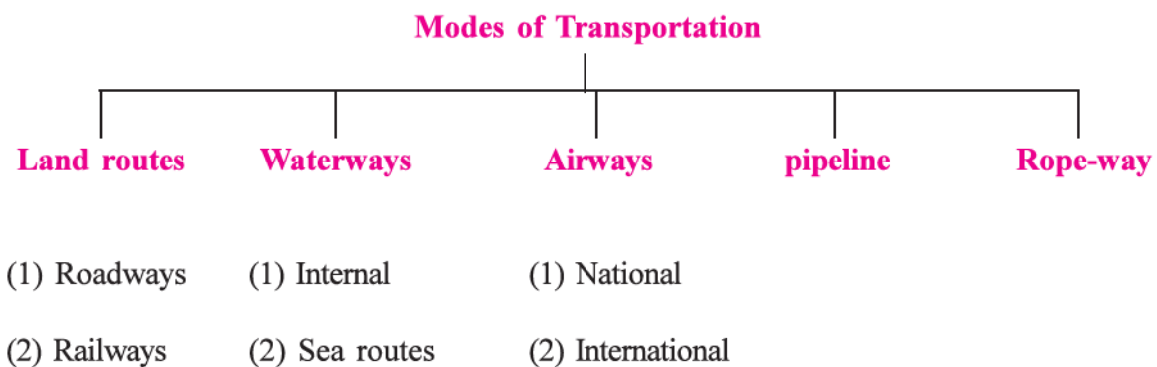


Raw material, industrial plant and market for a finished good cannot be at the same place. Use of natural resources is possible only if sources of raw materials are connected to areas of production, and they in turn are linked with the market areas. This is not possible without transport.

Carriage of persons and goods from one place to the other is called transport.

At the international level, goods are mainly transported by goods carrier ships. Transport by waterways has some limitation. It cannot transport goods into a region's interior. Roads are more favourable for transport over shorter distances and are also speedy. They also provide door-to-door service. But if heavier goods are to be transported in bulk over longer distances in a country, railways are the most favourable. Airways are the costliest. But these are favourable in speedy transport of man and goods. For efficient development of a transport system, different modes of transport need to supplement each other.

Modes of Transportation



Land routes :

Foot-tracks and unmetalled roads have long been used. Initially, goods used to be transported by man and animals. In the 18th century, industrial revolution led to the invention of machines. Initially man and animals were replaced by steam engines. Metalled roads, express ways and fly overs were constructed in the course of time.

Roadways :

Roads are important in that they provide door-to-door service. It is the cheapest option for short distance transport. Roads supplement railways, airways and waterways. Contribution of roads is maximum in agriculture, pastoralism and rural development. Roads also make transport of raw materials and finished goods easier for industries, and useful in case of relief and rescue operations during natural disasters.

World's major roads

Roads in North America are the most developed. Highest road density is in the eastern part of North America. Trans-Canada Highway connects St. John's on the Atlantic coast in the east with Vancouver on the Pacific coast in the west. Similarly, the Alaska Highway connects Edmonton city of Canada with Anchorage of Alaska.

Pan-American Highway connecting North, Central and South American continents is under construction.

The best roads have been constructed in Europe. Roads are well developed in England, France, Germany and other countries. But use of railways and waterways being more common, very long highways are few in Europe.

Road network is more dense in the industrial areas of western Russia. Vladivostok in the eastern part of Russia is connected with Moscow in west by road.

In Australia roads have developed mainly in its coastal areas. Stuart Highway connects Darwin city in northern Australia with Melbourne of Victoria State in the south.

Roads are of particular significance in Africa because of its topographical variations. One of the roads commencing from Algiers crosses Atlas mountains and the Sahara Desert and links Conakry in Guinea. Cairo and Cape Town are similarly connected by road.

In China, highways criss-cross the country connecting all major cities such as Tsungtso, with Beijing and Guangzhou via Shanghai. A new highway links Chengdu with Lhasa in Tibet.

Roads in India

Since ancient times, India has been a leading country as regards transport routes. A network of highways existed in India during the Gupta period and the Maurya period. The emperor Ashok and Chandragupta Maurya greatly encouraged construction of roads during their times.

In modern times, the Indian road network is the world's second largest after that of U.S.A. According to the latest available information, the total road length in India is about 33.24 lakh km.

Indian roads are categorized into 5 types as per significance : (1) National highway, (2) State highway (3) District road (4) Village road and (5) Border road.

National highway unites the nation from economic, cultural and security view point. Their total length is about 70934 km. Currently, number of national highways in India is 223, important among them are as follows.



5.1 Golden Quadrilateral and Express Roads



5.2 National Highways

Major National Highways

1. NH-1 Delhi to Amritsar (via Ambala and Jalandhar)
2. NH-2 Delhi to Kolkata (via Mathura, Agra, Kanpur, Allahabad, Varanasi)
3. NH-3 Agra to Mumbai (via Gwalior and Nasik)
4. NH-4 Thane to Chennai (via Pune and Belgaum)
5. NH-5 Kolkata to Chennai (via Vijaynagar and Vishakhapatnam)
6. NH-6 Dhule to Kolkata (via Nagpur and Raipur)

7. NH-7 Varanasi to Kanniyakumari (via Jabalpur, Nagpur, Bangaluru, Salem, Madurai). It is the longest highway
8. NH-8 Delhi to Mumbai (via Jaipur, Udaipur, Ahmedabad, Vadodara, Surat)

Besides, the four metro cities of Delhi, Mumbai, Chennai and Kolkata would be joined by the Golden Quadrilateral NH, with a total road length of about 5846 km.

Railways

Railways offer a cheap and convenient means of transport when heavier goods need to be carried over longer distances. The world's first rail service started in 1825, between Stockton and Darlington, in England. Thus, railway can be called a result of industrial revolution. It has proved to be the most popular means in the transport of people and goods.

Major railways of the World

The total length of railways in the world is about 13 lakh km. Density of railways is the highest in Europe. It has a total rail length of about 4.40 lakh km. They are mostly double line or multiple line rail routes. There are more rail lines in the industrial regions of western Europe. The Oriental Expressway from Paris in France to Istanbul in Turkey connecting seven countries is well known. World's densest rail lines are in Belgium.

Trans-Siberian Railroad connecting Europe and Asia is an intercontinental railroad. It connects St. Petersburg in west with Vladivostok in east. It has a total length of 9332 km.

European cities of London, Paris, Brussels, Milan, Berlin, Warsaw, Glasgow, Hamburg, and Moscow, etc. have metro rail.

North America has a vast rail network. It has about 40% of the world's rail routes. The Canada-Pacific Railway connects Vancouver on the west coast with Halifax on the east coast. Since this railway connects industrial region. The economic significance of the region of soft wood forests and wheat region of prairies has increased.

South America has a total of about 1.12 lakh km length of rail routes. About 40% rail routes are in Pampas area of Argentina and coffee growing areas of Brazil. A railroad connects Buenos Aires of Argentina to Valparaiso of Chile. It crosses the Andes at the Uspallata Pass at an altitude of 3960 metres. Chile has rail length of about 9300 km. In Chile, the rail road goes from Iquique to Puerto Montt.

Rail routes are very short in Peru, Bolivia, Ecuador, Columbia and Venezuela. They are single line rail routes, that connect ports with interior areas.

Africa is the second largest continent, after Asia. But it has only 40,000 km of rail routes. Among these, only South Africa has 18,000 km length of rail routes, mainly due to gold, copper and diamond mining. Among the major rail routes of Africa, the Benguela railway connects copper mines of Zambia with Dar-es-Salaam on the sea coast. Another railway connects South Africa with land locked countries of central Africa through Botswana and Zimbabwe. Railways of other

African countries such as Algeria, Senegal, Nigeria, Kenya and Ethiopia link ports with centres in the interior.

Australia has about 40,000 km long railways. A quarter of these railways are in New South Wales. A rail route connects Perth in the west with Sydney in the east. Canberra, Melbourne, Adelaide, and Kalgoorlie are major cities on this route.

A dense network of railways is seen in India, Japan and China. Japan and China have drawn world attention by developing high speed railways. In China, most of the railways are in the eastern areas. Besides, in countries like Pakistan, Bangladesh, Myanmar, Malaysia, etc. development of railways is relatively less.

Indian Railways

Indian railway is the nation's largest organization. It is the chief means of transport for the development of all sectors (agriculture, industry, trade, service, etc.) of Indian economy.

The first railway in India began on 16th April, 1853, between Mumbai and Thane. India has a total rail route length of about 64,600 km, with 7,133 railway stations.

The country has rail lines with three different gauges, broad gauge (1.676 m), metre gauge (1m) and narrow gauge (0.762m).

You would like to know		
Sr no.	Division	Headquarter
1	Central Railway	Mumbai-V.T.
2	Eastern Railway	Kolkata
3	Northern Railway	New Delhi
4	North-Eastern Railway	Gorakhpur
5	North-East Frontier Railway	Malegaon
6	Southern Railway	Chennai
7	South-Central Railway	Secunderabad
8	South-Eastern Railway	Kolkata
9	Western Railway	Mumbai-Churchgate
10	East-Central Railway	Hajipur
11	North-Western Railway	Jaipur
12	East Coastal Railway	Bhubaneswar
13	North-Central Railway	Allahabad
14	South-East-Central Railway	Bilaspur
15	South-Western Railway	Hubli
16	West-Central Railway	Jabalpur



5.3 Major Railway Routes

The Indian Railways Department, runs various types of trains providing various facilities to passengers. It includes express/mail, superfast trains, Garibrath, Gatiman Express, Pravasani Express, Rajdhani Express, Shatabdi and Janshatabdi Express. Online reservation can also be done. Metre gauge rail lines have been converted to broad gauge. Most of the rail routes have been electrified. Trains related to people's education and health are also being run. Besides, efforts have been initiated for a bullet train in India.

Waterways

One of the main advantages of waterways is that unlike roads, railways, etc. they do not require maintenance. Waterways are the cheapest means of transport. The major requirement for a waterway is that of port facility. Waterways can be divided into two : (1) Inland Waterways and (2) Oceanic waterways.

(1) Inland Waterways : Water borne traffic of a country in inland areas and along coasts based on rivers, canals and lakes is called inland waterway.

World's major inland waterways

(1) Great Lakes and St. Lawrence Waterway : St. Lawrence river originates from the Great Lakes located along the U.S.A.-Canada border and meets the Atlantic Ocean. These have been linked together to provide the world's largest waterway. As a result, small and big ports have developed along these lakes as, Duluth along Lake Superior, Chicago on Lake Michigan, Toronto on Lake Ontario, Buffalo, Cleveland and Toledo on Lake Erie, Huron on Lake Huron, etc. Hence, big ocean liners can reach far into the interior of the continent upto the south of Quebec through the St. Lawrence. This has contributed to the industrial and economic development of this region.

(2) Mississippi Waterway : Mississippi and its tributaries supplemented by the canals provide waterways upto the Gulf of Mexico. Also, canals along the east coast along with some rivers have helped in establishing contact with the Atlantic coast. Ships laden with goods can move to and fro upto Minniapolis through this route.

(3) Western and Central European Waterway : This waterway is very important in the industrially developed regions of Western and Central Europe. Rivers like Seine, Rhine and Elb, after flowing across the northern plains of Europe, drain into the North Sea. These rivers along with their tributaries, form important waterways.

(4) Volga Waterway : Rivers of East Europe like Volga, Don, Dneiper have formed a vast drainage pattern. It is possible to reach the Russian capital Moscow through Volga-Moscow Canal. Other rivers of Russia like Yenasey and Lena drain through sparsely populated areas, and hence are not so important.

(5) Parana-Paraguay Waterway : The waters of the Parana-Paraguay river system flow from the tidal mouths of Rio-de-la-Plata into the Atlantic Ocean. Parana river is navigable upto Santa-fe while Paraguay river is navigable upto Ascension.

Besides, the Amazon of South America, Huang-Ho, Chang-Jiang and Sikiang of China, Ganga of India are also useful as waterways.

Inland Waterways of India

In India, inland waterways are more developed in states of Uttar Pradesh, West Bengal, Bihar and Assam. The length of waterways in India is about 14,477 km. Among these, 10027 route length of rivers and 4438 long canals are useful as waterways. Major inland waterways are as under :

(1) National Waterway-I : In Ganga, water transport is carried out from Haldia to Allahabad. Its length is 1620 km.

(2) National Waterway-II : It is the waterway of the Brahmaputra. It is useful from Dhubri to Nadia. Its length is 891 km.

(3) National Waterway-III : The 250 km long Udyogamandal Canal in Kerala, and Champakar and Kottapattnam canals provide waterways.

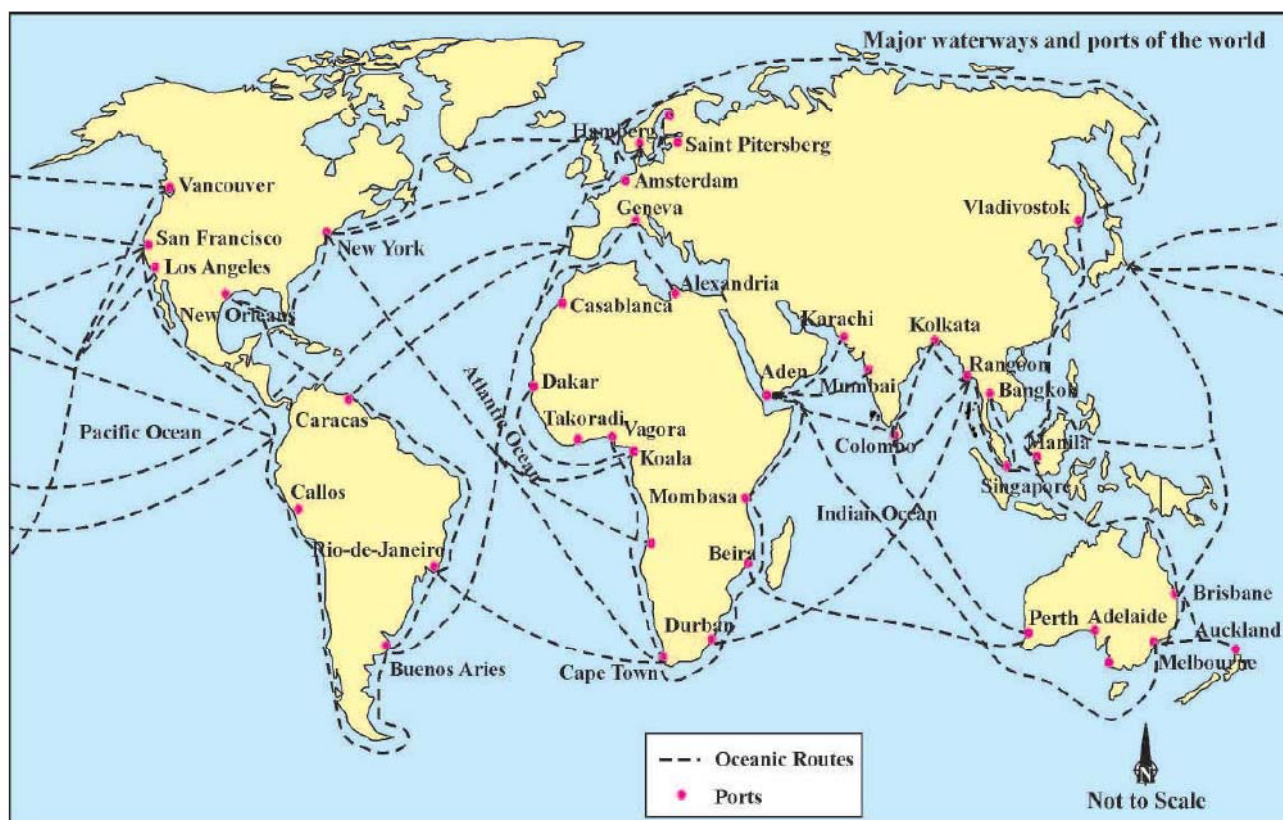
(4) National Waterway-IV : 1028 km long waterway of Godavari and Krishna rivers, based on Kakinada and Puducherry canals and Kaluveily lake.

(5) National Waterway-V : Talcher-Dhamara canal, Chhabatia-Dhamara waterway of Brahmani river (Odisha), has a length of 585 km.

Oceanic Waterway

Oceanic waterways are a cheap means of transport for goods and passengers because oceans are interconnected and ships of different sizes can ply on its surface. Any country can make use of oceanic waterways. Less energy is required in comparison to other means, hence transport of goods becomes easier.

Presently, ships have been modernized and equipped with latest technology. This includes Radar, wireless and remote sensing based navigation equipment.



5.4 Oceanic Routes of the World

(1) North Atlantic Route : This oceanic route connects Canada and the U.S.A. with western Europe, which is a very busy and important waterway. Among the ports of western Europe,

London, Liverpool, Glasgow, Manchester, Hampton, Rotterdam, Hamburg, Lisbon and Bremen are important. On the east coast of North America, Quebec, Halifax, New York, Boston, Portland and Philadelphia are important ports.

Clothes, chemicals, machines, steel, chemical fertilizers, etc. are exported through this route to Canada and the U.S.A. Ships on their return journey, carry wheat, pulp, copper, iron and steel to Europe.

(2) Suez canal Route : Mediterranean Sea and the Indian Ocean route are linked to the industrialised countries of Europe, Mediterranean Sea, Red Sea and with East Africa, South Asia and South-East Asia. This oceanic route connects Europe with Asia and Australia. Important ports along this route are Port Said, Aden, Mumbai, Kochi, Colombo and Singapore, etc.

The waterways developed by man that connect seas and oceans are known as Canals.

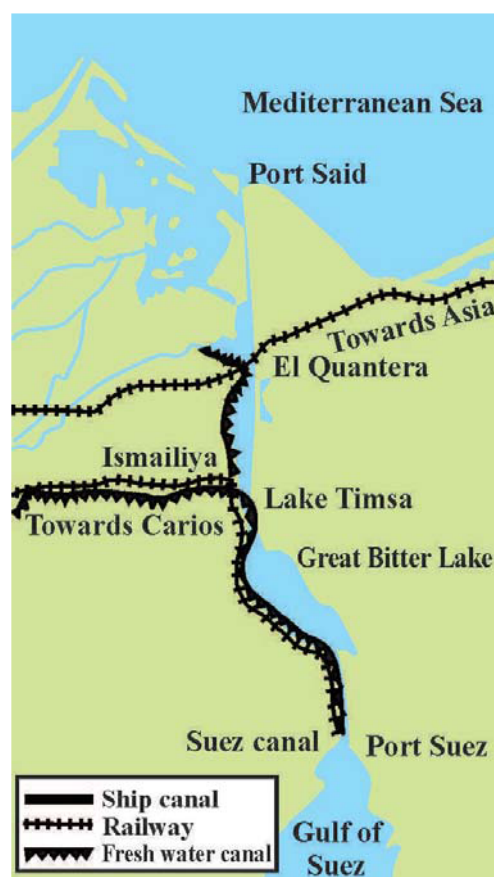
Suez Canal

This canal has been constructed to connect Mediterranean Sea and the Red Sea. The credit for constructing this canal goes to the French engineer Ferdinand-de-Lesseps. It was completed in 1869. With the opening of this canal the distance between western Europe and south-east European countries has almost reduced to half. Port Said is situated to the north and Suez port is to the south of the canal.

(1) Cape of Good Hope Route : Cape of Good Hope route was an important ocean route prior to the opening of the Suez canal. This route connects west Europe with west African countries, south-east Asia, Australia and New Zealand. Through this route, precious minerals like gold, copper, diamonds, tin, chromium, manganese and agricultural products like cotton, palm-oil, groundnut, coffee and fruits are traded.

(2) South Atlantic Route : This oceanic route connects countries of western Europe and western Africa with ports of Brazil, Argentina and Uruguay. This route is not so significant because the countries on the African coast and the South American coast are sparsely populated. Also, they are not highly developed economically. Only south-east Brazil and some parts of South Africa are highly developed industrially. Also trade is not significant along central-east-west route between Rio-de-Janeiro and Cape Town, because countries of both South America and Africa have similar resources and products. Coffee and cocoa from Brazil, wheat, meat, wool and jute from Argentina are exported to the industrialized regions of North America and Europe. Finished goods and semi- finished goods are imported in return.

(3) North Pacific Ocean Route : This route connects ports on the west coast of North America like Vancouver, Portland, San Francisco with the ports of East Asia like Yokohama, Kobe, Shanghai, Hong Kong, Manila and Singapore, etc. Many ocean routes pass through the north



5.5 Suez Canal

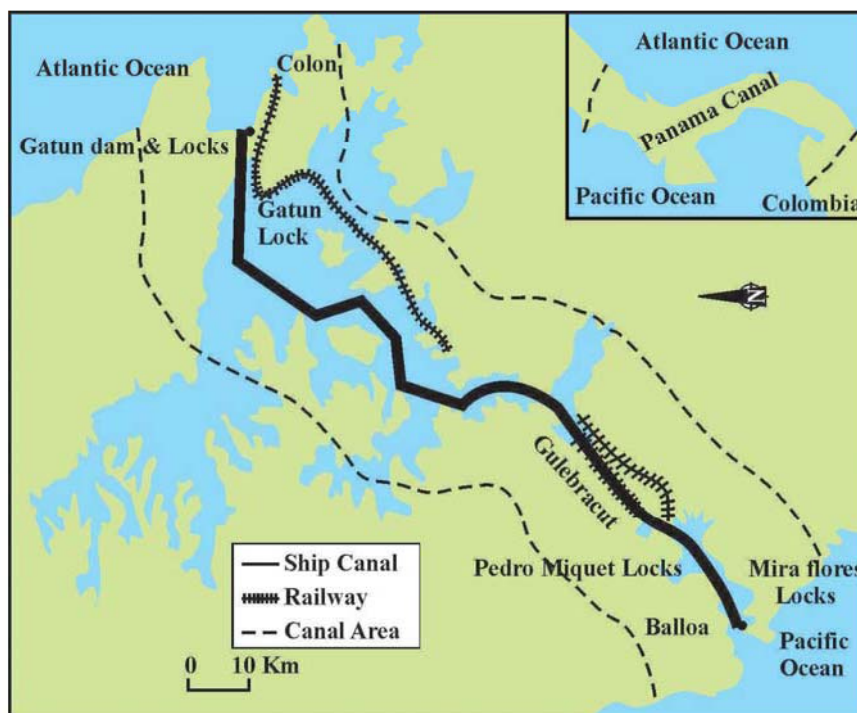
Pacific Ocean. All these routes meet at Honolulu. Industrial products like clothes and electrical appliances are exported from Asian countries like Japan, Hong Kong, South Korea and Taiwan. Rubber, coconut, sugar, tea, silk, tobacco and toys are exported from south-east Asia. While fruits, meat, milk products, wheat, pulp, crude oil and minerals are exported from countries of North America to the Asian countries.

(4) South Pacific Ocean Route : It connects North America and South America with Australia and New Zealand. It also connects scattered Pacific islands with the Panama Canal. Ships also go to Hong Kong, Philippines and Indonesia through this route. Shipment of wheat, meat, wool, fruits, milk products and industrial products is done through this route. Distance between Panama and Sydney is about 12000 km.

Panama Canal

This canal has been constructed between North and South America across the Panama country. It connects the Pacific Ocean in the west to the Atlantic Ocean in the east. With the opening of the Panama Canal, the distance between the west and east coasts of the north and south American continents has been greatly reduced.

Panama Canal is a canal with lock system, with which the ships can be raised or lowered. Ships take about 7 to 8 hours to pass through the canal.



5.6 Panama Canal

Airways

Airways developed during the 20th century, but its real development took place after the Second World War. The design, size and speed of aircraft have progressively improved.

Aircrafts have made it possible to dispatch valuable goods the world over. Airways are a boon in inaccessible regions. Required materials can be dispatched at times of natural disasters. Airways are an important means for a country's defense as well.

There is uneven distribution of airways in the world. Airways are more developed in the

economically and industrialized countries of the world. Airways are more in number in U.S.A., Western Europe and South-East Asia.

The world's busiest airways are London, Rome, Paris, Moscow, Dubai, New Delhi, Mumbai, Bangkok, Singapore, Tokyo, San Francisco, Los Angeles, Chicago, New York, Rio-de-Janeiro, etc.

Airways of India

The Indian Airports Authority is assigned the responsibility of developing India's airways and providing relevant facilities. It manages 127 airports including 15 international, 87 domestic airports and 25 public air terminals.

In 1953, air transport services in India were nationalized, and all companies were bifurcated into two new Corporations -Indian Airlines Corporations and Air India. Thereafter, two more companies, Vayudoot and Pavanhans Limited were established for international air transport.

Delhi, Mumbai, Kolkata, Chennai, Bangaluru, Ahmedabad, Hyderabad, Amritsar, Jaipur, Nagpur, Kochi, Guwahati, Lucknow, Bhuvaneshwar, Vishakhapatnam, etc. are major airports of India.



5.7 Major Air Routes of the World

Pipeline

Pipeline is the most convenient medium for transport of liquid and gaseous matter. Pipelines are used for transporting petroleum and its products and also natural gas over long distances.

Characteristics of pipelines are as follows : (1) pipelines can be laid on uneven terrain as well as under water. (2) its operation and maintenance cost is very less. (3) it is the best system as far as energy efficiency and environment protection are concerned.

Highest density of pipelines is seen in the U.S.A. 'Big Inch' is the most famous of these pipelines. It carries crude oil from the oilfields in the coastal areas of the Gulf of Mexico to the north-eastern areas. Pipelines carry oil from oilfields of Iraq, Iran and Saudi Arabia across deserts

to oil refinery located along the Mediterranean Sea coast. The main one is TAP Line. Its diameter is 750 mm and length is 1600 km. The COMECON pipeline in east European countries connects oil fields located between Ural and Volga. It is the world's largest pipeline.

Major pipelines of India

Oil India Limited established by the Ministry of Petroleum and Natural Gas looks after the exploration, production and distribution work of oil and natural gas in the country. It was established in 1959. Major pipelines of India are as follows :

(1) The construction of Asia's first pipeline with a length of 117 km began in 1962. It connects Nahorkatiya oil field in Assam to Noonmati Refinery and further extends upto Barauni Oil Refinery in Bihar.

(2) Pipelines have been laid from Barauni in Bihar upto Kanpur and Haldia Port in the Bay of Bengal.

(3) In Gujarat, pipelines have been built from Ankleshwar to Koyali, Kalol to Sabarmati, Navagam to Koyali, Bombay High to Koyali, Khambhat to Dhuvaran, Ankleshwar to Utran, Ankleshwar to Vadodara and Koyali upto Ahmedabad.

(4) A 1256 km long pipeline has been laid between Salaya in the Gulf of Kachchh to Mathura.

(5) Pipelines connect Mathura with Delhi, Ambala and Jalandhar.

Rope-Way

Rope-ways began in the world for crossing narrow deep rivers, valleys by sliding palanquins or trolleys on strongly tied metallic ropes. However, the motive force was human power at the time. Now, ropes are made to pass over distantly placed pillars and trolleys are pulled with mechanical power. Such kind of transport is more useful on steep slopes of mountains, inaccessible valleys and swampy areas.

Initially, ropeways were used to send minerals to factories or for sending plantation crops to the foothills or processing units. With the development of the tourism industry in the 20th century, ropeway is more commonly used to carry passengers to and fro.

In the world, ropeways are seen in Switzerland, Australia, China and other countries. In India, ropeways are used in many factories, particularly in cement factories for carrying limestone. In Uttarakhand, ropeway is available from Joshimath to Oli. Besides, ropeways are used in West Bengal, Himachal Pradesh, Rajasthan, Maharashtra and other states.

In Gujarat, ropeways are available for tourists in Pavagadh, Ambaji and Saputara. In Girnar, the ropeway is under construction.

Solutions to transport problems

- To dilute the problems of high density, pollution, traffic, etc., in main cities, modern suburbs can be established around them, thereby reducing pressure of urbanization.
- To reduce road traffic in cities, fly-overs can be built. Also traffic can be controlled by metro rail or mono rail.
- Parking of vehicles has become a major problem in cities nowadays. This problem can be solved by providing facilities of multi-level parking.

- To reduce consumption of minerals as sources of power and for controlling pollution, people may be encouraged to cycle by providing cycle tracks.
- Instead of personal vehicles, people should be encouraged for public transport (bus, metro rail, mono rail). People should be made aware of it and pollution can also be controlled.

Exercise

1. Answer the following questions in detail :

- (1) Explain the meaning of transportation and give details about the major roads of the world.
- (2) Discuss the major inland waterways of India.
- (3) Write a detailed note on important rail routes of the world.

2. Give to the point answers for the following :

- (1) Explain the importance of roads.
- (2) Write a short note about the Suez Canal.
- (3) Write about the development of Airways.
- (4) What are the advantages of Pipeline ?

3. Answer the following questions in brief :

- (1) Which are the major means of transportation ?
- (2) Into which five categories are the Indian roads divided ?
- (3) What is the Golden Quadrilateral Project ?
- (4) Which are the types of railroads in India ?

4. Answer the following in one-two sentences :

- (1) Define transportation.
- (2) Name the two sub-types of land routes.
- (3) Which National Highway passes through Gujarat ?
- (4) The world's first railway train ran between which two cities ?
- (5) On which river is India's Inland Waterway-I located ?

5. Select the correct option from the options given :

- (1) Which country has the world's densest rail roads ?
 (a) China (b) Brazil (c) Belgium (d) India
- (2) When did the first train run in India ?
 (a) 1950 (b) 1853 (c) 1801 (d) 1988
- (3) Which canal joins Atlantic and Pacific oceans ?
 (a) Suez canal (b) Liverpool canal (c) Panama canal (d) Pacific canal
- (4) Which is the world's longest pipeline ?
 (a) COMECON (b) Big Inch (c) Siberian (d) Volga
- (5) Which vehicle does not contribute to pollution ?
 (a) Rail (b) Bus (c) Cycle (d) Aeroplane

Activity

- Collect pictures of different types of vehicles and display them on bulletin board
- Hold a classroom discussion on change in transport modes and its significance