Build Indian railways for the Eurasian Land-Bridge

by Susan B. Maitra and Ramtanu Maitra

The key to fruitful trade along the southern tier of the Eurasian Land-Bridge, lies in strengthening the existing railroads that run through the Indian subcontinent from east to west. Out of an approximately 2,200 km-run through the subcontinent from the Myanmar border in the east to the Iranian border in the west, freight trains will traverse some 1,500 km of Indian territory. Aside from being the largest server in the subcontinent, the Indian railroads, serving 950 million people and a developed agro-industrial sector, will have to bear the brunt of future Land-Bridge freight. Equally important is the role of the railroad in bringing trade and commerce from and into Southeast Asia through the Land-Bridge (**Figure 1**). However, what emerges from the survey here, is that, barring the manpower requirements, Indian railroads are not equipped to handle the potentially large Land-Bridge freight effectively, unless speed and efficient functioning of the railroads are given immediate attention.

Unlike China, which set its focus a decade ago toward building a cheaper transportation system, such as railroads, to ferry bulk materials between China and Europe, and also to serve the Central Asian nations that lie in between, India lagged behind, both conceptually and physically, on the Land-Bridge issue. No serious thinking was done at the decision-making level, and no effort was made to establish a railroad-based trade and commerce route between Asia and Europe, with India at the hub of it. It is only in recent months, after the Chinese made their intent clear in 1996, that New Delhi has begun to wake up, and the necessity for setting up rail linkages between India and Southeast Asia through Bangladesh and Myanmar, and India and Europe through Pakistan and Iran, is being considered.

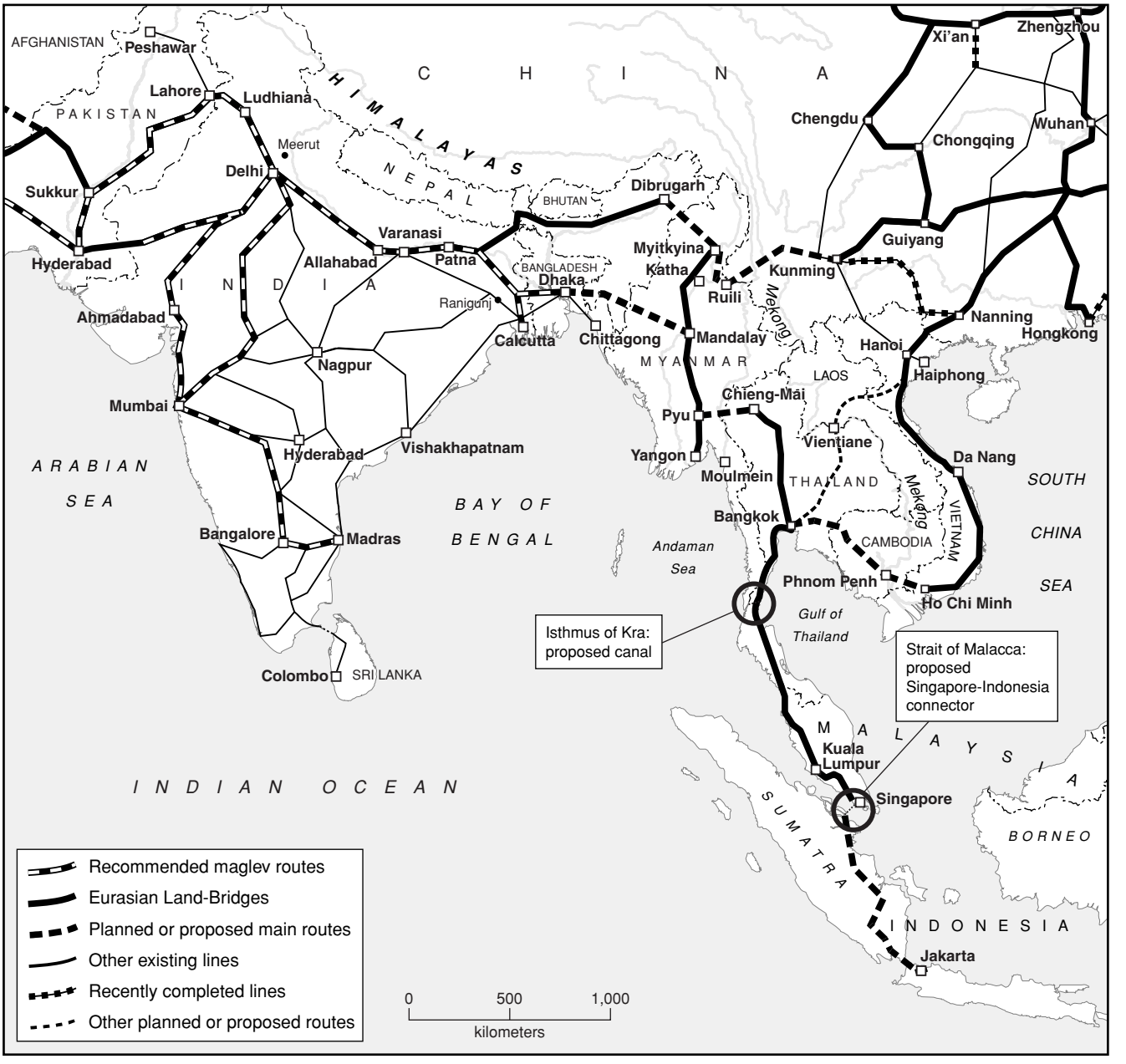
One of the reasons for such a delayed reaction, is perhaps the Cold War, which had pitted the subcontinental neighboring nations against each other, blocking trade, commerce, and infrastructural development of the region. Despite the change that occurred almost six years ago in the regional political environment, due to the collapse of the Soviet Union and the subsequent emergence of Central Asian countries as independent nations with vast untapped oil and mineral reserves, and China's build-up of its railroads, India's planning of the railroad sector has remained stultified. The Ninth Five Year Plan (1998-2002), which is now on the anvil and is expected to impose a fresh set of priorities on future railroads, on the basis of the changes in the regional environment, is, however, pursuing the age-old objective of providing every village in India an access to the railroads, and little more. Strengthening the railroads along the Land-Bridge route for heavy traffic, and introduction of a rail-based, high-speed modern transportation system, have so far escaped the attention of the policymakers.

It is not that the inadequacies of the Indian railroads can escape the notice of anyone living in or visiting India. The problem, perhaps, lies in the attitude of the policymakers toward what the railroads are for. There is no apparent realization that India is entering the 21st century with 950 million people, and that the exploitation of the potential to become a major world economic power is necessary for sheer survival. The mindset of the policymakers is to maintain the status quo of the days of the British Raj of the 19th century, that of a poor nation that gets by somehow.

Back in 1994, the Prakash Tandon Committee report on the restructuring of the railways said that the authorities should "regard themselves as being in the business of transportation, and not railways alone." The committee, whose report is collecting dust in the government office archives where such reports are piled up routinely, pointed out that

FIGURE 1

Southern Eurasian Land-Bridge, with emphasis on high-speed corridors

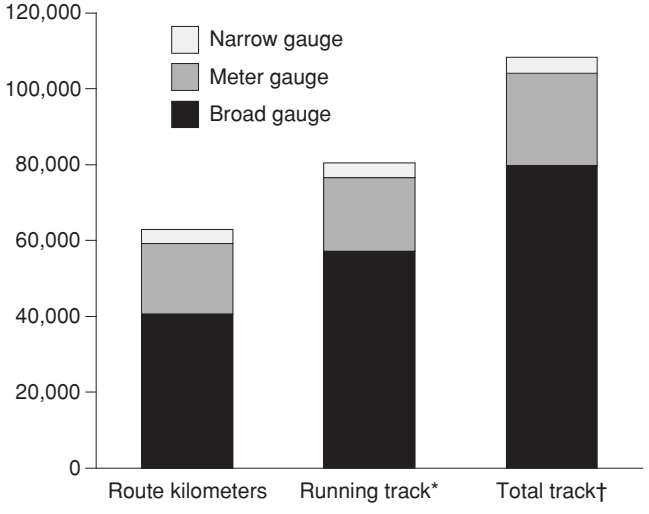


officials should take the initiative to integrate the railways into a multi-modal transportation system for freight and passengers.

Even the World Bank, which prefers all archaic and technologically inefficient systems over capital-intensive technologically advanced and efficient systems, particularly in the developing nations, suggested a complete overhaul of railway operations in India in a report in 1995.

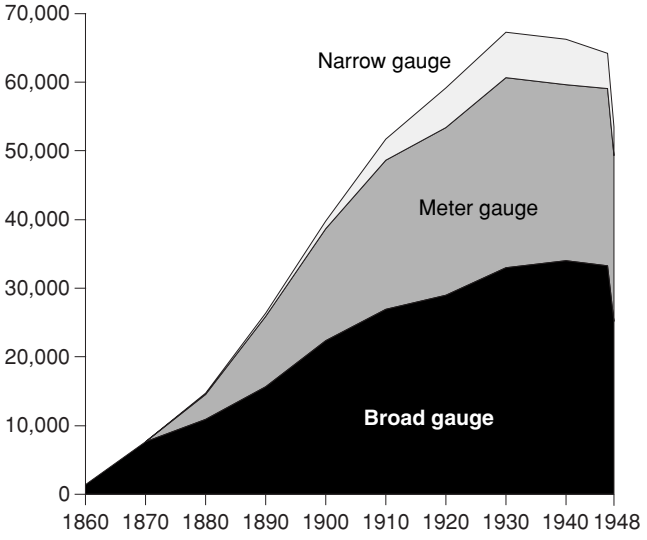
While the Prakash Tandon Committee report lingered over how to run the railroads more efficiently and make them profitable, without outlining the broader visions of modern high-speed railroads for the future, the World Bank concentrated on the necessity of eliminating subsidized travel, and the low-cost services and redundant employments provided by the Indian railways. The report suggested as a remedy to the present problems, the privatization of passenger services, and use of domestic double-stack container operations "to reduce pressures on the rail budget as well

FIGURE 2
Distribution of rail types
(kilometers)



* Includes double/multiple- and single-track together.
† Includes track in yards, sidings, etc.

FIGURE 3
Expansion of railways in India, 1860-1948
(route kilometers)



as the saturated road links." On the future objective of the Indian Railways, it should "concentrate exclusively on being an inter-city freight and passenger operation," the report propounded.

The backdrop

Despite various shortcomings, the railroads, founded 144 years ago, remain the principal mode of transport in India. In 1995-96, over 11 million passengers travelled every day by railroads over a network spread over 62,915 route-km, covering some 7,060 railroad stations. The railroad network consists of broad, meter, and narrow gauge, totalling 108,336 track-km (**Figure 2**).

India has the unique distinction of being the first country in Asia to have railways (**Figure 3**). In 1843, with the British East India Company governing India, a railway engineer of Great Western Railway in England, George T. Clark, went to Bombay (now Mumbai) to study the feasibility of laying railroads from Bombay to a port across the Western Ghats, the mountain range that runs along the western coast of India. Clark's proposal was launched under the banner of the Great Indian Peninsular Railway (GIPR), but was rejected while a rival project was pushed, which envisioned a railroad line from Bombay in the west to Calcutta on the east coast, with lines veering off northward to Allahabad and southward to Madras. This later project was seconded by the Liverpool cotton interests seeking fresh sources of raw cotton, and with an eye on the potential market for cotton goods.

Clark soon joined the latter group, and in 1849, Great Indian Peninsular Railway entered into a contract with the East India Company for construction of a 35-mile experimental line from Bombay. The project was completed in 1854, although the 20-mile stretch between Bombay and Thane had been opened in 1852, with two tracks running from the east side of Bombay Harbor, to Kalyan, a small town in the foothills of Western Ghats.

Another railway company, the Eastern Indian Railway, was inaugurated in 1845, and proposals were made before the Court of the East India Company, that the latter should guarantee a minimum return of 3% on an investor's capital. Later, the deal was sweetened by raising the return to 5% and half the surplus profits; no account was taken of deficits (losses); remittances were to be calculated for conversion at one shilling and ten pence to each rupee, and this was to be done each half year.

In his book, *Prosperous India: A Revelation from Official Records,* William C. Digby has documented the Raj exploitation of the Indians, in the context of building railroads. Digby, quoting a paper read to the British Association in the year 1900 by Miss Ethel Faraday, tells the following:

"The result was that the Indian Government (i.e., Indian taxpayers) bore all the losses of the unprofitable half-years, and, after 1875 never received its full share of the profitable ones as the rupee value fell below the floor of one shilling ten pence. The shareholders received a gradually increasing proportion of surplus profit. The contract obligation of a fixed interest of 5% prevented the state from taking advantage of cheaper money available at 2.5% with which they could have paid off the debt. On these three lines in question, taken to-

gether, the average proportion of earnings remitted to England 1892-1897 was 99.70%, and the net annual loss to government amounted to Rs. 13 million, a tax imposed on the Indian public for the benefit of British shareholders."

By October 1846, the Court of Directors of the East India Company was presented by the promoters by no fewer than 15 schemes for railways: six emanating from Calcutta, three from Bombay, four from Madras, and two in the Upper Provinces (now Uttar Pradesh) from Allahabad to Delhi, and then on to Meerut and Ludhiana in Punjab. Finally, in line with the proposal in the western coast in 1849, the East India Company asked the promoters of the East India Railway the same year to set up an experimental 120-mile railroad between Calcutta and the coal-rich Ranigunj.

Part of the agreement with the railway companies included the provision of free land for the railroad tracks and installations by the Government of India on a 99-year lease. It was early in 1851 that land was made available to the East India Railway for construction purposes. The engineer for the railway was responsible for all design work, which then had to be approved by the consulting engineer appointed by the government.

At the very outset, Indian railroad builders were caught up in the "battle of the gauges" raging in England then. Lord Dalhousie was appointed governor general of India in 1847, and he was fully aware of the gauge controversies in England. Two gauges—one 4 feet 8 inches, and another 7 feet 0 inch—were the main contenders. Dalhousie called for a broad gauge for India, compromising finally on the width of 5 feet 6 inches, instead of 7 feet. In India, throughout the subcontinent, 5 feet 6 inches came to be known as the broad gauge, and both the Bombay-Kalyan and the Calcutta-Ranigunj experimental lines were of that width.

Indian Railways has a rolling stock of 6,900 locomotives, 40,000 coaches, and seven times that number of freight cars. It employs 1.6 million people, making it India's single largest employer.

Railways for geopolitics

It is clear that the British government was keen to exploit the railway's inherent potential to consolidate its grip over India. Dalhousie had the experience of the "railway mania" in Britain, where, from 1825 to 1850, there were already 6,500 miles of railway lines laid, adding as much as 1,450 miles in two years between 1848 and 1850. Dalhousie was looking at the strategic interests. He recognized the necessity for moving forces to control the vast country. He adopted the policy of acquiring the territories of Indian princes, by what was known as the Doctrine of Lapse. This policy had given rise to a great deal of resentment, and Dalhousie realized that the building of the railroads would give the empire the capacity to move troops, use force, and keep India under the British flag.

Dalhousie was aware of the help that the railways had provided to the British to move forces in Ireland and also in the Crimean War to capture Sebastopol. Dalhousie, overruling the army chiefs of the East India Company, pushed ahead and planned a railroad system intended not only to produce political and commercial advantages, but to simplify administration and to facilitate troop movements. In 1857, when the first major widescale uprising for Indian independence took place, Dalhousie's policies helped the British to brutally crush that volatile movement. Subsequently, the British pushed ahead to connect the distant major cities by railroads, following Dalhousie's policies.

By January 1871, Calcutta was linked to Delhi via Patna, a distance of some 900 miles. By 1871, the East India Railway had put in about 5,000 miles, of which broad gauge accounted for most of it. Meter gauge accounted for about 20 miles, and and less than 30 miles was narrow gauge (0.762 meter or 0.610 meter).

Starting from 1853, Indian Railways, under British rule, had grown to 8,165 km by 1871, and had linked up not only the four metropolitan cities Madras, Calcutta, Bombay (all major ports), and Delhi—the entrance to the fertile Ganga Valley from the west—but also Lahore (now in Pakistan).

Thus, a strategic transportation network was established.

In Europe the railways were playing a major role in shaping history. The railway network assisted Germany immensely in humbling France in 1871 and in unifying the nation. Italian unification also came about in 1871. By 1870, Germany had put in 19,500 km of railways, as against England's 24,500, France's 17,500, and Italy's 6,000 km. By 1910, Germany had 61,000 km and had outstripped the United Kingdom in the extent of its railway network, as well as in the production of iron.

India, on the other hand, was under British rule, and the rapid growth of railways came to a premature halt. The Industrial Revolution, which was a reality in Europe and the United States, was unheard-of in India then. Except for being forced to purchase products from abroad, going down the scale in terms of wealth, India had no freedom even to emulate what had been done in Europe. Railway development was perceived as a way to loot India.

Relying on William Digby again, we come to know that the British adopted a stick and loot policy. In his book, Digby writes:

"Over 22,000 miles in length. Cost over 300 million pound sterling. Practically the whole of the sum invested in Indian Railways (share capital) is held by Europeans, barring that which certain Feudatory States [for example, Hyderabad, under Nizam, was taken over by the British and named as Nizam's Guaranteed State Railway. When a committee, formed by two Indian members of the elite, asked the government to make the whole thing transparent, those two gentlemen were deported from Hyderabad—RM] have 'benevolently' loaned. Amortization from the start would have made a difference of many million pounds sterling, to the Indian taxpayer, and, with wise provision, the earlier railways been largely redeemed."

India was hit hard on all these transactions. "The accounts show that 40 million pound sterling have been taken from general revenues to make up guaranteed interest to shareholders. The sum will never be repaid," Digby noted.

At the same time, the ruling British were paranoid about an "impending" invasion from the Tsarist Russia. The strategic purpose for which the railroads were built by the British stemmed from two factors:

- to take the raw materials out of India by sea at a minimal cost, and strengthen the Empire and gain control over Europe and Africa; and
- to build frontier posts in the western part of India, using Afghanistan as the buffer state between the British Empire and the "advancing" Russia.

It is for the latter reason, that the British disregarded serious railroad development north of the Ganga River. The Himalaya Mountains, considered by the British an insurmountable buffer, were used mainly for summer visits and as resorts. On the highly populated vast tract of extremely fertile land north of the Ganga River leading up to the Himalayas, the British built meter gauges.

But, through the sparsely populated desert-like terrain of Sindh and Frontier Province, the British built broad gauges, so that troops could be moved in large numbers to the Afghan border. This retrograde action left for posterity a continuing negative impact, as if the more highly populated areas of northeast Uttar Pradesh and Bihar had been amputated. This large area remained outside of the mainstream of commerce that was set up by the broad gauge trunk routes south of the Ganga, and were doomed to stagnate in a state of underdevelopment for almost a century.

If the entire foothills of the Himalayas from the northeast frontier up to the Kumaon hills remained underdeveloped because of the meter gauge, so did the south. Meter gauge was introduced in the south of India, and also in the west, from Saurashtra to the southern fringe of Punjab, covering an area whose potentials were great, but which was allowed to stagnate.

Railroad construction nonetheless proceeded at a reasonable speed. During 1890 and 1900, the maximum length of 13,439 km of rail lines was opened to traffic. Between 1880 and 1910, a total of 36,913 km had been constructed. However, the level of railroad development that was carried out by the British was negligible, compared to what was necessary. This can be understood, by comparison with the railroad development in Europe.

Countries of Europe are individually much smaller than India. Therefore, comparison of the Indian Railways can be valid only when European countries are grouped together, in a manner that would be representative of the geographical terrain that exists in India, and in which the overall area of the group becomes compatible to the undivided India's physical area.

For this purpose, one may consider the United Kingdom, France, Germany, Belgium, the Netherlands, and Denmark forming the western bloc, with Norway, Sweden, Finland, and Switzerland forming another bloc of mountainous countries. Add to this yet another bloc represented by Italy, Czechoslovakia (today the Czech Republic and Slovakia), Hungary, and Romania. All these European countries add up to 3.1 million square kilometers of land area, as against 3.28 million square kilometers of India's land area. The 14 European countries had put in, by the year 1940, a total of 225,108 km of railways of practically one gauge, namely 4 ft 8.5 inches (standard gauge). In contrast, the British had put in India, by 1940, a total of 66,234 km of railroads, consisting of three different gauges. It is evident from the comparative figures that the development of railroads during the rule of the British Raj was not only lopsided to serve British geopolitical interests, but was also grossly inadequate.

While the British maintained some momentum in building railroads in India till 1930, the whole thing slowed down

FIGURE 4
Freight loaded in 1995-96
(millions of metric tons)

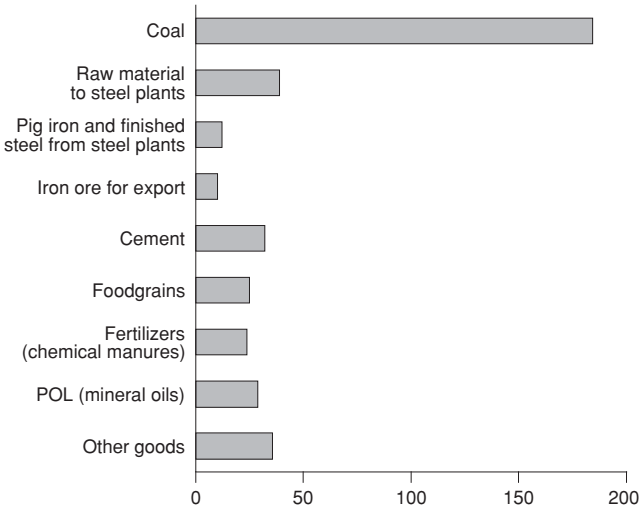
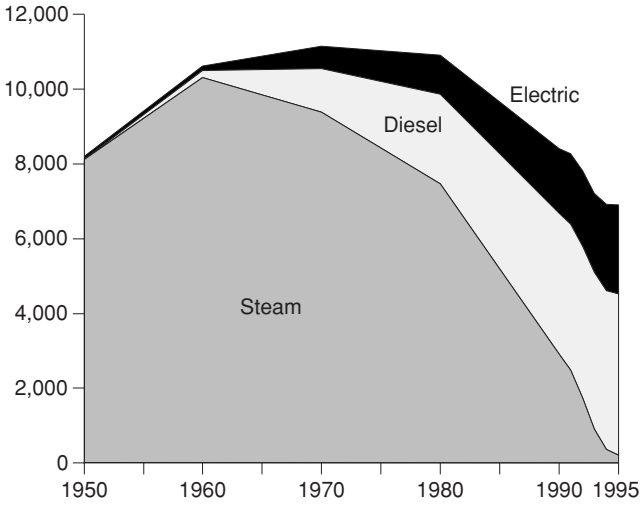


FIGURE 5
Locomotives
(number of units)



to the point of negative growth. For instance, the total route-kilometers of railroads built by 1930 were 67,148 (of which the broad gauge were 33,006), the route-kilometers of railroads at the time the British left in 1947 were 65,217—shrunk by almost 2,000 km over the succeeding 17 years. In 1947, at the time of India's partition, broad gauge railroads accounted for 33,289 route kilometers.

While investigating this retrograde action by the ruling British vis-à-vis the railroad building in India, it becomes evident that a number of factors were behind the British decision to slow down. To begin with, as the independence movement in India under Mohandas Karamchand Gandhi gained momentum, and the departure of the British from India became inevitable, the British were no longer interested in developing railroads to further their geopolitical or economic interests on the subcontinent.

The second factor was the worldwide economic depression of the 1930s, and then World War II. In fact, since 1939, the ruling British uprooted some railroad tracks in India, after closing down a few routes. These railroads showed up later in the West, serving British wartime interests.

On the date of Indian independence, Aug. 15, 1947, these meager route-kilometers were divided between India and Pakistan. The Indian share consisted of a network of 25,170 route-kilometers of broad gauge, 24,153 of meter gauge, and 4,153 of narrow gauge. As a result, Pakistan (which consisted then of West and East Pakistan; the latter part became an independent nation, Bangladesh, in 1971) got a mix of 8,119 route-kilometers of broad gauge, 1,616 of meter gauge, and 1,006 of narrow gauge.

It is not simply that the subcontinental railroad was truncated by the 1947 division of the country into three parts, but that partition resulted in far-reaching changes in the pattern of traffic. For instance, the flow of traffic from and to northern India, which used to be routed through Karachi, a very important port city which became the capital of Pakistan in 1947, was now diverted to Bombay, thus increasing the load on the Bombay-Delhi corridor, which was not designed for such heavy loads. To make the line somewhat functional, additional lines and facilities had to be constructed to augment existing capacity.

Worse happened with the partition of Punjab. The flow of traffic had been mostly to and from Delhi to Lahore, which became part of Pakistan. This traffic was abruptly stopped. In addition, the traffic needs of the State of Jammu and Kashmir were met by rail-heads at Rawalpindi, Pakistan's Army headquarters adjacent to the present capital of Islamabad, and Jammu. Both these rail-heads were directly connected to Lahore. With the partition of the subcontinent, Jammu and Kashmir was deprived of these two routes, and became inaccessible from India by rail.

Post-independence

Few will deny that Indian Railways is a wonder of its own kind. With a network of 62,915 route-km which cater to 11 million passengers and 1.1 million tons of revenue-earning freight daily (**Figure 4**), Indian Railways has a rolling stock of 6,900 locomotives, of which 209 are steam, 4,313 are diesel, and 2,387 are electric; about 40,000 coaches and seven times that number of goods-carrying wagons (**Figures 5** and

FIGURE 6
Types of wagons
(thousands of units)

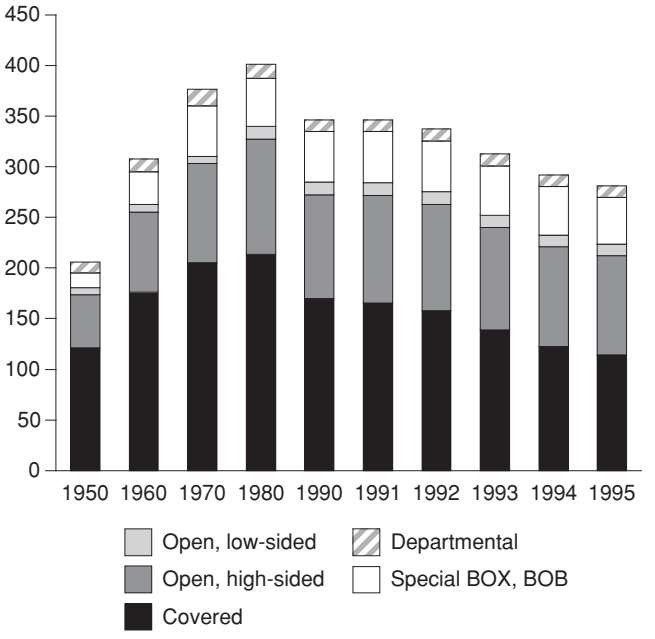


FIGURE 7
Average speed of freight trains
(kilometers per hour)

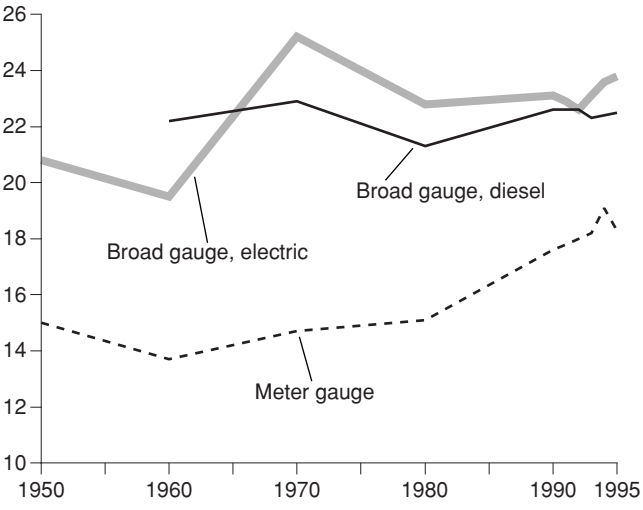
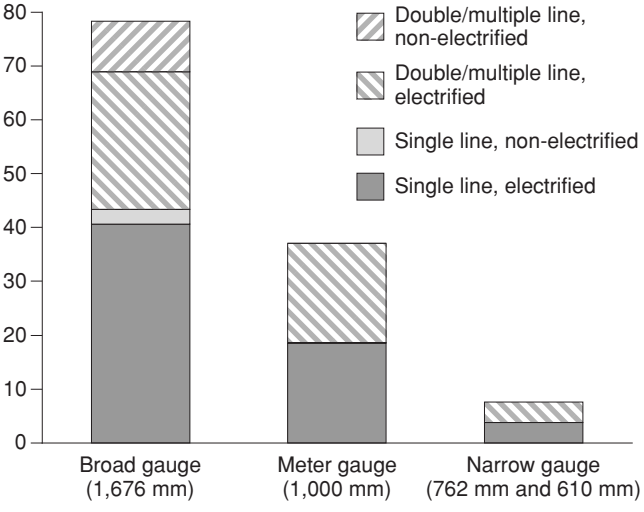


FIGURE 8
Double and single track, by gauge
(thousands of kilometers, as of March 31, 1996)



6). It employs 1.6 million people, making it the largest single employer in India. It provides more employment than the Army, Navy, and Air Force combined. Its direct, and particularly indirect, impact on the national economy cannot be overestimated.

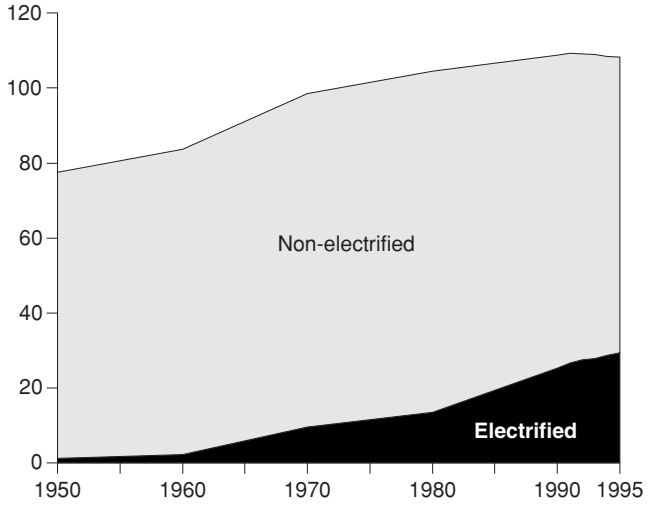
If the above figures project the importance of railroads in the national economy, their inadequacies are also worth noting, particularly in light of building an efficient Eurasian Land-Bridge.

To begin with, the average speed of both passenger and freight trains is abysmally low (**Figure 7**), because of poor management and use of overaged and technologically obsolete equipment. Since independence in 1947, India has added a meager 9,439 route-km of railroads and converted 5,652 route-km of meter gauge and 359 route-km of narrow gauge, to broad gauge (**Figure 8**). Out of the total 62,915 route-km, only 12,306 route-km, or about 20%, have so far been electrified (**Figure 9**).

What becomes evident from the figures exhibited here, is that Indian Railways is coasting along without solving the problems. In fact, the problems are getting bigger and more difficult to solve. Unfortunately, there do not exist the plans necessary to leap forward and catch up technologically. A series of ad hoc and incomprehensible policy decisions, the lackadaisical attitude of the population, and lack of long-range vision among the policymakers are the principal causes for this stagnant situation. However, few have shown any interest in breaking out of the status quo and pushing railroad development, in the way China began to do in the 1980s.

In an insightful article published last year, R.C. Acharya, a former member (mechanical) of the Indian Railway Board,

FIGURE 9
Growth of electrified track
(total track, thousands of kilometers)



pointed out that the Chinese, following in the footsteps of the Russians, decided in the '80s to make their railways a major vehicle for industrial and economic growth. A clear-cut long-term objective was laid out by the Chinese railroad authorities, under the leadership of Han Zhubin, minister for railways. A distinctive plan for additional track to overcome the existing traffic bottlenecks was drawn up, to focus the inputs so as to strengthen the existing railroad network, enabling it to meet the demands of the coming decades.

The 2,370 km Jing Jiu line from Beijing to the Shenzen special economic zone near Hongkong was given the push to become the second north-south trunk route. This route will serve nine provinces and municipalities with a population of over 70 million. The work includes construction of 1,045 bridges, 150 tunnels, and 180 stations, capable of carrying trains at 120 km per hour.

Projecting an economic growth rate of 8-9% a year, it is estimated that by the year 2000, the Chinese railroads will require the capability to haul 2,100 million tons of freight. In contrast, the Indian railroads have plans which are ridiculously inadequate. For the year 1996-97, the authorities set a target of moving at least 410 million tons—a growth of only 7% over the previous year's 385 million revenue-earning tons that the railroads moved. Unfortunately, even this target could not be achieved.

What is wrong?

There are many views of what went wrong with the Indian railways. Among the authorities, some would even argue that nothing is really wrong at all, and the Indian railways are doing famously. Perhaps one has to look for answers between these conflicting views.

The problem with the Indian railways is about the same as the problems that the Indian power sector has faced throughout the last two decades. As of yet, a clear understanding of the power requirement has not emerged among the bureaucrats and politicians, and hence, there is little hope that the power situation will improve in the near future.

The problem is that the Indian authorities have not shown the capacity to think beyond a linear rate of growth, and anything but maintaining the status quo. In the case of railways, as in the case of power, demand projections are not based on realities, but on the linear projection of what was achieved before. This is, however, absurd, in the context of changing times, changing economies around the world, changing opportunities around the world, the changing technologies in this country and elsewhere, and the changing attitude within the Indian population. Nonetheless, the planners, bureaucrats, and politicians assiduously project low demand, low financial outlays, and low expectations. All this leads to a complete lack of vision and a projection of a future which is painfully inadequate.

In fact, it is worse. By not pushing forward modernization of railroads based upon higher travel speed and a gross improvement in freight tonnage haul, the railroads have been run down. No consideration has been given to building railroads that would allow India to achieve a global competitive edge by developing its physical economy.

The freight and passenger trains in India travel at average speeds of 24 and 65 kmph, which is abysmal by any standard, and in fact, the freight traffic speed has become slower over the years. If India is to become competitive globally in trade and commerce, it has no option but to use the fast and cheap mode of transportation that the high-speed railroads offer nowadays. In contrast, in Europe, the average speed attained by passenger and freight trains is 150 and 250 kmph, respectively. Not surprisingly, the overall capacity utilization in the Indian railways compares poorly with railways elsewhere in the world. In fact, the railways in China, with as many wagons and a slightly larger number of locomotives, carry four times as large a freight traffic as Indian railways.

Another area of incomprehensible neglect is the computerization of freight movement. At the beginning of the 1970s, a decision was reached that freight computerization was a priority. However, that remained on paper, and what exists today is not computerized freight, but a miasma created over the two decades by the relevant authorities, without explaining why computerization has not been done, and how much the national economy suffered for lack of it.

Despite visits to the United States, United Kingdom, and Canada by a number of delegations since the early 1980s, ostensibly to check out the computerization systems in those countries, Indian railways has none. A contract was signed

India's railways will have a major role to play in freight traffic on the Eurasian Land-Bridge, but they are currently far from being able to handle such a potential. What is needed are modernization, computerization, and, most important, vision and inspiration on the part of policymakers.

with CANAC (a consultancy arm of the Canadian National Railway) in 1985 for the supply of software and consultancy for the central segment of the Freight Operation Information System (FOIS). The Center of Railway Information System (CRIS) was subsequently asked to customize the software for Indian conditions. An IBM computer was brought in, in 1989, and the project has gone through its initial development. In May 1993, the order was there for "urgent implementation." However, internal political problems within various railway institutions have blocked implementation of the FOIS, and, as a result, the Indian railroad freight service has still not been computerized.

On the other hand, such harebrained concepts as setting up new railway zones to serve the political interests of certain groups and individuals, go through at a breakneck speed. The inauguration of six new zonal railways—the last three saw the light of day on July 15—were just inserted in the 1996-97 budget. These new railways will not generate an iota of extra freight or passenger traffic, but will be a constant additional burden on Indian Railways' finances. The capital cost for setting up these new zones can be as high as 10 billion rupees (about $285 million).

The major innovations in railway engineering in Europe in recent years have come from computer and electronics applications. Powerful, well-distributed computer systems with networking capabilities have led to significant improvements in signalling and operations control systems. Automatic control by computers leads to better utilization of track, junctions, terminals, and trains, as well as enhancing safety. To improve the performance of its core networks and achieve high speeds, Indian Railways must adopt these systems quickly. With continuous automatic train control, solid-state interlockings, and computer-aided train monitoring, the performance would improve significantly. It is for this reason, that Europe has adopted computerized railroading.

Another weakness of the Indian railroads at present, is in signalling and telecommunications technology. It is not yet recognized by the authorities that improved signalling, at very little extra expenditure, could reduce the headway between trains and allow more trains to ply over a given block length.

Strengths to build on

Despite these weaknesses, the Indian railroads have developed a great deal of strength in certain areas. A computerized coach-manufacturing system, known as the Computer Integrated Manufacturing (CIM) at the Rail Coach Factory (RCF), is comparable to any in the world. Designing an undercarriage, which used to require 10-12 trials and almost two years, can now be done at the RCF in no time. An entire coach is manufactured in less than two months.

RCF routinely exceeds its annual capacity. In addition to shoring up its productivity, the factory is now going for faster design upgrades and variety. With introduction of the CIM, the RCF can now produce 10 different types of coaches, and has moved into developing containers.

Another recent breakthrough made by Indian Railways was in 1993, when it signed a contract with the ADtranz (a union of the Swiss Asea Brown Boveri with the German Daimler-Benz, in the area of locomotive manufacturing) for the import of 30 electric three-phase AC asynchronous induc-

tion motor-driven 6,000 HP locomotives and the transfer of the technology of the same to the Indian railways. The first of the Indian-made locomotives of the same specification will be rolling out next year. Out of the 30 locomotives imported, 13 came assembled, and the other 17 were assembled in India, as part of technology assimilation.

Two other railway institutions have earned their stripes internationally: Rail India Technical and Economic Services Limited (RITES) and IRCON International Limited. RITES provides comprehensive consultancy services in sectors such as railways, airports, highways, urban planning and transport, inland waterways, ports and harbors, ropeways, and industrial engineering.

Some of the important projects undertaken by RITES include: technical and management assistance to railway systems in Tanzania, Zambia, Botswana, Cambodia, Mozambique, Nepal, Swaziland, and Saudi Arabia; training local personnel, maintenance management, and electrification to Malaysian Railways; providing consultancy services of Advisory Consulting Engineer and Highway Planner to Ghana Highway Authorities; Nepal Multi-Modal Transit and Trade Facilitation project for planning and setting up three inland container terminals in Nepal; dieselization and upgrading of Nepal Railways through supply of diesel locomotives, coaches, and associated services.

IRCON is involved in construction of railways, roads, bridges, and highways, as well as of industrial and even residential complexes. It has a large number of projects overseas, in Tanzania, Malaysia, Turkey, Iran, and Bangladesh; it is involved in the electrification of railroad lines in Turkey. IRCON also plays an important role in domestic construction activities centering around railroads.

What needs to be done

To begin with, India must acknowledge immediately that speed in the movement of goods and passengers is of supreme importance. In order to give the priorities a definitive push in that direction, policymakers must seize upon the opportunity that the southern tier of the Eurasian Land-Bridge provides for the future (**Figure 9**).

In this context, the Indian planners would do well to look at recent developments in Europe. Germany has put in operation a magnetic levitation (maglev) transport system, Transrapid. The Transrapid, which is designed for passenger transport at maximum speeds of 450-500 kmph, will begin commercial operation between Hamburg and Berlin in 2005. There are indications that the Hamburg-Berlin line may widen to become an all-European rail network. Japan is also in the process of developing a slightly different system for high-speed passenger transport, and numerous countries, including China, are working on maglev technology.

The key feature of magnetic levitation systems, is that they eliminate the mechanical contact between vehicle and track, replacing the classical relationship between wheel and track by a magnetic (or electromagnetic) interaction operating at a distance. Thereby, the major source of vibration, friction, and wear on the vehicle and track, which affects all traditional modes of transport, is eliminated. At the same time, the magnetically levitated transport systems permit new methods of locomotion and control of moving vehicles. Unlike the frictional traction used by "wheel-track" systems, the magnetic/electromagnetic interactions in maglev systems can be regulated by electric currents supplied to linear motors and positioning devices which control the entire movement of the magnetically suspended vehicle. This advantage shows up in the following ways:

- Magnetically levitated trains are capable of routine operation at much higher speeds than any other traditional "wheel-track/road" mode of transportation.
- Maglevs are capable of much higher acceleration and deceleration than the "wheel-track" mode of transportation. For example, the Transrapid takes only 1 minute and a track length of 3 km to reach a speed of 300 kmph.
- Maglevs can operate on much steeper inclines and tighter curves for any given speed, than conventional trains.

There is no doubt that the maglevs are highly capital-intensive, and there is also little doubt that such high capital investment can be utilized, through developing systems which will have intensive use of these trains. Such intensive use can be achieved in main trunk lines in India. The southern tier of the Eurasian Land-Bridge is one such trunk line. In addition to that, high-speed trunk lines must be developed north-south, to connect the Land-Bridge with the vast agro-industrial potential of southern India and the industrial excellence already achieved in western parts of India and some belts in southern India. This concept must be incorporated in the long-term planning for the modernization of Indian railways. This, and not the cheap wage, will provide the competitive edge to India in future global trade.

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