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Comparative Evaluation of Highway and Railway Development in India and China

1992-2002

Contrasting Approaches to Transport Constraints on Economic Growth

Lessons Learned and Transferability Issues

March 28, 2005

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CONTRASTING APPROACHES TO TRANSPORT CONSTRAINTS ON ECONOMIC GROWTH:

LESSONS LEARNED AND TRANSFERABILITY ISSUES

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Contrasting Approaches to Transport Constraints on Rapid Economic Growth: Lessons Learned and Transferability Issues

CONTENTS

EXECUTIVE SUMMARY

The evolution of the two economies

In the last two decades, the GDP growth rate in India has been around 5.5% with the economy growing about 2.6 times reaching a level of about US$510 billion in 2002. In China the GDP has been growing at about 9.5 % over the same period with the economy growing more than five fold between 1982 and 2002 reaching a level of about US$ 1,232 billion in 2002. The GDP of China, which was about 1.2 times that of India in 1982, had by 2002 grown to 2.6 times that of India. In terms of impact of the economic growth on poverty reduction, by 2002 China had lifted 400 million people out of poverty and its poverty rate had declined to 4.6%. In India over the same period the poverty rate declined from 36% to 29%.

The structure of the two economies also evolved differently, with the share of the agriculture sector declining more sharply in China – to less than 15% of GDP in 2002, when in India it was nearly 23%. In India the contribution of services to GDP grew to just over 50% by 2002 and industry to almost 27%, while in China the share of services was stable at just over one-third of GDP, but industry grew to over 52% of GDP. Moreover, by 2002/2003, the amount of foreign direct investment and volume of trade in China have reached a level that is many times those in India. The Chinese economy has remained far more freight-transport-intensive than that of India.

Table 1. Key Economic Data for India and China, 1992-2002

	India		China	
	1991-92	**2001-02**	**1992**	**2002**
Population (million)	846	1000	1171	1300
Poverty rate (%)	36	29	40	7
GDP (current $ billion)	244.2	510.2	454.6	1232.7
GDP growth rate (%)	5.5	4.4	14.4	8.0
Share of GDP (%) – Industry	26.7	26.6	43.9	51.7
Share of GDP (%) – Services	42.3	50.7	34.3	33.7
Volume of trade (current $ billion)	46	157	165	623
Foreign direct investment (current $ billion)	1.8	4	11	53

Source: World Bank "India at a Glance" and "China at a Glance".

At the beginning of the 1990s, India's highway and railway infrastructure was ahead of that of China in terms of total route km, route km/square km, and route km/ head of population, but the utilization of the infrastructure, particularly for railways, was quite different.

The development of highway and railway infrastructure

The two railways in 1992 carried almost exactly the same volume of passenger km (314 vs 315 billion pkm), but China Railways (CR) managed to carry 1,157 billion tkm of freight – or 4½ times that of Indian Railways (IR) 257 billion tkm – through far more efficient exploitation of track, locomotives, and wagons, and by assigning lower priority to passenger services. IR operations were dominated by passenger services (including suburban operations, a burden not imposed on CR), but, reflecting the fact that India's citizen's enjoyed a far higher propensity to travel, the 314 billion pkm carried by IR constituted only 20% of India's estimated total passenger

pkm, while the 315 billion pkm via CR constituted 45% of China's estimated total passenger market. The share of both railways in their respective freight markets had already substantially eroded over the preceding two decades as trucking, coastal shipping, and, in China, also inland water transport took an ever larger share. IR's share stood at 45% in 1992, slightly superior to that of CR at just under 40%[1].

Although India's road network was more extensive than that of China in 1992, the ***quality of the road networks in both countries was severely deficient relative to the standards of modern highways*** in virtually all dimensions – pavements, road geometry, and traffic management. Based on personal observations by the co-author, the quality of the two road networks was roughly on a par, except that China had perhaps generally better road maintenance.[2] The uncontrolled mixing of pedestrians, animals, and other slow moving traffic was similar in both countries, contributing both to slow travel speeds, uncertain journey times, and high accident rates.

Over the ensuing decade (1992-2002), China leap-frogged India in both railway and highway development.

- China took advantage of the macro-economic slowdown following the Asian currency crisis that began in 1997 to more than double its spending on highways, from $13 billion in 1997 to $27 billion per annum or more during the ensuing years, thus turning adversity to advantage, as highway building is estimated to have increased China's GDP by a full 2 % per annum over the subsequent years. India's road expenditures averaged only $ 1 to 3 billion per annum.
- rail network extension and capacity expansion also dwarfed that in India, as the double-tracked network was extended by 69% (+9,400 km), electrified track km doubled (+8,975 km), and the overall network route km extended by 24% (+13,797 km). The latter included 12,367 km built by new local rail corporations, many with private participation, owned and operated separately from the National Railway, unlike India, where IR retained a monolithic monopoly for rail services. The investment in the government owned railways during the decade 1992-2002 in China and India was US$ 85 and 17.3 billion, respectively.
- the *increment* in annual freight traffic (from 1,157 to 1,551 = 394 billion tkm) taken on by China Railways over 1992-2002 exceeded the *entire* freight traffic carried by Indian Railways in 2002 (336 billion tkm), reflecting, *inter alia*, the far greater freight intensiveness of China's economy.

Over this period, India's rail network grew by only 682 route km (1%), double track by 1,519 km (10%), and electrified line by 5,192 km (48%). Interestingly, IR's gain in annual traffic carried per US dollar of investment (14.9 tkm+pkm) over the decade was more than twice (2.2 times) that of China Railways (6.8 tkm+pkm), but the gain in labor productivity was only 61% (from 402 to 648 tkm+pkm) vs the 90% gain on CR (from 728 to 1385 tkm+pkm). CR spent extra capital to purchase improved labor productivity, to achieve an average output per employee more than twice (2.1 times) that of IR., and CR has developed rail line capacity that would cater to growth of demand over the next 10 years or so, while India has not done so.

It was in the highways sector, however, where the contrast, in both objectives and achievements, was greatest. While India's road network officially grew by 600,000 km (from 2.7 to 3.3 million km, or

[1] Traffic statistics for the railways sector may be reasonably accurate, but statistics for other modes, particularly roads, are subject to wide margins of error, so that reported modal shares should be taken as indicative at best; published estimates vary widely: e.g. Pittman (2004) reports CR's current share at an implausible 70-80 % of surface freight transport.
[2] Clell Harral, formerly Highway Design and Maintenance Adviser to the Bank, traveled several thousands of km of highways in both India (1964-2003) and China (1980-1990).

22%), virtually all of the increase was in very low-standard roads to reach more of the rural areas which had before been outside the reach of all weather access. High standard arterial highways to connect even the four main cities of India were largely neglected; the effort merely to widen the Golden Quadrilateral to 4 lanes, minus controlled access features, did not get underway until 1998 and is not now expected to be completed before the end of 2007 at earliest. In contrast, China's road network officially grew by only 376,000 km (from 1.3 to 1.7 million km, or 28%), but the emphasis was on the arterial networks. By 2002 some 25,130 km of expressways with minimum 4-lanes and controlled-access features plus another 27,468 km of 4-lane dual carriageway highways without controlled access features had been completed, including 27,000 km (or 77%) of the planned 35,000 km National Trunk Highway System (NTHS) initiated in 1992.

This report, based on a desk review of literature available to the World Bank at April 2004, seeks first to draw a brief picture of the state of China's railway and highway systems circa 1992 and the constraints to development as then perceived. It next seeks an understanding of the various instruments that were employed in the subsequent decade to overcome the constraints and accelerate development, and, finally, it attempts to identify the successful elements of the Chinese experience that might be transferable to India.

While many differences between the situations of the two countries are recognized, it is argued that the extraordinary economic growth in China created a dynamic momentum – a 'juggernaut' in fact – that broke the bounds of inertia and overcame many impediments similar to those of India. If India is to overcome its transportation bottlenecks and sustain its future economic growth, it, too, will have to break the bounds of inertia and rise to new levels of performance in the creation and utilization of transport infrastructure. Several of the policies and institutional constructs used by China can be adapted to India's circumstances and purposes. At the same time, there are also lessons from China as to potential pitfalls to be avoided, particularly in the pricing and financing of road infrastructure.

Transport provides an essential framework for our national economy. It gives the foundation and serves as a precondition for establishing and developing a socialist market economy. However, transport system capacity falls far behind demand, and that lack of capacity has led the sector to become a serious bottleneck that restricts the development of the national economy. The problems are mostly caused by three factors: inadequate investment, insufficient strength of reform, and problems of management and operation. Director, Transportation Department, State Planning Commission of China, December 1993[3]

I. HIGHWAYS

1.1 Key Issues

In 1992, the highway network of China was among the smallest in the world relative to either geographic area (137.7 km/'000 sq km) or population (1.13 km/'000 population), and it consisted primarily of very low standard roads of antiquated design, with road geometry, pavements, and traffic management features grossly inadequate to meet traffic volumes then prevailing, as road traffic had reportedly been growing at an average rate of about 15% per annum since 1979, doubling every 5 years. At the same time, more than 30 % of China's villages were not accessible by motor vehicles.[4]

In addition to widespread traffic volume/capacity congestion problems on the main networks and the lack of access for large portions of the rural population, **the Bank identified a nascent road maintenance/pavement strengthening problem** as another of the country's major priorities, given that pavements had been designed for far lower traffic and axle loadings than had come about – and that the actual quality of materials and construction were in fact inferior to the designers' intentions, as **supervision and quality control procedures were very often deficient**.

Although modern highway planning, design, construction technologies, and competitive procurement procedures with proper supervision and quality control were being inseminated – in part through ongoing implementation of the Bank Group's first seven highway loans/credits made between 1985 and 1991 (totaling $722.2 million) – such capabilities were still limited in 1992. While more than 175 financially and managerially autonomous road construction corporations had by then been established, **the great majority of road works (outside the Bank's program) were still being procured through some 560 subsidized state-owned construction companies using primarily traditional technologies at artificially low government-controlled prices** – which distorted the markets, blocked the efficiency gains to be achieved from genuine competition, and necessitated continued subsidies to the state-owned enterprises.

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[3] As quoted in *China: Forward with One Spirit: A Strategy for the Transport Sector,* World Bank (p vii, April 23, 1998).

[4] While a large number of studies have been reviewed, this assessment of the highway system and key issues as perceived in 1992 draws particularly heavily on H. Levy, "China Highway Development and Management: Issues, Options, and Strategies," World Bank Report No. 11819-CHA (February 24, 1994), and C. Harral (ed.), *Transport Development in Southern China* (World Bank Discussion Paper No. 151, February, 1992). Those sources are generally consistent with the evaluation in other studies during the early 1990s.

In order to address the three primary problems it identified – (i) widespread traffic volume/capacity congestion problems on the main networks in the face of rapidly growing demands, (ii) lack of access for large portions of the rural population, and (iii) large-scale pavement strengthening/ maintenance requirements[5] – the Bank at the time suggested that solutions would be found through (a) large increases in finance for highways, (b) greater efficiency in utilization of resources, and (c) improved methodologies for investment planning and determination of priorities in the face of inevitable constraints on capital availabilities relative to demands, no matter how large the increase in funds that might be made available. Measures to improve the efficiency of resource utilization were further identified as (d) new road data bases to provide timely information on traffic and road conditions and support better planning, design, and maintenance decisions (e) introduction of comprehensive life-cycle-system-cost techniques, such as embodied in the Bank's Highway Design and Maintenance Standards Model; (f) increased freedom of competition in procurement with reliance on market-determined construction technologies and prices; coupled with (g) better supervision and quality control of construction. In most, but not all, aspects, the thinking of the Bank and Government of China (GOC) decision makers proved to be closely aligned during the ensuing decade.

The first strategic decision of the GOC was to greatly expand highway investments, which increased each year from 1992; funding for county and township roads, for example, increased 10-fold from 1992-1996 (from 1.7 to more than RMB 17.6 billion (>US$ 2 billion) per year.[6] However, much the largest increases came in the wake of the Asian currency crisis in 1997 (which itself followed a slowing of the growth of the Chinese economy over each of the preceding 5 years), and were undertaken partly as a counter-cyclical measure.[7] Highway investments were more than doubled from US$13 billion per annum in 1997 to more than US$27 billion per annum in 1998 through 2000, and further increased to US$32 billion in 2001 and US$38 billion in 2002.[8] A wide array of different financing techniques and sources were employed to produce the required funding, as discussed below.

The other major strategic decision of the Government of China was to give first priority to the construction of a nationwide system of arterial highways, which took 60% of the total funding, while 25% of funding went for improvement of existing roads and only 15% went to rural roads construction. China's road network officially grew by some 443,000 km (from 1.32 to 1.77 million km, or 34%) over 1993-2002. The centerpiece of the program was the National Trunk Highway System (NTHS), which received 30% of total funding. Planning for the NTHS had gotten underway in 1986 when the central Ministry of Communications was given the responsibility to develop a plan to link all cities of China with population of 500,000 or more with modern high-standard highways. The plan initially called for a network of 30,000 km (later extended to 35,000 km) of arterial highways to be completed by 2020, and

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[5] While the high incidence and costs of road accidents were noted, this problem was not singled out as a priority by either the Bank or the Government of China in the early 1990s.

[6] J. Yenny, "China Highway Strategy Review," draft report to World Bank (July 27, 2001).

[7] The Minister of Finance estimated in 2000 that the counter-cyclical effects of the massive increase in infrastructure construction, particularly roads, raised China's GDP by a full two percentage points over what it would otherwise have been. J. Yenny (2001).

[8] World Bank TUDTR, "Core Road Performance Measures and Indicators" October 20, 2003. The China Transport Sector Brief (March 1, 2004) states road investment in 2002, including construction and maintenance, totaled "roughly $45 billion".

construction got underway in 1992. By the end of 2002 some 27,000 km (or 77%) of the planned 35,000 km of the NTHS had been constructed, including 25,130 km of expressways (minimum 4-lanes with controlled access) and the target date for completion of the NTHS had been advanced to 2007. In addition, another 25,600 km of 4-lane dual carriageway highways without controlled access features had been completed. The breakdown of the remaining 390,400 km of new roads across the different functional classifications is not available, although the likelihood is that these were mostly lower standard rural roads.

The completion of an arterial highway network of over 52,000 km in little more than a decade is an extraordinary accomplishment,[9] *which promises to fundamentally alter the economic geography of China, reducing the economic distance of the heavily populated, impoverished central and western regions from the prosperous coastal regions and integrating those markets.* The superior service characteristics of road transport – frequent, timely, door-to-door delivery, with reduced handling and cargo casualty – will facilitate relocation of manufacturing industries to the lower-wage, labor surplus markets of the interior, and should contribute substantially to reducing regional income disparities.

How was this feat accomplished? What problems were encountered and how were they overcome? What are the current problems that have yet to be resolved satisfactorily and the prospective problems that can be anticipated for the future? Finally, what aspects of this experience are relevant for, or transferable to, India today?

The answer to the first question has already been foreshadowed above: (i) a dramatic increase in resources allocated to highway development. This was coupled with simultaneous measures to improve the efficiency of utilization of those resources through (ii) improvements in investment planning and design, (iii) greater reliance on competitive forces (including international competition) in award of construction contracts, and (iii) improved supervision and quality control in execution.

Of all these measures, **it was the first – the huge increase in funding – that brought forth the largest innovative efforts over previous practices**. A wide spectrum of measures, several of which have the characteristics of temporary expedients that will have to be substantially restructured or replaced for the long run, was employed to meet the immediate exigency of funding the explosion in road expenditures. The three mainstays of China's road user charges system – the misnamed Road Maintenance Fee (US$10 billion in 2002) the Vehicle Purchase Fee (US$ 4.5 billion), and the Highway Transport Management Fee (US$2.5 billion) – all largely unrelated to road use, and not formally part of the government budget – have contributed only about one-quarter of new construction expenditures. The Government has so far been unable to agree on a fuel tax for road construction – although one was authorized by the new road law in 1998, it has not so far been implemented – consequently vast additional sums had to be sought elsewhere.

Tolling of improved roads had already been introduced and widely practiced in China prior to initiation of the NTHS program, and it was decided from the beginning that the NTHS (like most other major new roads) would be operated as toll facilities. That decision, of course, did not provide the immediate finances for construction of the network, or its first years of

[9] By comparison, the United States began work on the 69,000 km Interstate Highway System in 1956 and its construction extended for more than 30 years.

operation before growth of traffic generated significant revenues. Financing of the construction of the NTHS and other major components of the highway development program has involved both public and private finance, the latter largely equity, as long-term debt from private sources has not generally been available without government guarantees.

The innovations in road finance, some more successful than others, have included extensive efforts to engage private finance to complement public funding. During 1990-2000, there were more than 80 cooperative joint-venture (PPP) road projects (concentrated mainly in the coastal provinces) between Hong Kong developers and provincial or municipal authorities which mobilized some RMB 75 billion (>US$9 billion) from private sources. In addition, since 1996 asset securitization (sale of equity in existing toll highway companies) raised another RMB 16 billion (US$2 billion) through listing of eight expressway development companies on the domestic stock exchanges and five in Hong Kong. The absolute magnitude of private finance is thus significant—and quite large relative to that achieved in any other emerging economy – but the total has been well under 10% of the total funding committed to road investments in China over this period.

The disinterest of institutional lenders (such as insurance companies and pension funds) in providing long-term debt to support road development in China in the absence of a government guarantee is a major constraint, as the amount of equity available for this type of venture has a finite limit (and that limit is a function of the expected rate of return on equity, which is itself heavily dependent on the availability of debt leveraging). "In the absence of a well structured legal and regulatory framework, most mainland companies do not have access to sources of long-term domestic funds from institutional investors (such as insurance companies) and are not able to raise adequate renmembi from domestic banks."[10] Only a few major Hong Kong developers with large project portfolios and relatively low credit risks have been able to issue corporate bonds in the US markets.

Thus, the great majority of financing for roads in China has been secured from public sources, either directly from the government budget or through government borrowings or guarantees. A notable feature over recent years (since 1998) is that virtually half of road development has been financed by domestic bank loans guaranteed by local government and by central government bond proceeds which were on lent to local governments.[11] This mode of finance, too, is unlikely to be sustainable at these magnitudes over time.

It must also be noted that the application of tolls has caused important operational problems, the most significant of which has been substantial traffic diversion, reducing both the financial and economic rates of return, as older non-tolled facilities have continued to carry heavier traffic in many cases than the newer, high quality facilities. This problem is expected to attenuate over time as total traffic volumes, incomes of motorists and associated values of travel time all continue to increase rise, but the short-run costs have been significant, and have also enlarged the financing required to bridge the initial deficit period after construction until traffic and revenues ramp up. Fragmentation of ownership and operation of the toll network has also caused other operational inefficiencies – e.g. more than 300 toll stations were reported in place in Guangdong Province alone in 2001, with the excessive segmentation increasing the costs of

[10] M. Bellier and Y.M. Zhou, *Private Participation in Infrastructure in China* (World Bank, 2003), p. 49.
[11] J. Yenny (2001).

construction and operation, causing road users much unnecessary delay, and magnifying risks for investors and lenders.

Arranging sustainable, economically efficient sources of finance for a highway system that is still expanding rapidly, while at the same time maintenance and rehabilitation demands are mounting, is as yet a major unresolved set of issues in China. The elements of a solution, if not a clear understanding of the economic effects of different options, are identifiable from traditional sources of finance as well as from the extensive experimentation that has occurred over recent years. First, of greatest importance, a fuel tax was mandated by the new road act of 1998; although it is yet to be implemented, the potential is of major magnitude, particularly as retail fuel prices remain low by world standards.

Second, now that a large, new system of high-standard highways is in place, the volume of toll revenues is already substantial and will grow as both freight and particularly passenger traffic continues to grow exponentially. Merging of toll segments under the umbrella of provincial (or regional) toll road authorities could present operational economies, diminish investment risks by pooling of diverse segments, and provide the opportunity to finance further expansion of the network on the security of revenues from existing segments. Further, as financial markets and associated regulatory systems mature, there is likely to be growing potential for domestic long-term debt/bond financing for the toll road entities, with and without government guarantees. Bellier and Zhou (2003), provide an excellent overview of the potentials of private finance and a blueprint for exploiting those potentials for highway finance in China. These potentials should not be exaggerated, however.

It must be recognized that the magnitude of funding required, as well as the strong public goods characteristics of roads (including indirect benefits to society that are not captured directly by road users), will normally dictate that the dominant portion of resources for roads development come from public funding. While there have been several studies of financing options for highways development (including at least two with Bank support[12]), a comprehensive study of road financing options that considers the *economic as well as financial dimensions* could be very helpful to China in assessing its options and resolving its choices at this point in time.[13]

1.2 Improvements in Investment Planning and Design Standards

Modern techniques for highway planning and management, including the Bank's Highway Development and Management Model (HDM-4) and derivative programs, including Pavement Management Systems (PMS), have by now been widely disseminated in China. Feasibility studies – which, *inter alia*, search for the least costly technical solution as well as require net benefits in each case at least equal to the expected social rate of return – are commonly done for all major highway investments. Road data bases are also increasingly being built up which will enhance the value of such tools in maintenance management and in considering strategic choice issues such

[12] The first was included in the Second Highway Project (Beijing-Tianjin-Tanggu Expressway, 1985) and a second one in the Guangdong Provincial Highway Project (1995).

[13] Although it does not deal specifically with China or India, a particularly well balanced treatment of both economic and financial aspects of private participation in road finance, ownership, and management is available in J.A. Gomez and J.R. Meyer, *Going Private: The International Experience with Transport Privatization* (1993). The discussion there of the history of toll roads development in France, which also suffered a series of ups and downs in the early years of development, suggests many parallels with China's experience during the past decade.

as the design strength of pavements, and the priority of maintenance and rehabilitation vs capacity expansion of existing networks, or new construction to extend networks.

This review has, however, turned up no evidence to indicate whether China's decision makers engaged such tools in systematic analyses to arrive at their fundamental decision to give first priority to developing NTHS and other arterial networks (and to develop fully half of those networks to expressway standards) ahead of the secondary, tertiary, and quaternary networks – a decision which shaped the principal thrust, content, and scale of China's massive highway development program after 1992.[14] It may simply have been a political decision taken at high levels, with the scale subsequently influenced by macro-economic counter-cyclical objectives.

1.3 Procurement of Works: Design, Competition, Supervision, and Quality

No major public works program, let alone one of the dimensions of China's highway development since 1992, can be accomplished without a high capacity for problem resolution. World Bank records reflect many problems, starting from its first highway projects in the mid 1980s with some similar problems recurring even in the most recent projects. Indeed, a too hurried reading of the project reviews over the years – with their primary focus on problem identification and resolution – could lead a careless reader to the impression that there has been little but problems. The ultimate outcome reflects something far different. For its part, during the period 1992-2002, the Bank was heavily engaged in the highways sector, continuing the implementation of 6 of the 7 projects approved in earlier years, while also approving 22 new projects for an additional commitment of US$ 4.9 billion. So far 16 projects have been completed, and OED audits are available for 12 of these. The overall outcome rating was Satisfactory for all 12 projects, institutional development impacts were rated as Substantial for 10 and Moderate for 2, while project Sustainability was rated as Highly Likely for 2 and Likely for the other 10.[15]

Many formidable obstacles had to be overcome, but the problem solving capacities of China's civil works industry, fueled by vast sums of money, and assisted in some key aspects (e.g. transfer of modern technologies in highway design and construction, together with proven contractual structures) by the international community, rose to meet the challenge. Nonetheless, it must be recognized that the result today is to a significant degree a 'dual economy' structure, with a highly modern industry existing side by side with a large residual industry still burdened with obsolete technologies, organizational structures and public procurement procedures that are not sustainable.

The industry – in its various facets of design, tendering, contracting, supervision and quality control – is far from mature. While quality of construction for arterial highways procured under ICB contracts is tightly supervised, there have been significant quality problems to be overcome

[14]Levy's 1994 highway sector study, which was discussed with the GOC, raised the issue and did explore related matters (e.g. time-staging of expressway development), but by then the governmental priority to NTHS over all other road investments was already clearly established. J. Yenny (2001) again raised the issue of appropriateness of the high standards employed in the NTHS, especially for the remaining lower priority segments which had not already been constructed, and suggested that some reallocation of resources from NTHS and Class I arterial highways to lower-class roads, particularly to spot improvements.

[15] Cordula Thum, "The Bank's Assistance to China's Transport Sector (1983-2001)", confidential draft report to World Bank OEDCR (2002).

even under ICB contracts. Because of problems with engineering design (e.g. insufficient soil investigations) in earlier Bank-financed highway projects, from 1991 onward the Bank utilized Consultant Trust Funds to engage international consultants working with local design institutes in the preparation of engineering designs. More recently, the Bank has dealt with the issue by including a highway design specialist for detailed review in project preparation missions. However, the problem of under-design of pavements – to meet the official legal limit rather than the actual much heavier loadings – has so far defied resolution, with the result that China will soon be facing large outlays for pavement strengthening that could have largely been deferred by several years at low marginal cost.

China has not yet generally adopted FIDIC principles according to which the Owner, Supervising Engineer, and Contractor should be separate and independent entities. While there has been growing independence of the contractors from the highway administration, there is as yet no independent supervision industry, and the staffing of the supervision units is still predominantly provided from the local highway administration. The contracting industry itself has not yet completed the transition to the market economy, and there are still very many contracting organizations functioning as traditional subsidized state-owned enterprises, contributing to a pervasive problem of very low bids, which undermines efforts to develop and sustain a growing cadre of managerially and financially independent contractors. Construction quality has also been a persistent problem, but, following collapse of some bridges in 1999, new laws were passed placing lifetime responsibility on designers and contractors for faulty design or construction.[16]

1.4 Reflections on China's Highway Development Experience

1.4.1 Choice of Investment Priorities. China made a clear-cut choice to give first priority to developing large arterial networks to high standards. Given the huge increase in funding for road development, substantial expenditures were also laid out for secondary and lower echelon road developments, but priority was given overwhelmingly to the NTHS and the other 25,000 km of 4-lane dual carriageway highways beyond the NTHS. The World Bank generally supported this strategy, both in its sector studies[17] and in its large lending programs.

It is reasonable to ask whether the vast sums spent developing the arterial highway networks were too much, too soon, too far ahead of demand, and whether, for example, expressways could have been developed in a modular, time-staged manner by initially building two lanes and subsequently adding the second carriageway after traffic had ramped up, or building 4-lanes without costly controlled access features. Levy did pose just such questions in his 1994 study of highway development strategy, and concluded at that time (when construction of the first, highest trafficked segments of NTHS was just getting underway) that time staged developments would likely quickly be overwhelmed, and subsequent upgrading would, on balance, be more costly. Given the continuing rapid growth of traffic since 1994, and the level of traffic

[16] Yenny (2001).

[17] Levy, *op.cit.* supported the priority of NTHS in his 1994 study, but 7 years later, after the majority of the NTHS had been constructed, Yenny (2001) began to argue that the highest priority segments of NTHS had been achieved, and that a re-evaluation of priorities would be appropriate. Nonetheless, subsequent Bank projects have continued to support completion of the NTHS, together with lower-level roads feeding into the NTHS, as requested by the Borrowers.

congestion throughout much of the network, it seems probable that the decision was correct, at least for much of the network which has subsequently been developed.

However, it is clear that the decision to charge for the use of the roads by direct tolling has substantially reduced the economic benefits to China from these huge investments, at least in the short run (which weighs most heavily in any proper analysis of net present values). A different method of collecting road user charges that caused less traffic diversion from under-utilized expressways to parallel untolled but congested highways would generate much higher benefits to China from these sunk investments. ADB as well as the World Bank have given attention to the toll diversion problem, but no satisfactory resolution of the problem has yet been agreed in China. Over time growing network congestion combined with increasing incomes and associated values attached to travel time are likely to mitigate the diversion problem, but the economic losses in the interim will be substantial. Further attention to this problem should be accorded high priority.

A competing priority that is now mounting is the need for more timely maintenance and particularly pavement strengthening. New construction has diverted maintenance funds, and egregious pavement design choices – to design to notional legal axle limits that are rarely honored – are creating a premature but increasingly urgent requirement for pavement strengthening. If caught in time, prior to structural failure of the existing pavement, strengthening overlays can provide a solution for a fraction of the cost of rehabilitation or reconstruction. A still much cheaper solution would be proper design *ab initio* to axle loadings that can be actually be expected to occur.

The other priority area for concern is road safety. Accidents prevention measures have only recently begun to attract the attention required. Among the international institutions, the ADB has provided an excellent blueprint for action in this area,[18] but the problem is a vast and complex one that merits combined efforts and far more attention than it has received to date. World Bank efforts have been limited largely to improved engineering design of highway infrastructure, an important facet, but not by itself adequate. A coordinated approach, including education and traffic law enforcement, together with development of insurance systems that impose accountabilities on poor driver behavior, is needed.

1.4.2 Financing Modalities. Much has been made of the fact that China has drawn more on private finance for highways development than any other newly industrializing economy through a wide variety of instrumentalities. While, as noted above, something more than US$ 11 billion of private finance has been raised, primarily in equity, the amount is well under 10% of China's total road investments during this period, and evidence is mounting that the limits on these structures may already have been breached, at least for the short run and under present regulatory policies, with some major players now seeking to reduce exposure. If the role of private financing is to be sustained and developed further, at least two major reform measures are recommended.

The first would be a staged regrouping and restructuring of the myriad of toll operators into larger (probably provincial- or regional-level) toll authorities pooling several toll assets that would permit cross-subsidy from mature, profitable segments to newer or weaker segments and

[18] ADB, *Road Safety Guidelines for the Asian and Pacific Region* (1998).

better manage risks. The second would be revised regulatory policies for the financial markets, particularly to allow non-bank institutions such as insurance companies and pension funds into the loan and bond markets for infrastructure, and associated improvements in governance and reporting.[19]

Ultimately, however, it must be recognized that the major burden of financing highway infrastructure will continue to fall on public finance, particularly as road building efforts are increasingly centered on development of the more impoverished central and western provinces and are focused more on lower-volume secondary and lower-order networks. Implementation of the fuel levy which was authorized in the new roads law in 1998 would be expected to produce a more sustainable source of funding than the ad hoc instrumentalities that were called upon to bridge the funding gap during the explosion in road building activity during recent years. Perhaps one day a workable technology will be invented that will permit toll collection for the entire road network, which could mitigate traffic diversion caused by the existence of parallel tolled and untolled roads, but such a system has so far eluded intensive development efforts.[20]

1.5 Highway Lessons from China of Potential Relevance to India

With the adoption of economic reforms, India's GDP growth accelerated to an average annual rate of 6.1% over the decade (1992-2002), substantially above earlier growth rates,[21] but well below those of China. Rail passenger traffic (pkm) grew at 4.6%, but freight traffic grew at a rate of only 2.7% as passenger trains continued to preempt constrained rail line capacity, there was little investment in capacity expansion, and insufficient funding for maintenance of track and equipment resulted in deteriorating performance and further constraints on throughput. Despite limited expenditures on development of modern highways and increasingly congested traffic conditions, trucking absorbed the major share of growing freight and passenger traffic, in part by continuing to overload trucks by wide margins, thereby accelerating road deterioration and worsening an already severe road accidents problem.

Are there lessons, positive or negative, to be learned from the sharply contrasting experience of China that might be helpful today for India's decision makers, in the various facets of both private industry and government, in approaching the challenges of the next decade, as well as for the World Bank in shaping its own country assistance strategy for transport?

1.5.1 Highway Finance: (i) Funding Levels and Choice of Priorities

As noted earlier possibly the most important of many contrasts between China's and India's performance in the transport sector has been the vastly larger outlay on highways, and the primary focus thereof on the arterial networks. In an otherwise exemplary study of highway

[19] Bellier and Zhou (2003).
[20] In a joint effort to develop a high-tech system for toll collection for the Government of Germany, Deutsche Telekom and Siemens have reportedly lost hundreds of millions of euros, and are not yet in sight of a workable solution.
[21] 3.5% per annum over 1972-1982 and 5.6% over 1982-92.

financing and road use pricing and taxation for India, Vickers et al. (2004)[22] relied on an estimate of highway development and financing requirements that, for unexplained reasons, *excludes any expressway development* or allowance for making up the backlog of maintenance (except as covered in the proposed upgrading program). That estimate, based on an application of the HDM-4 model, arrived at an astonishingly modest requirement for upgrading of about 15,000 km of National Highways from 2 to 4 lanes (apparently without controlled access) and an additional 16,500 km from intermediate to 2 lanes at a total cost of Rs 1,098 billion (US$ 23.9 billion). For state highways, the analysis indicated that about 25,000 km would require upgrading to 2-lane standards at a cost of Rs 623 billion (US$13.5 billion). The total requirement thus estimated for India over the next 10 years, US$ 37.4 billion, is actually less than China's current *annual* highway outlays (variously estimated at US$ 38 to 45 billion in 2002).[23]

It is unclear whether the analysis found no requirement for expressways, or such component was excluded merely due to some technical difficulty, e.g. because of the inability of HDM-4 to properly model the benefits of controlled-access features of expressways (a major safety feature). The exclusion of controlled access facilities from India's highway development plan, in sharp contrast to the choices made by China's highway planners, would also contradict the findings of earlier World Bank and ADB analyses, including the Country Assistance Evaluation by Hernan Levy (2002) which concluded that "development of a modern interstate highway system should be considered the most important single priority in India's transport sector."[24] It is also inconceivable to this reviewer (who spent many years concerned with the issue of the engineering-economic tradeoffs in highway design standards, and has traveled many km of highways in India, including the new toll roads from Delhi to Jaipur and Mumbai to Pune) that a system of modern access-controlled expressways would not be economically justified in India today. Because of the continuing problem of the mixture of pedestrians, non-motorized and other slow-moving traffic on India's highways, access-control features are particularly important for safety and efficiency of use (particularly realization of the much higher speeds and associated traffic carrying capacities for which modern highways are designed). Consequently, Vickers, et al. estimate of highway funding requirements is viewed here as a significant underestimate of economically desirable levels of highway funding.

1.5.2 Highway Finance: (ii) Private Sector Participation

Whereas China pursued bold experimentation across a wide range of models for private sector participation, in a very dynamic, sometimes ill-defined capital market, India so far has been far more cautious and its markets for private sector participation (PSP) have been more orderly and transparent, reflecting in part their relative maturity, including a better developed legal and regulatory infrastructure. A model concession agreement has been in use since 1997. Vickers, *et al.* (2004) provides an excellent overview and blueprint for further development of private finance of highways in India. While nearly 80% of all projects executed for the National Highway Development Program (NHDP) have been ordinary cash contracts paid from the

[22] Piers Vickers *et al.*, "India: Financing Highways," World Bank Report No. 30363-IN (2004).
[23] See footnote 8 above.
[24] Hernan Levy, "INDIA: Evaluation Bank Assistance for Transport Sector Development in the 1990s: A Country Assistance Evaluation," report for World Bank Operations Evaluation Department (2002). A study for ADB (c 1997) also estimated a need for 10,000 km of expressways by the year 2015, as cited in World Bank, *Indian Road Construction Industry: Constraints and Impediments* (November 1999).

budget of the National Highway Authority of India (NHAI), the NHAI has so far contracted for some 920 km of the NHDP network under BOT or annuity concessions, for a total value of US$ 1.4 billion; other BOT projects are being undertaken under the auspices of the various state Road Development Corporations.

Unlike China, banks in India have been willing to provide non-recourse debt (i.e. loans without formal government guarantees) for BOT highway projects with debt/equity ratios as high as 75:25 in the case of NHAI (which is viewed as implicitly guaranteed by GOI) or 70:30 in the case of state BOT projects. Although GOI has considered lowering the maximum public contribution to 25%, so far NHAI has been able to provide up to 40% of the total costs of the project, with as much as 30% in equity. NHAI receives its budget partly from the Central Road Fund based on the fuel cess, but NHAI can also borrow or sell bonds, and is capable of raising about US$ 1 billion per annum; so far it has raised about US$ 1.5 billion from various bond issues and another US$ 1.3 billion in a line of credit from the Life Insurance Corporation (LIC), which is the only NHAI debt instrument that is explicitly backed by the GOI.

While Vickers, et al. (2004) recommends a number of measures to strengthen the enabling environment for private sector participation in highway funding in India, the financial markets in India are already reasonably well developed compared with those of China, and there is clearly a substantial potential for private funding of highways development. The ADB in late 2004 awarded a major technical assistance contract to assist NHAI in developing an additional 10,000 km of high-density highways with private sector participation. The potential for expanding the role of the private sector in highway development in India appears high, particularly given that it is the high-volume networks that are now most in need of development, in contrast with the situation now prevailing in China. It is to be hoped that the potential is in fact realized, as it is unlikely that government in India, either at the central or state level, will be able to make anything near the level of contribution to highway finance that government in China has been making over the past decade, and is continuing to make today.

1.5.3 Procurement of Works: Design, Competition, Supervision, and Quality

India resisted the possibility of international competitive bidding for several years, so that the World Bank was precluded from financing highways until 1985. Subsequently, a variety of obstacles have prevented international contractors from participating other than as junior partners with local firms, and the expected benefits of ICB have not materialized in India, in contrast to China's experience where foreign companies introduced new technologies and work organization which brought about substantial change in the domestic contracting industry. [25] The growth of capability of India's contracting industry has been stunted by various protectionist measures, and when the GOI proposed in 1997 to almost double the annual investment in roads from just over US$ 1 billion per year to US$2 billion per year, there was wide concern that the industry would not be able to achieve such a large leap in output. A national seminar organized by the Central Road Research Institute in May 1997 identified the following concerns:

- Inadequate number of capable domestic contractors

[25] Levy (2002).

- Lack of clear understanding of laws relative to taxation and repatriation of profits by foreign construction companies
- Inappropriate and inadequate provisions for pre-qualification and final selection of the contractor
- Poor quality of design and supervision
- Poor working relationships between the contractor, employer, and the engineers
- Delayed and inadequate decision-making processes
- Poor experience of joint ventures between foreign and Indian contractors
- Poor quality of projects 'at entry' i.e. on initiation of contracts due to problems with land acquisition, site/environmental clearance, project design, and co-ordination among various agencies.

Consequently, the World Bank joined with the GOI and industry representatives to convene a Task Group on the Indian Road Construction Industry to assess the capacity of the industry, identify constraints, and recommend solutions. Its draft report was issued in May 1998 and discussed in seminars in India and Europe before being finalized in November 1999. The Task Group basically concurred in the findings of the CRRI seminar, and further noted that:

- The organizational setup for contract management by the Employer (i.e. road authority) was not generally suited 'to professionally handle jobs of large magnitude'… Customary international practices under FIDIC- type contracts involving well-defined roles for the Employer, Engineer, and Contractor were often not observed, with constant referral of requisite decisions up the bureaucratic chain-of-command a common practice, even in Bank-financed projects.
- The 7.5% preference for domestic contractors had distorted the ICB process, since foreign contractors consequently took the minor role in joint ventures and in doing so largely abdicated management authorities and responsibilities
- Delay in payments was a recurrent problem.

The Task Group made recommendations to address all of the identified problems. However, Levy (2002) detected little progress in the development of India's road construction industry and specifically contrasted its development with the more favorable development of that in China, which he attributed in significant part to the latter's more enthusiastic embrace of International Competitive Bidding and the customary FIDIC roles of Employer, Engineer, and Contractor.[26] We agree with this interpretation, and endorse the views of Levy and the Task Group on the Indian Road Construction Industry to move to strengthen competition in the road construction industry and support FIDIC structures, which have been well tested over time in many countries.

[26] In contrast, and in interest of balanced reporting, it is noted that the April 2002 Initial Completion Report for the Second National Highway Project found that "…as a result of this project and other externally aided projects, there has been a major improvement over the last decade in the Indian road sub-sector, with respect to road engineering practices, construction techniques and standards, and procurement and contract management practices… With the use of standard technical specifications and standard FIDIC-based contract agreements, a very large domestic human resource (PWDs, supervision consultants and contractors) with knowledge of modern highway construction and contract administration practices has developed in India." While some progress along these lines must have been made in India, the view taken here is that it is much too little, much too late to meet development needs of the Indian economy, and it certainly has been dwarfed by the transformation that has taken place in China.

We would add that the sheer pressure of the much larger magnitude of construction program in China simply forced Chinese authorities to shed the constraints of traditional past practices, either by transforming the old construction entities or simply bypassing them in favor of new enterprises – both practices were in fact pursued. Once large-scale expansion of India's road building program gets underway, similar forces will almost certainly come into play.

1.5.4 Pricing Distortions: Intra-modal and Inter-modal

Much has been made of the problem of traffic diversion caused in China by tolling the new highways where parallel untolled facilities are available. The same problem exists in India today (albeit in incipient stages, given the relatively modest amount of modern highways that have so far been constructed there). Moreover, India has a further pricing distortion not shared by China. China made explicit decisions in the late 1980s to relax controls on passenger transport that had, prior to that time, restricted Chinese citizens to one of the lowest levels of per capita travel of any in the world. By then, road transport passenger fares and volumes were already pretty much determined by the market, but railway fares were still controlled and subsidized to a significant degree. It was decided to raise rail passenger tariffs to profitable levels that would cover costs for additional track and equipment capacity, and let the market determine traffic volume. Passenger travel by both road and rail have been rising rapidly since, in something approaching a genuine market-based outcome for both price and volume.

The situation could hardly be more different in India today. As indicated above, government levies on road transport (be they user charges or taxes) far exceed government expenditures on the roads. Moreover, Vickers, et al. (2004) further shows that passenger buses bear a disproportionate share of government levies, while heavy trucks do not carry a commensurate share. Those distortions, however, are relatively small compared with the intra-modal distortions within the railways, which have been forced – in order to cover heavy losses on under-priced third-class (particularly local and suburban) passenger services and to cover the overall high operating costs due to low productivity of labor and equipment – to raise tariffs on freight to such high levels that much traffic that would normally be expected to move by rail has been diverted to the roads. Thus, rail freight is overpriced relative to road freight, and rail passenger movements are underpriced while passenger movements by road are overpriced. While we have not attempted to estimate the cost of these distortions to the Indian economy, they are surely of large magnitude, not least because rail capacity better suited to freight services has been preempted by non-profitable passenger services. India would benefit substantially if it elected to follow China's example in moving rail passenger pricing closer to economic costs and at the same time moved to substitute less costly services by road for low volume local rail services.

Unfortunately, for China there is no proper economic (as distinct from financial) study of road user costs and charges comparable to the recent study by Vickers, et al. (2004) for India.

1.6 Reflections on Transferability Issues

For approximately the first four decades after Independence, India was stuck in a low-growth mode, with socialist policies emphasizing distributional, rather than growth goals. In a relatively static situation, it perhaps should not be surprising that distributional issues are paramount, as, in

effect, the economic game being played is a zero-sum game – significant gains by one party are achieved primarily at the expense of another party. In such a context, there is great reluctance to embrace change and great inertia in political as well as economic institutions.

By contrast, in a high-growth context, redistribution of existing wealth is less important than creation of new wealth. Since the onset of economic reforms in 1978, China has, of course, been pursuing a phenomenally successful growth policy. An average annual growth of 9% compounded for 25 years generates an income nearly 9 times the initial level – truly an economic revolution in the course of one generation, that must fundamentally alter the perceptions, hopes, fears, and attitude toward change of the average citizen.

Since the onset of economic reforms in the early 1990s, India appears to have shifted gears from a low-growth to at least a moderately high-growth dynamic. In order to sustain that momentum, however, a large expansion in transport infrastructure will be required. The road transport industry cannot continue to carry ever heavier traffic at reasonable costs without relaxation of the highway infrastructure constraints. Service quality dimensions – speed, frequency, and especially dependability of delivery times as well as safety – will increasingly outweigh more narrowly defined transport costs, and these attributes, already at low level, will deteriorate further if congestion continues to worsen. Indeed, a recent study of automobile manufacturing industry in India by Sumila Gulyani[27]indicates that transport service quality dimensions have been more important than narrowly defined transport costs in determining the structure and geographical patterns of auto manufacture, as the industry was forced into innovative adaptations to compensate for the severe limitations of India's transport (and power) infrastructure.

China has shown what a dynamic road industry can do when faced with the challenge – and provided commensurate resources, that are in turn generally well managed. Specific steps worth consideration by India include:

1. A large scale increase in road infrastructure investments, particularly in the arterial networks, based on careful sector and project studies of economic priorities, oriented to relieve transportation bottlenecks and improve the speed, frequency, safety, and dependability of transport services.

2. To avoid further overloading an already strained government budget, funding for the additional highway expenditures must come from new and diverse sources. India may choose to rely in part on a larger role for increased cess on fuel, as recommended by Vickers *et al.* (2004) and most other economists who have considered the matter. Ultimately toll collections from the networks to be built can also contribute substantial funds, but immediate capital demands to expand and upgrade the network will require large scale financing to bridge the gap. Fortunately, India's more mature capital markets will support generally greater leveraging of public funding by private sources. In addition, also unlike China, in India equity can be leveraged substantially by long-term debt from institutional investors (insurance companies and pension funds), some without government guarantees and more with limited guarantees. Thus, while the

[27] Sumila Gulyani (2001), *Innovating with Infrastructure: The Automobile Industry in India* (Palgrave, St Martin's Press).

prospects for public finance are more limited in India, the short-term as well as long-term potentials of private finance are rather more promising.

3. India is also well positioned to avoid or minimize the problem of a myriad of short tolled segments with attendant high costs of collection and delays to travelers by grouping toll finance initiatives through statewide or region-wide highway corporations which can pool assets to reduce operational costs, improve risk management, and facilitate network extension through securitization of revenue streams from existing assets, rather than through piecemeal project segments. However, care needs be exercised that the Road Development Corporations that have been established in several states are indeed action-oriented to solve problems, and are not allowed to become another bureaucratic layer that is one more obstacle to individual initiative. The Chinese decision to draw upon private entrepreneur developers may have lacked a perfect blueprint, and the immediate result may not be sustainable in precisely its present forms, but it did create strong incentives to find solutions to problems, with a substantial contribution to development of high standard highways, which were badly needed in China then, as they are in India today.

II. RAILWAYS

2.1 Comparative Railway Assets and Physical Performance (1992 : 2002)

Comparative network assets and performance of China Railways (CR) and Indian Railways (IR) at 1992 and 2002 are given in the Railway Annex 4A. While in 1992 IR had a somewhat larger network infrastructure (including more route km, double track km, and electrified km) and rolling stock (except freight wagons, of which CR had 72% more), the utilization and productivity of the assets was quite different. While the two carried almost the same volume of passengers (314 vs 315 pkm), CR carried 4 ½ times the freight tkm (1,157 billion tkm vs 257 billion tkm) through far more efficient exploitation of track, locomotives, and wagons, and by assigning lower priority to passenger services. IR operations were dominated by passenger services (including suburban operations, a burden not imposed on CR), but, reflecting the fact that India's citizen's enjoyed a far higher propensity to travel, the 314 billion pkm carried by IR constituted only 20% of India's estimated total passenger pkm, while the 315 billion pkm via CR constituted 45% of China's estimated total passenger market.[28] The share of both railways in their respective freight markets had already substantially eroded over the preceding two decades as trucking (and coastal and, in China, also inland water transport) took an ever larger share. That CR's 1,157 billion tkm constituted only 40% of China's estimated total freight market, while IR's 257 billion tkm represented 45% of India's estimated total, calls attention to the far greater freight intensiveness of the Chinese economy at the time (reflecting particularly the vast, long-distance movements of coal). Freight throughput density on CR (21.56 million tkm/route km) was 3.37 times that on IR (6.4).

By 2002 the state of affairs had changed in both countries. Surprisingly, traffic, both passengers (pkm) and freight (tkm), had grown by almost the same percentages, with IR gaining 57% in pkm and 31% in tkm, while CR gained 58% in pkm and 34% in tkm. Since in 1992 CR was carrying 4½ times the tkm of IR, the gain of tkm on CR was slightly greater than 4½ times as large in absolute terms – in fact, the *increment* in CR's annual tkm over the decade (from 1,157 to 1,551 = 394 billion tkm), was larger than the *entire* freight traffic (336 billion tkm) carried by IR in 2002.

China's rail network extension and capacity expansion also dwarfed that in India, as the double-tracked network was extended by 69% (+ 9,400 km), the electrified track km doubled (+8,975 km), and the overall network route km extended by 24% (+ 13,797 km). The latter included 12,367 km built by new local rail corporations, many with private participation (Box 1), owned and operated separately from the National Railway, unlike India, where IR retained a monolithic monopoly for rail services. Over this period, India's rail network grew by only 1% (+682 route km), double track by 10% (+1,519 km), and electrified line by 48% (+5,192 km). The investment outlays of CR over the decade, US$ 85 billion, were nearly 5 times those of IR, US$ 17.3 billion.

[28] Traffic statistics for the railways sector may be reasonably accurate, but statistics for other modes, particularly roads, are subject to wide margins of error, so that reported modal shares should be taken as indicative at best.

Box 1. China's Guang-Mei-Shan Railway

The impoverished eastern region of Guangdong Province and the new deep-water port of Shantou were joined to the booming economy of the Pearl River Delta by the 480-km Guang-Mei-Shan (GMS) railway completed in 1995, one year ahead of schedule, under an ADB project approved in 1992. ADB provided $200 million of the total project cost of $732.6 million, plus technical assistance in two stages to assist in strengthening the management capabilities and commercial orientation of the project executing agency, the GMS Railway Corporation, a special purpose corporate enterprise created and initially wholly owned by Guangdong Province. The first stage focused on the planning and management of the construction process; the second stage involved the transformation of GMS from a construction-oriented development company into a diversified, commercially-oriented joint stock company with railway operations as its core activity. ADB also encouraged private investors, who financed 12 station buildings and 14 freight yards—in 1998, 2/3rds of the car loadings in Shantou port were handled at the joint venture terminals operated by private sector management. Following three years of satisfactory financial performance, GMS was converted into a joint stock shareholding company in 1998, and shares sold in a public offering.

The results of initial operations have far exceeded the forecast at appraisal. In 1998, freight, at 3.5 billion tkm, was nearly double appraisal estimates, and passengers, at 2.5 billion pkm, were more than twice original projections. This must be attributed in part to the substantial marketing efforts of GMS, which has taken several initiatives under a flexible strategy to establish a market niche for GMS in the face of competition from other modes of transport. Favorable tariffs have been provided to bulk shippers and first-time customers. Because of a shortage of wagons for loading, preferential tariffs are applied to freight unloaded on the GMS line. Passenger traffic has been attracted by off-season discounts and by improved quality of services, including computerization of reservations, convenient ticketing offices and hours of operation in stations and private sector ticketing agencies, providing more facilities, and improving the safety and security of the travelling public. The speed of passenger trains has been increased, reducing travel time between Guangzhou and Shantou progressively from 11 to 6.5 hours.

The project and associated developments, including implementation of provincial social programs, have also contributed to a substantial reduction in poverty in the project area. More than 1,100 new jobs in additional iron ore mining operations have been reported, in one of the poorest areas of the province.

Source: ADB, "Project Completion Report: Gaung-Mei-Shan Railway Project," PCR:PRC 23043 (June 1998).

Interestingly, with its limited outlays for new facilities, IR's gain in annual traffic carried per US dollar of investment (14.9 tkm+pkm) over the decade was more than twice (2.2 times) that of China Railways (6.8 tkm+pkm), but the gain in labor productivity was only 61% (from 402 to 648 tkm+pkm per worker) vs the 90% gain on CR (from 728 to 1,385 tkm+pkm). CR's extra capital expenditures purchased not only substantial capacity enhancements on the existing networks and a much extended network, but also labor productivity improvements to achieve an average output per employee more than twice (2.1 times) that of IR. Freight density on CR (25.33 million tkm/route km, for the national railway networks excluding local and joint venture lines), some 3.4 times that on IR's broad gauge network (7.38 million tkm/route km), changed little. The only dimension of operating performance where IR achieved anywhere near that of CR in 2002 was the productivity of passenger coaches, where (at 34,425 pkm/coach day) IR's average was 96% that of CR (35,887).

IR did make up part of its deficit in terms of freight wagon productivities relative to CR, by increasing the daily output per wagon by 54% (from 1,439 to 2,223 tkm), while that of CR actually declined by 8.3% (from 9,924 to 9,100 tkm), reflecting some slight easing of the critical shortage of wagons for CR's clients; the productivity of wagons on CR was nonetheless still more than 4 times as great. Part of that superior productivity is derived from the fact that average speed of freight trains on CR is 33% higher (at 32 kph vs 24 kph on IR). Another part is due to the much shorter detention for unloading; while IR expects these operations to occur only during daylight hours and allows generous free time therefor, CR allows only 3 to 4 hours for wagon unloading, regardless of time of day and, if the consignee fails to unload, CR does the unloading itself at the cost of the consignee and releases the wagon for its next customer. A third part is due to the fact that CR has installed a system-wide Transportation Management Information System (TMIS) and wagon distribution is controlled centrally, although normally

the wagon is released to the nearest client in demand. That operating system allows CR to carry less-than-train-load wagon loads efficiently, in contrast to IR, which has withdrawn from all of India's freight markets except full train-load lots.

2.2 Financial Performance

A summary of reported financial results for IR and CR is given in Table 2 below. The operating ratio for IR is shown to have deteriorated from 0.90 in 1991/92 to 0.96 in 2002. The operating ratio for CR is much healthier at 0.74 in 2002 (based on operating revenue plus construction surcharge).

Table 2: Financial Results for IR and CR, 1991/2 - 2001/2

	INDIA			CHINA		
	1991-92	**2001-02**	**Ratio 01-02 /91-92**	**1992**	**2002**	**Ratio 2002/ 1992**
Employees total (million)	1.65	1.51	0.91	3.41	1.76	0.51
Operational employees (est. million)	1.42	1.3	0.91	2.04	1.39	0.68
Output per operational employee 1000 equated units	402	648	1.61	728	1,385	1.90
Transportation revenue (billion) incl. construction surcharge for CR	INR 137	INR 378	2.76	RMB 69.9	RMB 181.3	2.96
Operating expenses & pensions (billion)	INR 104	INR 343		RMB 24.6	RMB 112.0	
Depreciation	INR 20	INR 20		RMB 11.2	RMB 22.3	
Total working Expenses including depreciation and pensions	INR 124	INR 363	2.92	RMB 35.8	RMB 134.3	3.75
Working ratio %	0.76	0.94		0.35	0.62	
Operating ratio %	0.90	0.96		0.51	0.74	

IR's operating ratio of 0.96 is substantially understated, as the provision of depreciation at 2% of the historical value of assets is well below actual requirements. **If IR were to make adequate provision for annual asset renewal, and *a fortiori* if it were to make adequate provision for the large backlog of overdue equipment and track renewals, it would be shown to be a heavily-loss-making entity in normal commercial accounting terms.** The fact that IR had to defer payment of dividend (interest) due to the Central government on its investments in railways for the past two years is an indicator of just how unhealthy IR's finances actually are.

This is all the more extraordinary because, unlike so many other under-performing and financially stressed railways elsewhere in the world, ***IR's rail monopoly has been greatly protected from inter-modal competition by the failure of India to develop a system of modern highways***. Unlike CR (and most other public carrier railways), IR now normally turns away wagon-load consignments that do not comprise a full trainload, traffic that could surely be financially profitable and more economical to move by an efficient railway than by road.[29]

[29] Eleven bulk commodities accounted for 95.5% of tons hauled and 94.6 % of revenues for IR in 2001/02.

Moreover, in order to provide cross-subsidies to loss-making passenger services, freight tariffs are already above the level that many shippers are willing to pay, contributing to the continuing erosion of IR's share of the profitable freight markets.

At the opposite extreme, the operating ratio of CR is substantially overstated. Since 1991, **freight traffic on CR pays a substantial 'construction surcharge' (about 56% of basic tariff) that is credited to a separate Rail Construction Fund (RCF) held by the Ministry of Finance, but used only for railway capital investments**. If the construction surcharge were included in the revenues used in calculating CR's working and operating ratios, CR would be shown to have a healthy operating ratio. **Further, CR has been a significant taxpayer, contributing positively to the public exchequer**, in contrast to Indian Railways.

It is also to be noted that, **on the expenditure side, IR's staff costs account for an extraordinary 53% of working expenses, while on CR these costs are only 25%**. Finally, it is noted that **all but a small portion of the passenger services that dominate IR's operations are loss-making**. The most extreme case is the 'ordinary stopping trains' as illustrated in Box 2.

Box 2. Profitability of Ordinary Stopping Passenger Trains

The short distance stopping passenger trains are not only a drain on capacity, but remain unviable even at hundred per cent occupancy at the present levels of tariffs. The same is illustrated through a sample calculation given below

Cost of hauling a coaching train per km.	Rs. 301.94
Cost of hauling a passenger train for 250 kms.	Rs. 75,485
Average rate charged per passenger per km. in 2nd class	Rs. 0.11
Earnings with 100% occupancy	Rs. 22,000
Loss per trip at 100% occupancy	Rs. 53,485
Loss per trip at 70% occupancy	Rs. 60,085
Cost of Monthly Season Ticket (MST) per trip up to 150 kms.	Rs. 5.50
Earnings with 100% occupancy with MST	Rs. 4,400
Loss per trip with 100% occupancy and MST	Rs. 71,085
Loss per Trip with 70% occupancy and MST	Rs. 72,405

Even under the best scenario of 100% occupancy and revenue based on full fare, the cost recovery would be only 29%. The cost recovery drops to 6% when all passengers buy season tickets.

This calculation, however, excludes altogether much the largest economic cost to India: the preemption of scarce railway line capacity, precluding freight movements that would be much more economic by rail than by highway – whereas the passenger services could be provided much more economically by road.

Source: *Annual Statistical Statement, Indian Railways 1997-98*

CR has managed passenger business quite differently. Till the late 1980s, government controlled tariffs did not cover cost of passenger services. In order to minimize losses CR kept the volume of passenger business low. The seats on trains were rationed and prospective rail passenger had to wait weeks for a seat allocation. With the transition to market economy it was apparent that this situation would not be sustainable. MOR persuaded GOC to allow substantial fare increases to cover costs plus an element of profit. Once this was achieved, CR then started

increasing capacity for passenger trains. As shown in Table 3, in the decade under review CR's passenger throughput (pkm) increased by 58% and the revenue by 130%. For freight the throughput increased by 34% and revenue by 65%. Significantly, CR's ratio of revenue per pass km to ton km, which had been less than 1 in 1992, stood at 1.4 in 2002. For Indian Railways, this ratio stood at only 0.31.

Table 3. Cost and Fare Structure for IR and CR, 2002

	IR	CR
Passenger pkm % total output	59	24
Passenger revenue % of total revenue	30	41
Average cost per equated unit US cent	0.75	0.65
Average freight tariff per tkm US cent	1.6	0.96*
Average pass. fare per pkm US cent	0.55	1.25

*including construction surcharge of 0.4 c

2.3 Factors underlying China Railways Superior Performance

Very many factors contribute to the performance of any railway system, particularly for such large, complex systems as China Railways and India Railways. At the risk of oversimplification, we point here to just two groups of factors: **(i) physical features and (ii) institutional determinants**. These factors are, of course, interrelated. In comparisons of most railways, since railways are subject to important economies of scale and scope, we would add a third nexus of factors, viz. total transport market demand, intermodal competition, and the resulting volume of railway traffic. However, that set of issues is not of major concern in the case of CR and IR for the 1992-2002 period under consideration, as both railways are quite large systems and both have been in the unusual position of facing more demand (for passengers and freight) than either could handle, since the continuing erosion of modal share has so far been more than offset by growth of total transport demand. Intermodal competition will, however, certainly be an issue of growing importance in future decades, given recent highway developments in China and projected developments in India.

2.3.1 Physical Features

Two dimensions of the physical features are of concern: (i) technology, and (ii) condition of assets.

Many facets of **Indian Railways' infrastructure, locomotives, wagons, coaches, and management information systems comprise older assets that, even when new, did not incorporate performance standards that have since become industry standards** that would be encompassed if the asset were being replaced today.[30] Worse yet – and this seems to be a problem of already serious and steadily worsening proportions for IR – **many of its assets (including way and structures, locomotives, wagons, and coaches) are in a poor state of repair**. Speed restrictions due to poor track maintenance are common, and are not unheard of

[30] A converse example perhaps illustrates the point best: IR's improvement in wagon productivity (net tkm/wagon day) is largely attributable to the replacement of low productivity 2-axle wagons by an increasing proportion of lower tare/higher capacity BOXN wagons.

even in major corridors. Rolling stock is subject to breakdowns in service between normal scheduled maintenance actions. These factors affect not only the productivity of the particular asset, but, given system interdependencies, also propagate shock waves and reduce the throughput capacity of broader network segments.

China Railways has been growing rapidly, and consequently much of its system is new, incorporates higher design standards, has high service reliability and requires less maintenance and less downtime. Moreover, maintenance of older assets is also performed in a timely manner to high standards, so that equipment downtime is low and full productivity is generally sustained. Investments of particular importance in increasing line capacity on congested segments have been automatic block signaling (allowing closer spacing of trains); longer sidings (allowing longer, heavier trains); and electrification of specific segments (for heavier trains, particularly in more difficult terrain). Modern management information systems, such as TMIS and including network operations optimization models also contribute to extracting the maximum throughput from the network.

Had similar investments been made in modernization of IR's congested main corridors, traffic that had to be turned away could have been carried, generating much needed revenues with little additional costs. The one area where IR did invest in improved technology – new, larger freight wagons with lower tare/payload ratios – has, as noted above, sharply boosted productivity of the wagon fleet. The investment budget available to IR has, of course, been much less (barely more than $1/5^{th}$) that available to CR, but it is also the case that **much of the capital budget that was available to IR – as much as 80% by some estimates[31] –has been strung out across a long list of projects with negative or negligible financial or economic benefit, some socially motivated and others simply poor choices (e.g. gauge unification)**. This brings us to the larger, more fundamental issues: the institutional determinants.

2.3.2 Institutional Factors

Commercial objectives and competition. Although China's national railways, like Indian Railways, are still part of a government Ministry of Railways, since 1985 CR has increasingly been run as if it were a commercial, profit maximizing entity rather than a government department or state owned enterprise with conflicting objectives. From 1999 (after a series of pilot projects and experimentation with management and compensation methods) MOR introduced an assets operation liability system (AOLS) under which **MOR entered into management contracts with the 14 Regional Railway Administrations (RRAs), which are engaged in a closely monitored benchmark competition, with clear management incentives, both positive and negative, to encourage profitability, rather than physical targets**. The best performing managers receive significant financial and other incentives, while poor performers are quickly identified and removed.

CR has also undergone major restructuring since 1999, a vertical dis-integration that has separated non-core activities and cut CR staffing rosters by half, down to 1.7 million employees. In accordance with modern railway management structures in almost all countries today, many of CR's former social services (education and health services) have been divested, as

[31] See J. Sondhi, "Comparative Review of Indian Railways and China Railways (1992-2002)", draft report to World Bank (April 2004).

have 38 construction units, 4 railway design units, and extensive manufacturing facilities (for locomotives, coaches, wagons, signaling and communications equipment, and track components). The former CR units which produced these services and manufactures now compete as separate companies to supply the needs of CR and other clients – and management of these entities does not divert the attention of CR's managers, who are now more closely focused on the core activities of railway operations. In addition, in a first step to deal with non-economic branch lines, about 100 such line segments have been separated from main lines on an accounting basis, and some have already been concessioned. Three special purpose companies have also been created to handle containers, special cargo (oversized and perishable cargos), and Post and Parcels.

China's 10thFYP (2001-2005) would go further, calling for the **separation of government functions (regulatory policy and enforcement) from enterprise functions, and separation of infrastructure from operations, introducing competition and enhancing regulation, in what would appear to be an intended emulation of the European Union model of railway sector reform and competition**.[32] The advent of the local and joint venture railways under separate management from MOR could ultimately prove a stepping stone in the direction of opening the railway operations to competition, and a new law has been passed to permit foreign investment in China's railway sector, in accordance with the WTO articles. A possibly faster route to achieving the same end could be separating each of the 14 different RRAs into infrastructure providers and carrier operators, and then permitting the latter to operate system-wide in competition with one another. So far, however, such direct competition in the provision of the end product – rail transport services –has not emerged, and it is not clear whether there is in fact a firm consensus within the GOC to pursue this route, or, if so, how soon such radical reforms would actually take place. Till now, the primary purpose served by the creation of the local and joint venture railways has been to allow extension of the rail network through local initiative and financing to areas without access sooner than would have been possible by relying solely on the MOR, and from MOR's perspective they have served as feeder operations, not competitors.

Even if China does not proceed so far as to implement the full competitive restructuring model intimated in the 10thFYP, it must nonetheless be recognized that there has been increasing cultural change within CR over the past few years, particularly since 1999. It now behaves more like a forward-looking commercial business, with a long-term strategy that is progressing under a management with strong incentives for profitability, which focuses the various departments on a common business plan with one coherent set of objectives, rather than leaving the various functional departments to pursue their own separate agendas.

2.4 Lessons from China of Potential Relevance to Indian Railways

As indicated above, in most dimensions the performance of China Railways has come to surpass (mostly by wide margins) that of Indian Railways, including:

1. Network length and standards
2. Realized throughput capacity
3. Equipment productivity (locomotives, wagons, coaches)

[32] Ministry of Railways, Development & Planning Department, "Tenth Five-Year Plan of Railway Development (Excerpts)" *Chinese Railways* (vol 9, no 2, 2001).

4. Labor productivity
5. Maintenance of assets
6. Financial profitability
7. Restructuring along client-centered lines of business as a modern commercial organization.

CR's superior performance can be attributed largely to six closely interrelated groups of factors:

1. Better focused, less conflicted objectives of the government owner, which is seeking an increasingly market-based commercial determination of price and outputs, relatively free of unprofitable public service obligations and employment generation demands, and is willing to grant railway management relative autonomy to achieve the agreed objectives, together with the associated accountabilities.
2. Commitment to reform (in both government and railway management) to achieve efficiency and profitability, backed by strong individual and collective incentives.
3. Large scale restructuring, including separation of non-core activities and restructuring as competitive supply industries under outsourcing arrangements
4. Introduction of quasi-competition in rail operations (benchmarking of RRAs)
5. Superior financial management, including at least five key facets:
   - 5.1 Willingness of the government to accept market-based pricing principles and output decisions for passenger as well as freight transport
   - 5.2 Implementation of better information systems on costs and profit/loss of specific lines of business, services, and facilities, which are used to control costs (including, particularly, labor costs and non-economic lines of business) and to guide management decisions on prices, and the array and volume of services offered
   - 5.3 Better maintenance of assets, which has sustained productivity
   - 5.4 Application of available investment funds to most productive uses
   - 5.5 Availability of larger investment budgets; and
6. Introduction of privatization through local railway joint ventures and corporatization with sale of shares in existing railway units (including listing in the New York as well as Hong Kong stock exchanges). So far, the main impact has been to increase the amount of funding available for investment in extending the rail network, but the door has also been opened for more extensive privatization, including competitive services under independent management.

Can any of these factors which support the superior performance of China Railways be translated into actionable measures that can be undertaken in India to assist the revival of Indian Railways?

2.5 Indian Railways Prospects for Revitalization and Development

> *"Indian Railways is one of the most studied institutions on the planet. For almost every conceivable question that can be asked there already exists a comprehensive and rigorous report that lays out the facts and indicates the answers. What is striking, however, is that there has been little action on the many reports IR has commissioned, both internal and external."* Expert Group on Indian Railways, The Indian Railways Report 2001: Policy Imperatives for Reinvention and Growth, vol I, p 64.

In our view there are reasonable prospects for revitalization and development of Indian railways provided that there is, first, recognition of the failure of the governance and management of Indian Railways in its present structure, and, second, that there is a genuine, sustained commitment on the part of the new Government of India, in its capacity as the State Owner, to put its house, as well as that of the operating management of IR, in order. It must be recognized, however, that countless others have pursued similar goals over many years, to little effect. After 22 loans stretching over decades, the World Bank finally suspended further lending to Indian Railways in the mid 1980s, after it was finally recognized that there was little significant progress in restructuring IR as a modern railway, capable of providing efficient railway services to meet the needs of the emerging Indian economy.

Most recently, in response to what was perceived as a precipitous decline over the 1990s in Indian Railways' finances and the growing gap between IR's performance and the transportation requirements of the Indian economy, the Government of India appointed a distinguished Expert Group led by Rakesh Mohan on December 31, 1998, to examine IR's situation and recommend necessary actions. The efforts of the Group spanned 2 ½ years, and its well articulated final report[33] was not submitted until July 2001. Its earliest efforts encompassed a brief review of experience with railway restructuring in China and other countries, which was sufficient to demonstrate that the problems faced by Indian Railways were common problems that had earlier been faced by other countries' railways, but no comparison of the performance of IR with CR or other railways was given. Moreover, when that review was done, many of the most important changes that occurred in China Railways from 1999 onwards had not yet taken place or had barely gotten underway.

The main findings and recommendations of the Mohan Report are summarized in **Box 3**. Although the report bears the subtitle "reinvention," it is noteworthy that any significant degree of privatization of IR operations appears to have been ruled out from the beginning, in favor of a continued effort within the existing framework of a corporatized state enterprise. While the experience of China offers some hope that such a strategy, if pursued diligently, can succeed to some extent, experience from several other countries – and from other sectors within India, as well
as experience with earlier reform initiatives for Indian Railways itself – suggests that the probability of a significant turnaround under such a strategy is low. Repeated attempts over the years to improve the performance of Japanese National Railways, for example, achieved little and resulted in
accumulation of massive debts (US$ 310 billion) prior to bankruptcy and privatization in 1987, but in the ensuing decade, the world's most deficit-ridden enterprise, under entirely new management and a radically different organizational structure, was reborn as one of the most profitable businesses in Japan.[34]

Nonetheless, the Mohan Report provided the basis for resumption of lending by the Asian Development Bank in 2002. Drawing on the Mohan Report, ADB and IR agreed on a reform program for transformation of IR to a commercially oriented organization in three stages over the period 2002–2010.[35] Phase 1 (2002–05) will entail:

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[33] Expert Group on Indian Railways, *The Indian Railways Report 2001: Policy Imperatives for Reinvention and Growth* (July 2001), National Council of Applied Economic Research [hereafter *Mohan Report*].
[34] *Mohan Report*, vol. II, Pt 1, 56.
[35] ADB loan document for Railway Sector Improvement Project, RRP IND 36317, Nov. 2002.

Box 3. Mohan Report (2001)

Key Issues

- IR is facing a financial crisis that needs to be addressed sooner rather than later.
- Freight market share is down and falling, mainly due to low quality, overpriced services.
- Large backlog of investments that cannot be funded by the state under the current setup as the state does not have adequate resources.
- IR must invest only in remunerative projects.
- Large workforce, low productivity and growing staff cost as proportion of total costs.
- Inefficiency and lack of market incentives.
- Continuing with current system and structure clearly not a feasible option.

Need for Restructuring

- Lack of customer focus – IR's three markets (freight, intercity passengers, and suburban passengers) need differentiated organization. IR's current management structure and "government department" attitude does not allow proper response to customer needs
- Lack of clear purpose, confusion between commercial objectives and social roles, which should be separated
- Outdated business structure: limited flexibility for responding to market changes as IR functions as a government department, too much vertical integration prevents focus on its core business of transportation
- Lack of autonomy and subject to political pressures

Suggested Actions

- Restructuring the organization
  International experience over past two decades with railway restructuring was based on three principles:
  - creating an arms-length relationship between railways and the government;
  - inducting management with commercial skills to create customer-focused organizations; and
  - defining the appropriate business focus and spinning off non-core businesses.

  Broad changes suggested are:
- separate railway from government and establish an independent regulator
- manage railway commercially, with focus on lines of business and market segments
- focus on core business and spin off non-core activities, target staff reductions
- Strategies for business segments
  - Freight: better quality of service including shorter transit time for premium services, lower tariffs & removal of distortions, focus on customer needs to recapture commodities that have drifted away;
  -Passenger: rebalance passenger tariffs, flexibility, introduce private management of commercial operations
  - Improve efficiency, 25 percent reduction in manpower in seven years with safety net
- Financing from other than government sources including private sector & joint ventures
- Recast accounts in line with Indian commercial conventions & format
- Aim for a high growth scenario ***since 'business as usual' scenario would rapidly drive IR to fatal bankruptcy***
- Use Information Technology in key areas of revenue enhancement, cost reduction & investment optimization.

Reinventing IR

The evidence for rapid, deep seated change is clear, compelling and overwhelming. IR must have the autonomy to work free of political interference. Wholesale privatization as pursued in some countries is premature in India and focus should be on commercialization rather than privatization. Recommendations include:

- Separate policy, regulation, and business management. Policy makers would set policy and pay for what they ask for and regulator would fix competition rules and pricing. IR to be corporatised as a business entity to facilitate coporatisation with a clear commitment from the government that it will have freedom to manage and be allowed to operate on commercial lines.
- Clear differentiation between social obligations and performance imperatives
- Commercialisation (spinoff non-core businesses, lines of business structure & commercial accounting).
- New management that provides leadership team committed to changing the status quo. Will require influx of experienced commercial managers.

1. establishing an improved accounting system for IR that is capable of meeting government and commercial accounting requirements
2. operating IR as a business, with social responsibilities to be delineated and separately funded by the Government
3. a first stage of restructuring noncore activities
2. various measures to improve customer orientation, with IR to concentrate on operating rail services and the private sector to take increasing responsibility for customer interface
3. continued rightsizing of staff strength
4. continued tariff rationalization
5. strengthening investment planning to concentrate on investments needed to improve business performance.

In Phase 2 (2006–07), the improved accounting system is intended to support a deepening of reforms through (i) restructuring core businesses as independent profit/cost centers, and (ii) completing non-core restructuring. Phase 3 (2008–10), which is envisaged to complete the implementation of reforms, has not yet been defined in detail.

This plan appears of less ambitious scale and scope than that undertaken in China, particularly since 1999, but the key issue is whether the commitment to carry the indicated reforms through will be sustained in the face of strong vested interests in the status quo, both within the government and political circles and within IR itself, whether of management or labor. It is appropriate to quote Peter Drucker who wrote "Unless commitment is made, there are only promises and hopes but no plans".

2.6 Conclusions and Recommendations for Indian Railways

The experience of China (as well as that of Japan, and most other countries that have earlier coped with failing railways) shows that much will depend, in the first instance, on whether the new Government of India musters a political consensus to come to grips with the overwhelming failure of governance of IR under its present structures. It must be recognized that the organizational structure of IR and governance by the Railways Board – with senior management rotating in and out every two years, perpetually beholden to diverse political interests to win support for its capital budget from the public exchequer – is not a structure well designed for solving problems; it is rather a structure for proliferation and perpetuation of problems.

Indian Railways' governance and management structures need to be modified to be responsive to market conditions and meet the emerging challenge from globalization of international trade, developing highway infrastructure and a new generation of heavy road vehicles. In addition Railways need to cut unit costs to realize higher internal accruals to fund capacity expansion without which transport will constrain economic growth. Most importantly, the government must allow IR to function as a commercial entity. The government should pay for all social/strategic investments mandated by it and also meet the consequent operational losses imposed on IR.

The Government, as Owner, must:

- resolve the conflict between the objectives it has attempted to impose on IR – on the one hand, the ostensible obligation (honored primarily in the breach) to operate as a

commercial organization, and on the other, the very real social obligations, including hugely loss making ordinary rail passenger services (although very often these services could be provided far more efficiently and to higher standard by road transport), maintenance of uneconomic levels of employment and existing (*already-sunk*) investments in non-economic branch lines, and, worst of all, a long list of politically/socially motivated investments that not only generate losses and little benefit themselves, but also continue to divert scarce (*new*) investment resources from profitable investments critically needed to reduce congestion and improve service standards on the arterial mainlines; and

- refrain from interference in the day-to-day management of railway operations, but, in return for the grant of management autonomy, impose an effective system for contracting performance targets with IR Management, monitoring them in a serious benchmark competition, and holding Management accountable, including significant positive incentives for those managers and labor forces who meet or exceed expected performance and prompt replacement for those who do not.
- make a firm and public commitment to transform Indian Railways so that it can play an important role in accelerating the economic development of the country. In line with international experience, the drive for railway restructuring must come from outside the railways, and therefore, government as the owner and users as stake holders need to push for development of a time bound road map for railway restructuring and not depend on IR's internally driven initiatives only.

IR Management and Labor must:

- recognize that the prolonged period of extraordinary protection of Indian Railways from inter-modal competition will be coming to an end in the near future, as the long-delayed development of a modern highway network finally begins to take shape, and the road transport industry will increasingly be able to draw on modern vehicle technology to better customize their services to compete away the highest-rated freight and passenger services offered by IR, at the same time that airline deregulation and privatization is already competing away another of IR's most profitable market segments;
- recognize that the performance of IR in terms of productivity of labor, equipment, and infrastructure is a low fraction of the productivity of China Railways and other well run railways;
- restructure IR, separating non-core functions (not only social services but also manufacturing services to create a competitive railway supply industry) and discarding IR's traditional functional organization in favor of a modern lines-of-business structure, centered around the major clients, with the management of each unit focused on meeting client service quality requirements, costs, pricing, and net revenues to sustain IR in future years. CONCOR in many respects provides an effective model worthy of emulation (particularly the degree of autonomy exercised by its management and their effective focus on their client's demands), but it must also be recognized that a substantial element of CONCOR's perceived success stems from the monopoly status that it has so far enjoyed. Neither CONCOR, nor any other profitable element of rail services in India, will be able to hide from competition in the future;

- implement a 'benchmark competition' system across the 16 regional administrations of IR based on comparative performance of key indicators such as costs control, revenue generation and, particularly, profitability;
- prepare a long-term (10-15 year) business strategy and associated investment plan to enable IR to better meet profitable market demands and shed unprofitable services and facilities, including financial modeling under alternative scenarios concerning IR's success (or lack thereof) in meeting market demands and competition; and
- implement a new system of capital budgeting and investment prioritization based on Net Present Values using the opportunity cost of capital in the marginal application that must be forgone. Comparative evaluation of investment experience in China and India suggests the following areas:
    - Invest in areas that would help increase productivity of existing assets and reduce capacity constraints, e.g. technology improvement in signaling (automatic signals that will permit reducing headway between trains on main corridors, longer loops, heavier trains, more powerful locomotives, modern train control systems, IT etc.)
    - Invest in improving maintenance of infrastructure and rolling stock so that these are used to full potential, and loss of capacity due to failures and speed restriction is reduced drastically. (Set substantially higher standards for reliability and incidence of failures, since failures on a heavily utilized corridor cause cascading effect on several other trains).
    - Invest in improving quality of service, both for freight and passenger services in order to compete for high margin traffic. (Freight: shorter transit time, guaranteed delivery time, tracking of wagons/consignments etc. Passenger: Improvement in on- board services and facilities, higher speeds and shorter transit time etc.)
    - Invest in areas (technology up gradation) that would help reduce unit costs or increase margins.
    - Invest for capacity enhancement on corridors where additional traffic is expected.

While the performance of corporatized state enterprises in India (and other countries) generally does not encourage optimism, nor does the history of the many past efforts to restructure IR, the example of reform of China Railways since 1999 does suggest that substantial progress is possible, provided serious commitment of senior leadership in both government and railway management, and that an accommodation acceptable to the literally millions of affected labor is found.

To the extent that IR reinvents itself as a much leaner, more productive, client-centered, profit-seeking organization with strong incentives for efficiency, eager to meet (and beat) any competition from any source, the better will be its chances of surviving in more or less its present form and scale as a corporatized state-owned enterprise.

On the other hand, if the Government of India and IR delay once again coming to fundamental grips with IR's serious performance and financial problems, it will increasingly default on its transport responsibilities to the Indian economy. Under that scenario, IR would continue to limp along until the organization is so burdened with debt and the age and condition of its assets are so bad that the Government will be forced to recognize the bankruptcy and intervene

in a massive manner. In that case the apposite model is not China Railways of the last 10 – 15 years, but rather the Japanese National Railways over the 10 – 15 years leading up to its bankruptcy and privatization in 1985, with a debt of US$ 310 billion. The cost to the growth of the Indian economy will be even more – much more – than to the public exchequer.

Reducing the conflicts inherent in public ownership and creating incentives to management, labor, and other stakeholders in favor of restoring and sustaining high quality, low cost railway services needed to support a growing economy is inherently difficult to achieve under public ownership. That is why Japan, New Zealand, most Australian states, and several other countries around the world have privatized state railways in recent years.

While China Railways over the past 10 years, and particularly since 1999, provide an important example of what can be accomplished under continued state ownership, provided a reasonably close alignment of government and railway management objectives, it is noteworthy that the Government of China is increasingly acting today to engage the private sector, including foreign investors, in railway development and operations in China, and has set the first foundations for intra-modal competition. While China's particular experience with private participation and intra-modal competition in the railways sector is so far limited, there is extensive experience from other countries around the world to suggest that these measures, too, should be considered by India as it seeks to come to grips with its deep-rooted problems in its railway sector.[36] Even the European Union, with a policy set that heavily favors railway transport, has nonetheless separated railway infrastructure from rail operations, to encourage private participation and intra-modal competition as a spur for rail efficiency.

[36] For a comprehensive review of railway restructuring and competition policies, see Clell Harral, *et al.* "Asian Railways and the Role of the ADB," report to the Asian Development Bank (July 2001). A more recent, academic review of rail competition in various countries is available in Russell Pittman, "Chinese Railway Reform and Competition: Lessons from the Experience in Other Countries," *Journal of Transport Economics and Policy* (May 2004, v 38, pp 309-332).

COMPARATIVE EVALUATION OF HIGHWAY AND RAILWAY DEVELOPMENT IN CHINA AND INDIA, 1992-2002

APPENDIX

RAILWAYS SECTOR REVIEW

1. Background

India commenced its economic reform in 1982 when it decided to break away from the socialist system and centrally planned economy the country had adopted soon after independence in 1947. As a result of economic liberalization, India's GDP growth accelerated from an average of 3.5% in the decade 1972-1982 to 5.2% per year in the decade 1982-1992. During 1991 India faced balance of payment and fiscal crisis and responded with significant reforms that led to further increase in GDP growth to an average of about 6% per year in the decade 1992-2002. The reform has continued to gather steam, albeit with caution and against considerable political resistance. Continued economic reforms coupled with a good monsoon season, have made 2003-04 into a land mark year and it is estimated that in this year (2003-04) the GDP growth would touch a high rate of about 8%. In recent years, inflation rate has been low and foreign exchange reserves have grown steadily and exceeded US $ 100 billion in December 2003. The 10th Five Year Plan (FYP) from April 2002 to March 2007 sets an ambitious target of an average GDP growth rate of 8% per year. There is optimism that the Indian economy would continue to grow at around 8% per year for the next decade or longer.

The accelerating pace of economic development is sought to be achieved by utilizing the forces of market economy and growth through rapid increase in international trade and industrial activities. Efficient, reliable and low cost transport services are an essential pre-requisite for economic growth rate of the order of 8 percent. Substantial efforts are being made to augment the capacity of transport infrastructure and equipment, and improve the quality of transport services by rail, road, and air. Efforts have also been made to expand road and rail networks to connect the less developed and relatively poor areas to the economic and industrial centers to encourage development, access to markets and reduce inequalities and poverty.

However, overall progress has fallen short of what is needed for transport to facilitate faster economic growth and trade, as well as poverty reduction. In India infrastructure deficiencies continue to be viewed as a major hindrance to business and trade. India is struggling to widen its 13,000 km trunk national highways from mostly 2 lanes to 4 lanes and has negligible length of expressways. China, on the other hand, has completed 27,000 km access controlled expressways in the last 10 years and is on the way to build at least 30,000 km more in the next ten years. China has also been far ahead of India in quality of railway infrastructure, rail capacity augmentation and, in many respects, policy reform in recent years.

The two countries were roughly at the same starting point about 15 years ago, in terms of transport infrastructure capacity, levels and variety of services offered, and management organizational structure. There are many similarities between the two countries in objectives and strategy for transport development at the highest level of abstraction. Similar to India, China is in transition from central planning to market economy, with growth heavily relying on trade and industrial production.

However, there are differences between the two countries in the magnitude and specific modalities of implementation for transport development. India's transport development policy can be viewed as one of incrementalism, to develop capacity only marginally ahead of demand (if not following demand), in contrast to China's much bolder thrust not only to relieve immediate bottlenecks, but to add capacity and service enhancements for years ahead by vastly larger investments and more innovative pricing and financing modalities.

While it is too early to judge the relative economic wisdom of such radically contrasting strategies (which will hinge in good part on the future rates of economic growth and the social opportunity cost of capital in the respective economies), it is quite clear that a major implementation gap exists in India between government strategy/policies and current sector practice on the ground. This gap not only explains at least in part why the incremental approach is favored in India, but also accounts for much of the shortfall between objectives and achievements.

2. Objectives

The objective of this study is to carry out a comparative analysis of rail transport sector strategies, policies and developments for India and China during the decade 1992-2002. The conclusions and recommendations of the study provide decision-making information for future development of the transport sector and Bank financing of transport investments and technical assistance to promote policy development and institutional strengthening in the transport sector in India.

3. Economic Growth (1992-2002)

3.1 India

The 8th and the 9th Five Year Plans covered the 10 year period April 1992 to March 2002. The GDP growth achieved was 6.68% and 5.35% in 8th and 9th FYP respectively. The economic growth in the 9th FYP (1997-2002) was lower than the target of 6.7% per year but was achieved in spite of the Asian crisis in 1997 that slowed down economic activities in several countries. Indian exports were affected due to lower demands internationally. Lower growth in agricultural sector due to below average rain falls, Kargil war and natural calamities such as cyclone and earthquakes also contributed to the slowing down of economic growth. The annual growth in agriculture, manufacturing and services during the 9th plan period was 2.06, 4.51 and 7.78 percent respectively showing that low rate of growth in agricultural sector was a drag on the over all pace of economic development.

A reference to **Annex 3.1A** shows that in the decade 1992-2002 the proportion of agriculture in GDP continued to decline while that of services increased significantly from 42.1 to 49.2%. By 2002, services contributed a little over half the GDP. The value of export of goods and services as a proportion of total GDP has also risen significantly in the ten years 1992-2002, the ratio in 2002 being 69% higher than the ratio in 1992.

The salient features of growth of the Indian economy by sectors in the decade 1992-2002 are summarized in Annex 3.1B. Export as well as import of goods and services in the decade 1992-2002 experienced robust growth, indicating that India's efforts in driving economic growth

through exports has been successful to a large extent. Further, services continued to grow at a higher pace than that achieved in the decade 1982-92.

In spite of the increasing growth rate of the economy achieved in the decade 1992-2002, India faces the formidable challenges of eradicating poverty, reducing unemployment and improving the quality of life of its citizens. Poverty reduction continues to be the main focus of India's development plans even though poverty in India has fallen in 1990s. As per official claims poverty in India declined from 36% to 26% of population between 1994 and the end of the decade. The other challenge is to reduce vast disparities in per capita income level between and within India's states.

3.2 China

The Chinese economy has gown at a blistering pace in the twenty years 1982-2002. The GDP growth averaged 9.7 and 9.0 percent in the decades 1982-1992 and 1992-2002 respectively. A reference to **Annex 3.2A** shows how the structure of China's economy changed during the decades 1982-1992 and 1992-2002.

It is noted that in the decade 1992-2002 the proportion of agriculture in GDP continued to decline while that of industry and services increased significantly. By 2002, industry and services contributed a little over half and a third of the GDP respectively. The value of export of goods and services as a proportion of total GDP has also risen significantly in the ten years 1992-2002, the ratio in 2002 being 50% higher than the ratio in 1992.

The salient features of growth of the Chinese economy by sectors in the decade 1992-2002 are summarized in **Annex 3.2B**. Export and import of goods and services as well as industry (including manufacturing) and services recorded robust growth in the decade 1992-2002. China was successful in achieving remarkable rate of GDP growth that was driven by high growth in exports as well rapid growth of the domestic market as per capita income doubled every nine years.

China has been singularly successful in poverty reduction and since 1979 (the year the economic reforms were introduced) it has lifted about 400 million people (about a third of its population) out of poverty at the $1 a day expenditure level. However, disparities in incomes between population in urban and coastal areas and rural and less developed regions have increased. The challenge for China is to enable the population in rural and inland areas to have a greater share of the economic prosperity of the country. One of the critical factors for increasing economic activity in less developed regions is the provision of high quality transport services at competitive prices that connect these with the east coast as well as centers of consumption.

3.3 A comparison

China embarked on economic reforms in 1979 and over the years carried out structural changes including shifts from central planning to market economy and from agriculture to manufacturing and services. China also moved from a closed to a globally-integrated economy. The government was able to implement reforms although it meant pain and hardship for a significant proportion of work force that lost jobs and had to learn new skills or take to small businesses. The high rate of economic growth was initially driven by exports but soon the growing domestic consumption as a result of rising incomes gave the economy the basis for continuing growth.

The economic reform in India started in 1982, but after a good start petered out due to political opposition and vested interests of labour, business community that had acquired considerable skills in manipulating the bureaucrats and politicians who presided over the centrally planned economy. Real reform measures were implemented in 1991, but again due to political opposition the pace of reform was slow.

Due to the early start of economic reforms, single minded focus on deepening the reform process and absence of political resistance to change, China has been an economic miracle in the last two decades with GDP growing at an average of nine percent or more and growing more than five fold between 1982 and 2002. India on the other hand not only came to the game later but also embraced economic reforms more cautiously and in the two decades its GDP growth rate per year was a shade below 5 percent and grew 2.6 times between 1982 and 2002. In absolute terms, India's performance is very creditable as it has been one of the fastest growing large economies. However, in comparison to the performance of China over the same two decades, it is less flattering.

4. Railways

4.1 Comparison of salient features of the railway systems in the two countries

The salient features of the railways in India and China are summarized in **Annex 4A**. Some important aspects are compared in the following paragraphs.

4.1.1 Density by geographic area and population

In terms of land area China is about three times as large as India and has 30 percent more population. In terms of route km, the size of the railway system in China was smaller by about 7 percent in 1992, but by 2002 it was 14% larger than that of India in 2002, thanks in large part to the rapid expansion of the Local and JV railways (the latter drawing in part on private investment) from 4,535 to 12,367 route km. During the decade 1992-2002 the railway route km grew by 24 % and 1% in China and India respectively. As seen in the table below, in 2002 the density of railway network per unit of surface area in China was much lower than India but only slightly lower in terms of per million of population.

Rail Density in 2002

	Route Km	Surface Area Million sq km	Population Million	Route km per million sq km	Route km per million population
India	63,140	3.3	1,000	19,133	63.1
China	71,897	9.6	1,300	7,489	55.3

It will be seen from Maps that railways are fairly evenly spread over India, except that the railway density is relatively low in north east of the country. In China, the railways are rather unevenly spread over the country. Railway density is much higher in the coastal regions and eastern part of China and very sparse in the western region. This imbalance is sought to be corrected in China over the next decade by extending railways in the west and improving the railway network in the hinterland so that availability of transportation services help in economic development of such regions.

The transportation output of Indian and China Railways for passenger, freight and total in terms of equated transport units (passenger km plus net ton km) in 1992 and 2002 is shown in **Annex 4.1 B.** The total transportation output of CR was about two and a half times that of IR in 1992 as well as 2002. The growth rates of passenger, freight and total rail transport has been of the same order in the decade 1992-2002, reflecting that, in absolute terms, the increase in output on CR (excluding local and JV railways) was approximately 2 ½ times that of IR – in fact the increase in freight on CR (394 btkm) over this period was more than the entire freight (336 btkm) carried by IR in 2002, while the increase in passengers on CR was only slightly larger than on IR (182 vs 179 bpkm). In 1992 as well as 2002 the volume of passenger transport output of both railways was of the same level, but China Railway's freight transport output was 4.5 times that of Indian Railways.

4.1.2 Services offered and product mix

Passenger Services

Indian Railways (IR) is a passenger dominated railway and 59% of its transportation output in 2001-02 was from passenger services. China Railways (CR) on the other hand derived 24% and 76% of its transportation output from passenger and freight traffic respectively in 2002.

IR's passenger services can be divided into two main segments i.e. suburban and non-suburban. Traditionally IR has provided commuter rail services in Mumbai, Kolkata, and Chennai. In 2002 the suburban services accounted for 59% of passengers carried and 19% of passenger km. CR on the other hand has not been involved in providing significant commuter services and has been engaged mainly in providing long distance transportation to passengers.

Commuter services are operated in China mainly by local authorities and not CR. Commuter services provided by CR account for 4% in terms of originating passengers and 0.2% in terms of passenger km. As mentioned earlier, CR is mainly engaged in running long and medium distance passenger trains. As a result the average lead of passengers on CR is 471 km in 2002. The average lead for mail express trains on IR is comparable at 476 km. However, short lead for suburban (31km) and ordinary trains (87.7km) cause the overall lead of passenger trains to be depressed to 96.9 km.

IR's non-suburban passenger services can be sub-divided into long distance mail and express services (including premium services) and short distance slow trains (Ordinary). The table in Annex **4.1B** indicates the split of services, output, revenue and earning per pass km from different segments/sub-segments. An analysis shows that 10.5% mail and express trains generate 53.5% of pass km and 72% of revenue. In this segment, the upper class services have a greater margin than the second class services. It is, therefore, imperative that this segment of passenger business receive priority and the product mix be altered in favour of long distance express and mail trains. Further the proportion of upper class services should also be increased as the purchasing power of the Indian population increases with GDP. IR is doing so gradually by introducing additional mail express trains. A recent feature of IR's strategy is the increase in premium services (Rajdhani, Shatabdi and Jan- Shatabdi trains) that provide exclusively air conditioned long and medium distance services at premium prices.

Freight Services

The freight traffic on Indian Railways consists mainly of bulk commodities transported over long leads. Eleven bulk commodities account for over 95 percent of freight traffic carried by IR; coal traffic being half of the bulk traffic carried. The average lead of freight traffic in 2001-02 was 677 km and has been of this order for the past several years. In recent years IR has concentrated on train load traffic of bulk commodities and has neglected and lost high rated less than train load traffic. A large proportion of freight trains are operated as unit trains and it is common for the same locomotive to operate over more than one zonal railway with crew changes as necessary. The utilization of wagons in terms of net ton- km per wagon day to BG has shown an improving trend and increased to 2,223 in 2001-02 from 1439 in 1991-02 and 986 in 1980-81. This improvement is mainly due to the phasing out of low productivity 2 axle wagons, increasing proportion of lower tare/higher capacity BOXN wagons and reduction in terminal detention (Wagon turnaround reduced from 11.5 days in 1991-02 to 7.2 days in 2001-02). The average speed of freight trains on BG has, however, stagnated around 24-23 km/hr. for the last ten years, mainly due to increasing congestion on high density corridors and high failure rate of infrastructure and rolling stock. Terminal detentions to wagons are comparatively high. The comparatively high failure rate not only lowers average train speeds but also causes erosion of capacity especially on high density corridors. Recent studies have concluded that very substantial investments are required for enhancing operational efficiency and capacity and reducing unit costs through technological up-gradation in several areas including traction, higher payload to tare ratio wagons, higher axle loads, improved signaling, mechanized handling at terminals, improved maintenance and reliability of assets, freight traffic management systems etc.

China Railways is a freight dominated railway system. CR runs fewer block trains (mainly on closed circuit coal lines) and freight locomotives rarely cross administration boundaries. Freight trains invariably pass through marshalling yards, though efforts are being made to form long distance trains so that some marshalling yards could be bypassed. Unlike IR, less than train load traffic is sought and carried.

The comparative performance of freight business is summarized in **Annex 4.1C**. The turnaround of wagons (number of days between successive loadings) of CR is superior and so is the daily output per wagon. Higher average train speed and low terminal detention of wagons helps in improving wagon utilization. CR has installed a system wide Transportation Management Information System (TMIS) and wagon distribution is controlled centrally. The wagon turnaround and daily output from wagons for IR has been improving, but it has substantial scope for further improvement.

4.1.3 Performance

The performance of a railway system is evaluated by several measures. The most common measures are:

-density of equated traffic units (passenger km + ton km) per route km;
-output in equated traffic units per employee;
-working ratio[37]; and

[37] Working ratio is the ratio of working expenses (before depreciation) to revenue

-operating ratio[38].

The above four parameters are compared for the two railway systems in **Annex 4.1D**. In case of India for traffic density, the comparison is made for the entire railway as well as for the BG system only (other gauges cover 29% of route km but carry about one percent of freight and 6 percent of passenger traffic). For China the comparisons are made for the national railway that is managed by the Ministry of Railways (excluding local and joint venture railways).

China Railway's performance in respect of traffic density and employee output is substantially better than that of Indian Railways. China has a larger proportion of double as well as electrified track. Further CR has adopted automatic signaling more aggressively than in India. As a result CR operates roughly twice the number of trains on electrified double tracks than Indian Railways. This results in a high level of utilization of the fixed infrastructure. This shows that there is considerable scope for enhancing traffic density on IR.

In response to the government's policy in China for change from centrally planned economy to market economy, CR has taken several measures to transfer non core activities to other central ministries and provinces. As a result its work force has been reduced from 3.41 million in 1992 to 1.76 million in 2002. This has given a substantial boost to its staff productivity. IR has not taken similar measures yet and it continues to carry out diverse activities not directly related with IR's core business. The staff reduction from 1.65 million in 1992 to 1.51 million in 2002 has taken place mainly due to natural wastage and strict control over recruitment. It is, however, generally accepted that Indian Railways could reduce its staff by another 30 percent and significantly improve employee productivity. Such a measure if implemented would also benefit IR's working and operating ratios since staff costs account for over half its revenue expenditure.

The working and operating ratios of CR are much better than of IR.

Financial Performance

IR's financial performance is summarized in **Annex 4.1E**. The annual revenue of IR is of the order of Rs 37,800 crores (2001-02) which constitutes about 1.5 percent of country's GDP. Although passenger traffic accounts for 59 percent of the total transportation output (passenger km + freight ton km) it contributes about 30 percent of revenue indicating that passenger services are heavily cross subsidized from freight services. The cross subsidy on social service obligations including passenger services stood at about 10% of revenue in 2001-02. IR has, according to the official accounts, consistently operated profitably, the operating ratio being in the range of 82-87% in years 1992-93 to 1996-97 (8th FY Plan) and 91 to 98% in years 1997-98 to 2001-02 (9th FY Plan). There is, however, a perception that in recent years IR has made inadequate provision for depreciation and its asset base has deteriorated. For example, in the year 2001-02, the allocation to Depreciation Reserve Fund was Rs 2000 crores. That is considered inadequate at about 2 percent of historical value of assets. It is possibly less than one percent of the replacement value of railway assets. Thus, if IR were to make adequate provision for asset renewal, it is doubtful if it could continue to return any significant profits. The fact that IR had to defer payment of dividend (interest) due to the Central government on

[38] Operating ratio is the ratio of working expenses including depreciation to revenue

its investments in railways in two recent years shows that IR's financial performance was not healthy.

The broad breakdown of expenses as a proportion of ordinary working expenses (before provision for depreciation) in 2001-02 was as follows:

Staff (including pensions) 53.2%
Fuel and power 19.8%
Stores 7.3%
Lease charges 9.3%
Miscellaneous 10.4%

The proportion of expenses on labor of ordinary working expenses is high at 53 percent.

CR's financial performance is summarized in **Annex 4.1F**. The annual revenue of CR is of the order of RMB 181 billion (2002) including construction surcharge on freight of RMB 39 billion (used exclusively for capital investments) which constitutes about 1.4 percent of country's GDP. In 2002 passenger traffic accounted for 24 percent of the total transportation output (passenger km + freight ton km) and contributed about 44 percent of revenue. It is the perception that passenger services make marginal profits in China. The social service obligations are estimated at RMB 10 billion (about 7% of revenue) in 2001[39]. It made a profit in years 1992-93 and 1998-2002 but had incurred losses in four years 1994 to 1997. CR had the operating ratio in the range of 0.51-0.74 in years 1992-2002. Depreciation accounted for RMB 22.3 billion in 2002 that is 4.4% of the net value of railway assets.

The broad breakdown of expenses as a proportion of ordinary working expenses (before provision for depreciation) in 2002 was as follows:

Staff 25%
Fuel and power 21%
Stores 11%
Others 43%

Financial Results for IR and CR, 1991/2 -- 2001/2

	INDIA			CHINA		
	1991-92	**2001-02**	**Ratio 01-02 / 91-92**	**1992**	**2002**	**Ratio 01-02 / 91-92**
Employees total (million)	1.65	1.51	0.91	3.41	1.76	0.51
Operational employees (est. million)	1.42	1.3	0.91	2.04	1.39	0.68
Output per operational employee 1000 equated units	402	648	1.61	728	1,385	1.90
Transportation revenue (billion) incl. construction surcharge for CR	INR 137	INR 378	2.76	RMB 69.9	RMB 181.3	2.96
Operating expenses & pensions (billion)	INR 104	INR 343		RMB 24.6	RMB 112.0	
Depreciation	INR 20	INR 20		RMB 11.2	RMB 22.3	

[39] Reference: Report on study on the state allowance policy for railway PSO on China Railways (June 30, 2003)

Total working Expenses including depreciation and pensions	INR 124	INR 363	2.92	RMB 35.8	RMB 134.3	3.75
Working ratio %	0.76	0.94		0.35	0.62	
Operating ratio %	0.90	0.96		0.51	0.74	

4.2 System ability to meet demand, capacity and service quality constraints

The modal share of railways in India for freight as well as passengers has declined over the years (in terms of originating tons from 89% in 1950-51 to 30% in 2002 for freight and in terms of originating passengers from 80% in 1950-51 to 20% in 2002 for passenger) in spite of the fact that the highway system is relatively less developed and suffers from constraints of capacity as well quality of infrastructure. The continued decline in market share of railways in freight transport is attributed to capacity constraints on its high density corridors due to insufficient investment, indifferent quality of service in respect of speed and reliability of transit time, lack of focus on less than train load traffic, inflexible tariff policies in face of growing competition from deregulated trucking industry and general inability to meet competition from road transport. A 'shippers survey carried out in 1999 indicated that railway service for long distance bulk transport was significantly inferior to that on road.

There is no significant improvement in the service quality and freight transport and transit times continue to be uncertain. The wagon availability to customers is tight and IR continues to concentrate on train load traffic. Customers with less than train load do not receive the service they desire. This leads to diversion of less than train load and high value long distance traffic to road.

IR has introduced scheduled express parcel services between metro cities and these have proved to be popular. It also encourages freight forwarders to act as consolidators for parcel and wagon load freight traffic.

In passenger transport, IR faces constraints of line capacity, rolling stock and maintenance capacity. With the deregulation of air transport, IR is now under considerable pressure from air services also for its high end profitable passenger services and shall need to improve quality of long distance mail and express train services to meet the emerging competitive challenge from highway as well as air transport. IR has made efforts to improve the service quality of passenger trains by the introduction of more air conditioned trains and medium and long distance express/premium trains. It has also established an excellent computerized seat reservation system that enables users to reserve accommodation on long distance trains between any pairs of stations for outwards as well as return journey. However, there has been little progress in increasing operating and commercial speeds of trains.

The modal share of railways for freight as well passengers transport in China has also been on a decline. In 2002, it was 6.6% and 35.2% in terms of passengers and passenger km respectively and 14% and 31.7% in terms of tons and ton km respectively for freight traffic. This was much lower than 66.7% and 80.9% in terms of passengers and passenger km respectively and 41.9% and 79% in terms of originating tons and ton km respectively in 1952.

Railways in China also suffer from capacity constraints for freight as well as passenger rail transport. As per a recent estimate, against 90,000 freight wagons loaded daily, the demand is of

the order of 200,000 wagons per day and shippers need to wait several days before wagons are allocated. (see Box 1).

4.3 Investments made and growth of network, capacity and qualitative changes in infrastructure and service quality

Traditionally investments on IR were funded by the central government (budgetary support: a loan in perpetuity on which railways pay a dividend @ about 7%) and through internal accruals. However, recent years saw scaling down of budgetary support from a peak of 75% in the Fifth Plan to 23% in the 8th FYP (1992-93 to 1996-97) and 34% in the Ninth FYP (1997-98 to 2001-02). Railways took to market borrowing from 1987-88 to part finance its capital needs.

Box: 1 Shortage of Freight Transport Capacity in China

In early April 2004, the Chinese press reported that "China's overloaded transport system was struggling to keep up with demand. Delays in deliveries of commodities such as coal, iron and steel, fertilizer and grain have pushed up some prices, putting inflationary pressure on the nation's economy. Railway congestion has led to an undersupply of coal to power plants in some areas including Shanxi Province."

The report further added that according to Ministry of Railways statistics, the daily demand for freight wagons has surged to 280,000 in recent months, up from last years daily average of 160,000. The railway network can offer less than 100,000 wagons per day. Apparently the demand has peaked as result of increase in imports and domestic consumption.

The docks at some ports are congested with imported iron ore and steel forcing ships to wait offshore for as long as a month before unloading cargo. Importers have had to pay for port delays.

The demand for passenger travel also is only partially met and one needs to book well in advance for a rail journey. During holiday seasons, CR is unable to meet peak in demand for passenger service although it imposes a 20% surcharge and curtails freight trains to run additional passenger services. The quality of service offered to passengers, has in recent years improved significantly. The proportion of air conditioned trains has increased and so have the operating speeds. The number of stops enroute have also been curtailed and the commercial speeds of long distance express trains have improved substantially. Several train services that connect major cities (1000-1500 km apart) are now operated on sunset to sunrise schedule.

Annex 4.3A shows the investment trends for IR It is noted that internal accruals have declined and IR is relying on market borrowings increasingly and 31% of total investments made in the five years 1997-2002 were with market borrowings. Market borrowings are made mainly through Indian Railway Finance Corporation (IRFC) a wholly owned subsidiary of IR. IRFC procures rolling stock with funds raised and the same are leased to IR for which IR makes lease payments. Currently the lease payment is of the order of nine percent of working expenses. Any further increase in lease payments is not considered sustainable in the long term.

In the past ten years or so, IR has sanctioned a large number of projects for social and political considerations. Almost all of them are financially unviable and would impose recurring financial burden on IR's finances. A White Paper published in 1998 stated that most of the ongoing sanctioned projects were financially unviable. As in April 2002, IR had a shelf of projects (new lines – INR 21,305 crore, gauge conversion – INR 10,467 crore, doubling – INR 3,930 crore, Electrification – INR 932 crore, etc.) that required investment of INR 38,000 crore. The implementation of financially non-viable projects would further debilitate the financial performance of IR and reduce its ability to fund development from internal resources.

In India the investment in railways as a proportion of total plan outlay was 7.6% in the Seventh Plan (1985-90). It tapered down to 6.3% and 5.3% in the Eighth and Ninth plans respectively. The ratio of railway capital investment to total capital construction investment in China was 5.4% in 1992. It touched a maximum of 7.5% in 1993 and then tapered down gradually to 4.7% by 2001 and 4.3% in 2002.

The investments made on IR and CR in the 10 years are summarized in **Annex 4.3B**. Although the two rail systems were about equal in size (route km) in 1992, the investments on CR in the 10 years upto 2002 (US$ 85 billion) were about five times larger than on IR (US$ 17.3 billion). In India the investments made (in 2002-03) [40]. on rolling stock (29%), track renewals (20%), doubling, traffic facilities and signaling (11%), new lines (8%), and gauge conversion (6%) In China construction received 64% of investment, upgrading 19% and rolling stock 17%. As a result of large investments on construction in China the railway network expanded by over 10,000 route km in the decade 1993-2002. The upgrading investments were on improvements in track and signaling (automatic signals, CTC, etc.) and electrification which helped increase capacity as well as service quality.

In the five years ending 2002, CR had annual average total sources of funds of approximately RMB 100 (US$ 12) billion. Of that amount, RMB 3.3 (US$ 0.4) billion were from earnings, RMB 16.6 (US$ 2) billion from depreciation and RMB 37.2 (US$ 4.5) billion from construction fund (after taxes) making a total of RMB 57.2 (US$ 6.9) billion internally generated funds (57 percent) while loans and other sources made up the remaining 43 percent. The average annual application amounted to an average of RMB 91.8 (US$ 11) billion over this period consisting of RMB 66.4 (US$ 8) billion on capital investment including equipment replacements (72 percent) and debt service (26.5 percent). A small amount was transferred to the Government for an Irrigation fund. If the construction fund accrual is considered as internal generation then the self financing ratio (internally generated funds less interest and principal repayments as a percent of capital outlays including equipment replacement), a measure of the ability of MOR to fund its capital needs[41] is higher for China than India due to CR's lower working ratio and access to funding from 'construction surcharge'.

In the future, CR plan to raise capital investments substantially. The recently declared "Mid and Long Range Plan" for railway development calls for capital expenditures over a 16 year period (2004-2020) of more than RMB 1.6 trillion (US$ 200 billion)[42]. This equates to an annual average of about RMB 100 billion (US$ 12 billion). In the context of spending levels in the last five years, this represents a 50 percent increase. In order to sustain this level of capital investment CR could tap the following sources of funding:

- Internally generated funds. This will require significant improvement in operating ratio that has stagnated around 0.9 (excluding the Construction Surcharge revenues).
- Borrowed funds. Increase in level of borrowings to some extent.
- Private Sources. The private sector could fund investments on CR in a number of different forms – specialized freight wagon investments, operation of dedicated

[40] Reference Indian Railways Budget 2003-04.
[41] Reference: PAD for the World Bank's Second National Railway Project in China (April 2004). Annex 9.
[42] Press reports and discussions held by Mr. L. Thompson with MOR and other officials in China.

commodity, container transport, or passenger trains, even particularized equity opportunities. Resort to the private capital markets, it should be recalled, is not unprecedented as evidenced by the Guangshen Railway Corporation's successful listing on both the Hong Kong and New York stock exchanges.

It is apparent that meeting the needs of the Mid- and Long-Term Plan poses a significant challenge.

In the decade under review, the IR network expanded only marginally (682 km, or 1%), although due to gauge conversion the broad gauge route Km increased by 28%. electrification and doubling increased by 48% and 10 percent respectively. Over the same period the CR network expanded by 11% (28% for China as a whole as the route km of joint venture and local railways increased from 4.535 to 12,367 km). The increase in electrification and doubling was 106% and 69% respectively. The quality of infrastructure in India did not show any significant improvement as operating speeds of passenger and freight trains did not change much. In China, however, the track on selected routes was upgraded that permitted passenger train speeds to be increased from 100 km/h to 140 and 160 km/h. Passenger coaches capable of higher speeds were also introduced.

4.4 Projected investments during the decade 2003-2012 and anticipated impacts on networks, capacity and service quality

A summary of investments proposed for the rail and highway sub-sectors during the Indian 10th FYP is shown in **Annex 4.4A**.The total outlay would be at an average of about INR 120 billion per year in the 10th FYP as compared with about INR 100 billion per year in the 9th FYP. It is interesting to note that the increase in the total investment outlay from the 9th to 10th FYP is 19.75% on the railways and 58.5% for road transport and highways. There are no indications for the level of investment in railways over the 11th FYP period (2007-12), but to keep pace with growth in demand and pressure to upgrade services substantially higher investment levels would be called for. National Rail Vikas Yojna (NRVY) has been started as an investment initiative by IR. An investment of INR 150 billion is to be made under NRVY over five years 2003-2007 to

-Strengthen the railway golden quadrilateral and its diagonals to remove critical capacity bottlenecks on high density corridors;

-Strengthen rail connectivity to ports and development of multimodal corridors to hinterland; and

-Construction of four mega bridges

The investment on the golden quadrilateral shall improve track structure, strengthen bridges, improve signaling and enable freight train speeds of 100 km/h. It is not clear whether, after the above investments, IR would be able to operate higher axle load freight wagons on the golden quadrilateral. The current general axle load limit is 20.3 tons. About 300 wagons with 22.9 ton axle load are already in service on selected routes and it desirable that such wagons are used widely over the IR system.

NRVY is to be funded largely from non-budgetary sources including borrowings from multilateral and bilateral agencies and the domestic market. An SPV called Rail Vikas Nigam Limited (RVNL) was established in January 2003 for handling resource mobilization and

execution of the golden quadrilateral and other bankable projects. An ADB loan (US$ 313.6 million, INR 15 billion) would fund projects to the extent of US$ 299 million. Four mega bridges to be constructed at an estimated cost of INR35 billion (US$ 730 million) have social and economic significance but are not likely to be financially viable. These are not to be executed by RVNL.

Since internal accruals have been dwindling, IR has now sought additional investment resources to overcome the arrears in asset renewals (track, bridges, signaling, telecommunications, rolling stock and safety items) by imposing a safety surcharge on passenger tickets that funds the Special Safety Fund. The central government has also agreed to partly fund the Special Railway Safety Fund (Total INR 170 billion, US$ 3.5 billion). This is a non lapsable fund that receives inflow each year.

Annex 4.4 B shows the level and sources of investment in railways for 2002-03 and 2003-04. IR could fund only about 20 percent of capital investments from internal resources. It is expected that over the next five years, the level and pattern of investment funds would be on the above lines.

CR plans to continue expansion of network, doubling and electrification along with technological up gradation of the railway during the Tenth Plan (2001-05). This plan is based on total national transport demand growth forecast of 7 and 3.5% for passenger and freight traffic per year (all modes). Railway's traffic growth is pegged at 2.4 and 1.0% per year for passenger and freight traffic respectively. It was anticipated that during the tenth plan there shall be a strong growth at the rate of 5.1% of intercity passenger travel in terms of pass km. It is planned to construct 6,000 km of new lines, 3,000 km of double tracking and 6,000 km of electrification. The Tenth FYP development program included:

- Raising of passenger train speeds on 16 corridors up to 160 km/h and develop a framework of fast passenger transportation;
- Speeding up the separation of tracks for passenger and freight traffic on congested corridors;
- Completion of inter regional corridors, especially those connecting east to west;
- Raise freight service quality in terms of speed, develop multi modal transport services and a basic container transport system including setting up of 15 container terminals and 20 container handling stations;
- Development of local railways as joint ventures; and
- Extensive use of information technology in management of railways.

The investment requirements for the Tenth Plan period (2001-05) were estimated at RMB 350 billion (US$ 42 billion) including RMB 270 billion for infrastructure and RMB 80 billion for rolling stock[43]. Since the proceeds of the railway construction fund shall not be adequate, CR intended to promote funding from non-traditional sources. The government does not normally fund investments on CR, the exception being government funding for construction of new lines in the western part of China including the line to Lhasa.

[43] Reference: Tenth Five Year Plan for railway development. *Chinese Railways* (Vol.9 No.2 2001, Serial No. 17).

In January of 2004, the State Council approved "in principle" the "Mid and Long Range Plan" for railway development in China covering 16 years from 2004 through 2020. This plan envisions:

- Continued expansion of the network from 70,000 km in 2001 to 100,000 km;
- An increase in double track lines from 23,000 km to 50,000 km, and an increase of electrified line from 17,000 km to 50,000 km;
- Creation of around 12,000 km of dedicated passenger lines with maximum speed of 200 km/h;
- Construction of the Beijing to Shanghai high speed line (>300km/h);
- Construction of a set of high density freight corridors;
- Construction of a set of new lines in Western China including the Qinghai line (Golmud to Lhasa).
- Creation of specialized operating companies (including a container company)

This plan would require an adjustment in the 10th Five Year Plan to yield 75,000 km of line by end of the Plan (2005), with 25,800 km of double track line and >20,000 km of electrified lines. This is an ambitious program of investment and expansion aimed at rectifying existing freight capacity problems, creating a new, higher-speed passenger network in an attempt to compete with highways and airlines, and expanding rail access in Western China in order to support regional economic development. The total cost of the 16-year program is estimate at $200 billion, an average of US$ 12 billion per year. The planned average annual investment is about 50% higher than the level approved for the Tenth Plan. Information on sources of funding for this ambitious investment plan is not available, but it is anticipated that it would be a combination of internal generation (including earnings and construction surcharge), borrowings, private sector investments and government support.

4.5 Anticipated ability of each transport system to meet forecast demands over the next 10 years

The expected high rates of economic growth in the next 10 years in India and China would generate commensurate demand for rail transport in both the countries. It is estimated that for India for the Tenth FYP period while the elasticity of total freight transport demand with respect to GDP growth would be around 1.25, the elasticity for rail freight transport would be at least 1.0. In China, the growth of total freight traffic in terms of ton km grew at an average annual rate of around 9% between 1952 and 2001, but it tapered off to an average of 5.4% in the 1990s reflecting the maturing Chinese economy having relatively higher growth in the service sector. The freight traffic on CR grew at an average of 2.3% between 1992 and 2002 (partly due to capacity constraints), although the growth for the road freight traffic was at an average of 6.3%. Over the next ten years the elasticity of total and railway freight with respect to GDP growth for China would possibly be 0.7 and 0.4 respectively.

Similarly, as the populations grow (@ 1.5 percent per year in India and 0.7 % per year in China) and people have more disposable incomes, the demand for rail passenger transport would also grow. The increasing competition from public as well private transport on highways and air for long distances may however, depress the growth in demand for rail transport to some extent.

India

The demand projections as per the draft corporate plan of IR are summarized in **Annex 4.5A**. For rail freight it projects an average annual growth at 5.4%. The estimated demand through 2006-07 as per the Indian 10th FYP is based on an average growth per year of 5%. Since the 10th FYP itself is based on an average GDP growth of 8% over the next 10 years and growth in rail freight demand is likely to be of the same order, the FYP freight demand forecast appears to be on the low side. Thus, there is a risk of a shortage of rail freight capacity by the end of the 10th plan. It is noteworthy, that IR is unable to meet the current freight demand (early 2004), presumably due to high GDP growth (estimate 10%) in the first three quarters of year 2003-04

As per IR's draft Corporate Plan passenger traffic projections till 2012 are based on an average growth of 4.5 % per year although the Indian Tenth Five Year Plan estimates passenger traffic growth at 5.7% per year. A lower growth rate would possibly materialize if IR rationalizes passenger fares to eliminate cross subsidy of passenger services and volumes suffer due to increase in passenger fares.

China
For CR, the projections for freight and passenger for the next 10 years are not available. However, CR plans to address the existing capacity shortage and future growth in demand through the proposed investment of US$ 200 billion over the period 2004-2020. It is reasonable to expect that with this investment sufficient rail transportation capacity would be developed both for freight and passenger services. It is understood that the current coal transport capacity of 1.0 billion tons would be increased to 1.5 and 3.0 billion tons by 2007 and 2020 respectively.

4.6 Organizational structure, and the role and responsibilities of various agencies, and how it has affected the sector development.

India Indian Railways is a vertically integrated system. It is owned by the Ministry of Railways (MOR) which has the overall responsibility for its management. A Railway Board in the Ministry of Railways headed by a Chairman, reports to the Minister for Railways and is responsible for formulation of policies, strategies, regulation and operation of railways. The safety aspects are looked after by an independent Chief Inspector of Railway Safety who is located in another Ministry. IR has its own budget, distinct from the national budget, which is approved by the national parliament. Investment plans need approval of the Planning Commission. Although MOR has nominal powers to make changes in freight tariff and passenger fares, in practice these require approval at the highest political level and are announced in the parliament. IR does not pay any taxes on profits or turnover.

The railway system is divided into zonal railways (ZRs), 9 in 2002 but now split into 16, each headed by a General Manager. The zonal railways are further divided into divisions (59 in 2002). The assets of IR including fixed assets and rolling stock (locomotives, freight wagons and passenger coaches) are nominally allocated between ZRs and each is responsible for the upkeep of its respective assets except for routine servicing of rolling stock. The General Managers are responsible for all operational matters but all policy and most investment decisions are made by the MOR. Besides carrying out the core business of rail transport, IR, also owns and manages activities such as design and manufacture of rolling stock, overhaul and remanufacture of rolling stock, construction projects, schools, technical institutes, housing, hospitals, hotels etc. IR supports a work force of about 1.5 million. IR is essentially organized at all levels by functions

(departments) and not by businesses. Its employees are governed by central government rules for salary and other conditions of service.

IR is also required to function as a commercial organization providing vital transport services to support a growing economy and generate surpluses for its development and expansion. At the same time it is perceived as an instrument for economic development and a provider of essential social services. These multiple objectives, that often require conflicting strategies, have lead to confusion and prevented IR from achieving its commercial goals. For example, commercial considerations would require IR to invest its limited resources in projects that would provide additional capacity in corridors where traffic growth is anticipated and to upgrade service quality to meet the challenge from competing modes. The social and political considerations, on the other hand, cause IR to invest in projects that have social benefits but negative financial returns. Its pricing policies are also dictated by social and political considerations. It has continued to operate passenger services at a loss and made good the deficits by raising freight tariff. This cross subsidy has two negative effects. Firstly, it makes railway freight service price uncompetitive that causes customers to use alternative modes. Secondly, by distorting the price of passenger services, it generates additional demand. As IR strives to meet this demand, some times by diverting capacity from profitable freight business, it makes more losses. This results in vicious cycle of *"low fares-more demand-more capacity-greater losses"* in passenger business. As a result IR is not able to raise adequate internal resources to increase capacity and improve service quality but makes large investments that serve social goals but cause operational losses. Consequently, it has not developed in line with the requirements of national economy and is constrained for capacity on its main corridors.

The disadvantages of a production oriented, functionally organized railway are well known. There is little accountability with individual managers with respect to profitability of specific services or activities since most management information is designed for functional management. There is low sensitivity to change in customer needs and response time to market conditions is high. Such an organization is not likely to come up winners in a competitive environment.

It is important that IR takes measures for growth in capacity with strategies focusing on improved quality and delivery of service, strengthened customer relationships, aggressive marketing. Reorganizing the railway on business lines with profit centers is considered appropriate to achieve commercial orientation. IR has taken initial steps towards commercial orientation by appointing dedicated freight and passenger heads at the zonal railway headquarters. Much more, however, requires to be done to put in place empowered multi-disciplinary teams who can reach out to the customers to develop lasting relationships and modal loyalty. The managers/staff comprising the teams should be motivated through incentives related with profits generated. A prerequisite for this would be a switch over by IR to an activity based costing system which will allow accurate measurements of costs within an activity centre, in addition to the existing government accounting system.

China has four kinds of railways. The national railway (CR) is the main system (84%) that is owned and managed by the Ministry of Railways (MOR). The others are the Joint Venture Railways (9%), Local Railways (7%) and Private Railways. Guangshen Railway is a private railway that is owned privately through issue of shares that are traded in Hong Kong and New York stock exchanges. CR is also a vertically integrated railway although in recent years it has divested its manufacturing and construction activities and has become more commercially oriented.

The development of local railways in China started in 1960s. Such railways are mainly financed, built and operated by provinces and autonomous regions. By 2001, there was an investment of RMB 1732 million (US$ 208 million) in such railways (RMB 1414 million from local governments and RMB 319 from MOR). Joint venture railways have investments jointly from MOR and local governments and were developed from mid 1990s. By 2001, JV Railways had an investment of RMB 9.7 billion (US$ 1.2 billion), split almost equally between MOR and local enterprises. **Annex 4.6** summarizes the growth in length and traffic for such railways. It is noted that these railways have experienced robust growth in terms of transport units carried in the last 5-10 years.

MOR is headed by a Minister and co-ordinates railway activities in China. Unlike India, where the minister is a politician, in China, the railway Minister and Vice Ministers are more often than not professionals with long railway experience. Major investments require approval of the National Development and Reform Commission while policy changes need approval of the State Council. For operational management the railway system is divided into 14 Regional Railway Administrations (RRAs). Most RRAs have sub-administrations also. MOR has decentralized a significant degree of power to its RRAs.

In mid 1980's the Economic Contract Responsibility System (ECRS) was established under which MOR retained all profits and financed all of its own construction and purchases of rolling stock. A system of construction surcharge on all freight transportation was also introduced. The funds accrued from construction surcharge are used only for investment in railway construction with the approval of NDRC and the government. The fixed and rolling assets (except freight wagons) were allocated to RRAs and they are required to pay to MOR certain rate of return on the value of assets allocated to respective RRA. Wagon allocation and operations are managed on a system wide basis from Beijing using a computerized transport management information system (TMIS). Each RRA pays hire charges to MOR for wagons in use on its territory. The RRAs are allowed to manage most rehabilitation and construction projects, make basic staffing and organizational decisions, and retain some profits based on their performance. Managers in RRAs receive bonuses that are linked to performance. The Government did retain control over tariffs and fares, but, significantly, committed itself to more flexibility on MOR's tariff increase requests, and it has honored this commitment since

During 1992-2002, CR made large investments to develop and expand the railway network (US$ 85 billion). It expanded the CR network (excluding Local and JV railways) by almost 6,000 route km, doubled 9,400 km of track, electrified 8,975 route km and installed automatic block system on 9,395 route km. The growth in traffic carried has been impressive at 58 % for passengers (pass km) and 34% for freight (ton km). Passenger train speeds were increased from 100 km/h to 140 and 160 km/h on selected routes. It is significant that growth and upgrading have been self-financed, through revenues and borrowing. Further, CR has been a significant taxpayer, in contrast to Indian Railways.

Indian Railways in 2002 formulated a reform program for its transformation to a commercially oriented organization in three stages over the period 2002–2010.[44] Phase 1 (2002–05), will entail (i) establishing an improved accounting system for IR that is capable of meeting government and commercial accounting requirements; (ii) operating IR as a business, with social responsibilities to be delineated and separately funded by the Government; (iii) a first stage of

[44] Reference: ADB loan document for Railway Sector Improvement Project, RRP IND 36317, Nov. 2002.

restructuring noncore activities; (iv) various measures to improve customer orientation, with IR to concentrate on operating rail services and the private sector to take increasing responsibility for customer interface; (v) continued rightsizing of staff strength; (vi) continued tariff rationalization; and (vii) strengthening investment planning to concentrate on investments needed to improve business performance. In Phase 2 (2006–07), the improved accounting system will support a deepening of reforms through (i) restructuring core businesses as independent profit/cost centers, and (ii) completing non-core restructuring. Phase 3 (2008–10), which will be intended to see through the implementation of reforms, has not yet been defined in detail.

China Railways has been preparing for reform for some years now and is committed to make changes that will enable it meet the challenge of functioning in a market economy and growing competition from road and air. While it is preparing its reform strategy, it has taken several preparatory steps that would facilitate structural and organizational reforms to follow. The measures implemented already include:

- RRAs entered into a large number of localized, non-rail businesses in order to shift employees from railway to non-railway payrolls.
- A number of non core units including manufacturing factories, companies handling materials and supplies and railway communications, four railway design bureaus, and 38 construction units have been separated from MOR and after consolidation established as competing state owned enterprises under State Assets Management Committee (SAMC).
- A large number of social activities separated, mostly by transfer to local authorities. These include 225 primary and secondary schools, about 50 kindergartens and 13 hospitals.
- As a result the CR employees that stood at 3.4 million in 1992 were down to 1.76 million in 2002 and are further reduced to 1.7 million in 2004.
- Within RRAs, passenger transport business has been separated on an accounting basis.
- About 100 branch lines have been separated from main lines on an accounting basis and some have been concessioned.
- New regulations introduced to permit foreign investment in railways as required under WTO agreements.
- Three, special purpose companies have been created to handle containers, special cargo (oversized and perishable cargos) and Post and Parcels.

Indian Railways has been less active in the railway reform area. It has, however, succeeded in reducing its employees roughly @ 2% per year, mainly by a strict control over recruitment. It has also set up a number of companies to carry out certain non core and support activities. Such companies are active in areas such as consulting, construction, leasing, muti-modal transport logistics, information technology applications on railways, catering, tourism, seat reservation services and communications. IR has so far not separated any of the social services such as schools, medical services, housing etc.

4.7 Pricing policies

Both IR and CR do not have effective powers to establish passenger fares and freight tariffs and need approval of respective governments in doing so. As a result, political and social considerations weigh heavily on this important aspect of railway management in both countries,

although the Government of China has been far more flexible and much more inclined to commercial concepts of pricing for railway

The passenger services on IR are cross subsidized heavily from freight revenue to the extent of INR 5,657 crores (about 15% of total revenue and 46% of passenger revenue). The main loss makers are the suburban trains in three metro cities and short distance stopping ordinary passenger trains. The long distance express trains are 10.5 percent in number, generate 53.5% of pass km and 72% of passenger revenue. These services are possibly financially viable. Assuming that mail/express passenger services on IR break even, analysis after considering losses incurred on other segments shows that cost recovery for various segments is as follows:

Segment	Cost recovery
Mail/express	1.0 (assumed)
Ordinary	0.27
Suburban	0.65
All passenger	0.66

Cost and Fare Structure for IR and CR, 2002

	IR	CR
Passenger pkm of total output %	59	24
Passenger revenue of total %	30	41
Average cost per equated unit US cent	0.75	0.65
Average freight tariff per tkm US cent	1.6	0.96*
Average pass. fare per pkm US cent	0.55	1.25

*including construction surcharge of 0.4 c

The freight tariff of IR is distorted to the extent of cross subsidy i.e. freight tariff is increased by over 25% to cover losses on passenger services. The sustained under pricing of passenger and over pricing of freight services has on the one hand impacted IR's competitiveness in its profitable and revenue generating freight market and on the other hand caused high growth in loss making passenger volumes. IR could use a combination of the following measures to eliminate this cross subsidy:

- Rationalize fares
- Separate suburban services from IR and ask state/local governments to rationalize fares or bear losses
- Increase the number of profitable express trains
- Increase the proportion of higher margin upper class accommodation in trains
- Drastically reduce the number of slow short distance ordinary passenger services
- Separate and concession uneconomic branch lines

The elimination of passenger losses would enable IR reduce freight tariff leading to growth in profitable business as well generate internal resources for capital investments.

CR has managed the problem of financial viability of passenger business very well. Till late 1980s it did not cover cost of passenger services. In order to minimize losses CR kept the volume of passenger business low. The seats on trains were rationed and prospective rail passenger had to wait weeks for a seat allocation. With the transition to market economy it was apparent that this situation was not sustainable. MOR decided to raise fares substantially so that it covered costs and then started increasing capacity for passenger trains. In the decade under review CR's passenger through put (pass km) increased by 58% and the revenue by 130%. For freight the through put increased by 34% and revenue by 65%. The ratio of revenue per pass km to ton km was less than 1 in 1992 stood at 1.4 in 2002. This ratio for IR stood at 0.31 indicating that passenger fares are low and freight tariff relatively high.

BOX 2 - Profitability of Stopping Passenger Trains

The short distance stopping passenger trains are not only a drain on capacity but remain unviable even at hundred per cent occupancy at the present levels of tariffs. The same is illustrated through a sample calculation given below –

- Cost of hauling a coaching train in per km. Rs.301.94
- Cost of hauling a passenger train for 250 kms. Rs.75485
- Average rate charged per passenger per km. in 2nd class Rs.0.11
- Earnings with 100% occupancy Rs.22000
- Loss per trip at 100% occupancy Rs.53485
- Loss per trip at 70% occupancy Rs.60085
- Cost of MST per trip up to 150 kms.Rs.5.50
- Earnings with 100% occupancy with MST (Monthly Season Ticket) Rs.4400
- Loss per trip with 100% occupancy and MST Rs.71085
- Loss per Trip with 70% occupancy and MST Rs.72405

Even under the best scenario of 100% occupancy and revenue based on full fare, the cost recovery is only 29%. The cost recovery drops to 6% when all passengers buy season tickets.

**Annual Statistical Statement, Indian Railways 1997-98*

4.8 Financing infrastructure development and maintenance

As discussed in section 4.4, IR has traditionally raised investment capital through internal accruals, budgetary support from the central government and market borrowings. It would need to substantially enhance the level of investments over the average of INR 10,000 crores (US$ 2.2 billion) per year (Ninth Plan) and INR 12,000 crores (US$ 2.6 billion) per year in the 10th Plan in order to meet the expected growth in demand and need of upgrading services over the next 10 years. IR is unlikely to receive enhanced budgetary support the central government and the additional investment funds would need to be raised by enhancing internal accruals and borrowings.

CR has already decided to invest at the rate of about US$ 12 billion per year for years 2004-2020 against an average of US$ 8 billion in its 10th Plan. It is anticipated that the funding for the above investment would be from a combination of internal generation (including earnings and construction surcharge), borrowings, private sector investments and government support.

Tapping funding from multilateral agencies to enhance investment levels would be an attractive option. The present borrowing scenario from multilateral agencies is ideal for IR and CR since the interest rates are at historic lows (of the order of 2% that can be frozen for 15-20 years). If borrowed funds are applied on projects for developing infrastructure and capacity that have reasonable financial rate of returns, these would generate substantial financial benefits for the two railways besides alleviating the present and projected capacity constraints of the respective systems.

4.9 Key operating strategies of the two railways

IR has, over the past 25 years, focused on long distance train load bulk traffic and has paid relatively less attention to wagon load and less than train load freight traffic. It also took to operating increasing number of unit trains in which the trains worked on close circuits returning empty to loading stations. The ratio of loaded to total wagon moved dropped from 65.5% in 1990-91 to 61.2% in 2001-02. 11 bulk commodities accounted for over 95% of tons hauled by IR in 2001-02. The remaining 5% included other commodities and container traffic. The operation of unit trains over long distances in excess of 1000 km bypassing marshalling yards has improved the utilization of freight wagons considerably although the ratio of empty to loaded wagon travel increased some what. Of late IR is trying to focus on less than train load high value long distance traffic as with the economic growth the proportion of such traffic is increasing. It is yet to make a mark in this segment of freight traffic. It has, however, introduced express parcel trains between major cities and these have proved to be popular.

CR has not neglected the less than train load traffic, although the customers have to wait for allocation of wagons. CR operates only a few unit trains and in general prefers to direct an empty wagon for loading in the vicinity of the place of its unloading. Generally CR operates trains from yard to yard and few trains bypass a marshalling yard. It, however, has very modern and efficient marshalling yards.

Freight trains on IR typically have 58 wagons with the gross train load of 4,600 tons. Such trains operate with one locomotive on flat terrain and with two locomotives on graded sections at booked speed of 60-65 km/h. Since most corridors are congested and have mixed passenger

and freight traffic, freight trains need to stop frequently to give way to over taking passenger trains. This depresses the average speed of freight trains to around 25 km/h.

Depending upon the terrain and type of traction, CR operates 4,000 and 5,000 gross load trains. These are booked at 80 km/h. The average speed of freight trains is around 32 km/h. Both railways have to deal with the ill effect of speed differential between passenger and freight services on the same tracks.

IR has generous free time for unloading of wagons. Customers are expected to unload wagons during day light hours only. This results in excessive detention at terminals with adverse impact on wagon turnaround and utilization. CR on the other hand allows 3-4 hours for wagon unloading, irrespective of the time of the day. In case the consignee fails to unload, CR unloads at the cost of the consignee and releases the wagon.

Each zonal railway has specific allocation of locomotive fleets. Freight as well as passenger train locomotives routinely cross boundaries of ZRs. A locomotive may traverse through five or six ZRs before returning to its home railway for maintenance at least once in 30 days. This allows extended runs of locomotives and improves their utilization rate. IR has facilities for filling diesel fuel on locomotives in freight yards itself without detaching from the train.

On CR also locomotives are allotted to RRAs. Unlike IR, these locomotives rarely haul trains beyond the RRA boundary. Diesel locomotives need to detach from the train and visit a maintenance facility for refueling.

On IR express passenger trains are booked at 100 km/h while premium trains are booked at 120 km/h. IR suffers from numerous 'speed restrictions' that limit the speed of trains well below the booked speed. Therefore, even the express trains do not get extended runs at booked speed resulting in comparatively low commercial speed. The travel time of premium service train between Delhi and Mumbai is 16 hours 35 minutes over a distance of 1388 km giving an average of 84 km/h compared to a booked speed of 120 km/h.

The express trains on CR are booked at 160 or 140 km/h. Further, there are few speed restrictions. Express trains stop only at very large cities and these factors lead to relatively high commercial speed in excess of 110 km/h.

4.10 Multi-modal transport services

India

Indian Railways commenced provision of container transport in 1966 for domestic transport and the main selling point was door to door service. Containers were carried as part of normal freight trains and container business was managed by the freight service department. Although by 1988 seven container terminals were established the container business did not grow significantly. In order to focus on and promote growth of multi-modal transport business, the Container Corporation of India (CONCOR) was set up in 1988 as a wholly owned subsidiary of IR and it commenced operations from November 1989. It was mandated to develop multi modal logistics support for India's international and domestic containerized cargo and trade. Right from its inception CONCOR has used rail as well as road transport in order to provide efficient and economical integrated service to its customers. By early 2004, CONCOR had over fifty terminals all over the country. Majority of terminals are rail served ICD and CFS that provide international as well as domestic services, while a few are only road served or handle only domestic containers. CONCOR provides regular container train services over several routes that connect major production centers with ports and consumption centers. It runs about five

pairs of container trains daily between Delhi and ports at Mumbai. The strategy of CONCOR focusing exclusively on container transport business has paid handsome dividends. The container transport business has grown rapidly and annual growth has exceeded 15% in recent years. In the year 2002-03, CONCOR handled 1.3 million TEUs (70% international and 30% domestic). About 70% of container transport was by rail and the rest by road. It follows a spoke and hub system and container trains are formed at its major terminals that are moved as block rakes by IR. CONCOR owns most of the container flats but no locomotives and only a few containers that are deployed for domestic service. CONCOR, under a Bank funded project, acquired modern container flat cars that operate at 100 km/h. The higher speed and high reliability of these trains has enabled CONCOR to substantially upgrade the quality of its service as also the transit time . The transit time on Delhi- Mumbai (JNPT) has been cut to 40% of that that prevailed with old rolling stock and on time arrival exceeds 90%. The export and import trade has benefited immensely with the improved services and capacity offered by CONCOR.
Government has sold 37 percent of CONCOR's equity to public and its stock is listed on the stock market. It is one of the better performing stocks in India. CONCOR expects that by 2007-08, its business would nearly double in terms of TEUs handled to 2.5 million TEUs. It has opened a new large ICD near Delhi at Dadri and this terminal has capability of expansion to a capacity of 1 million TEUs per year.

CONCOR has been singularly successful in achieving rapid growth of containerized multi-modal transport services, improvement in service quality and profitability. This success arose from empowerment of its management, intense management focus on multi modal transport, commercial approach, sensitivity to customer needs, policy of outsourcing equipment and services and incentives for staff and managers. The Board of Directors of CONCOR has substantial financial authority and is empowered to take all operational and most investment decisions without any reference to MOR. The focus of the management is on a specialized market and it has endeavored to maintain a close contact with its existing and potential customers. It is already providing enquiry facilities to customers through its website and plans to provide web enabled services in the near future.

CONCOR is the only entity that provides to shippers containerized freight transportation by rail in India. It thus has a monopoly in this field, though option of transport of containers by road provides certain competition.

China
Initial economic development in China took place in coastal areas and lead to ports for export import cargo was rather small. The emphasis, therefore, was to develop container handling facilities at ports and not on multi-modal services. CR has continued to manage container transport as part of its freight business.

In recent years with government's emphasis on spreading industrial activities in the hinterland, the availability of container based multimodal transport services, both for international and domestic business assumes critical importance. China container based import-export trade is booming and it grew by 35% between 2001 and 2002. CR is in the process of initiating a study (funded by USTDA) that would help develop its strategy for growth of rail based multimodal services. It is apparent that movement of containers over longer distances would be economical and efficient by rail.

China has encouraged private sector participation in development and operation of container terminals at ports. For example the Dalian Container terminal is owned and operated by a Singapore based company. A joint venture company, Shanghai Tie Yang Multi Modal Transportation Company Limited, was established in 1996. It is a joint venture between two subsidiaries of MOR and A. P. Moller-Maersk Group and provides domestic rail services for containers (scheduled as well as ad-hoc) to a number of inland points in China. Container trains are run between Dalian and Harbin. CR operates such trains and also furnishes flat cars as well as locomotives. CR has so far not offered regular or scheduled container train services from cities in the hinterland to ports. Efficient multimodal services between inland production centers and ports as well as domestic consumption centers by rail would help reduce logistic costs and make transportation services more reliable.

At the end of 2003, a separate company was formed by CR to handle container transport by rail in China. The company is in the public sector, fully owned by the government through the 14 railway administrations. The railway administrations hold the equity for this company. As is the case in India, this company would need to develop close working relationship with the railways, road authorities and customs department so that it is able to provide desired level of multi modal services to its customers.

4.11 Strategies and policy issues

The strategy and policy issues for India in respect of economic growth and transport sector were discussed in India's 10th FYP document. In summary:

- The per capita income is to be doubled within the next ten years by targeting a growth rate of 8 per cent during the Tenth Plan period and 9.3 per cent during the Eleventh Plan, and by focusing attention on the growth of employment intensive sectors;
- Reduction of poverty ratio by 5 percentage points by 2007 and by 15 percentage points by 2012;
- Economic and social development of the country must take full cognizance of the growing regional imbalances in practically all indicators;
- Redefine the role of government and provide an environment in which private sector can drive industrial growth. The government's role in social sector and infrastructure development will expand;

The energy-transport infrastructure will be a major constraint on any effort to achieve a significant acceleration in the growth of GDP during the Tenth Plan period. The planned high GDP growth will place heavy demands on these. Without speedy resolution of problems of these sectors, India will neither be able to accelerate its growth nor compete effectively in the increasingly integrated international economy;

- Indian Railways should have a lead role in the transport sector, not to mention other considerations such as greater energy efficiency, ecofriendliness and relative safety;
- Railway continues to lose market share mainly due to policy distortions including skewed tariff policy which overcharges freight movement in order to subsidise ordinary passenger traffic and an investment strategy, which has placed excessive emphasis on opening new lines for passenger traffic and not enough emphasis on expanding capacity

in areas where there is potential commercial traffic. The system of subsidizing ordinary passenger services must be phased out gradually over the Tenth Plan period;
- Due consideration should be given to establishing an independent Rail Tariff Regulatory Authority for tariff fixation on technical and commercial considerations; and
- Emphasis on prioritization of all ongoing projects, augmentation of capacity on high density corridors, acceleration of containerized transport to increase share of high value traffic**.**

Indian Railways has not published a document describing its 10th FYP, nor has it finalized its Corporate Plan for period 2000-2010. There seems to be a disconnect between the strategies and policies included in the national 10th FYP and what IR has done so far. For example, so far there are no initiatives that would help IR expand its role in transport market, increase its modal share, remove policy distortions, reduce subsidy of ordinary passenger trains, establishment of a rail tariff regulator and prioritization of on going projects.

An outline of **China's strategies for the 10th FYP** was furnished by Premier Zhu Rongji's Report on the Outline of the Tenth Five-Year Plan for National Economic and Social Development (2001-2005), delivered on March 5, 2001. In summary it includes:

The objectives include: maintain a fairly rapid growth rate in the national economy, achieve noticeable success in the strategic restructuring of the economy, and make marked improvement in the quality and benefits of economic growth to lay a solid foundation for doubling the 2000 GDP by 2010; make significant progress in establishing a modern corporate structure in state-owned enterprises, increase the soundness of the social security system, improve the socialist market economy, and open wider to the outside world and strengthen cooperation with other countries; expand avenues of employment, increase the income of urban and rural residents steadily, etc.

Policies include:
- Readjusting and improving industrial structure is the key to the strategic restructuring of the economy;
- Intensifying construction of water conservation, transportation, energy and other infrastructural facilities and attaching great importance to strategic issues concerning resources;
- In transportation, build highways, railways, ports, channels, airports and pipelines in order to establish a comprehensive modern transportation system that is unimpeded, safe and convenient;
- Implementing the strategy for developing the western region to promote coordinated progress of different areas including building the Qinghai-Tibet Railway;
- Further deepening reforms and opening the economy wider to the outside world;
- To gradually bring the system of socialist market economy to completion and to stimulate structural readjustment and economic growth;
- Deepening the reform of state-owned enterprises to enable them to compete as equals in the market economy;
- Further reform the management systems of industries such as electricity, railways, civil aviation and telecommunications, and introduce a mechanism for competition; and

- Encourage foreign investors, especially transnational corporations, to invest in high-tech industries and infrastructure, and encourage them to set up research and development centers in China and to participate in the restructuring and renovation of state-owned enterprises.

The 10th FYP of China Railways is generally aligned to the above stated overall strategies and policies, except that MOR has not yet finalized its restructuring plan that would enable it compete successfully in the emerging competitive environment. In fact MOR is the only ministry in China dealing with services that has not been fully restructured.

What did China Railways not do?

- CR did not develop sufficient capacity for freight transport in time to meet the demand from increased imports and domestic consumption. CR is now struggling to keep up with demand for freight transport.
- CR has not created an enabling environment for attracting private capital. In fact, recently it cancelled the existing system of private ownership of freight wagons. It has thus missed an opportunity of sourcing private capital for rolling stock that would have helped alleviate the current wagon shortage.
- Unlike IR (in the case of Concor), CR was slow in providing enabling environment for movement of containers by rail. As a result most container traffic in China moved by road. CR has recently established a company that would focus on rail transport of containers.
- Although CR has taken several steps to separate its non core business and has been formulating plans for restructuring for some years, it has not yet been able to establish a road map for separation of ministry functions (policy and regulation) from the operational railway responsible for the enterprise.

5. Conclusions and recommendations

Economic Development

China has achieved an economic miracle in the last two decades with GDP growing at an average of nine percent or more and growing more than five fold between 1982 and 2002. India on the other hand not only came to the game later but also embraced economic reforms more cautiously and in the same two decades its GDP growth rate per year was a shade below 5 percent and grew 2.6 times between 1982 and 2002. In absolute terms, India's performance is very creditable as it has been one of the fastest growing large economies. However, in comparison to the performance of China over the same two decades, it is less flattering.

India faces the formidable challenges of eradicating poverty, reducing unemployment and improving the quality of life of its citizens. The other challenge is to reduce vast disparities in per capita income level between and within India's states. Poverty reduction continues to be the main focus of India's development plans. As per official claims, poverty in India declined from 36% to 26% of population between 1994 and the end of the decade.

The challenge for China is to enable the population in rural and inland areas to have a greater share of the economic prosperity of the country. China has been singularly successful in poverty

reduction and since 1979 it has lifted about 400 million people (about 30% of its population) out of poverty at the $1 a day expenditure level. However, disparities in incomes between population in urban and coastal areas and rural and less developed regions have increased.

Railways

Railway and its place in national economic development

In terms of land area China is about three times as large as India and has 30 percent more population. In terms of route km, the size of the railway system in China was 14% larger than that of India in 2002, although in 1992, it was smaller by about 7 percent. During the decade 1992-2002 the railway route km grew by 24 % and 1% in China and India respectively. The density of railway network per unit of surface area in China was much lower than India but only slightly lower in terms of per million of population. Railways are fairly evenly spread over India, except that the railway density is relatively low in north east of the country. In China, the railways are rather unevenly spread over the country. Railway density is much higher in the coastal regions and eastern part of China and very sparse in the western region.

Railways in India and China have important role to play in the economic development of respective countries. Both countries are striving for comparatively high rate of GDP growth (order of 8% per year or more) over the next 10 years and that will cause commensurate increase in demand for rail transport not withstanding the huge investments being made to develop highways. Railways, therefore, need to create capacity and improve service quality both for passenger and freight segments to adequately support the economic development and meet the challenge of globalization of international trade and intense competition from the road sub-sector. China has unfolded a vision and a plan under which it will invest about US$ 200 billion in railways over 16 years (2004-20) to address the capacity and service quality issues. India, on the other hand has not so far announced a long range vision and an investment plan for the medium term.

India needs to develop a vision for its railways that will meet the needs of the country over the next 15 years of expected rapid economic growth. Such a vision needs to be supported by an implementation and investment plan. IR must relieve existing bottlenecks and ensure that railways do not constrain economic development of the country. Such a plan would address issues related not only with capacity and service quality but also reduction of unit cost. It would consider construction of dedicated corridors for freight and passenger services on its high density congested corridors. For reducing unit costs it would consider increased axle loads, wagons with better load to tare ratio, and increase in train capacity on existing corridors (automatic signaling and heavier freight trains). Such a plan would require investments on a much larger scale than is planned for the 10th Plan.

Comparative performance

The total transportation out put (equated units= pass km + ton km) of China Railways (CR) was about two and a half times that of Indian Railways (IR) in 1992 as well as 2002. The growth rates of passenger, freight and total rail transport has been of the same order in the decade 1992-2002, reflecting that, in absolute terms, the increase in output on CR (excluding local and JV railways) was approximately 2 ½ times that of IR – in fact the *increase* in freight on CR (394 btkm) over this period was more than the *entire* freight (336 btkm) carried by IR in 2002, while the increase in passengers on CR was only slightly larger than on IR (182 vs 179 bpkm) At the

same time, China has added nearly 14,000 route km to its network and dramatically expanded throughput capacity of its previously existing networks. In 1992 as well as 2002 the volume of passenger transport output of both railways was of the same level but China Railway's freight transport output was 4.5 times that of Indian Railways.

IR is a passenger-dominated railway with 59% of its transportation output but barely 30% of its revenues from passenger services, while CR is freight-dominated deriving 76% of its transportation output but only 49% of its revenues from freight traffic. The disparities in physical output and revenue percentages reflect the fact that passenger services are priced far lower by IR than by CR. CR has raised passenger fares to profitable levels and expanded passenger services in pursuit of a market determination of the economic level and mix of these products, while IR has priced most (but not all) passenger services at below cost, and market demand for these services has naturally expanded, preempting capacity needed to meet high demand for freight, driving IR's losses ever larger, and resulting in a major economic and financial distortion that precludes effective rail freight services to the Indian economy. Only 10% of IR's passengers (53% pass km but 72% revenue) travel by long distance mail and express trains, while the rest use loss making suburban and short distance ordinary trains. CR on the other hand provides mainly long/medium distance passenger transport and is not engaged in provision of suburban (commuter) services.

IR's freight business consists of bulk commodities transported over long leads. IR has concentrated on train load traffic of bulk commodities and has neglected and lost high rated less than train load traffic. Eleven bulk commodities account for over 95 percent of freight traffic carried by IR. The utilization of wagons in terms of net ton- km per wagon day to BG has shown an improving trend and increased by 54% 2001-02 in comparison with 1991-02. This improvement is mainly due to the phasing out of low productivity 2 axle wagons, increasing proportion of lower tare/higher capacity BOXN wagons and reduction in terminal detention (Wagon turnaround reduced from 11.5 days in 1991-02 to 7.2 days in 2001-02). The average speed of freight trains on BG has, however, stagnated around 24-23 km/hr for the last ten years mainly due to increasing congestion on high density corridors and high failure rate of infrastructure and rolling stock.
On CR also bulk commodities account for most the freight traffic but it carries about 11% non-bulk traffic. Unlike IR, less-than-train-load traffic is sought and carried. It runs fewer block trains (mainly on closed circuit coal lines) and freight locomotives rarely cross administration boundaries. Freight trains invariably pass through marshalling yards, though efforts are being made to form long distance trains so that some marshalling yards could be bypassed. The average speed of freight trains has improved in the decade under review and in 2002 at 32.4 km/h is 32% higher than IR broad gauge performance. CR's performance for wagon turnaround, output per wagon, locomotive output, track density and employee output is far superior to IR's performance.

Financial Performance
IR's operating ratio of 0.96 is considered to be substantially understated, as the provision of depreciation at 2% of the historical value of assets is well below actual requirements. If IR were to make adequate provision for annual asset renewal, and make adequate provision for the large backlog of overdue equipment and track renewals, it would be shown to be a loss-making entity in normal commercial accounting terms. Moreover, in order to provide cross-subsidies to loss-

making passenger services, freight tariffs are already above the level that many shippers are willing to pay, contributing to the continuing erosion of IR's share of the profitable freight markets.

All freight traffic on CR pays a substantial 'construction surcharge' (about 56% of basic tariff) that is used only for capital investments. On the expenditure side a glaring contrast is that while IR's staff costs account for 53% of working expenses, on CR these costs are 25%. The high ratio of staff costs on IR is unsustainable and if not controlled will spell its financial disaster. It is thus clear that IR has to go all out to contain staff numbers and costs and increase staff productivity.

Productivity

CR's performance in respect of traffic density and employee output is far better than that of IR. China has larger proportion of double as well as electrified track. Further CR has adopted automatic signaling more aggressively than in India. As a result CR is able to operate roughly twice the number of trains on electrified double tracks than Indian Railways. This results in a high level of utilization of the fixed infrastructure.

CR has taken several measures to transfer non core activities to other central ministries and provinces and improve staff productivity. As a result its work force has been reduced from 3.41 million in 1992 to 1.76 million in 2002. This has given a substantial boost to its staff productivity. IR has reduced staff from 1.65 million in 1992 to 1.51 million in 2002, mainly due to natural wastage and strict control over recruitment.

Unlike CR, IR continues to carry out diverse activities not directly related with IR's core business. IR should seriously consider separation of its non-core activities so that management could focus on the core business.

Strategies and funding for development

Over the years, both railways have lost market share in freight as well as passenger segments. With major investments in the road sector and deregulation of air lines, both railways face increasing competition from road as well air lines and need to devise strategies to meet the emerging competitive environment. Both economies are poised to grow rapidly leading to increase in transportation demand. With change in character of economic activities and globalization of trade, the customers would need higher service quality in terms of transit time, reliability and tracking of consignments. Both railways thus need to add substantial capacity and enhance service quality. Some additional capacity could possibly be realized by more intensive utilization of existing assets, but both IR and CR would need to raise large amounts of capital for investments at levels much higher than in the past to achieve desired capacity enhancement. The three obvious options are:

- **Internally generated funds**. This will require significant improvement in operating ratio
- **Borrowed funds**. It will be possible to increase level of borrowings to some extent from international as well as domestic financial institutions provided the investment is directed at financially viable projects.

- **Private Sources**. The private sector could fund investments in a number of different forms – specialized freight wagon investments, operation of dedicated commodity trains, container transport, or passenger trains, even particularized equity opportunities via SPVs for dedicated freight corridors. Joint ventures with stakeholders, especially for branch lines and feeder lines.

It is, however, imperative that the investments be made by IR only where there is compelling financial justification.

Passenger services pricing and products

While CR is focusing on long distance passenger services, IR is bogged down in providing loss making suburban and ordinary stopping passenger trains. The losses are caused by low passenger fares that are driven by social and political considerations. As a rough estimate IR recovers only 65% cost of its passenger services i.e. for every INR of passenger revenue it loses INR 0.5. The cost recovery for ordinary passenger services is possibly around 27%.

CR also had cost recovery problems in passenger business some years ago and it minimized losses by keeping passenger volumes low. When it was realized that rationing of passenger capacity was not sustainable, it decided to raise passenger fares to a level of full cost recovery. It then expanded capacity for passenger services and improved quality of service as well. The ratio of unit revenue from passenger (per pass km) to freight (per ton km) rose from less than 1 to 1.4. In India it is still at a low of 0.31.

It is clear that IR must urgently address issues related to passenger service viability, pricing and product mix. It should assess the financial viability of each pair of passenger trains. IR could utilize the development of the highway sector to its advantage by withdrawing substantially from the short distance stopping train services (ordinary passenger trains) which have a very low cost recovery (0.27) and consume massive line capacity. Train services should then be designed on a clean slate on the basis of reliable market information for demand and financial viability. Such an exercise in itself would reduce IR's losses on passenger services.

IR also needs to separate suburban services and uneconomic branch lines.

Management of loss making branch lines

Both IR and CR have branch lines that are short in length, located in less developed areas and low levels of traffic in comparison to capacity. Such branch lines make losses and impose increasing financial burden on the railway system. IR is currently carrying out an internal study to develop a strategy for managing such branch lines so that losses are eliminated or minimized.

CR is also seized of this problem and has identified 100 loss making branch lines for reform aimed at increasing revenue, reducing costs and minimizing losses. The total length of selected branch lines on CR is 7,428 km (12.6% of national network) and generates only 0.8% of the total traffic units (2001). CR has initiated a reform program that includes:

- Separation of accounts for each line
- Setting up targets for revenue, costs and losses
- Administrative organization and manning levels restructured
- Some stations closed
- Maintenance of track and signals rationalized to reduce costs

- Fewer departments and multi-skilled staff
- Excess staff transferred to alternative off line small business activities.

The branch line reform has succeeded and it is estimated that between 1999 and 2001, the operating losses on the 100 selected branch lines were reduced from RMB 1,225 (US$ 147 m) to 901 million (US$ 108m), a decrease of 26%.[45]

IR is working on the development of a strategy for managing loss making branch lines and could usefully apply some of the CR initiatives to improve the management of such branch lines.

Project implementation

Experience with World Bank and ADB funded construction and electrification projects in China has demonstrated the excellent project management capability of CR in planning and implementing these projects. The project implementation periods are relatively short and actual implementation is either on schedule or earlier. In India, the experience is that project implementation takes much longer than planned duration. There are possibly two main reasons for slower project implementation on railways in India. Firstly the project managers are not adequately empowered which necessitates frequent references to IR Board. The second reason is inadequate funding for the entire project due to the tendency to commence far too many projects and spreading the resources thin. Project managers are required to stretch activities over inordinately long periods leading to cost over runs as well as idling of investment till project completion. The experience of Delhi Metro Rail project, where the project management has unrestricted decision making powers has demonstrated that large rail projects can be delivered on time if projects are adequately funded and project managers are suitably empowered.

IR should provide upfront funding for the project completion, strengthen the project management skills of its managers and empower them adequately so that time taking references to higher authorities are eliminated.

Politically driven investments

Two major investment policies in the past 10 years that ignored IR's investment priority for capacity enhancement and improvements in quality of service (in particular of freight services) have had a profound effect on the development (rather the lack of it) of IR.

- Uni-gauge policy under which IR made investments on large scale conversion of Meter Gauge to Broad Gauge. Only a few of these conversions were justified on financial and or economic basis. Most of these investments have high negative rates of return that have imposed long term financial burden on IR financial performance.
- Investments driven by political and social considerations notwithstanding the substantial adverse impact on the financial health of IR.

IR has a shelf of financially non viable approved projects for which it provides token allocation of funds year after year. It should review the shelf of all projects justified on socio-economic

[45] Reference: Report on study on the state allowance policy for railway PSO on China Railways (June 30, 2003)

considerations and suggest to the promoters that either these be cancelled or funded as a PSO by the state or central ministry promoting such projects.

Separation of non core activities and railway reforms

CR and IR are the only two major railway systems that are owned and operated by a Ministry of Railways since the railway in Russian was converted to an SOE in 2003. Railway's business environment is changing in India and China. Both face greater competition and customer expectation of higher quality of service in terms of speed and reliability at competitive prices. Railways also need to access high levels of investments to create capacity and raise productivity. Railways need to restructure so that they could be more responsive to the market conditions and meet the emerging challenge from globalization of international trade, developing highway infrastructure and new generation of heavy road vehicles. In addition Railways need to cut unit costs to realize higher internal accruals to fund capacity expansion without which transport will constrain economic growth. Reform of railways is considered essential to achieve the above stated objectives.

CR is committed to railway reform. It has established a group of mangers to study restructuring options and develop a policy for reform and has already taken several preparatory steps in advance of the railway reform and restructuring. This includes separation of non core activities. As a result it has transferred about half of its workforce from MOR to other central or provincial agencies. The activities that have been separated include manufacturing factories, companies handling materials and supplies and railway communications, four railway design bureaus, construction units, schools and hospitals. It also developed a large number of localized, non-rail businesses in order to shift employees from railway to non-railway payrolls. It has developed costing systems and has established passenger transport businesses within RRAs on accounting basis to focus on profitability of services. It has also separated about 100 branch lines and established special purpose companies to handle containers, special cargo (oversized and perishable cargos) and Post and Parcels.

IR's main achievement in this area has been reduction of staff from 1.65 to 1.51 million between 1992 and 2002. It has also established some entities outside IR to manage certain non core activities. Unlike China, where the separation was outside MOR, in India the separation has been to units that are fully owned by IR. Further, IR has not been able to build a momentum towards shedding non core activities on a large scale. Although, in November 2002 IR indicated to ADB of its intention to carry out certain reform measures, it is yet to make any changes of significance and there is a growing perception that IR is not yet committed to reform.

GOI and IR must articulate clearly the policy on reform and seek support of its staff, mangers and stake holders for early implementation. Business as usual is not an option.

Management structure

Both IR and CR are being managed on functional lines, which is not the best way to manage a commercial organization. A successful commercial entity is organized on business lines so that interests of customers can be served best and costs and revenues can be assessed for each activity. It is recommended that management structure should be recast so that main businesses are profit centers and costs and revenues for each business and segment are clearly identified. The focus of business managers must be service delivery to customers and profitability. Aligning the management

structure of IR with lines of business is neutral to staffing and political issues and could be implemented over a relatively short period.

IR has taken some initial steps towards commercial orientation by appointing dedicated freight and passenger heads at the railway headquarters. Much more, however, requires to be done to put in place empowered multi-disciplinary teams who can reach out to the customers to develop lasting relationships and modal loyalty. The managers/staff comprising the teams should be motivated through incentives related with profits generated.

The other important organization change recommended is to separate the enterprise function from the government policy and regulatory functions. Appointment of an independent regulator is an essential pre-requisite for attracting private sector investment in railways through SPVs.

The blossoming of multi modal container transport in India since the assignment of management of this specialized business to CONCOR has demonstrated the potential of growth, improvement in service quality and profitability by separating specialized services from the main line business in railways and managing them on commercial basis. The success arose from empowerment of its management, intense management focus on multi modal transport, commercial approach, sensitivity to customer needs, policy of outsourcing equipment and services and incentives for staff and managers. IR could replicate CONCOR experience and form more "CONCOR like" units to develop profitable and high quality rail transport services in other specialized business areas.

Strategies and Policy Issues

In order to harmonize with declared government strategies and policies, IR must take initiatives that would help IR increase its modal share of the transport market, reduce subsidy of ordinary passenger trains, establishment of a rail tariff regulator and prioritization of on going projects. These objectives would be achieved with a combination of railway restructuring and investments.

If IR fails to restructure in the near future, there is a high risk that high transport cost and constraints of capacity and service quality would slow down the economic development of the country. If a larger proportion of freight moves by less economic transport modes due to railway's inability to meet demand in terms of capacity or service quality, the country shall incur high economic cost. The other branches of Indian government (Ministries of Finance, Commerce, Industry etc. and Planning Commission) and industry and business associations who are stakeholders in IR's performance and development, therefore, need to be proactively engaged in championing restructuring of IR.

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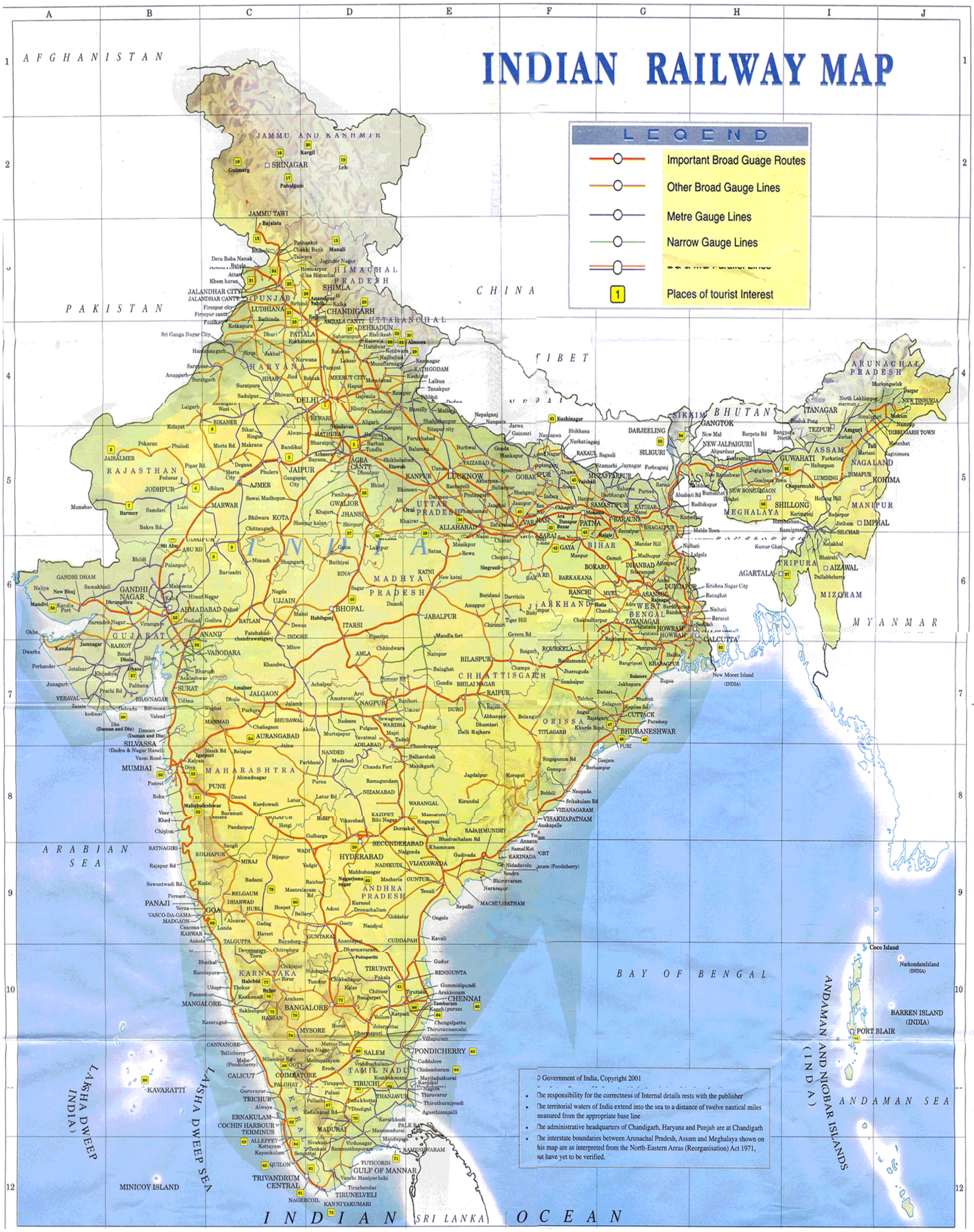
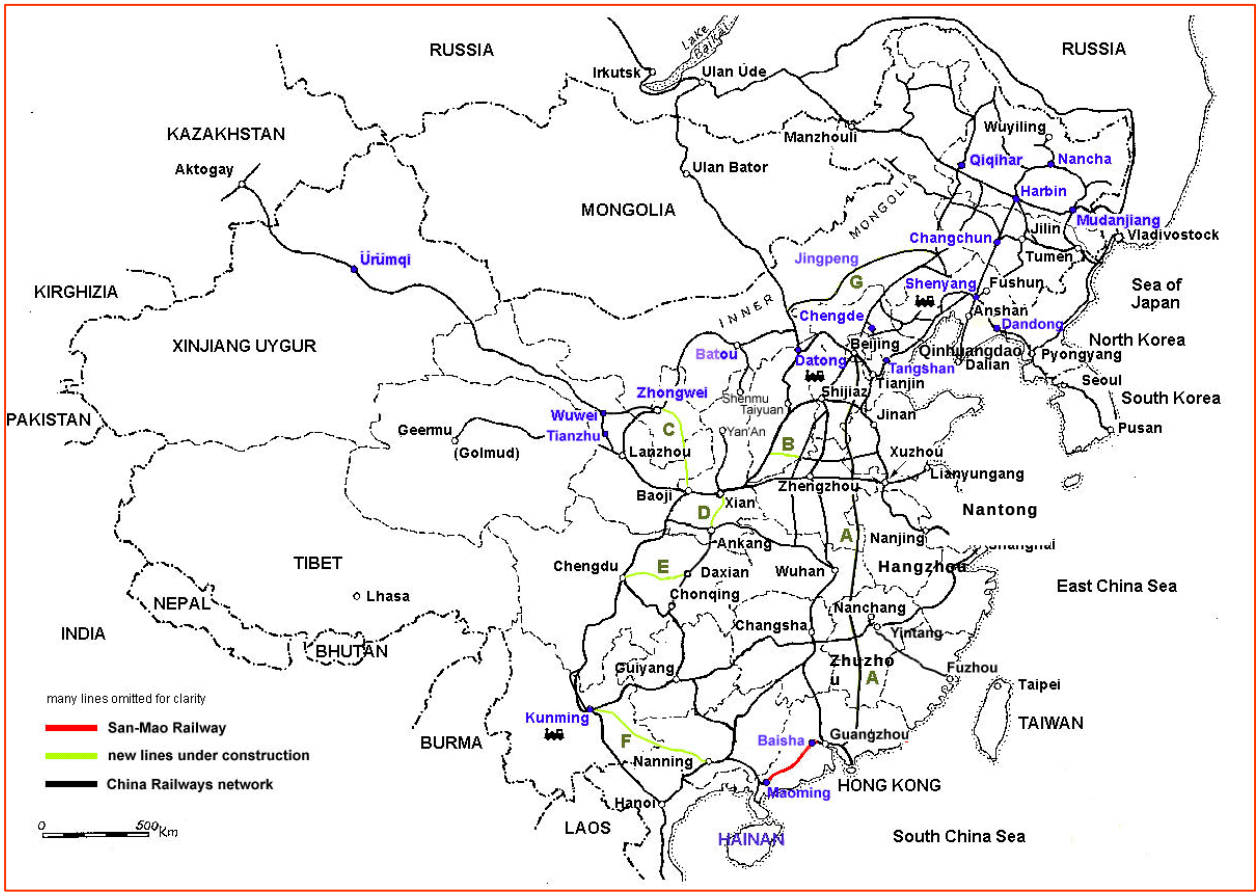


INDIAN RAILWAY MAP
LEGEND
Important Broad Guage Routes
Other Broad Gauge Lines
Metre Gauge Lines
Narrow Gauge Lines
Places of tourist Interest
AFGHANISTAN
PAKISTAN
CHINA
TIBET
BHUTAN
MYANMAR
ARABIAN SEA
BAY OF BENGAL
ANDAMAN SEA
INDIAN OCEAN
SRI LANKA
JAMMU AND KASHMIR
HIMACHAL PRADESH
PUNJAB
HARYANA
UTTARANCHAL
RAJASTHAN
GUJARAT
UTTAR PRADESH
MADHYA PRADESH
BIHAR
JHARKHAND
WEST BENGAL
CHHATTISGARH
ORISSA
MAHARASHTRA
ANDHRA PRADESH
KARNATAKA
TAMIL NADU
KERALA
ASSAM
ARUNACHAL PRADESH
NAGALAND
MANIPUR
MEGHALAYA
TRIPURA
MIZORAM
SIKKIM
INDIA
LAKSHA DWEEP SEA
ANDAMAN AND NICOBAR ISLANDS (INDIA)
SRINAGAR
JAMMU TAWI
SHIMLA
CHANDIGARH
LUDHIANA
DEHRADUN
DELHI
JAIPUR
AGRA
LUCKNOW
KANPUR
ALLAHABAD
PATNA
GUWAHATI
CALCUTTA
HOWRAH
BHOPAL
JABALPUR
AHMADABAD
VADODARA
SURAT
MUMBAI
PUNE
NAGPUR
RAIPUR
BHUBANESHWAR
HYDERABAD
SECUNDERABAD
VIJAYAWADA
VISAKHAPATNAM
CHENNAI
BANGALORE
MYSORE
MANGALORE
COIMBATORE
MADURAI
TRIVANDRUM CENTRAL
PANAJI
PONDICHERRY
KAVARATTI
MINICOY ISLAND
PORT BLAIR
© Government of India, Copyright 2001
• The responsibility for the correctness of Internal details rests with the publisher
• The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line
• The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh
• The interstate boundaries between Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the North-Eastern Areas (Reorganisation) Act 1971, but have yet to be verified.

CHINA RAILWAYS MAP



Annex:3.1A Structure of Indian Economy

	1982	1992	2002	Remarks
GDP (US$ billion)	194.8	244.2	510.2	
Exports of goods and services as % of GDP	6.1	9.0	15.2	
Percent of GDP				
Agriculture	35.9	30.9	22.7	
Industry	25,8	26.7	26.6	
Manufacturing	16.2	16.2	15.6	
Services	38.3	42.3	50.7	

Source: World Bank "India at a glance"

Annex: 3.1B Salient Features of Indian Economy

	1982-1992	1992-2002	Remarks
Average annual growth percent			
GDP	5.6	6.0	
GDP per capita	3.4	4.2	
Export of goods and services	6.9	13.5	
Import of goods and services	5.7	12.0	
Sectoral average annual growth percent	3.1	2.5	
Agriculture	6.7	6.2	
Industry	6.5	6.6	
Manufacturing	6.8	8.2	
Services			

Source: World Bank "India at a glance"

Annex 3.2A Structure of Chinese Economy

	1982	1992	2002	Remarks
GDP (US$ billion)	221.5	454.6	1232.7	
Exports of goods and services as % of GDP	8.9	19.5	29.5	
Percent of GDP				
Agriculture	33.3	21.8	14.5	
Industry	45.0	43.9	51.7	
Manufacturing	37.3	33.1	44.5	
Services	21.7	34.3	33.7	

Source: World Bank "China at a glance"

Annex 3.2B Salient Features of Chinese Economy

	1982-1992	1992-2002	Remarks
Average annual growth percent			
GDP	9.7	9.0	
GDP per capita	8.1	8.0	
Export of goods and services	5.9	14.3	
Import of goods and services	7.3	18.0	
Sectoral average annual growth percent			
Agriculture	4.6	3.7	
Industry	11.6	11.3	
Manufacturing	11.2	10.4	
Services	11.7	8,4	

Source: World Bank "China at a glance"

Annex 4A

COMPARATIVE RAILWAY ASSETS AND PHYSICAL PERFORMANCE (1992 AND 2002)

	INDIA			CHINA		
	1991-92	2001-02	Ratio 91-92/ 01-02	1992	2002	Ratio 1992/2002
Population million	846	1000	1.18	1171	1300	1.11
Railway route km	62,458	63,140	1.01	58,100	71,897*	1.24
Broad Gauge	35,109	45,099	1.28	NR53565	NR 59530	1.11
Double track km	14,605	16124 (25.5%)	1.10	13658(25.5%)	23,058(38.7%)	1.69
Electrified km	10,809	16001 (25%)	1.48	8434(15.7%)	17,409(29.2%)	2.06
Railway track km	109,338	109,227	1.0	106,184	127,949	1.20
Automatic Block track km	2594	3571	1.38	11287	20682	1.83
Passengers carried million (non Suburban)	4049 (1637)	5093 (2094)	1.26 (1.28)	997	1056	1.06
Average per capita trips per year total (non suburban)	4.78 (1.93)	5.09 (2.09)		0.85	0.82	
Passenger km billion	314	493	1.57	315	497	1.58
Passenger originating market share %	20	15		11.6	6.6	
Av. Trip length Total	77.7	96.9	1.25	316	471	1.49
Non suburban km	153.4	191.6	1.25			
Freight originating tons million	360	522	1.31	1576	2043	1.30
Freight tkm billion	257	336	1.31	1157	1551	1.34
Average haul distance km	714	643	0.90	734	759	1.034
Freight originating ton market share %	45	30		15.1	14.6	
Equated traffic units (pkm+tkm) billion	571	829	1.45	1472	2048	1.39
Passenger coaches	32792	39236		28464	37942	
Freight wagon fleet	346394	216717		373233	446707	
Employees million	1.65	1.51	0.91	3.414	1.758	0.51
Operational employees million	1.42 (estimate)	1.3 (estimate)	0.91	2.038	1.394	0.68
Output per operational employee 1000 converted Tkm	402	648	1.61	728	1385	1.90

Source: Chinese Railways CR Facts 2002 Edition, Indian Railways Year Book 2001-02 and 1992-93
*In China, Total (71,897 km) consists of National Railway (NR), managed by Ministry of Railways (MOR): 59,530 km; Local Railways managed by local governments: 4,716 km, and Joint Venture Railways, jointly funded by governments and enterprises: 7,651 km. Most data relates to National Railway.

Annex: 4.1A Transportation Output India and China

Railway	1992	2002	Ratio 1992:2002	Remarks
India				Increase
-Passenger: pass km billion	314	493	1.57	179
-Freight: ton km billion	257	336	1.31	79
Total (pass km+ton km) billion	571	829	1.45	258
China				
-Passenger: pass km billion	315	497	1.58	182
-Freight: ton km billion	1157	1551	1.34	394
Total (pass km+ton km) billion	1472	2048	1.39	576
Ratio of total transportation output India: China	0.39	0.40		258/576 = 0.45

Annex: 4.1B Segmentation of Passenger services on IR (2002)

	Suburban	Non- suburban			Total all services
		Mail/ Express	Ordinary	Total	
Passengers million	2999 (58.9%)	537 (10.5%)	1557 (30.6%)	2094	5093
Pass Km billion	92.9 (18.8%)	264.0 (53.5%)	136.6 (27.7%)	400.6	493.5
Trains run daily	3660	1467	3393	4860	8520
Average lead km	31.0	476.5 (682 for upper classes)	87.7	181.6	96.9
Revenue INR Million	11560 (10.4%)	70406 (72%)	19656 (17.6%)	100062 (89.6%)	111622 (100%)
Earning per pass km INR	0.12			0.25	0.23

Source: Indian Railways Year Book 2001-02 and earlier issues

Annex: 4.1C Freight Business Comparison - India and China

	INDIA (Broad Gauge)		**CHINA (National Railway)**	
	1991-92	**2001-02**	**1992**	**2002**
Wagon turnaround days	11.1	7.2	4.15	5.10
Daily output per wagon operated tkm	1439	2223	9924	9100
Wagon fleet	346394	216717	373233	446707
Average trip km	740	677	734	760
Average Speed kmph	22.7	24.4	29.9	32.4
Freight density (million tkm/route km)	6.4	7.38	21.56	25.33

Annex: 4.1D Performance of Indian and China Railways 1992 and 2002

	INDIA			**CHINA**			**Remarks**
	1991-92	**2001-02**	**Change**	**1992**	**2002**	**Change**	
Traffic density (Indian BG system) Million equated traffic units per route km	9.1 (14.21)	13.1 (17.56)	+44% +24%	27.4	34.4	+25%	China/India ratio is 3.0 and 2.6 in 1992 and 2002 respectively
Output per employee Million equated units	402	648	+61%	728	1385	+90%	China/India ratio is 1.8 and 2.1 in 1992 and 2002 respectively
Working ratio	0.67	0.76		0.51	0.79		
Operating ratio	0.90	0.96		0.75	0.95		

Annex: 4.1E IR - Financial performance

	1991-92	2001-02	Ratio 91-92/01-02	Remarks
Transportation revenue billion INR	137	378	2.76	
Freight	95	248	2.61	Ratio of ton km= 1.30
Passenger	37	112	3.02	Ratio of pass km= 1.64
Operating Expenses billion INR	92.1	343	3.7	
Depreciation billion INR	20	20		
Total working Expenses including depreciation and pensions billion INR	124	363	2.9	
Working ratio %	0.67	0.94		
Operating ratio %	0.895	0.96		

Annex: 4.1F CR - Financial Performance

	1992	**2002**	**Ratio**	**Remarks**
Transp.revenue billion RMB incl. const. surcharge	69.9	181.3	2.6	
Freight	32	70	2.18	Ratio of ton km= 1.34
Passenger	14	50	3.57	Ratio of pass km= 1.58
Operating Expenses billion RMB	24.6	112.0	4.5	
Depreciation billion RMB	11.2	22.3		
Total working Expenses including depreciation Billion RMB	35.8	134.3	3.75	
Working ratio %	0.35	0.62		
Operating ratio %	0.51	0.74		
Construction surcharge billion RMB	22.0	39.3		

Annex: 4.3A Investment Trends for Railways in India

INR Crores

Plan	Total Outlay	Internal Generation Rs Crore	%	Market Borrowings Rs Crore	%	Budgetary Support Rs Crore	%
5th	1525	384	25	0	0	1141	72
6th	6585	2783	42	0	0	3802	58
7th	16549	7089	43	2520	15	6940	42
8th (1992-97)	32306	18832	58	6161	19	7313	23
9th (1997-02)	45413	16352	35	14581	31	15472	34

Annex 4.3B Railway Investments in India and China

INDIA			CHINA		
	Total investment (all sources)		Total investment (all sources)		
	INR billion	US$ million		RMB billion	US$ million
1992-93	61.62		1993	44.92	
1993-94	58.61		1994	56.57	
1994-95	54.72		1995	57.25	
1995-96	63.35		1996	61.34	
1996-97	83.10		1997	65.55	
1997-98	82.39		1998	83.16	
1998-99	88.57		1999	80.58	
1999-00	90.57		2000	78.84	
2000-01	93.95		2001	80.87	
2001-02	101.77		2002	96.27	
Total in 10 years	778.68	17,300 (US$=INR 45)	Total in 10 years	705.25	85,000 (US$= RMB 8.3)

All at current prices

Annex: 4.4A INDIA- TENTH FIVE YEAR PLAN (April 2002-March 2007)

Rs crores 2001-02 prices

Ministry/Department	Budgetary Support			IEBR*			Total Outlay		
	Ninth Plan Actual	Tenth Plan Projections	% *Increase*	Ninth Plan Actual	Tenth Plan Projections	% *Increase*	Ninth Plan Actual	Tenth Plan Projections	% *Increase*
Railways	16491	27600	*67.4*	34120	33000	*-3.3*	50611	60600	*19.7*
Road Transport & Highways	19393	35000	*80.5*	18279	24700	*35.1*	37672	59700	*58.5*

Extracts from the 10th FYP document

Source: TENTH FIVE YEAR PLAN 2002-07 *IEBR: Internal and Extra Budgetary Resources

Annex: 4.4B Annual Investments in 2002-03 and 2003-04

(INR crores)

	2003-03 Revised Estimate	Percent	2003-04 Budget Estimate	Percent
Total	**12,315**		**12,918**	
Internal generation	**2,471**	**20**	**2,630**	**21**
Market borrowing	**2,880**	**23**	**3,000**	**23**
Budgetary support	**4,390**	**36**	**4,544**	**35**
Special railway safety fund*	**2.310**	**19**	**2,311**	**18**
Safety fund**	**264**	**2**	**433**	**3**

Source: Railway Budget 2003-04

*Funded from safety surcharge on passenger tickets and central government

** Funded from cess on diesel fuel consumed by road vehicles

Annex: 4.5A

Projections for Freight Traffic

	2001-02	2006-07	2011-12
Revenue earning traffic (Million Ton)	497	650	851
Lead	670	665	660
Transport Output (BTKM)	333	432	562
Annual %age growth	4.3	5.3	5.4

Passenger Traffic Projections

	2001-02			2011-12			
	Suburban	**Non-suburban**	**Total**	**Suburban**	**Non-suburban**	**Total**	
Passengers(million)	2999	2094	5093	4016	3132	7148	
PKM (billion)	93	401	494	119	558	677	

Source IR Estimates (Draft Corporate Plan 2000)

Annex: 4.6

Joint Venture and Local Railways in China

	Year	Main Line Km (route Km)	Pass. Volume million	Pass-km billion	Freight volume tons	Freight tkm billion	Transport Units billion
Joint Venture Railways							
	1992	0	0	0	0	0	0
	1996	3044	6.34	2.2	21.1	12.2	14.4
	2002	7651	33.5	16.1	61.1	37.4	53.5
Local Railways							
	1992	4511	9.05	0.39	53.10	2.7	3.09
	1996	5210	6.12	0.34	71.2	4.9	5.24
	2002	4716	5.75	0.53	112.4	6.3	6.83
Total							
	1992	**4511**	**9.05**	**0.39**	**53.10**	**2.7**	**3.09**
	2002	**12367**	**39.25**	**16.63**	**174.0**	**43.7**	**60.33**
Ratio 2002/1992		**2.7**		**41.8**		**16.1**	**19.5**

Source: CR Facts 2002 edition and updates