All types of transport including railways, roadways, waterways, airways and pipelines are available in India.

RAILWAYS

Indian railway system is the main artery of the country's inland transport. Railways virtually form the life-line of the country, catering to its needs for large scale movement of traffic, both freight and passenger, thereby contributing to economic growth and also promoting national integration. In fact, railways constitute the backbone of surface transport system in India.

Development and Growth of Indian Railways

The first railway line in India was opened for public traffic on 16 April, 1853 between Mumbai and Thane over a distance of 34 km. This line was extended to Kalyan on 1 May, 1854 and to Khopoli

on 12 May, 1856. The Khandala-Pune section was opened to traffic on 14 June, 1858.

Meanwhile, the construction of the railway lines was going on in eastern part of the country and the first section of the East Indian Railway, from Haora to Hugli, a distance of 37 km was inaugurated on 15 August, 1854. The Haora-Hugli section was extended to Pundooah on 1 Sept, 1854 and to Raniganj Coal Mines on 3 Feb, 1855. The line from Kanpur to Allahabad was opened in 1859 and the Haora-Khana-Rajmahal section was completed in 1860. Mughal Sarai also appeared on the railway map of India in 1862. In 1860, the Kanpur-Etawah section was opened to traffic and between 1862 and 1866, all the gaps between Haora and Delhi were filled.

The southern part of the country did not lag behind and got its first 105 km long railway line from Royapuram to Arcot in 1856. This line was extended to Kadalundi (near Calicut) on the west coast in 1861. The Jolar Pettai-Bangalore Cantonment section was opened in 1864.

In 1870, the all-rail route between Kolkata and Mumbai started functioning and the main line from Mughal Sarai to Lahore (now in Pakistan) was completed. In 1871, the Mumbai-Chennai route was also opened. Thus within a short span of 18 years from 1853 to 1871, most of the important cities of India were connected by rail. The total route kilometreage in 1870 was 7,680 km which rose to 39,834 km by the turn of 19th century and to 66,234 by 31 March, 1940. As on 15 August 1947, Indian Railways consisted of 65,217 km out of which 10,523 km went to Pakistan, leaving India with 54,694 km.

Phenomenal growth of Indian Railways has taken place in the post-Independence era as is clear from **table 26.1**.

At present, India has the second largest railway network in Asia and the fourth largest in the world after the USA (2,27,736 km), Russia (2,22,293 km), and China (87,157 km). But India tops world's leading countries with regard to passenger/kilometre carried. It is the largest public sector undertaking of the country comprising a vast network of 7,146 stations spread over a route length of 64,600 km with a fleet of 9,549 locomotives, 55,339 passenger services vehicles, 6,560 other coaching vehicles and 2,39,321 vagons as on 31st March, 2012. The growth of Indian Railways since its incaption in 1853 has been phenomenal. It has played a vital role in the economic, industrial and social development of the country.

Factors affecting Railways

The pattern of Indian railway network has been influenced by geographical, economic and political factors.

TABLE 26.1. Progress of Railways in India

Year	Route-length (kilometre)			Running track (kilometres)		
	Electrified	Non-electrified	Total	Electrifield	Non-electrified	Total
1950-51	388	53,208	53,596	937	58,378	59,315
1960-61	748	55,499	56,247	1,752	61,850	63,602
1970-71	3,706	56,084	59,790	7,447	64,222	71,669
1980-81	5,345	55,895	61,240	10,474	65,386	75,860
1990-91	9,968	52,399	62,367	18,954	59,653	78,607
2000-01	14,856	48,172	63,028	27,937	53,928	81,865
2007-08	18,274	44,999	63,273	34,700	50,458	85,158
2008-09	18,559	45,456	64,015	35,471	51,466	86,937
2009-10	18,927	45,047	63,974	35,811	57,276	87,087
2010-11	19,607	44,863	64,460	36,000	51,040	87,040

Source : Data computed from Statistical Year Book, India, 2013.

1. Geographical factors. The North Indian plain with its level land, high density of population and rich agriculture presents the most favourable conditions for the development of railways. However, the presence of large number of rivers makes it necessary to construct bridges which involves heavy expenditure. There are practically no railways in the flood plains of many rivers in Bihar and Assam. The plateau region of south India is not as much suitable for railways as the North Plain area. The Himalayan

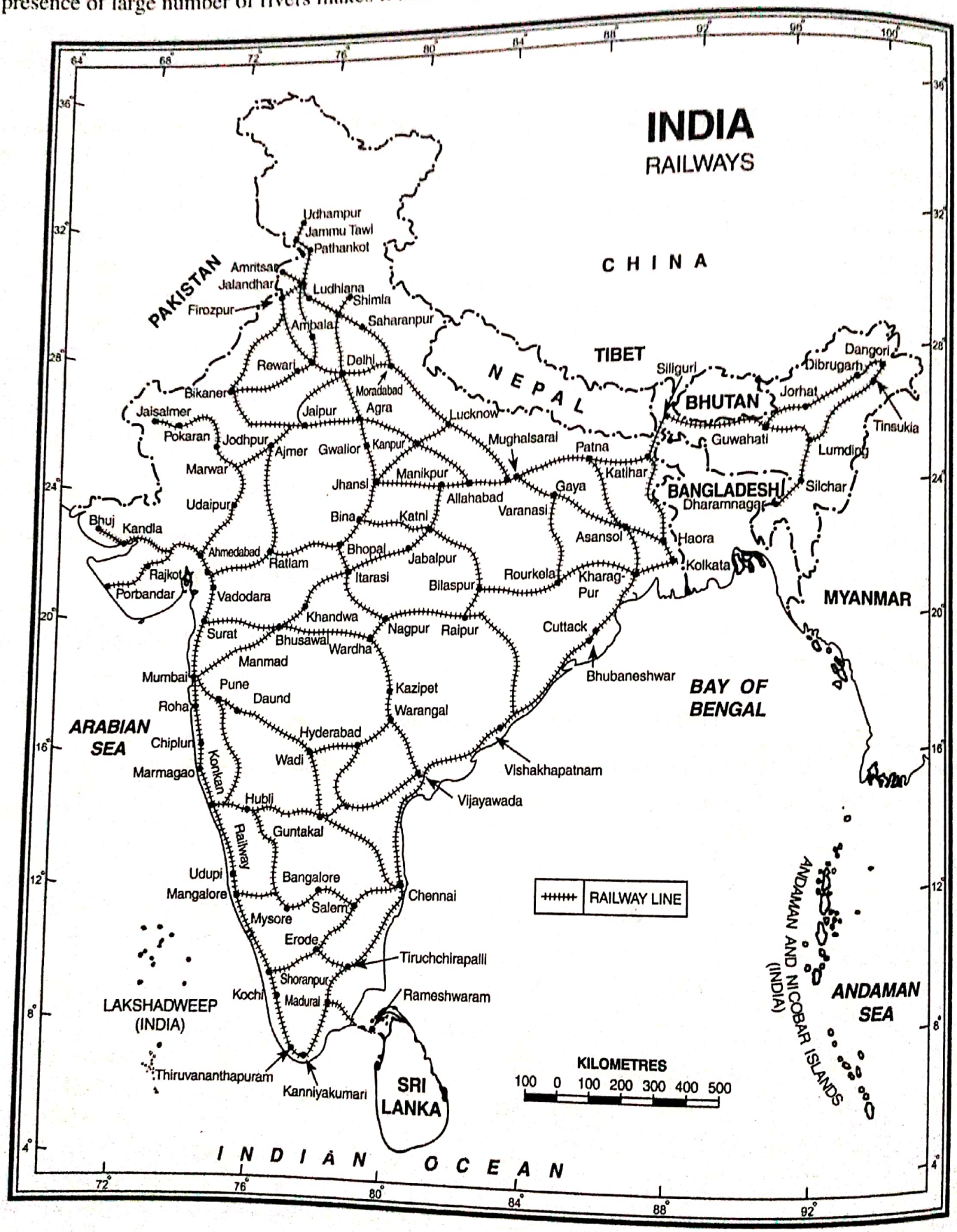

FIG. 26.1. India : Railways

region in the north is almost entirely devoid of railways due to its rugged topography. Some railway terminals such as Hoshiarpur, Kotdwar, Dehra Dun, Kathgodam, etc. are found on the foothills. Some narrow gauge railway tracks are found in the Himalayan region. A railway link between Jammu and Kashmir valley is being planned at a very high cost. The sandy areas of Rajasthan are also not much favourable for railways. There was no railway line between Jodhpur and Jaisalmer till 1966. Similarly, forested areas of Madhya Pradesh and Odisha, deltaic swamps of West Bengal, marshy areas of Rann of Kachchh and hilly tract of Sahyadri are also unfavourable for the development of railways. Sahyadri can only be crossed through gaps like Thalghat, Bhorghat and Palghat to reach coastal rail heads like Mumbai, Vasco-de-Gama, Mangalore and Kochi. Obviously, the *railways tend to follow the path of least resistance.*

2. Economic factors. Railways develop more in the economically advanced areas where the need for railway network is felt more. Conversely, railways bring economic prosperity to the areas through which they pass. This is because of the economic linkages that we find the highest density of railways near big urban and industrial centres and in areas which are rich in mineral and agricultural resources.

3. Political and Administrative factors. The present railway system in India is the legacy of the British rule. The British administration planned the direction and pattern of the railway lines in such a way that they could exploit the valuable raw materials of India for the benefit of their industries and flood the Indian markets with the finished goods from Britain. Besides, the Britishers wanted to maintain their military supremacy, for which quick movement of troops, arms and ammunition was necessary and construction of railways became unavoidable. Thus, top priority was given to the big ports of Mumbai, Kolkata and Chennai. These ports were connected with their hinterlands by railway lines to facilitate imports and exports. It is from the ports that the railway network spread to the other parts of the country.

Distribution of Indian Railways

Fig. 26.1 shows the following distribution pattern of Indian railways :

1. The North Indian Plain. This region has a dense network of railways from Amritsar to Haora. This is a plain area which is very much suitable for the construction of railways. This densely populated region has highly developed agriculture and industry. Large scale urbanisation has also helped in the development of the railways. The density of railway network is closely related to the agricultural and industrial development. There are a few focal points such as Delhi, Kanpur, Mughal Sarai, Lucknow, Agra and Patna. However, Delhi is the main point from where railway lines radiate in all directions. For political, administrative and economic reasons, Delhi is connected with major ports like Mumbai, Kolkata, Haora and Chennai through superfast trains.

2. The Peninsular Plateau. The whole of Peninsular plateau has hilly and plateau terrain which hinders the development of railways. The population density is also moderate. For such reasons, excepting, Saurashtra and Tamil Nadu, a relatively open and more loose network has developed here. However, some trunk routes cross the peninsula and provide efficient rail service between Mumbai-Chennai, Chennai-Kochi, Chennai-Delhi, Mumbai-Kolkata, Chennai-Hyderabad and Mumbai-Thiruvananthapuram.

3. The Himalayan Region. Railways are conspicuous by their absence in the Hinmalayan region. The rugged terrain, hill and valley topography, backward economy and sparse population are the factors responsible for the sparse rail network in this region. There are only three narrow gauge railway lines in the Himalayan region. These are Kalka-Shimla, Pathankot-Kangra and Siliguri-Darjeeling. The Kalka-Shimla Railway, built in 1903 winds itself through picturesque country from Kalka to Shimla over a distance of 96.6 km. It has 103 tunnels, totalling 8 km in length, the longest tunnel is 1,144 metre. The railway track from Kalka to Shimla passes over 869 bridges. The Siliguri-Darjeeling Railway is 82 km long and was constructed in 1878. There is practically no railway line in the north-eastern states of Meghalaya, Tripura, Arunachal Pradesh, Mizoram, Manipur and Nagaland. These areas have rough terrain covered with thick forests. The population is sparse and the economy is in a backward state. Construction of railways under these conditions is a difficult and costly affair.

However, plans are afoot to provide rail links to Meghalaya, Arunachal Pradesh and Tripura, although at a very heavy cost. A vital rail link to Kashmir valley has already made much headway.

4. The Coastal Plains. There is a distinct contrast in the rail network between eastern coastal plains and western coastal plains. The eastern coastal plain is quite wide and permits the construction of railways, as a result of which, there is a long trunk route along the east coast from Kolkata to Chennai. But such a route has been eluding the western coastal plain since long. This is due to the structure and relief of the area. The outcrops of the Western Ghats are very close to the coast, especially near Goa and make the construction of railway lines a difficult task. However, the completion of Konkan Railway Line from Roha to Mangalore is a dream come true. It passes through several tunnels and over numerous bridges. This line has one of the longest tunnels in the country 6.5 km long, about 23 km south of Ratnagiri. It has become the life line of the western coastal plain. The total saving in travel distances are Mangalore-Mumbai (1,050 km), Mangalore-Ahmedabad (1,218 km), Mangalore-Delhi (707 km) and Kochi-Mumbai (437 km).

The above description leads us to the conclusion that railway services are unevenly distributed in India. The maximum concentration of railway network is found in the Indo-Gangetic plain followed by the peninsular plateau. The railways are practically absent from the Himalayan region. Such a lop-sided railway development has kept many areas away from the railway routes.

Railway Zones

At the time of Independence, there were as many as 42 different railway systems administered by 37 different companies. Immediately after the Independence, the Railway Board prepared a plan in 1950 for regrouping the Indian Railways into six zones, namely the Southern Zone (9,654 route km), Central Zone (8,689 route km), Western Zone (9,122 route km), North Zone (9,667 route km), North-Eastern Zone (7,726 route km) and Eastern Zone (9,109 route km). These zones were formed between 14 April 1951 and 14 April 1952. The Eastern railway was split into two zones *viz.*, Eastern Railway (3,735 route km) and South-Eastern Railway (5,374 route km). The North-Eastern Railway was also bifurcated on 15 January 1958 and new zones were inaugurated. They were North-east Frontier Railway (2,797 route km) and the North-Eastern Railway (4,929 route km). Another zone known as the South-Central Railway zone (6,072 route km) was carved out of Southern and Central railways on 2 Oct., 1966. These nine railway zones remained operative for about three decades and proved very effective in administrating the railway system. The administrative requirements of the railways became more pressing with the passage of time. Currently the railway network consists of 17 zones (**Table 26.2**).

TABLE 26.2. India : Railway Zones and their Headquarters

Zonal Railways	Headquarters
1. Central Railway	Mumbai CST
2. Eastern Railway	Kolkata
3. Northern Railway	New Delhi
4. North Eastern Railway	Gorakhpur
5. Northeast Frontier Railway	Maligaon (Guwahati)
6. Southern Railway	Chennai
7. South Central Railway	Secunderabad
8. South Eastern Railway	Kolkata
9. Western Railway	Church Gate, Mumbai
10. East Central Railway	Hajipur
11. East Coast Railway	Bhubaneshwar
12. North Central Railway	Allahabad
13. North Western Railway	Jaipur
14. South East Central Railway	Bilaspur
15. South Western Railway	Hubli
16. West Central Railway	Jabalpur
17. Metro Railway	Kolkata

Source : India 2014, A Reference Annual pp. 842-43.

1. Railway Gauges. 'Gauge' is the name given to the distance between the inner faces of the pair of rails in the track. Indian railways comprise three gauges *viz.*, broad gauge (1.675 metre), metre gauge (1.000 metre), and narrow gauge (0.762 metre and 0.610 metre). Different gauges had been the legacy of the British rulers. They constructed broad gauge railways on trunk routes connecting the port cities of

JAMMU-BARAMULA RAILWAY LINE

The Government of India has launched the most ambitious and at the same time most challenging programme to provide railway link connecting Baramula with Jammu-Tawi. When completed this 292 km long railway route will pass over 165 big and 650 small bridges. The bridge over the Chenab river is 1.3 km long and 359 metre tall which happens to be the tallest bridge in the world. Its 120.44 km stretch will pass through nearly 21 tunnels. The longest 11 km long tunnel is the PirPanjal tunnel which is the second largest tunnel of Asia after Wushaoling Tunnel (20 km) in Gansu, China. This tunnel has a maximum overburden (height of mountain strata above the tunnel) of 1,100 metres. This is 190 km away from Jammu and provides railway link between Qazigund in Kashmir valley and Jammu in the Jammu region. The work on the project started in 1984 most of the work has already been done and the work on the remaining portion is likely to be completed in due course of time. Work on the prestigious railway line is often hampered by unwanted law and order position, terrorism, sabotages, land acquisition, difficult terrain, landslides, etc. This railway line is expected to usher into a new era of economic growth and national integration by bring people of the Kashmir valley into the main stream of the country.

Mumbai, Kolkata and Chennai and some other major cities. In areas lying beyond the frame work of trunk routes, only metre gauge lines were constructed. Thus, the area lying north of the Ghagra-Ganga alignment, whole of Rajasthan and Gujarat as well as large parts of the peninsular India were covered by metre gauge.

Different gauges create serious hinderance in the smooth flow of traffic. Passengers have to change trains at the *break of gauge* station and are put to great inconvenience. Goods have to be transhipped which results in loss of time, increased cost of transportation, pilferage and damage to consignments. The Government of India have, therefore, adopted a policy of gauge conversion, mainly from metre gauge to broad gauge. *The unigauge system of railways assures larger capacity, higher speed and cheaper transportation*. The process of gauge conversion was initiated immediately after Independence but significant achievement has been recorded in recent years (**Table 26.3**). Such a large scale gauge conversion is rightly called the *Operation Gauge Conversion or Operation Uni-Gauge*.

Track Electrification. It has been estimated that use of electric locomotives increases the capacity by as much as 100 per cent. But the use of electric locomotives is possible only if the railway tracks are electrified. Track electrification is a major thrust area by virtue of which efficiency of the railways can be increased considerably. Track electrification was introduced in early 1920s and the first two sections from Victoria Terminus to Kurla and from Victoria Terminus to Bandra, totalling 16 route km were electrified in 1925. Thus the Indian railways entered the push button era. In the first four decades from 1920-21 to 1960-61, the process of track electrification was rather slow and the length of electrified track stood at 388 km in 1950-51 and 748 km in 1960-61. After that the electrification of railway tracks picked up and the length of electrified track increased to 3,706 km in 1970-71, and 19,607 km in 2010-11. The percentage of electrified track was a meager 1.33 in 1960-61 which increased to 30.42 in 2010-11.

TABLE 26.3. Gaugewise Route Length of Railway in India

Year as on 31st March	Broad gauge		Metre gauge		Narrow gauge		Total
	Length in km	Percentage of total route length	Length in km	Percentage of total route length	Length in km	Percentage of total route length	
1992	35,109	56.21	23,283	37.28	4,066	6.51	62,458 (100)
2002	45,099	71.43	14,776	23.40	3,265	5.17	63,140 (100)
2012	55,956	88.62	6,347	9.82	2,297	3.56	64,600 (100)

Source : Data computed from Statistical Abstract, India, 2003, p. 213.

RAIL TRAFFIC

Rail traffic is broadly divided into two segments, *viz.*, passenger traffic, and (*ii*) goods traffic.

Passenger Traffic

Railway journey particularly long journey is preferred because it is cheaper and more convenient. The number of passengers has risen from 1,284 millions in 1950-51 to 8,420.7 millions in 2012-13. Passenger kilometres represent the real indices of the volume of passengers handled. These are arrived at by multiplying the total number of passengers carried by the respective number of kilometres over which they are moved. The passenger kilometres increased from 66.5 billion in 1950-51 to 1,098.1 billion in 2012-13. For passenger service five types of trains are run by the Indian Railways, based on their speed and comfort levels— Ordinary Passenger trains, Express/Mail trains, superfast trains, Rajdhani Express, and Shatabdi and Jan Shatabdi trains. Sampark Kranti Express trains have been introduced to connect the national capital, Delhi, with the state capitals and other important places. Further, Indian Railways have introduced computer reservation system making it possible to get instant reservation between any two stations from any booking office.

The above developments have resulted in phenomenal growth in passenger earning by railways. The passenger earnings increased from ₹ 98.2 crore in 1950-51 to ₹ 31,322.8 crore in 2012-13 (**Table 26.4**). On an average, 14 million people are moved by the Indian railways.

There are plans to introduce high speed trains on following routes.

1. Delhi-Agra.
2. Delhi-Chandigarh
3. Delhi-Kanpur
4. Nagpur-Bilaspur
5. Mysore-Bengaluru-Chennai
6. Mumbai-Goa
7. Mumbai-Ahmedabad
8. Chennai-Hyderabad
9. Nagpur-Secuderabad

Further, a bullet train has been planned between Mumbai and Ahmedabad.

The Railway Ministry has also drawn a blue print of **'Diamond Quadrilateral'** of high speed trains like the Golden Quadrilateral with reference to road transport. This diamond quadrilateral will provide high-speed trains service to important cities such as Amritsar, Delhi, Agra, Lucknow, Varanasi, Patna, Haora, Haldia, Jaipur, Ajmer, Ahmedabad, Mumbai, Thiruvananthapuram, Bengaluru, Chennai, Vijaywada, Hyderabad, etc.

Frieght Traffic

Along with passenger traffic, the freight traffic also increased tremendously. Development in industrial and agricultural sectors has generated high demand for rail transport. Major commodities transported by railways include coal, iron and steel, ores, petroleum products and such essential commodities as food grains, fertilizers, cement, sugar, salt, edible oils, etc. Consequently, freight traffic increased from 73.2 million tonnes in 1950-51 to 1008.1 million tonnes in 2012-13. Transport effort measured in terms of net tonnes kilometres increased from 37.6 billion in 1950-51 to 691.7 billion tonnes kilometres in 2012-13. Tonne kilometres are arrived at multiplying the total tonnage of goods carried by the number of kilometers over which they are moved.

Table 26.4 shows that railways earnings from goods carried is always higher than the passenger earnings. Earning from freight, traffic increased from ₹ 139.3 crore in 1950-51 to 84,378.8 in 2012-13.

Following measures have been taken to improve freight traffic by the Indian Railways :

(*i*) line capacity augmentation on certain critical sectors and modernization of signalling system.

(*ii*) improve in unit train operation for bulk commodities like coal.

(*iii*) increase in roller-bearing equipped wagons.

(*iv*) increase in tracking loads to 4,500 tonnes.

(*v*) operation uni-gauge on Indian Railways.

(*vi*) strengthening the track structure by providing heavier and stronger rails and concrete sleepers.

(*vii*) production of prototype electric locomotive of 5,600 HP for freight operation by Chittaranjan Locomotive Works.

TABLE 26.4. Operations of Indian Railways

Year	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2009-10	2010-11	2011-12	2012-13
Originating traffic (million tonnes)	73.2	119.8	167.8	195.9	318.4	473.9	887.8	921.7	969.01	1,008.1
Goods carried (billion tonnes km.)	37.6	72.3	110.7	147.7	235.8	312.4	600.6	625.7	667.61	691.7
Passengers originating (million)	1,284.0	1,594.0	2,431.0	3,613.0	3,858.0	4,833.0	7,245.8	7,651.1	8,224.4	8,420.7
Passengers kilometres (billion)	66.5	77.7	118.1	208.6	295.6	457.0	903.0	978.5	1,046.5	1,098.1
Earnings from goods carried (₹ crore)	139.3	280.5	600.7	1,550.9	8,247.0	23,045.4	56,937.3	60,687.1	67,761.41	83,478.8
Passengers earnings (₹ crore)	98.2	131.6	295.5	827.5	31,44.7	10,575.1	23,488.2	25,792.6	28,296.9	31,322.8

Source : Economic Survey 2013-14, Statistical Appendix, p. 29.

Dedicated Freight Corridor Project

A very ambitious plan of Dedicated Freight Corridors (DFC) was initiated in the year 2009 which aims at improving the freight carrying capacity of the Indian Railways, reducing the unit cost of transportation and improving service quality. It consists of two corridors *viz*. Eastern Dedicated Freight Corridor (EDFC) and Western Dedicated Freight Corridor (WDFC). The EDFC is 1,839 route kilometres (RKM) and extends from Dankuni near Kolkata to Ludhiana in Punjab while the WDFC is 1,499 route kilometre (RKM) and extends from Jawahar Lal Nehru port in Mumbai to Dadri in Haryana. A special purpose vehicle, the Dedicated Freight Corridor Corporation of India Limited has been set-up to implement the project. Out of 10,703 hectares of land to be acquired for the project 7,768 hectares (73 per cent) has already been awarded under the Railway Amendment Act (RAA) 2008. Following are the salient features of this project.

- Only goods trains will be allowed to operate on these corridors. These trains will run at a speed of 100 kilometres per hour.
- These corridors are planned to run along the existing railway routes, but will provide services to railway junctions.
- With a view to keep minimum impact on social and environmental aspects, these corridors will have provision of bypasses for thickly populated big cities.
- Rail track on DFCs will strengthened by providing heavier and stronger rails on concrete sleepers.
- Transport cost will be reduced by increasing work efficiency.
- Efforts will be made to deliver the goods at their destinations well in time and minimise losses due to delayed deliveries of goods.
- Give impetus to industrial growth by providing cheap and efficient transport.
- Bring freight carrying capacity at par with world's best currently, long distance carrying capacity of Indian Railways is only 5,000 tonnes as against 20,000 tonnes in China and 35,000 tonnes in Australia.

Significance of the Indian Railways

1. Railways provide the cheapest and most convenient mode of passenger transport both for long distance and suburban traffic.

2. Railways have played a significant role in development and growth of industries. Growth of textile industry in Mumbai, jute industry in areas surrounding Kolkata, coal industry in Jharkhand, etc. is largely due to

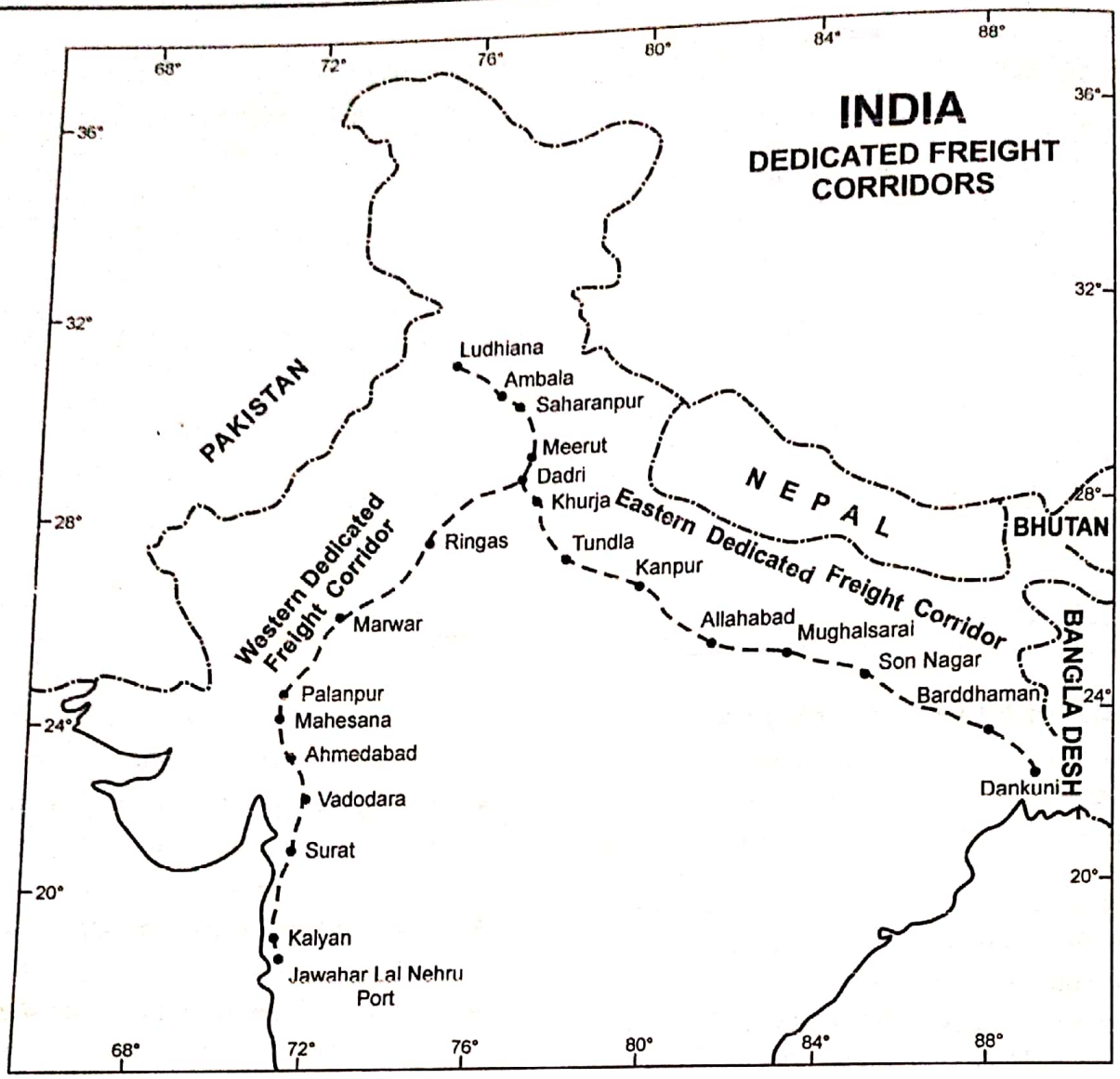

FIG. 26.2. Dedicated Freight Corridors.

the development of railway network in these areas. Railways help in supplying raw materials and other facilities to the factory sites and finished goods to the market.

3. Agriculture also owes its growth to railways to a great extent. Now farmers can sell their agricultural produce to distant places and even sell them in the world market at remunerative prices.
4. Railways are also helpful in removing isolation between cities and countryside and have played a significant role in disseminating innovations and new ideas.
5. Railways are particularly suited to long distance journey and provide a strong medium of national integration.
6. Railways play a vital role in mitigating the sufferings of the people in the event of natural calamities like droughts, floods, famines, earthquakes, etc. This is done by carrying relief and rescue teams and essential items to the affected areas and save people from sufferings and starvation.
7. Railways also help in facing man-made calamities like social, political, religious disturbances, insurgency, etc. It facilitates easy movement of police, troops, defence equipment, etc. The importance of railways to save the country's freedom and integrity from external aggression has been proved at several occasions.
8. Railways carry the British legacy and

connect major ports to their hinterlands, thereby lending a helping hand to the overall prosperity of the coastal areas.

9. Introduction of superfast trains and container services in major cities of India have ensured quick movement of men and material.

10. Railways are specially suited to long haulage of bulky materials like coal, petroleum and ores.

Problems of Indian Railways

Although Indian Railways have progressed a lot, both quantitatively and qualitatively, during the last few years, this system is still plagued by a number of problems which require immediate attention. A lot has been done, but a lot more is yet to be done. Some of the major problems faced by the Indian Railways are briefly discussed as under :

1. Safety. Indian Railways have been in the news albeit for wrong reasons. With the rapid increase in passenger and goods traffic, the frequency of train accidents is increasing very fast. This has raised serious doubts in the public mind about safety of rail travel and the general health of the railway network. The credibility of an organisation with a long and proud history of nation building has been seriously eroded. On an average the Railways report 20 major collisions, 350 derailments and around 80 level crossing accidents in a year. Approximately 3000 passengers have lost their lives in ten years from 2003 to 2013.

There are several factors which are responsible for increasing number of railway accidents; some outstanding being overaged tracks, wagons, coaches, bridges and signaling system. According to the Khanna Railways Safety Review Committee Report, nearly 25 per cent of the total railway track in India is overaged and is due for replacement. The tracks suffer from fatigue and wear and tear in due course of time, and their replacement should be carried on side by side. In several derailments poor condition of tracks had been found responsible. The condition of tracks becomes more significant when one looks at the other assets of the Railways. The Khanna Railways Safety Committee had reported that Indian Railways have 34,000 overaged wagons, 1,322 overaged coaches, and 1,560 stations with overaged signalling. Moreover, 262 bridges are listed "distressed." The white paper released by the Railway in April, 2003 acknowledges that over 51,000 bridges are of 19th century vintage. Out of a total of 1,27,154 bridges in India, 56,178 are more than 80 years old. Thus 44.17 per cent of the bridges have outlived their life. According to the review conducted by the Comptroller General of India on various aspects of bridge management between 1997-98 to 2001-02, these old bridges include 339 important, 4,210 major and 51,629 minor bridges built before 1920. The Khanna Committee had further reported that 76 per cent of all rail accidents are due to derailments, 7 per cent due to collisions, 16 per cent take place at level crossings and 1 per cent are due to fires. Resource crunch is said to be the main cause of all these happenings in the Indian Railways.

Worried about the increasing rate of accidents and loss of life and property resulting from these accidents, the Indian Railways have come out with Anti-collision Devices (ACDs) or '*Raksha Kavach*' to get rid of such happenings. World's first Networked Anti-collision Devices (ACDs) *Raksha Kavach*, invented by Konkan Railway is a microprocessor system comprising of a central processing unit, a Global Position System (GPS) Receiver and a digital radio modem for communication between ACDs. When fitted to a guard van it becomes a Guard ACD. When fitted at stations it becomes a Station ACD and when fitted at level crossing gates, it becomes a Gate ACD. They all network among themselves, exchange information and take decision to prevent collision type of dangerous situations well in time automatically, without mannual inputs, forming *Raksha Kavach* against collisions.

Extensive field tests of *Raksha Kavach* have been conducted successfully on Indian Railways. Survey for implementation of ACDs has already been completed for 3,300 route km on Indian Railways and 760 km on Konkan Railway. About 1,770 ACDs on 1,736 km route length of North East Frontier Railways covering 183 stations have been installed at the cost of ₹ 50 crore.

Modern signalling like panel inter-locking, route relay inter-locking, centralised traffic control, automatic signalling and multi-aspect colour light signalling, are being progressively introduced.

2. Cost and Revenue Problems. As is the case with most of the government organisations, Indian Railways face chronic financial crisis. The annual rate of increase in cost has overtaken that of revenues during the last few years. A study of Railways finances from 1998 to 2004 revealed that the revenues increased at an average annual rate of 8.7 per cent against the 9.65 per cent average annual growth in costs. While the Indian Railways' input costs increased by 10.6 per cent per annum between 2004-05 and 2010-11, passenger fairs remained unchanged or were even reduced in lower classes thereby constraining internal resource generation, essential for replacement/renewal of assets, operation and maintenance activities and critical safety and amenity works. In certain years, the revenue growth rate does exceed that of cost. But this position is achieved by providing inadequacy for replacements and severely controlling the costs. Such a situation has long term implications as it affects the internal generation of resources. Following are the main causes of costs and revenue problems. In 2013-14, half of the 17 railway zones reported an operating ratio (rupee spent against every rupee earned) of more than 100 per cent which means that the railways are spending either equal or more than the money earned.

(i) Low level of employee productivity. Indian Railways face a serious problem of low level of employee productivity. Transport output in terms of passengers and freight tonne kilometres per employee on Indian Railways is only 400 as compared to 500 for Chinese and 570 for French Railways. An estimated 30 per cent surplus workforce and operation of a number of lines with low traffic and assets not essential for the Railways are contributory factors.

(ii) Staff Wages. With the implementation of the recommendations of the Sixth Pay Commission, staff wages have increased tremendously and have put heavy strain on the financial resources of the Railways. With life expectancy going up and wage escalations taking place periodically, the position will only worsen leaving little scope for development plans. The recommendation of the Seventh Pay Commission will put further heavy burden on the financial resources of the railways.

(iii) Increase in lease charges. Paucity of funds forces the Indian Railways to resort to market borrowings which results in increased lease charges. Market borrowings started in 1986 and the trend is increasing. At present payout of lease charges constitute about 8.5 per cent of the revenue.

3. Slowdown in Revenue Growth. With saturation of trunk routes and low quality of services and reliability, the revenue growth has registered a slowdown. The railways are increasingly becoming a transporter of bulk commodities for public sector (coal, iron ore, foodgrains, etc.) and are consistently loosing to roadways. Most of the national highways run parallel to railways and are consistently snatching revenues from the railways.

4. Social Burden. Indian Railways have to play a dual role of revenue earning as well as meeting the social obligations. The Expert Group, constituted in December 1998 to study the railway sector, termed it as the 'split personality'. On one hand, the Railways are seen as a commercial organisation and on the other hand, it is treated as a social organisation which must fulfil its social obligations. The two functions are diametrically opposite and difficult to reconcile. There are several social obligations on the railways which are always running below cost. Suburban passenger services, concessionary travel to certain section of travellers, concessional freight movement of certain commodities, particularly to remote and inaccessible areas like the North-east region, providing rail services to backward regions are some of the outstanding social obligations on the Indian Railways.

5. Other Problems. A large number of miscellaneous problems include late running of trains, lack of passenger facilities including cleanliness at the railway stations, lack of security arrangement on the railways resulting in thefts and dacoities, etc. Political pressure and interference is a very big problem which the Indian Railways are facing with increasing impact. Several projects which are not economically viable have been initiated for political considerations.

METRO RAIL

Mero rail offers fast, cheap and comfortable journey in metropolitan cities of India. It helps in reducing pressure on the existing road transport and provides clean and eco-friendly transport at the local level. With the introduction of metro rail in the big cities, traffic jams on road crossings have reduced

considerably. It is a part of rapid mass transport and is of recent origin in India. The first rapid transit system in India was the Kolkata Metro, which started operations in 1984. The Delhi Metro was India's first modern metro and third rapid transit system in India, after the Kolkata Metro and Chennai Mass Rapid Transit System. The Delhi Metro Rail started its operations in 2002 and is now providing transport facilities to most parts of the capital city. It also provides metro rail lines to most of the satellite towns

TABLE 26.5. Metro Rail in India

City	System	Start Operation	System length in km		
			In operation	Planned	Under construction
1. Kolkata	Kolkata Metro	24 October, 1984	28.4	—	90
2. Chennai	Chennai MRTS	1 November, 1995	19.34	—	—
3. Delhi	Delhi Metro	24 December, 2012	192.27	—	—
4. Bengaluru	Mamma Metro	20 October, 2011	16.6	114.39	42.3
5. Gurgaon	Rapid Metro Rail, Gurgaon	14 November, 2013	5.1	—	—
6. Jaipur	Jaipur Metro	2014	—	32.5	—
7. Chennai	Chennai Metro	20.14	45.1	—	—
8. Mumbai	Mumbai Metro	2014	146.5	—	—
9. Navi Mumbai	Navi Mumbai Metro	2016	106.4	—	—
10. Kochi	Kochi Metro	2016	25.6	—	—
11. Lucknow	Lucknow Metro	2017	36	—	—
12. Hyderabad	Hyderabad Metro	2015	71.6	—	—
13. Ahmedabad and Gandhinagar	Metrolink Express Gandhinagar and Ahmedabad (MEGA)	2017	83	—	—
14. Bhopal	Bhopal Metro	—	—	—	—
15. Chandigarh	Chandigarh Metro	2018	37.5	—	—
16. Indore	Indore Metro	2020	30	—	—
17. Kanpur	Kanpur Metro	2018	84	—	—
18. Ludhiana	Ludhiana Metro	2017-18	—	—	—
19. Nagpur	Nagpur Metro	—	39.8	—	—
20. Nashik	Greater Nashik Metro	—	—	—	—
21. Patna	Patna Metro	2016	60	—	—
22. Pune	Pune Metro	2018	82	—	—
23. Surat	Surat Metro	2018	—	—	—
24. Mumbai	Western Railway Elevated Corridor	2020`	63.27	—	—
25. Guwahati	—	—	44.2	—	—
26. National Capital Region	National Capital Region Metro	2021	381	—	—

Source : en.wikipedia.org/wiki/rapid_transit-in-India.

like Gurgaon, NOIDA, Faridabad, Bahadurgarh, etc. Rapid Metro Rail Gurgaon is India's first privately owned and operated metro rail system. In started its operations in November, 2013. After the grand success of Delhi Metro Rail, other cities like Bengaluru, Hyderabad, Lucknow, Kanpur, Ludhiana, and many more are planning to have metro rails and in many cities this rail system is already in operation. The Government has planned to provide metro rail facilities in all cities of India having a population over two billion. **Table 26.5** gives details of metro rail system in different cities of India.

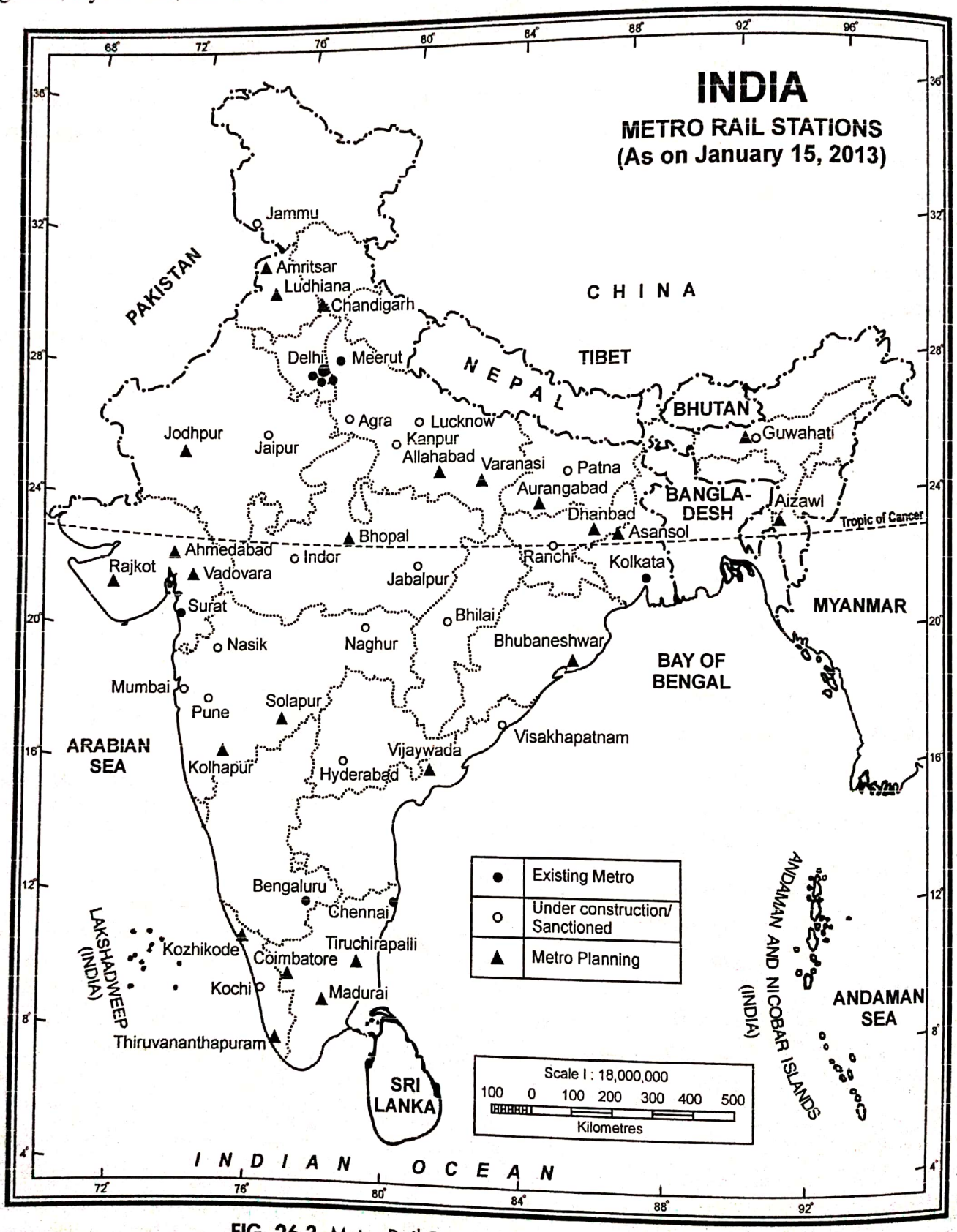

FIG. 26.3. Metro Rail Status (as on January 15, 2013)