought in Table 7.1.6. The provider who has primary responsibility and accountability for the infrastructure and services is also identified. Even when activities are contracted (out), the principal continues to bear primary responsibility, though that brings in the principal–agency problem. Hence stakeholding and appropriateness of incentives become important.

Air

When 'air' is considered as a mode of transport, right of way is not a significant infrastructure. However, the operation associated with it, namely air traffic control, has significant regulatory and safety aspects. The terminals have also never been privatized, though they have been privatized in so far as the terminal buildings or portions thereof are concerned. The rolling stock and equipment, customer services, and other special services (for example reservation) are all privatized.

Rail

In the case of rail, currently all activities are being handled by one organization, namely Indian Railways. Only recently, certain value-added special services like tourist trains on popular tourist circuits are beginning to be offered through the private sector. The Indian Railways are viewed as providing a robust and bare minimum service, but with poor customer service.

Road

In the case of road, in contrast to rail, a variety of organizations are involved, with regard to the 'right of way' state governments, the central government (for national highways), and local governments are involved. Apart from these, the Defence Ministry (border roads) and large industries (project roads) too are involved in a minor way. In recent years, some financing for rural roads has come from the Agriculture Ministry. Regarding terminals, for mass passenger transport either State Road Transport Undertakings (SRTUs) or local governments are generally involved. For freight transport, large industries have their own loading and unloading areas while smaller organizations tend to use public roads. Trans-shipment terminals are usually provided by various carriers. A few cities have organized truck terminals under supervision of the local governments. The rolling stock and equipment are manufactured by a few large auto manufacturers, while ownership is diffused across a large number of owners (usually drivers themselves). Many operators often own no more than five trucks.

TABLE 7.1.6
Transport Sector Components and Involvement of the State and Private Sector

Physical basis/assets	Ownership/control			
	Air	**Rail**	**Road**	**Water**
Right of way	**(State controlled)** DGCA, AAI	**(State controlled)** Indian Railways	**(State controlled)** NHAI, PWD, urban administrations, local governments, defence	**(State controlled)** Major ports—Government of India, State Maritime Boards, Port Directorates
Terminals	**(State controlled)** AAI, Defence	**(State controlled)** Indian Railways, large industries for captive sidings	**(Open to all)** SRTUs, large industries, trucking companies, etc.	**(Partly Open)** Major Ports—Government of India, State Maritime Boards, Port Directorates, some private and captive ports
Rolling stock and equipment	**(Open to all)** IA, AI, other private airlines	**(State controlled)** Indian Railways	**(Open to all)** SRTUs, private vehicle owners	**(Open to all)** SCI, Great Eastern, ESSAR, and others
Maintenance Services				
	Air	**Rail**	**Road**	**Water**
Right of way	**–NA–** DGCA, AAI	**(State controlled)** Indian Railways	**(State controlled)** NHAI, PWD, urban administrations,	**(State controlled)** Major ports—Government of India, State Maritime Boards, Port Directorates
Terminals	**(State controlled)** AAI	**(State controlled)** Indian Railways, large industries for captive sidings	**(Open to all)** SRTUs, large industries, trucking companies, etc.	**(State controlled)** Major Ports—Government of India, State Maritime Boards, Port Directorates, some private and captive ports
Rolling stock and equipment	**(Open to all)** IA, AI, other private airlines	**(State controlled)** Indian Railways	**(Open to all)** Innumerable small-scale garages, large organized workshops for SRTUs, few private sector large workshops	**(Open to all)** Port Dry Docks, HSL, CSL, Chokhani, and others
Operations	Operations			
	Air	**Rail**	**Road**	**Water**
Right of way	**(State controlled)** DGCA, AAI	**(State controlled)** Indian Railways	**(State controlled)** Police Department in case of high traffic density	**(State controlled)** Major ports—Government of India, State Maritime Boards, Port Directorates, Light House Authority
Terminals	**(State controlled)** DGCA, AAI	**(State controlled)** Indian Railways, large industries for captive sidings	**(Open to all)** SRTUs, large industries, transport companies, Control and State Warehousing Corporation	**(Partly Open)** Major Ports—Government of India, State Maritime Boards, Port Directorates, some private and captive ports
Rolling stock and equipment	**(Open to all)** IA, AI, other private airlines	**(State controlled)** Indian Railways	**(Open to all)** SRTUs, private vehicle owners	**(Open to all)** SCI, Great Eastern, ESSAR, and others

(Contd.)

Table 7.1.6 contd.

Customer Services *(associated)*	**Air**	**Rail**	**Road**	**Water**
Basic services	**(Open to all)** IA, AI, private airlines	**(State controlled)** Indian Railways	**(Open to all)** SRTUs, private bus operators, TCI, Patel Roadways, forwarding agents, etc.	**(Open to all)** brokers, chartering agents, forwarding agents
Special services	**(Open to all)** IA, AI, private airlines	**(State controlled)** Indian Railways	**(Open to all)** SRTUs, private bus operators, tour operators, TCI, Patel Roadways, forwarding agents, etc.	**(Open to all)** brokers, chartering agents, forwarding agents
Regulation	Controls			
	Air	**Rail**	**Road**	**Water**
Licensing	DGCA	IR	RTO	DG Shipping
Environmental controls	DGCA	Department of Environment	RTO	DG Shipping
Safety	DGCA	CRS	Traffic Police	DG Shipping
Pricing	–	Parliament, Railway Rates Tribunal	–	DG Shipping, TAMP
Service levels	DGCA	IR, Railway Claims Tribunal	–	DG Shipping

Source: Excerpted and modified from Pangotra and Raghuram (1999).

In road services, the maintenance of right of way and terminals is vested with the respective governments and organizations providing such infrastructure. The maintenance services for rolling stock and equipment is largely sought from a vast number of small-scale garages dotted over the country by the owners of the rolling stock. Only in the case of mass passenger transport provided by the SRTUs are organized large-scale workshops available. Regarding operations and customer services in mass passenger transport, the SRTUs and private parties provide both. About 20 per cent of vehicle (rolling stock) ownership is under the SRTUs. Special services like school trips and contract services are provided by various organizations who hire buses. In the case of freight transport, operations are largely in the hands of the truck owners, while customer interface and value-added services are provided by trucking companies.

Given this complex web of organizations involved in the road sector, the services are seen to be very competitive, though not always of sufficient quality and reliability. The poor condition of roads has adversely affected the quality and reliability of road services.

Water

Water transport is another area where a large number of organizations are involved. The right of way (approach channels to port) and terminals (ports) are under the central and state governments. A few private terminals exist for captive use. The rolling stock (ships) ownership is open to private parties. However, nearly 50 per cent of the ship tonnage is owned by one public sector organization, the Shipping Corporation of India. Customer services and special services are significantly privatized. While services are viewed as being competitive, the major bottleneck is in the terminal (port) delays.

Pipeline

Another mode of transport gaining in significance as a viable alternative to road and railways for liquid bulk is pipeline. This technology is useful for transportation of fluids (crude oil, petroleum products, natural gas, etc.) and other commodities transportable in slurry form (coal, iron ore pellets, etc.). Conceptually, even conveyor belts and aerial ropeways serve the same purpose for transportation of bulk commodities in

solid form, though usually for much shorter distances. Currently, all investments in pipelines, belts, and ropeways are for captive use and hence managed by the respective user organizations. However, a 'public' network of pipelines may be useful and even necessary for the oil and gas sector. Two companies, Petronet and Petronet–LNG have been set up with equity participation from the oil and gas companies for this purpose. Questions regarding the actors, the service arrangements, and appropriate regulation of infrastructure investments, maintenance, operations and services still have to be resolved.[5]

Role of Regulation

It would appear that there is much inefficiency wherever the state has had direct and dominant involvement in transport infrastructure. This is primarily due to lack of accountability in a commercial sense. The state's role is nevertheless essential in regulation and catalysing infrastructure development and services.

The first area for regulation would be licensing, to ensure proper market structuring and competition. Regulating to reduce or mitigate environmental impact is essential in both development and service provisioning. With competition, in many areas for instance pricing of road transport or rail services could be scaled down. But regulations related to ensuring environmental soundness would have to continue.

Unbundling

Appropriate unbundling would be an important step in attracting private participation in 'smaller' and more manageable businesses. Unbundling would also make transparent the business transactions between those aspects of the market where competition can exist and those where there is a natural monopoly.

In the above framework, the first task of unbundling is to separate the fixed infrastructure (right of way and terminals) from movable infrastructure and services. Further unbundling can be thought of between right of way and terminals, along geographical dimensions, and along well-defined markets with separate characteristics (passenger and freight, urban commuter, long distance and feeder routes, etc.).

While unbundling would increase transaction costs between businesses, they could be offset by the increased value from the focused approach to each business, and from competition. In this context, ensuring market access is very important. A recent counter-example is the Konkan Railway Corporation, structured as a BOT (build, operate, and transfer) project to bridge the 'Konkan Gap' from a place about 120 km south of Mumbai to Mangalore. While the asset creation was successfully carried out due to the autonomy provided by the BOT structure, the operations phase has been far less successful due to market access being less than desirable. Having direct access to the major industrial market of Mumbai would be a key success variable. The project has been flawed from the start since it began from the Railways' idea of bridging the 'Konkan Gap', rather than starting from the needs of the customer.

Cherry Picking: Cross-subsidies and Subsidy

One of the possible outcomes in seeking private involvement for commercialization of the unbundled businesses is 'cherry picking'. Private interests would naturally be interested in those businesses which are commercially lucrative and less risky. This would leave the not so attractive businesses without any takers. There are two ways of dealing with this. One is to bundle the not so attractive businesses with the attractive ones and view the viable market as cross-subsidizing the unviable ones. This has been attempted in the 'open skies' policy for attracting private airlines. The other is to keep these businesses separate and provide a subsidy to the operator of the commercially unviable business.

The argument for cross-subsidy is not tenable unless a good rationale can be provided for the relationship between markets in terms of network economies and such other considerations. Apart from there being incentive incompatibilities (private airlines are often known to 'drag their feet' in maintaining the committed schedules on the unviable routes), there is also a lack of transparency in the true costs, since there is no longer an incentive to maintain separate accounts. For example, in the IR, it is often stated that freight subsidizes passenger, and the long-distance passenger subsidizes the short-distance and urban commuter. While these facts may be true the degree of cross-subsidization has hardly been estimated. In any case a large part of the costs are allocated costs and much could depend on the basis of allocation. In trains running significantly faster than the average speed of trains there are negative externalities on the other trains which are possibly not being captured. In other words, sensitivity to systemic effects would mean much more careful analysis would have to be carried out. Apart from transparency on cost, the basic issue is that cross-subsidization is highly distortionary in relation to direct subsidization.

The specific unviable business can be offered to that operator who is technically qualified and would manage the service obligations of the business with the least subsidy requirement. This would be a better way of improving service obligations.

[5] See section 7.4 in this report for a review of the oil pipeline sector.

Pricing

This is an important area, where due to practices of administered and often 'placative' pricing, major distortions have set in. They may have been in existence long enough to have even influenced investment decisions, that is resulted in allocative distortions. The most glaring example is the shift of freight traffic from rail to road due to *inter alia* pricing way above the true economic cost. This has resulted in a significant increase in road traffic along the golden quadrilateral, where large investments are now being channelized.

On the passenger side, there are demand distortions in commuter and short haul traffic, primarily due to concessional season tickets. There are also distortions due to free and subsidized rail travel provided to various segments, including railway employees themselves. With nearly 1.6 million employees, and an average free travel eligible family size of three including the employee, the total number of persons eligible for free travel is 4.8 million. The free travel privileges are available between three and six times a year (depending upon the category of employee). Subsidized travel is also available for a few more occasions. Assuming that three free trips a year are being made, with an average round trip distance of 2000 km, this results in total travel of 29 bpkm. In addition, there were one million pensioners as of 31 March 1998 (Asian Institute of Transport Development 1998) eligible for free travel. Assuming two free trips a year at an average of 1.5 persons per pensioner, with an average round trip of 2000 kms, this works to a further 6 bpkm. Together the 35 bpkms would form nearly 9 per cent of the total IR bpkm! It goes without saying that these distortions in pricing urgently need to be corrected.

With private participation in road development, the following issues need attention: (i) whether and which roads should be tolled, (ii) if to be tolled, what is the appropriate toll and toll-setting mechanism, and (iii) if not to be tolled, what is the appropriate shadow tolling mechanism for providing revenues to private developers. Irrespective of private involvement, many congested road segments, especially in urban areas, could be considered for congestion-based tolling or taxes.

For most other transport infrastructure services where there is reasonable competition (or at least competition can be ensured), pricing could be left to the free market.

Low Investment Approaches to Improving Infrastructure Quality and Capacity

Given that congestion and wear and tear are two of the most significant consequences of the current state of 'transport myopia', there is a lot of latent opportunity in activities that would give high returns for low investments in improving quality and capacity of the infrastructure.

For example, simulation runs by the planning group in the Railway Board using the Long Range Decision Support System (LRDSS) software show that a 20 per cent increase in capacity is straightaway possible by improving wagon maintenance (and avoiding breakdowns and accidents). Further increases are possible by improving freight train speeds to reduce the variance in speeds across categories of trains.

The capacity of the IR could substantially increase if the cumulative effect of certain modes of working and certain constraints are removed. The investments required would be very low in comparison to those required to create fresh capacity (see Box 7.1.3).

Bottlenecks on highways and roads reduce considerably the service levels on highways in India, even to the point of reducing the effective capacity of the roads. The potential gains in relaxing these constraints are very large, and the costs very small (see Box 7.1.4).

In the case of road, speed breakers could be located appropriately, not on the higher speed route but on roads joining such routes. Roadside signs have never been given their due role in providing information to road users allowing them to anticipate road conditions. Very often, it is also the case that the 'signage cycle' is incomplete, in that the road user is never informed that the special condition that he was asked to anticipate is over and normalcy has returned.

There is an urgent need to create appropriate incentives that would attract investors and make existing organizations take up these low investment options to relax current constraints. The examples of toll revenue-based maintenance contracts of highway stretches in Madhya Pradesh and Maharashtra are welcome but only small beginnings in this direction.

Land Acquisition and Management

Land is an asset valued dearly by everyone in India. This makes land acquisition and land management for transport infrastructure projects a significant issue. It is also clear that land acquisition has to necessarily stay with the government, since it is government alone which has the 'right of eminent domain'.[6] Under this right, the government can take possession of land from private citizens and bodies for infrastructure projects. The only recourse against the government is the court, in which only the compensation amount can be challenged.

[6] For a different view see the discussion on land acquisition in chapter 1 of this report (ed.).

BOX 7.1.3

Constraints which Deplete Rail Transport Capacity but which are Removable by Low Investments

There are significant opportunities to enhance rail transport capacity with soft investments. The best achieved capacity on a double line non-suburban section is 65 trains each way. A spacing of 10 minutes between trains should yield a maximum capacity of 144 trains and an actual of 115 trains at 80 per cent utilization. But the following constraints prevent achievement of this high capacity:

Constraints of flow across stations

- Yard layout, junction arrangements
  - Access to common loops requiring mainline crossover
  - Platforms only on loop lines, especially within smaller stations
- Stop boards in yards
- Diamond crossings on approaches to stations
- Level crossings, especially in station limits
- Provision of washable apron on main lines
- Equipment failures, especially related to signalling

Track-related constraints

- Slow speed of turnouts
- Permanent speed restrictions
- Poor spacing of intermediate block stations
  - Special restrictions at stations due to inappropriate track geometry

Operations-related constraints

- Speed and operating characteristic differential between trains (Rajdhani/Shatabdi, mail/expresses, passengers transport, container trains, freight trains, other operational movements)
- Timetabling with substantial slack
- Frequent crew changes for freight trains
- Attachment/detachment of bankers
- Light running of locos and bankers, sometimes at restricted speed
- Inadequate number of bankers

Rolling stock-related constraints

- Poor braking power
- Inadequate tractive power of engines
- Clamped wagons
- Locos running with deficiencies (like isolated traction motor) affecting speed and acceleration
- Derailments (usually of freight wagons)

Source: Based on (i) Raghuram and Rao (1991).
(ii) Thoopal (1998).

Apart from large tracts of land required for ports and airports, the complexity of land acquisition is increased by the need for linear alignments of road and rail routes. There was a time when the government thought that private involvement in transport projects could also result in land acquisition being done by private parties. However, it is now very clear that land acquisition is an activity that will have to remain with the government.

As a result of such acquisition, certain issues arise. The first is the issue of the quantum of land. The Gujarat Industrial Development Board [GIDB] has used a point system for evaluating potential bidders for infrastructure development, in which a bidder with less land requirement scores higher.) The second is the processes followed by the government in acquiring the land. Lately the large amount of land acquired for Poshitra port in Gujarat has come in for criticism.[7] Similarly, how long can the land be retained if the project is delayed or never takes off. Currently once the land is taken over, it stays with the government. Can extra land (keeping in view a future possible expansion), it be commercially exploited? A Kerala High Court judgement struck down such an ambition of the Kerala PWD, based on litigation by the original landowner. It was ruled that the landowner would have first rights for commercial

[7] See Box 5.6.1 in this report.

BOX 7.1.4

Low Investment Strategies to De-bottleneck Road Systems

A section of roadway to which more demand is delivered than can be processed is referred to as a 'bottleneck'. When a narrow road section exists on a roadway, then accumulation of vehicles takes place upstream of this section. Capacity analysis indicates that the best speed and the lowest density is downstream of the bottleneck; the worst speed and the highest density is just upstream of the bottleneck. *Thus an assumption that the section with the poorest speed is actually the bottleneck is wrong and would lead to erroneous identification of the problem, when it is caused by a 'bottleneck'.*

Bottlenecks may occur because of some permanent geometric feature, some construction activity, or as a consequence of some incident. Some bottleneck situations are too trivial to identify. However in many cases, it is necessary to identify both the bottleneck situation and the true demand. A bottleneck situation affects the vehicle-operating cost due to delays and discomforts, and adversely affects safety. Useful descriptive statistics below could be used to estimate the costs imposed by the bottleneck:

- Number of vehicles affected
- Total duration of time
- Maximum number of vehicles queued
- Maximum queue length
- Total vehicle-hours of delay
- Average delay per affected vehicle.

The estimation of the above statistics would be necessary to identify the non-obvious bottlenecks. An understanding of safety implications will also help in benefit–cost analysis of any proposed improvement of the bottleneck.

The following strategies can be adopted to relax the bottlenecks and improve safety:

- realignment of road sections with sharp curves and steep grades, especially where these are below the standard of adjacent road sections
- reducing road roughness
- realignment to improve passing sight distance
- improving intersection geometry
- increasing lane width
- adding auxiliary lanes, especially where traffic demand is higher for a short stretch
- introducing passing lanes at intervals
- providing gentle slopes and removing fixed objects from the sides of the roads
- use of paved shoulders
- installing guard fence to protect hazards
- providing special facilities for runaway trucks on steep downgrades
- improving and controlling roadside development and activity.

Source: Marwah (2000).

development, since that was not the purpose for which the land was acquired. The principle behind this ruling has laid to rest all intentions of the IR and road developers. While the principle has its merits, it should not result in a 'dog in the manger' policy resulting in land being idle by which no value is obtained from such land. The IR have used such land temporarily leasing it out for agriculture and horticulture.

There are still opportunities in terms of land management which do not violate the above principle. The land can be used for activities that would directly benefit the infrastructure user (for example petrol pumps, restaurants, garages, and staying places). It is also possible to use the air space above the land for commercial ex-ploitation, since the land is anyway required for the transport activity. Many cities internationally have taken advantage of this possibility. The new suburban stations of Mumbai have been built with multistorey structures to be used as commercial office space. Along the same lines, air space over the existing right of way in all the metropolitan cities would be a valuable opportunity to exploit and make infrastructure development more viable.

Coordinated Inter-sectoral Development and Centre–State Issues

Another crucial challenge is to channelize investments to realize multimodal benefits in an environment which has long settled down to a sub-sectoral outlook.

There was an attempt in the mid-1980s to make a unified Ministry of Transport. The experiment failed since in itself it did not lead to any improvement in coordination between the departments. A major opportunity like coastal shipping is underexploited primarily because nobody has taken the onus of coordinated development at ports between various modes. The type of coastal shipping that has taken off is that initiated by large corporates who have invested in the required multimodal logistics of their cargo movement. If an initiative with coordinated development can take place, private investment in various aspects of coastal shipping would naturally flow.[8]

Even if the ministries[9] cannot be integrated, task forces or boards that would look at specific areas of multimodal development would be essential.

In the context of roads and ports, which come under both central and state governments, there have not only been situations of conflict, especially with regard to financing, but also competitive situations to gain control over the activity. An example of the latter is the development of minor and intermediate ports in Gujarat and Orissa. This has no doubt served the purpose of a better industrialization in the states. It could also, however, lead to expensive excess capacity creation.

Common Carrier versus Captive Infrastructure

If coordinated development does not take place, then more 'captive infrastructure' than required would come about, leading to systematic inefficiencies. This is especially true of ports and pipelines.

While the benefit of captive infrastructure in offering better control and customization for the supply chain cannot be denied (for example the port of Mul-Dwarka for Gujarat Ambuja Cement Limited), the trade-off in terms of better utilization of infrastructure could very well lie in open access and public infrastructure.

In the case of pipelines, two organizations have been set up, namely Petronet and Petronet–LNG, to promote common carrier pipelines for the hydrocarbon sector. Currently, there is debate as to whether the captive pipelines of the petroleum companies should be handed over to Petronet for use in a common carrier mode.[10]

[8] We came across certain urban administrations who would redefine their urban boundaries so that the passenger rail transport system can be kept under their control, and they would not have to involve the IR.

[9] Even if ministries are merged, the older 'departments' once formed have a life of their own and cross-departmental coordination has proved to be very difficult for the Indian bureaucracy.

[10] See section 7.4 in this report.

In the case of project roads developed by specific industrial projects as a primary user, the government has ensured public use by providing land at subsidized rates or even at no cost.

It is thus important that as far as possible, infrastructure development be carried out under the common carrier principle, and preferably with stakeholding by the primary user who would also commercially gain by the public use.

The Neglect of R&D

One of the important determinants of efficient transport infrastructure is technology, especially that of the 'rolling stock' or vehicle. India suffers from poor technology. The net weight of commodity carried to the weight of the vehicle is among the lowest in the world. The standard truck has a ratio of 1:1 (multi-axle trucks can go up to 3:1 internationally, while in India the best multi-axle trucks have achieved 2.5:1). The best railway wagons in India have a ratio which is slightly higher than 2:1. Ratios greater than 4:1 have been achieved in container flats internationally. As far as ships are concerned, the ratio is typically 1.6:1, both in India and abroad.

The typical bus in India, which does not have to carry more than 4 tonnes, uses the same chassis as a truck, which is designed to carry 10 tonnes. This has been the result of a market oligopoly and a distorted view of economies of scale. Due to these inefficiencies, especially on roads, the nation suffers fuel wastage and road wear and tear. It is important to have a focused effort on appropriate R&D. National-level projects funded by government with contributions from industry to find solutions to such problems, especially those where the social benefits are larger than the private benefits, are required.

Regulatory Framework

In the context of transport infrastructure, the regulatory framework has been vested in the very same ministry, which also licenses and often is a key player in the activity. To facilitate private infrastructure development, the player must be different from the regulator and the licensor. Even when public enterprise is involved in provisioning, the traditional assumption that the public sector would act in the public interest is not necessarily true, especially when state failure is widespread. This would be relevant in the context of railways, roads, ports, and airports, where the potential for privatization is significant. The licensor has an important role in ensuring proper market structures.

BOX 7.1.5

Role of Citizens in Monitoring Roads

Preamble

Excepting some minor routine maintenance, most road works are contracted out to the private sector with a tendering process.

Quality control cells do exist in many public agencies responsible for roads. Maintenance is an ongoing process and is not given enough attention because it may be politically more exciting to build something new and take credit for it than to fix or maintain an existing system. Lack of proper planning and coordination between the various government agencies and illegal overloading of trucks are two other major constraints that plague road maintenance management in India. All these have contributed to the vicious circle of construction and reconstruction without proper maintenance and management. Other factors are:

- Lack of supervision/poor supervision, ignorance, and unethical work practices.
- The funds allocated for routine and periodic maintenance are not sufficient, in which case it is all the more necessary to be quality conscious.
- Lack of transparency in tendering and contracting process, resulting in collusion and corruption.
- Flaws and loopholes in rules and regulations.
- Absence of records pertaining to construction and maintenance details of each stretch of road.

Why Citizen Monitoring?

Safe and motorable roads are important for improvement in the overall *quality of life*. Citizens and taxpayers are the ultimate users and have a right to good quality roads. Rights cannot be divorced from duties. Therefore being vigilant is one of the important duties of citizens. It is in this context that citizen monitoring of the quality of road works, which is a culmination of both rights and duties, attains critical importance. They can most effectively mount pressure for a positive change.

Scope of the Guide

In this context, the Public Affairs Centre, an NGO based in Bangalore, brought out a Citizen's Guide for roads and related infrastructure monitoring which has become popular.

The most important objective of the guide is to provide the citizens with some information on road maintenance works and quality checks so as to strengthen citizens' voice. The guide describes some of the standard procedures and specifications as may be provided for in the contractual/tender documents. Only those methods of routine maintenance, resurfacing, and overlaying of road pavements which are most commonly being practised in this region have been covered. The coverage itself is, however, not comprehensive, but critical nevertheless. The specifications stated in the guide are based on those given by the Ministry of Surface Transport (MoST) and relevant specifications and code of practices of IRC. The extent to which they are followed and implemented by State Public Works Departments (PWDs) and local governments like Municipalities and Panchayats is a matter, which merits wide spread public debate. This is precisely what the manual aims to achieve in the longer run. Imagine a situation when citizen groups all over the country become quality conscious and begin to demand accountability of public work expenditure from a technical view point. Surely then, positive changes occur?

Though the guide attempts to simplify the 'technicalities' of road quality monitoring, it does not shy away from the same. Unless citizens educate themselves about some essential technical matters pertaining to public works expenditure, unethical practices will prevail resulting in huge wastage of pubic money and deterioration in the quality of life. If, however, some readers find these details too complex, they could seek assistance from civil engineers or other competent persons residing in their neighbourhood to explain these relevant matters.

Source: Public Affairs Centre, Department of Science and Technology (1999) mimeo.

In the case of air and water (primarily shipping), the corresponding ministries regulate almost all aspects through the respective Directorate Generals. In the case of the major ports, a Tariff Authority for Major Ports (TAMP) was set up. However, since ports operate in a competitive environment, a body like TAMP was really not called for. In fact, it serves more as a body for recourse than any strategic directions for pricing.

For railways, there are different bodies that look after various aspects of regulation. An interesting concept in avoiding conflict of interest is the Commissionerate of Railway Safety (CRS), which though manned by railway officers on deputation, does not report to the Ministry of Railways, but to the Ministry of Civil Aviation! Furthermore, for recourse on rates and claims, there are tribunals with judicial powers. On the matter of pricing the Railway Budget, which contains the

pricing proposals like taxes, is voted annually in Parliament! This makes tariff setting a political process. Typically fares have risen when a 'stable' government does not have to, over the next several years, face an electorate. They have been held back by governments that face an election. Recently though, the politics of coalition have added additional dimensions to the rate-setting process. More importantly, the required flexibility to price differentially through the seasons, or in such a manner as to optimize the use of resources or recover costs is systematically vitiated. It would make sense to delink this role from Parliament and possibly have a tariff authority, as a stop-gap arrangement, before reform and restructuring can begin in earnest.

Similarly, an appropriate mechanism for determining road tolls and ensuring appropriate service levels would be necessary. For example, when an additional bridge is constructed across a river for four laning and a toll is levied, then on days when one of the bridges is closed for maintenance, the toll ought be rolled back since the appropriate service level is not being provided. Today, there is no recourse to such tolling, except through the courts.

Other Substantive 'Checks and Balances'

Transport infrastructure development is too important a business to be left entirely to the commercial parties involved. Being as much if not more a public activity as the activities of large widely held corporations, infrastructure development must create the spaces for bringing in other 'stakeholders' and professionals. This would bring about the required 'checks' and 'balances'.

Good examples are the Infrastructure Leasing and Financial Services Limited (ILFS) engineered Gujarat Toll Roads Limited and a few of the projects promoted by the GIDB, where at important stages experts and steering committees of professionals and other stakeholders have been involved.

Involving citizens' groups in an organized manner is an important mechanism. Box 7.1.5 provides an example of an attempt by the Public Affairs Centre, Bangalore, to involve citizens in monitoring road construction and maintenance.

Intellectuals and academics can similarly contribute. Unfortunately, research and development in managerial, economic, socio-political, and even relevant technological issues related to infrastructure are not adequate. Box 7.1.6 excerpts from the 1983 Plan of Action accepted by the Planning Commission, based on the National Transport Policy Committee Recommendations, wherein transport research and training in ample measure are recommended. Unfortunately, they have not been taken further in a meaningful and purposive manner.

BOX 7.1.6

Transport Research and Training

An interdisciplinary centre should be set up to stimulate research, conduct studies, and impart training in transport planning and management. It should enjoy autonomy on the lines of the Institutes of Management and Institutes of Technology. (Para 8.2.1 and 8.2.2)	Accepted in principle.	To start with a separate wing for transport studies may be set up in an institute like the Staff College at Hyderabad and which could later become an independent institute for transport studies. Planning Commission in consultation with transport sector ministries may take further action.
Efforts should be made to encourage research and training at the universities and other specialized institutions. Necessary financial support should be provided. (Para 8.2.3)	Accepted in principle.	Further action may be taken by the Ministry of Education in consultation with the Planning Commission.
A wing or a unit should be organized as part of the National Transport Commission to function as a central forum for co-ordinating the research and development efforts undertaken by different institutions for various modes of transport. This wing should be appropriately advised by a group of experts. (Para 8.2.5)	Accepted as modified. The specialized group suggested under recommendation No 6.3-6.4 may co-ordinate this function	Planning Commission may take further action.

Source: Excerpts from Planning Commission (1988).

7.2 SECTORAL ISSUES IN TRANSPORTATION

G. Raghuram

Herein each of the sectors that constitute transportation is examined in detail.

AIR

Air transport consists of airports, air services, aircraft manufacture, and air traffic control. Since air traffic control is closer to a public good and regulatory in nature, it has been in government hands in most countries. In the aircraft manufacturing sector, India has developed little or no capabilities, except in certain low end defence aircraft. Airports and air services have much scope for private provisioning.

Airports

There are over sixty airports, either under the Ministry of Civil Aviation and managed by the Airports Authority of India (AAI), or under the Ministry of Defence. The total traffic handled by them in 1998–9 was 37 million passengers and 0.7 million tonnes of cargo, using 0.42 million aircraft movements (Table 7.2.1). The traffic trends over the past four years have not shown any significant growth. What is worth noting is that the cargo traffic has gone up at a compound annual growth rate (CAGR) of 2.5 per cent and the numbers of international passengers have gone up at a CAGR of 3.9 per cent. Forecasts, however, had been estimating the growth in domestic passengers at 8.5 per cent and international passengers at 6 per cent annually. At those rates, India is expected to handle 63 million passengers by 2004–5.

TABLE 7.2.1
Traffic at Airports

Total traffic	Units	1995–6	1996–7	1997–8	1998–9
Domestic					
Passengers	(million)	25.6	24.3	23.8	24.1
Cargo	('000 tonne)	212.6	201.0	218.5	224.5
Aircraft movement	('000)	314.7	303.3	291.4	325.1
International					
Passengers	(million)	11.5	12.2	12.8	12.9
Cargo	('000 tonne)	436.7	479.1	487.4	474.7
Aircraft movement	('000)	92.5	92.7	95.1	99.6
Total					
Passengers	(million)	37.1	36.5	36.6	37.0
Cargo	('000 tonne)	649.3	680.1	705.9	699.2
Aircraft movement	('000)	407.2	396.1	386.6	424.7

Source: CMIE (2000) and author's analysis.

In 1998–9, Mumbai and Delhi handled 51.1 per cent of passenger traffic (Table 7.2.2), 63.2 per cent of cargo traffic (Table 7.2.3) and 45.0 per cent of aircraft movements (Table 7.2.4). International cargo constituted 67.8 per cent of the total cargo (in tonnes), of which these two airports handled 70.6 per cent. Chennai, followed by Calcutta and Bangalore, are next in order of importance. This is followed by the airports of Hyderabad, Trivandrum, and Ahmedabad, and Goa and Calicut. These ten airports account for 84.9 per cent of passenger traffic, 95.6 per cent of cargo traffic, and 76.5 per cent of aircraft movements.

The key requirement at airports is enhanced service levels and reduction of congestion. Towards this end the AAI envisages an expenditure of Rs 34.21 billion in the Ninth Plan period (1997–2002). A significant share of this is expected through private sector participation. The government formulated a policy on airport infrastructure development in 1997. This policy allows up to 74 per cent foreign equity through automatic approval, and 100 per cent through special permission. It proposes to set up an independent regulatory board to fix tariffs, allot time slots, and allocate space in airports.

In May 1999, the first private sector airport built by Cochin International Airport Limited at Nedumbassery near Cochin was inaugurated. The total project cost was Rs 2.3 billion, financed through equity of Rs 0.9 billion and term loans of Rs 1.4 billion. The Kerala state government has 26 per cent equity participation. New private sector airports at Bangalore, Hyderabad, and Goa have been sanctioned. Privatizing a variety of services at Mumbai, Delhi, Calcutta, and Chennai airports has also been approved. The need now is to pursue these privatization goals proactively. One of the problems has been lack of consistency in the approach of the government. In the case of the Bangalore airport, the contractual conditions between the interested parties and the government were contentious. The contract documents were sent back and forth among the parties. There was much wasted effort, and finally the private parties withdrew. One of the important conditions stipulated by the parties was the closure of the existing airport, which the government after having raised their hopes finally refused to carry out.

TABLE 7.2.2
Passenger Traffic at Airports 1998–9

(numbers in millions)

Airports	Domestic	% share	International	% share	Total	% share
Mumbai	6.18	25.7	4.84	37.5	11.02	29.8
Delhi (IGIA)	4.09	17.0	3.79	29.4	7.88	21.3
Chennai	1.79	7.4	1.74	13.5	3.53	9.5
Calcutta	1.91	7.9	0.61	4.7	2.52	6.8
Bangalore	1.86	7.7	0.14	1.1	2.00	5.4
Hyderabad (Begumpet)	1.17	4.9	0.18	1.4	1.35	3.7
Trivandrum	0.31	1.3	0.83	6.4	1.14	3.1
Ahmedabad	0.63	2.6	0.14	1.1	0.77	2.1
Goa (Dabolim)	0.51	2.1	0.19	1.5	0.70	1.9
Calicut	0.22	0.9	0.28	2.2	0.50	1.4
Others	5.40	22.4	0.17	1.3	5.57	15.1
All airports	24.07	100.0	12.91	100.0	36.98	100.0

Source: CMIE (2000) and author's analysis.

TABLE 7.2.3
Cargo Traffic at Airports 1998–9

('000 tonnes)

Airports	Domestic	% share	International	% share	Total	% share
Mumbai	58.9	26.3	184.7	38.9	243.6	34.8
Delhi (IGIA)	47.9	21.3	150.6	31.7	198.5	28.4
Chennai	15.4	6.9	58.7	12.4	74.1	10.6
Calcutta	26.6	11.9	22.5	4.7	49.1	7.0
Bangalore	21.9	9.8	22.6	4.8	44.5	6.4
Trivandrum	5.8	2.6	24.9	5.2	30.7	4.4
Hyderabad (Begumpet)	8.6	3.8	4.6	1.0	13.2	1.9
Ahmedabad	6.4	2.9	1.5	0.3	7.9	1.1
Goa (Dabolim)	2.8	1.3	0.5	0.1	3.3	0.5
Calicut	2.1	0.9	1.0	0.2	3.1	0.4
Others	28.0	12.5	3.1	0.7	31.1	4.4
All airports	224.4	100.0	474.7	100.0	699.1	100.0

Source: CMIE (2000) and author's analysis.

TABLE 7.2.4
Airport Movement at Airports 1998–9

('000)

Airports	Domestic	% share	International	% share	Total	% share
Mumbai	80.9	25.3	33.1	33.2	114.0	27.2
Delhi (IGIA)	44.7	14.0	30.0	30.1	74.7	17.8
Chennai	20.7	6.5	11.2	11.2	31.8	7.6
Bangalore	25.1	7.8	2.8	2.8	27.9	6.7
Calcutta	17.7	5.5	6.7	6.8	24.4	5.8
Hyderabad (Begumpet)	12.7	4.0	2.1	2.1	14.8	3.5
Ahmedabad	10.0	3.1	0.9	0.9	10.9	2.6
Trivandrum	2.6	0.8	6.4	6.5	9.1	2.2
Goa (Dabolim)	5.7	1.8	1.1	1.1	6.8	1.6
Calicut	3.4	1.1	3.1	3.1	6.5	1.6
Others	96.3	30.1	2.2	2.2	98.5	23.5
All airports	319.6	100.0	99.6	100.0	419.2	100.0

Source: CMIE (2000) and author's analysis.

While considering new airports, location and land acquisition are important issues. Location has to be seen in conjunction with urban growth, access to key urban centres and environmental problems, especially pollution, and ease of land acquisition. While considering access to urban centres, an intermodal perspective is important.

For example, it is possible to think of a new international airport location midway between Ahmedabad and Vadodara, with direct access from the Ahmedabad–Vadodara Expressway, rather than upgrading the two airports independently. Also, scheduled coach services and even rail connections could improve catchment areas for airports, thereby allowing them to take advantage of economies of scale. Most European airports are examples of good design.[11] The existing airports at Mumbai and Delhi are connectable by rail, since suburban rail lines go very close to the airport boundary. At Chennai, the situation is even easier, with the suburban rail having a railway station very close to the terminal. However, the systems do not 'feel' integrated. A dedicated covered walkway over a dividing highway would solve the problem.

Both the proposed Bangalore and second Mumbai airports have faced problems regarding location. Apart from local resistance, there are also concerns that locations are being moved around to permit 'insider trading' in land, in view of the expected high land compensation prices.

Air Services

One of the first areas of liberalization in the early 1990s was permitting private participation in domestic scheduled air services. Luckily, the country had not forgotten that air services in the country had emerged with private entrepreneurship, until they were nationalized after Independence to form the Indian Airlines and Air India. Though many airlines entered the fray, only two have survived and one of them (Jet Airways) is now a major competitor to Indian Airlines, scoring better on most dimensions of service. Private scheduled airlines now account for more than 40 per cent of domestic air traffic.

Fares and schedules are deregulated. However, the policy of 'bundling', according to which a proportion of seat kilometres operated in the Category I routes (inter-metro routes, expected to be highly commercially viable) must be offered in Category II and III routes, which constitute the unviable, and metro to smaller city routes respectively.

The policy allows the required offers of seat kilometres in these categories to be traded among the private firms. However, this approach to bundling is problematic because the airlines have been known to drag their feet in operating the less lucrative and unviable routes and operational monitoring by the regulator is weak. In fact, this categorization of routes should really be an approach to unbundling, wherein airlines willing to provide such services are allowed to bid on a minimum subsidy basis for the unviable routes.

The current policy of private investment in domestic air transport permits 40 per cent foreign equity holdings. However, equity participation by foreign airlines is not permitted! This aspect of the policy is questionable since it would imply incentive incompatibility. Surely foreign airlines' 'know-how' would be an important ingredient in upgrading domestic service levels and efficiency.

International air services are controlled by bilateral agreements between countries. However, the route rights are tradable, as in the recent example of Air India offering its unused rights to Virgin Airways of the UK in the India–UK sector. A recent welcome policy decision is that of privatization of Air India (to the extent of 60 per cent equity), in which foreign airlines are also allowed to participate. One hopes that after the hiccups have been ironed out, the privatization would go through.[12]

Cargo traffic is completely deregulated, both in the domestic and international segments. This has given a boost to especially international cargo traffic during the 1990s. In the domestic segment, courier/third party logistics companies entered the fray, and one (Blue Dart) still operates.

As part of the 'open skies' policy of the early 1990s, non-scheduled air taxi operators were allowed free entry. Today, there are over forty operators providing air taxi services, catering to tourist circuits, executives of industries, etc. A fairly extensive infrastructure of landing facilities across the country (thanks to British development initiatives during the Second World War) has come in handy for such air travel operations.

Safety is a matter of serious concern for air transport in India. Maintenance standards, airport landing and take-off facilities, and disaster management need to improve considerably. The recent examples of the air crashes in India (Patna) and in France (Concord) provided a stark contrast in disaster management abilities.

[11] As the urbanization pattern in India is shifting away from the 'extreme metropolitan' to the more normal real size mode, many more mid-sized cities are likely to emerge, creating large potential for such strategies.

[12] Newspaper reports would indicate that there is a 'mafia' operating in Air India. Employees at all levels have hijacked the airlines for their private gain.

The Director General of Civil Aviation (DGCA) needs to get tough in implementing safety standards.

RAIL

Rail transportation is managed by a single organization, the Indian Railways (IR), a 'departmental enterprise' and possibly the largest business in India. As on 31 March 1999, there were 62,809 route kilometres, 81,511 running track kilometres, and 6896 stations. Its total freight traffic was 442 billion tonnes kilometres (btkm) and passenger traffic 404 billion passenger kilometres (bpkm), of which non-suburban traffic was 321 bpkm. Table 7.2.5 gives the investment input and traffic output indices, normalized at 100 for 1950–1. Wagon capacity, number of passenger coaches, tractive efforts of locos, which are the average input indices, had grown by 124 per cent and 156 per cent respectively over the same period. The route and running track kilometres went up similarly by 17 and 37 per cent respectively. In the 1970s and early 1980s, the productivity gains were rather modest. Much of the productivity gains have been realized in the late 1980s and 1990s. The output indices have gone up sixfold. The above growth in factor productivity has come about due to improvements in technology, improved operating practices, and upgradation of congested infrastructure. However, scope for further improvements, especially in asset utilization, is very large.

This can also be seen by benchmarking with a similar large system like the Chinese Railways (CR) (Table 7.2.6), which has achieved a significantly higher output with almost the same route kilometres. The Chinese Railways have maintained their focus on freight transportation, though water transportation is the market sharewise leader.

Over the period 1950–1 to 1998–9, the market share of Railways has dropped from 89 per cent to 33 per cent (40 per cent as claimed by IR) in btkm and from 80 per cent to 16 per cent (20 per cent as claimed by IR) in bpkm. In fact, over the past four years, even absolute freight traffic growth has been marginal and in fact has fallen over the past two years![13]

The market profile of freight and passenger traffic with a comparison across a decade is given in Tables 7.2.7 and 7.2.8 respectively. The share of coal has gone up and iron and steel has dropped, whatever the measures used. Though not presented here, the reason that the market share of finished goods like iron and steel, cement, and fertilizer has gone down for the IR is primarily that the IR has outpriced itself out of this market. In the passenger business, the most noticeable change is the increase in the share of non-suburban upper class, and

TABLE 7.2.5
Indices of Growth of Traffic Output and Inputs (1950–1 = 100)

Year	Traffic output indices		Fixed capital input indices				
	Freight traffice*	Passenger traffic (non-suburban passenger km)	Route km	Running track km	Tractive efforts of locos	Wagon capacity	Passenger coaches
1950–1	100	100	100	100	100	100	100
1960–1	199	110	105	107	144	152	154
1970–1	289	159	112	121	178	226	188
1980–1	359	279	114	128	201	269	210
1990–1	550	394	116	133	192	278	219
1991–2	582	419	117	133	194	286	225
1992–3	585	400	117	134	194	285	231
1993–4	583	389	117	134	188	273	233
1994–5	573	419	117	134	196	260	229
1995–6	620	448	117	136	196	256	225
1996–7	635	468	117	136	202	257	229
1997–8	650	502	117	136	215	258	234
1998–9	644	535	117	137	224	256	241

* includes non-revenue freight traffic
Source: IR (2000b).

[13] The problem is particularly serious, since India is undoubtedly at that stage of development where the need for connectivity between its growing cities is increasing more rapidly than the gross domestic product.

TABLE 7.2.6
Freight and Passenger Traffic (Chinese Railways) 1997

	National	Railways		Highways	Waterways	Civil Aviation	Petroleum and gas pipelines	Total
		Local	Total					
Freight traffic (mt)	1618.8	78.5	1697.3	9765.4	1134.1	1.3	160.0	12,758.1
Freight km (btkm)	1304.6	5.1	1309.7	527.1	1923.5	2.9	57.9	3821.1
% of freight to total	34.1	0.1	34.3	13.8	50.3	0.1	1.5	100.0
Passenger traffic (million)	919.2	6.6	925.8	12,045.8	225.7	56.3	–	13,253.6
Passenger km (bpkm)	354.4	0.5	354.8	554.1	15.6	77.4	–	1001.9
% of passenger to total	35.4	0.0	35.4	55.3	1.6	7.7	–	100.0

Comparison of Indian and Chinese Railways

	CR (1997)	IR (1998–9)
Route km	57,566	62,809
Double track route (per cent)	33.1	24.8
% of Route electrified	20.9	21.9
Tonnes (million)	1619	421
Tonne km (billion)	1305	282
Market share of freight (per cent)	34.3	32.7
Passengers (million)	919	4411
Passenger km (billion)	354	404
Market share of passenger (per cent)	35.0	16.5
Total traffic units (btkm + bpkm)	1659	686
Freight % of traffic units	78.6	41.1
Traffic units per route km (million)	28.8	11.9

	CR (1995)	IR (1994)
Route km/1000 sq km	5.7	19
Route km/million population	50	69
No. of staff (million)	3.37	1.62

Source: IR Year Book (2000b); Chinese Railways (1997).

reduction in the share of non-suburban ordinary second class. The increase in upper class has come about both due to better service differentiation and a relatively price inelastic market. The reduction in second class ordinary is partly due to competition from bus, and due to reduction in the quantum of services by the IR.

Table 7.2.9 presents the summary statistics of the IR with respect to engine, wagon, and track utilization. On almost all parameters (except for meter gauge, whose share of traffic has been dropping rapidly to insignificant levels due to large-scale conversion), increase in the asset is viewed in the 1990s. Only diesel engine utilization in km per day has come down to 552 km from a high of 673 km in the early 1990s. This is primarily due to diesel losing its prominence on the mainline routes, which have increasingly been electrified. Yet average speeds have increased, as has average wagon turnaround.

The key problem with the IR is its lack of customer orientation and irrational pricing. Customer expectations and competition have grown, especially as alternatives emerged. IR needs is to realize the full scope of its assets through proper use of systems, technology, and information technology, and 'small' investments in balancing equipments.

The IR itself sees the source of most of its problems in inadequate resources. Typically, generating resources tend to be seen more as budgetary support, and there is some justification for such attitudes, since the government has denied the IR the freedom to set tariffs.

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TABLE 7.2.8
Passenger Business of IR

Particulars	Suburban			Non-suburban						Grand total
	Season tickets	full fares	Total	Upper class	Mail/ express	Sleeper	Second class ordinary	Total of mail/ express/ sleeper and second class	Total non-suburban	
1998–9										
No. of passenger journeys (million)	1715.0	953.0	2668.0	30.0	336.0	125.0	1252.0	1713.0	1743.0	4411.0
(%)	38.9	21.6	60.5	0.7	7.6	2.8	28.4	38.8	39.5	100.0
Passenger km (billion)	53.2	29.5	82.8	17.2	109.6	88.0	106.2	303.8	321.0	403.8
(%)	13.2	7.3	20.5	4.3	27.1	21.8	26.3	75.2	79.5	100.0
Passenger earnings (crores)	444.0	556.0	1000.0	1484.0	2362.0	2328.0	1353.0	6043.0	7527.0	8527.0
(%)	5.2	6.5	11.7	17.4	27.7	27.3	15.9	70.9	88.3	100.0
Average lead (km)	31.0	31.0	31.0	573.3	326.2	704.1	84.8	177.4	184.2	91.5
Earnings per passenger km (paise)	8.4	18.8	12.1	86.3	21.6	26.5	12.7	19.9	23.4	21.1
Earnings per passenger journey (Rs)	2.6	5.8	3.7	494.7	70.3	186.2	10.8	35.3	43.2	19.3
1988–9										
No. of passenger journeys (million)	1414.0	591.5	2005.5	14.0	322.0		1158.5	1480.5	1494.5	3500.0
(%)	40.4	16.9	57.3	0.4	9.2		33.1	42.3	42.7	100.0
Passenger km (billion)	36.6	15.3	51.9	7.9	121.6		82.3	203.9	211.8	263.7
(%)	13.9	5.8	19.7	3.0	46.1		31.2	77.3	80.3	100.0
Passenger earnings (crore)	122.7	164.4	287.0	279.8	1330.1		557.1	1887.1	2167.4	2454.3
(%)	5.0	6.7	11.7	11.40	54.2		22.7	76.9	88.3	100.0
Average lead (km)	25.9	25.9	25.9	564.3	377.6		71.0	137.7	141.7	75.3
Earnings per passenger km (paise)	3.4	10.7	5.5	35.4	10.9		6.8	9.3	10.2	9.3
Earnings per passenger journey (Rs)	0.9	2.8	1.4	199.8	41.3		4.8	12.7	14.5	7.0

Souce: IR Year Book (1999).

Notes: The average lead is assumed to be the same in case of season tickets and full fares for suburban, to calculate the passenger kilometers.

The number of journeys for a monthly season ticket is assumed to be 50.

Nevertheless, there is increased potential to restructure the organization to make it more commercial in orientation and responsive to the needs of stakeholders, including customers and capital markets. An expert committee, headed by Dr Rakesh Mohan, is examining restructuring of the IR with the view to increasing its resource-generating potential.

A way to restructure the IR is to separate the facilities infrastructure from the provision of services. Thus infrastructure or facility could be kept under a single entity, while services are restructured to bring in competition and private participation. A regulator is essential to oversee the process and ensure equity of access of the service providers to the infrastructure. The British restructuring has been on these lines. But some arguments against a major break up of the IR are that (i) its integrated nature has strengths of better coordination and lower transaction costs, and (ii) unlike the railways companies of Europe, which were restructured, IR is not a marginal player in the transportation business struggling for survival.

It is possible without the break up of the IR, to

TABLE 7.2.9
Utilization of Assets by Railways

(broad guage)

Year	Engine utilization (kms per day per engine)		Gross tonne km per kg of tractive effort	Avg. speed of goods train (kmph)	NTKM per engine hr	NTKM per wagon per day (four wheelers)	Wagon turnaround (days)
	Diesel	Electric					
1950–1	–	191	1525	17.4	3283	710	11.0
1960–1	300	156	1864	16.1	4170	998	11.2
1970–1	347	316	2147	17.9	4904	908	13.3
1980–1	303	274	2372	19.7	6295	986	15.2
1990–1	445	398	3873	22.7	10,393	1407	11.5
1991–2	436	395	4026	22.7	10,911	1439	11.1
1992–3	426	412	4110	22.6	10,901	1457	10.8
1993–4	407	423	4272	22.7	10,864	1506	10.6
1994–5	413	423	4287	23.0	10,909	1590	9.9
1995–6	415	422	4376	23.3	11,629	1792	9.1
1996–7	403	401	4355	23.4	11,894	1840	8.5
1997–8	400	422	4690	23.8	12,104	1894	8.1
1998–9	396	444	4588	23.7	12,145	1904	8.2

Source: IR (1999).

have joint ventures (JVs) and special purpose vehicles (SPVs) for both infrastructure development and service provisioning. These JVs and SPVs would have to be built on the leverage of the complementary strengths and risk-taking capabilities of the partners.

Resource Generation

Some potential modes of resource generation for the IR are now outlined.[14]

IMPROVEMENT AND EXPANSION OF SERVICES

The present emphasis on increasing freight rates to generate additional revenues has boomeranged, leading to a decrease of market share even in bulk commodities. To improve traffic revenues, the IR should concentrate on attracting traffic through service quality improvement, and possibly even reduce the freight tariffs. Multimodal transport efforts should also be taken up seriously which could divert freight traffic from road to rail.

Focus on value-added services (both in passenger and freight) at premium prices could also generate additional revenues. Recent studies have shown that increased capacity in upper class passenger services would be viable. Reservation for journeys from stations other than from where booking is being made, reservation-related inquiries, tourist train circuits, etc. are services for which customers would be willing to pay premium charges. Similarly, in the case of freight, time guarantees both for wagon allotment and transit time, transit and handling insurance, etc. are services for which customers would be willing to pay, especially since there would be savings for them on inventories and avoidance of losses in transit.

The IR can expand its customer base to include advertisers, telecom operators, and real estate developers. For these parties, the IR infrastructure and service operations offer valuable inputs to leverage their own businesses. The potential remains underexploited. The IR needs to put up such projects, and possibly even nurture them.

REDUCING COSTS

The IR has made some efforts to cut down costs. The main element of railway costs, which can be brought down in the future, is manpower costs which now account for over half the total working expenses. Wage rates are low, but the numbers employed are far in excess of the requirement, given current technology. Some of the steps taken to reduce manpower are abolishing of posts on retirement, privatization of maintenance activities, and increasing use of contractors for execution of works. But reduction of manpower has not been seriously pursued. An earlier minister of Railways was committed to creating six additional railway zones to 'develop' backward regions and provide employment! Another minister set the clock back on privatization of maintenance services by going back to increased in-house employment merely to create 'government jobs'.

[14] The remaining part of the discussion on IR is excerpted from Raghuram and Babu (1999).

Similarly, asset utilization has much potential to reduce the overall unit cost of output. This is especially so with regard to rolling stock and track, the principal assets of any railway systems. In 1996–7 a broad gauge wagon moved 158 km in a day. With the average goods train speed being 23 kmph, a wagon was effectively running for seven hours a day. Similarly, broad gauge electric and diesel locomotives moved an average of just over 400 km in a day, giving an average utilization of just about 16 hours in a day. Passenger coaches for broad gauge mail/express services achieved a utilization of over 500 km per day, giving an average of ten hours a day at an average speed of 50 kmph. Even if one accounts, for time spent at yards and terminals, and for maintenance, the scope for improving rolling stock utilization is very high. Track utilization can improve on the golden quadrilateral to great advantage. Even though these are high density tracks that presently carry over 70 trains each way on double track sections, the potential to carry at least 100 trains each way can be immediately exploited through improved signalling and information systems! Since the quadrilateral accounts for over 60 per cent of traffic, and there is no shortage of demand (with the right prices), such improvement in asset utilization could result in an increase of at around 30 per cent in turnover!

MARKET BORROWINGS

Domestic market borrowings are expensive, with interest rates being over 15 per cent. The average return (revenues less expenses, but before dividend payment) on equity (budgetary support) has been 14.9 per cent and 11.7 per cent during 1995–6 and 1996–7, respectively. The average return on total investment has been 10.4 per cent and 8.1 per cent during these years. A study in 1997 by Mckinsey Consultants on behalf of the Asian Development Bank thought railways in India to be a 'sunrise sector' for investments. However, customer and commercial orientation within the IR and the internal organizational structure would have to undergo dramatic changes for the IR to be able to attract large investments.

BOT

The only experience to date under a BOT (build, operate, and transfer) scheme in the IR is the Konkan Railway Corporation (KRC). While the Special Purpose Vehicle (SPV) set up for this gained from reduced pro-ject financing and completion risks, it was a victim of perverse contracts that enhanced market risk and denied it market access. With no direct access to major traffic originating/terminating points, the KRC is dependent on neighbouring railway zones for traffic. The existing railway zones would like to hold on to their traffic to post better financial results at a time when overall freight market growth for rail traffic is uncertain or falling.[15] The KRC would certainly have been better off with direct access into the Mumbai area, as also other areas in the south.

A vanilla BOT model can hardly be applied without substantial modification for a part of a large interconnected network. Specific clauses to share revenues, as in originating and distributing demand and interconnect aspects, have to be part of an enhanced BOT. The BOT concept though would have ready application in value-added services like tourist circuits, catering services, terminal operations, multimodal operations, freight forwarding, and consolidation services. In such areas the market can be directly accessed by the BOT operator. In some of these where the life of the assets is not substantially longer than the term of the debt, the projects need not be BOT. BOO (build, own and operate) would be better.

BOLT

The BOLT (build, operate, lease, and transfer) scheme has not been successful since projects under it are being treated conventionally in awarding and finalizing contracts. The potential of the scheme is difficult to assess since sufficient experience has not yet been built up.

To make BOLT schemes successful, the IR needs to appreciate the fact that the risks faced by the BOLT operator are quite high and different from small contracts. The BOLT operator should also be capable of absorbing the expected down swing in business. The operator should have a long-term interest in the project. The IR should attempt to build long-term relationships with potential BOLT operators based on mutual interest. Case by case approach is best avoided. To offer economies of scale to the operator, especially for his supply contracts, equipment purchase and deployment, either large projects or bundling of smaller projects may be necessary.

The present procedures for obtaining clearances and clarifications from ministries like finance and environment do not, in all cases, explicitly recognize the BOLT operator as a body different from the IR! Matters that could be taken for granted or even dealt with during the project execution stage between ministries would have to be consciously considered prior to the project award stage. Similarly, hidden costs such as use of rolling stock, transport of material and men, and use of captive communication facilities need to be explicitly considered. These could significantly affect project viability.

BUDGETARY SUPPORT

While it is clear that budgetary support would decrease, the IR should renegotiate an annual contribution

[15] Because of absurdly high prices, over which the Railways as such have little control.

towards social obligations imposed on it by the government. The extent of social service obligation during 1996–7 was assessed at Rs 1826 crores on account of:

(i) transport of essential commodities carried at very low rates;

(ii) concessional passenger fares to season ticket holders and a variety of social welfare constituents, including 'forced' operation of certain unremunerative passenger trains;

(iii) investment in uneconomic railway lines on national considerations and 'forced' operation of uneconomic branch lines.

The first step in this exercise would be to develop a robust valuation model that can use various assumptions of alternative use of the capacity. With regular 'subsidy' contribution coming from the government it would be necessary to calculate the same in a manner that is transparent and convincing.

Further, to make a strong case for such contributions, the present costing system of the IR is inadequate and needs to be redesigned. Regarding item (iii) above, there have been situations in which other ministries like Defence, or state governments, have contributed part of the costs. The government has also declared the Rs 2100 crore Udhampur–Srinagar–Baramula line in Jammu & Kashmir to be a national project and has agreed to fully fund the project.

While renegotiating government support, financial restructuring of the capital at charge (which was nearly Rs 31,000 crore by the end of 1996–7 and is likely to be about Rs 35,000 crore by the end of 1998–9) as equity would have to be considered.[16] This would enable the IR to hold back the obligatory dividend payment, which has been of the order of Rs 1500 crore per annum in recent years.

Road Transport

Roads

The total road length in the country is 2.5 million km, which represents about a sevenfold growth over the past fifty years. The net outcome of this has been 'extensive connectivity' across the country. However, the quality of the connectivity in terms of reduction of journey times may not have been much. More importantly in com-parison to other countries in East Asia and elsewhere, this achievement is very much below the average!

Roads are classified as national highways, state highways, other district roads (all three of which are maintained by the Public Works Department [PWD]), panchayat raj roads, urban roads, project roads, and JRY (Jawahar Rozgaar Yojana) roads.

Village connectivity still remains a problem. Only 37.5 per cent of villages with population less than a thousand were connected as of 31 March 1994! Besides the capacity and quality of even many national highway segments is very poor. The same is true of many of the state highways and many of the urban roads.

An important aspect of road development is safety. Unfortunately this is not integral to the design of road and highway systems in India (Dinesh 2000). Table 7.2.10 gives statewise data on various safety parameters, for the year 1994–5. Safety indicators with regard to vehicles, such as accidents per 10,000 vehicles or persons killed per 10,000 vehicles are presented. At an all-India level, while the parameters with respect to vehicles have come down, they have gone up with respect to the road length. This is a reflection of both increased traffic on roads and the vehicle profile having changed. The proportion of motorized two wheelers (MTWs) has gone up substantially (Table 7.2.11). MTWs are accident-prone, especially in conjunction with heavy vehicles. Some inter-state comparisons with respect to vehicles would not be valid, since the base is against number of vehicles registered, while accidents could be on any vehicle passing through the state. For example, a state like Arunachal Pradesh, which has fewer registered vehicles, would reflect poorer performance compared to Delhi, Pondicherry, or Chandigarh on the vehicle-related statistics.

Another significant aspect is developing higher capacity roads on key segments, to take advantage of the fact that less than 2 per cent of the roads carry over 40 per cent of the tonne km traffic. Success of private involvement in long stretch road development has been poor, while de-bottlenecking investments in bypasses, bridges, and over/under passes have been more successful.

The late 1980s saw the initiation of discussions over involvement of private players in toll road development. A case in point is the acquisition of land for the purpose. As the government itself was very vulnerable to local political and other forces, and consequent litigation, it was expected that the private sector could 'manage' its way better towards land acquisition!

Much has changed since then, and the government can acquire land and hand it over to private sector road developers prior to the project. It is only the government which can operate under the principle of 'eminent domain', to attempt land acquisition in the larger interest of society. Over the years, project structuring has increasingly provided for greater incentives. These include roadside concessions (for licensing petrol pumps,

[16] The idea of an obligatory dividend payment is an anathema to any business, and especially a cyclical industry like the railway.

TABLE 7.2.10
Road Safety Statistics 1994–5

State	No. of accidents	No. of persons killed	No. of persons injured	No. of vehicles registered*	Road length (km)	Accidents/ 10,000 vehicles	Accidents/ 10,000 km of road	Persons killed/ 10,000 vehicles	Persons killed/ 10,000 km of road	Vehicle density/ 100 km of length
Andhra Pradesh	17,128	5561	20,122	2,212,363	171,785	77.4	997.1	25.1	323.7	1287.9
Arunachal Pradesh	176	85	254	14621	11,860	120.4	148.4	58.1	71.7	123.3
Assam	1862	914	2657	352,874	68,090	52.8	273.5	25.9	134.2	518.2
Bihar	6892	2681	5120	1,246,132	87,854	55.3	784.5	21.5	305.2	1418.4
Delhi	10,138	2074	9805	2,432,295	24,512	41.7	4135.9	8.5	846.1	9922.9
Goa	2903	231	2243	192,684	7303	150.7	3975.1	12.0	316.3	2638.4
Gujarat	30,111	4871	29,180	3,021,166	85,768	99.7	3510.7	16.1	567.9	3522.5
Haryana	6610	2559	6717	952,434	27,180	69.4	2431.9	26.9	941.5	3504.2
Himachal Pradesh	1784	609	3499	104,939	29,926	170.0	596.1	58.0	203.5	350.7
Jammu and Kashmir	2917	434	3005	177,874	12,590	164.0	2316.9	24.4	344.7	1412.8
Karnataka	30,186	5653	43,898	2,014,141	139,768	149.9	2159.7	28.1	404.5	1441.1
Kerala	37,980	2708	53,400	1,005,922	139,320	377.6	2726.1	26.9	194.4	722.0
Madhya Pradesh	27,449	4596	–	2,069,646	211,025	132.6	1300.7	22.2	217.8	980.8
Maharashtra	73,085	8552	48,776	3,621,331	224,973	201.8	3248.6	23.6	380.1	1609.7
Manipur	352	111	641	58,342	10,530	60.3	334.3	19.0	105.4	554.1
Meghalaya	365	152	525	41,963	7721	87.0	472.7	36.2	196.9	543.5
Mizoram	78	78	208	16,340	6577	47.7	118.6	47.7	118.6	248.4
Nagaland	98	55	238	86,376	12,880	11.3	76.1	6.4	42.7	670.6
Orissa	6202	1661	7810	594,140	209,888	104.4	295.5	28.0	79.1	283.1
Punjab	2601	1897	2385	1,769,754	57,039	14.7	456.0	10.7	332.6	3102.7
Rajasthan	16,613	4865	20,512	1,584,776	130,085	104.8	1277.1	30.7	374.0	1218.3
Sikkim	164	46	351	6876	1824	238.5	899.1	66.9	252.2	377.0
Tamil Nadu	41,685	8773	38,312	2,423,448	204,475	172.0	2038.6	36.2	429.1	1185.2
Tripura	421	135	795	32,103	14,706	131.1	286.3	42.1	91.8	218.3
Uttar Pradesh	16,644	8922	14,050	2,544,215	200,010	65.4	832.2	35.1	446.1	1272.0
West Bengal	13,050	2615	7225	1,198,733	68,316	108.9	1910.2	21.8	382.8	1754.7
Andaman & Nicobar	103	22	133	13,283	871	77.5	1182.5	16.6	252.6	1525.0
Chandigarh	345	119	347	352,308	1632	9.8	2114.0	3.4	729.2	21,587.5
Dadra & Nagar Haveli	93	21	99	9161	509	101.5	1827.1	22.9	412.6	1799.8
Daman & Diu	–	–	–	15,872	–	–	–	–	–	–
Lakshadweep	3	–	6	1320	–	22.7	–	–	–	–
Pondicherry	915	140	849	119,290	2338	76.7	3913.6	11.7	598.8	5102.2
All states	348,953	71,140	323,162	30,286,722	2,171,355	115.2	1607.1	23.5	327.6	1394.8

Source: CMIE (2000), MoST, Motor Transport Statistics in India, various issues.

* MoST.

garages, eateries, and lodges), part financing as equity, debt with lower interest rates, and even commercial development opportunities to tap into the likely increased property value along the road. Despite the willingness to allow similar provisions, the private sector costs were too high in the case of the Mumbai–Pune Expressway which finally had to be undertaken by a state level corporation. Financial closures have been achieved on very few long segment projects; even in these, the segments are in the 40 to 80 km range (for example Vadodara–Halol, Ahmedabad–Mehsana).

Land is a premium resource in urban areas. In this context, parking fees, both to reduce roadside congestion and to raise revenues, should be considered a priority item by urban administrations. As viable alternatives, multistorey parking facilities can be provided as a

TABLE 7.2.11
Total Registered Motor Vehicles in India (Aggregate and per cent)

('000 nos)

Year (as on 31 March)	Two wheelers	Car, jeeps, and taxis	Buses	Goods vehicles	Others*	All vehicles
1951	27	159	34	82	4	306
	9	52	11	27	1	100
1961	88	310	57	168	42	665
	13	47	9	25	6	100
1971	576	682	94	343	170	1865
	31	37	5	18	9	100
1981	2618	1160	162	554	897	5391
	49	22	3	10	17	100
1991	14,200	2954	331	1356	2533	21,374
	66	14	2	6	12	100
1992	15,661	3205	358	1514	2769	23,507
	67	14	2	6	12	100
1993	17,183	3361	364	1603	2994	25,505
	67	13	1	6	12	100
1994	18,899	3569	392	1691	3109	27,660
	68	13	1	6	11	100
1995	20,831	3841	423	1794	3406	30,295
	69	13	1	6	11	100
1996	23,111	4189	449	1785	4024	33,558
	69	12	1	5	12	100
1997(E)	25,915	4682	512	2265	4207	37,581
	69	12	1	6	11	100

Source: Central Institute of Road Transport (2000).

Figures in the second row of the same year indicate the per cent of all registered motor vehicles.

Notes: *Others includes tractors, trailers, three wheelers (passengers and goods vehicles), and other miscellaneous vehicles which are not separately classified.

commercial venture. It should also be made mandatory for all urban commercial development projects to assess their impact on parking (given their customer and employee profile) and provide plans for dealing with the same, before they are permitted to do business.

One important reason for recommending private involvement in road development is the need for sound project management. This is a multi-functional task, requiring a high level of coordination and a proactive approach to anticipating and avoiding delays. A live example of poor project management is that of the Ahmedabad–Vadodara Expressway (Gupta 2000). This was originally slated for completion in 1991, but is still incomplete in 2000. The capital waste factor on this has been assessed at 865 per cent, indicating that the deployed resources would have actually financed nearly nine such projects, if on schedule. A mechanism to ensure maintenance so as to avoid capital degradation during the project phase is essential. (The Sardar Sarovar Project canals would be a case in point.)

It may be worthwhile considering a legislation that would prevent reallocation of funds from committed projects, unless that particular project has been given up.

One of the most significant aspects in the measure of capacity on Indian roads arises out of the mixed traffic conditions. The concept of passenger car equivalent units (PCUs), which is used for capacity assessments and road designs in the advanced West, needs a fresh look in the Indian context.

In India it would be difficult to come up with a single PCU measure for each of the vehicle types, since it will depend upon the particular vehicle mix and road geometrics (see Box 7.2.1). This measure should be pegged on to the modal vehicle type (the 10-tonne truck on the highways, the passenger car on the central business district (CBD) roads of the metros of Mumbai, Chennai, and Calcutta, the MTW in all the other metros, the tractor or the animal drawn vehicle (ADV) on rural roads, etc.). Even while planning for better flow of motorized vehicles, the interaction with non-

motorized vehicles (NMVs) needs to be recognized and dealt with (Tiwari 2000).

So far as de-bottlenecking and better maintenance of roads are concerned, MOT (maintain, operate, and transfer) contracts with (professionally managed) private parties could yield significant benefits. Madhya Pradesh and Maharashtra have already achieved financial closure on certain important stretches under this model. An important element of the MOT contract should be to provide high service levels for post-accident support and breakdown removal.

Road Freight Transport

While this industry is completely privatized, it is highly unorganized. There is a major divide between trucking companies and truck owners. Trucking companies deal with the customer, bid for contracts, and help consolidate traffic. The truck owners, many of whom are also drivers, are part of entities that typically own less than five trucks each. The only semblance of 'organization' is a few large trucking companies, that provide 'branded' service.

The consequences and the operational dynamics of this industry, structure along with poor road conditions, are that (i) service levels are very poor, resulting in losses and higher logistics costs, and (ii) cut-throat price competition.

The major issues which need a careful review towards sorting out the problems arising out of the highly fragmented industry structure are:

- The special financing incentives offered to the educated unemployed for buying trucks for commercial use, as long as the number of trucks owned is small may have unnecessarily fragmented the industry;
- The Motor Transport Workers Act, which requires provision of proper rest facilities and time limits for drivers is often violated;
- The need for 'side payments' at various checkposts, which add up to a big 'unaccountable' amount for a large fleet owner, but can be managed by the smaller players.

Road Passenger Transport

Road passenger transport can be categorized into (i) private; (ii) intermediate; and (iii) public. People aspire to move to private modes. This is clearly visible in the vehicle profile of the country, especially in urban areas. However, improving the provisioning of public transport on urban, intercity, and rural routes has emerged as a major challenge to developers. Private stakeholding and competition seem to be potential means of managing the infrastructure. As of 1996–7, nearly 23 per cent of buses were in the public sector, a significant reduction from the 43 per cent in 1980–1. The public sector state road transport undertakings (SRTUs) have not been well managed. As seen in the time-series data in Table 7.2.12, all the SRTUs together have posted a loss of over Rs 1900 crore in 1998–9, up from a loss of Rs 700 crore four years earlier.

The SRTUs offer significant potential for restructuring through private involvement, route rationalization, vehicle size mix, etc. A case study of attempted restructuring of the Delhi Transport Corporation by route rationalization is given in Marwah *et al.* (2000). While it is not addressed here, route rationalization would become even more significant in the context of the Delhi Mass Rapid Transit (DMRT) project. The success of a highly capital-intensive 'backbone' project like

TABLE 7.2.12
Performance Indicators of All State Road Transport Undertakings

Year	Fleet strength (thousand)	Fleet utilization (%)	Annual km (crore)	Vehicles km/bus (daily)	Passengers carried/day (crore)	Revenue (Rs crore)	Expenditure (Rs crore)	Profit (Loss)
1990–1	104.1	85.3	881	240	5.9	5052.3	5731.7	–679.3
1991–2	107.1	87.0	941	248	6.0	6054.3	6705.1	–650.9
1992–3	109.7	87.9	985	257	5.9	6967.6	7626.1	–658.5
1993–4	111.2	88.0	1018	264	5.7	7936.6	8558.2	–621.5
1994–5	111.5	89.0	1047	271	6.1	8773.4	9475.8	–702.4
1995–6	111.1	87.7	1072	271	6.4	9050.2	8679.6	370.6
1996–7	113.4	88.0	1074	270	6.4	9599.1	10903.9	–1304.8
1997–8	115.2	90.2	1129	278	6.4	11556.1	12838.4	–1282.4
1998–9	116.0	89.9	1176	279	6.7	12367.0	14284.9	–1917.9

Sources: Central Institute of Road Transport (1998–9); and CMIE (2000).

the DMRT and the bus transport system would depend on how well they complement each other, smoothly feeding into each other, ever if this implies a change in existing travel patterns.

In the sphere of private entrepreneurship, intermediate transportation (chartered buses, taxis, three-wheelers, etc. for public hire) has grown significantly, both in urban and rural areas, providing a much needed transport service. However, strict regulation, especially for licensing, ensuring professionalism amongst the service providers (possibly through required training), and good vehicle condition to protect the customer and the environment, are

Vehicle Manufacture

This sector is open to private participation, and has matured thus. While production capacity is no longer an issue (due to the dismantling of the licence raj), technology upgradation and pollution management are significant concerns. The R&D effort by the industry is far less than desirable and needs to be incentivized. Emission norms and control measures are below international standards (Pundhir 2000). Implementation of policy is a major issue, especially in ensuring that vehicles are properly maintained. States like Andhra Pradesh, Gujarat, and Maharashtra are making progress in this matter (and in related areas of regulation like licensing of drivers) through e-governance, that is use of information technology.

MARITIME TRANSPORT

Maritime transport consists of ports, overseas shipping, coastal shipping, inland water transport, ship building and ship repair, and light houses and light ships. There is ample scope for private involvement in all aspects of the maritime sector, especially because all segments are contestable.

As of now, inland water transport does not seem to have much potential, unless a massive investment programme in 'training' some of the perennial rivers' segments and coastal waterways is undertaken. A discussion on various aspects of ports, overseas shipping, and coastal shipping areas is presented here.

Ports

Table 7.2.13 presents traffic and performance indicators at major ports for 1998–9. The total traffic handled at the major ports during 1998–9 was 252 million tonnes (mt) (237 mt excluding trans-shipment), and at the minor and intermediate ports it was 36 mt. Of this, 72 mt and 11 mt, respectively, were coastal traffic. In minor and intermediate ports, Gujarat is the dominant player, accounting for 26 mt of traffic. Gujarat is expected to show significant increase in traffic due to the Reliance Refinery and the private ports, which have started operations during 1999–2000. Traffic is expected to reach 60 mt by 2000–1 and 100 mt within another couple of years. Maharashtra traffic has been growing rapidly over the past four years and is now over 5 mt.

TABLE 7.2.13
Traffic and Performance Indicators at Major Ports 1998–9

Port	Total			Revenue	Expenditure	Revenue/ tonne	Expenditure/ tonne
	Total*	Overseas*	Coastal*				
	('000 tonnes)			(Rs crore)		(Rs)	
Calcutta Port trust	5638	3297	2341	905	662	350	256
Haldia	20,224	13,889	6335	**	**	**	**
Paradip	13,108	5282	7826	173	113	132	87
Visakhapatnam	28,928	18,840	10,088	274	181	95	63
Chennai	33,646	16,438	17,208	314	219	93	65
Tuticorin	10,150	4970	5180	85	45	84	44
Cochin	12,665	7326	5339	163	129	129	102
New Mangalore	14,172	11,672	2500	155	83	109	58
Marmugao	17,996	17,090	906	121	100	67	56
Mumbai	30,925	22,573	8352	607	434	196	140
JNPT	11,650	10,762	888	383	187	329	160
Kandla	37,907	32,919	4988	232	86	61	23
All ports	237,009	165,058	71,951	3412	2241	144	95

* Excluding trans-shipment of 14.7 mt.
** included in the Calcutta Port Trust.
JNPT: Jawaharlal Nehru Port Trust.
Sources: MoST (1999).
Indian Ports Association (2000).

BOX 7.2.1

A Relook at Passenger Car Equivalents in the Indian Context

B. R. Marwah

The composition of traffic must be taken into account in highway capacity analysis. Passenger car equivalents (PCEs) or passenger car units (PCUs), by which the mixed traffic volumes are expressed as an equivalent number of passenger cars, are instruments used for this. The American Highway Capacity Manual (HCM-1985), defines a passenger-car equivalent as the number of passenger cars a single heavy vehicle of specified type displaces in a given traffic stream. The nature of this 'displacement' or 'equivalence' is, however, not uniformly defined or understood.

The PCE value varies greatly depending upon several factors. Trucks have higher PCE value than buses, which have generally better operating capabilities. PCEs decrease as the percentage of heavy vehicle in the traffic increases. This is because as more heavy vehicles enter the traffic stream, they tend to segregate from passenger cars, by concentrating in certain lanes and forming platoons of heavy vehicles. As heavy vehicles have more uniform operating characteristics when operating in platoons, the impact of each vehicle in such circumstances is less than that of an isolated heavy vehicle operating among passenger cars.

Nevertheless, the cumulative effect of many heavy vehicles in the traffic stream is more severe than that of a few. PCEs increase with the severity of terrain and are largest on long sustained upgrades. PCEs are more severe on two-lane highways, where the passing maneuver is more difficult, than on multi-lane facilities. Finally, PCE values may differ depending upon the exact interpolation of 'equivalence' used in their calibration.

The estimation of passenger car equivalents for different types of vehicles in India is of great importance due to the mixed traffic on Indian roads. Very limited research work has been attempted in this area. The PCEs specified by IRC are adopted in estimating the equivalent passenger car demand on the roads. Estimation of this demand is of relevance in planning for benefit-cost analysis of new highway projects.

The PCE values as recommended by Indian Roads Congress (IRC) for rural and urban roads is tabulated here. However, the guidelines do not elaborate as how these values are computed. The guidelines on capacity of urban roads do acknowledge the fact that PCE value of a vehicle is dependent on traffic composition. Yet, only two levels of compositions trucks (less than or equal to 5 per cent and greater than 10 per cent) are taken into account.

- The value of PCE for a vehicle depends upon various road and traffic characteristics: road geometrics, comprising width, shoulder type and width, horizontal curve, longitudinal grades, road roughness etc.; and taffic characteristics, consisting of volume, composition of different types of vehicle, and directional distribution.
- The relative impacts of a vehicle on speed, capacity, overtaking, platoon formation and other traffic characteristics may lead to quite different estimates of its PCE value.
- PCE for a truck based on overtaking delays may be much higher on long steep gradients.
- PCE values vary with the traffic volume and proportion of slower vehicles in the traffic stream. It is found that the incremental effect of the first ten percent trucks in a traffic stream is greater than that of an additional ten percent
- The magnitude of the directional split also affects the PCE values.
- Impact on delays to the traffic stream by an isolated slow moving vehicle may be much higher than when it is moving in a platoon of slow moving vehicles.
- The passenger car equivalents of a slow or heavy vehicle may be considered to have two components: the extra space taken by the vehicle; and the extra delay caused by slower speed and greater difficulty in overtaking. The space component should represent a lower PCE for capacity conditions on level roads where speeds are uniformly low and overtaking is not possible.

Recommended PCE Factors for Vehicles

Vehicle type	% composition of heavy vehicle type in traffic on urban roads		Rural roads
	< 5%	10% £	
Motor Cycle or Scooter	0.50	0.75	0.50
Passenger Car: Pickup Van	1.00	1.00	1.00
Agricultural Tractor, LCV	1.20	2.00	1.50
Auto Rickshaw	1.40	2.00	3.00
Light Commercial Vehicle	2.20	3.70	4.50
Truck or Bus	4.00	5.00	0.50
Bicycle	0.40	0.50	2.00
Cycle Rickshaw	1.50	2.00	3.00
Horse Cart	1.50	2.00	4.00
Hand Cart	2.00	3.00	8.00

An Indian Traffic Simulation Model for two lane and four lane highways was implemented jointly by IIT Kanpur and CRRI, New Delhi, under the sponsorship of MoST. International agencies like the World Bank, Swedish Road Research Institute and Australian Road Research Board participated for in some of the activities. The model was calibrated over a wide spectrum of road and traffic characteristics.

The simulation results were then used to estimate the level of service (LOS) under different operating conditions. This will help estimate PCEs of vehicles under different road and traffic characteristics. The amount of data needed to fully calibrate a set of passenger-car equivalents for different types of Indian vehicles is very large. Hence, no common concept of equivalence emerged and researchers have not agreed on specific calibration techniques.

It is therefore desirable to develop traffic simulation models for Indian traffic and to conduct experiments on the models to predict the behavior of mixed traffic under different conditions. More than PCEs as such, traffic simulation calibrated for various road and traffic conditions especially those specific to India, would be very useful in project analysis.

Of the 252 mt of traffic handled at the major ports in 1998–9, non-POL (petroleum oil and lubricant) (products and crude), coal, and iron ore accounted for 71 per cent traffic, at 107 mt, 39 mt, and 34 mt respectively (Table 7.2.14). This was followed by container handling at 24 mt, fertilizer (finished) at 4.7 mt, fertilizer (raw material) at 4.3 mt, and foodgrains at 3.5 mt. These seven commodities constituted 86 per cent of total traffic.

Soon even the JNPT could be out of reckoning since 6000 plus TEU vessels are expected to come in.

The primary issue in port development is congestion at ports, resulting in unacceptable average turnaround times of 5.9 days (Table 7.2.19). The net cost of congestion at the major ports in India, benchmarking with an acceptable average of two days at ports internationally, was $ 457.9 million, that is Rs 1623 crores for 1998–9.[17]

TABLE 7.2.14
Commodity-wise Cargo Traffic Handled at Major Ports

('000 tonnes)

Year	POL (%)	Coal (%)	Iron ore (%)	Container (%)	Fertilizer		Food-grains (%)	Others (%)	Total	of which	
					finished (%)	raw material (%)				Unloaded	Loaded
1991–2	44	14	20	5	2	3	1	12	157,598	84,853	69,327
1992–3	44	14	18	5	2	2	0	13	166,611	95,810	67,380
1993–4	43	15	19	7	2	2	1	12	179,260	100,492	78,768
1994–5	42	15	18	8	2	2	0	13	197,262	113,776	83,486
1995–6	42	15	16	8	3	2	1	13	215,338	126,629	88,709
1996–7	43	15	15	9	1	2	1	13	227,257	139,208	88,049
1997–8	41	15	16	9	2	2	1	13	251,659	155,977	95,682
1998–9	43	16	14	9	2	2	1	14	251,720	164,601	87,119

Source: Indian Ports Association (2000).

The total tonnage of 24 mt through containers was handled across 1.93 million twenty feet equivalent units (TEUs) (Table 7.2.15). Over the eight years preceding 1998–9, container tonnage grew at 14.5 per cent CAGR, while the TEUs grew at 13.9 per cent CAGR. The major portwise containers handled for 1998–9 are given in Table 7.2.16. While container traffic has been growing in India, the total TEUs handled across all the ports are still less than the tenth port among developing countries. The top two ports in the world classified as being in the developing countries handled over 16 million TEUs, that is over 8 times the total TEUs handled at all Indian ports (Table 7.2.17).

Another issue with respect to containers is that most of the containers from/to Indian ports are serviced by feeder vessels for/after trans-shipment at the ports in Colombo, the Middle East, or Singapore. Table 7.2.18 provides data on this, from which we see that except the Jawaharlal Nehur Port Trust (JNPT), all the other ports handle transhipped containers anywhere from 80 to 100 per cent. One of the reasons for this is our inconsistent cabotage policy. Draft restrictions that prevent mother vessels from being directly received at Indian ports is another. Currently the JNPT is the only port that can receive mother vessels of up to 4000 TEUs.

Good multimodal evacuation infrastructure remains a problem. Three of the oldest ports (Calcutta, Chennai, and Mumbai) are located in the city centre, constraining evacuation to and from the port. Each of these ports now has an 'alternate', namely Haldia, Ennore, and JNPT respectively. (Ennore port, the first corporate port under the central government, is nearing completion and is expected to begin operations during this financial year.) The other major ports have scope

TABLE 7.2.15
Container Traffic Handled at Major Ports

('000s)

Year	Tonnage total	TEUs total
1990–1	8042	681
1991–2	7627	683
1992–3	9009	799
1993–4	12,249	1052
1994–5	15,358	1257
1995–6	17,618	1449
1996–7	20,590	1698
1997–8	23,299	1891
1998–9	23,782	1932

Source: Indian Ports Association (2000).

[17] See section 7.2.

TABLE 7.2.16
Container Traffic 1998–9

('000s)

Port	Tonnage			TEUs (nos)		
	Unloaded	Loaded	Total	Unloaded	Loaded	Total
Calcutta	1159	812	1971	77	55	132
Haldia	51	376	427	4	24	28
Paradip	–	1	1	–	–	0
Visakhapatnam	88	84	172	7	7	14
Chennai	1471	1471	2942	146	138	284
Tuticorin	428	785	1213	48	52	100
Cochin	357	620	977	63	66	129
New Mangalore	–	–	0	–	–	0
Mormugao	18	19	37	2	1	3
Mumbai	3938	3160	7098	274	235	509
JNPT	3795	4234	8029	316	353	669
Kandla	394	521	915	33	31	64
All Ports	11,699	12,083	23,782	970	962	1932

Source: Indian Ports Association (2000).

TABLE 7.2.17
The World's Top 20 Container Ports

Rank		Port	TEUs ('000)		% change
1999	1998		1999	1998	
1	2	Hong Kong*	16,100	14,636	10.0
2	1	Singapore	15,900	15,100	5.3
3	3	Kaohsiung	6985	6271	11.4
4	4	Rotterdam	6400	6000	6.7
5	5	Pusan	6311	5753	9.7
6	6	Long Beach	4408	4098	7.6
7	10	Shanghai	4210	3066	37.3
8	8	Los Angeles	3829	3378	13.3
9	7	Hamburg	3738	3547	5.3
10	9	Antwerp	3614	3266	10.7
11	14	New York*	2863	2466	16.1
12	11	Dubai	2845	2804	1.4
13	12	Bangkok	2808	2538	10.6
14	15	Felixstowe	2610	2462	6.0
15	13	Tokyo	2595	2495	4.0
16	16	Gioia Tauro	2253	2126	5.9
17	17	Kobe*	2200	2101	4.7
17	18	Yokohama*	2200	2091	5.1
18	22	Bremerhaven	2181	1812	20.3
19	19	Manila	2090	1851	12.9
20	–	San Juan	2085	1990	4.7

Source: Mundy (2000). * Port authorities

TABLE 7.2.18
Distribution of International Container Traffic between Direct and Trans-shipment Traffic, 1998–9

Port	Direct		Trans-shipment			
	Traffic ('000 TEUs)	%	Colombo %	ME %	Singapore %	Total trans-shipment %
JNPT	669	80	10	5	5	20
Mumbai	509	20	30	40	10	80
Kandla	80	5	30	60	5	95
Cochin	128	10	75	11	4	90
Tuticorin	100	0	100	0	0	100
Chennai	283	16	50	0	34	84

Source: Sarosh (2000).

TABLE 7.2.19
Port Statistics 1998–9

Port	No. of vessels (numbers)	Total DWT ('000 tonnes)	Cargo traffic ('000 tonnes)	Avg DWT ('000 tonnes)	Turnaround time (days)	Vessel days
Calcutta	1049	15,741	9163	15.0	7.1	7468.9
Haldia	1291	42,353	20,224	32.8	4.8	6248.4
Paradip	695	21,059	13,108	30.3	4.2	2891.2
Visakhapatnam	1514	56,191	35,653	37.1	5.5	8342.1
Chennai	1816	52,653	35,201	29.0	7.6	13,765.3
Tuticorin	1073	18,527	10,150	17.3	4.9	5268.4
Cochin	1113	25,040	12,665	22.5	3.6	4017.9
New Mangalore	738	24,861	14,206	33.7	3.8	2767.5
Mormugao	483	22,839	18,020	47.3	5.4	2627.5
Mumbai	2222	46,476	30,970	20.9	6.8	15,198.5
JNPT	974	21,112	11,723	21.7	3.4	3292.1
Kandla	1708	60,079	40,637	35.2	8.3	14,176.4
Total Ports	14,676	406,931	251,720	27.7	5.9	86,064.3

Source: Indian Ports Association (2000).

Notes: For 1998–9: International good average for turnaround time was two days. Hence extra turnaround time in India was 3.9 days. Extra vessel days was 57,236.4. At the average standing charges of $ 8000 per day, the cost of congestion was $ 457.9 million, i.e. Rs 1923 crore.

Regulator	*Landowner*	*Utility*
• Conserving and pilotage	• Manage port estate	• Cargo handling
• Vessel traffic management or surveillance services	• Port policy and development strategies	• Passenger terminals
• Laws and regulations	• Civil engineering works	• Towage
• Port police	• Marketing and promotion	• Linehandling
• Emergency services	• Maintain channels, etc.	• Waste disposal
• Licensing port works	• Maintain wharves	• Security
• Ensuring competition	• Provide land access	• On-dock warehousing
• Customs		• Equipment maintenance
• Port planning and monitoring		

Fig. 7.2.1: Roles of ports: Regulator, landowner, and utility.

Source: Alfred (2000).

for improving the evacuation infrastructure. All the major ports have broad gauge rail connectivity and are expected to be connected through four lane roads with the golden quadrilateral highway project. The evacuation problem is more acute at the minor and intermediate ports, especially those which have tremendous potential for growth, like those in Gujarat, some of which do not even have rail connections.

Minimum of turnaround time and fast evacuation are all the more important in the context of containers. Countries like Singapore, Hong Kong, and the United Arab Emirates (UAE) have made container handling a source of significant national income through the effective use of information technology in improving productivity at ports for container handling (Ramani 2000). There is scope for the same at Indian ports.

Ports are basically a viable business (Table 7.2.13 shows that average revenue per tonne across all major ports in 1998–9 was Rs 144, while average expenditure per tonne was Rs 94.5). With government encouragement, ports are an attractive proposition for private participation. It would however be important to separate three roles related to ports, namely that of regulator, landowner, and utility (Fig. 7.2.1). The landowner function could involve private participation for infrastructure development and maintenance. The utility function could involve private participation in port-related operations and services. Private involvement of appropriate combinations of

the landowner and utility functions can also be considered. The key issues would be the criteria for selection of private parties and the framework for charges.

Recent successful examples of privatization are the container berth and handling at the JNPT by the P&O Australia-led consortium, called the Nhava Sheva International Container Terminal or NSICT Limited, the Gujarat Pipavav Port Limited (GPPL), Gujarat Adani Port Limited (GAPL), etc. A few other projects have also seen financial closure and are expected to be on stream soon. At Poshitra in Gujarat, the private port developer is also planning a large special economic zone complementing the port.

CRITERIA FOR SELECTION

The criteria for selection[18] have been examined here under two heads, namely infrastructure development and port operations.

Infrastructure Development

For investment in infrastructure, we propose the following set of six criteria for evaluation of parties and their organizations.

(a) *Size of the organization*: It should already be a medium to large sized organization.

(b) *Management quality*: The company should be professionally run with proper systems in place.

(c) *Experience with ports*: The organization should have sufficient experience with ports, either as a user or through being involved in port operations in a significant manner.

(d) *Relevant expertise*: The company should have sufficient technological manpower and demonstrated expertise in port infrastructure requirements.

(e) *Financial viability*: The company should be financially viable with sufficient cash for investment as well as a proper financing plan for its scheme.

(f) *Interest in captive commodity*: The organization should be in a position to provide a significant share of the traffic either through commitments of a sister industrial organization or through organizations with whom it has been dealing quite consistently.

FRAMEWORK FOR CHARGES

The current structure of charges levied by a port varies by different factors, either due to the use of private jetties or private services. The most striking of the charges is the wharfage charge, whose rate varies depending upon the use of private jetties. The lighterage charge also varies quite significantly, depending upon whether the ship has berthed directly or not.

[18] The criteria for selection and framework for charges are excerpted from Raghuram (1999).

Based on a comparison of net container handling charges at various ports in India and the nearby Asian region, it is quite clear that the productivity achieved at foreign ports gives them a strong price advantage over Indian ports, even though it is often claimed that labour is cheaper in India. For example, container handling costs at Singapore could be as low as $ 281 per TEU, while in India, at Mumbai, the costs could run as high as $ 530 per TEU. The total charges applicable in the Gujarat Maritime Board (GMB) ports are a little under $ 140 per TEU. This is quite a competitive price and reflects the price advantage that the GMB and other ports in India can enjoy with better management.

Thus the framework of charges should be such that a port can retain the overall price advantage that it can offer to customers. Under privatization, whatever rents/royalties levied should be constrained by the need to keep the port competitive. Of course, the profitability of a port would also be a consideration.

The framework of charges can be examined under two heads, namely infrastructure development and port operations.

Infrastructure Development

In the case of infrastructure development, the party should be willing to pay a minimum periodic (say annual) rent/royalty for the following rights access to waterfront; equipment installation.

This royalty is payable to the port. Apart from this, a per ton rate is leviable on the traffic handled.

Apart from the criteria listed above for evaluating parties, they should be asked to make bids in which the royalty amounts and the per ton rates should be specified. Everything else being equal, the parties bringing in the highest expected revenue should be considered.

Since infrastructure investments would easily run over Rs 100 crore per party, they must be given rights for long periods to enable long-term planning.

Port Operations

Here two kinds of port operations are considered: those in which the port is directly responsible to the customer, but gets the job done through private parties; and those in which private parties are directly responsible to the customer, but are given rights of port operations by the port.

In the first case, which includes essential activities like dredging (maintenance of right of way), pilotage, and maintenance of port infrastructure charges, levied by the port from port users in one form or the other, should pay for 'private contractors' who could undertake the above mentioned tasks. Such contractors must be selected for the lowest bids made for a given service level, which should be monitored by the port.

Such contracts can be given out on a period basis, say annually, or on a target achievement basis.

In the second case, which includes activities specific to each port user's requirements like loading and unloading operations, storage and warehousing, water provision and chandlering, bunkering, and ship repair and dry docking, different parties can be authorized to perform these tasks for a charge which they can directly levy from port users. However, if the service is to be privatized, more than one service provider must be ensured so that competition can control prices. A fixed royalty and a proportion of the earnings could be made payable to the port. The licence to such parties can be given for a period like one year, renewable if the party is providing the service to the port users' satisfaction.

Overseas Shipping

Overseas shipping is open to the private sector and foreign participation. Though dominated by the public sector company, the Shipping Corporation of India (SCI), which owns nearly about 50 per cent of the shipping tonnage of the country, Indian shipping is open to the private sector. Indian shipping handled about 31 per cent of India's overseas seaborne trade in 1999 (62 per cent of POL, 14 per cent of dry bulk, and 12 per cent of general and container cargo) (INSA 1999).

There is an element of support for Indian shipping companies through an organization under the MoST, called Transchart, which acts as a broker for public sector cargo and provides first right of refusal to Indian companies. Notwithstanding the recent debate as to whether Transchart be wound up, especially since many of the public sector companies prefer to use their own agents, Transchart is among the largest brokers, with an excellent network. With a better marketing approach, and even without the first right of refusal support, Transchart should be able to provide useful service.

Coastal Shipping

Coastal shipping is an untapped mode of transportation with vast potential, especially because it is environment friendly and operationally inexpensive. Currently, it has a market share of 8.5 per cent of the total domestic transport movement in btkm. Coastal tonnage during 1998–9 was 87.4 mt. It is expected that at least another 50 mt of general cargo traffic can be attracted to coastal movement over the next five years. At present, coastal movement is majorly used by few large corporates as part of their efficient logistics management. Coastal traffic is significant for some of the major ports like Paradip, Chennai, and Tuticorin.

An analytical perspective with policy recommendations is provided in (Raghuram 2000). For growth of coastal shipping, the multimodal infrastructure facilities and the regulatory issues (customs and cabotage laws) need emphasis.

Greater attention should be given to reduction of turnaround times. Ports with sufficient capacity for coastal traffic should be located at a distance of every 300 km (about twenty locations for the Indian coastline) to reduce land leads. These ports should have geared jetties, warehousing, and access to other modes of transport. It is not necessary that the ports be 'big'. Smaller ports (for 3000 to 5000 tonnes parcel size) of about 4 m draft are sufficient for coastal shipping. This would also keep investments low. Further, with the latest relaxations in the cabotage for chartering foreign flag vessels, the scope of coastal shipping has already increased.

All the additional investment at ports should be private investment by appropriate stakeholders. Coordinated development with other modes, and location policy in terms of manufacturing and redistribution facilities are essential.

Ship Building and Ship Repair

Ship building was attempted to be developed in the public sector, with the hope that India would be able to build modern ships (reliving its traditional role as a maritime nation). Ship repair has largely been in the private sector, but not catering to modern vessels. The ship building industry did not really take off. This was primarily due to a *pari passu* clause, which required all Indian shipping companies importing modern vessels to place a formula-based equivalent order on public sector companies. This clause effectively killed the industry by offering protection through a captive market. These companies did not invest in R&D, nor did they even work towards matching international standards on order delivery. Distortions against exports confined them to the small home market.

This clause has since been removed and the order book position has gone down. The ship-building companies are trying to reposition themselves as offering ship repair services also. Success is uncertain, even though there is a cost advantage, as there is absence of adequate knowledge about modern vessel technology. Also, the existing private players confined to building small ships and ship repair.

PIPELINES

In the context of freight movement, pipelines is a growing segment; it is environment friendly, with low operating costs. The primary use of pipelines is for transporting oil (crude and products). Gas is gaining as another major user.

No data are available on the tonne km movement of water through pipelines. However, for oil, one can arrive at such a figure using the data provided by Barua and Madhavan in this report.[19] Assuming that maximum capacity exists throughout the pipeline and capacity utilization is 100 per cent, the total btkm would be 70.2 (51.5 btkm of crude and 18.7 of products). This would amount to about an 8 per cent share of total domestic movement. In terms of share of originating tonnes of product from refineries/imports, pipelines currently account for 20 per cent of the mode primary movement. This is expected to reach 40 per cent in the next couple of years.

The crucial issue in pipeline development is enabling it to become a 'common carrier', as opposed to a captive carrier. This requires appropriate institutional infrastructure and regulation. Petronet and Petronet–LNG are two companies which have been set up as holding SPVs, with equity participation from the oil companies. While each new pipeline being developed has stakeholding by the primary user in its specific SPV, the issue of making it a common carrier is still not resolved. Further, the issue of opening up the existing not-so-insignificant pipeline network from its captive format still remains. Issues related to government policy, regulation, and tariff gain significance in this context. This chapter criticizes the current SPV route for pipeline development and recommends that the oil majors should be allowed to build the infrastructure and a regulator kept in place to ensure common carrier access. The underlying issue is that of incentive compatibility for driving infrastructure development.

Multimodal Transport

Unless the movement is by road all the way, almost every commodity and passenger would require to use more than one mode, since at least the 'first' and the 'last' miles would be by road (or on foot). Ensuring smooth inter-modal transfer is essential. Today, multimodal transport gains even more importance with more than one mode constituting significant segments of transportation. Apart from appropriate infrastructure, this requires a 'single window' service interface. For freight movement, containerization as a technology has enabled multimodal freight transport substantially throughout the world. India is catching up, but has a long way to go.

During 1998–9, out of 1.93 million export/import TEUs handled at major ports, 0.58 million (30 per cent) originated at container freight stations (CFSs) other than port sites. Out of this, 0.33 million (17 per cent) were connected with inland locations by rail through inland container depots (ICDs) (Indian Ports Association 2000). The slow movement towards using networked computer services, especially electronic data interchange (EDI), is also an indication of the growing preference for containerization.

Apart from multimodal transport for the export/import business, the potential for domestic transportation remains far from being fully exploited. Multimodal transport also needs to be a focus area for carrying passengers. It has a significant bearing on development of high speed, high capacity corridors (intercity and intracity), and location of terminals (airports, railway stations, ferry ports, etc.).

Various infrastructural issues[20] were identified in a study by the then Shipping Credit and Investment Corporation of India (SCICI) (now a division of the Industrial Credit and Investment Corporation of India [ICICI] in the mid-1990s.

In the first place, the container handling facilities at the ports are not adequate to attract main line container vessels who continue to rely to a large extent on feeder services entailing additional cost. Secondly, the cost of moving a container through an Indian port is comparatively higher than the cost in other South-East Asian ports. Thirdly, both road transport and rail transport have not been adequately developed as yet for the inland movement of containers. The national highways are already overburdened to cope with the increasing volume of container traffic. The position in regard to rail transport is not satisfactory either. The quality of rail service for catering to container traffic needs improvement. More regular scheduled rail services carrying containerized cargo connecting ICDs and gateway ports are necessary. Besides, the progress in the modernization and technological upgradation of Railways in several areas such as electrification, track renewal, conversion of narrow gauges into broad gauges, signaling system computerization, etc. have been slow, obviously due to resources crunch. Apart from these factors, the trade appears to be besieged with a number of problems relating to documentation, handling and more importantly lack of coordination among the agencies involved such as ports, customs, Railways, carriers agents, etc. As a result, most shippers, consignees and shipping lines are still wary of patronizing ICDs to the maximum extent. There are several inter-related and complementary elements—procedures and formalities—at different points in the multimodal transport chain which need to be coordinated preferably under the overall control of a single authority in order to ensure smooth and efficient operations. The need for establishing such a high powered national coordinating body for the purpose has been emphasized at several forums in the recent past.

[19] See section 7.4.

[20] The following issues are modified excerpts from Raghuram (1999).

Multimodal transport requires significant investments in the following:

- Ships (container ships, pallet ships, roll-on–roff-off (ro–ro) ships, barge carriers, multipurpose ships, etc.).
- Cargo units (pallets, containers, wheeled units, barges, etc.).
- Port facilities (container berths/multipurpose berths, gantry cranes, mobile cranes, forklift trucks, straddle carriers, etc.).
- Transport vehicles (trucks, trailers, etc.).
- Inland transport facilities (roads, railways, inland waterways, etc.).
- Inland container depots with handling and storage facilities.
- Container freight stations, warehouses, packaging organizations, etc.

All the above would be attractive for private investment and operation. Ensuring of coordinated development would be the only responsibility of the state.

IR has the potential of becoming a major player in the multimodal (export/import and domestic) transport system in India. The following are some of the areas which would need examination:

- Development of non-containerized multimodal transport through appropriate rail–road and rail–water trans-shipment facilities, under a single transport document. Joint ventures could be a possible organizational form to ensure this.
- Development of containerized multimodal transport by:
  - improving service levels to the Container Corporation of India (CONCOR) through guaranteed departure and transit times and associated incentives and penalties;
  - providing unutilized and strategically located railway land for ICD and CFS use, both for international and domestic trade;
  - manufacturing and maintaining railway wagon flats for carrying containers;
  - offering innovative 'bridge' routes, possibly in collaboration with CONCOR (for example tea exports to the Middle East and Europe from the northeast could be minibridged to Mumbai port rather than being exported through Calcutta which involves feedering via Singapore);
  - nominating certain routes for 'no electrification' so that double stack container trains can be run on high container traffic routes, exploiting cost economies;
  - appropriate pricing strategies, as a function of service levels and value offered to the customers.

7.3 PORT AND SHIPMENT MANAGEMENT AT SINGAPORE PORT: THE REVOLUTION IN THE USE OF ELECTRONIC DATA INTERCHANGE

K. V. Ramani

Singapore had its humble beginnings as a riverine port on the banks of the Singapore river in 1819. Today Singapore port is the busiest seaport in the world, handling more than 15 million containers per year. In the last few years, international trade handled annually by the Port of Singapore Authority (PSA), valued at US $ 300 billion, has been almost four times the gross domestic product (GDP) of Singapore itself. The PSA, which is a major trans-shipment port, serves as a super logistics hub for the entire Asia–Pacific region.

Dubai is another example of a port that serves an entire region. The Dubai Ports Authority (DPA), which operates the twin terminals of Port Rashid and Jebel Ali, is positioning itself as one of the most prominent players on the economic scene in Dubai and the Middle East. The DPA does more than channel goods to and from the domestic market. It acts as the distribution hub for the whole region which includes the Organization of the Petroleum Exporting Countries (OPEC), Iran, the Indian subcontinent, and the Commonwealth of Independent States. It is worthwhile to mention here that Jebel Ali Port in Dubai is a man-made port, strategically constructed by the DPA to promote the economic development of the Gulf region.

India has several natural ports but has not been able to attract a significant level of the international cargo traffic. Several other countries such as Sri Lanka, Malaysia, Indonesia, and the Philippines offer much better port facilities. If India is to actively participate in international trade, and get even a share of international shipping proportional to its trade, it has to modernize its seaports and improve working efficiency.

Port planning has undergone several fundamental changes over a period of time; some of these are described here. Traditional ports were designed to serve the local community around the port, while modern ports are designed as trans-shipment ports to serve the needs of a geographically larger dispersed community. Port

configurations and operations in the past were influenced by the demand for multipurpose cargo handling. As a result, most traditional ports handled all types of cargo, though not very effectively. Today's trend is to build dedicated ports or at least terminals for handling each type of cargo (such as containers) effectively and efficiently, thereby offering high quality of service.

Developments in ship technology, port technology, and information technology (IT) are providing new insights into port planning and configuration. Container traffic is rapidly gaining popularity on account of security, safety, and cost effectiveness. Bigger and bigger ships, such as Post-Panamax vessels carrying 6000 containers, demand sophisticated port facilities. Even countries like India which have policies and modes of operation that discriminate against containerization and multimodal traffic are forced to containerize due to the pressure of exports and imports. Port operations have perhaps seen the sharpest fall in labour intensity, especially blue collar work. Indeed, the handling technologies and port work flow organization have changed enough to render the older intense labour-using modes absolutely inefficient. The logistics and systemic gains possible with containerization are denied if an efficient factory shopfloor-like organization of ports is not maintained.

Non-POL (petroleum oil and lubricant) bulk includes fertilizers, coal, foodgrains, and other such cargo usually assumed to be not amenable to containerization. POL handling almost from the very beginning, has been through dedicated terminals. POL handling has technological characteristics very different from that of containers. Many bulk items like ores, fertilizers, and foodgrains have characteristics of material handling and may impose negative externalities on other more general cargo and container operations, when carried out close to container berths.

Container traffic has been growing rapidly since its introduction in the US coastal services in 1957–8. The Australian coastal trade was containerized in 1959; the Europe–North America trade in 1966, the Far West–North American trade in 1967, and the Europe–Far East trade in 1971. By the mid-1970s container traffic had become very popular on all the three arterial trade routes of the world, namely the Pacific, Atlantic, and Asia–Pacific routes. Today, more than 90 per cent of international cargo moves through seaports and 80 per cent of seaborne cargo moves in containers through major seaports.

Management of Container Terminals

The most important tasks in the management of a container terminal consist of berth allocation, yard planning, stowage planning, and logistics planning of container operations.

Information regarding the status of a ship, which indicates whether the ship is a priority ship or not, besides the nature of its cargo, is an important determinant in berth allocation. Berth allocation is extremely important since it has significant influence on the performance of both the ship and the berth. Most international seaports use computer-based expert systems for berth allocation, which assign berths to ships by matching the ship and the port characteristics.

Yard planning thus involves optimal allocation of storage areas for import, export, and trans-shipment containers. Most major international seaports use computer-based expert systems for yard planning. While yard planning assigns storage locations to the containers in the yard, stowage planning assigns storage locations to the containers in the bay of the ship. Stowage planning is also usually done with the help of expert systems which match the ship's bay characteristics with container details and marine considerations. Logistics planning deals with assigning and coordinating the operations of port equipment such as quay cranes, prime movers, and yard cranes in the transportation of containers between the ship's bay and the storage yards. Logistics planning and its execution are the most challenging of all the operations at ports. It is here, through appropriate information and communication technology and a disciplined approach, that ports like Jebel Ali or Singapore have been able to take the lead. The challenge for ports is to reduce the overall average time a ship waits in unloading and loading while restricting the maximum time taken by any ship within the given constraints of availability of cranes, prime movers, storage yards, or spaces within ships. Much administration is possible through operations research (OR) and on-line (on time) data generation and use.

The second level of technological change that has the potential to greatly decrease the role of white collar workers and remove dead-weight losses to the economy is in automation of documentation, which is generated in the interface of the port, the customer, and many other agencies. Indeed, ports and countries in this race would be pushed into the feeder and secondary markets. More importantly, such ports would impose huge relative costs on their international traders.

Numerous government bodies usually regulate international trade through ports. In addition, port customs, immigration, health, shipping, security and other governmental authorities or their agents (such as banks), and operators and their agents all claim a need for detailed and repetitive documentation. Although the basic information regarding shipment of goods is quite

simple, each of the parties or agencies to the shipment demands this information in its own preferred or traditional format and at particular times and locations.

The extent of this documentation work far exceeds many real requirements. However, the tremendous importance of streamlining this paperwork can be seen from the following excerpts from a report[21] by the Department of Transportation and the National Committee of International Trade Documentation, USA.

- A total of 46 different types of firms and government agencies are regularly involved in international trade in the United States.
- As many as 28 of these parties may participate in an export shipment.
- A total 125 different types of documents are in regular and special use.
- The 125 types of documents represent more than 1000 separate forms.
- A total of 80 types of documents are in regular use, and the remaining 45 types of documents are in special use.
- Average shipments involve 46 separate documents, with an average of over 360 copies of documents in special use.
- US international trade annually creates an estimated 828 million documents and these generate an estimated 6.5 billion copies.
- Average export and import shipments require 64 man-hours to prepare and process.
- Total US international trade documentation annually consumes more than one billion man-hours, equivalent to more than 144 million days of work and equal to 600,000 work years.
- Average documentation cost per international shipment amounted to US $ 351.04 [in 1982].
- On the basis of current shipping volumes, total documentation costs aggregate to almost US $ 6.5 billion a year and represented 7.5 per cent of the value of total US export and import shipments [in 1982].
- The report recommends the elimination of 85 documents. If achieved, this would eliminate over 400 million separate papers (and almost 4 billion copies per year) with an aggregate saving of an estimated US $ 3 billion per year.

It can be seen from this that the port interface with other departments and agencies is governed by a multitude of processes and procedures and requires a tremendous amount of paperwork involving many government and private agencies. Studies by international trade bodies estimate the cost of documentation at 7–10 per cent of the value of goods transacted. Even a possible saving of 1 per cent in trade documentation costs would lead to a substantial saving for any country involved in international trade. Potentially much of these costs can be saved through computerization, including use of the Internet, and the potential excess white collar manpower is large.

Port operations are very complex, especially the management of container terminals. Container terminals are highly capital intensive. They have to be well managed in order to realize their potential capacity and achieve a reasonable level of efficiency and service performance.

Advancements in IT provide a wide range of options for port management to computerize operations to save on capital invested in ports and also costs for clients.

Some of the IT applications for port management are in the areas of:

- Management Information Systems (MIS) to monitor port performance indicators such as ship turnaround time, port resource utilization, and costs for providing services (Holguin-Veras and Walton 1994).
- Executive Information System for investment decisions and port planning decisions.
- Decision Support System to facilitate the logistics planning of port operations for loading and unloading cargo of various types (Ramani 1996).
- Expert Systems for berth allocation, stowage planning, and yard planning.
- Computer simulations to support port operational planning.

Electronic Data Interchange (EDI), to facilitate the port interface with other departments and agencies involved in trade and commerce (Ramani 1995), is the key to the next revolution in port management.

Trade documentation is a complex and expensive activity. The Trade Development Board (TDB), a statutory board responsible for managing all incoming and outgoing trade activities at the Singapore port, was handling about 10,000 declarations daily in 1986 and the number was rising. Yeo Seng Techm, chief executive officer of the TDB, Singapore, explained the situation his agency faced in 1987:

> Our agency was loaded with paperwork in 1987 we were handling about 10,000 declarations each day, and the number was rising. And TDB was only part of the system. The trade process involves agencies such as the port authorities, customs, and so on, each with its own rules. Shipping agents and freight forwarders prepared all the documents and physically carried them to service centres where they would be handled

[21] 'Paperwork or Profits', 1982.

manually by government officials and clerks. Two-day turnaround was common. The cost of these transactions was high for all concerned. Swedish and US studies of the costs of trade documentation in those countries estimated the cost at 4.7 per cent of the values of goods shipped. And such transactions are error prone. A British study estimated that half of all Letter of Credit (LoC) applications were turned down on first application due to errors in completion. This seemed like a lot of work with little payoff. It also provided an opportunity for us. Singapore is a small country. We have no natural resources. Our population has stabilised. We know we cannot compete by just bringing in new labour. If we are to be successful, we must improve our competitiveness in every way and especially in external trade, which is our largest business sector. This means cutting costs. That 4.7 per cent was the best place to start.

EDI offers a convenient and cost-effective alternative for processing and exchanging documents and information electronically. For example, Singapore achieved a saving of more than S $ 2 billion with the help of TRADENET, an EDI application (King and Konsynski 1990).

TRADENET, an electronic network to facilitate international trade, integrates all the processing procedures for import, export, and trans-shipment documents and licences. It uses a single document to satisfy all the trade documentation needs of Singapore. The same document is routed electronically through all the parties associated with trading such as traders, freight forwarders, shipping lines, and the various government and controlling agencies. All these parties[22] are linked to each other electronically under a large IBM mainframe computer system owned and operated by the Singapore Network Services (SNS) Pvt. Ltd.

The host computer at SNS acts as an electronic clearing house for TRADENET. It receives and transmits trading papers and forwards them to the relevant government agencies for processing and approval. For example, a trader can obtain approval from the TDB by filling up a TDB declaration form available on his Personal Computer (PC). The TRADENET software then automatically establishes communications with the TRADENET computer at SNS, transmits his declaration to the TDB and receives the TDB approval in his electronic mailbox. Subsequently, this approval is transmitted to other parties such as customs and shipping lines for further processing. The software also ensures confidentiality and integrity of all the communication between trading partners and the approving authorities. It permits all payments for government duties and fees for TDB, customs, and other controlling agencies to be made electronically. It also offers an on-line enquiry system, which gives the status of any trade declaration at any point in time, twenty-four hours a day. Under TRADENET, most of the transactions are processed within 15 to 30 minutes.

TRADENET also provides a comprehensive information service. Direct access to critical company and business information such as company and business information and trade opportunities facilitates users in making key decisions quickly so as to gain an edge over their competitors. Traders can gain access to third-party databases owned by PSA, the Civil Aviation Authority of Singapore (CAAS), etc. on shipping schedules, airline schedules, and related information. Its electronic bulletin board has eliminated the need to subscribe to multiple information providers. With information services, TRADENET subscribers are able to enjoy effective business communication and speedy information.

Starting with a pilot group of 50 users in 1989, TRADENET has more than 2000 users today accounting for almost 90 per cent of the traders. Several freight forwarders have reported savings of 25 to 30 per cent in handling trade documentation on account of TRADENET. The total time for documentation processing has been reduced from an average of two days in 1987 to less than half a day in 1991. Governmental agency duties, such as customs and excise, are paid even before the cargo arrives. But the biggest pay-off from TRADENET is perhaps the enormous growth in international trade over the last few years, making the Singapore economy very competitive.

PORTNET, another EDI network of the PSA, provides an on-line computer service to support the daily operations at the port. For example, the shipping lines/agents can input the sailing schedule of their vessel into PORTNET and obtain information on services they need, such as identifying a second carrier for their transshipment cargo. The TRADENET–PORTNET link provides an interface between the maritime and trading communities to electronically exchange real-time operational and trade information.

To better serve the maritime and trading communities, a new system called Maritime Information System (MAINS) is currently under development. MAINS will generate cargo manifests, match them against import/export permits electronically and eliminate some manual procedures, such as storage/despatch of paper manifests to TDB and customs and endorsing

[22] These are the Trade Development Authority (TDA), the Port of Singapore (PSA), customs, controlling bodies, the Civil Aviation Authority of Singapore (CAAS), Changi International Air Services (CIAS), for passenger traffic, Singapore Airlines Transport Services (SATS) for cargo, air cargo agents, traders, freight forwarders, shipping agents, among others!

of customs permits by ship masters. It will provide instantaneous confirmation to shippers about their import/export consignments. Shipping lines will receive their bills of lading electronically from their shippers. Above all, MAINS will have an on-line real-time comprehensive database of shipping schedules and cargo consignments to meet almost all the needs of the maritime and trading communities.

Why should a port be concerned with cost and time reduction for shippers and others? Clearly, the port itself would not be able to internalize all or even a great deal of the gains. The gains would be largely external. Yet the port, of all institutions involved in international trade, is crucially placed to bring about this revolutionary change. Are Indian ports ready to begin thinking about this next round of technological change?

7.4 AT THE CROSSROADS: PIPELINE INFRASTRUCTURE FOR OIL PRODUCTS

Samir K. Barua and T. Madhavan

INTRODUCTION

There are two types of oil pipelines: crude oil pipelines and product pipelines. While the former carry crude oil to refineries, the latter transport refined products such as gasoline, kerosene, jet fuel, and heating oil from refineries to the market. Offshore (submarine) pipelines are needed for transporting oil from offshore wells to overland pipelines, which further transport the oil to a refinery. They are more expensive and difficult to build than overland pipelines. Several developments in the last fifty years such as the use of 'pigs' to clean the interior of pipelines, the use of 'batching' to transport different petroleum products through the same pipeline, the use of cathodic protection to reduce corrosion of pipelines, and the use computers and communication technologies to monitor and control pipeline operations have seen pipelines emerge as the preferred mode of transport. Pipelines are safer and more convenient and reliable and environment friendly than other modes of transport for bulk liquids. Although most countries have an extensive network of pipelines, its contribution and importance to the economy goes unrecognized by the general public. These are now discussed.

OPERATION

Modern long distance pipelines operations are largely automated. The various flow parameters are automatically monitored and the requisite feedback sent to operate the valves and pumps attached to pipelines. Manual intervention is essentially needed to direct different batches of liquids to different temporary storage tanks or when the systems must be shut down or restarted.

ADVANTAGES OF PIPELINE TRANSPORTATION

- Transit losses are also lower in pipeline transportation vis-à-vis other modes.
- Pipeline transportation consumes the least energy; hence it has lower energy intensiveness (see Figs 7.4.1 and 7.4.2).
- Pipelines also offer large-scale economies in transportation.
- It is a reliable mode.
- As the handling of products is minimal, it is a safe mode.
- Environmental impact during construction, operation, and maintenance is negligible and reversible. Thus it is environment friendly (see Box 7.4.1).
- Unlike other modes, in which different containers may be required for different products, pipeline transportation can handle multiple products.
- Pipeline transportation is flexible, as the volume transported can be increased/decreased quickly and at negligible cost.
- Additional energy consumption for transportation of dead-weight of containers is not incurred in pipeline transportation.

OIL PIPELINES IN INDIA

Despite a well-established industrial base, India's consumption of oil and gas as primary sources of energy (Table 7.4.1) is well below world percentages.

The growth rate in the consumption of oil products in India over the last three decades, however, has been among the highest in the world (Table 7.4.2). The consumption of oil products has grown at the rate of about 5.5–6 per cent per annum over the thirty-year period. In contrast, world consumption of oil grew at the rate of about 1.5 per cent per annum in the 1990s. In India per capita consumption at 93 kg per annum is about one-tenth that of the world, which is 920 kg. A comparison of growth rates of oil consumption and gross domestic product (GDP) shows that the elasticity of oil consumption has declined over the years. It is currently less than 1.

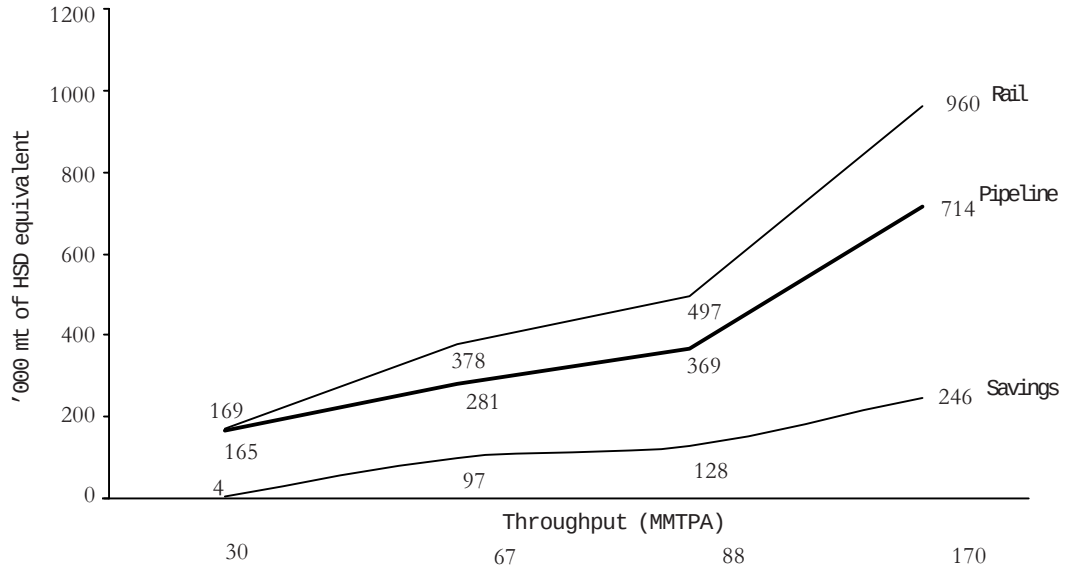

Fig. 7.4.1: Energy conservation in pipelines fuel consumption (pipeline vis-à-vis rail).

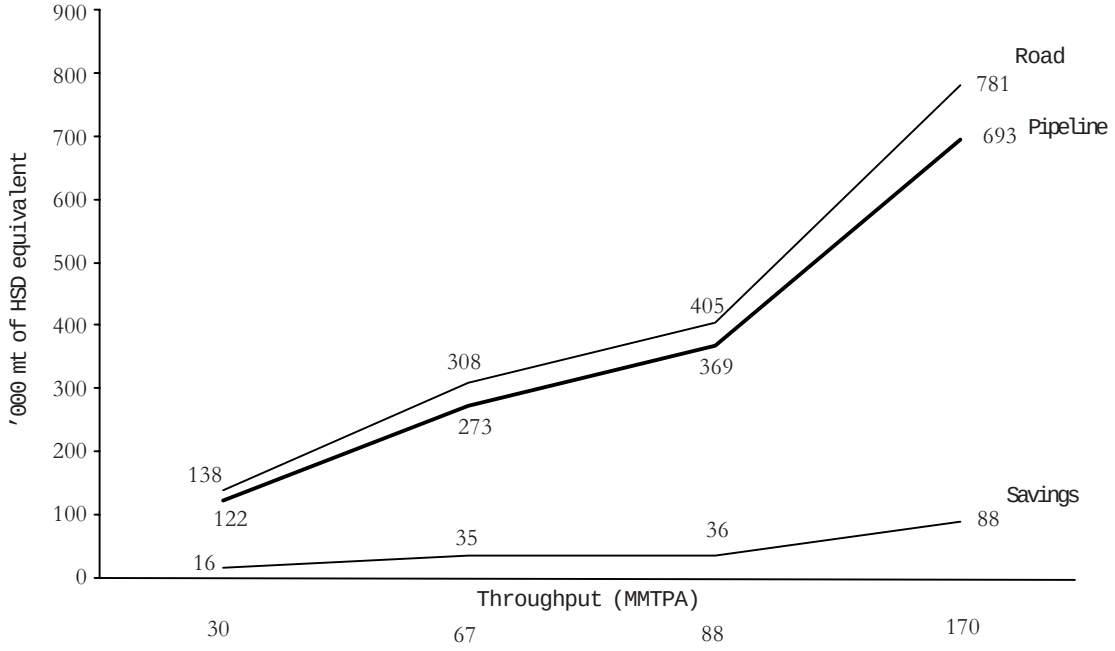

Fig. 7.4.2: Energy conservation in pipelines fuel consumption (pipeline vis-à-vis road short distance).

The Subgroup on Development of Refinery, Marketing and Transportation Infrastructure Requirement (of the main group on Hydrocarbon Vision 2025) assessed the demand for oil products at about 370 million metric tonnes per annum (MMTPA) as against current consumption of 94 MMTPA. This projection is consistent with an annual growth in oil consumption at the rate of 5.5 per cent per annum. Even if there were a shift towards natural gas and coal, the oil consumption would grow very rapidly if the economy grew at rates similar to or better than those for the 1990s. At a pessimistic growth rate of 4 per cent per annum, the projected consumption would rise to about 250 MMTPA in 2025. Given the pressure on road and rail transport, safe transportation of crude and oil products would pose a huge challenge to the country. However, as is clear from the figures in Table 7.4.3 the share of pipelines has remained stagnant. If further additions are not made to

pipeline infrastructure in India, the percentage share of pipelines in transportation of oil would go down substantially by 2025. There is therefore an urgent need to plan and implement a network of pipelines for distribution of crude and oil products.

BOX 7.4.1

Ambient Air Quality and Noise

Parameter	Ambient air quality standrads ($\mu g/m^3$)	Performance of pipelines ($\mu g/m^3$)
SO_2	80	14.3–17.1
NO_x	80	7.4–8.0
Suspended Particulate matter (SPM)	360	156–168
Noise (continuous 8 hours)	75 db	69–72 db

Exhaust emission is localized in pump stations where large diesel/crude oil engines are operated.

TABLE 7.4.1
Primary Sources of Energy: India and World

(per cent)

Source	India	World
Oil	32	40
Gas	8	23
Others	60	37

TABLE 7.4.2
Growth Rates in Consumption of Oil

(per cent)

Period	Compounded annual growth rate in oil consumption	Compounded annual GDP growth rate
1971–80	5.63	3.20
1981–90	6.13	5.60
1991–9	5.64	5.80

The growth rate in demand for pipelines is likely to increase more rapidly than that of oil for several reasons. Given the environment friendly nature of pipeline transportation, 60–70 per cent of transportation of oil products is done through pipelines in most developed countries. A comparison of the shares of various modes between India and the United States (Table 7.4.4) clearly shows that with increasing urbanization and greater concern for environment and safety, the share of pipeline transportation is likely to increase in India. The growth in pipelines stagnated to accommodate the demand from railways to use oil tankers for transportation of oil. With the dismantling of controls in the oil sector, the formal and informal restraints on adding pipelines would cease. There is therefore likely to be an explosive addition to pipeline capacity in the near future.

The major existing crude and oil products pipelines in India are listed in Table 7.4.5. The projected addition to capacity, based on the plans of various companies, is presented in Table 7.4.6.

The 11,500 km of pipelines under consideration or conceptualization would require an investment of over Rs 15,000 crore. These pipelines have been conceived to create a network that could be connected to form a grid. As of now, the density of pipelines in southern India is distinctly low.

EXISTING POLICY

While energy consumption varies between 50 and 135 British thermal units (BTU) per tonne km for transportation of oil products by pipelines, movement by rail consumes about 320 BTU per tonne km. The railways are facing increasing constraints in movement of oil products due to saturation and mismanagement of track capacity and non-availability of locomotives and tank wagons. The utilization of tank wagons has shown little improvement. Recognizing the importance of creating oil pipeline infrastructure, the government formed a working group of general managers from

TABLE 7.4.3
Shares of Alternative Modes for Transportation of Oil in India

Mode	1993–4		1994–5		1995–6		1996–7	
	MMT	per cent share	MMT	per cent share	MMT	per cent share	MMT	per cent share
Road	15.3	25.2	17.9	27.3	22.2	30.6	23.4	30.3
Rail	26.1	42.9	28.1	42.9	29.3	40.4	29.1	37.7
Pipeline	14.5	23.8	14.9	22.8	15.5	21.4	18.9	24.5
Coastal	4.9	8.1	4.6	7.0	5.5	7.6	5.8	7.5
Total	60.8	100.0	65.5	100.0	72.5	100.0	77.2	100.0

TABLE 7.4.4
Mode-wise Distribution of Petroleum Products

(per cent)

Mode	India	USA
Rail	37.50	3.20
Road	27.50	5.10
Coastal	7.50	33.70
Pipeline	25.00	59.00

TABLE 7.4.5
Major Crude and Product Pipelines in India*

Pipeline	Length (km)	Capacity (MMTPA)	Owner
Crude oil			
1. Nahorkatiya–Barauni	1156	5.5	OIL
2. Salaya–Mathura	1881	21	IOCL
3. Ankleshwar–Koyali	95	2	ONGC
4. Kalol–Navagam–Koyali	127	2	ONGC
5. Bombay High–Uran (offshore)	203	15	ONGC
6. Haldia–Barauni	506	4.2	IOCL
Total (Crude)	3968	49.7	
Products			
1. Guwahati–Siliguri	435	0.818	IOCL
2. Koyali–Ahmedabad	116	1.1	IOCL
3. Barauni–Kanpur	669	1.8	IOCL
4. Haldia–Barauni	525	1.25	IOCL
5. Haldia–Mourigram–Rajbandh	277	1.35	IOCL
6. Mathura–Jalandhar	526	3.7	IOCL
7. Kandla–Bhatinda	1443	7.5	IOCL
8. Digboi–Tinsukhia	75	0.73	IOCL
9. Bombay–Pune	161	3.67	HPCL
10. Mumbai–Manmad	252	4.33	BPCL
11. Vizag–Vijayawada	356	4.1	HPCL
Total (products)	4835	30.348	
Grand total	8803	80.048	

*Excluding about 2300 km of sub-sea and about 7600 km of on-land oil and gas pipelines of small diameters in the oil fields of ONGC.

Note: OIL is Oil India Limited; IOCL is Indian Oil Corporation Limited; ONGC is the Oil and Natural Gas Commission; HPCL is the Hindustan Petroleum Corporation Limited; and BPCL is Bharat Petroleum Corporation Limited.

TABLE 7.4.6
Projected Growth of Pipelines in India C. 2000

Description	Length	Cumulative length
Existing pipelines	8803	8803
Pipelines under construction	3630	12,433
Pipelines under consideration	5000	17,433
Pipelines under conceptualization	6500	23,933

various oil companies in December 1994 to examine the issue of infrastructure creation for distribution of oil products through pipelines. The report prepared by the group recommended setting up a financial holding company, Petronet India Limited (PIL), to expedite development of pipeline infrastructure. PIL would promote each pipeline as a separate joint venture company (JVC) owned by PIL and a group of oil companies. The actual operation of the pipeline would be one of the public sector oil companies, especially that having the largest stakes in the JVC.

The Government of India approved the establishment of the holding company on 10 April 1996. PIL was duly incorporated on 26 May 1997, with equity contributions of 16 per cent each by the Indian Oil Corporation Limited (IOCL), Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL), 2 per cent by Indo-Burma Petroleum Limited (IBPL), the balance 50 per cent to be warehoused by Infrastructure Leasing and Financial Services Limited (ILFS). In the long run, the oil companies are expected to have a 50 per cent stake in the equity of PIL, while the balance 50 per cent is to be offered to private companies with the proviso that the holding of any individual entity shall not exceed 10 per cent. As stated earlier, PIL is to function as a financial holding company with the mandate to create JVCs for construction, operation, and maintenance of oil products pipelines in the country. PIL would retain adequate equity stake in each JVC to ensure a decisive say in the functioning of the JVCs.

Each JVC would function as an independent business entity with equity ownership distributed among potential users of the pipeline. Each entity would have complete freedom of operation. The rate to be charged would be decided by each JVC based on factors such as structure of the company, expectations of the JVC partners, demand and supply scenario, and the cost of alternate modes of transportation.

The government has already given, in principle, clearance to eleven such pipeline projects. The total outlay at the time of conception of these projects (early 1996) was Rs 3220 crore. The debt to equity mix for funding these projects was assumed at 2:1.

ON-GOING PROJECTS OF PIL

PIL identified five product pipelines for implementation. The status of these five projects is as follows:

Vadinar–Kandla pipeline: The appraised cost of the project was Rs 410 crore. The pipeline would essentially evacuate products from the Reliance Petroleum Limited (RPL) refinery in Jamnagar and would join the existing

Kandla–Bhatinda pipeline of the Indian Oil Corporation Limited (IOCL). The project, being implemented by the IOCL, has been completed.

Chennai–Trichi–Madurai pipeline: The appraised cost of the project is Rs 539 crore. It is to be completed by July 2001 and the IOCL is the lead company for the project. In view of the proposed refinery at Cuddalore, the viability of the project is being re-examined.

Environmental and right of way (ROW) clearances have been received for the Mangalore–Hasan–Bangalore pipeline (Rs 667 crore) and the Cochin–Coimbatore–Karur pipeline (Rs 535 crore). Engineers (India) Limited (EIL) has also completed the detailed route surveys and the processes and design for these projects. The Bina–Jhansi–Kanpur pipeline is still in the preliminary stages of implementation.

Though, in principle, financial institutions have agreed to fund these projects, they have held up the actual disbursement of funds pending the signing of 'take or pay' contracts. The institutions insist on such contracts to eliminate uncertainty associated with cash inflows. However, given high commercial and operational uncertainties, potential users are unwilling to sign long-term 'take or pay' contracts at rates that would be attractive for the pipeline projects. The government is yet to take a final view on issues connected with tariff. PIL has therefore put these projects on hold, pending resolution of the above issues.

Tariff

The tariff regime prevailing under the administered pricing mechanism (APM) for the petroleum sector essentially guarantees a 12 per cent return on net worth. Operating costs are reimbursed under a predetermined formula. The compensation paid by the Oil Co-ordination Committee (OCC) today for investment in pipelines is quite inadequate:

- The return provided is less than 1 per cent based on the replacement cost of the assets; as a result, the margins are inadequate to plan replacement of existing pipelines.
- The norms for cost computations are unrealistic. There is no compensation for escalation in the costs of chemicals and power tariff. The actual working capital required is much higher than the normative working capital used for reimbursement of expenses.
- The compensation is based on quantity delivered and not received; transit losses, if any are borne by the pipeline operators.
- There is no compensation if pipeline usage decreases because of non-availability of products.

It is absolutely imperative to evolve a new sensible tariff structure to ensure that requisite investments are made in the creation of pipeline infrastructure. The tariff structure will have to balance the requirements of different constituencies. Users would prefer a competitive tariff structure that is transparent and devoid of intractable cross-subsidization. They would be reluctant to sign long-term 'take or pay' contracts as that would constrain both their distribution and marketing activities. Lenders would look for stable and guaranteed cash inflows to ensure repayment of debt. They would obviously prefer long-term 'take or pay' contracts with credible parties. Shareholders would look for returns that justify the various risks to which they are exposed. They would obviously prefer pipeline companies to charge rates based on the market capacity to pay. Regulators would be interested in ensuring that monopoly gains do not accrue to the owners of pipelines. They would also like to ensure that equitable rates are charged so that the customers do not suffer.

Pipeline Projects Remain Unbankable

Like other infrastructure projects, pipeline projects also require large investments and have long gestation periods. The risks associated with these projects arise from time and cost overruns, high uncertainty in demand over the long operating life of the projects, limited possibility of alternative uses of assets created, and uncertainty about the regulatory regime in which the projects would have to operate.

The chief sources for delays in completion of a pipeline project are delays in acquisition of ROW. Despite parliamentary sanctity in the form of the Petroleum and Pipeline Act, 1975, protracted litigations do arise while acquiring land. Heightened concern about the environment, particularly in situations where there could be permanent displacement of a population due to non-reversible changes in land use pattern can also be a major source of delay in completion.

In India, pipelines have operated at 100 per cent capacity since these are captive pipelines of oil companies. However, if pipelines were to be operated under a common carrier principle, they would face uncertainty in utilization arising from demand–supply dynamics. The viability of a pipeline project crucially depends on the demand for the facility in the future. Since these are projects with long lives, high capacity utilization over long periods becomes a prerequisite for financial viability. Demand may many a time be affected by developments outside the control of the pipeline company. A case in point is the poor utilization of the Kandla–Bhatinda pipeline till demand picked up from

the Panipat refinery. The setting up of the Panipat Refinery has also had an impact on the utilization of the Mathura–Jalandhar pipeline which serves the Delhi–Ambala consumption zone. The throughput in the Vadinar–Kandla pipeline, specifically set up to evacuate products of RPL, would also be seriously affected if RPL were to resort to exporting products as a result of oversupply in the country. These uncertainties about sustained demand for capacity are a major concern of financiers of pipeline projects.

In the Indian context, financiers also have to contend with regulatory risk. The regulatory regime that would be in force in the post-APM era is still unclear. To attract investments it would be necessary for the government to frame stable and credible guidelines for tariff determination and disclose its regulatory and restructuring intentions.

Tariff Determination in the US and UK

In the United States, no approval is required for construction of pipelines. Pipelines have to be operated under the 'common carrier' principle. Tariff is fixed by the pipeline company every year through negotiations with users. It is subject to a ceiling based on the oil price index. The Federal Energy Regulatory Commission regulates the tariff and practices of oil pipeline companies. In the UK, pipeline companies are assured a fixed return by the government. In France and Spain, pipeline companies require government approval for operation. A two-part tariff structure is followed for compensation of fixed and variable expenses.

The Road Ahead

In India the government appears to have gone wrong from the very beginning. The creation of PIL as a financial holding company, and the setting up of a separate JVC for each pipeline, is an incorrect policy choice. The supply–demand scenario is so uncertain that each JVC would face enormous commercial risks. Since financing is being done independently, the stakeholders in each JVC would demand compensation for the risks assumed which would be quite high. Instead, if these pipelines belonged to one or a fewer number of companies, the risks would be considerably reduced due to the portfolio effect. The losses incurred on some pipelines could have been off-set by profits realized on the others. But with each pipeline as a separate company, all projects are ex ante exposed to the demand risk. It would therefore be very difficult to achieve financial closure of these projects. In addition, even if funds were available, the interest rate demanded would be high to reflect the high risk. As is already evident for the projects conceived by PIL, lenders are justifiably demanding tariff contracts which provide them the required protection. A better policy would be to permit the major refining and marketing companies such as the IOCL, BPCL, and HPCL to expand their existing pipeline infrastructures such that a grid is created for the entire country, and simultaneously to set up a pipeline regulatory authority to ensure equitable operation of the network. These companies have the necessary resources as well as the experience to quickly set up the network.

Regulatory Framework is Necessary

Since pipelines create natural monopolies, a comprehensive regulatory framework is required. The role of the regulatory authority would include ensuring adherence to stipulated safety and quality norms, ensuring that facilities are not needlessly duplicated, and determining the tariff that is attractive to investors and yet does not exploit consumers. The issue that would require resolution is the demand by financial institutions that the projects should enter into long-term 'take or pay' contracts. Acceding to this demand would largely violate the common carrier principle that attempts to ensure equitable access to all users. If 'take or pay' contracts are to be permitted to a limited extent, then should the tariff be different for those who sign such contracts and those who do not? How should this difference, if any, be determined?

The principles governing the tariff structure should ensure adequate competition among various mode combinations, fair return to investors, that is returns commensurate with the risks assumed, equitable access to all users, and equitable costs to consumers. While it is easy to enunciate the broad principles, implementing them would be an extremely complex task given the peculiarities of the situation. Since the pipelines would essentially be links in a multimodal network of paths for transportation of oil products, a change in the tariff of any one pipeline or segment would change the flow pattern in the entire network with sometimes significant consequences for the other links (pipelines) in the network. For example, reducing the tariff for one pipeline could make several other pipelines financially unviable. The authors have experimented with a comprehensive optimization model for production, import, and distribution of oil products and found that the tariff structure creates significant interdependencies in the financial performance of various pipelines and modes. In addition, as was discussed earlier, setting up of a new

refinery (source) also significantly impacts the fortunes of pipeline segments. The regulatory authority would have to be given a say in the establishment of supply points to ensure that pipelines assessed as financially viable do not become unviable due to unexpected change in the source structure.

It is thus clear that if the government is serious about creation of pipeline infrastructure, it must without delay set up a regulatory authority to frame the tariff structure and norms for operation of the pipeline companies. Such a move would remove the regulatory uncertainty and encourage investments in pipelines. Given the complexities involved, the tariff structure would have to be decided based on supply and demand of products for the entire country. Such simultaneous determination of the tariff structure for different pipelines and pipeline segments would require use of a comprehensive mathematical model which would be able to faithfully capture the actual behaviour of users in response to tariff rates fixed.

7.5 INTEGRATING COASTAL SHIPPING WITH THE NATIONAL TRANSPORT NETWORK[23]

G. Raghuram

A Review of Trends and Patterns

Coastal shipping constitutes about 30 per cent of the total traffic handled at our ports. Table 7.5.1 gives data for the past years for the major ports, the Gujarat Maritime Board (GMB) ports, and non-GMB minor and intermediate ports. We see that the total coastal traffic for 1998–9 was 87.4 million tonnes (mt). Out of this, 75.8 mt (86.7 per cent) was handled at major ports, 6.4 mt (7.3 per cent) was handled at GMB ports, and the remaining 5.2 mt (5.9 per cent) at non-GMB minor and intermediate ports.

1998–9

Port	Coastal traffic (mt)	per cent
Major ports	75.8	86.7
GMB ports	6.4	7.3
Non-GMB minor and intermediate ports	5.2	5.9
Total	87.4	100.0

Table 7.5.1
Cargo Traffic at Major and Minor Ports and the Share of Coastal Shipping

('000 tonnes)

Year	Total				per cent of coastal to total			
	Unloaded	Loaded	Trans-shipment	Total	Unloaded	Loaded	Trans-shipment	Total
Major Ports								
1997–8*	142,468	94,764	14,727	251,659	24.8	35.2	27.5	28.9
1998–9*	150,780	86,229	14,711	251,720	26.5	37.1	26.4	30.1
GMB Ports								
1997–8**	15,409	10,215	0	25,624	24.8	22.4	0.0	23.8
1998–9**	16,927	8082	0	25,009	20.7	35.4	0.0	25.4
Non-GMB Minor and Intermediate Ports								
1997–8***	8556	4427	0	12,983	16.4	43.8	0.0	25.7
1998–9***	5076	5565	0	10,641	53.5	44.1	0.0	48.6
All India Traffic								
1997–8	166,133	109,406	14,727	290,266	24.4	34.3	27.5	28.3
1998–9	172,783	99876	14,711	287,370	26.7	37.4	26.4	30.4

Sources: * Indian Ports Association (1998–9). ** Gujarat Maritime Board (1997–8 and 1998–9) Administration Report.
*** MoST (1998–9) Basic Port Statistics.

[23] Assistance by Deepa Kheskani is acknowledged. This part chapter has benefited by inputs from Partha Mukhopadhyay of the IDFC, based on earlier drafts. Financial assistance was provided by the IDFC through the 3iNetwork.

The time series data for major, minor, and intermediate ports of overseas, coastal, and total cargo, split as unloaded, loaded, and trans-shipment are given decadally from 1960–1 till 1990–1 and annually therefrom till 1998–9 in Tables 7.5.2 and 7.5.3.

Table 7.5.2 shows that for major ports in 1960–1, coastal traffic constituted a similar share (27 per cent) as now, but it fell to about 15 per cent until 1980–1, primarily due to the growth in overseas traffic. In the 1980s, coastal traffic grew rapidly to regain about a 33 per cent share, which has declined marginally during the 1990s. The compounded annual growth rate (CAGR) over 8 years (between 1990–1 and 1998–9) was nearly 5.6 per cent (the growth actually occurred in spurts in 1994–5 and 1997–8). This was less than the growth in total port traffic, which was 6.5 per cent for the same period.

For minor and intermediate ports, coastal traffic constituted over 50 per cent of total traffic in 1960–1. Since 1970–1 it has fallen to around 30 per cent. The variance around the 30 per cent share has been significant, primarily because the total volumes are small. The

TABLE 7.5.2
Cargo Traffic at Major Ports and the Share of Coastal Shipping

('000 tonne)

Year	Total			per cent of coastal to total			
	Unloaded	Loaded	Trans-shipment	Total	Unloaded	Loaded	Trans-shipment	Total
1960–1*	22,581	10,542	N A	33,123	21.6	39.8	N A	27.4
1970–1*	25,557	30,022	N A	55,579	15.9	11.5	N A	13.5
1980–1*	46,816	33,454	N A	80,270	16.5	14.8	N A	15.8
1990–1**	85,088	66,577	N A	151,665	30.6	34.5	N A	32.3
1991–2**	84,844	69,304	N A	154,148	31.0	36.2	N A	33.3
1992–3**	95,351	67,526	3373	166,250	25.1	36.2	26.8	29.6
1993–4**	96,671	76,634	5925	179,230	22.4	30.6	32.7	26.2
1994–5**	109,717	81,419	6126	197,262	26.7	36.1	32.3	30.8
1995–6**	120,634	85,675	9017	215,326	23.5	33.7	33.6	28.0
1996–7**	129,089	87,411	10,757	227,257	23.6	33.9	24.6	27.6
1997–8**	142,168	94,764	14,727	251,659	24.8	35.2	27.5	28.9
1998–9**	150,780	86,229	14,711	251,720	26.5	37.1	26.4	30.1

Sources: * MoST Basic Port Statistics of India (1994–5).
**Indian Ports Association Major Ports of India—A profile (1992–3).

TABLE 7.5.3
Cargo Traffic at Minor and Intermediate Ports and Share of Coastal Shipping

('000 tonne)

Year	Total			per cent of coastal to total		
	Unloaded	Loaded	Total	Unloaded	Loaded	Total
1960–1*	1332	3075	4407	77.1	47.3	56.3
1970–1*	1740	4948	6688	50.1	31.5	36.3
1980–1*	2498	4234	6732	23.1	20.1	21.2
1990–1*	7677	5105	12,782	25.6	24.5	25.2
1991–2*	7781	5477	13,258	38.8	25.1	33.1
1992–3*	9327	6076	15,403	33.2	22.0	28.8
1993–4*	11,424	8046	19,470	33.6	17.7	27.0
1994–5**	14,973	8309	23,282	42.5	22.7	35.4
1995–6**	15,067	10,643	25,710	34.0	23.2	29.5
1996–7**	16,884	10,948	27,832	36.2	29.9	33.7
1997–8**	23,965	14,642	38,607	2108	28.8	24.5
1998–9**	22,003	13,605	35,608	28.2	38.8	32.3

Source: Same as Table 7.5.2.

CAGR over 8 years (between 1990–1 and 1998–9) was nearly 17.3 per cent (the growth occurred in spurts in 1994–5, 1996–7, and 1998–9). To that extent, the share of minor and intermediate ports (including GMB ports) of total coastal traffic has increased from 6.1 to 13.2 per cent.

As seen in Table 7.5.1, for the all-India traffic, the coastal tonnage that was unloaded was greater than what was loaded during both 1997–8 and 1998–9. The difference could arise because of time lag between loading and unloading, and other inaccuracies in the data.

It is interesting to note from Table 7.5.1 that for major ports in 1998–99, the share of coastal cargo for unloading (26 per cent) was less than the share for loading (37 per cent), even though for absolute tonnage it is the reverse. This is simply due to the fact that our total cargo has a significantly greater overseas import component than export. For non-GMB minor and intermediate ports, the shares cannot be interpreted since the volumes are small.

There was more passenger traffic at minor and intermediate ports than at major ports. It is further evident that most of the passengers were coastal. Passenger traffic is important for short hauls near ports and to and between the offshore islands of the Union Territories of Andaman & Nicobar and Lakshadweep. Tourism-based coastal passenger traffic could have potential. As such, for coastal movement the commercial potential of passenger traffic is not high compared to freight traffic at ports. The discussion here focuses on freight traffic.[24]

In 1998–9 coastal traffic constituted 87.4 mt out of a total port traffic of 288 mt. Out of this, 3.9 mt was transshipment cargo (Table 7.5.1) at major ports, primarily Vishakhapatnam (Table 7.5.4). GMB ports and the

TABLE 7.5.4
Portwise Cargo Traffic 1998–9 and the Share of Coastal Shipping

('000 tonne)

Year	Total				per cent of coastal to total			
	Unloaded	Loaded	Trans-shipment	Total	Unloaded	Loaded	Trans-shipment	Total
*Major ports**								
Calcutta	4497	1141	3525	9163	47.1	19.4	0.5	25.7
Haldia	13,600	6624	0	20,224	3.2	89.0	0.0	31.3
Paradip	4507	8601	0	13,108	12.6	84.4	0.0	59.7
Vishakhapatnam	15,377	13,551	6725	35,653	19.1	52.7	45.4	36.9
Chennai	24,313	9333	1555	35,201	67.9	7.6	50.0	51.1
Tuticorin	8485	1665	0	10,150	60.6	2.2	0.0	51.0
Cochin	10,358	2307	0	12,665	36.7	66.7	0.0	42.2
New Mangalore	6894	7278	34	14,206	5.0	29.7	55.9	17.7
Mormugao	2536	15,460	24	18,020	30.8	0.8	0.0	5.0
Mumbai@	19,139	11786	45	30,970	8.5	57.1	0.0	27.0
JNPT	7347	4303	73	11,723	11.4	1.1	34.2	7.8
Kandla	33,727	4180	2730	40,637	14.3	3.8	0.0	12.3
All Major Ports	150,780	86,229	14,711	251,720	26.5	37.1	26.4	30.1
*GMB***								
Magdalla	7596	1273	0	8869	40.6	55.1	0.0	42.7
Mul-Dwarka	414	1656	0	2070	0.0	73.5	0.0	58.8
Jafrabad	524	2347	0	2871	0.0	25.6	0.0	20.9
Other Ports of GMB	8393	2806	0	11,199	5.0	12.2	0.0	6.8
All Ports of GMB	16,927	8082	0	25,009	20.7	35.4	0.0	25.4
All Major Ports and GMB Ports	167,707	94,311	14,711	276,729	25.9	37.0	26.4	29.7
Non-GMB Minor and Intermediate Ports***	5076	5565	0	10,641	53.5	44.1	0.0	8.6
All India Traffic	172,783	99,876	14,711	287,370	26.7	37.4	26.4	30.4

@ Break-up of trans-shipment cargo is not available.
Source: * Indian Ports Association (1998–9).
** Gujarat Maritime Board (1998–9).
*** MoST, Basic Port Statistics of India (1998–9).

[24] For details, see Table 4 of Raghuram (2000).

non-GMB minor and intermediate ports reported nil trans-shipment, raising doubt as to whether it is a classification category. The total originating traffic during 1998–9 was 37.3 mt, subject to limitations of available data.

The tonne km (tkm) of coastal movement is now estimated. Average traffic moved during the year is taken as 41 mt (average of unloaded and loaded traffic). Over 70 per cent consisted of thermal coal and POL (petroleum oil and lubricant), whose average coastal lead has been estimated as 1600 km (Raghuram and Chaudhary 1994). Assuming a lead of 1600 km for all coastal traffic, total tkm would be 65.6 billion. The corresponding figure for Indian Railways was about 284 btkm (1998–9), which is 40 per cent of railroad share. Total land movement was thus 710 btkm and total domestic movement (including coastal) about 775.6 btkm. Thus coastal movement had a market share of 8.5 per cent of domestic movement. (Pipeline and inland water transport have not been considered here. While inland water transport is insignificant, the pipeline is a growing mode of freight movement.)

Examining portwise data from Table 7.5.4, the share of coastal cargo can be seen as varying across ports and within ports between unloading and loading. For example, in 1998–9, more than 50 per cent of the cargo at Paradip, Chennai, and Tuticorin was coastal, while at Marmugao and Jawaharlal Nehru Port Trust (JNPT) less than 8 per cent was coastal. At Haldia 89 per cent of loaded cargo and only 3.2 per cent of unloaded cargo was coastal. At Chennai 7.6 per cent of loaded cargo and 67.9 per cent of its unloaded cargo was coastal (The loading and unloading shares are expanded upon later in the discussion.) Thus the significance of coastal cargo as a business varies across ports and would be important in determining the interest of a port in servicing coastal traffic (See Table 7.5.5).

The hinterland of the port, the volume of cargo, and multimodal and port infrastructure play significant roles in determining port traffic. These aspects are later elaborated upon.

It is widely felt both by the industry and policy makers that coastal shipping has been underexploited in India, especially since the country has over 6000 km of coastline catering to the direction of significant flows of traffic. Further, coastal shipping is more environment friendly, less expensive, and has the potential of relieving congestion in land transport. (The market share of coastal shipping and inland water transport in the United States is nearly 40 per cent of the tkm freight movement). Historical reasons for not exploiting coastal shipping have been many and varied, including that the Industrial Revolution missed India under the colonial yoke. Today the reasons are primarily infrastructural and regulatory. It is thus important to examine what can be done to increase coastal shipping by integrating it with the rest of the transportation system.

TABLE 7.5.5
Share of Coastal Cargo at Various Ports 1998–9

S. no.	Port	% share of cargo to total cargo of each port	Coastal cargo (mt)
Major ports			
1	Paradip	59.7	7.8
2	Chennai	51.1	18.0
3	Tuticorin	51.0	5.2
4	Cochin	42.2	5.3
5	Vishakhapatnam	36.9	13.1
6	Haldia	31.3	6.3
7	Mumbai	27.0	8.3
8	Calcutta	25.7	2.3
9	New Mangalore	17.7	2.5
10	Kandla	12.3	5.0
11	JNPT	7.8	0.9
12	Marmugao	5.0	0.9
	Total major ports	30.1	75.8
GMB ports			
1	Mul-Dwarka	58.8	1.2
2	Magdalla	42.7	3.8
3	Jafrabad	20.9	0.6
4	Other GMB ports	6.8	0.7
	Total GMB ports	25.4	6.4
	Non-GMB minor and intermediate ports	48.6	5.2
	All India traffic	30.4	87.4

COASTAL TRAFFIC PROFILE

Cargowise coastal movement data are available for 1997–8 from *Basic Port Statistics of India, 1998–9*. Out of 37.6 mt of originating coastal traffic during 1997–8, 14.2 mt was accounted for by thermal coal, 8.6 mt by POL crude, 8.4 mt by POL products, 2.9 mt by iron ore and pellets, 0.8 mt by cement, and 0.7 mt by clinker.

1998–9

S. no.	Commodity	Quantity (mt)
1	Thermal coal	14.2
2	POL crude	8.6
3	POL product	8.4
4	Iron ore and pellets	2.9
5	Cement	0.8
6	Clinker	0.7
7	Others	2.0
	Total	37.6

Tables 7.5.6 and 7.5.7 give the details of various coastal cargoes loaded and unloaded at different ports.

The major coastal cargo flows are as follows:

• Thermal coal (from Haldia, Paradip and Vishakhapatnam to Chennai and Tuticorin). This traffic is driven by the Tamil Nadu Electricity Board (TNEB).

• POL products (between major ports, with sources being Mumbai, New Mangalore, Cochin, and Haldia, where the refineries are situated. Jamnagar will become an important port for loading and unloading POL products, from 2000–1, with the Reliance Petroleum plant coming on stream. The key destinations are Calcutta and Marmugao. Chennai and Vishakhapatnam, which also have refineries, seem to be using their capacities for distribution by land); POL crude (from Mumbai (Bombay High) to Chennai and Cochin); Imported crude obviously moves directly to the refinery ports. This traffic is driven by the petroleum companies, that is, the Indian Oil Corporation Limited (IOCL), Bharat Petroleum Corporation Limited (BPCL), Hindustan Petroleum Corporation Limited (HPCL), and Reliance.

• Iron ore and pellets (Vishakhapatnam and New Mangalore to Magdalla). This traffic is driven by Essar.

From the minor and intermediate ports the principal cargoes are:

• Cement (Mul-Dwarka to Magdalla and Maharashtra minor ports)—This traffic is driven by GACL;

• Clinker (Jafrabad to Magdalla and Maharashtra minor ports)—This traffic is driven by Gujarat Narmada Cement Limited (GNCL).

Tables 7.5.8 and 7.5.9 give the profile of ports where coastal movement (loading and unloading) is significant. For major ports and GMB ports, commodity-wise performance indicators including average turnaround time, pre-berthing time, and parcel size.

Much of the traffic is driven by large corporates that view coastal movement as a part of their logistics management. They themselves have invested in the necessary multimodal evacuation infrastructure and in some places even port infrastructure (Gujarat Ambuja Cements Limited [GACL] at Mul-Dwarka and Essar at Magdalla). Reliance has invested in its own port

TABLE 7.5.6
Cargoes Loaded at Major, GMB, and Minor Ports 1997–8

(mt)

Port	Coal/ coke	POL-product	Iron ore/ pellets	POL-crude	Cement	Clinker	Others	Loaded	Total loaded	per cent of loaded to total loaded
*Major ports**										
Haldia	4.1	1.9	–	–	–	–	–	6.1	6.6	92.4
Paradip	6.1	6.4	4.2	–	–	–	–	7.1	8.8	80.7
Cochin	–	1.5	–	–	–	–	–	1.5	2.5	60.0
Mumbai	–	0.9	–	6.7	–	–	–	7.6	12.7	59.8
Vishakhapatnam	4.0	0.1	1.9	–	–	–	1.4	7.4	14.2	52.1
New Mangalore	–	2.3	0.4	–	–	–	–	2.7	9.2	29.3
Calcutta	–	0.1	–	–	–	–	0.1	0.2	1.6	12.5
Chennai	–	1.0	–	–	–	–	–	1.0	10.9	9.2
Kandla	–	–	–	–	–	–	0.2	0.2	3.9	5.1
JNPT	–	–	–	–	–	–	0.1	0.1	3.4	2.9
Tuticorin	–	–	–	–	–	–	..	..	1.6	..
Marmugao	..	–	..	–	–	–	..	..	19.2	..
*GMB ports***										
Mul-Dwarka	–	–	–	–	0.8	–	..	0.8	1.4	57.1
Jafrabad	–	–	–	–	-	0.7	–	0.7	1.8	38.9
Others	–	–	0.4	–	0.1	–	0.3	0.8	7.1	11.3
Non-GMB minor and intermediate ports	–	–	0.2	–	–	–	1.7	1.9	4.3	44.2
Total	14.2	14.2	7.1	6.7	0.9	0.7	3.8	38.1	109.2	34.9

.. Negligible.

Sources: *MoST (1998–9).

**Gujarat Maritime Board Administration Report (1998–9).

TABLE 7.5.7
Cargoes Unloaded at Major, GMB, and Minor Ports 1997–8

(mt)

Port	Coal/ coke	POL-crude	POL-product	Iron ore/ pellets	Clinker	Cement	Others	Unloaded	Total un-loaded	per cent of unloaded to total unloaded
Major ports										
Tuticorin	5.2	–	0.4	–	–	–	..	5.6	8.4	66.7
Calcutta	–	–	2.0	–	–	–	0.2	2.2	4.2	52.4
Chennai	8.6	2.6	..	–	–	–	..	11.3	24.3	48.3
Marmugao	..	–	0.8	–	–	–	..	0.9	2.0	45.0
Cochin	–	4.1	0.1	–	–	–	..	4.3	9.8	43.9
Vishakhapatnam	–	3.3	2.2	0.4	–	–	..	5.9	14.7	40.1
Kandla	–	3.7	1.5	–	–	–	..	5.3	31.5	16.8
Mumbai	–	–	1.7	–	–	–	..	1.7	19.0	8.9
Haldia	–	–	0.8	–	–	–	–	0.8	13.4	6.0
JNPT	–	–	–	0.3	–	–	..	0.3	5.3	5.7
New Mangalore	–	..	0.2	–	–	–	..	0.3	7.0	4.3
Paradip	–	0.1	–	–	–	–	–	0.1	4.5	2.2
GMB Ports										
Magdalla	–	–	–	2.6	0.4	0.3	0.1	3.4	7.3	46.6
Others	0.2	–	–	–	–	–	0.2	0.4	8.1	4.9
Non-GMB minor and intermediate ports	–	–	–	0.1	–	–	1.3	1.4	8.6	16.3
Total	14.0	13.8	9.7	3.4	0.4	0.3	1.8	43.9	167.2	26.3

.. Negligible.

Source: Same as for Table 7.5.6.

infrastructure at Jamnagar for receiving POL crude and sending POL products. The shipping capacity is provided as a kind of 'alliance' with traffic guarantees. Examples are the Shipping Corporation of India (SCI) and Great Eastern for oil companies' POL and Poompuhar Shipping for TNEB thermal coal.

The future traffic potential of coastal shipping lies in large corporates shipping bulk products and general cargo in containerized form which is almost non-existent today.

For thermal coal, traffic moves from the collieries at Orissa, West Bengal, and Bihar by rail to Haldia, Paradip, and Vishakhapatnam, as specific berths and loading facilities are provided there. At Chennai and Tuticorin, similar unloading facilities are provided. At Chennai, coal moves by rail to two thermal power stations, one located just north of Chennai and the other at Mettur, about 250 km south-west. At Tuticorin, coal is unloaded and moves directly to the thermal power station by conveyor belt.

Currently, a new port called Ennore, just north of Chennai is in the finishing stages of construction, both to serve the thermal power station located nearby. Ennore also removes the pollution in Chennai, due to coal handling that would have otherwise resulted. Ennore port will supply coal to the neighbouring Ennore Thermal Power station by conveyor belt and to Mettur by rail. This project is funded by the Asian Development Bank (ADB) and takes care of necessary integration with rail as well as the conveyor belt system for proper evacuation.

For POL, appropriate investments in railway sidings, tank farms, pump installations, jetties, buoys and pipelines are in place for integration with the land transport infrastructure. In future, due to investments in pipelines there is a possibility that this traffic might decrease, though the main target is road and rail movement. Almost all the pipelines, including those proposed, are hinterland pipelines from the ports, leading away from the sea. The only 'coastal' pipeline is the one from Vishakhapatnam to Vijayawada, whose lead is, however, too small to be an alternative to coastal shipping. If a common carrier pipeline network of reasonable length and density comes into being, then some of the port-based refineries may be in a position to service hinterland areas directly by pipeline, rather than coastal shipping, rail, or road. Such a network is expected to be in place by 2010.[25]

[25] See section 7.3.

TABLE 7.5.8
Some Aspects of Cargo Handling at Major Ports that Have Significant Coastal Traffic 1997–8

Port	Cargo	Coastal loaded (million tonnes)	Average turnaround time (days)	Average berthing time days	Average parcel size (tonnes)
Hadia (L)	Coal/coke	4.1	8.9	2.7	22,898
(91.4)	POL (product)	1.9	4.2	2.6	17,531
Paradip (L)	Coal/coke	6.1	4.8	0.8	27,766
(83.4)	POL (product)	0.6	4.5	3.4	9935
	Iron ore (raw/pellets)	0.4	5.3	2.3	43,214
Cochin (L)	POL (product)	1.5	4.3	2.1	29,661
(65.2)					
Mumbai (L)	POL (crude)	6.7	5.6	2.5	33,057
(64.3)	POL (product)	0.9	5.6	2.5	33,057
Vishakhapatnam	Iron ore (raw/pellets)	1.9	7.0	2.4	68,220
(54.4)	Coal/coke	4.0	11.6	5.2	33,286
	POL (product)	0.1	2.3	0.6	23,320
	Other cargo	1.4	–	–	–
New Mangalore (L)	POL (product)	2.3	2.7	1.3	22,839
(37.7)	Iron ore (pellet)	0.4	3.0	1.4	45,062
Tuticorin (U)	Coal/coke	5.2	5.1	1.1	120,000
(66.3)	POL (product)	0.4	3.0	1.4	45,062
Calcutta (U)	POL (product)	2.0	4.1	1.1	8837
(47.7)	Other cargo	0.2	–	–	–
Chennai (U)	Coal/coke	8.6	13.2	6.9	19,762
(46.5)	POL (crude)	2.6	7.4	5.3	30,010
	POL (product)	NA	7.4	5.3	30,010
Cochin (U)	POL (crude)	4.1	4.3	2.1	29,661
(41.8)	POL (product)	0.1	4.3	2.1	29,661
Vishakhapatnam (U)	POL (crude)	3.3	2.3	0.6	23,320
(38.6)	POL (product)	2.2	2.3	0.6	23,320
	Iron ore (raw/pellet)	0.4	7.0	2.4	68,220
Marmugao	POL (product)	0.8	2.4	0.9	7277

Source: Indian Ports Association (2000).
Note: 'U' and 'L' in brackets refer to unloaded and loaded respectively.
Figures in brackets are percentage of coastal loaded or unloaded to total loaded and unloaded respectively.

TABLE 7.5.9
Coastal Traffic in Certain Commodities at GMB Ports 1997–8

Port	Commodity	Loaded coastal mMt
Mul-Dwaraka (L)	Cement	0.8
(56.9)		
Jaffrabad (L)	Clinker	0.7
(39.4)		
Magdalla (L)	Iron ore	0.4
(37.3)	Other cargo	0.6
Magdalla (U)	Iron ore	2.6
(46.5)	Clinker	0.4
	Cement	0.3
	Other cargo	0.1
Okha (U)	Furnace oil	0.2
(25.9)	Coal	0.1

ECONOMICS OF COASTAL MOVEMENT

Studies of iron ore, sponge iron (Raghuram and Mathew 2000), and cement movement (Banerjee, Raghuram, and Rangaraj 2000) show that, given the infrastructure at ports and mines for material unload-ing, the operating economics are in favour of coastal movement, whose transport cost per tonne km would be Re 0.25 or less (even for vessels of 3000 tonne capacity). Corresponding rail or road costs, depending on distance, would be Re 0.60–Rs 1.20.

As a proportion of total logistics cost (including transportation, related inventory, handling, and related losses), the transportation cost for low value bulk commodities to high value consumer goods ranged from 90 per cent to 40 per cent for road, 85 per cent

to 30 per cent for rail, and 80 per cent to 20 per cent for shipping, for a 1000 km lead.

Despite the fact that coastal shipping would in general require additional land leads, cost differentials favour it even for an east–west movement. In such cases, the sea distances would be 2500 to 4000 km and about twice the port to port direct land lead. More interior the origin/destination, the less the advantage of coastal shipping (see Box 7.5.1).

A professionally run company like the GACL prefers coastal movement, wherever possible, over land transportation. It has therefore made investments to integrate coastal movement with the land leads. While data on its costs for coastal movement are not available, its rail and road freight costs (not total logistics cost) from its plant at Kodinar (served by the port of Mul-Dwarka) to Surat are Rs 600 and Rs 558 per tonne, respectively (GACL 1999). The rail cost by the shortest route would

BOX 7.5.1

Advantages of Coastal Shipping[26]

The total logistics cost advantage for coastal shipping was over Rs 1 crore for the raw material from Daitari, as compared to rail whose total cost was Rs 3.25 crore. Similar advantages would accrue for other raw material sources. This analysis does not take into consideration the investment cost at the plant end for dealing with sea cargo. This was partly due to the fact that some investments in a jetty had already been made for importing plant machinery during the project stage. The additional investments in the jetty were less than the investments required for constructing a railway siding from the nearest rail access point.

Another interesting dimension for this company was the choice of market based on logistical competitive advantage. The finished product (sponge iron) could use the returning empty vessels to the east coast at an additional transportation cost of Rs 140 per tonne (the inbound full cost of transportation including the empty return of the vessel was Rs 260 per tonne), while rail would have costed anywhere between Rs 382 and Rs 544 per tonne. In this instance, for coastal shipping, the costs due to inventory, handling, and losses would be significant since the inherent value of sponge iron was Rs 4000 per tonne (as opposed to Rs 250 per tonne for iron ore). However, the total costs were still in favour of using the coastal route and servicing a market with competitive advantage over other suppliers who were located closer to the eastern markets. The same was true of markets near Mangalore.[27]

Appropriate infrastructure to integrate with the land movement was key both for raw material and finished goods at the ports which were at the non-plant end. These being major ports, such infrastructure was readily available, including appropriate dumping space. Rail/road connectivity was in place. At the plant end, the key infrastructure was floating cranes to augment the unloading/loading rates of the mother vessel at anchorage and barges to shuttle between anchorage and jetty. Handling and conveyor-based evacuation were required between the jetty and the port-based plant.

[26] Here the specific case of raw material sourcing for Laxmi Transformers (LT) is taken up. LT is a company making sponge iron at Alibag. It sources iron ore in pellets and lumpy from Daitari. It has a total requirement of 0.6 mt tonnes of pellets and 0.155 of lumpy ores. One tonne of steel by the direct reduction process than LT uses, requires 1.24 mt of pellets and 0.31 mt of lumpy ore. Daitari is in Orissa. If the pellets and ore were to be routed by rail from Daitari up to Penn and then by road from Penn to Alibag the transport cost per tonne would be Rs 524 per mt (consisting of Rs 5175 for the rail segment and Rs 7.5 for the road segment). The total transport cost would be Rs 3.25 crore. For a 35,000 DWT ship picking up the ore at Paradip, brought there by rail, the transport cost would be Rs 1.99 crore.

In summary the total transport costs are as follows:

	Rs crore
1. From Daitari to Penn by rail and then by road to Alibag	3.2
2. From Daitari to Alibag by road	5.52
3. From Daitari to Paradip by rail and then by 35,000 DWT ship to Alibag	1.99
4. Same as above but with a 65,000 DWT ship	1.84
5. By rail to Penn and then to Alibag	3.25

The total mode cost per tonne for three of the modes above is as follows:

Mode	Transport cost (Rs crore)	Inventory cost (Rs crore)	Cost/ tonne (Rs/mt)
(3) Rail + 35000 DWT ship	1.99	0.22	356+extra handling+buffer stock cost
(4) Rail + 65000 DWT ship	1.84	0/39	359+extra handling+buffer stock cost
(5) All the way by rail upto Penn and road to Alibag	3.25	Negligible	5221+extra handling+buffer stock

[27] This analysis uses the given rail freight charges as reflecting the true cost of rail. We know that railways overprice freight to cross-subsidize passenger traffic. Unfortunately, there are no accurate estimates of freight costs by rail either. Similarly, coastal shipping is itself subject to large distortions arising out of the sabotage laws of the country. The question as such remains open.

be Rs 545. However, since this route has restrictions due to the Gir sanctuary, the actual cost works out to be Rs 600, whereas the transportation cost from Kodinar to Surat using coastal movement would not exceed Rs 150 per tonne including the land leads. Part of the saving is also due to the shorter coastal lead across the Gulf of Khambat.

Traffic Potential

Given such advantages for bulk movement as in the case of GACL and Laxmi Transformers, the scope for increased use of coastal shipping, with appropriate infrastructure to integrate with the rest of the transport network, is quite large.

It would be difficult to quantify the traffic potential for coastal movement, since much of it would depend on the port and multimodal infrastructure and industrial and distribution centre location strategies. Of the domestic originating tonnes, the railways handled about 420 mt in 1998–9. Assuming that traffic using road as the primary movement had similar leads as rail and given that road share in tkm is one and a half times the rail share, the originating traffic for primary road movement would be about 630 mt. ('Primary' is emphasized since almost every unit of traffic starts its journey by road, but then could be serviced by rail or sea, both coastal and overseas, with very short leads. A primary movement would not include such movements.)

Out of the resultant total of over 1 billion tonnes of domestic originating traffic, a 5 per cent share captured by coastal shipping would amount to 50 mt. This would be in addition to the 41 mt of originating coastal traffic for 1998–9. With a five-year horizon it ought to be possible for coastal shipping to capture 50 mt of traffic. In fact, this figure would be less than the annual growth in originating tonnes in India. This would amount to a 14 per cent annual growth rate compared with the figure of 41 mt in 1998–9 to reach about 90 mt in 2004–5. At a macro level, the transport demand effort multiplier for India has been estimated at 1.5, which means the total tkm of traffic would grow at 1.5 times the gross domestic product (GDP) growth rate. Over the next few years, with an estimated 6–7 per cent gross domestic product (GDP) growth rate, transportation demand would grow at 10 per cent per year. The expectation for coastal movement growth is thus higher.

The scope for increasing coastal traffic would be the movement of coal (along the east coast and from east to west, with port-based distribution centres), iron ore (east to west and along the west coast), fertilizers, and cement (port-based plant to port-based distribution centres), salt (along the west coast and west to east), foodgrains (north to south, partly by land and coast), and plantation produce (south to north, partly by coast and partly by land).

Projection of additional coal movement from Paradip for power plants in Tamil Nadu by 2004–5 is 13 mt, out of which 8 mt would be to the new port at Ennore, 3.5 mt to Cuddalore, and 1.5 mt to Tuticorin. Another forecast for 2006–7 suggests a total that ranges from 16 mt to 30 mt, covering the thermal coal requirements through Chennai and Ennore (Ennore Port 1999). This compares with the current (1998–9) thermal coal unloading of about 10 mt at Chennai.

Much of the increased tonnage on coastal shipping would be driven by corporates and investments depending on the nature of the cargo.

There is also scope of moving higher value manufactured goods in a containerized manner from industrial concentrations to redistribution centres. The Mumbai area is one possible source; industrial zones which could be developed near port locations are others. There is also the possibility of moving tea from Assam to the west coast consumption points of Gujarat and Maharashtra.

The government of Gujarat has done some work on this issue of joint development of industry and ports (for example Dahej) and has come out with a vision document (Gujarat Infrastructure Development Board 1999).

A study (Banerjee, Raghuram, and Rangaraj 2000) was made of the use of the Konkan Railway Corporation (KRC) to assess the traffic potential along the west coast. Thirteen companies were studied and their inputs closely considered. The study did not quantify the likely market realization but concluded that the KRC should focus on marketing service concepts since customers' willingness to shift modes was a function of the desired services being offered. A study by RITES (RITES 1996) provided a list of commodities and the quantity estimates moving to and from Kerala on the western north–south axis. These were taken up for analysis. (Banerjee, Raghuram, and Rangaraj 2000). For the year 2005–6 the south to north and north to south traffic for Kerala was estimated at 67,000 and 131,000 tonnes per day respectively, amounting to about 25 mt (south to north) and 50 mt (north to south) per year. Coastal shipping could compete for such large and significant movements.

Utilization of Ships

In terms of number of vessels, there has been a gradual increase in the coastal share, while in terms of gross registered tonnage (GRT) the share has remained steady. The average GRT of a coastal vessel is 2500 while that of an overseas vessel is 26,400. Coastal vessels also

include non-cargo-carrying vessels like tugs, dredgers, and offshore supply and service vessels. Coastal tonnage is on average older than overseas tonnage (Raghuram 2000). While coastal is reserved for Indian vessels, it should be noted that non-Indian flag vessels leased to Indian operators are also pressed into service for meeting coastal traffic requirements.

Regulatory Issues

Customs is viewed as a significant bottleneck, leading to extra paperwork, consequential delays, and corruption. The government thus constituted the Working Group on Coastal Shipping (1993) which recommended that coastal traffic should be removed from the purview of strict day-to-day control of the Customs Act.[28] However, as to whether customs should be completely off coastal traffic, some shipowners said that this would not be appropriate and customs must have the right to inspect any vessel/cargo. Regarding customs control, the paradigm needs to change from 'prove that you are not at fault' to 'beware of the consequences of illegal doings'. To ease customs inspections, streamline coastal cargo flow, and reduce the possibilities of illegal doings, it is suggested that: (i) there be specific ports or jetties earmarked for coastal traffic, and (ii) coast guard monitoring be improved. Indonesia is an example of a country with significant coastal shipping where separate ports and jetties are earmarked for coastal movement.

Ports with bureaucratic orientation are also a major bottleneck especially in turnaround times. This is because they are not stakeholders in this process even though they have a business interest in coastal shipping. Given their present structures and relationship with the government, public sector ports continue to be rule bound. Shipowners have also pointed out that definitions of 'overseas' and 'coastal' vary between customs and ports, causing extra documentation and complexity. This needs to be standardized. The right direction for ports would be corporatization and increased autonomy.

Box 7.5.2 shows how GMB ports are moving in the right direction. The lesson from the GMB is that port development could be more effective if it were market driven, if it leveraged initiatives by major users (captive jetties and ports), and if it were carried out with private participation. Even in the GMB context, one does get the feeling that a lot more can be achieved if the role of the GMB became more and more that of a facilitator, rather than executor.

Cabotage is an international issue, supposedly driven by security, protectionist, and 'others are doing it, why not me' concerns. Cabotage rules in India are relatively liberal compared to many other countries like the United States, Japan, and the EC (European Community) countries. All that is required is 75 per cent Indian ownership in a company providing coastal shipping services.

It is important for coastal shipping that the cabotage regulations stay at the current liberal level which will help bring in the most appropriate shipping capacity and commercial management. An important step, however, would be to change the Indian ownership requirement to 74 per cent, which would permit a foreign partner to seek a board position with 26 per cent equity.

A draft Coastal Shipping Act is under consideration, to put coastal shipping outside the purview of the existing Merchant Shipping Act, 1958 (Gill 1990), with a view to providing less stringent mandatory requirements in respect of design, construction, equipment, manning, and liability without, however, compromising on safety (MoST 1999). The expert committee which drafted this felt that the Act would facilitate the development of coastal shipping.

In my view, however, lack of such an Act has not been a deterrent for the development of coastal shipping.

Box 7.5.2

A Relative Success Story

In the recent past, the GMB can be viewed as a success story in facilitating coastal traffic through faster responses to customer requirements and proactive marketing to traffic. For example, between 1990–1 and 1998–9, coastal traffic at the GMB ports grew from 2.3 to 6.4 mt at a CAGR of 13 per cent. During the same period, the major port coastal traffic grew from 49.0 to 75.8 mt at a rate of 5.6 per cent.

While the GMB has 40 registered minor and intermediate ports, the top six ports account for nearly 72 per cent of its traffic. Of these six ports, five are direct berthing. Two do not have rail connection, but are really ports serving cement plants located closely. Among the remaining four having rail connection, Magdalla (the port with the highest traffic) is least dependent on rail, since most of its traffic either terminates or originates at plants near the port. While traffic in and out of Bedi, Okha, and Sikka uses railways, rail access is not right up to the jetty, thereby requiring extra handling by road.

The relative success of the GMB is attributable both to a strategic vision driven by political will and operational autonomy. The GMB has been successful in facilitating captive jetties and ports and more recently joint venture ports (the Gujarat Pipavav Port Limited (GPPL) at Pipavav and the Gujarat Adani Port Limited (GAPL) at Mundra) which are at the 'take-off' stage.

[28] Based on Recommendations of the Working Group on Coastal Shipping, 1993, as in Ministry of Surface Transport (1993).

While the proposed Coastal Shipping Act could lend focus to this transport mode, it should in no way bring in greater controls or bureaucracy in decision making.

Infrastructure Focus Areas

Turnaround Times

One of the key, if not the most important, concerns of coastal movement is turnaround times at ports. Given that coastal movements would by definition be of short duration (in Europe, similar services are called 'short sea shipping'), the port turnaround times should also be small. With a speed of 10 knots per hour (25 km per hour), distances of 1000, 2000, and 3000 km would be completed in 40 (1.66), 80 (2.33), and 120 (5) hours (days) respectively. However, as per Table 7.5.8, the average turnaround times range from 3 to 5 days at most ports and up to 8 days at Chennai and Visakhapatnam for coastal cargo. At Magdalla, due to lighterage operations, the turnaround time for iron ore and pellets could be as high as 15 days. The pre-berthing detentions range from 0.5 to 2 days at most ports and up to 6 days at Chennai. Greater attention is, therefore, called for in reducing the pre-berthing detention and turnaround times. Priority for coastal vessels including dedicated jetties, direct berthing, and better loading, unloading, and evacuation systems would be essential.

Parcel Sizes

From Table 7.5.8, it can be seen that the average parcel size for thermal coal is about 30,000 tonnes, for POL products between 8000 and 30,000 tonnes, POL crude about 29,000 tonnes, and iron ore and pellets between 47,000 and 67,000 tonnes. All this cargo is handled at the major ports both for loading and unloading, except iron ore and pellets which are unloaded at Magdalla with a floating crane for lighterage. Cement and clinker movement takes place in vessels and barges with parcel sizes between 3000 to 5000 tonnes.

Other commodities which could potentially use coastal shipping would move in parcel sizes at the smaller end of the range, that is 3000 to 5000 tonnes. This would also be applicable for containerized general cargo, to that extent requiring lesser consolidation efforts. Such vessels would typically run with 150 to 250 twenty feet equivalent units (TEUs).

The smaller parcel sizes are in line with the just-in-time concept of supply chain management. Even though the economies of scale for ship movement would not be fully exploited, the cost advantage over land transport is still significant. Another major advantage is that draft requirements (about 4 m) for such vessels would be low, thereby offering flexibility in locating new ports for coastal traffic.

It is important to think 'small' (3000 to 5000 tonnes parcel size), while considering infrastructure for coastal movement, especially in terms of handling equipment, jetties, and shipping capacity. The draft requirement for jetties/ports handling such parcel sizes would be about 4 m. This is especially so the non-captive coastal shipping. Coastal shipping by captive users could think of parcel sizes most economical to their operations (for example TNEB coal, POL oil companies, and ESSAR iron ore).

Evacuation infrastructure at each of the port sites, both road and rail access, needs to be provided. While thinking of rail and coastal shipping integration, the parcel sizes should be multiples of rake sizes. This will enable quick evacuation, without having to consolidate cargo across vessels.

Even though ports with low draft are being proposed here, in view of the small parcel size approach, the ports need to be geared well to permit quick loading and unloading. The emphasis on gearing is all the more critical since (i) ports are usually not well equipped and (ii) the small parcel size low draft vessels would be more economical with no gear. The ports also need to permit round-the-clock and round-the-year operations. Only then would the desired flexibility and service levels be achieved to ensure a growing market for coastal shipping.

Elsewhere the economies of gearing at ports versus that in ships have been examined (Raghuram 2000). This yields that for a given level of non-bulk originating coastal traffic (say 50 mt), 667 ships of 3000 dwt and 140 jetties are needed. For the same loading/unloading effectiveness, a crane on a ship is more expensive not only in terms of investment, but also in terms of operating costs. Moreover, the numbers of shipboard gearing requirement alone would be more than four times those for port gearing. Thus port-based gearing would be more economical than ship-based gearing and also easier to implement since private sector shipowners would want to keep their investments low.

In Europe and the United States, coastal shipping is also integrated well with inland water transportation for through movement and evacuation. Unfortunately, our potential inland waterways have not been properly maintained and thus cannot really be integrated with the coastal system. If at all, the options are the three national waterways, namely Hooghly–Ganga, Brahmaputra, Kerala coastal waterway, and also the Godavari. Currently, it would be difficult to envisage parcel sizes even as small as 300 tonnes moving in a reliable manner!

Port Locations

To facilitate coastal movement and reduce land leads, ports would need to be spaced all along the coastline, with a gap of no more than say 300 km. This would require about 20 port locations along India's 6400 km coastline, of which 10 could be at or adjacent to the existing major ports. Locations should be easily accessible from sea and have good land evacuation facilities. Some locations may be captive to industries. Others would serve the purpose of decongesting existing major ports, both in terms of berthing capacity and evacuation access. Chennai and Calcutta would need to be bypassed on account of these criteria. Visakhapatnam and Ennore could be allocatives for Chennai and Haldia for Calcutta. Haldia could be an alternate for Calcutta and Ennore for Chennai. Similarly, alternatives to Mumbai need to be considered.

Port Economics

For an additional 50 mt of originating coastal traffic, we would need 140 jetties spread over 20 locations, that is, 7 jetties per port. The typical cost of a 4 m draft, seven-geared jetty port would be in the range of Rs 50 to 100 crore, depending on the hydrographics (based on interviews with port executives and shipowners). According to sources from the GMB, a berth for up to seven 5000 dwt ships would need to be 350 m long (50 m per ship). With a 30 m backup area, the total berth area would be 10,500 sq. m. The cost per sq. m for a 4 m draft jetty would be Rs 40,000, thus amounting to a total of Rs 42 crore. Seven cranes with a 60 tonne capacity would be required to ensure unloading/loading within 24 hours at a 100 per cent peak berth occupancy. Each such crane would cost Rs 2 crore. Thus total crane cost would be Rs 14 crore. Warehousing and rail/road access would cost an additional Rs 4 crore. The total cost of the port, excluding any navigation dredging would be Rs 60 crore.

The annual operating and maintenance costs of such a port would be around 30 per cent of investment cost, that is about Rs 20 crore per annum. Since each additional port is expected to handle about 5 mt per annum, even at the low end revenue per tonne of Rs 100, the total revenue would be Rs 50 crore per annum. The surplus would be more than sufficient for financing costs, thus making ports for coastal operations a viable business. A port business is in general a very viable one. This may have much to do with the fact that all our ports are financially healthy.

Private Investment

All this additional investment should take place with private investment of appropriate stakeholders (high intensity users, shipping companies, and other organizations with significant multimodal/maritime experience). Tying up investments for industry and/or distribution centres near ports, along with easy integration with land transport would be key requirements for success. What is really important is coordinated development.

Shipping Capacity and Manning

Shipping capacity as such is not a problem, since vessels required for coastal operations can either be manufactured in India or sourced in through a bare boat charter or even, as per latest relaxations, chartering in of a foreign flag vessel.

Further, depending on the economics of the market, Indian owners can easily change the registration of vessels between coastal and overseas.

The manning requirements of coastal vessels are less stringent than overseas vessels, thereby offering scope for economy. Some shipowners state that there is further room to reduce manning requirements. However, the crucial issue in manning is the quality of manpower, since better take home salaries are available in overseas shipping. In the words of one coastal shipowner, coastal vessels are manned by 'grandfathers'. There does not seem to be any solution to this 'problem' other than being able to pay higher salaries, which would only happen with better market conditions and utilization of vessels.