SECRET
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Transportation and Telecommunications

India

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NATIONAL INTELLIGENCE SURVEY

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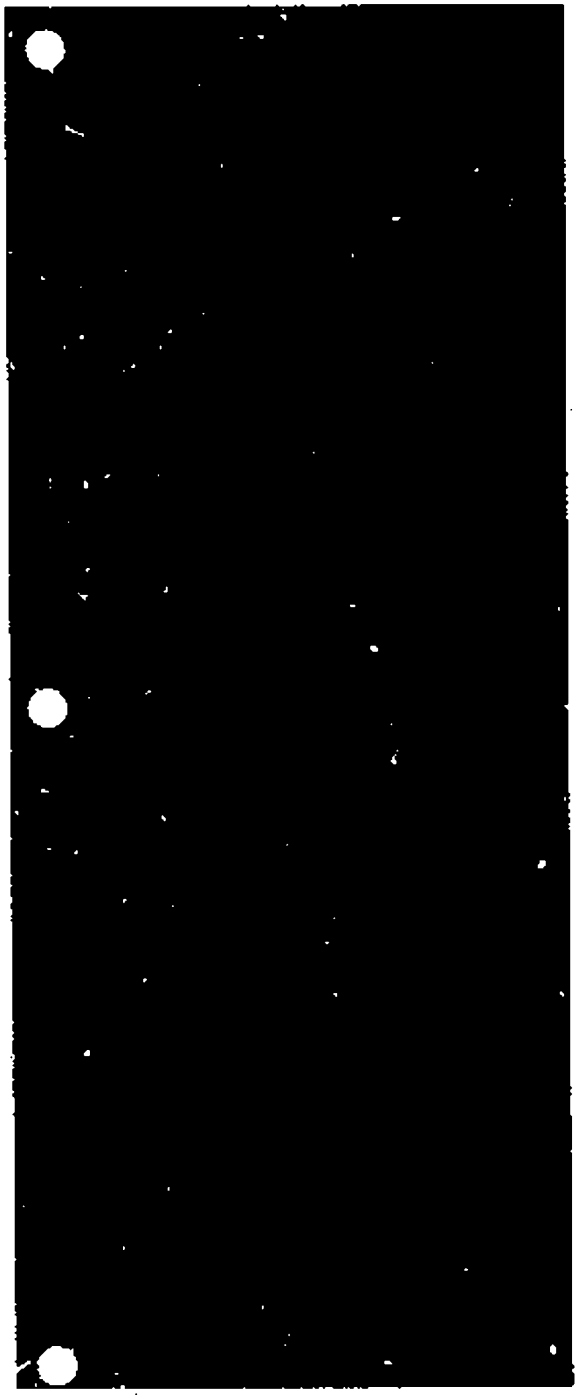

INDIA

CONTENTS

This chapter supersedes the transportation and telecommunications coverage in the General Survey dated February 1970

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FIGURES

Transportation and Telecommunications

A. Appraisal (C)

Although the transportation and telecommunication (telecom) systems of India have undergone many improvements, expansion and improvements have not kept pace with the nation's economic development, and in some areas the systems are still inadequate to meet the needs of the large population. Facilities are fairly well distributed throughout the country, but many areas, including some which are heavily populated, have no modern means of transportation or telecommunications. The heaviest concentrations of facilities are near the larger cities in the Ganges valley and in the southern part of the country; the areas with the poorest service are the island groups and the Himalayan regions, including the State of Jammu and Kashmir. There are, however, a few surfaced roads in Jammu and Kashmir, but normally these are not open all year, and most other overland routes are nonmotorable tracks and trails. A rail line being constructed to link the strategic town of Jammu with Pathankot[1] and the rest of the country was scheduled to be opened to traffic in September 1972. Srinagar and the town of Jammu are served by civil air flights, and both have domestic radiobroadcast stations.

The railroads are the principal means of internal transportation, and the highways and inland waterways function chiefly as feeders to them. Since the beginning of the First Five Year Economic Development Plan in FY1951/52 (1 April-31 March), the increase in internal traffic has fallen mainly on railroad and highway transport. During the 20-year period from 1951 through 1970, railroad traffic increased about 290%, and traffic on the highways is estimated to have increased almost 600%. Of the total traffic carried in FY1970/71 by both rail and road transport, on a basis of ton-miles and passenger-miles, the railroads carried about 76% of the freight and 55% of the passenger traffic. Although the percentage of volume carried by coastal shipping, inland waterways, pipelines, and civil air is small, these modes are important supplements to the railroads as well as to the highways. Only air and rail services are reasonably adequate. The other modes have been unable to keep up with the growing demands for either freight or passenger service, and this failure has handicapped economic growth. Coastal shipping is of importance in that it relieves the burden on overland routes; however, the improvement of rail services has reduced the demand for coastal shipping.

The most important international connections are by sea, and the greatest volume of traffic moves through the seaports. There are rail, road, and inland waterway connections with Bangladesh and rail and road connections with Pakistan, but cross-border operations with Pakistan ceased during the hostilities of 1965 and by 1973 still had not been resumed. A number of road connections and two rail connections exist with Nepal, and there are road connections with Bhutan, Sikkim, Burma, and China. The long coastline affords few good sites for ports. As a result the port system is not extensive. Foreign trade has increased rapidly, bringing increased port traffic congestion, and increasingly taxing the already inadequate facilities within the ports. Despite substantial growth of the merchant fleet, it carries only about a fifth of the country's seaborne foreign trade.

Telecom facilities are similarly overtaxed. The domestic networks provide fair services within and

[1]For diacritics on place names see the list of names on the apron of the Terrain and Transportation map and the map itself.

between the major urban areas, but in the remainder of the country they are less reliable and improvements have been too slow to satisfy the demands of the public. Facilities for international communications, which include modern systems, are adequate for normal traffic requirements.

The transportation and telecom networks are based on those established by the British during the colonial period. Many of the basic British policies still prevail—for example, putting primary reliance on railroads for internal transportation. Over the 26 years since independence great effort has gone into improving the systems. Though significant improvements have been achieved, they have been offset by the increasing requirements of a changing economic structure.

Since independence, the government has provided for its major transportation and telecom projects under various 5- and 1-year plans. Notable achievements include building about 2,860 miles of rail lines, double tracking and electrifying many sections of line, and manufacturing large quantities of rolling stock and many steam, diesel, and electric locomotives. In addition, the total length of the highway system has been increased by about 160%, and the mileage of surfaced roads by more than 100%. The civil air fleet has been largely converted to jet aircraft, and the maritime tonnage has been significantly increased. A pipeline system also has been built under the plans. The telecom networks have also been expanded and improved. The government's announced policy is to continue improvements in transportation and telecom facilities under successive plans until the systems have a capacity adequate to support an industrialized economy.

B. Strategic mobility (C)

The movement and supply of military forces in a sustained operation would be largely dependent on the railroads and coastal shipping. The railroads are considered capable of supporting military operations, but the movement of military supplies by highways would be hampered by numerous physical bottlenecks, the low supporting characteristics of the largely unsurfaced road network, and the prevalence of one-lane roads throughout the system. Inland waterways are important in the Ganges valley and the Assam region of northeast India and would provide a valuable supplement to the land routes in these areas.

About 95% of India's petroleum pipelines are also located in the northeast and can be used to supplement the major lines of communications. Refineries at Baruni and Gauhati are the focal points for the largest segment of the pipelines. Refined products lines extend from Gauhati to Siliguri and from Baruni to Kanpur and Calcutta. The 323-mile Baruni-Calcutta line has a reverse-flow capability for carrying crude to the Baruni refinery as well as refined products to the Calcutta area.

The seven major ports are suitable for military use. Their facilities and estimated military port capacities are given in Figure 8, a table in Section G, below.

The merchant marine would be of major importance in sustained logistic support of military operations. The 182 dry-cargo ships have a considerable potential for short-haul (up to 48 hours steaming) troop lift and sustained logistics support in nearseas operations. These ships have a military lift and supply transport potential of about 1.5 million cargo deadweight tons. Their self-loading and unloading capability is enhanced by the fact that 55 units have heavy-lift booms (40 tons or more) and 26 units have both heavy-lift booms and large hatches (more than 50 feet in length). However, many of these cargo-type ships are engaged in worldwide operations; some might well not be available for military support operations when needed. With expansion of the total normal passenger capacity of about 1,000, the three passenger and 11 combination passenger-cargo ships would have a moderate potential for longer haul (more than 48 hours steaming) troop transport. The 12 tankers have an estimated capacity of about 3.3 million barrels of petroleum and related products, and thus could provide a considerable fleet-oiler support potential for a short period.

Civil air transport facilities in India are government owned, and all equipment and personnel could be made available to the military in time of national emergency. During the 1971 hostilities with Pakistan, many aircraft from both airlines were used for military transport services. Although the number of commercial flights were reduced, the airlines still maintained operations. The Indian Air Force, however, temporarily took over most of the functions of the Directorate General of Civil Aviation.

Of the 372 usable airfields, 28 are military, 20 are joint military/civil, 38 are civil, and 286 are state-owned, private, or abandoned facilities which could be used in emergencies.

India's domestic telecom system provides fair services in and between major cities but are less reliable in other areas of the country. Telecom systems and facilities are vulnerable to attack. Sabotage of open-wire lines would be easy, and the theft of copper wire is on the increase. Landline communications

could be further interrupted in any area by damaging selected long-distance switching centers. Although domestic radiocommunication stations are numerous, they cannot provide adequate alternate traffic routes. During past emergencies, telecom services have been marginal at best, and efforts to improve them have yet to remedy all deficiencies. Furthermore, some of the international radiocommunication and submarine cable facilities, particularly the recently installed satellite ground station, are in isolated locations, making them more vulnerable to sabotage.

C. Railroads (C)

The Indian railroad network is the largest in Asia and the fourth largest in the world. As of 31 March 1971, the network consisted of 37,152 route miles of government-owned lines and 129 route miles of private lines, as follows:

Gage	Government	Private	Total
Broad (5'6")	18,299	0	18,299
Meter (3'3⅜")	16,072	0	16,072
Narrow (2'6" and 2'0")	2,781	129	2,910
Total	37,152	129	37,281

There were 6,933 miles of double- or multiple-track lines (6,645 miles of broad-gage and 288 miles of meter-gage) and 2,303 route miles of electrified lines, of which 2,200 were broad-gage. The government-owned Indian Railways are the most important and best developed mode of transportation and are generally adequate for the country's requirements. The privately owned lines are entirely local in character and are not discussed here.

Except for the mountainous state of Jammu and Kashmir, most areas of the country are served by rail; the network is particularly dense in the heavily populated Ganges valley. The broad- and meter-gage lines are interconnected by transloading points and are distributed generally throughout the network, with only a few areas where one gage predominates; the upper Ganges valley has more broad-gage, and the lower part more meter-gage. In western India, the density of meter-gage lines is quite high; the eastern region south and southeast from the lower half of the Ganges valley to the east coast has broad-gage lines only. The broad-gage lines carry most of the freight and passenger traffic; most meter-gage lines serve areas where there is comparatively little traffic. Particularly important broad-gage lines are those that connect Calcutta and Delhi, traversing the Gangetic Plain and serving the high-grade coalfields northwest of Calcutta; those from Calcutta down the east coast to Madras and across the southern part of the peninsula to Cochin and Mangalore; those connecting Bombay with New Delhi, Calcutta, and Madras; and those that, in conjunction with meter-gage lines, connect Calcutta with the extreme northeast. International connections are made with the rail systems of Pakistan, Bangladesh, and Nepal. However, there are no cross-border operations with Pakistan. Since the 14-day war with Pakistan in December 1971, rail connections have been established between India and Bangladesh in three locations. Equipment is interchangeable with Pakistan and Bangladesh at most of the border stations; those where it is not interchangeable are equipped for transloading, as are both connections with Nepal.

Track structure is light compared to that of U.S. railroads. On the broad-gage lines, rail weights range from 75 to 115 pounds per yard, with 90-pound rail predominating; 110- and 115-pound rail is used in areas of heavy traffic and high speeds. Rail weights range from 50 to 90 pounds per yard on meter-gage lines, with 60-pound rail predominating; a majority of the narrow-gage lines have 50- and 60-pound rail. Rail weight standards have been fixed at 105 pounds for broad-gage trunk and heavily traveled lines, and 75 pounds for meter-gage lines. T-section rails have been designated as standard, but considerable trackage is laid with bull- and double-head rails. Rail lengths range from 20 to 42 feet, the most extensively used being 42 feet on broad-gage and 29 feet on meter-gage lines. In March 1971 there were 12,184 miles of welded rail. Over half the rail required is still being imported, but indigenous supplies are increasing annually. Ties are made of timber, cast iron, steel, and concrete. Metal ties predominate on the broad-gage lines, those of timber predominate on the meter and narrow gages. Limited domestic supplies make it necessary to import some timber ties, which have been obtained from Burma and Nepal. Steel also must be imported; however, it is expected that domestic production eventually will supply all tie requirements. Ballast materials in general use are broken stone, gravel, *mooram* and *kunkur* (soft lime aggregates), slag, broken brick, sand, cinders, and selected earth; broken stone is used on most of the important lines.

In March 1971, bridges on the Indian Railways totaled 104,368, of which 8,424 were considered major bridges with lengths of 60 feet or more. Most bridges with spans over 80 feet long are of steel truss construction (Figure 1), and those with spans 30 to 80 feet long are usually plate-girder type; the shorter spans are generally reinforced concrete or masonry-arch structures. There are at least 177 tunnels on the

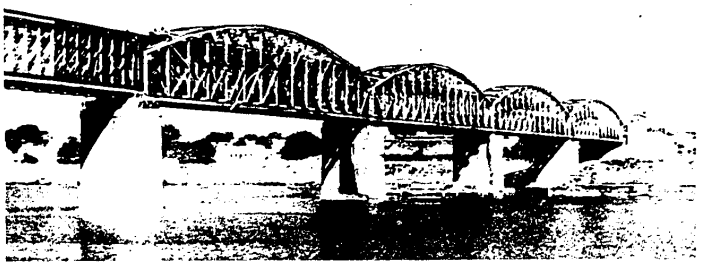


FIGURE 1. Malaviya Bridge. Rail-highway structure over the Ganges at Benares (C)

principal lines. In general, they are adequately drained and ventilated.

Construction and maintenance are difficult and costly, primarily because of the subtropical monsoonal climate that prevails over most of India. Heavy rains during the southwest monsoon season (June through September) cause widespread damage to bridges, culverts, and roadbed—it is normally expected that after each rainy season whole sections of track, particularly in the south and northeast, will require major repairs or replacement. Construction and maintenance, generally accomplished from October to March, are still done almost entirely by hand.

Under the Fourth Five Year Plan (1 April 1969-31 March 1974) the railroad freight traffic was expected to increase to about 291.2 million short tons and passenger traffic to increase by about 20%. However, as freight traffic has been much below that initially anticipated, the target has been reduced to 264.5 million short tons. In order to increase the capacity of existing lines, the plan calls for double tracking 1,925 miles, electrifying 1,615 miles, and procuring 2,177 locomotives, 163,250 freight cars, and 9,282 passenger cars. The plan emphasizes the improvement of existing lines but provides for construction of 1,366 miles of new lines. Extensions of the network are for meeting the needs of basic and heavy industries and of traffic in minerals such as coal and iron ore. Provision has been made for conversion of 280 miles of meter-gage lines to broad gage. By the end of FY1970/71 (1 April-30 March) 122 miles of new lines had been constructed; 265 miles of double tracking completed; 288 miles electrified; and 424 locomotives, 26,043 freight cars, and 2,790 passenger cars procured.

During FY1970/71 freight traffic on the railroads was slightly less than in FY1969/70; however, substantial net gains have been made over the last decade. Official revenue traffic statistics, in millions, for representative fiscal years are as follows:

	1961/62	1966/67	1969/68	1970/71
Freight:				
Short tons	172	221	228	216
Short ton-miles	60,043	79,654	87,850	87,240
Passengers	1,594	2,190	2,338	2,431
Passenger-miles	48,261	63,425	70,452	73,396

In FY1970/71 the Indian Railways had gross traffic receipts equivalent to US$1,342 million and operating expenses of $1,130 million, for an operating ratio of 84.2. However, with the addition of miscellaneous expenses and agreed payments to general revenues, the railroads had a deficit equivalent to about $24.5 million. Deficits have occurred each year since FY1966/67, the first year of deficit.

The absolute manual block system of train control is in general use, but automatic block has been installed on short sections around congested areas of large cities. Two sections of lines in the northeast, totaling 191 miles, are being equipped for centralized traffic control. Semaphore and color-light signals (two- and three-aspect) are in use. Both telephone and telegraph communications are used on main lines, but branch lines are equipped with telegraph only.

Equipment on the Indian Railways is in good condition but is barely adequate in quantity. Equipment acquisition has been a major item in all 5-year plans. Procurement of rolling stock constituted 33% of expenditure during the Third Five Year Plan (FY1960/61-1965/66), and is expected to constitute about 38% in the Fourth Plan (FY1969/70-1973/74); expenditures for rolling stock amounted to about 40% of total expenditures in FY1970/71. A major feature has been replacement of overage equipment; although the situation has improved, a significant amount of overage equipment is still in use.

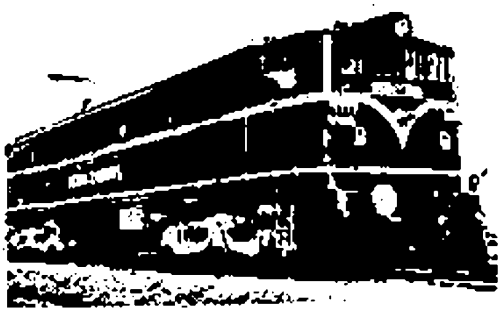
Inventory of the serviceable railroad equipment as of 31 March 1971 was as follows:

	Broad gage	Meter gage	Narrow gage	Total number
Locomotives:				
Steam	5,599	3,393	700	9,257
Diesel	872	554	33	1,109
Electric	562	70	0	632
Total	7,033	3,652	433	11,155
Passenger cars	14,259	10,023	1,453	25,435
Freight cars	270,857	91,337	5,714	367,908

The above passenger-car figures include 1,658 broad-gage and 174 meter-gage electric multiple-unit coaches in operation in suburban sections of Bombay, Calcutta, and Madras. Freight-car figures exclude overaged stock replaced but still in use.

All steam locomotives (Figure 2) and most diesel and electric locomotives are supplied by domestic production. Because steam locomotive production was being phased out, only 35 steam locomotives were built in FY1970/71. During the same year, 84 mainline diesels (65 broad, 33 meter, and five narrow gage), 35 broad-gage diesel shunters, and 50 broad-gage electric locomotives were added and, except for eight mainline diesels, all were manufactured locally. The mainline broad-gage and meter-gage diesel locomotives are built by the Diesel Locomotive Works (DLW) at Benares. By the end of the Fourth Five Year Plan in March 1974, the DLW should have the capability to produce 150 broad-gage diesel locomotives annually. The broad-gage diesel shunters, narrow-gage diesels, and electric locomotives are produced at the Chittaranjan Locomotive Works (CLW) at Chittaranjan. Steam-locomotive production was accomplished at the CLW until February 1972, when production of steam locomotives was discontinued. Fifty-seven WCG2 Co-Co 1,500-volt direct current electric locomotives and 141 WAM4 Co-Co 25-kilovolt alternating current locomotives are on order from CLW (Figure 3). By the end of the Fourth Five Year Plan, CLW annual production of electric locomotives should be increased to 150. All rolling stock is now produced domestically. Most of the freight cars are built by private firms, but some are constructed in the major railroad shops. Passenger cars are manufactured by the Integral Coach Factory at Perambur near Madras and by other government-owned and private factories. In FY1970/71 a total of 11,125 freight cars and 1,203 passenger car units were built.

FIGURE 2. Broad-gage steam locomotive, class WG (U/OU)



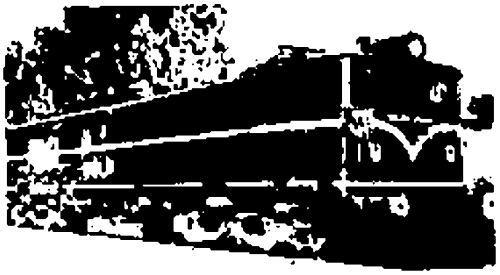


FIGURE 3. Indian Railways has standardized on Co-Co electric locomotives to meet a wide range of operational needs. The WCG2 (top) for d.c. sections and the WAM4 (bottom) for 25 kv. a.c. lines share a large number of standard components. (U/OU)

Locomotives use coal, diesel oil, wood, and electricity. Coal is the principal fuel and is available in large quantities, but it is of poor quality; fuel oil is imported, chiefly from Indonesia and the Middle East. India is generally deficient in wood, which is used on only a few branch lines. Water is available at all main stations, the quality is generally poor, and tannin is used to treat it. Standard since 1957, 25-kilovolt single-phase alternating current is in use on about 85% of the electric lines. Exceptions are the 1,500-volt direct current system in use on 223 miles of

lines around Bombay and Madras, and the 3,000-volt direct current system in use on 46 miles of lines in the Calcutta area. Conversion to the 25-kilovolt alternating current system on remaining lines is in progress except in the Bombay area.

The Indian Railways are operated by the Railway Board, under the Ministry of Railways. The Railway Board, with full responsibility for administrative and technical supervision and direction of the railroads, consists of a chairman, a financial commissioner, and nine members. The railroads are divided into nine zonal systems, each headed by a general manager who is responsible to the Railway Board for operation, maintenance, and the financial position of his rail zone.

On 31 March 1971, there were 1,379,000 railroad employees. Employee training is provided at basic training centers and advanced schools. Officers are trained at the Railway Staff College at Vadodara (formerly Baroda), and courses for supervisory staff are held at the Zonal Railway Training School, Chandausi. Indian Railway Institutes at Pune (Poona), Secunderabad, and Jamalpur offer specialized technical courses. Adequate numbers of personnel are available and their ability, particularly in the case of executives, is reported to be good.

D. Highways (C)

The Indian highway network is inadequate for current economic needs, but the movement and supply of military forces would be seriously hampered by the scarcity of surfaced roads, the low-carrying capacity of existing roads, the prevalence of one-lane surfaced roads, and the numerous physical bottlenecks throughout the system. Highways provide feeder service for the railroads and short-haul services as a supplement to rail facilities. Highway transport operations are being expanded, particularly in long-haul services, but they have not kept pace with the increased transport needed to support economic development programs.

The extent of the transportation deficit in India is indicated by comparison with transport resources in the remainder of the world. India accounts for about 15% of the world's population but for only a very small percentage of the worldwide total of improved roads, rail-freight traffic, and truck and bus inventories. Road transport in India is considerably understressed. Although the country is the seventh largest in the world in size, with a total land area of approximately 1.2 million square miles and a population of about 571 million in January 1973, it has only about 643,000 miles of roads, one-third of which are surfaced and the remainder are earth. The inadequacy of roads in India is clearly borne out by the following comparison—whereas India has only 13 miles of road per 100 square miles of area, the United Kingdom has 86.9 miles, West Germany 94.4 miles, France 102.1 miles, and Japan 103.4 miles. The all-India average is 0.49 per square mile of area and 1.12 per 1,000 of population. Thus, by any standard, there is considerable latitude for increasing and upgrading the present road mileage. Among the more than one-half million villages, only one out of nine is served by an all-season road. In the past, attention has been focused primarily on intercity rail movement, but the transport problems of agriculture, rural development, consumer goods industries, and retail trade have been neglected.

The road network of India totals 643,025 miles, of which 100,854 miles are concrete and bituminous surfaced (mostly bituminous-surface treated); 83,031 miles are gravel, crushed stone, or laterite surfaced; 184,631 miles are improved earth; and 256,469 are unimproved earth. Administratively, the highways are classified as national highways (15,500 miles), state highways, major and minor district roads, and rural and village roads. The national highways constitute the principal routes and connect major cities, ports, and strategic areas. State highways are the main trunk roads within the various states; major and minor district roads connect areas of production and markets with either a principal highway or railroad and form the main links between neighboring districts; and rural and village roads connect villages and form the farm-to-market roadnet within districts. These latter roads are extremely inadequate for modern needs, even for this local type of use.

The national highway network is generally sparse and unevenly distributed. It is patterned on a system of national highways which, although constituting only 2.4% of the total road mileage, forms a well-balanced network of through routes. The highest road density is in the southern part of India, where roads extend across the peninsula and are linked by numerous north-south roads to form a well-developed regional network. The lowest density is in the northern part of the country, where the rugged Himalayan mountains have made road construction difficult and costly. The Gangetic Plain has a fair density of roads, but in the northeast, the only principal road is the Assam Trunk Road (Figure 4), which services the states of Assam, Meghalaya, and Nagaland, and the union territories of Manipur and Tripura. In the west and northwestern areas, particularly the state of

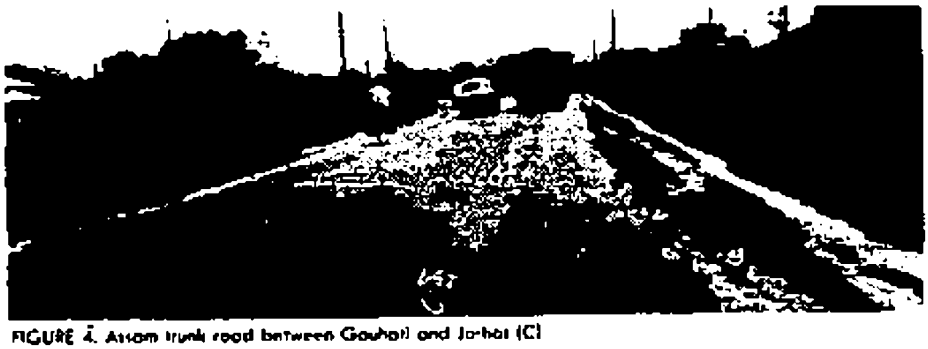


FIGURE 4. Assam trunk road between Gauhati and Jorhat (C)

Rajasthan the desert terrain has restricted the construction of good roads. The Indian highways density of about 0.09 miles of highway per square mile of area compares favorably with the ratio of 0.070 1 in Burma, 0.05 1 in the People's Republic of China and 0.011 in Pakistan but is somewhat less than the ratio of 0.32 1 in Bangladesh. International road services have exist with Burma, China, Pakistan, Bangladesh, Nepal, Bhutan and Sikkim.

The road network is characterized by a predominance of unsurfaced roads which account for almost two-thirds of the total mileage. The intermediate and intermediate-surface treated roads are generally constructed with a 1- to 2-inch treatment of bituminous over a crushed stone surface. Gravel crushed stone and laterite surfaces are usually found with either earth or clay on both for compaction. Most roads on gentle alignment and maintained generally despite rutted and often little more than unusable tracks. Surface widths are usually 10 to 12 feet but range from 9 to 24 feet with some as wide as 40 feet in urban areas. Most road have some crushed stone or gravel or earth although predominately 2 to 6 feet wide some are 12 feet or more in width. Shoulders are generally too narrow and uneven for safe use in avoiding opposing traffic especially during the monsoon period (June to October) when they become soft. This combined with the narrow pavements represents a serious hazard because of the need to turn off frequently to avoid approaching vehicles. Steep curves exist throughout the network and steep grades are common on mountainous roads.

Most bridges on the national highways are deck type concrete or masonry structures timber bridges predominate on minor district roads and rural and village roads. Steel truss or girder bridges are generally located at large river crossings (Figure 5). Many rivers on the most of the year and are spanned by low level bridges and causeways during the flood season many of these crossings are impassable. Horizontal clearance is about 12 feet for single lane structures with an additional 10 feet for each added lane. Most bridges have unlimited vertical clearance but some have 5- to 10-foot clearances. Many of the bridges are old and in poor condition because of inadequate steel reinforced concrete and prestressed concrete are used in new bridge construction throughout the system. There are 14 tunnels ranging in length from 30 to 5,120 feet and 20 proposed tunnels are on the principal highways. During the rainy season however ferry services are used at many points where bridges and roads become impassable.

Highway construction and maintenance generally are the joint responsibility of the central state and local authorities. Constitutional responsibility is vested in the Ministry of Shipping and Transport which through its Roads Wing is primarily responsible for the development control and project priority assignments coordination and control of standards and specifications administration of the Central Road Fund and the general administration and inspection of construction and maintenance of the national highway system throughout the country for all roads in union territories and selected roads in strategic areas financed by the central government. Actual work however is executed by the Public Works Departments of the various states and union territories. The responsibility for the construction and maintenance of state highways district roads and rural and village roads rests with the respective states and local authorities. In 1960 a Border Roads Development Board was established to carry out a program involving the construction of 3,500 miles of new roads and the improvement of 2,000 miles of existing roads in strategic border areas. The annual

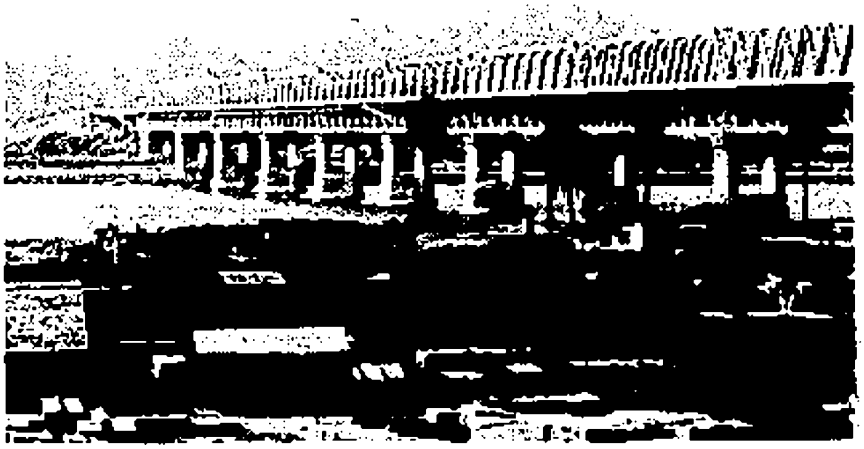


FIGURE 5. Rail-highway bridge over the Brahmaputra at Gauhati (C)

work in these fors and areas is entrusted to the General Reserve Engineer Force, with the resulting maintenance becoming the responsibility of the Public Works Departments of the states and union territories in which they are located. Progress to date includes construction of 1,400 mile of new roads, improvements to 1,980 miles of existing roads, and surfacing of 1,070 miles of roads. In addition, 4,760 feet of new bridging and 11,800 feet of permanent bridging replacing old temporary bridging have been completed.

Principal construction and maintenance problems are those imposed by adverse climate and topography. Large mountainous areas, swamps, and deserts are unsuitable for road construction. During the southwest monsoon season (June through September), construction and maintenance are temporarily halted in many areas. Other problems are insufficient funds, limited quantities of construction equipment and materials from local sources, and an insufficient number of skilled and technical personnel. The use of mechanized road-building equipment is steadily increasing, especially on the national highway system and some principal state affects, however, most construction and maintenance are still performed by antiquated hand methods. Availability of gravel, crushed stone, sand, and timber varies from area to area. Adequate supplies of cement are produced within the country. Most bituminous material and steel are imported, but efforts to provide domestic production are making some headway in reducing the import requirements. Construction equipment such as bulldozers, graders, mixers, and similar items is being produced in increasing quantities by some 135 companies, but the import of these items is still required.

The development and rehabilitation of the Indian road network have been carried out through a system of three 5-year plans (FY1951-52–FY1965-66) and three annual plans (FY1966-67 through FY1968-69). The current Fourth Five Year Plan (FY1969-70–1973-74) provides for a 32% increase in public funds for transport and introduces important changes in emphasis. The plan calls for the construction of missing road links (340 miles), widening of roads to two lanes (4,300 miles), strengthening of existing pavements (3,000 miles), and the improvement of low-grade sections (375 miles) for a total of 7,715 miles. It also includes construction of 74 major bridges, reconstruction of 50 major bridges that are in a weakened condition, and the reconstruction of many minor bridges and culverts. The aims of the plan reflect a continuation of the government's 20-Year Road Development Plan (1961-81), which called for at least one-lane bituminous or bituminous-surface treatment for all national and state highways, the widening to 20 feet of all main roads near cities and towns, and the replacement of all temporary bridges with permanent-type structures.

During the 5-year period FY1966/67-FY1971/72, estimated expenditures on the national highway system were the equivalent of about US$143.36 million. Actual achievements included the construction of 171 miles of missing road links and bypasses, 41 major bridges, and the improvement of 3,567 miles of roads. During FY1970/71, the pattern of central government assistance to State Roads of interstate or economic importance was changed from grant-in-aid to 100% loan assistance, applicable to both continuing and new projects. Inadequate and uncertain allocations are the main obstacles to the development of the highway system. Progress in the central government's road program has been markedly slow thus far with only 29% of total allocations being committed, resulting in only minor additions to the highway system. Overall indications are that whenever there is a need to reduce governmental expenditures, both highway development and maintenance have perennially been the first casualty, even under the most trying transport situations.

Highway movement is hampered by the climate and by the numerous physical bottlenecks existing throughout the network. During the rainy season, vast areas are flooded by torrential rains, especially in northeast India. Numerous low-level bridges and causeways become impassable, unpaved roads become quagmires, and major bridges are often destroyed. During the dry season, unpaved roads and the shoulders of paved roads become extremely dusty, reducing visibility and hindering traffic movement. Narrow low-capacity bridges, sharp curves, and numerous grade crossings exist throughout the network. The streets in cities, towns, and villages, and the roads leading into them are a teeming mass of pedestrians, beasts of burden, bullock carts, camel carts, and pushcarts. The most critical factor, however, is the narrow 10- to 12-foot surface widths that are characteristic of most Indian roads. In mountainous areas, traffic is interrupted by land and snow slides, blockages by both snow and rock slides, deep drifting of snow, and the constant movements of geologically unstable terrain.

Administrative control of interstate highway transport is vested in the Transport Division of the Transport Wing of the Ministry of Shipping and Transport. The responsibilities of the Transport Division include the regulation of road transport throughout the country in all matters relating to registration of motor vehicles; licensing of vehicles and drivers; insurance of motor vehicles; organization of road transport on national lines; uniformity and simplicity in motor vehicle taxation; rail and road coordination; highway safety measures; regulation of imports and exports of motor vehicles and spare parts; and the administration of the Roads Transport Corporations Act of 1950. In addition, the Interstate Transport Commission, appointed under the Motor Vehicles Act of 1939, is responsible for the development, coordination, and regulation of motor vehicles involved in interstate operations. State and union territory governments have created State Boards of Transport to consider all general policy matters regarding motor transport and to ensure the maximum coordination of all forms of inland transport to avoid wasteful competition. Each state government has also created the office of State Transport Commissioner which acts as the chief transport administrative office in the state. A State Transport Authority has also been set up under the Motor Vehicles Act, as the ultimate controller of motor vehicle operation and licensing. The policy of nationalization of motor transport, at least in the field of passenger services, has been accepted and state-operated services exist primarily on national and state highways and on some major district roads, but overall services are inadequate. Buses and facilities are generally overcrowded and poorly equipped and maintained. Despite the efforts of all transport agencies, no common national approach to highway transport matters appears to be existent or operative. Diverse regulations, varying taxation, uncoordinated issuance of permits and licenses, and obstacles, discrimination, and constraints continue in highway operations.

Although freight-hauling services continue to be provided by private carriers, there is a reluctance on the part of private carriers to expand their facilities and operations because of burdensome taxation, maladministration in the issuance of interstate permits, discriminations, and the continued threat of nationalization. The number of publicly owned commercial vehicles engaged in the carrying of freight is negligible—currently estimated at 2,286 vehicles. Of the 33 nationalized state transport enterprises in the public sector, 13 are operated on a departmental basis, 14 by corporations, and six by municipal bodies. Over one-third of the buses in the country are operated by these agencies, and it is estimated that by the end of the current 5-year plan the figure will increase to 40%. It is the policy of the government to nationalize gradually all passenger bus service in the country. The central government has entered the goods transport industry by organizing the Central Road Transport Corporation, which is responsible for the northeast area of the country; however, freight-hauling services continue to be provided there mainly by private

carriers. The government, as a matter of policy, encourages the formation of transport cooperatives; progress, however, in this area has been minimal.

Total traffic carried by highway transport during FY1970/71 amounted to about 27,416 million short ton-miles of cargo and 6,894 million passenger-miles. By the end of the Fourth Five Year Plan on 31 March 1974, freight traffic is expected to increase to 57,574 million short ton-miles and passenger traffic to 86,992 million passenger-miles. Commercial-type vehicles are expected to increase from the 1972 total of 481,812 to about 500,000 in 1973, and buses are expected to increase from 86,590 in 1972 to over 110,000 by the end of the plan. During the past few years, the percentage of both cargo and passenger traffic has increased on both rail and highway, with that of highway being proportionately higher. It is estimated that about 30% to 50% of the total road traffic is carried on the national highways, which represent roughly 5% of the total surfaced road mileage in the country. Freight handled via highways consisted mainly of foodstuffs, textiles, machinery, iron, steel, and building materials; a small percentage, primarily manufactured goods, is hauled long distances. The shift from rail to road transport has been primarily in high-value commodities and perishables. Cargo transport, as distinguished from passenger transport, has remained almost entirely in the private sector and continues to be more or less unorganized. Growth of long-distance bus travel is still inhibited by poor roads, restrictive licensing policies, and various administrative constraints, but the sharp upward trend in bus travel can be expected to continue as existing obstacles are gradually eliminated. Nonmotorized transport continues to play a vital role in rural areas where it is often the only mode of transportation. It is estimated that there are 10 million bullock carts in India; they, in addition to horses, camels, elephants, etc., account for about 70% of the total volume of freight tonnage, roughly 100 million tons, moved by all road transport media.

In January 1972, India had about 1,128,387 motor vehicles, including 559,985 passenger cars, jeeps, and taxicabs; 86,590 buses; and 481,812 trucks and special-purpose vehicles. The demand for motor vehicles is being met almost entirely by the country's eight vehicle assembly plants which are licensed to produce foreign and domestic vehicles. About 26% of the component parts for these vehicles are imported, and the remainder are produced at some 200 domestic automobile-parts plants. Trucks cannot be imported into India. India's automobile industry has a rated annual capacity for 30,000 passenger cars, 12,000 jeeps, and 48,000 commercial vehicles.

E. Inland waterways (C)

India has about 8,750 miles of navigable inland waterways with seasonal depths of 3 feet or more. Although railroads are India's principal means of national transport, waterways have considerable importance to local and regional commerce for hauling of bulk agricultural commodities. Principal cargoes include raw agricultural products, fertilizers, textiles, bamboo, jute, and hides. The modern segment of the waterway fleet accounts for only a minor percentage of the country's reported national freight tonnage; small primitive craft whose performance goes unrecorded probably account for several times the reported inland waterborne tonnage.

The principal arteries of waterway transport are the Hooghly, Bhagirathi, Ganges, and Brahmaputra rivers in northeast India; the canals of the Godavari and Krishna rivers, together with the Buckingham Canal along the southeast coast; and the West Coast Canal and its affluents along the southwest coast. The three principal rivers in peninsular India, the Mahanadi, Godavari, and Krishna, support only limited navigation in their lower reaches.

The Hooghly-Bhagirathi-Ganges river system in northeastern India provides an important connection between the Bay of Bengal and the populous Gangetic Plain. The Hooghly is perennially navigable by oceangoing vessels for 80 miles to Calcutta. During the 4- to 6-week peak of the high-water season (June through October), 6-foot-draft steamers can navigate from Calcutta, on the Hooghly, to Patna, on the Ganges—a distance of 489 miles. During the same period, vessels of 4-foot draft can navigate 100 miles beyond Patna and vessels with a maximum draft of 3 feet can ply 345 miles upstream from Patna. During the dry season (November through May) through navigation is interrupted, as the water level of the Bhagirathi, which links the Hooghly with the Ganges, is too shallow for most steamers. A total of 13 bridges span the navigable reaches of these rivers—three on the Hooghly, one on the Bhagirathi, and nine on the Ganges. The Farakka Barrage, located on the Ganges about midway between Calcutta and Patna, has a navigation lock 490 feet long and 65 feet wide. The recently completed barrage is primarily intended to improve navigation on the Hooghly and Bhagirathi and to provide a bridge for rail and highway traffic. A feeder canal from the barrage makes the Bhagirathi perennially navigable. Organized steamer services

transport about 1.2 million tons of cargo on the Hooghly and 300,000 tons on the Ganges annually. About 450,000 tons of cargo are moved on the Bhagirathi during the 6-week period that it is navigable by steamers. There are numerous inland waterway wharves at Calcutta, but elsewhere along the route ports are poorly equipped and in general lack alongside berthing, except of the port of Haldia, located 58 miles downstream from Calcutta, which should be completely operational by mid-1973.

The Brahmaputra, an important year-round waterway, flows from China through the center of the Assam region of northeast India into the Ganges in Bangladesh. The 250-mile section of the river flowing through Bangladesh is navigable by vessels of 6-foot draft. The Brahmaputra is navigable by vessels of about 5-foot draft from the India-Bangladesh border to Disangmukh, a distance of about 340 miles. Above this point, navigation is restricted to shallow-draft native craft. At least 800,000 tons of cargo are transported annually on the Brahmaputra by organized carriers. A combination highway and railroad bridge at Pandu, near Gauhati, is the only one spanning the river. Ports along this waterway are generally small steamer landings with limited facilities.

Sections of the Godavari, Krishna, and Buckingham Canal systems combine to make up a continuous 450-mile route along the southeastern coast of India between Kakinada and the route's southern terminus 58 miles south of Madras. The canals of the Godavari and Krishna rivers and the northern part of the Buckingham Canal can accommodate craft with up to 3-foot draft; craft drawing 2 feet navigate the 58-mile-long southern section of the Buckingham Canal south of Madras. Approximately 105 bridges span the canals and there are 155 locks; the controlling lock chamber is 105 feet long and 15 feet wide. Lock gates are primarily manually operated by resident lock keepers. The canals fed by the Godavari and Krishna rivers are generally closed to navigation from March through May, when the already reduced dry-season flows of the Godavari and Krishna rivers are diverted for irrigation purposes. Local movement of agricultural products, firewood, lime, salt, and some iron ore accounts for most of the canal traffic. Most of the traffic on the Buckingham Canal, which handles an estimated 300,000 tons of cargo annually, is destined for the port of Madras. Navigation of the Godavari and Krishna rivers is restricted along sections of their lower reaches. Ports are widely distributed throughout the systems, but they are small and inadequately equipped for efficient cargo handling.

The West Coast Canal, a series of canals, canalized coastal streams, lagoons, and lakes, extends 280 miles along the southwest coast from Trivandrum, north-northwest to a terminous near Mahe. Through navigation is limited to small local craft of 2-foot draft; however, some sections can be used by deeper draft vessels of up to 180-ton capacity. Thirty-one miles north of Trivandrum the canal passes through two tunnels that are masonry lined and have horizontal and vertical clearances of 14 feet and 12 feet, respectively. Near the northern end of the canal are four locks with limiting dimensions of 50 feet in length and 12.5 feet in width. There are 53 bridges spanning the canal. An estimated 4 million tons of cargo are transported annually on the West Coast Canal—mainly agricultural and forestry products. Heaviest traffic is on the 80-mile stretch between the ports of Quilon and Cochin, where regular transport service with vessels of 20- to 40-ton capacity is available.

Serious navigation difficulties have developed on the waterways because of excessive sedimentation, shifting channels, and diversion of river water for irrigation. Shoaling on the Hooghly north of Calcutta and on the Brahmaputra occasionally requires offloading to avoid grounding. During the southwest monsoon season (June through September) widespread flooding causes recurrent destruction of waterway facilities and disruption of all surface transportation; during the winter season (December through February) diminishing water levels limit the size of craft operating on the waterways.

The inland waterway fleet of India includes vessels ranging in size from small native craft of less than 1-ton capacity to large paddle wheel river steamers of more than 1,000-ton capacity. However, the fleet consists largely of various types of small native "country boats" numbering in the thousands (Figure 6). These boats range up to 70 feet in length and 20 tons capacity, have wooden hulls, and are propelled by oars, sails, or poles. Powered craft include steamers, tugs, launches, and barges. A typical stern-wheel paddle steamer has a length of 239 feet, a beam of about 40 feet, a draft of about 5 feet, and a maximum carrying capacity of 400 tons. Most of the larger powered craft are found on the waterways of northeastern India. In the early 1960's about 860 vessels (steamers, tugs, launches, and barges) were operated on the Hooghly, Ganges, and Brahmaputra, but termination of Indian transport operations on Pakistani waterways has caused the collapse of a number of transport companies operating between Calcutta and northeast India. As a result, many of the

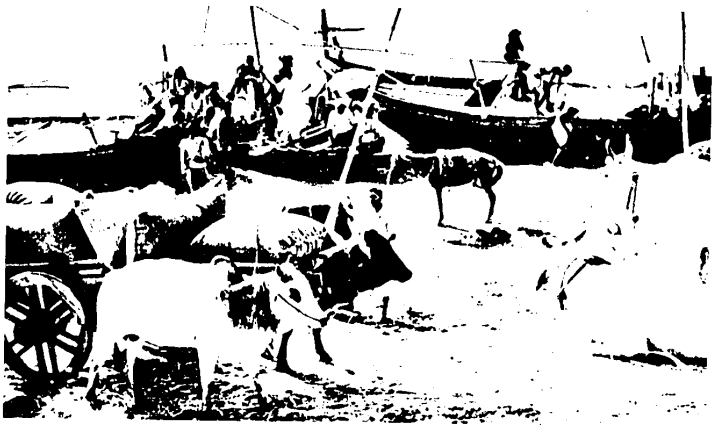


FIGURE 6. "Country boat" traffic on the Ganges (U/OU)

powered craft that formerly operated over this route have been allowed to deteriorate.

Inland waterway transport is under the control of the Ministry of Transport and Shipping. The ministry exercises control over the operation of powered vessels, but no effective control is exercised over the thousands of native craft which navigate the Indian waterways. Agencies operating under the ministry include the Ganges-Brahmaputra Water Transport Board, which is concerned with the development of navigational aids and port facilities on the Ganges and Brahmaputra systems, and the Inland Water Transport Committee, which directs inland waterway research and planning. Inland waterway transportation is not a high-priority item in the Indian budget. The first three 5-year plans (1 April 1951-31 March 1966) provided relatively small amounts of money for inland waterway improvements and development. The current 5-year plan (FY1969/70-1973/74) includes allocations for dredging the Buckingham Canal and for the improvement of port facilities at Jogighopa and the planning of a new inland waterway port at Pandu, both on the Brahmaputra.

F. Pipelines (S)

India has 2,161 miles of principal pipelines; an additional 2,590 miles are planned. Of the existing lines, 881 miles are used to transport crude oil from the fields in the states of Assam and Gujarat directly to the refineries, 1,151 miles are for refined products, and 129 miles are for natural gas (Figure 7). The pipelines planned will be used to transport refined products to distribution centers; one planned line will have a crude oil refined product reverse-flow capability.

The refineries at Baruni and Gauhati are the focal points for the largest portion of the pipelines. Refined products lines extend from Baruni to Kanpur and to Calcutta. Baruni is also the terminal point for the 720-mile-long pipeline that carries crude oil from the Digboi, Nahorkatiya, and Moran fields. This pipeline, which has a control center at Gauhati; is one of the longest in the eastern hemisphere and one of the most technically advanced in the world. A refined products line parallels the crude line from Gauhati to Siliguri, where the meter-gage rail line serving Assam connects with the broad-gage system.

In the western part of the country, the focal point of the pipelines is the Koyali refinery at Vadodara (formerly Baroda), which is supplied by two crude oil lines—one from the Kalol field and the other from the Ankleshwar field. A refined product line extends from the Koyali refinery to Ahmadabad, a junction of the broad- and meter-gage railroad systems. Other pipelines in the area, all for natural gas, are from Ankleshwar field to Vadodara and the Utran powerplant, Khambat (formerly Cambay) to the Dhuwaran powerplant, and Kalol to the Ahmadabad powerplant.

The government's goal is to develop the public sector in all phases of the petroleum industry and to restrict the expansion of those activities in which the government does not have at least part ownership. With the exception of the Nahorkatiya-Gauhati-Baruni line and short lines from Digboi to Tinsukia, the existing pipelines are government owned. The ownership for the planned lines has not been determined, but it is likely that the government will have a large share in them.

FIGURE 7. Principal and planned pipelines (S)

TERMINALS				
From	To	DIAMETER	LENGTH	REMARKS
		Inches	*Miles*	
Crude oil:				
Nahorkatiya	Gauhati	16	260	Automatically and remotely controlled; main center at Gauhati.
Gauhati	Baruni	14	460	*Do.*
Ankleshwar	Vadodara (Baroda)	16	61	
Kalol	*....do*	*na*	70	
Digboi	Nahorkatiya	*na*	30	
Gulf of Kutch	Mathura	24	750	Planned crude oil line will extend from offshore terminal in Gulf of Kutch to planned refinery at Mathura and will have a 100-mile branch line to refinery at Koyali.
Crude oil or product:				
Baruni	Kanpur	12	423	Handles refined products.
Do.	Calcutta (Haldia)	12	323	The line, which can handle refined or crude oil, has a reverse-flow capability for carrying crude to the Baruni refinery.
Gauhati	Siliguri	8	270	Handles refined products. Siliguri is the junction of the broad- and meter-gage railroad systems.
Vadodara	Ahmadabad	8	53	Ahmadabad is the junction of the broad- and meter-gage railroad systems.
Digboi	Tinsukia	4	21	2 parallel 4-inch refined product lines to storage area.
Do.	*....do*	6	21	Refined product line parallels Digboi to Tinsukia lines. Tinsukia is storage area for the Digboi refinery.
Baradahar	Mauriaram	*na*	40	Refined product line.
Kanpur	Delhi	*na*	240	Planned refined product line.
Cochin	Madras	*na*	380	Planned refined product line will go through Coimbatore and Bangalore.
Bombay	Bhusaval	*na*	300	Planned crude and refined product pipeline will have a reverse-flow capability.
Do.	Pune (Poona)	*na*	120	Planned refined product line.
Pune	Hyderabad	*na*	300	*Do.*
Natural gas:				
Ankleshwar	Baroda	14	61	
Do.	Utran powerplant	16	26	
Cambay	Dhuwaran powerplant	14	16	
Kalol	Ahmadabad powerplant	*na*	15	
Nahorkatiya	Namrup	14	11	
Jaisalmer	Delhi	*na*	400	Planned natural gas line.

na Data not available.

G. Ports (S)

India has a long, low-lying, very regular coastline that affords only a few deep, well-sheltered natural harbors. The seven major ports are fairly evenly spaced along the coasts, but most of the 75 minor ports are located along the west coast. Bombay, on the west coast, and Calcutta, in the northeast, are the two largest ports; Cochin, Kandla, Madras, Marmagao (formerly Mormugao), and Vishakhapatnam are also of major importance. Indian ports are under the jurisdiction of the Ministry of Transport and Shipping. The central government administers the major ports through the National Shipping Board; the states administer the minor ports. Details of the major ports are given in Figure 8).

In India the most important international connections are by sea, and the greatest volume of traffic moves through the seaports. The port system was long considered adequate for normal traffic, and

FIGURE 8. Major ports (C)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Bombay..... 18°56′N., 72°50′E.; on the Arabian Sea coast. 65,000 long tons	Largest and most important port in India. Principal receipts—chemicals, food grains, bulk petroleum, iron and steel, machinery, cotton, and building materials. Shipments—ores, petroleum products, cotton products, and rice. Several important shipyards, including 1 with a drydock which has a floor length of 1,000 ft.; shipyard engaged primarily in repair activities. Principal logistic support and operating base of the Indian Navy and headquarters for Flag Officer Commanding, Indian Fleet, and the Flag Officer, Bombay. Components include landing, shipyard, ordnance, supply, communications, training, and medical facilities.	Improved natural coastal harbor consisting of 2 divisions: Tidal Harbor, the larger of the 2, comprises a water area of approximately 95 sq. miles with central depths ranging up to 70 ft.; Controlled-Level Basins, the other division, is subdivided into 4 basins, general depths 21, 22, 24, and 33 ft. at MHWN. Bombay harbor has natural protection except from SW.	Alongside—For numerous large and standard ocean-type cargo vessels and several small coasters, 2 ocean-type tankers, numerous lighters, and several submarines, minesweepers, and patrol craft. Free-swinging mooring—3 berths for small ocean-type cargo and naval vessels. Anchorage—For numerous standard ocean-type cargo vessels.
Calcutta..... 22°32′N., 88°19′E.; on the Hooghly River, 80 miles upstream from the Bay of Bengal. 30,000 long tons	Chief port on east coast of India and the major outlet for the world's largest jute-processing center. Principal receipts—grain, petroleum, iron and steel, machinery, salt, and railroad equipment. Shipments—gunny, coal, ores, and tea. Numerous shipyards with extensive repair facilities but only limited building capacities. Site of minor naval activity.	Harbor comprises 3 sections: 6-mile stretch of Hooghly River and 2 wet docks, both at Calcutta; and a 1-mile stretch of the river at Budge Budge, 8 miles downstream. Harbor depths are 30–35 ft. at Budge Budge, 20–42 ft. in the river at Calcutta, and 30 ft. in the wet docks. The entrance lock at King George's Dock has a depth of 20 ft. (33 ft. at MHWN) over the sill; the lock at Kidder docks has a depth of 18 ft. (31 ft. at MHWN) over the sill.	Alongside—For a large number of standard and small ocean-type and coaster-type cargo vessels and lighters, a few small tankers, and a small naval vessel. Fixed-mooring—For about 40 standard and small ocean-type cargo vessels. Anchorage—None.
Cochin..... 9°58′N., 76°15′E.; on the Arabian Sea coast at mouth of Cochin River. 8,800 long tons	Second-ranking port on W. coast, and fourth most important port in India. Principal receipts—petroleum products, coal, and food grains. Shipments—mineral sands and ores, coir (coconut fiber) products, cashew nuts, and tea. One medium and several small shipyards; largest drydock is 230 ft. long. Principal shore training base of Indian Navy. Naval components include training center, landing, shipyard, ordnance, supply, communications, medical, and naval air facility.	Natural, almost completely landlocked harbor comprising several channels and/or areas. Alongside depths at the principal wharves range from 4 to 30 ft.	Alongside—For several large and a few standard and small ocean-type cargo vessels, several medium-sized tankers, lighters, and a few small naval vessels. Fixed mooring—For several standard and 1 small ocean-type cargo vessels. Free swinging—One large ocean-type cargo vessel. Anchorage—None.

Kandla 23°02′N., 70°13′E.; on Kandla Creek. 6,900 long tons	Developed following partition of India in 1947 to replace Karachi; is the newest of the major ports in India. Principal receipts—food grains, petroleum, iron, and steel. Shipments—salt, iron ore, cotton, and alcohol. Shipyard has 1 floating drydock of 1,500 tons lifting capacity and several support shops. To increase traffic the government has established a free trade zone in the port area.	Natural river harbor; general depths 20–60 ft.; well sheltered.	Alongside—Several large and 2 small ocean-type vessels, 1 standard coaster-type vessel, and 14 lighters. Free-swinging mooring—For 1 standard and 2 small ocean-type vessels. Anchorage—Several ocean-type and numerous coaster-type vessels.
Madras 13°06′N., 80°18′E.; on SE. coast of India. 15,700 long tons	Third largest port in terms of cargo handled. Principal shipments—iron and magnesium ores, peanut oil, seeds, hides and skins, and textiles. Receipts—petroleum products, food grains, coal, fertilizers, and machinery. One medium shipyard for ship repairs; one small shipyard constructs wooden-hulled vessels up to 100 ft. in length.	Artificial harbor protected by 2 breakwaters and groin; water area totals about 1/2 sq. mile. Depths alongside main wharves maintained at 31 ft. by dredging.	Alongside—For about 12 large and 7 standard and small ocean-type cargo vessels, 1 coaster, and 5 lighters. Fixed mooring—For one large ocean-type cargo vessel. Anchorage—None.
Marmagao (Mormugao) 15°24′N., 73°48′E.; on W. coast in the former Portuguese enclave of Goa. 4,400 long tons	Primarily an iron and manganese ore loading port. Principal receipts—rice, sugar, cement, canned foods, petroleum, coal, hardware, motor vehicles, and machinery. Shipments—iron and manganese ores and cashew nuts. Naval facilities include an air station, communications, and medical facilities, and an ammunition storage dump. Shipyard repairs small craft only. A port development project, scheduled for completion in 1974, will be able to handle alongside ore vessels of 60,000 d.w.t.	Improved natural harbor, comprising 2 sections: outer harbor in the bay and a breakwater-protected basin inner harbor.	Alongside—For several standard and small ocean- and coaster-type cargo vessels and lighters. Anchorage—For large numbers of coaster-type vessels.
Vishakhapatnam 17°41′N., 83°17′E.; on the Bay of Bengal. 13,000 long tons	Important petroleum and ore port and the site of one of the nation's largest shipyards, Hindustan Shipyard, Ltd. A graving dock, recently completed, 800 ft. by 125 ft., is the largest in the country. Principal receipts—crude oil, building materials, food grains, and jute products. Shipments—fuel oil, diesel oil, coal, jute, manure, iron, steel, and iron ore. Naval operating base with landing, shipyard, ordnance, supply, communications, training, and medical components.	Improved natural harbor, almost completely landlocked. Harbor is divided into an entrance channel and a turning basin with 4 arms. Harbor depths range from 9 to 35 ft.	Alongside—For several large, standard, and small ocean-type cargo vessels, several coasters, and several ocean-type tankers and naval vessels.

*The estimated military port capacity is the maximum amount of general cargo—expressed in long tons—that can be unloaded onto the wharves and cleared from the wharf aprons during a period of one 24-hour day (20 effective cargo-working hours). The estimate is based on the static cargo-transfer facilities of the port existing at the time the estimate is prepared and is designed for comparison rather than for operational purposes; it cannot be projected beyond a single day by straight multiplication.

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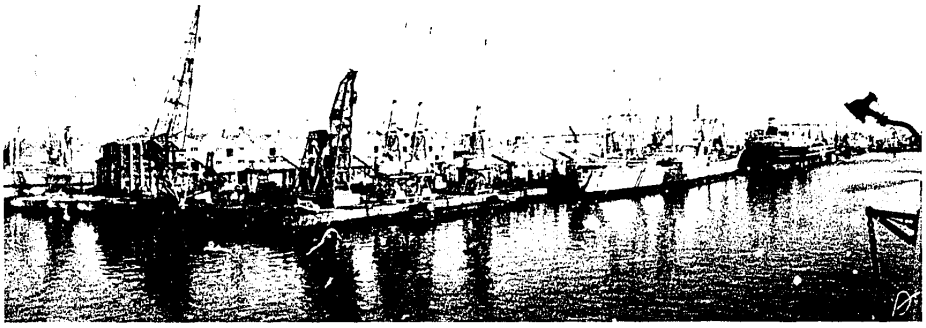


FIGURE 9. Alexandria Dock at Bombay (S)

the occasional problems of congestion were attributed primarily to the lack of good road and rail clearance. In recent years, foreign trade has increased rapidly, mainly because of large-scale imports of grain, and traffic congestion has developed. However, the problem today is caused mainly by inadequate port facilities than by clearance facilities. Fifty-six million tons of cargo were handled during FY1970/71 (April-March); it is anticipated that this total will increase by 30 million tons by 1974. Port operations, particularly at the minor ports, are also affected by the monsoons on the west coast, mainly by the southwest monsoon, and on the east coast by both the southwest and northeast monsoons (June through September and December through February or March). Operations are also hampered by shortages of both covered and open storage space, heavy-lift cranes, and by the lack of proper maintenance and repair of port equipment.

Several projects to enlarge or improve the port system have been completed and others are either planned or underway. The ports of Bombay (Figure 9), Madras, Vishakhapatnam (Figure 10), and Cochin are undergoing extensive enlargement or improvement projects. Bombay, the largest port, is undergoing continuous expansion. The recent completion of two berths at Vishakhapatnam, with an estimated total length of 1,200 feet and crane tracks along the apron, will enhance the port's activities. A breakwater foundation was laid in the outer harbor and is scheduled for completion in early 1974; the breakwater will accommodate along its inner side vessels of 100,000 deadweight tons (d.w.t.) and over. At Madras, construction is soon to be completed on the petroleum dock and the mechanized ore-loading berth. A major shipyard expansion program is underway at Cochin, and when completed in late

FIGURE 10. Main wharf at Vishakhapatnam (S)

1973, the yard will have the capability to build ships up to 85,000 d.w.t., with repair facilities for ships of up to 100,000 d.w.t. Haldia's petroleum facility is already in operation, and the construction of five additional dry-cargo berthing facilities are nearing completion. These facilities are to consist of an iron ore berth with a loading rate of 6,000 tons per hour; a coal berth capable of loading conventional vessels up to 60,000 d.w.t., a fertilizer berth capable of unloading up to 8,000 tons per hour; and two general-cargo berths—one for conventional cargo and the other for container traffic. In addition, construction work is being continued at the new deepwater ports of Mangalore and Tuticorin.

H. Merchant marine (C)

Merchant shipping plays a prominent role in the economy of this trade-dependent nation. Although rich in natural resources, India depends heavily upon the import of manufactured and processed goods and some basic foodgrains. Despite substantial growth during the last 5 years, its merchant fleet capacity has not kept pace with the country's rapidly increasing volume of foreign trade. Of the nation's international seaborne trade, totaling about 53 million metric tons in 1970, only about 21% was carried aboard Indian-flag ships.

In April 1972 the Indian merchant fleet consisted of 251 ships of 1,000 gross register tons (g.r.t.) and over, totaling 2,562,473 g.r.t. or 3,928,370 deadweight tons (d.w.t.), as follows:

	No. of ships	G.R.T.	D.W.T.
Dry cargo	183	1,913,087	1,879,987
Bulk cargo	35	679,227	1,129,505
Tanker	12	286,203	453,766
Combination tanker/ore carrier	7	202,051	340,051
Combination passenger/cargo	11	45,205	41,008
Passenger	3	26,030	23,167
Sand carrier	1	10,680	17,963
Total	251	2,562,473	3,928,370

Among the merchant fleets of Asia, the Indian fleet is second only to that of Japan in size and modernity. Eighty-seven of the ships (about 51% of the total deadweight tonnage) are less than 10 years old; 124 ships (38% of the tonnage) are 10 to 20 years old, and only 40 ships (11% of the tonnage) are over 20 years old. There are 78 ships that are under 10,000 d.w.t., 131 ships between 10,000 and 19,999 d.w.t., 36 ships between 20,000 and 39,000 d.w.t., and 5 ships over 40,000 d.w.t. The largest ship in the fleet is a 94,200-d.w.t. tanker. Six ships (five dry cargo, one combination passenger-cargo) have service speeds of 18 knots, 132 have speeds of 14.1 to 17.0 knots, 112 have speeds of 10 to 13 knots, and one (a dry-cargo ship) has a speed under 10 knots. Powerplants of 190 ships are diesels, 48 have oil-fired boilers, and four have coal-fired boilers.

Fleet ownership is divided among 29 government and private domestic beneficial owners (entities that assume profit or loss from operations). The government is the largest owner with 102 ships totaling 1,813,046 d.w.t., and these are operated principally by the Shipping Corporation of India, Ltd. (SCI). Six private companies, each owning more than 100,000 d.w.t., control 40% of the total fleet deadweight tonnage as follows:

Company	No. of ships	D.W.T.
Scindia Steam Navigation Co., Ltd.	45	642,851
Great Eastern Shipping Co., Ltd.	16	300,852
South India Shipping Corp., Ltd.	5	215,780
India Steamship Co., Ltd.	17	199,393
Deepo Steamships, Ltd.	5	123,479
Ratnakar Shipping Co., Ltd.	5	104,139

More than 90% of the total fleet deadweight tonnage is employed in scheduled (liner) and nonscheduled (tramp) trade. Liner services are maintained between India and the United Kingdom, Europe (North, Baltic, Mediterranean, Adriatic, and Black Sea), the United States, Canada, South America, Africa, Australia, New Zealand, Japan, Malaysia, and other southeast Asian countries. Passenger and combination passenger-cargo ships carry passengers between India and the Andaman and Nicobar Islands and the east coast of Africa and also carry Muslims to Jeddah in Saudi Arabia during the annual pilgrimage to Mecca.

With a mainland coastline of 3,600 statute miles, coastal shipping is essential to the nation's economy and serves as a supplement to the railroads and highways. In January 1972, 60 ships of 1,000 g.r.t. and over, totaling 318,449 d.w.t., were engaged in coastal shipping. In 1970, domestic coastal vessels carried all of the country's waterborne bulk and dry cargoes, totaling 1.3 million tons, but only about 900,000 tons of about 3.5 million tons of petroleum cargoes.

Principal exports carried by the fleet are jute products, tea, iron ore, and cotton textiles; principal imports carried are electrical machinery, transport equipment, chemical fertilizers, iron and steel products, foodgrains, petroleum and related products, and raw cotton.

The government supports an extensive fleet expansion program. The current 5-year plan calls for a

fleet tonnage goal of 4 million g.r.t. and about 6.4 million d.w.t. As of February 1972, 59 ships (about 1.9 million d.w.t.) for Indian registry were on order for construction by foreign and domestic shipyards, deliveries scheduled between 1972 and 1976. Forty-two ships totaling about 1.7 million d.w.t. are being built in foreign shipyards as follows:

Country	No. of ships and type	Total D.W.T.
West Germany	3 dry cargo	44,850
	1 bulk cargo	108,000
Japan	2 bulk cargo	251,960
Netherlands	1 bulk cargo	66,300
Spain	1 container	16,880
Sweden	1 ore/oil carrier	100,600
United Kingdom	4 bulk cargo	289,200
East Germany	8 dry cargo	106,000
Romania	10 bulk cargo	150,000
U.S.S.R.	4 dry cargo	66,400
	3 tanker	48,900
Yugoslavia	2 tanker	230,000
	2 ore/oil tanker	216,000

The remaining 17 ships under construction in domestic shipyards are as follows:

Shipyard	No. of ships and type	Total D.W.T.
Cochin	1 bulk cargo	27,000
Hindustan	7 dry cargo	72,731
	7 bulk cargo	150,150
Mazagon Dock	2 passenger	19,000

About 86% (215 ships) of the merchant fleet is foreign built; only 36 ships (33 dry cargo, three combination passenger cargo), were built in domestic yards. The necessity of buying most of the ships from foreign shipyards involves a substantial expenditure of foreign exchange. To partially offset this foreign exchange drain, facilities at the Hindustan Shipyard, Vishakhapatnam, are being expanded to increase annual construction from three to six ships, each of about 12,000 d.w.t. In addition, a new shipyard at Cochin, being built in collaboration with Japanese interests, will begin construction in the latter part of 1973 of one of two 66,000-d.w.t. bulk carriers to be built annually.

In addition to ships of 1,000 g.r.t. and over, there are about 130 Indian merchant ships in the category of vessels between 100 to 999 g.r.t. They total about 50,000 g.r.t. and are utilized primarily in coastal and nearseas trade. The fishing fleet consists of about 86,000 small craft and operates in nearby coastal waters. Of this fleet, about 2,500 vessels are motorized.

Maritime policy and legislation are administered by the Ministry of Transport and Shipping, through the Director General of Shipping. India is a member of the Inter-Governmental Maritime Consultative Organization (IMCO) and a party to the Safety of Life at Sea, 1960; Prevention of Collisions at Sea, 1960; and Load Lines, 1966 conventions.

Major merchant marine policy has been predicated on the deficit in the balance of payments that has persisted in the Indian shipping account. The national objective is that at least 50% of the nation's total seaborne foreign trade be carried by Indian-flag vessels in order to reduce this deficit by lessening India's dependence on foreign shipping.

Although no direct operating subsidies are provided shipowners, the government, under the Development Rebate System, allows Indian shipping companies to deduct 40% of the cost of new ships and 20% for used ships from their annual taxable income. The government also grants a "tax holiday" concession, which exempts from income tax profits up to 6% per annum on capital involved in the operation of new vessels, and extends loans at reduced rates from the Shipping Development Fund for the acquisition of new and used ships from abroad.

Cargo preference is extended to Indian-flag ships and those countries which have entered into bilateral shipping agreements with India (U.S.S.R., Czechoslovakia, East Germany, Egypt, Hungary, Poland, Romania, West Germany, and Yugoslavia). Coastal shipping is generally reserved for domestic ships; foreign-flag ships operating in Indian coastal trade must be licensed by the Director General of Shipping.

In 1972 there were about 50,000 Indian seafaring personnel. The supply of trained seamen far exceeds the demand, both domestic and foreign; in January 1971, a total of 42,366 seamen were registered at the Seamen's Employment Offices in Bombay and Calcutta for 27,096 jobs aboard domestic- and foreign-flag ships. Compared to European standards, Indian maritime wages and compensation are low; however, certain fringe benefits complement the modest wage schedule. Four maritime unions (one officers, three seamen) are officially recognized by the government.

There are six merchant marine training schools (three each for officers and seamen). The Directorate of Marine Engineering Training provides pre-sea training for engineering officers and the Nautical and Engineering College offers post-sea training for navigation and engineering candidates preparing for various grades of examinations. Navigation officers receive instruction prior to sea duty aboard the training ship *Rajendra*. Seamen qualifying for deck and engineering billets receive pre-sea instruction aboard the three training ships, *Bhadra*, *Mekhala*, and *Naulakshi*.

I. Civil air (C)

Since World War II, civil aviation in India has gradually expanded to provide service for the sprawling country and to attract badly needed foreign currency via the tourist route. The government well realizes the value of civil aviation, and since 1953 it has carefully controlled the development of Indian airlines. In that year the government nationalized the air transport industry and established two government-owned air corporations, assigning each to a separate area. Air India (AI) was designated the international flag carrier, and Indian Airlines Corporation (IAC) was assigned the scheduled regional and domestic route structure of India and nearby countries. In addition to this division of air services, the government set up Air-India Charters in September 1971. This airline, a wholly owned subsidiary of Air India, operates point-to-point charter services in an effort to promote tourist traffic to India. Aircraft are rented from the parent company when required.

Civil aviation in India is supervised and controlled by the Ministry for Tourism and Civil Aviation. The Directorate General for Civil Aviation (DGCA) within the ministry administers all civil aviation matters. This directorate is responsible for the operation of civil airfields; licensing of aircraft and air and groundcrews; conducting air and groundcrew training; and certification of registration and airworthiness for all aircraft based in India. It also operates and maintains navigational aids, enforces air regulations, and investigates accidents.

The government has entered into formal or informal bilateral air agreements or arrangements which permit the exchange of scheduled air services with 37 countries. Under the terms of these agreements or arrangements, 31 foreign air carriers, including Czechoslovakia and the U.S.S.R., serve India on scheduled international flights. These flights link India to 66 cities in 48 countries in Africa, Asia, Australia, Europe, and North America. India is a member of the International Civil Aviation Organization and is a party to most of the other major multilateral conventions governing international civil aviation. Both IA and IAC are members of the International Air Transport Association. Air India is also a member of the International Society of Aeronautical Telecommunications (SITA), and the Aero Club of India is a member of the International Aeronautical Federation (FAI).

Air India provides scheduled international services to 28 cities in Europe, Asia, Africa, the Middle East, North America, and Australia over a network of more than 86,000 unduplicated route miles. The company's airfleet consists of four Boeing 747 (Figure 11) and 10 Boeing 707 aircraft. Future plans consist of an option to purchase two Concorde supersonic transports. The carrier staff of over 9,000 employees includes about 210 pilots and about 1,400 skilled maintenance technicians.

IAC, the Indian regional and domestic carrier, operates an extensive passenger and freight network throughout the country and to Afghanistan, Nepal, Bangladesh, Burma, and Sri Lanka. IAC also operates a night airmail service linking Bombay, Delhi, Calcutta, and Madras. Its airfleet consists of seven Boeing 737 (Figure 12), 16 HS-748, 12 Fokker F-27, 7 BAC Viscount Series 700, and nine DC-3 aircraft. IAC has purchased seven additional HS-748's, which were scheduled for delivery in 1972, and has plans to purchase five more Boeing 737. IAC staff of over 14,000 persons includes about 425 pilots and 4,500 maintenance personnel. In addition to the government-owned carriers, six privately owned companies, which hold government permits, provide nonscheduled services. These nonscheduled operators are Air Survey Company of India, Ltd.; Airways (India), Ltd.; Bharat Commerce and Industries, Ltd.; Cambata Aviation Private, Ltd.; Jamair Co. Private, Ltd.; and Kasturi and Sons, Ltd. These nonscheduled airlines are quite small, averaging about two or three DC-3 aircraft each, and to insure they remain small, the government assigns them routes that will not interfere with or be competitive with IAC's scheduled services. Many of India's flying clubs also hold government permits to operate nonscheduled services, and several small private companies are engaged in charter and airwork services. The central government also operates 18 Curtiss C-46 (Commando) aircraft and the state governments operate a total of 18 to 20 Douglas DC-3 and C-46 aircraft.

Pilot training is conducted by the 25 government-subsidized aeroclubs operating under the direction of the Directorate for Civil Aviation. The goal of these clubs is to provide elementary flight training in light

FIGURE 11. Boeing 747 of Air India, popularly described as the "flying palace" (U/OU)

FIGURE 12. Boeing 737 used by the Indian Airlines Corporation for regional and domestic services (U-OU)

aircraft for pilots who may subsequently join the civil airlines or the military. There are also 13 government-subsidized gliding clubs scattered throughout the country. This represents a decrease of two from previous years as the clubs at Lucknow and Bangalore were closed for financial reasons. All has a flight and ground training school at the Bombay's Santa Cruz airport, where training has been improved with the acquisition of a Boeing 747 flight simulator. IAC conducts pilot training at its facility in Hyderabad. In 1972 the airline purchased (financed by a U.S. development loan) a HS-748 and a Boeing 737 flight simulator in an effort to upgrade pilot training. The government operates a Civil Aviation Training Center at Allahabad which is the primary source of technically trained personnel for the DGCA. The center offers various degrees of certification in aeronautical communications and airport operations and administration.

There are 65 Indian firms approved by the DGCA for performing aircraft maintenance in India. Among the most significant of these certified firms is Al's large maintenance base at Bombay, which performs all maintenance for its own aircraft and provides maintenance for other international carriers. IAC has maintenance bases strategically located at Delhi, Calcutta, Bombay, and Hyderabad which can service and overhaul IAC aircraft. Hindustan Aeronautics Ltd (HAL) based in Bangalore and one of the most important aircraft manufacturing and repair firms in the country, is government owned and is managed by the Ministry of Defence. HAL is approved by the U.S. Federal Aviation Agency for repair and overhaul of DC-3 aircraft and its military version (C-47), and Pratt and Whitney aircraft engines. The company performs a considerable amount of maintenance and overhaul work for the domestic airlines and repair work for the Indian Air Force.

J. Airfields[1] (C)

The air facilities system of India (including the Laccadive, Minicoy and Amindivi Islands, and Jammu and Kashmir) consists of 339 airfields, 260 sites, and four seaplane stations. Of the airfields, 86 are military, 20 are joint military-civil, 85 are civil, and 158 are state-owned, private, or abandoned facilities that could be used in emergencies.

Most of the military and or joint facilities are distributed across the northern part of the country near the border. The main clusters are in the states of Assam, West Bengal, and Bihar. The remaining air facilities are evenly distributed throughout the country. All major cities having adequate air facilities nearby.

The nation's international airfields and airports of entry are Bombay, Calcutta, Delhi, and Madras. All have runways 10,000 feet or longer and facilities that can support sustained operations of aircraft as large as the Boeing C-135. Ahmadabad, although not an international airfield, serves as an alternate to Bombay. It has a 7,500-foot runway and is capable of receiving up through C-130-type aircraft. Trivandrum, with a 6,000-foot runway, serves as an airport of entry from Sri Lanka (Ceylon) only. Details of 31 of the most important airfields are given in Figure 13.

The four seaplane stations can receive amphibious-type aircraft, but three of the four have either limited facilities or no facilities for refueling or maintenance. The exception is Cochin Naval Base, adjacent to and part of Cochin Naval Air Station. It has squadron capabilities for small-type amphibious aircraft.

In general, airfield maintenance for military and government-owned facilities is good. Maintenance at the state and privately owned airfields is fair to poor.

[1] For detailed information on air facilities in India, including the Laccadive, Minicoy and Andaman Islands and the disputed area of Jammu and Kashmir, see Volume 2A, AIRFIELDS AND SEAPLANE STATIONS OF THE WORLD, published by the Defense Mapping Agency Aerospace Center (DMAAC) for the Defense Intelligence Agency.

FIGURE 13. Selected airfields (C)

NAME AND LOCATION	CONCRETE RUNWAY: SURFACE, DIMENSIONS; ELEVATION ABOVE SEA LEVEL	FUEL[1]	TACTICAL AIRCRAFT NORMALLY SUPPORTED	REMARKS
	Feet	*Pounds*		
Adampur 31°26'N., 75°46'E.	Concrete 9,000 x 150 775	13,700	F-102	Military. Avgas, jet fuel, and organizational maintenance estimated to be available.
Agra 27°09'N., 77°58'E.	Concrete 8,000 x 150 551	36,807	B-57	Joint. A major IAF facility. Avgas, jet fuel, and field maintenance available.
Ahmedabad 23°01'N., 72°37'E.	Concrete 7,600 x 150 183	35,300	C-130	Civil. Avgas, jet fuel, and organizational maintenance available. Alternate for Bombay.
Allahabad 25°26'N., 81°44'E.	Concrete 8,000 x 150 322	35,800	do	Joint. Aviation fuel and organizational maintenance available. IAF Central Air Command Headquarters.
Ambala 30°22'N., 76°49'E.	Concrete 9,500 x 150 900	36,807	C-135	Joint. Avgas, jet fuel, and field maintenance available.
Awantipur 33°53'N., 74°58'E.	Asphalt 10,500 x 150 5,600	35,500	C-130	Military. Airfield being developed.
Bangalore 13°57'N., 77°40'E.	Asphalt 10,850 x 200 2,937	62,000	Boeing 707	Civil. Owned and operated by Hindustan Aviation, Ltd. (HAL). Organizational maintenance available.
Bombay 19°05'N., 72°53'E.	Concrete 11,005 x 150 35	52,000	do	Civil. International airport of entry. All types of fuel and depot maintenance available.
Calcutta 22°39'N., 88°27'E.	Concrete 10,500 x 150 16	63,130	do	*Do.*
Chandigarh 30°40'N., 76°47'E.	Asphalt 8,300 x 150 1,012	46,550	73A	Joint. Avgas, jet fuel and depot maintenance available.
Cochin NAS 9°57'N., 76°16'E.	Asphalt 5,400 x 150 5	35,500	C-130	Military. Aviation fuel and field maintenance available. Seaplane landing area adjacent to E. side of airfield.
Delhi 28°34'N., 77°07'E.	Asphalt 12,540 x 150 776	52,000	Boeing 707	Civil. International airport of entry. All types fuel and depot maintenance available.
Dundigal 17°38'N., 78°31'E.	Concrete 8,250 x 150 1,013	35,500	C-130	Military. Indian Air Force Academy. Aviation fuel and organizational maintenance available.
Gauhati 26°06'N., 91°35'E.	Concrete 9,000 x 150 158	35,500	do	Joint. Avgas, jet facilities, and limited maintenance.
Goa 15°23'N., 73°50'E.	Concrete 7,850 x 150 167	35,300	do	Military. Indian Naval Air Station. Avgas, jet fuel, and organizational maintenance available.
Gorakhpur 26°44'N., 83°27'E.	Concrete 9,060 x 150 18	35,500	B-57	Military. Avgas and jet fuel available.
Hakimpet 17°33'N., 78°31'E. N. of Secunderabad	Concrete 7,350 x 150 2,020	17,934	C-131	Military. Avgas, jet fuel, and field maintenance available.
Hindon 28°42'N., 77°23'E.	Concrete 9,000 x 150 700	35,100	C-130	Military. Airfield being developed.
Hyderabad 17°27'N., 78°28'E.	Concrete 9,000 x 150 1,741	22,484	C-123	Joint. Avgas, jet fuel, and organizational maintenance available.

Footnote at end of table.

FIGURE 13. Selected airfields (C) (Continued)

NAME AND LOCATION	LONGEST RUNWAY: SURFACE, DIMENSIONS; ELEVATION ABOVE SEA LEVEL	MSL*	LARGEST AIRCRAFT NORMALLY SUPPORTED	REMARKS
	Feet	*Pounds*		
Jammu	Concrete	28,160	C-5I	Joint. Aviation fuel and organizational maintenance.
32°41'N., 74°50'E.	5,534 x 150			
	1,029			
Jorhat	Concrete	24,500	C-130	Joint. Avgas and jet fuel available.
26°44'N., 94°11'E.	9,000 x 150			
	294			
Kalaikunda	Concrete	35,500	F-104	Military. All types of facilities available.
22°20'N., 87°13'E.	8,000 x 150			
	300			
Leh	Asphalt	35,500	C-130	Military. Aviation fuel available.
34°08'N., 77°33'E.	10,500 x 150			
	10,630			
Madras	Concrete	52,000	Boeing 707	Civil. International airport of entry. All types of fuel and organizational maintenance available.
13°00'N., 80°11'E.	10,050 x 150			
	48			
Nagpur	Concrete	37,410	C-130A	Joint. Avgas, jet fuel, and organizational maintenance available.
21°05'N., 79°03'E.	10,050 x 150			
	1,033			
Pathankot	Asphalt	33,500	C-130	Military. Avgas and jet fuel available. Being improved.
32°16'N., 75°39'E.	9,190 x 150			
	1,017			
Poona (Pune)	Concrete	35,500	do	Joint. All types of facilities available.
18°35'N., 73°55'E.	8,100 x 150			
	2,931			
Srinagar	Concrete	35,500	do	Joint. Avgas, jet fuel, and organizational maintenance available.
33°59'N., 74°47'E.	12,200 x 150			
	5,455			
Sulur	Concrete	17,034	C-141	Military. Avgas, jet fuel, and limited maintenance. Aircraft storage depot.
11°01'N., 77°10'E.	8,300 x 150			
	1,250			
Tezpur	Asphalt	35,500	C-130	Joint. Avgas, jet fuel, and organizational maintenance available.
26°43'N., 92°48'E.	8,100 x 150			
	210			
Trivandrum	Asphalt	35,500	L-382	Civil. Limited avgas, jet fuel, and maintenance. An airport of entry from Sri Lanka only.
8°29'N., 76°55'E.	6,000 x 170			
	14			

*Equivalent Single-Wheel Loading: Capacity of an airfield runway to sustain the weight of any multiple-wheel landing-gear aircraft in terms of the single-wheel equivalent.

The government has consistently maintained an air facilities expansion program and has better air facilities than any country in southeast Asia or Africa. Improvements and developments are planned but have had to be somewhat curtailed because of monetary problems.

K. Telecommunications (C)

India's domestic telecommunication (telecom) facilities provide only fair service within and between cities and are less reliable throughout the remainder of the country. Service is adversely affected by significant shortages of facilities, equipment, and skilled personnel. Telephone service formerly was available only to the larger urban areas, but projects are underway to connect some of the smaller towns and villages, many of which have only a telegraph connection. In late 1972, there were an estimated 1,350,000 telephones, or about 0.25 instruments per 100 inhabitants, as compared to about 1.8 instruments per 100 inhabitants for Asia as a whole. Telex and facsimile services, once available only between the larger urban areas, are also provided in less populated areas. International connections have been improved by installation of a communications satellite earth station.

The domestic system has four regional centers—Bombay, Calcutta, Madras, and New Delhi. Although reliance is placed on open-wire lines, mostly equipped with multichannel carrier equipment, the coaxial cable system which radiates from New Delhi to most urban centers to provide high-capacity connections is probably the most important part of the telecom network. Radio-relay links connect remote areas in the northeast and in Jammu and Kashmir with the intercity network. Radiocommunication facilities, also increasing, serve remote areas and supplement existing landlines and radio-relay links.

International connections via carrier-equipped open-wire lines, submarine cables, radiocommunication stations, and a communications satellite ground station provide relatively reliable telephone, telegraph, telex, and facsimile services. Radio circuits provide most of the international service and are interconnected with domestic networks via the four main regional centers. Submarine cables extend to Sri Lanka, Aden, and Malaysia, and open-wire lines reach Bangladesh, Nepal, and Pakistan. The Vikram (formerly Arvi) communication satellite earth station, located east of Bombay, began operations in February 1971. The facility is connected by radio relay to a modern communication center in Bombay. In May 1972, 52 circuits linked India, via the Indian Ocean (INTELSAT IV) satellite, to 15 countries. This station should satisfy a substantial portion of India's growing requirements for international radiocommunications. A second earth station, currently under construction at Hardwar, near Dehra Dun, is scheduled for operation in 1975 and will be connected by radio relay to a new traffic center in New Delhi.

About 270 short- and medium-wave AM radiobroadcast stations are operated in about 75 communities. Stations at the four regional centers are equipped with medium- and high-frequency transmitters as powerful as 1,000 kilowatts (kw.). Elsewhere, low-power medium-frequency transmitters predominate. However, the medium wave, superpower (1,000 kw.), broadcast transmitters are located only at Calcutta and Rajkot, and the two 250 kw. shortwave transmitters at Aligarh. In late 1972 there were about 13 million licensed radiobroadcast receivers. Headquarters for the national broadcast network is at New Delhi, which has one of the six international broadcast stations. Telecom improvements planned through 1974 indicate that 90% of India will be covered by medium-frequency broadcasts. In addition, commercial broadcasts will be increased on a regional basis.

New Delhi is the nucleus for television programing and broadcasts, and broadcast coverage has been increased to a 37-mile radius of this city. TV transmission also is planned for off-the-air pickup and rebroadcast at Amritsar to combat the increasing effectiveness of propaganda broadcasts transmitted into the Punjab area from the TV station located at Lahore, Pakistan. There are an estimated 40,000 TV sets. West German technicians have completed installation of a main TV studio and transmitter station at Worli, near Bombay, and a connecting radio-relay rebroadcast facility near Pune (formerly Poona). The 10-kw. Bombay TV transmitter, opened in October 1972, provides for a broadcast coverage of 28 miles. In late January 1973 a TV station was inaugurated in Srinagar. The current 5-year plan provides for installation of TV stations at Amritsar and Mussoorie, and subsequently at Calcutta, Lucknow, and Madras. Within 10 years, TV coverage is expected to be available to all Indian cities with populations of 100,000 or more. Closed-circuit TV, which is on the increase, is mostly used for educational purposes and serve about 250,000 students. Closed-circuit TV also is used commercially at the Delhi airport and is planned for others.

A special plan, Satellite Instruction Television Experiment (SITE), has been scheduled for FY1974/75 in cooperation with United States and international organizations. An experimental ATS-F communications satellite will be launched into geostationary orbit over India during 1973 to receive TV signals transmitted from the modified Ahmadabad communication satellite station. A number of specially designed TV receiver base stations will be deployed and utilized to receive and redistribute terrestrially the incoming satellite TV signals. TV receivers will be placed in 5,000 villages for community viewing.

Two major government organizations, the Department of Communications (DOC) and the Ministry of Information and Broadcasting (MIB), control, administer, and operate most of the telecom facilities. The DOC is responsible for providing public domestic telephone, telegraph, and postal services, and the MIB is solely responsible for providing radiobroadcast and TV services. The Ministry of Defense, the Ministry of Railways, the Ministry of Shipping and Transport, and the Ministry of Tourism and Civil Aviation have authority to operate special-telecom systems. No commercial or foreign organizations own telecom facilities.

India is a member of the International Telecommunication Union (ITU), the British Commonwealth Telecommunication Board, the International

Telecommunications Satellite Consortium (INTELSAT), the Asian Broadcasting Union, and is a partner in the Commonwealth Cable System. The government has bilateral telecom agreements with Bhutan and Nepal.

Educational facilities are not considered wholly adequate, and there is a shortage of telecom engineers and technicians. Government telecom organizations operate training centers on a national, regional, and state level. Fourteen educational institutions conduct courses in electronics, telecommunications, and engineering; seven others offer advanced courses. A communication satellite ground station at Ahmadabad, sponsored by the United Nations, is a center for research and training in the use of satellites for communications. The center is open for both foreign and indigenous students.

Climate, rugged terrain, and language differences complicate telecom operations. From June to September, monsoon rains cause floods that damage wire lines and hinder repair work. The Himalayas and other mountain ranges restrict development of telecom networks. The many different written languages hamper the operation of the telegraph service. The standardization of Hindi as the official language using Devanagari, the Sanskrit alphabet, is intended to ease this problem and is meeting with some success.

India does not have the production capability to meet all of its civilian and military telecom requirements. Domestic production is not adequate in quantity or sophistication and must be supplemented by imports. Although India produces a variety of wire and radio equipment for both civilian and military use, output often is dependent upon the use of imported components and parts. Principal sources of civil-related equipment and components are the European economic community, Japan, and the United States. Hong Kong, Hungary, Singapore, and Yugoslavia provide radio equipment and components only. Principal suppliers of military equipment have been Czechoslovakia, Switzerland, the United Kingdom, the United States, and, more recently, the U.S.S.R.

Places and Features referred to in this General Survey

	COORDINATES	
	° 'N.	° 'E.
Āgra	27 11	78 01
Āgra (*dist*)	27 05	77 58
Ahmadābād	23 02	72 37
Ahmednagar	19 05	74 44
Aijal	23 44	92 43
Ajanta	20 32	75 43
Ajmer	26 27	74 38
Aksai Chin (*region*)	35 05	79 30
Alibāg	18 39	72 54
Aligarh	27 53	78 05
Allāhābād	25 27	81 51
Ambāla	30 21	76 50
Amindivi Islands (*isls*)	11 23	72 23
Amritsar	31 35	74 53
Andaman Islands (*isls*)	12 30	92 45
Andhra Pradesh (*state*)	16 00	79 00
Ankleshwar	21 36	73 00
Arunachal Pradesh (*union territory*)	28 00	94 30
Arvi	18 22	73 49
Asansol	23 41	86 59
Assam (*state*)	26 00	93 00
Āvadi	13 07	80 07
Badagara	11 36	75 35
Bāghdogra	26 42	88 19
Bāndel (*rr sta*)	22 56	88 22
Bangalore	12 59	77 35
Baradahar	23 32	81 15
Barauni	25 41	78 23
Bareilly	28 21	79 25
Barhi	24 18	85 25
Bāruni	25 29	85 59
Batāla	31 48	75 12
Bay of Bengal (*bay*)	15 00	90 00
Begampet (*rr sta*)	17 28	78 28
Benares	25 20	83 00
Bhāgirathi River (*strm*)	23 25	88 23
Bhākra Dam (*hydro pwr site*)	31 25	76 28
Bharat	24 20	72 14
Bhilai	21 13	81 26
Bhopāl	23 16	77 24
Bhubaneswar	20 14	85 50
Bhusāval	21 03	75 46
Bidar	17 54	77 33
Bihār	25 11	85 31
Bihār (*state*)	25 00	86 00
Bhusāval	21 03	75 46
Bhutan, Kingdom of	27 30	90 30
Bokāro Coalfield (*coalfield*)	23 49	86 00
Bokāro Nadī (*strm*)	23 46	85 55
Bombay	18 58	72 50
Brahmaputra (*strm*)	24 02	90 59
Buckingham Canal	15 39	80 13
Budge Budge	22 27	88 10
Cāchār (*dist*)	25 05	92 55
Calcutta	22 32	88 22
Cape Comorin (*cape*)	8 04	77 34
Car Nicobar (*isl*)	9 10	92 47
Chābua (*rr sta*)	27 29	95 11
Cha-hsi-kang, China	32 32	79 41
Chālna, Bangladesh	22 36	89 31
Chandausi	28 27	78 46
Chandigarh (*rr sta*)	30 44	76 55
Chandigarh (*union territory*)	30 45	76 48
Chandrapura (*rr sta*)	23 46	86 07
Cherrapunji	25 18	91 42
Chhānga Mānga, Pakistan	31 05	73 58
Chittagong, Bangladesh	22 20	91 50
Chittaranjan	23 52	86 52
Ch'u-mu-pi Shan-ku, China (*valley*)	27 39	87 03
Chushul	33 36	78 39
Chutupālu	23 34	85 32
Cochin	9 58	76 14
Cochin (*former native state*)	10 25	76 30
Coimbatore	11 00	76 58
Colāba (*section of Bombay*)	18 55	72 49
Colombo, Sri Lanka	6 56	79 51
Haryana (*state*)	29 00	76 00
Himachal Pradesh (*union territory*)	31 00	78 00
Himalayas (*mts*)	28 00	84 00
Hindan (*strm*)	28 27	77 28
Hindu Kush (*mts*)	35 00	71 00
Hooghly River (*strm*)	21 55	88 05
Hyderābād	17 23	78 28
Hyderābād (*state*)	18 00	78 00
Imphāl	24 49	93 57
Indo-Gangetic Plain (*plain*)	27 00	80 00
Indraprast	28 29	77 18
Indus River (*strm*)	24 20	67 47
Indus Valley (*valley*)	29 00	71 00
Islāmābād, Pakistan	33 42	73 10
Izatnagar	28 23	79 25
Jabalpur	23 10	79 57
Jaduguda (*ore mill*)	22 39	85 20
Jaipur	26 55	75 49
Jaisalmer	26 55	70 54
Jālahalli	13 02	77 33
Jamālpur	25 18	86 30
Jammu	32 44	74 52
Jammu and Kashmir (*state*)	33 00	77 00
Jāmnagar	22 28	70 04
Jamshedpur	22 48	86 11
Jessore, Bangladesh	23 10	89 13
Jodhpur	26 17	73 02
Jogighopa	26 14	90 35
Jorhāt	26 45	94 13
Jullundur	31 19	75 34
Kābul, Afghanistan	34 31	69 12
Kākināda	16 56	82 13
Kalol	23 15	72 29
Kālpākkam	12 34	80 10
Kandla	23 02	70 13
Kandla Creek (*strm*)	22 58	70 15
Kānpur	20 25	85 10
Kānpur	26 28	80 21
Karāchi, Pakistan	24 52	67 03
Kāraikkudi	10 04	78 47
Karakoram Range (*mts*)	34 00	78 00
Kārikāl	10 55	79 50
Karnataka (*region*)	16 00	75 00
Kasauli	30 55	76 57
Katarbaga	21 38	84 07
Kāthiāwār (*peninsula*)	21 58	70 30
Kathmandu, Nepal	27 43	85 19
Kerala (*state*)	10 00	76 15
Khadki	18 34	73 52
Khambhāt (Cambay)	22 18	72 37
Kharagpur	22 20	87 20
Kharakvasla	18 26	73 46
Khāsi Hills (*mts*)	25 35	91 38
Khulna, Bangladesh	22 48	89 33
Kirkee (see Khadki)	18 34	73 52
Kodaikānal	10 14	77 29
Kohima	25 40	94 07
Koraput	18 49	82 43
Korba	22 21	82 41
Kota	25 11	75 50
Kottagūdem	18 04	80 28
Kottayam	9 35	76 31
Koyali	22 22	73 07
Koyna (*strm*)	17 18	74 10
Kozhikode (Calicut)	11 15	75 76
Krishna (*strm*)	15 57	80 59
Laccadive Islands (*isls*)	11 00	72 00
Ladākh (*dist*)	34 20	77 25
Lahore, Pakistan	31 35	74 18
Leh	31 10	77 35
Lhasa, China	29 39	91 06
Lonāvale	18 45	73 25
Longju	28 38	93 33
Lucknow	26 51	80 55
Ludhiāna	30 54	75 51
Lungleh	22 53	92 44
Nicobar Islands (*isls*)		
Orissa (*state*)		
Ootacamund		
Pachmarhi		
Paudi		
Parādip		
Parādip Garh (*port*)		
Pathānkot		
Patna		
Patna		
Pechi		
Perambur (*rr sta*)		
Pondicherry (*union territory*)		
Port Blair		
Powāi		
Punākha, Bhutan		
Pune (Poona)		
Punjab (*state*)		
Puri		
Quilon		
Rājasthān (*state*)		
Rājkot		
Rājmahāl Hills (*hills*)		
Rana Pratap Sagar Dam (*dam*)		
Rana Pratap Sagar (*powerplant*)		
Rānchi		
Rangāpuram		
Rānippettai		
Rann of Kutch (*marsh*)		
Raurkela		
Rāwalpindi, Pakistan		
Rihand (*strm*)		
Roorkee		
Sabarigiri (*hydro pwr site*)		
Sābarmati (*rr sta*)		
Sāgar		
Sāha		
Sāmbre		
Sānchi, Bhutan		
Sankosh (*strm*)		
Secunderābād		
Sharavati (*strm*)		
Shillong		
Shipki La (*pass*)		
Shirāla		
Sholapur		
Shwebo, Burma		
Sikkim (*protectorate*)		
Silchar		
Siliguri		
Simla		
Sindi		
Singarsi Peak (*peak*)		
Sriharikota Island (*isl*)		
Srinagar		
Sylhet, Bangladesh		
Tālcher		
Tambaram		
Tamil Nādu (*state*) (formerly		
Tārāpur		
Tawang		
Telengana (*area*)		
Thar Desert, Pakistan (*desert*)		
Thumba (*rocket launching stati*		
Tinsukia		
Tripura (*state*)		
Trivandrum		
Trombay		
Tuticorin		
Udhampur		
United Khasi-Jaintia Hills (*di*		
Utrān (*rr sta*)		
Uttar Pradesh (*state*)		
Vadodara (Baroda)		
Vishākhapatnam		
Waltair		

to in this General Survey

	COORDINATES	
	° 'N.	° 'E.
.....	27 11	78 01
.....	27 05	77 58
.....	23 02	72 37
.....	19 05	74 44
.....	23 44	92 43
.....	20 32	75 43
.....	26 27	74 38
.....	35 05	79 30
.....	18 39	72 54
.....	27 53	78 05
.....	25 27	81 51
.....	30 21	76 50
.....	11 23	72 23
.....	31 35	74 53
.....	12 30	92 45
.....	16 00	79 00
.....	21 36	73 00
ory)	28 00	94 30
.....	18 22	73 49
.....	23 41	86 59
.....	26 00	93 00
.....	13 07	80 07
.....	11 36	75 35
.....	26 42	88 19
.....	22 56	88 22
.....	12 59	77 35
.....	23 32	81 15
.....	25 41	78 23
.....	28 21	79 25
.....	24 18	85 25
.....	25 29	85 59
.....	31 48	75 12
.....	15 00	90 00
.....	17 28	78 28
.....	25 20	93 00
.....	23 25	88 23
.....	31 25	76 28
.....	24 20	72 14
.....	21 13	81 26
.....	23 16	77 24
.....	20 14	85 50
.....	21 03	75 46
.....	17 54	77 33
.....	25 11	85 31
.....	25 00	86 00
.....	21 03	75 46
.....	27 30	90 30
.....	23 49	86 00
.....	23 46	85 55
.....	18 58	72 50
.....	24 02	90 59
.....	15 39	80 13
.....	22 27	88 10
.....	25 05	92 55
.....	22 32	88 22
.....	8 04	77 34
.....	9 10	92 47
.....	27 29	95 11
.....	32 32	79 41
.....	22 36	89 31
.....	28 27	78 46
.....	30 44	76 55
.....	30 45	76 48
.....	23 46	86 07
.....	25 18	91 42
.....	31 05	73 58
.....	22 20	91 50
.....	23 52	86 52
alley)	27 39	87 03
.....	33 36	78 39
.....	23 34	85 32
.....	9 58	76 14
.....	10 25	76 30
.....	11 00	76 58
.....	18 55	72 49
.....	6 56	79 51

	COORDINATES	
	° 'N.	° 'E.
Haryana (*state*)	29 00	76 00
Himachal Pradesh (*union territory*)	31 00	78 00
Himalayas (*mts*)	28 00	84 00
Hindan (*strm*)	28 27	77 28
Hindu Kush (*mts*)	35 00	71 00
Hooghly River (*strm*)	21 55	88 05
Hyderābād	17 23	78 28
Hyderābād (*state*)	18 00	78 00
Imphāl	24 49	93 57
Indo-Gangetic Plain (*plain*)	27 00	80 00
Indraprast	28 29	77 18
Indus River (*strm*)	24 20	67 47
Indus Valley (*valley*)	29 00	71 00
Islāmābād, Pakistan	33 42	73 10
Izatnagar	28 23	79 25
Jabalpur	23 10	79 57
Jaduguda (*ore mill*)	22 39	85 20
Jaipur	26 55	75 49
Jaisalmer	26 55	70 54
Jālahalli	13 02	77 33
Jamālpur	25 18	86 30
Jammu	32 44	74 52
Jammu and Kashmir (*state*)	33 00	77 00
Jāmnagar	22 28	70 04
Jamshedpur	22 48	86 11
Jessore, Bangladesh	23 10	89 13
Jodhpur	26 17	73 02
Jogighopa	26 14	90 35
Jorhāt	26 45	94 13
Jullundur	31 19	75 34
Kābul, Afghanistan	34 31	69 12
Kākināda	16 56	82 13
Kalol	23 15	72 29
Kālpākkam	12 34	80 10
Kandla	23 02	70 13
Kandla Creek (*strm*)	22 58	70 15
Kānpur	20 25	85 10
Kānpur	26 28	80 21
Karāchi, Pakistan	24 52	67 03
Kāraikkudi	10 04	78 47
Karakoram Range (*mts*)	34 00	78 00
Kārikāl	10 55	79 50
Karnataka (*region*)	16 00	75 00
Kasauli	30 55	76 57
Katarbaga	21 38	84 07
Kāthiāwār (*peninsula*)	21 58	70 30
Kathmandu, Nepal	27 43	85 19
Kerala (*state*)	10 00	76 15
Khadki	18 34	73 52
Khambhāt (Cambay)	22 18	72 37
Kharagpur	22 20	87 20
Kharakvasla	18 26	73 46
Khāsi Hills (*mts*)	25 35	91 38
Khulna, Bangladesh	22 48	89 33
Kirkee (see Khadki)	18 34	73 52
Kodaikānal	10 14	77 29
Kohima	25 40	94 07
Koraput	18 49	82 43
Korba	22 21	82 41
Kota	25 11	75 50
Kottagūdem	18 04	80 28
Kottayam	9 35	76 31
Koyali	22 22	73 07
Koyna (*strm*)	17 18	74 10
Kozhikode (Calicut)	11 15	75 76
Krishna (*strm*)	15 57	80 59
Laccadive Islands (*isls*)	11 00	72 00
Ladākh (*dist*)	34 20	77 25
Lahore, Pakistan	31 35	74 18
Leh	34 10	77 35
Lhasa, China	29 39	91 06
Lonāvale	18 45	73 25
Longju	28 38	93 33
Lucknow	26 51	80 55
Ludhiāna	30 54	75 51
Lunglch	22 53	92 44

	COORDINATES	
	° 'N.	° 'E.
Nicobar Islands (*isls*)	8 00	93 30
Orissa (*state*)	21 00	84 00
Ootacamund	11 24	76 42
Pachmarhi	22 28	78 26
Pandu	26 10	91 40
Parādip	20 17	86 42
Parādip Garh (*port*)	20 19	86 37
Pathānkot	32 17	75 39
Patna	21 38	85 53
Patna	25 37	85 09
Pechi	24 08	77 00
Perambur (*rr sta*)	13 06	80 14
Pondicherry (*union territory*)	11 56	79 49
Port Blair	11 40	92 45
Powāi	27 21	95 39
Punākha, Bhutan	27 37	89 52
Pune (Poona)	18 32	73 52
Punjab (*state*)	31 00	76 00
Puri	18 40	73 55
Quilon	8 53	76 36
Rājasthān (*state*)	26 00	74 00
Rājkot	22 18	70 47
Rājmahāl Hills (*hills*)	24 40	87 25
Rana Pratap Sagar Dam (*dam*)	24 56	75 38
Rana Pratap Sagar (*powerplant*)	24 57	75 38
Rānchi	23 21	85 20
Rangāpuram	15 25	78 06
Rānippettai	12 56	79 20
Rann of Kutch (*marsh*)	24 05	70 10
Raurkela	22 12	84 53
Rāwalpindi, Pakistan	33 36	73 04
Rihand (*strm*)	24 33	82 59
Roorkee	29 52	77 53
Sabarigiri (*hydro pwr site*)	9 21	77 08
Sābarmati (*rr sta*)	23 05	72 40
Sāgar	23 50	78 43
Sāha	30 19	76 59
Sāmbre	15 52	74 37
Sānchi, Bhutan	27 18	90 37
Sankosh (*strm*)	26 23	89 48
Secunderābād	17 27	78 30
Sharavati (*strm*)	14 16	74 25
Shillong	25 34	91 53
Shipki La (*pass*)	31 49	78 45
Shirāla	16 59	74 08
Sholapur	17 41	75 55
Shwebo, Burma	22 34	95 42
Sikkim (*protectorate*)	27 45	88 30
Silchar	24 49	92 48
Sillguri	26 42	88 26
Simla	31 06	77 10
Sindi	20 48	78 52
Singarsi Peak (*peak*)	24 38	87 28
Sriharikota Island (*isl*)	13 45	80 10
Srinagar	34 05	74 49
Sylhet, Bangladesh	24 54	91 52
Tālcher	20 57	85 13
Tambaram	12 55	80 07
Tamil Nādu (*state*) (formerly Madras)	11 00	78 00
Tārāpur	19 51	72 42
Tawang	27 35	91 52
Telengana (*area*)	18 00	79 30
Thar Desert, Pakistan (*desert*)	27 00	71 00
Thumba (*rocket launching station*)	8 32	76 51
Tinsukia	27 30	95 22
Tripura (*state*)	24 00	92 00
Trivandrum	8 29	76 55
Trombay	19 02	72 56
Tuticorin	8 47	78 08
Udhampur	32 56	75 08
United Khasi-Jaintia Hills (*dist*)	25 30	92 00
Utrān (*rr sta*)	21 15	72 52
Uttar Pradesh (*state*)	28 00	80 00
Vadodara (Baroda)	22 18	73 12
Vishākhapatnam	17 42	83 18
Waltair	17 43	83 20

Bhākra Dam (*hydro pwr site*)	31 25	76 28
Bharat	24 20	72 14
Bhilai	21 13	81 26
Bhopāl	23 16	77 24
Bhubaneswar	20 14	85 50
Bhusāval	21 03	75 46
Bidar	17 54	77 33
Bihār	25 11	85 31
Bihār (*state*)	25 00	86 00
Bhusāval	21 03	75 46
Bhutan, Kingdom of	27 30	90 30
Bokāro Coalfield (*coalfield*)	23 49	86 00
Bokāro Nadī (*strm*)	23 46	85 55
Bombay	18 58	72 50
Brahmaputra (*strm*)	24 02	90 59
Buckingham Canal	15 39	80 13
Budge Budge	22 27	88 10
Cāchār (*dist*)	25 05	92 55
Calcutta	22 32	88 22
Cape Comorin (*cape*)	8 04	77 34
Car Nicobar (*isl*)	9 10	92 47
Chābua (*rr sta*)	27 29	95 11
Cha-hsi-kang, China	32 32	79 41
Chālna, Bangladesh	22 36	89 31
Chandausi	28 27	78 46
Chandigarh (*rr sta*)	30 44	76 55
Chandigarh (*union territory*)	30 45	76 48
Chandrapura (*rr sta*)	23 46	86 07
Cherrapunji	25 18	91 42
Chhānga Mānga, Pakistan	31 05	73 58
Chittagong, Bangladesh	22 20	91 50
Chittaranjan	23 52	86 52
Ch'u-mu-pi Shan-ku, China (*valley*)	27 39	87 03
Chushul	33 36	78 39
Chutupālu	23 34	85 32
Cochin	9 58	76 14
Cochin (*former native state*)	10 25	76 30
Coimbatore	11 00	76 58
Colāba (*section of Bombay*)	18 55	72 49
Colombo, Sri Lanka	6 56	79 51
Cossipore (*rr sta*)	22 38	88 22
Cox's Bāzār, Bangladesh	21 26	91 59
Cuttack	20 30	85 50
Dabolim	15 24	73 52
Dacca, Bangladesh	23 43	90 25
Damān (*dist*)	20 25	72 53
Deccan (*plateau*)	14 00	77 00
Dehra Dūn	30 19	78 02
Delhi	28 40	77 13
Delhi (*union territory*)	28 45	77 15
Deolali	19 28	74 37
Dhuwaran	22 14	72 48
Dibrugarh	27 29	94 54
Digboi	27 23	95 38
Dighwāra	25 44	85 00
Disāngmukh	27 04	94 33
Diu (*dist*)	20 42	70 55
Durgāpur	20 00	79 18
Durgāpur	25 32	88 08
Durgāpur	23 39	87 19
Eastern Ghats (*mts*)	14 00	78 50
Faizābād	26 47	82 08
Farakka	24 49	87 54
Ganges River (*strm*)	23 22	90 32
Gangetic Plain (*plain*)	26 00	84 00
Gangtok	27 20	88 37
Gāro Hills (*dist*)	25 30	90 30
Gāro Hills (*mts*)	25 30	90 20
Gauhāti	26 11	91 44
Ghātsila	22 36	86 29
Goa (*dist*)	15 35	74 00
Godāvari (*strm*)	17 00	81 45
Gorakhpur	26 45	83 22
Great Indian Desert (*desert*)	27 00	71 00
Gujarāt (*state*)	23 00	72 00
Gulf of Kutch (*gulf*)	22 36	69 30
Gulf of Khambhāt (*gulf*)	21 00	72 30
Gulmarg	34 03	74 23
Guntūr	16 18	80 27
Hakimpet	17 33	78 31
Haldia	22 01	88 04
Halwāra	30 43	75 39
Hardwār	29 58	78 10
Kānpur	20 25	85 10
Kānpur	26 28	80 21
Karāchi, Pakistan	24 52	67 03
Kāraikkudi	10 04	78 47
Karakoram Range (*mts*)	34 00	78 00
Kārikāl	10 55	79 50
Karnataka (*region*)	16 00	75 00
Kasauli	30 55	76 57
Katarbaga	21 38	84 07
Kāthiāwār (*peninsula*)	21 58	70 30
Kathmandu, Nepal	27 43	85 19
Kerala (*state*)	10 00	76 15
Khadki	18 34	73 52
Khambhāt (Cambay)	22 18	72 37
Kharagpur	22 20	87 20
Kharakvasla	18 26	73 46
Khāsi Hills (*mts*)	25 35	91 38
Khulna, Bangladesh	22 48	89 33
Kirkee (see Khadki)	18 34	73 52
Kodaikānal	10 14	77 29
Kohima	25 40	94 07
Koraput	18 49	82 43
Korba	22 21	82 41
Kota	25 11	75 50
Kottagūdem	18 04	80 28
Kottayam	9 35	76 31
Koyali	22 22	73 07
Koyna (*strm*)	17 18	74 10
Kozhikode (Calicut)	11 15	75 76
Krishna (*strm*)	15 57	80 59
Laccadive Islands (*isls*)	11 00	72 00
Ladākh (*dist*)	34 20	77 25
Lahore, Pakistan	31 35	74 18
Leh	34 10	77 35
Lhasa, China	29 39	91 06
Lonāvale	18 45	73 25
Longju	28 38	93 33
Lucknow	26 51	80 55
Ludhiāna	30 54	75 51
Lungleh	22 53	92 44
Madhya Pradesh (*state*)	22 00	79 00
Madras	13 05	80 17
Madurai	9 56	78 07
Mahānadi (*strm*)	20 19	86 45
Mahārāshtra (*state*)	19 30	75 00
Mahe	11 42	75 32
Malabar (*dist*)	11 15	76 00
Malwa Plateau (*plateau*)	24 00	76 00
Mangalore	12 52	74 53
Mangla, Pakistan	33 07	73 39
Manipur (*state*)	25 00	94 00
Marmagao	15 25	73 48
Mathura	27 30	77 41
Meghalaya (*state*)	25 30	91 20
Meerut	28 59	77 42
Mettūr Tunnel (*hydro pwr site*)	11 48	77 48
Mhow	22 33	75 46
Mikir and North Cāchār Hills, United District of	25 30	93 00
Mikir Hills (*hills*)	26 10	93 30
Minicoy Island (*isl*)	8 17	73 02
Mizo Hills (*hills*)	23 10	92 50
Mizoram (*union territory*)	23 00	93 00
Morān	27 11	94 56
Mukteswar	29 29	79 39
Mukuria	25 37	87 53
Mussoorie	30 27	78 05
Mysore	12 18	76 39
Mysore (*state*)	13 30	76 00
Nāga Hills (*mts*)	26 00	95 00
Nāgāland (*state*)	26 00	94 15
Nagpur	21 09	79 06
Nāgpur (*dist*)	21 07	79 05
Nahorkatiya	27 17	95 20
Nāmrup	27 11	95 20
Naini Tāl	29 23	79 27
Naini Tāl (*dist*)	29 12	79 25
Naksalbāri	26 41	88 13
Nāngal	27 22	76 13
Nāsik	19 59	73 48
Nathu La (*pass*)	27 24	88 49
New Delhi	28 36	77 12
Neyveli	11 32	79 29
Sāha		
Sāmbre		
Sānchi, Bhutan		
Sankosh (*strm*)		
Secunderābād		
Sharavati (*strm*)		
Shillong		
Shipki La (*pass*)		
Shirāla		
Sholapur		
Shwebo Burma		
Sikkim (*protectorate*)		
Silchar		
Siliguri		
Simla		
Sindi		
Singarsi Peak (*peak*)		
Sriharikota Island (*isl*)		
Srinagar		
Sylhet, Bangladesh		
Tālcher		
Tambaram		
Tamil Nādu (*state*) (formerly M		
Tārāpur		
Tawang		
Telengana (*area*)		
Thar Desert, Pakistan (*desert*)		
Thumba (*rocket launching statio*		
Tinsukia		
Tripura (*state*)		
Trivandrum		
Trombay		
Tuticorin		
Udhampur		
United Khasi-Jaintia Hills (*dist*		
Utrān (*rr sta*)		
Uttar Pradesh (*state*)		
Vadodara (Baroda)		
Vishākhapatnam		
Waltair		
Wellington		
West Bengal (*state*)		
West Coast Canal (*canal*)		
Western Ghats (*mts*)		
Worli (*section of Bombay*)		
Yamuna (*strm*)		
Yanam		
Yelahanka		

AIRFI

Adampur	
Agra	
Ahmadabad	
Allahabad	
Ambala	
Awantipur	
Bangalore	
Bombay	
Calcutta	
Chandigarh	
Cochin NAS	
Delhi	
Dundigal	
Gauhati	
Goa	
Gorakhpur	
Hakimpet	
Hindan	
Hyderabad	
Jammu	
Jorhat	
Kalaikunda	
Leh	
Madras	
Nagpur	
Pathankot	
Poona	
Srinagar	
Sulur	
Tezpur	
Trivandrum	

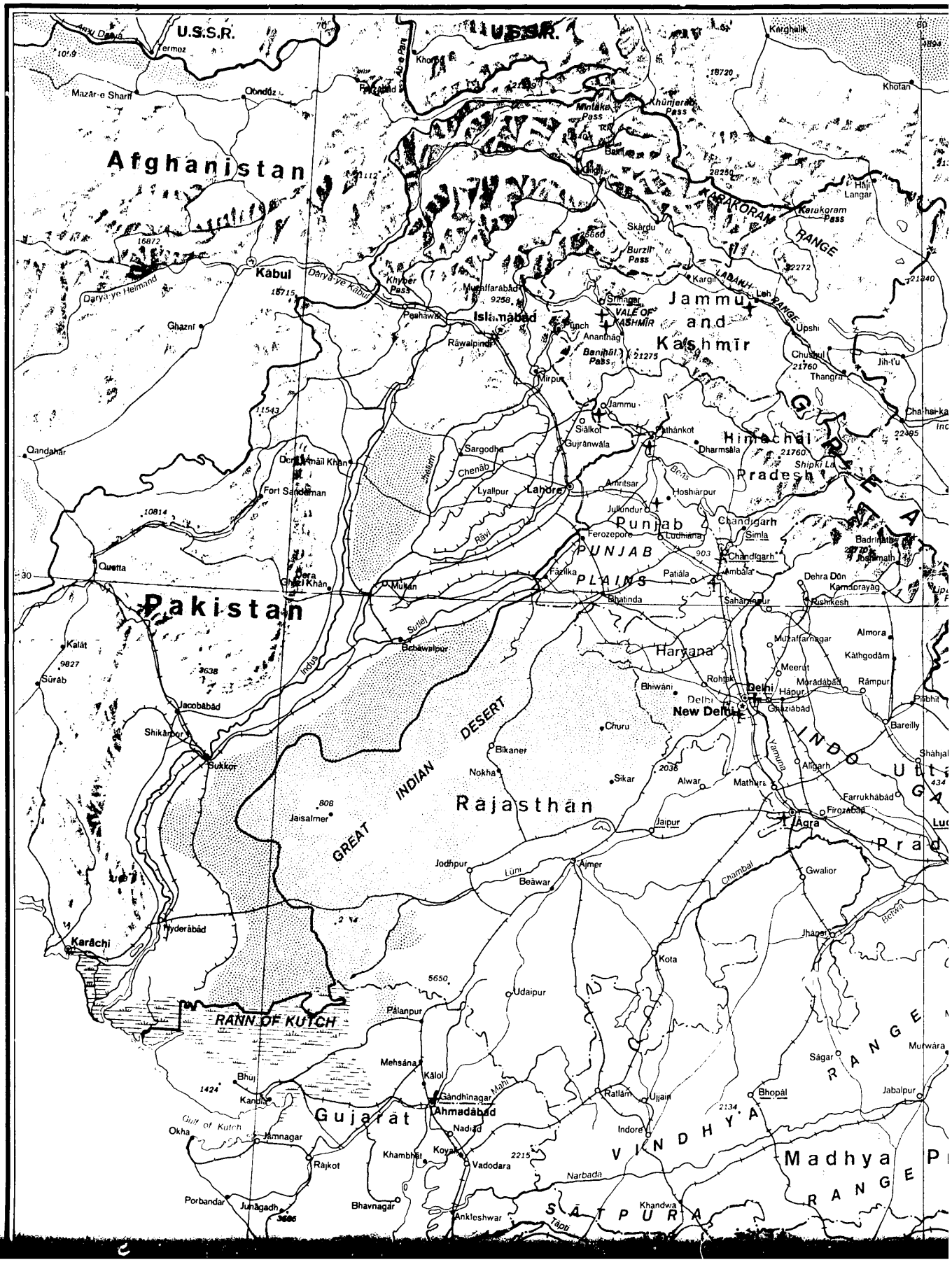
18	81	26
16	77	24
14	85	50
03	75	46
54	77	33
11	85	31
00	86	00
03	75	46
30	90	30
49	86	00
46	85	55
58	72	50
02	90	59
39	80	13
27	88	10
05	92	55
32	88	22
04	77	34
10	92	47
29	95	11
32	79	41
36	89	31
27	78	46
44	76	55
45	76	48
46	86	07
18	91	42
05	73	58
20	91	50
52	86	52
39	87	03
36	78	39
34	85	32
58	76	14
25	76	30
00	76	58
55	72	49
56	79	51
38	88	22
26	91	59
30	85	50
24	73	52
43	90	25
25	72	53
00	77	00
19	78	02
40	77	13
45	77	15
28	74	37
14	72	48
29	94	54
23	95	38
44	85	00
04	94	33
42	70	55
00	79	18
32	88	08
39	87	19
00	78	50
47	82	08
49	87	54
22	90	32
00	84	00
20	88	37
30	90	30
30	90	20
11	91	44
36	86	29
35	74	00
00	81	45
45	83	22
00	71	00
00	72	00
36	69	30
00	72	30
03	74	23
18	80	27
33	78	31
01	88	04
43	75	39
58	78	10

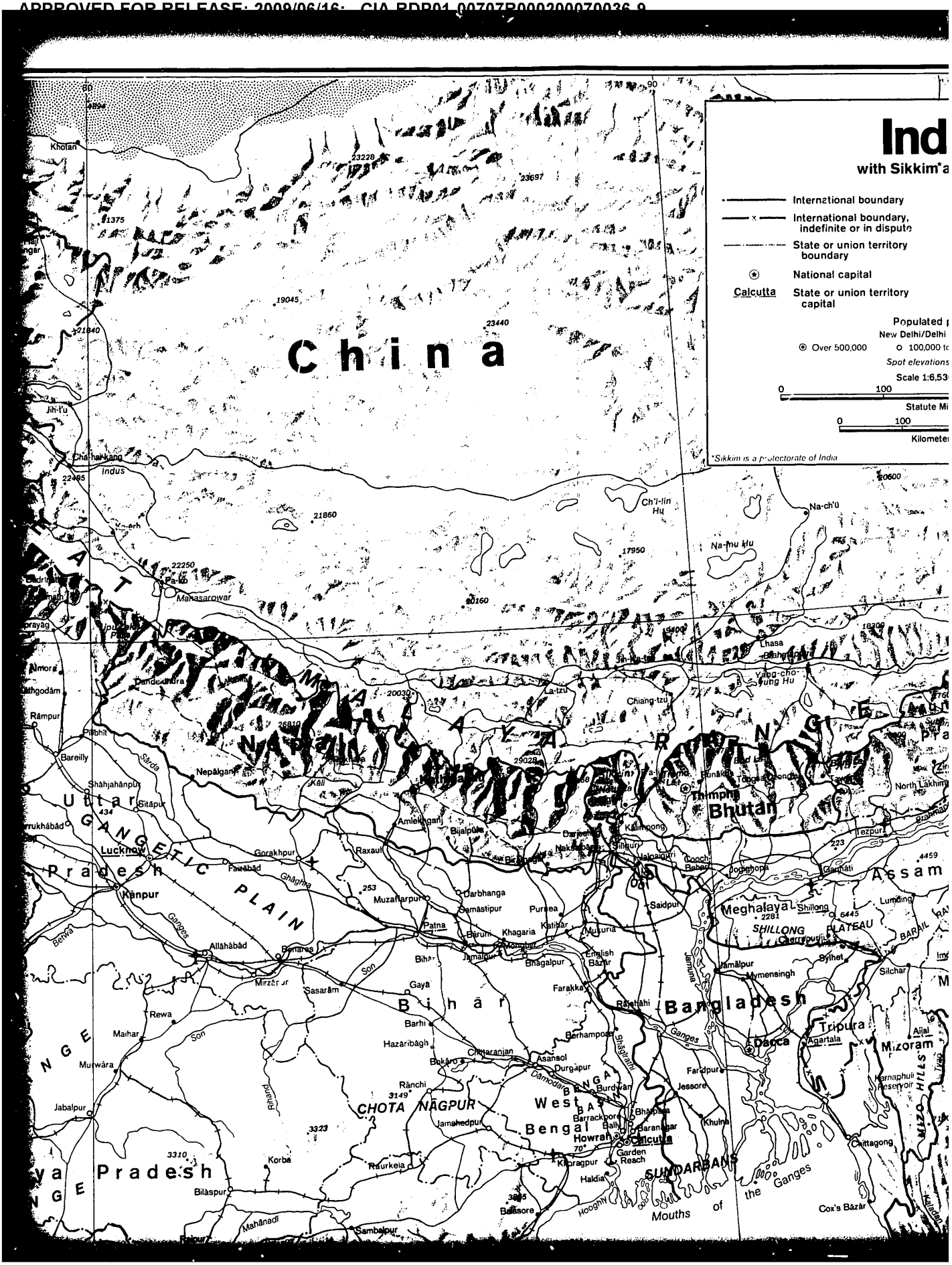
Karāchi, Pakistan	24 52	67 03
Kāraikkudi	10 04	78 47
Karakoram Range (*mts*)	34 00	78 00
Kārikāl	10 55	79 50
Karnataka (*region*)	16 00	75 00
Kasauli	30 55	76 57
Katarbaga	21 58	84 07
Kāthiāwār (*peninsula*)	21 58	70 30
Kathmandu, Nepal	27 43	85 19
Kerala (*state*)	10 00	76 15
Khadki	18 34	73 52
Khambhāt (Cambay)	22 18	72 37
Kharagpur	22 20	87 20
Kharakvasla	18 26	73 46
Khāsi Hills (*mts*)	25 35	91 38
Khulna, Bangladesh	22 48	89 33
Kirkee (see Khadki)	18 34	73 52
Kodaikānal	10 14	77 29
Kohima	25 40	94 07
Koraput	18 49	82 43
Korba	22 21	82 41
Kota	25 11	75 50
Kottagūdem	18 04	80 28
Kottayam	9 35	76 31
Koyali	22 22	73 07
Koyna (*strm*)	17 18	74 10
Kozhikode (Calicut)	11 15	75 76
Krishna (*strm*)	15 57	80 59
Laccadive Islands (*isls*)	11 00	72 00
Ladākh (*dist*)	34 20	77 25
Lahore, Pakistan	31 35	74 18
Leh	34 10	77 35
Lhasa, China	29 39	91 06
Lonāvale	18 45	73 25
Longju	28 38	93 33
Lucknow	26 51	80 55
Ludhiāna	30 54	75 51
Lungleh	22 53	92 44
Madhya Pradesh (*state*)	22 00	79 00
Madras	13 05	80 17
Madurai	9 56	78 07
Mahānadi (*strm*)	20 19	86 45
Mahārāshtra (*state*)	19 30	75 00
Mahe	11 42	75 32
Malabar (*dist*)	11 15	76 00
Malwa Plateau (*plateau*)	24 00	76 00
Mangalore	12 52	74 53
Mangla, Pakistan	33 07	73 39
Manipur (*state*)	25 00	94 00
Marmagao	15 25	73 48
Mathura	27 30	77 41
Meghalaya (*state*)	25 30	91 20
Meerut	28 59	77 42
Mettūr Tunnel (*hydro pwr site*)	11 48	77 48
Mhow	22 33	75 46
Mikir and North Cāchār Hills, United District of	25 30	93 00
Mikir Hills (*hills*)	26 10	93 30
Minicoy Island (*isl*)	8 17	73 02
Mizo Hills (*hills*)	23 10	92 50
Mizoram (*union territory*)	23 00	93 00
Morān	27 11	94 56
Mukteswar	29 29	79 39
Mukuria	25 37	87 53
Mussoorie	30 27	78 05
Mysore	12 18	76 39
Mysore (*state*)	13 30	76 00
Nāga Hills (*mts*)	26 00	95 00
Nāgāland (*state*)	26 00	94 15
Nagpur	21 09	79 06
Nāgpur (*dist*)	21 07	79 05
Nahorkatiya	27 17	95 20
Nāmrup	27 11	95 20
Naini Tāl	29 23	79 27
Naini Tāl (*dist*)	29 12	79 25
Naksalbāri	26 41	88 13
Nāngal	27 22	76 13
Nāsik	19 59	73 48
Natu La (*pass*)	27 24	88 49
New Delhi	28 36	77 12
Neyveli	11 32	79 29

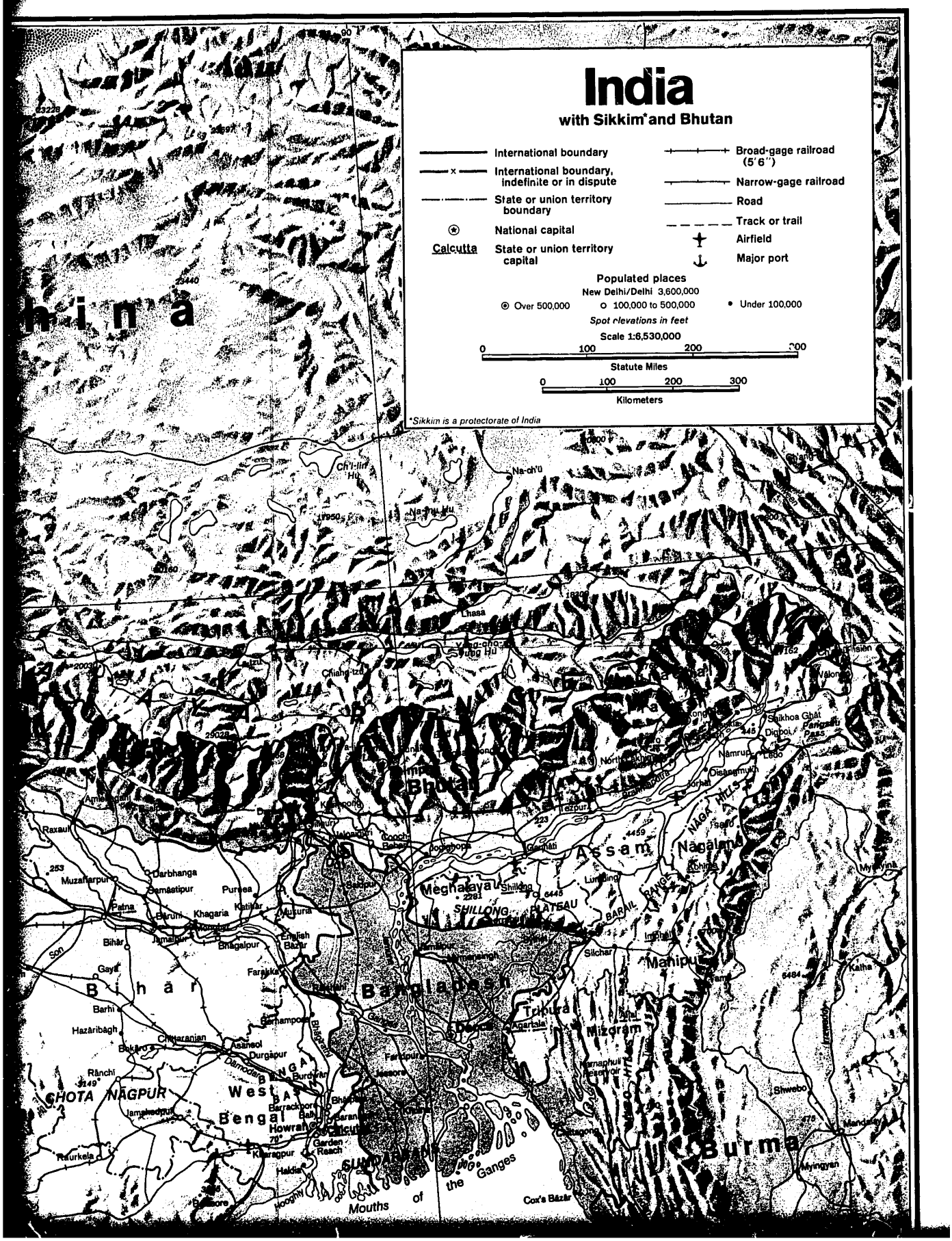
Sāncni, Bhutan	27 18	90 37
Sankosh (*strm*)	26 23	89 48
Secunderābād	17 27	78 30
Sharavati (*strm*)	14 16	74 25
Shillong	25 34	91 53
Shipki La (*pass*)	31 49	78 45
Shirāla	16 59	74 08
Sholapur	17 41	75 55
Shwebo, Burma	22 34	95 42
Sikkim (*protectorate*)	27 45	88 30
Silchar	24 49	92 48
Siliguri	26 42	88 26
Simla	31 06	77 10
Sindi	20 48	78 52
Singarsi Peak (*peak*)	24 38	87 28
Sriharikota Island (*isl*)	13 45	80 10
Srinagar	34 05	74 49
Sylhet, Bangladesh	24 54	91 52
Tālcher	20 57	85 13
Tambaram	12 55	80 07
Tamil Nādu (*state*) (formerly Madras)	11 00	78 00
Tārāpur	19 51	72 42
Tawang	27 35	91 52
Telengana (*area*)	18 00	79 30
Thar Desert, Pakistan (*desert*)	27 00	71 00
Thumba (*rocket launching station*)	8 32	76 51
Tinsukia	27 30	95 22
Tripura (*state*)	24 00	92 00
Trivandrum	8 29	76 55
Trombay	19 02	72 56
Tuticorin	8 47	78 08
Udhampur	32 56	75 08
United Khasi-Jaintia Hills (*dist*)	25 30	92 00
Utrān (*rr sta*)	21 15	72 52
Uttar Pradesh (*state*)	28 00	80 00
Vadodara (Baroda)	22 18	73 12
Vishākhapatnam	17 42	83 18
Waltair	17 43	83 20
Wellington	11 22	76 48
West Bengal (*state*)	24 00	88 00
West Coast Canal (*canal*)	10 30	76 00
Western Ghats (*mts*)	14 00	75 00
Worli (*section of Bombay*)	19 01	72 49
Yamuna (*strm*)	25 30	81 53
Yanam	16 44	82 13
Yelahanka	13 06	77 36

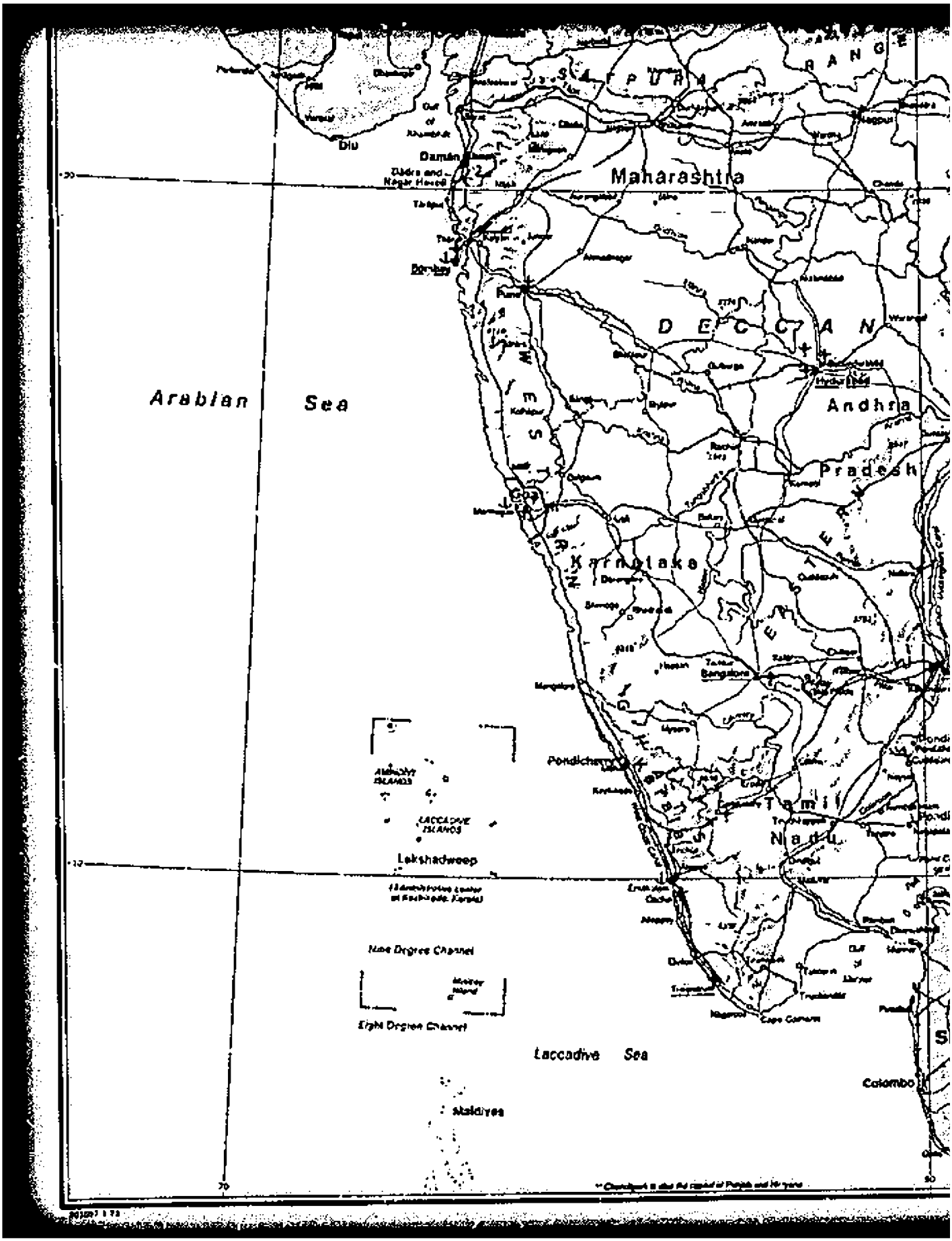
AIRFIELDS

Adampur	31 26	75 46
Agra	27 09	77 58
Ahmadabad	23 04	72 37
Allahabad	25 26	81 44
Ambala	30 22	76 49
Awantipur	33 53	74 59
Bangalore	12 57	77 40
Bombay	19 05	72 52
Calcutta	22 39	88 27
Chandigarh	30 40	76 47
Cochin NAS	9 57	76 16
Delhi	28 34	77 07
Dundigal	17 38	78 24
Gauhati	26 06	91 35
Goa	15 23	73 50
Gorakhpur	26 44	83 27
Hakimpet	17 33	78 31
Hindan	28 42	77 22
Hyderabad	17 27	78 28
Jammu	32 41	74 50
Jorhat	26 44	94 11
Kalaikunda	22 20	87 13
Leh	34 08	77 33
Madras	13 00	80 11
Nagpur	21 05	79 03
Pathankot	32 14	75 38
Poona	18 35	73 55
Srinagar	33 59	74 47
Sulur	11 01	77 10
Tezpur	26 43	92 48
Trivandrum	8 29	76 55









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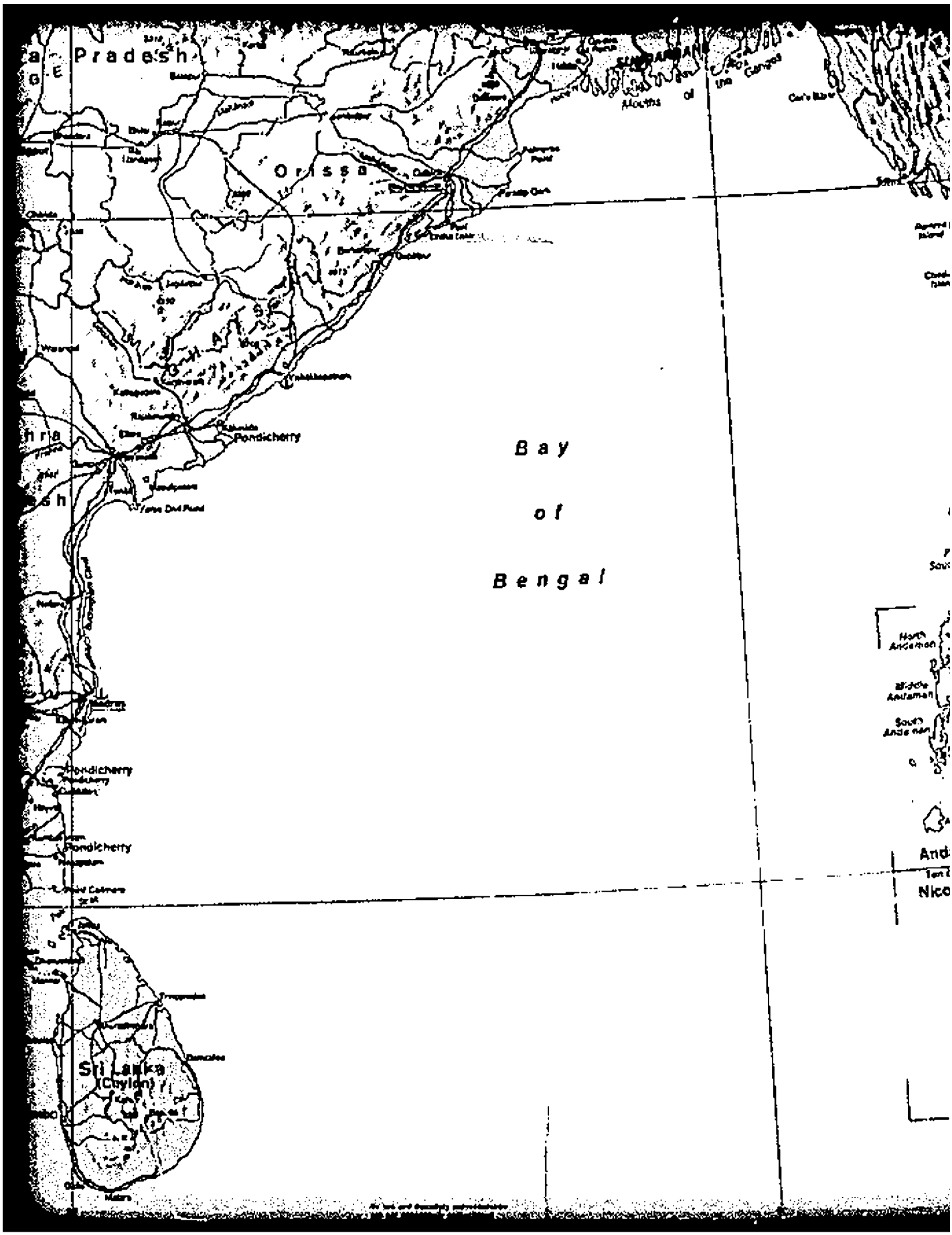

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