Features

Indian Solutions to Suburban Rail Transport

Ram Chandra Acharya

The total population of India has increased by 350% since early this century, but its urban population has shot up by 840%. As a result, metropolises, cities and towns have sprawled out, engulfing nearby villages or smaller townships and converting them to suburbs. The teeming populations of these satellite towns, where housing was available at reasonable prices, has no choice but to commute long distances, thereby throwing an increasing burden on road and rail. Since rail transport is a vital development area in any city's infrastructure, it continues to play a key role in transportation, especially in the cities of India.

2600-hp Diesel Electric Locomotive in Middle Providing Acceleration Comparable to EMU *(Author)*

Growth of Suburban Rail Traffic

Over the last 30 years, suburban rail traffic in India has experienced phenomenal growth. Some interesting statistics of this traffic on Indian Railways in 1995–96 are shown below (Table).

In the Indian Railways' system, the commuter or suburban train is heavily subsidized and is part of their social burden. Monthly season tickets cost only about the same as 10 return fares. Consequently, although suburban trains carry 21% of the total passenger traffic of 320 billion passenger km, they contribute only 12% of total earnings of about US$1.56 billion. Bombay (now Mumbai) continues to be the largest city with an urban population of over 12.6 million, followed by Calcutta with 11.1 million. Delhi ranks third with 8.4 million, followed by Madras at 5.4 million.

EMUs—The Workhorse

Mumbai, where the first Indian train ran over 140 years ago, takes the credit of operating perhaps one of the most heavily worked suburban networks in the world! The two 1,676-mm-gauge suburban networks of the Central and Western Railways, transport almost 1 million passengers every day with clockwork regularity, headway being down to just 3 minutes during peak hours. Compared to the normal 3,251-mm wide passenger stock, the EMUs (Electric Multiple Units) with an extra-wide 3,658-mm body can carry an average load of 110 seated and 220 standing. The EMU design also takes into account running at twice this capacity at Dense Crush Load (DCL), and at three times at Peak Dense Crush Load (PDCL). Over 3,600 of these wide-body EMU coaches, manufactured by the Integral Coach Factory (ICF) of Madras, and M/S Jessops of Calcutta, form the backbone of the suburban services of South-Eastern (315 km) and Eastern Railways (430 km) around Calcutta, Southern Railways (300 km) around Madras and Bangalore, Northern Railways (440 km) around Delhi, and Central Railways (350 km) around Mumbai.

Last but not least is the 85-km stretch of Western Railways which for most part

Growth of Suburban Rail Traffic in India

	1960–61	1990–91	Increase
Total passenger journeys (millions)	680	2258.5	381%
Passenger-km (millions)	11,770	59,578	506%
Average distance travelled (km)	17.3	26.4	152%

Indian Railway Statistics (1995–1996)

	Suburban	Non-Suburban
% of total number of passengers	62	38
% of passenger-km travelled	21	79
Earnings per km (pais)	9.5	19.1
% of total revenue	12	88
Total number of trains run (approx.)	3000	900 Long dist. 600 Others
Average distance travelled (km)	28	170

runs at quadruple capacity, perhaps carrying the highest level of commuter traffic in the world. While the older systems of the Western and Central Railways operate at 3,000 volts DC, all other sections including the IR main line and trunk routes, operate at 25 kV AC. Normal train formation consists of three or sometimes four motor coaches (powered by four 167-kW nose-hung traction motors) and two trailer coaches.

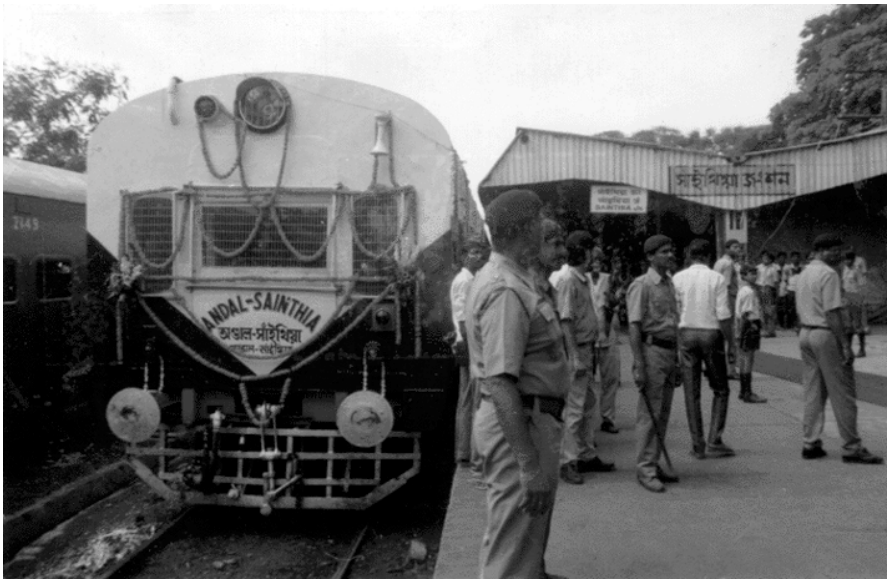
However, introduction of the wide-body EMU coaches posed serious problems for most of the electrified trunk routes, on account of the extensive infringement and relocation of fixed structures that introduction would have involved. ICF came to the rescue by developing and manufacturing 3,250-mm wide EMU stock for mainline service (MEMUs); over 60 motor and 200 trailer coaches have been put into service, bringing much-needed relief to commuters on about 1,700 route km around smaller cities. Six more sections have been identified for MEMU introduction in 1996–97, replacing the standard steel-body coaches hauled by main-line locomotives.

Meanwhile, ICF has been steadily increasing its output of wide-body EMU stock over the last few years and achieved a record of sorts by manufacturing 107 motor coaches in 1995–96, a quantum leap over the 46 manufactured in 1991-92. This signifies a major input for the ever-increasing demand for EMUs for commuter service. ICF has also designed and manufactured 47 coaches of the special 2.74-m wide stock for the 17-km Calcutta METRO system.

Electrification No Longer A Constraint

On non-electrified sections, old slow passenger services have been modified over the years to serve as commuter trains. Consisting of ordinary steel-body coaches, they were hauled by steam locomotives which were replaced in due course by diesels. However, no attempt was made to change the basic features of the train, so they were almost incapable of meeting the basic requirements for commuter service, and remained unpopular. The hordes of commuters preferred boarding long-distance trains and applying the emergency brakes to force unscheduled stops. This was fast becoming a major nuisance, and tended to create law-and-order problems.

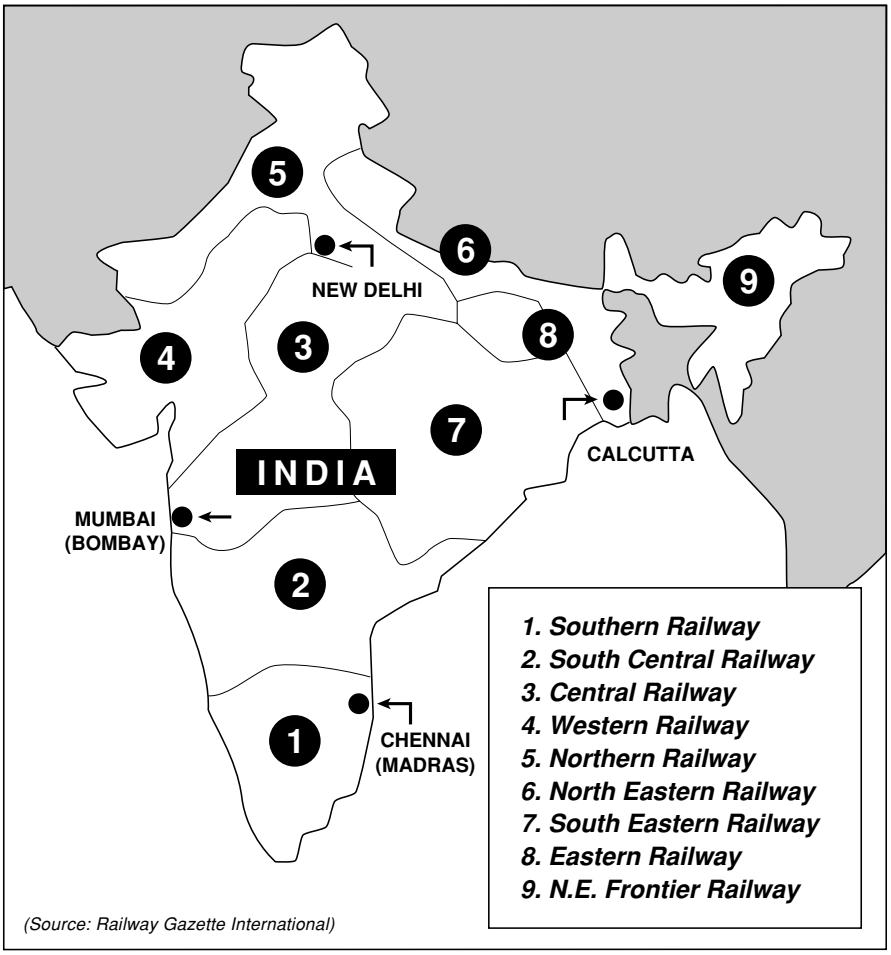
The wide-body EMU coaches on the other hand, had large doorways, adequate standing room, higher seating capacity, air brakes for fast deceleration, and higher horsepower per coach for quick acceleration. They were very popular with commuters and set the standard for expected service and comfort. Consequently, the



Push-Pull Rake on Inaugural Run at Sainthia Junction *(Author)*

Commuters Spilling Out of EMU Rakes at Churchgate Station, Mumbai *(Author)*

Indian Railway Regions



(Source: Railway Gazette International)

Push-Pull Rake Leaving Maintenance Shed at Ambala, Northern Railways *(Author)*

suburban or mass transit services came to be closely identified with electrification, which was considered a precursor to any proposal to introduce commuter service.

Enter Push-Pull Service

The performance shortfalls of the diesel-loco-hauled steel-coach trains were overcome by an innovative design introduced first on Eastern Railways in 1990. The train was configured of the same steel coaches that had hitherto been working on fast passenger and commuter service, but the diesel loco was attached in the middle, eliminating the need to reverse the loco at terminal stations. The leading part of end coaches was converted into a fully-fledged driver's cabin with the control stand accommodating the air brake system, etc. The diesel locomotive was controlled via a standard Multiple Unit (MU) cable running the full length of the train.

Limiting the train to 10 coaches ensures the same acceleration levels as the EMUs—a vital factor in making the Push-Pull trains an efficient and fast suburban service, comparable to what major metropolises such as Mumbai, Calcutta, Madras and Delhi could offer. Efficiency and braking force were also brought to par by replacing the coach vacuum brakes with more powerful and quick-acting air brakes. The coach interior was modified and doors widened to permit adequate standing room and quicker entry and exit. This Push-Pull service has been the answer to the prayers of a large section of population commuting to cities still awaiting railway electrification (and given the present resource crunch, who may be in for a long wait). By the end of 1995, over 75 such rakes are plying the non-electrified sections of various local railways. The conversion cost of Rs.60 lacs (about US$200,000) is a cost effective

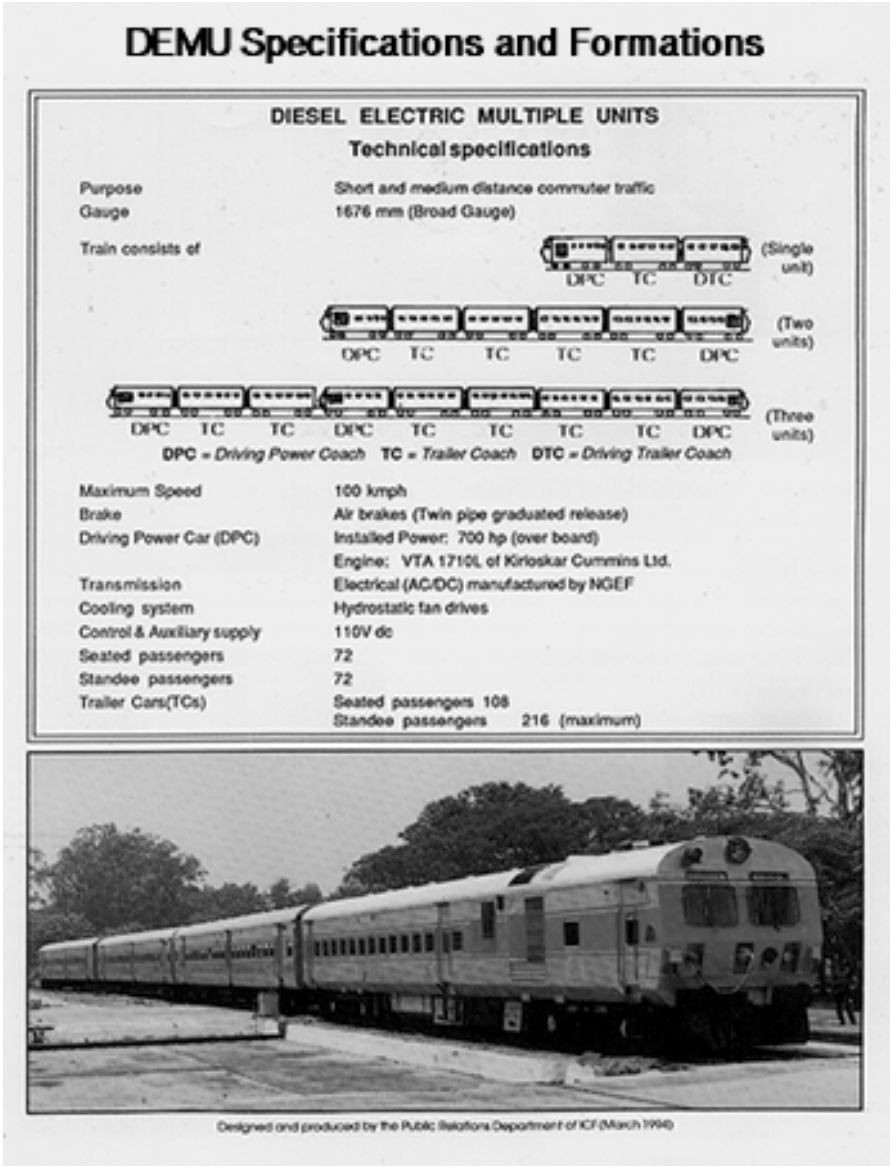
way of meeting the urgent requirements of mass transit.

Sprawling cities like Jaipur, Trichy, Trivandrum, Coimbatore, Ludhiana, Chandigarh with large commuting populations can now have hope of fast and efficient suburban train services matching the ability of EMUs in major metropolises. For once, the resource crunch excuse is not good enough; the resources are already in place waiting to be redeployed in a more innovative and imaginative way.

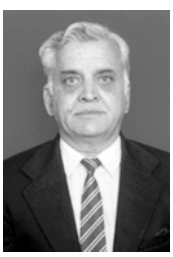
Better Deal for Commuters

At the same time, the Research Design and Standards Organization (RSDO), the R&D arm of Indian Railways has come up with other innovative solutions in the form of Diesel Electric Multiple Units (DEMUs) fitted with a 700-hp VTA 1,710-liter Kirloskar Cummins engine. With 1,100-volt DC for controls and auxiliary supplies, and AC/DC electrics from NGEF Bangalore, they are expected to run with two trailer coaches like EMUs. While the power car has a capacity of only 72 seated and 72 standing due to the space taken by the overboard engine, the trailer cars have a capacity of 108 seated and 216 standing.

Railcars with a 300-hp Kirloskar Cummins engine, and capable of carrying 150, have also been designed for sections with comparatively lower levels of commuter traffic. They are currently being manufactured but in limited numbers. ICF is now set to manufacture the MEMUs, DEMUs and railcars, which should soon hit the tracks in ever-increasing numbers. The company is executing a master plan to introduce no less than 81 Push-Pull/ DEMUs, 66 MEMUs, 23 BG and 30 MG rail buses in the near future —a bonanza indeed for commuters in India. ■



(Source: Integral Coach Factory, Madras)



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