

Indian Railways—Where The Commuter is The King!

Ram Chandra Acharya

Over the past 100 years the population of India registered a fourfold increase from 238 million to 1 billion. However, the urban population grew almost 13 times—as a percentage of the total population, it tripled from 11% to about 34%. In suburbs, railways are a preferred mode of transport and although commuters account for only 20% of the total passenger-km carried by Indian Railways (IR), in terms of passenger numbers, the 12 million commuters boarding 7500 IR passenger trains for myriad destinations on 63,000 route-km of tracks comprise a huge 60% of all passenger traffic.

150 Years of Sustained Growth

The first railway in the world was the Stockton & Darlington Railway in the UK,

which was opened in 1825. Railways reached France in 1829, the USA in 1830, Germany in 1835, Italy and the Netherlands in 1839, and Spain in 1848. Railways came relatively late to India when the first line of 21 miles (33.6 km) was opened from Boribunder to Thane in 1853. The grand occasion was marked by a 21-gun salute and even the Governor's band was in attendance when 14 railway carriages carrying 400 guests left Boribunder at 15:30 and arrived at Thane at 16:45.

By the time of Indian Independence in 1947, the British had built a railway network of more than 58,000 km primarily for developing the hinterlands and transporting agriculture produce, minerals, and troops to suppress uprisings. Rather surprisingly, private enterprise played the leading role in railway

construction during the early 19th century. Since the colonial government guaranteed a 5% return on investment, growth was phenomenal in the early stages. Companies like the Bengal Nagpur Railway achieved progress of almost 1 mile a day even using primitive construction methods depending heavily on manual labour.

The American Civil War also spurred the growth of railways in India. The Unionist blockade of Confederate ports in 1861 soon began to starve Lancashire cotton mills of precious raw materials and the Great Indian Peninsular Railway (GIPR) found it profitable to push its tracks into the Deccan southern plateau over the mountain range hugging the western coast to transport Indian cotton to Bombay by rail and then by ship to Lancashire.

The second railway track was built by the



Passengers disembarking at Mumbai's Churchgate Station, the Western Railway terminus

(Author)

East Indian Railway and opened on 15 August 1854 from Howrah to Hooghly (38.4 km) in eastern India, where Calcutta was to become the seat of government. Meanwhile the Bombay Baroda and Central India Railway Company (BB&CI) was incorporated by an Act of the British Parliament on 2 July 1855 and soon set about concluding an agreement with the East India Company to construct a line from Surat (where the latter had its factories) to Baroda and Ahmedabad to move cotton from Gujarat by rail. More track was built later from Utran near Surat to Bombay (Grant Road Station) to reach Bombay Port, which was opened on 28 November 1864.

Sir Keskie Wilson, Governor of Bombay, declared the first electric line (1500-Vdc overhead catenary) open when a train ran from Victoria Terminus (Boribunder) to Kurla on the Harbour Branch Line of GIPR. The Western Railway soon adopted the same system for its suburban services and the combined suburban networks of the Central and Western railways have grown to about 120 km carrying over 5 million commuters in some 2500, 12-car electrical multiple unit (EMU) trains each day.

Reorganization and Post-independence Development

By Independence in 1947, the railway network consisted of 10 government and 32 private railways, including those belonging to former princely states. To meet the demands of industrial growth, the network was reorganized in 1950 into seven zones (later expanded to 9) with headquarters at existing major government/private railways.

Although the last 50 years have seen a drop in the railway's market share from 80% to 20% for passengers and from 90% to 40% for freight, thanks to the right of way and convenience of commuter railways, commuter traffic has registered an all round increase, with increasing clamour for better metro networks serving suburbs.

Rail is also still the preferred mode for passengers travelling 500 km or more. Fast intercity trains compete effectively with airlines and are very popular on some short-haul routes such as Delhi–Agra, Delhi–Chandigarh, Mumbai (Bombay)–Ahmedabad, Calcutta–Rourkela, Chennai–Bangalore to name a few. Of course, the millions of rural labourers have no alternative to railways for their annual

trips from the densely populated east to the labour-hungry agricultural belt of Punjab, Haryana, etc.

Growth of Urban Railway Systems

There have been two distinct patterns of railway growth in urban India. The first pattern consists of suburban sprawl along the track and has occurred in metropolitan cities near ports, such as Mumbai, Calcutta and Chennai. The second pattern consists of radiating growth filling in between tracks converging on the city (eight in Delhi). Growth in cities such as Delhi, Bangalore and Hyderabad has mostly been of this second pattern and these cities have increasingly assumed the shape of a giant pumpkin!

Suburban fare hikes are very unpopular and politically sensitive. As a result, monthly commuter tickets often cost as little as seven single fares, so many suburban services are loss making and require high government subsidies. In cities such as Mumbai, suburban services consume a disproportionately high level of resources to keep them running at peak efficiency. Even a breakdown of just a few minutes results in serious law and

1997–98 Statistics for Suburban Railways

Items	Central Railway	Western Railway	Eastern Railway	SE Railway	Metro Railway	Northern Railway	Southern Railway
Route-km	254.69	124.60	716.46	225.00	16.45	256.00	141.82
Passengers (millions)	113.51	106.84	41.51	6.63	68.28	0.25	23.99
Daily services	1063	953	957	153	122	78	513
EMU Trainsets	107	73	122	26	18	29	64
Maintenance depots	3	2	4	2	2	1	2
Income (Rs. crores)	397.62	305.05	158.43	23.02	18.53	*	66.99
Expenses (Rs. crores)	361.02	262.15	431.52	118.95	55.30	*	137.04
Profit(+)/loss(-) (Rs. crores)	+36.60	+42.90	-273.09	-95.93	-36.77	*	-70.05

Note: No separate financial accounts are maintained for the Delhi suburban system.

order problems as commuters vent their anger on everyone and anything in sight. Most suburban service are primarily loss-making social obligations, and only the Western and Central railways made a profit in the last two financial years. Eastern Railway has one of the highest levels of fare evasion, which resulted in a huge loss of Rs273.09 crores (US\$1 million = Rs2.2 crores); South Eastern came second with a loss of Rs95.93 crores in 1997–98.

Wide-Body Rolling Stock

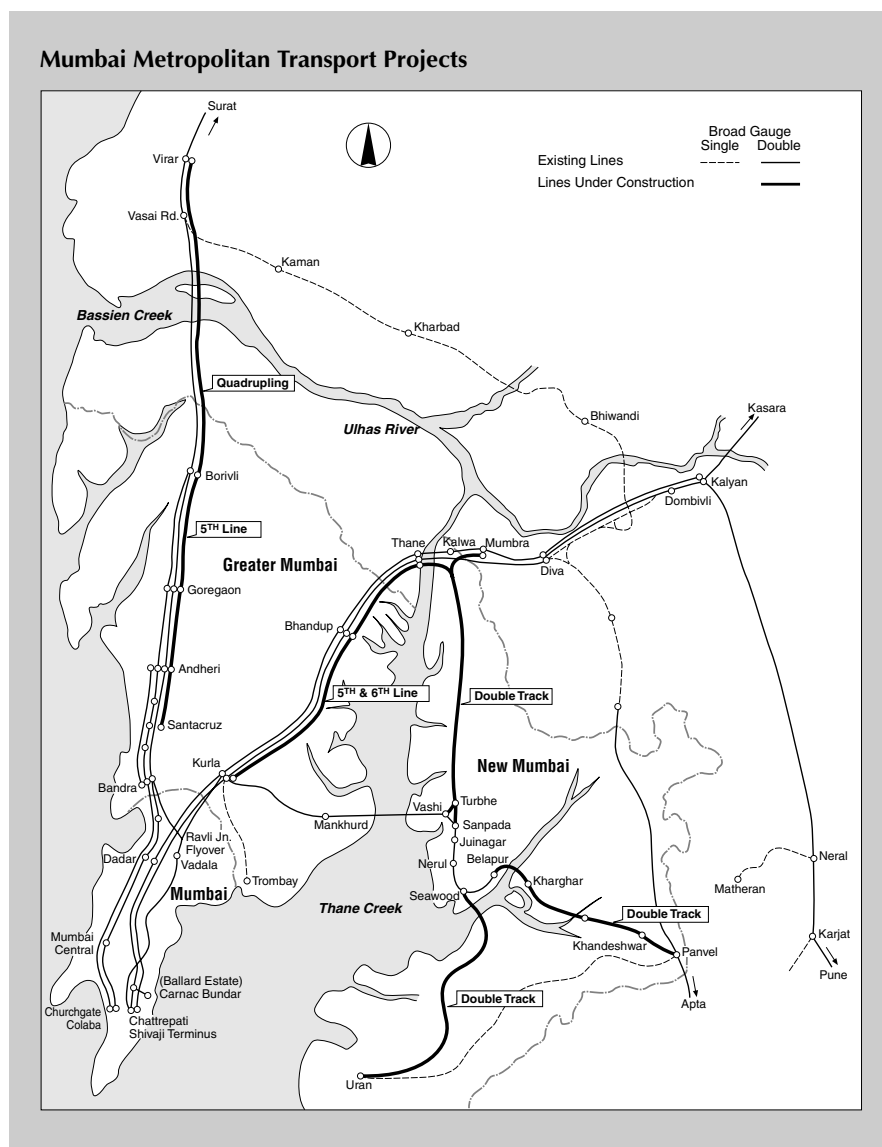
Almost 50 years ago, IR realized that alleviation of rush-hour crush resulting from the exploding commuter population would require rolling stock 1' 4" wider than the existing size of 10' 8". However, a 12' wide carriage requires large-scale modification of trackside structures on trunk lines designed for 10' 8" cars. To solve this problem, about 10 years ago, the Integral Coach Factory (ICF) designed a special mainline EMU that is now being built by IR's carriage works at Chennai. While the old suburban systems of both Western and Central railways in Mumbai still operate on 1500 Vdc, the more recent systems of Calcutta, Delhi, Chennai, Bangalore, Hyderabad, etc., use 25 kVac, which is also the standard for mainline services. However, in view of the burgeoning traffic, and the need for better service reliability coupled with energy saving, in 1996–97, both the Central and Western railways planned to invest Rs574.57 crores and Rs273.67 crores, respectively, to convert their existing 1500-Vdc systems to 25 kVac. The Calcutta Metro is the only system in India using a 750-Vdc third rail system. As part of upgrades to improve work efficiency and conserve power, the ancient resistor step-control system was replaced in 1985 on a trial basis by chopper control on a few trainsets; disc

brakes were introduced on three sets in 1987.

Need for Separate Metro Organizations

In the last 20 years, all the major metro operators have realized that it is not sufficient to just carry commuters to and from the suburbs—commuters still have to reach their ultimate workplace, requiring a far more widespread and

interconnected network especially in the pumpkin-shaped cities of Delhi, Bangalore, Hyderabad, etc. Furthermore, railways have their hands full with the major business of moving long-distance freight and passengers, creating an urgent need to establish separate organizations for fuller and more active cooperation with local city governments. Ultimately, this would make rail-based rapid mass-transit systems both cost effective and user friendly.



However, given the huge numbers of people to be moved, the time-tested broad-gauge system with 12' wide EMU carriages is probably preferred over any light rail system that would seldom meet the transport needs of most million-plus Indian cities.

Mumbai Railway's— The Commuter's Lifeline

Mumbai (formerly Bombay) is a 440 km² island on the west coast of India. It became a British possession when given as a dowry from King John I of Portugal at the marriage of his daughter Catherine of Braganza to King Charles II of England in 1661. The British government took possession in 1665 and soon leased the island to the East India Company at an annual rent of £10. King George V was the first British monarch to set foot on Indian soil in 1911 at the Gateway of India, a marble arch built in his honour in Bombay harbour. Although Delhi is India's political capital, Mumbai is the commercial and financial powerhouse and contributes more than 33% of the nation's tax revenues.

The Mumbai suburban rail network is the largest in the world in terms of the number of commuters carried daily, and the Central and Western railways carry a mind-boggling 5 million passengers every day. Nearly half of all passengers using public transport are ferried by railways, which carry 80% of the total commuter passenger-km due to the longer average journey length (25 km compared to 5 km by road).

Despite expansion of New Mumbai to the mainland, most work places and the business centre are still at the southern tip of the island, so the vast majority of commuters still travel to this area, at least for the present. Efforts are underway to reduce congestion by shifting many government offices to New Mumbai, which now has Nhava-

Sheva as its new port.

The Central Railway network is 255-km long with 89 stations compared to Western Railway's 125-km network with 64 stations. Each operator runs about 1100 and 1000 trains, respectively, with each train carrying about 4500 passengers during the rush hour. These networks are the lifeline for all commercial and business activity in Mumbai and it is no wonder that chaos breaks loose when this human conveyor belt breaks down for even a few minutes.

If these rail services fail, thousands of MEST double-decker buses choke the highways to a standstill, a scenario that Delhi commuters face practically every day without a whimper!

In line with the policy to involve state governments in footing the mounting bills for adding capacity, the Maharashtra Rail Vikas Corporation was recently formed, but it has yet to firm up plans for a mix of underground and elevated tracks for the third and fourth corridors. A major investment would be optimization of both the Central and Western railway networks, including introduction of 12-car

trainsets on both through and local lines at an estimated cost of Rs84.60 crores.

Quantum Jump in Track Capacity

After rioting in the early 90s by commuters angered by poor overcrowded services, the double-track section from Borivli to Virar is slated for quadrupling by 2006 at a cost of Rs401.66 crores. The quadrupled track will separate slow and express traffic to improve the commuting conditions. A fifth 12-km line from Mumbai Central to Santacruz is expected to be completed by 2002 with addition of a 16.8-km extension from Santacruz to Borivli by 2004. The survey work is nearing completion and engineering works should start within 12 months.

To give a boost to New Mumbai, a slew of projects providing additional track capacity and connectivity with the existing Central Railway system are on the cards, including Thane-Turbhe-Nerul/Vashi as part of the Second Corridor at a cost of Rs403.39 crores, and double tracking of the Belapur-Panvel section at a cost of Rs279.83 crores, with the City &



Passengers disembarking at Churchgate Station, the terminus of Western Railway's suburban lines

(Author)

Industrial Development Corporation (CIDCO) bearing 66% of the cost. Since both the BBCI and GIP alignments run north-south, they divide the city into east and west corridors with distinctive land use patterns. The western coastline is the preferred residential area, while the eastern side is used for harbours, factories and general industrial development, with housing for lower income groups.

Reclaiming Right-of-Way

Unfortunately, as often happens in development of suburban railway systems, land for residential and commercial use has priority and

municipal authorities are unwilling to make land (let alone money) available for approach roads or parking areas. As a result, most suburban stations have little or no room for 'park and ride' facilities. Moreover, hordes of poor people searching for a job and a better life are attracted to Mumbai. Most end up living in slums surrounding the metropolis. Many of these slums spring up illegally on railway land adjoining tracks and the local police are often persuaded to look the other way by powerful slum landlords. Such slums often prevent adequate track maintenance, block drainage, and interfere with train operations, resulting in reduced train speeds and increased journey times.

Since maintenance of law and order is outside the responsibilities of IR, it was helpless in evicting slum residents from its land. However, after nearly a year of opinion-building among state bureaucrats and politicians (who are seldom happy to support what may be seen as an unpopular action), the administration of Central Railway formed a special task force to remove the encroachments while police stood by to ensure law and order. The politicians gave their support to the demolition of over 6,000 illegal structures when they realized that the railways are a lifeline for millions of *voting* Mumbai commuters and could be closed down by IR due to lack of maintenance. To ensure that the cleared land does not



Central Railway's Harbour Branch Line in Mumbai illegally occupied by slums (top left). Houses were manually demolished due to difficult bulldozer access (top right). General view of demolition half way through (bottom left). Recovered railway land is leased to railway staff for food production (bottom right). (Photos: Author)

become encroached again, it has been leased to IR track maintenance personnel. There are further major plans to demolish the remaining structures and rehouse the occupants at other sites made available by the state government.

Delhi—Capital Commuter Problems

Delhi's population of 10 million is crowded into an area of some 1600 km², stretching the public transport system to the limit. As a result, Delhi is more heavily dependent on commuting by road than Mumbai, Calcutta and Chennai

(Madras). Vehicles spew exhaust gases as they crowd into Delhi from a 50-km radius around the city, creating massive traffic jams and contributing to a mounting road death toll.

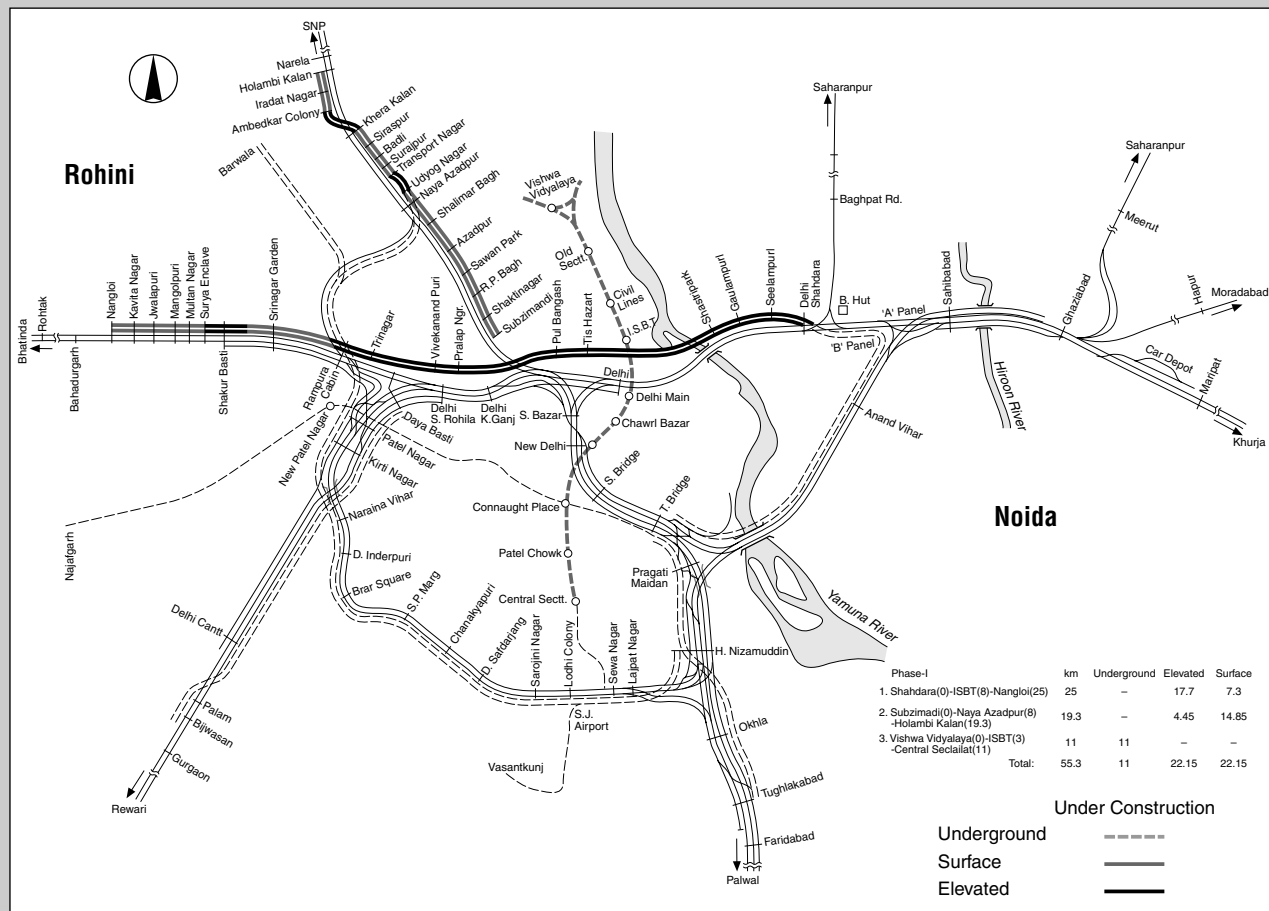
The nation's capital is spreading radially like a giant pumpkin into the countryside of the surrounding three states of Haryana, Uttar Pradesh, and Rajasthan. Existing Northern Railway tracks enter the metropolis from 8 directions but still do not serve many of the old and new residential and business areas, so the burden on the roads is mounting.

Moreover, the city planners have long relied heavily on roads while relegating

the railways to a secondary role. However, the inner and outer ring roads and flyovers have been swamped by the virtual explosion in commuter traffic.

While the Northern Railway tracks converging from eight directions into five main corridors of Delhi, New Delhi, Hazrat Nizamuddin, and Sarai Rohilla offer a unique transport advantage befitting the nation's capital, the large number of long-distance trains converging on the city also impose a heavy burden on city transport systems. For example, 10 trains arrive daily from Ghaziabad and Palwal, six trains from Rohtak and Sonapat, and five trains from

Delhi Metro Railway Corporation's Project



Rewari. Once these train passengers reach the metropolis, they must rely on buses, cars, and taxis to complete their journeys in a competition of survival of the fittest.

Delhi Metro Railway Corporation

1986 was a watershed year for long-suffering Delhi commuters when the Ministry of Urban Development took over responsibility for rail mass transit as part of overall development of the city's metro. Undoubtedly, IR heaved a sigh of relief at having shaken off its expensive social obligations, which apart from losing money also had its own heavy backlog of required investment.

After almost 20 years of surveys, reports and studies to find a viable solution, Rail India Techno-Economic Services (RITES) proposed a scheme composed of surface, elevated, and underground tracks. As a result, the Delhi Metro Railway Corporation (DMRC) was established in May 1995 as a joint venture between the Ministry of Urban Affairs and the Government of the National Capital Territory of Delhi (GNCTD).

The proposed system is standalone with no physical link to the Northern Railway except for commuter interchanges at New Delhi and Old Delhi. It will be limited to

providing north-south and east-west corridors that are presently non-existent. There will be 35 stations on 44.3 km of surface and elevated track running parallel to the existing arterial roads from Shahdara in the east, Nangloi in the west and Holambi Kalan in the north to Tis Hazari at the heart of Delhi. Another 11 km of underground track will connect Delhi University to Central Secretariat passing through 10 stations in some of the most congested parts of Delhi. The estimated cost is Rs4860 crores (April 1996 values) and it is expected to carry 3.2 million passengers each day at a 3-minute headway during peak hours. The opening is scheduled for 2005.

In August 1998, DMRC awarded a consultancy contract to a consortium of five companies composed of Pacific Consultants International (PCI) of Japan as lead member, Parsons Brinckenhoff International of the USA, Tonichi Engineering Consultants of Japan, the Japanese Railway Technical Services, and RITES, which prepared the first feasibility and later detailed reports.

The real challenge is in land acquisition without litigation as well as in relocating nearly 30 slums, and 4000 structures and small businesses. Last but not least, many temples along the route must be relocated. The 8-km stretch from Shahdara to Tis Hazari is currently a priority because its

completion will take almost 1 million commuters off one of the most congested roads into Delhi at cost Rs550 crores.

The first contract to construct a 554-m prestressed concrete bridge to carry double track on a well foundation sunk 36 m below the riverbed was awarded to M/S Larsen Toubro. Works are already well ahead of schedule and the completion will be a major factor in decreasing road congestion, journey times, accidents and pollution levels in Delhi.

Calcutta—India's First Subway

Calcutta is only some 300 years old, having been created by the British when the East India Company moved its trading post in 1686 from Hooghly to a settlement of three villages at Sutanali, Govindpur and Kalikata—the anglicised corruption of Kalikata gave Calcutta its present name. However by 1911, after Queen Victoria's proclamation taking over the government of the sub-continent from the East India Company, the seat of government moved to Delhi. With a population of just over 12 million, Calcutta has huge demand for urban transport and most needs are met by railways and thousands of public and private buses and taxis.

The 16.45-km line with 17 stations from Dum Dum to Tollygunge is India's first





Calcutta Subway under construction by cut-and-cover method (top). Completed subway station and domestically built trainset (opposite page left). Busy platforms (opposite page right and bottom left) and crowded train (bottom right) of Calcutta Subway. (Photos: Author)



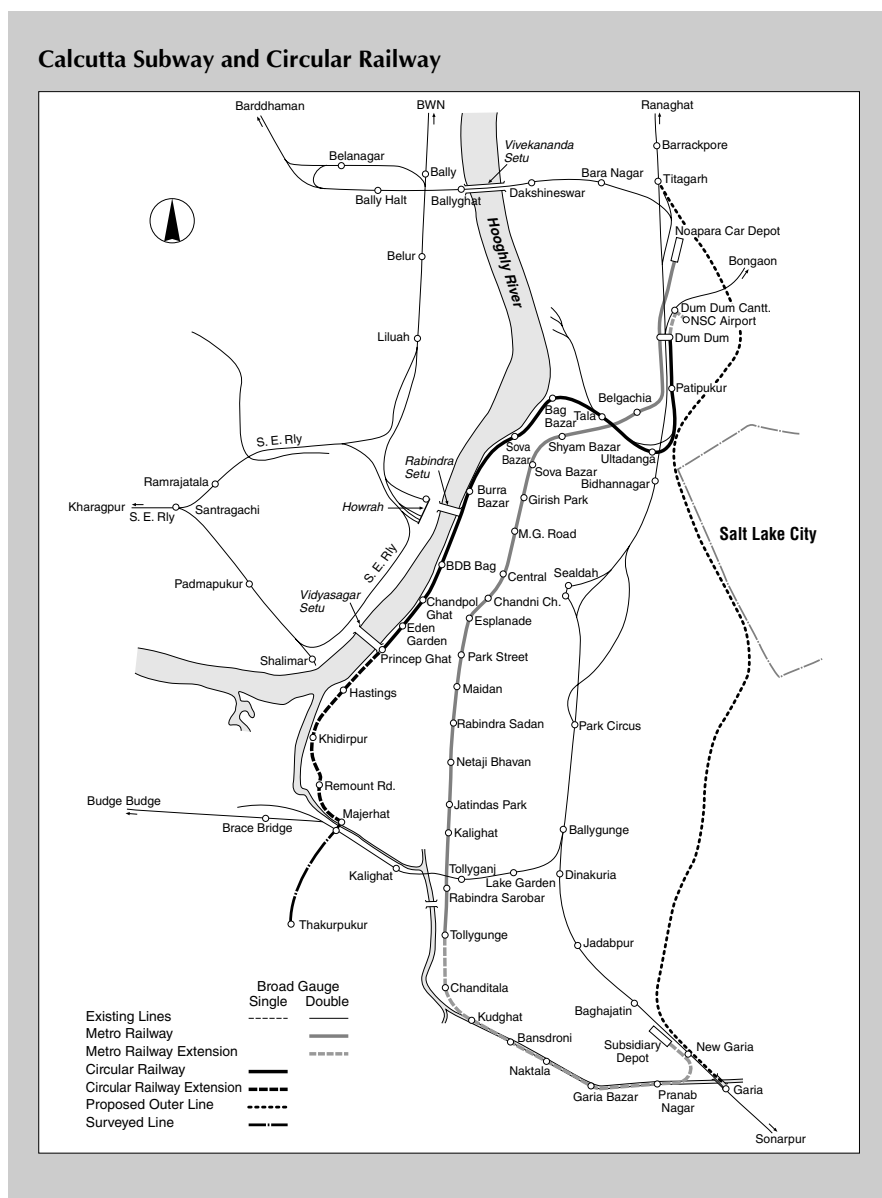
subway. It was opened fully to traffic as a standalone system in September 1995 and a 8.5-km extension from Tollygunge to Garia is expected to be completed by 2005 at a cost of Rs696 crores. However delays in starting work have caused cost overruns of about Rs2,400 crores, but 33% will be borne by the government of West Bengal. Although 122 daily trains carried 68.28 million passengers in 1997–98, the line lost Rs34.77 crores.

An unfortunate feature of the suburban systems of the Eastern and South Eastern railways serving Calcutta is the rampant fare evasion, despite the fact that a monthly season ticket costs the equivalent of just seven singles! As a result, in 1997–98, while the suburban systems of the Central and Western railways posted profits of Rs36.60 crores and Rs42.90 crores, respectively, the Eastern and South

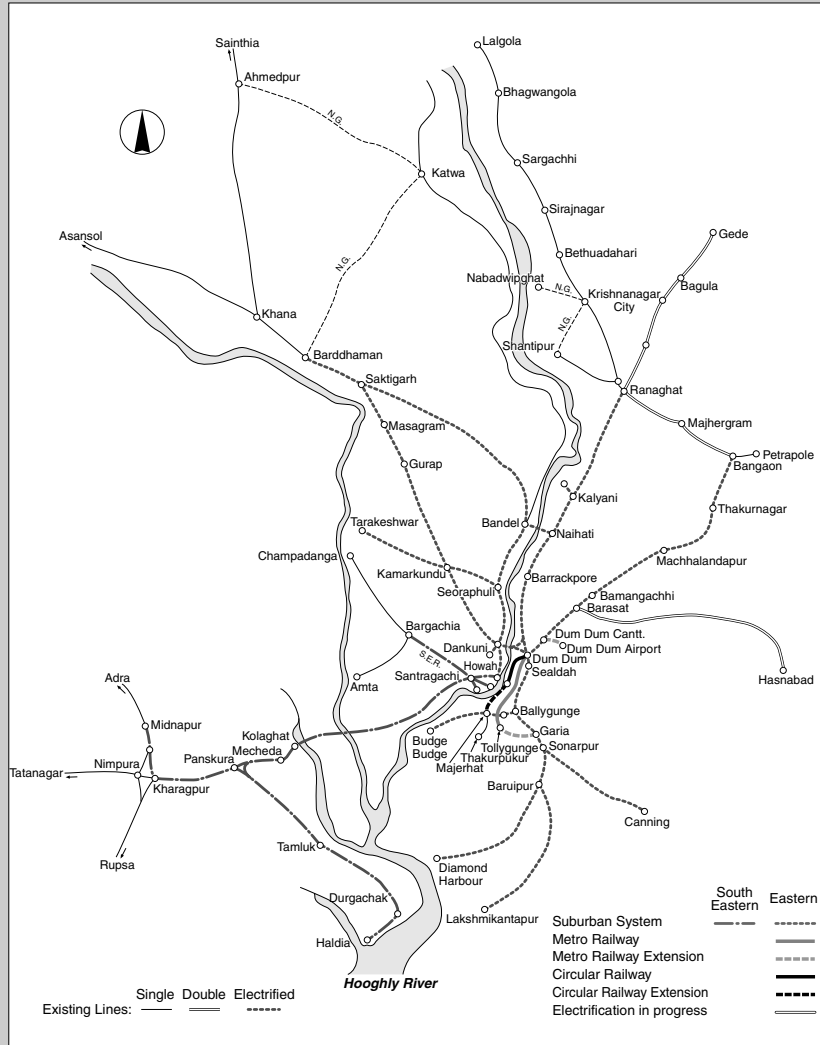
Eastern systems lost Rs273.09 crores and Rs95.93 crores, respectively.

Eastern Railway System

The Eastern Railway system consists of two distinct alignments running north-south on the east and west banks of the River Hooghly. In 1997–98, 957 EMU trains composed of 618 from Sealdah Station on the east bank and 342 from Howrah on the west bank ran daily to carry 41.51 million passengers for the year at a huge loss of Rs273.09 crores. South Eastern Railway, which uses Eastern Railway's Howrah terminus, ran 153 services daily to carry just 6.63 million passengers at a loss of Rs95.93 crores. Disused tracks serving Calcutta port were converted into the 13.5-km Circular Railway from Dum Dum to Princep Ghat that was opened to traffic in stages from 1990. Extension of the railway from Princep Ghat to Majerhat and from Dum Dum to Calcutta Airport with electrification of the entire line is expected to be completed by March 2004 at a cost of Rs192.90 crores. Some existing diesel-loco hauled commuter sections, which are short spurs ending at the Bangladesh border, are slated to be electrified in the near future. This would reduce operating costs by eliminating the diesel locomotive maintenance depot at Ranaghat.



Calcutta Eastern and SE Railways



Chennai Chooses Elevated Track

In their efforts to colonize India, the British decided to display their military might at the village of Madraspatnam, which was shortened to Madras (and renamed Chennai a few years ago). The East India Company built the massive Fort St. George along Marina Beach in 1653 and it is presently the seat of the Tamil Nadu government. British supremacy in the region was established by the annexation of Deccan, the soft underbelly of India in 1819, and the East India Company started looking for ways to link Madras (Chennai) with Bombay (Mumbai) along the Konkan coast.

The first train covered the 63.22 miles (101 km) from Veyasarpadi (near Chennai) to Waljah Road on the way to Katpadi in 1856, just 3 years after the first train ran in India. The Madras Guaranteed Railway which started the service was soon taken over by the government and became the Madras and Southern Mahratta Railway in 1908. In 1953, it was reorganized with other railways in the south to form the basis of the present Southern Railway. The population of Madras in 1900 was just 0.8 million, grew to nearly 6 million by 1991 and is still growing. As in Mumbai and Calcutta, the suburban railways are very much the preferred mode of transport for Chennai's commuters. The 144-km suburban system make extensive use of the Southern Railways' mainline tracks to provide commuter trains from Gummidipundi 48 km to the North, Arakkonam 69 km to the West, and Chengalpattu 59 km to the south. The Madras Beach-Tambaram-Chengalpattu section is still meter gauge but is slated for conversion to broad gauge at a cost of Rs455.24 crores. The Tamil Nadu government



A typical local EMU at supercrush levels heading for Eastern Railway's Sealdah Station at Calcutta (Author)

has agreed to bear half the cost because this section can be integrated into the broad-gauge suburban network, resulting in a major easing of congestion on roads into Chennai. The 8.55-km Mass Rapid Transit System (MRTS) from Madras Beach to Luz has an elevated section of about 6 km from

Park Town to Luz. The surface alignment was opened in 1991, but the elevated section took another 6 years to complete. Built at cost of Rs268.87 crores, it has not proved popular because the approach roads, parking, and connections to other transport modes are minimal, rather like Delhi's

Circular Railway. To make the system more user friendly, station approaches, circulating areas, parking, etc., are being upgraded. To reach a larger commuter base, the track is being extended by 10.8 km (7.58 km elevated) beyond Luz to Vellachery at a cost of Rs605.70 crores. Work is in progress and should be completed by March 2002. Realizing the vital role it could play in reducing road congestion, the Tamil Nadu government has gone one step further by agreeing to bear 66% of the costs.

The MRTS is planned to run another 40 km beyond Velachery to Tiruvanmiyur/Ennore passing through some major industrial areas and providing a faster, safer, economical and pollution-free mode of transport within the city and its suburbs.

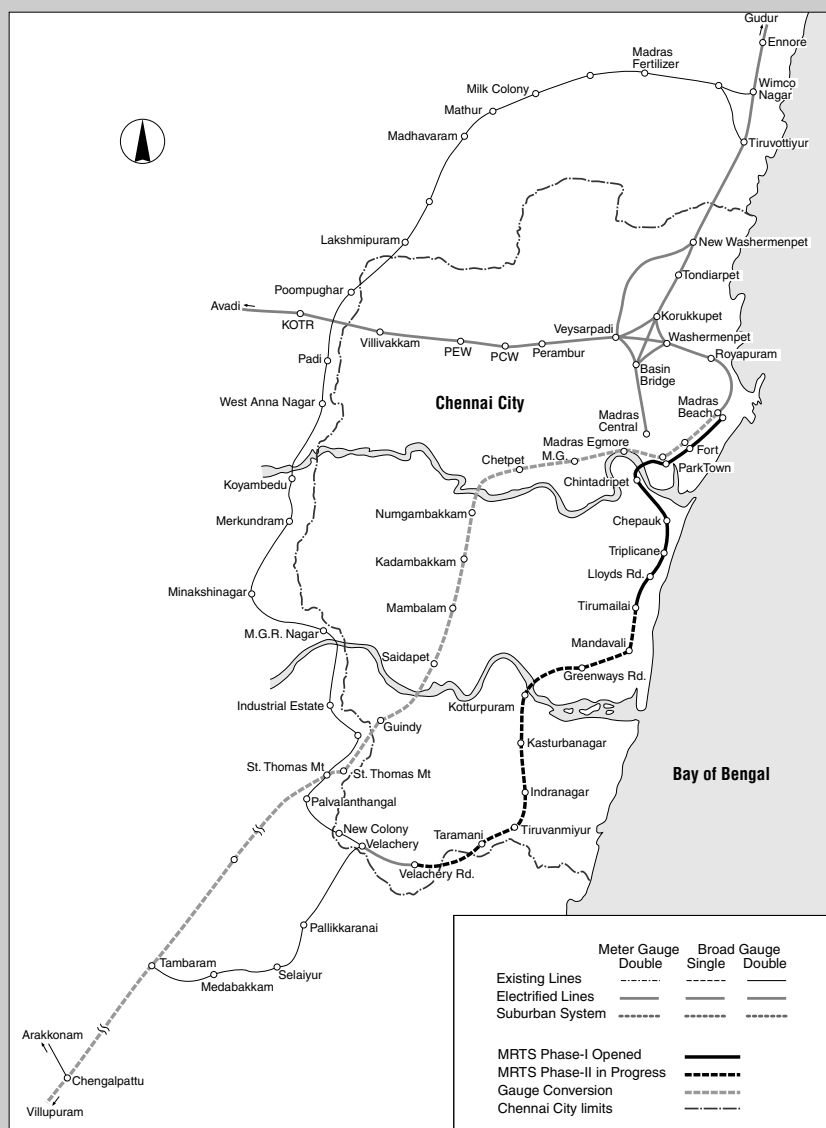
Bangalore—Attempts to Keep the Garden City 'Green'

Situated on the southern tip of the Deccan plateau at an elevation of 1000 m, Bangalore enjoys a balmy climate year round. Despite rapid urban development and industrialization, it has retained its image as a Garden City. The broad-gauge tracks from Chennai in the east, Mysore in the west, Miraj in the north-west and Hindupur in the north-east have lead to Delhi-like sprawl along these alignments.

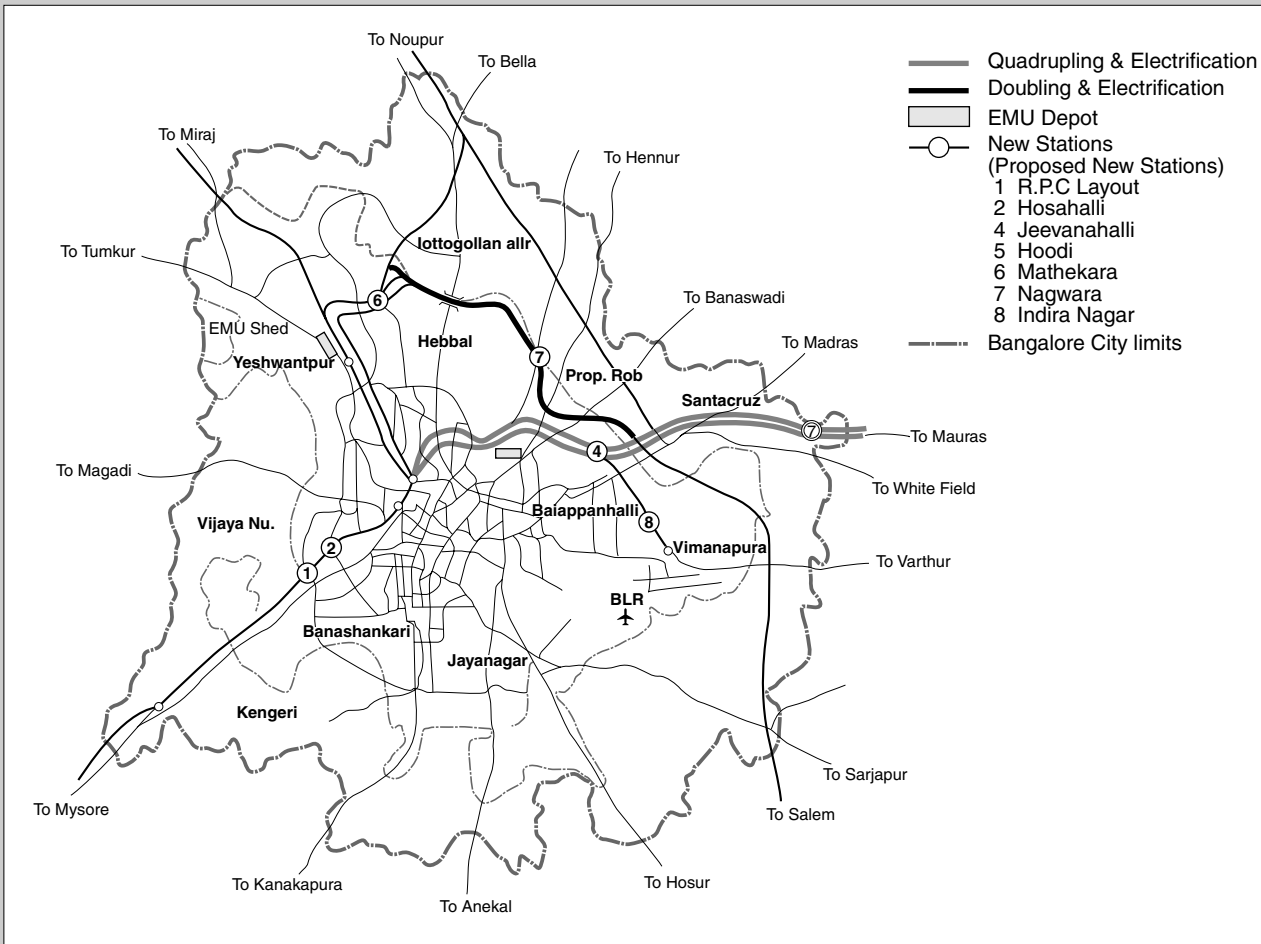
A recent commuter inter-modal survey by RITES found that Bangalore's population of 4.3 million in 1991 is likely to reach 7.2 million by 2011. The number of vehicle registrations has also grown tenfold in the last 20 years. In 1997, there were 1 million registered vehicles of which 72% were motorbikes, which are increasing at an annual rate of 13%.

Based on an earlier 1983 RITES study on the Mass Transit Project Railway and a study by the Indian Institute of

Metropolitan Transport Projects for Chennai



Phase II of Bangalore MTP



Management (IIM), RITES recommended forming a circular railway by connecting existing alignments and adding a few elevated sections along some congested roads at an estimated cost of Rs840 crores. Hopefully, the proposed metro will check the exponential growth of road traffic and related air pollution to maintain Bangalore's image as a Garden City. ■



Ram Chandra Acharya

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