

Transport

Transport infrastructure consists of the fixed installations, including roads, railways, airways, waterways, canals and pipelines and terminals such as airports, railway stations, bus stations, warehouses, trucking terminals, refueling depots (including fueling docks and fuel stations) and seaports. Terminals may be used both for interchange of passengers and cargo and for maintenance.

Introduction of Transportation

- Transport in the India is an important part of the nation's economy.
- Since the economic liberalization of the 1990s, development of infrastructure within the country has progressed at a rapid pace, and today there is a wide variety of modes of transport by land, water and air.
- Transportation sector accounts for a share of 6.4 % in GDP.
- Road Transportation in India's transportation sector with a share of 5.4% in India's GDP.

Mode of transport

A mode of transport is a solution that makes use of a particular type of vehicle, infrastructure, and operation. The transport of a person or of cargo may involve one mode or several of the modes, with the latter case being called intermodal or multimodal transport. Each mode has its own advantages and disadvantages, and will be chosen for a trip on the basis of cost, capability, and route.

Human-powered

Human-powered transport remains common in developing countries. Human-powered transport, a form of sustainable transport, is the transport of people and/or goods using human muscle-

power, in the form of walking, running and swimming. Modern technology has allowed machines to enhance human power. Human-powered transport remains popular for reasons of cost-saving, leisure, physical exercise, and environmentalism; it is sometimes the only type available, especially in underdeveloped or inaccessible regions.

Although humans are able to walk without infrastructure, the transport can be enhanced through the use of roads, especially when using the human power with vehicles, such as bicycles and inline skates. Human-powered vehicles have also been developed for difficult environments, such as snow and water, by watercraft rowing and skiing; even the air can be entered with human-powered aircraft.

Animal-powered transport

Animal-powered transport is the use of working animals for the movement of people and commodities. Humans may ride some of the animals directly, use them as pack animals for carrying goods, or harness them, alone or in teams, to pull sleds or wheeled vehicles.

Air

An Air France Airbus A318 lands at London Heathrow Airport.

A fixed-wing aircraft, commonly called airplane, is a heavier-than-air craft where movement of the air in relation to the wings is used to generate lift. The term is used to distinguish this from rotary-wing aircraft, where the movement of the lift surfaces relative to the air generates lift. A gyroplane is both fixed-wing and rotary wing. Fixed-wing aircraft range from small trainers and recreational aircraft to large airliners and military cargo aircraft.

Two things necessary for aircraft are air flow over the wings for lift and an area for landing. The majority of aircraft also need an airport with the infrastructure to receive maintenance, restocking, refueling and for the loading and unloading of crew, cargo, and passengers. While the vast majority of aircraft land and take off on land, some are capable of take-off and landing on ice, snow, and calm water.

The aircraft is the second fastest method of transport, after the rocket. Commercial jets can reach up to 955 kilometres per hour (593 mph), single-engine aircraft 555 kilometres per hour (345 mph). Aviation is able to quickly transport people and limited amounts of cargo over longer distances, but incurs high costs and energy use; for short distances or in inaccessible places, helicopters can be used.^[6] As of April 28, 2009, The Guardian article notes that "the WHO estimates that up to 500,000 people are on planes at any time."

Land transport

Land transport covers all land-based transport systems that provide for the movement of people, goods and services. Land transport plays a vital role in linking communities to each other. Land transport is a key factor in urban planning. It consists of 2 kinds, rail and road.

Rail transport

Intercity Express, a German high-speed passenger train. The Beijing Subway is one of the world's largest and busiest rapid transit networks. Rail transport is where a train runs along a set of two parallel steel rails, known as a railway or railroad. The rails are anchored perpendicular to ties (or sleepers) of timber, concrete or steel, to maintain a consistent distance apart, or gauge. The rails and perpendicular beams are placed on a foundation made of concrete or compressed earth and gravel in a bed of ballast. Alternative methods include monorail and maglev.

A train consists of one or more connected vehicles that operate on the rails. Propulsion is commonly provided by a locomotive, that hauls a series of unpowered cars, that can carry passengers or freight. The locomotive can be powered by steam, diesel or by electricity supplied by trackside systems. Alternatively, some or all the cars can be powered, known as a multiple unit. Also, a train can be powered by horses, cables, gravity, pneumatics and gas turbines. Railed vehicles move with much less friction than rubber tires on paved roads, making trains more energy efficient, though not as efficient as ships.

Intercity trains are long-haul services connecting cities;^[8] modern high-speed rail is capable of speeds up to 350 km/h (220 mph), but this requires specially built track. Regional and commuter trains feed cities from suburbs and surrounding areas, while intra-urban transport is performed by high-capacity tramways and rapid transits, often making up the backbone of a city's public transport. Freight trains traditionally used box cars, requiring manual loading and unloading of the cargo. Since the 1960s, container trains have become the dominant solution for general freight, while large quantities of bulk are transported by dedicated trains.

Road transport

The Harbor Freeway is often heavily congested at rush hour in Downtown Los Angeles. A road is an identifiable route, way or path between two or more places. Roads are typically smoothed, paved, or otherwise prepared to allow easy travel;^[10] though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance.^[11] In urban areas, roads may pass through a city or village and be named as streets, serving a dual function as urban space easement and route.

The most common road vehicle is the automobile; a wheeled passenger vehicle that carries its own motor. Other users of roads include buses, trucks, motorcycles, bicycles and pedestrians. As of 2010, there were 1.015 billion automobiles worldwide. Road transport offers a complete freedom to road users to transfer the vehicle from one lane to the other and from one road to another according to the need and convenience. This flexibility of changes in location, direction, speed, and timings of travel is not available to other modes of transport. It is possible to provide door to door service only by road transport.

Automobiles provide high flexibility with low capacity, but require high energy and area use, and are the main source of harmful noise and air pollution in cities;^[13] buses allow for more

efficient travel at the cost of reduced flexibility.^[14] Road transport by truck is often the initial and final stage of freight transport.

Water transport

Automobile ferry in Croatia Water transport is movement by means of a watercraft—such as a barge, boat, ship or sailboat—over a body of water, such as a sea, ocean, lake, canal or river. The need for buoyancy is common to watercraft, making the hull a dominant aspect of its construction, maintenance and appearance.

In the 19th century, the first steam ships were developed, using a steam engine to drive a paddle wheel or propeller to move the ship. The steam was produced in a boiler using wood or coal and fed through a steam external combustion engine. Now most ships have an internal combustion engine using a slightly refined type of petroleum called bunker fuel. Some ships, such as submarines, use nuclear power to produce the steam. Recreational or educational craft still use wind power, while some smaller craft use internal combustion engines to drive one or more propellers, or in the case of jet boats, an inboard water jet. In shallow draft areas, hovercraft are propelled by large pusher-prop fans. (See Marine propulsion.)

Although it is slow compared to other transport, modern sea transport is a highly efficient method of transporting large quantities of goods. Commercial vessels, nearly 35,000 in number, carried 7.4 billion tons of cargo in 2007.^[15] Transport by water is significantly less costly than air transport for transcontinental shipping;^[16] short sea shipping and ferries remain viable in coastal areas.

Other mode

Pipeline transport sends goods through a pipe; most commonly liquid and gases are sent, but pneumatic tubes can also send solid capsules using compressed air. For liquids/gases, any chemically stable liquid or gas can be sent through a pipeline. Short-distance systems exist for sewage, slurry, water and beer, while long-distance networks are used for petroleum and natural gas.

Cable transport is a broad mode where vehicles are pulled by cables instead of an internal power source. It is most commonly used at steep gradient. Typical solutions include aerial tramway, elevators, escalator and ski lifts; some of these are also categorized as conveyor transport.

Spaceflight is transport out of Earth's atmosphere into outer space by means of a spacecraft. While large amounts of research have gone into technology, it is rarely used except to put satellites into orbit, and conduct scientific experiments. However, man has landed on the moon, and probes have been sent to all the planets of the Solar System.

Impact

Sustainable transport

Transport economics

Transport is a key component of growth and globalization, such as in Seattle, Washington, United States.

Transport is a key necessity for specialization—allowing production and consumption of products to occur at different locations. Throughout history, transport has been a spur to expansion; better transport allows more trade and a greater spread of people. Economic growth has always been dependent on increasing the capacity and rationality of transport.^[34] But the infrastructure and operation of transport have a great impact on the land, and transport is the largest drainer of energy, making transport sustainability a major issue.

Due to the way modern cities and communities are planned and operated, a physical distinction between home and work is usually created, forcing people to transport themselves to places of work, study, or leisure, as well as to temporarily relocate for other daily activities. Passenger transport is also the essence of tourism, a major part of recreational transport. Commerce requires the transport of people to conduct business, either to allow face-to-face communication for important decisions or to move specialists from their regular place of work to sites where they are needed.

Transport planning

Transport planning allows for high utilization and less impact regarding new infrastructure. Using models of transport forecasting, planners are able to predict future transport patterns. On the operative level, logistics allows owners of cargo to plan transport as part of the supply chain. Transport as a field is also studied through transport economics, a component for the creation of regulation policy by authorities. Transport engineering, a sub-discipline of civil engineering, must take into account trip generation, trip distribution, mode choice and route assignment, while the operative level is handled through traffic engineering.

The engineering of this roundabout in Bristol, United Kingdom, attempts to make traffic flow free-moving.

Because of the negative impacts incurred, transport often becomes the subject of controversy related to choice of mode, as well as increased capacity. Automotive transport can be seen as a tragedy of the commons, where the flexibility and comfort for the individual deteriorate the natural and urban environment for all. Density of development depends on mode of transport, with public transport allowing for better spatial utilization. Good land use keeps common activities close to people's homes and places higher-density development closer to transport lines and hubs, to minimize the need for transport. There are economies of agglomeration. Beyond transport, some land uses are more efficient when clustered. Transport facilities consume land, and in cities pavement (devoted to streets and parking) can easily exceed 20 percent of the total land use. An efficient transport system can reduce land waste.

Too much infrastructure and too much smoothing for maximum vehicle throughput mean that in many cities there is too much traffic and many—if not all—of the negative impacts that come with it. It is only in recent years that traditional practices have started to be questioned in many places; as a result of new types of analysis which bring in a much broader range of skills than

those traditionally relied on—spanning such areas as environmental impact analysis, public health, sociology and economics—the viability of the old mobility solutions is increasingly being questioned.

Environmental impact of transport

Transport is a major use of energy and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide, for which transport is the fastest-growing emission sector. By subsector, road transport is the largest contributor to global warming. Environmental regulations in developed countries have reduced individual vehicles' emissions; however, this has been offset by increases in the numbers of vehicles and in the use of each vehicle. Some pathways to reduce the carbon emissions of road vehicles considerably have been studied. Energy use and emissions vary largely between modes, causing environmentalists to call for a transition from air and road to rail and human-powered transport, as well as increased transport electrification and energy efficiency.

Other environmental impacts of transport systems include traffic congestion and automobile-oriented urban sprawl, which can consume natural habitat and agricultural lands. By reducing transport emissions globally, it is predicted that there will be significant positive effects on Earth's air quality, acid rain, smog and climate change.

Classification of Transportation

There are **4 types** of Transportation:

1. Roadway

- National
- State
- Normal

2. Railway

3. Airway

- Domestic
- International

4. Port way

- Shipping
- Inland waterway

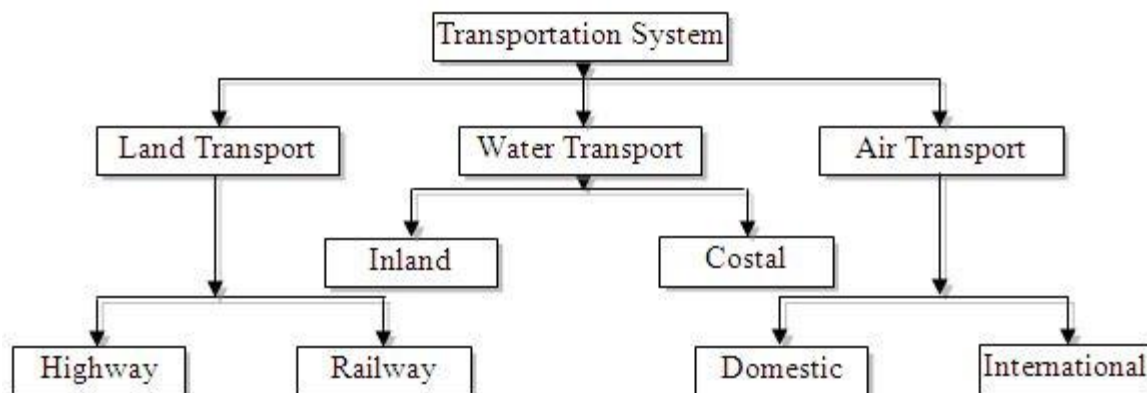


Fig: Classification of transportation system.

Roads in India

The Mumbai-Pune Expressway was the first expressway to be operational in India in 1995. A dual carriageway section of National Highway 48 connecting Delhi to Gurgaon. As per 2017 estimates, the total road length in India is 5,603,293 km (3,481,725 mi); making the Indian road network the second largest road network in the world after the United States. At 0.66 km of highway per square kilometre of land the density of India's highway network is higher than that of the United States (0.65) and far higher than that of China's (0.16) or Brazil's (0.20).

India has a network of National Highways connecting all the major cities and state capitals, forming the economic backbone of the country. As of 2013, India has a total of 70,934 km (44,076 mi) of National Highways, of which 1,205 km (749 mi) are classified as expressways.^[34] Although India has more than 35,000 km of four or more lane highways of international quality standards, but without access control (entry/exit control), they are not called as expressways but simply as highways.

As per the National Highways Authority of India, about 65% of freight and 80% passenger traffic is carried by the roads. The National Highways carry about 40% of total road traffic, though only about 2% of the road network is covered by these roads. Average growth of the number of vehicles has been around 10.16% per annum over recent years.

Under National Highways Development Project (NHDP), work is under progress to equip national highways with at least four lanes; also there is a plan to convert some stretches of these roads to six lanes. All national highways are metalled, but very few are constructed of concrete, the most notable being the Mumbai-Pune Expressway. In recent years construction has commenced on a nationwide system of multi-lane highways, including the Golden Quadrilateral and North-South and East-West Corridors which link the largest cities in India.

In 2000, around 40% of villages in India lacked access to all-weather roads and remained isolated during the monsoon season.^{[1][36]} To improve rural connectivity, Pradhan Mantri Gram Sadak Yojana (Prime Minister's Rural Road Program), a project funded by the Central Government with the help of World Bank, was launched in 2000 to build all-weather roads to connect all habitations with a population of 500 or above (250 or above for hilly areas).

Generally, traffic in most of the cities in India moves slowly, where traffic jams and accidents are very common, but in some cities like Chandigarh, wide roads and less vehicles contribute to lesser traffic. India has very poor records on road safety—around 90,000 people die from road accidents every year. At least 13 people die every hour in road accidents in the country, also in the year 2007 road accidents claimed more than 130,000 lives, overtaking China. A Reader's Digest study of traffic congestion in Asian cities ranked several Indian cities within the top ten for worst traffic.

Type of Road	Length
Expressways	1,206 km (749 mi) as of 2011
National Highways	79,116 km (49,160 mi)
State Highways	155,716 km (96,757 mi)
District and Rural Roads	4,455,010 km (2,768,210 mi)
Total Length	4,689,842 km (2,914,133 mi) (Approx)

Bus

Mumbai's B.E.S.T. is India's oldest operating transport body

Buses are an important means of public transport in India. Due to this social significance, urban bus transport is often owned and operated by public agencies, and most state governments operate bus services through a State Road Transport Corporation. These corporations have proven extremely useful in connecting villages and towns across the country. Alongside the public companies there are many private bus fleets:As of 2012, there were 131,800 publicly owned buses in India, but 1,544,700 buses owned by private companies.

However, the share of buses is negligible in most Indian cities as compared to personalised vehicles, and two-wheelers and cars account for more than 80 percent of the vehicle population in most large cities.

Bus rapid transit in India

Bus rapid transit systems (BRTS), exist in several cities of the country. Buses take up over 90% of public transport in Indian cities, and serve as an important mode of transport. Services are mostly run by state government owned Transport Corporations. In 1990s all government State Transport Corporations have introduced various facilities like low-floor buses for the disabled and air-conditioned buses to attract private car owners to help decongest roads. The Ahmedabad Bus Rapid Transport System, in 2010 won the prestigious Sustainable Transport Award from the Transportation Research Board in Washington.

Rainbow BRTS in Pune is the first BRTS system in the country. Mumbai introduced air conditioned buses in 1998. Bangalore was the first city in India to introduce Volvo B7RLE intra-city buses in India in January 2005.

Bangalore is the first Indian city to have an air-conditioned bus stop, located near Cubbon Park. It was built by Airtel. The city of Chennai houses one of Asia's largest bus terminus, the Chennai Mofussil Bus Terminus.

Two-wheelers

Motorised two-wheeler vehicles like scooters motorcycles and mopeds are very popular mode of transport due to their fuel efficiency and ease of use in congested roads or streets. The number of two-wheelers sold is several times to that of cars. There were 47.5 million powered two-wheelers in India in 2003 compared with just 8.6 million cars.

Manufacture of motorcycles in India started when Royal Enfield began assembly in its plant in Chennai in 1948. Royal Enfield, an iconic brand name in the country, manufactures different variants of the British Bullet motorcycle which is a classic motorcycle that is still in production. Hero MotoCorp (formerly Hero Honda), Honda, Bajaj Auto, Yamaha, TVS Motors and Mahindra 2 Wheelers are the largest two-wheeler companies in terms of market-share.

Manufacture of scooters in India started when Automobile Products of India (API), set up at Mumbai and incorporated in 1949, began assembling Innocenti-built Lambretta scooters in India. They eventually acquired licence for the Li150 series model, of which they began full-fledged production from the early sixties onwards. In 1972, Scooters India Ltd (SIL), a state-run enterprise based in Lucknow, Uttar Pradesh, bought the entire manufacturing rights of the last Innocenti Lambretta model. API has infrastructural facilities at Mumbai, Aurangabad, and Chennai but has been non-operational since 2002. SIL stopped producing scooters in 1998.

Motorcycles and scooters can be rented in many cities, Wicked Ride, Metro bikes and many other companies are working with state governments to solve last mile connectivity problems with mass transit solutions. Wearing protective headgear is mandatory for both the rider and the pillion-rider in most cities.

Automobiles

Private automobiles account for 30% of the total transport demand in urban areas of India. An average of 963 new private vehicles are registered every day in Delhi alone. The number of automobiles produced in India rose from 6.3 million in 2002–03 to 11 million (11.2 million) in 2008–09. There is substantial variation among different cities and states in terms of dependence on private cars: Bangalore, Chennai, Delhi and Kolkata have 185, 127, 157 and 140 cars per 1000 people respectively. This reflects different levels of urban density and varied qualities of public transport infrastructure. Nationwide, India still has a very low rate of car ownership. When comparing car ownership between BRIC developing countries, it is on a par with China, and exceeded by Brazil and Russia.

Compact cars, especially hatchbacks predominate due to affordability, fuel efficiency, congestion, and lack of parking space in most cities. Chennai is known as the "Detroit of India" for its automobile industry. Maruti, Hyundai and Tata Motors are the most popular brands in the order of their market share. The Ambassador once had a monopoly but is now an icon of pre-liberalisation India, and is still used by taxi companies. Maruti 800 launched in 1984 created the first revolution in the Indian auto sector because of its low pricing. It had the highest market share until 2004, when it was overtaken by other low-cost models from Maruti such as the Alto and the Wagon R, the Indica from Tata Motors and the Santro from Hyundai. Over the 20-year

period since its introduction, about 2.4 million units of the Maruti 800 have been sold. However, with the launch of the Tata Nano, the least expensive production car in the world, Maruti 800 lost its popularity.

India is also known for a variety of indigenous vehicles made in villages out of simple motors and vehicle spare-parts. A few of these innovations are the Jugaad, Maruta, Chhakda, Peter Rehda and the Fame.

In the city of Bangalore, Radio One and the Bangalore Traffic Police, launched a carpooling drive which has involved celebrities such as Robin Uthappa, and Rahul Dravid encouraging the public to carpool. The initiative got a good response, and by the end of May 2009, 10,000 people are said to have carpooled in the city.

There have been efforts to improve the energy efficiency of transport systems in Indian cities, including by introducing performance standards for private automobiles or by banning particularly polluting older cars. The city of Kolkata, for example, passed a law in 2009/10 phasing out vehicles over 15 years old with the purpose of reducing air pollution in the city. However, the distributional effects were mixed. On the one hand, poorer urban residents are more likely to see public health improvements from better air quality, since they are more likely to live in polluted areas and work outdoors than richer urban residents. On the other hand, drivers of such vehicles suffered from losing their livelihoods as a result of this environmental regulation.

Utility vehicles

The first utility vehicle in India was manufactured by Mahindra. It was a copy of the original Jeep and was manufactured under licence. The vehicle was an instant hit and made Mahindra one of the top companies in India. The Indian Army and police extensively use Mahindra vehicles along with Maruti Gypsies for transporting personnel and equipment.

Tata Motors, the automobile manufacturing arm of the Tata Group, launched its first utility vehicle, the Tata Sumo, in 1994. The Sumo, owing to its then-modern design, captured a 31% share of the market within two years. The Tempo Trax from Force Motors till recently was ruling the rural areas. Sports utility vehicles now form a sizeable part of the passenger vehicle market. Models from Tata, Honda, Hyundai, Ford, Chevrolet and other brands are available.

Taxis in India

Most of the taxicabs in Kolkata and Mumbai are either Premier Padmini or Hindustan Ambassador cars. In rest of cities all modern cars are available, However, with app based taxi services like Uber coming to India as well as homegrown Indian app based taxi services like Ola coming to the fore, taxicabs now include Sedans, SUVs and even motorcycle taxis. Depending on the city/state, taxis can either be hailed or hired from taxi-stands. In cities such as Bangalore, Chennai, Hyderabad and Ahmedabad, taxis need to be hired over phone, whereas in cities like Kolkata and Mumbai, taxis can be hailed on the street. According to government of India regulations, all taxis are required to have a fare-meter installed. There are additional surcharges for luggage, late-night rides and toll taxes are to be paid by the passenger. Since 2006, radio taxis have become increasingly popular with the public due to reasons of safety and convenience.

In cities and localities where taxis are expensive or do not ply as per the government or municipal regulated fares, people use share taxis. These are normal taxis which carry one or

more passengers travelling to destinations either on one route to the final destination, or near the final destination. The passengers are charged according to the number of people with different destinations. The city of Mumbai will soon be the first city in India, to have an "in-taxi" magazine, titled MumBae, which will be issued to taxis which are part of the Mumbai Taximen's Union. The magazine debuted on 13 July 2009. In Kolkata, there are many no refusal taxi available with white and blue in colour.

Auto rickshaw

An auto is a three-wheeler vehicle for hire that does not have doors and is generally characterised by a small cabin for the driver in the front and a seat for passengers in the rear. Generally it is painted in yellow, green or black colour and has a black, yellow or green canopy on the top, but designs vary considerably from place to place. The color of the autorickshaw is also determined by the fuel that it is powered by, for example Agartala, Ahmedabad, Mumbai, Pune and Delhi have green or black autos indicating the use of compressed natural gas(CNG), whereas the autos of Kolkata, Bangalore, Hyderabad have green autos indicating the use of LPG.

In Mumbai and other metropolitan cities, 'autos' or 'rickshaws' as they are popularly known have regulated metered fares. A recent law prohibits auto rickshaw drivers from charging more than the specified fare, or charging night-fare before midnight, and also prohibits the driver from refusing to go to a particular location. Mumbai and Kolkata are also the only two cities which prohibit auto rickshaws from entering a certain part of the city, in these cases being South Mumbai and certain parts of Downtown Kolkata. However, in cities like Chennai, it is common to see autorickshaw drivers demand more than the specified fare and refuse to use fare meter.

Airports and railway stations at many cities such as Howrah, Chennai and Bangalore provide a facility of prepaid auto booths, where the passenger pays a fixed fare as set by the authorities for various locations.

Electric rickshaw is new popular means of transport, rapidly growing in number in India, due to low running and initial cost, other economic and environment benefits, these vehicles are becoming popular in India. E-Rickshaws are made in fiberglass or metal body, powered by a BLDC Electric Motor with max power 2000W and speed 25 km/h.

Rail transport in India and Indian Railways

Country-wide rail services in India, are provided by the state-run Indian Railways under the supervision of the Ministry of Railways. IR is divided into eighteen zones including the Kolkata Metro Railway. The IR are further sub-divided into sixty seven divisions, each having a divisional headquarters.

The railway network travels through the length and breadth of the country, covering more than 7,000 stations over a total route length of more than 65,000 km (40,000 mi) and track length of about 115,000 km (71,000 mi). About 22,224 km (13,809 mi) or 34% of the route-kilometre was electrified as on 31 March 2012. IR provides an important mode of transport in India, transporting over 18 million passengers and more than 2 million tons of freight daily across one of the largest and busiest rail networks in the world.^[101] IR is the world's largest commercial or utility employer, with more than 1.4 million employees. As to rolling stock, IR owns over 200,000 (freight) wagons, 50,000 coaches and 8,000 locomotives. It also

owns locomotive and coach production facilities. It operates both long distance and suburban rail systems on a network of broad gauge.

The IR runs a number of special types of services which are given higher priority. The Rajdhani trains introduced in 1969 provides connectivity between the national capital, Delhi and capitals of the states. On the other hand, Shatabdi Express provides connectivity between centres of tourism, pilgrimage or business. The Shatabdi Express trains run over short to medium distances and do not have sleepers while the Rajdhani Expresses run over longer distances and have only sleeping accommodation. Both series of trains have a maximum permissible speed of 110 to 140 km/h (81 to 87 mph) but average speed of less than 100 km/h. The Duronto Express (without any commercial stop between the origin and the destination but with a few technical stops for crew change and food intake) and Garib Raths express that provide cheap no-frill airconditioned rail travel.

Besides, the IR also operates a number of luxury trains which cater to various tourist circuits. For instance, the Palace on Wheels serves the Rajasthan circuit and The Golden Chariot serves the Karnataka and Goa circuits. There are two UNESCO World Heritage Sites on IR, the Chhatrapati Shivaji Maharaj Terminus and the Mountain railways of India. The latter consists of three separate railway lines located in different parts of India, the Darjeeling Himalayan Railway, a 610 mm (2 ft) narrow gauge railway in Lesser Himalayas in West Bengal, the Nilgiri Mountain Railway, a 1,000 mm (3 ft 3 ³/₈ in) metre gauge rack railway in the Nilgiri Hills in Tamil Nadu and the Kalka-Shimla Railway, a 762 mm (2 ft 6 in) narrow gauge railway in the Siwalik Hills in Himachal Pradesh.

In India, freight (goods) trains can carry standard containers double-stacked on flat-bed wagons with normal axle load of about 22 tonnes and do not require special low-bed wagons unlike in other countries that have (relatively narrow) 1,435 mm (4 ft 8 ¹/₂ in) standard gauge. They carry almost 4000 tonnes per rake which is almost twice the load a normal goods train can haul. Some double-stacked container freight trains on the route through Rewari station also carry "high cube" containers that are 2896 mm (9 ft 6-inch) high (higher than standard containers that are generally 8 ft or 2.438 mm high) on special low-well wagons owned by private clients. Some private logistics operators have built container storage yards north of Rewari near Garhi Harsaru for this purpose.

In 1999, the Konkan Railway Corporation introduced the Roll on Roll off (RORO) service, a unique road-rail synergy system, on the section between Kolad in Maharashtra and Verna in Goa, which was extended up to Surathkal in Karnataka in 2004. The RORO service, the first of its kind in India, allowed trucks to be transported on flatbed trailers. It was highly popular, carrying about 110,000 trucks and bringing in about ₹ 740 million worth of earnings to the corporation till 2007.

Urban rail transit in India

The first modern rapid transit in India is the Kolkata Metro which started its operations in 1984 as the 17th Zone of the Indian Railways. The Delhi Metro in New Delhi is India's second conventional metro and began operations in 2002. The Namma Metro in Bangalore is India's third operational rapid transit and began operations in 2011.

The operational systems are Kolkata Metro, Delhi Metro, Namma Metro, Rapid Metro, Mumbai Metro, Jaipur Metro, Chennai Metro, Kochi Metro, Lucknow Metro, Nagpur Metro and Hyderabad Metro.

The planned systems are Noida Metro, Ghaziabad Metro, Navi Mumbai Metro, Nagpur Metro, Metro-Link Express for Gandhinagar and Ahmedabad, Varanasi Metro, Kanpur Metro, Bareilly Metro, Pune Metro, Vijayawada Metro, Patna Metro, Meerut Metro, Guwahati Metro, Chandigarh Metro, Bhopal Metro, Kozhikode Light Metro, Indore Metro, Thiruvananthapuram Light Metro, Agra Metro, Coimbatore Metro, Visakhapatnam Metro, Surat Metro, Srinagar Metro, Greater Gwalior Metro, Jabalpur Metro, Greater Nashik Metro and Bengaluru Metro

Currently, rapid transit is under construction or in planning in several major cities of India and will be opened shortly.

Aviation in India

Directorate General of Civil Aviation is the national regulatory body for the aviation industry. It is controlled by the Ministry of Civil Aviation. The ministry also controls aviation related autonomous organisations like the Airports Authority of India (AAI), Bureau of Civil Aviation Security (BCAS), Indira Gandhi Rashtriya Uran Akademi and Public Sector Undertakings including Air India, Pawan Hans Helicopters Limited and Hindustan Aeronautics Limited.

Air India is India's national flag carrier after merging with Indian (airline) in 2011 and plays a major role in connecting India with the rest of the world. IndiGo, Air India, Spicejet and GoAir are the major carriers in order of their market share. These airlines connect more than 80 cities across India and also operate overseas routes after the liberalisation of Indian aviation. Several other foreign airlines connect Indian cities with other major cities across the globe. However, a large section of country's air transport potential remains untapped, even though the Mumbai-Delhi air corridor was ranked the world's tenth busiest route by Amadeus in 2012.

Airports in India

While there are 346 civilian airfields in India – 253 with paved runways and 93 with unpaved runways, only 132 were classified as "airports" as of November 2014. Of these, Indira Gandhi International Airport in Delhi is the busiest in the country. The operations of the major airports in India have been privatised over the past five years and this has resulted in better equipped and cleaner airports. The terminals have either been refurbished or expanded.

India also has 33 "ghost airports," which were built in an effort to make air travel more accessible for those in remote regions but are now non-operational due to a lack of demand. The Jaisalmer Airport in Rajasthan, for example, was completed in 2013 and was expected to host 300,000 passengers a year but has yet to see any commercial flights take off. Despite the number of non-operational airports, India is currently planning on constructing another 200 "low-cost" airports over the next 20 years.

Length of runways	Airports with paved runways ^[139]	Airports with unpaved runways ^[139]
3,047 m (10,000 ft) or more	21	1
2,438 to 3,047 m (8,000 to 10,000 ft)	59	3
1,524 to 2,438 m (5,000 to 8,000 ft)	76	6
914 to 1,524 m (3,000 to 5,000 ft)	82	38
Under 914 m (3,000 ft)	14	45
Total	253	93

Heliports

As of 2013, there are 45 heliports in India. India also has the world's highest helipad at the Siachen Glacier at a height of 6400 m (21,000 ft) above mean sea level.

Pawan Hans Helicopters Limited is a public sector company that provides helicopter services to ONGC to its off-shore locations, and also to various State Governments in India, particularly in North-east India.

Water transport in India

India has a coastline of 7,517 km (4,671 mi), and thus ports are the main centres of trade.

India also has an extensive network of inland waterways.

Shipping Corporation of India and Ports in India

In India about 96% of the foreign trade by quantity and 70% by value takes place through the ports. Mumbai Port & JNPT(Navi Mumbai) handles 70% of maritime trade in India.^[150] There are twelve major ports: Navi Mumbai, Mumbai, Kochi, Kolkata (including Haldia), Paradip, Visakhapatnam, Ennore, Chennai, Thoothukudi, New Mangaluru, Mormugao and Kandla. Other than these, there are 187 minor and intermediate ports, 43 of which handle cargo.

Maritime transportation in India is managed by the Shipping Corporation of India, a government-owned company that also manages offshore and other marine transport infrastructure in the country. It owns and operates about 35% of Indian tonnage and operates in practically all areas

of shipping business servicing both national and international trades. The only Indian state with three ports is Tamil Nadu, they are Ennore, Chennai and Tuticorin.

It has a fleet of 79 ships of 2,750,000 GT (4.8 million DWT) and also manages 53 research, survey and support vessels of 120,000 GT (060,000 DWT) on behalf of various government departments and other organisations. Personnel are trained at the Maritime Training Institute in Mumbai, a branch of the World Maritime University, which was set up in 1987. The Corporation also operates in Malta and Iran through joint ventures.

The distinction between major and minor ports is not based on the amount of cargo handled. The major ports are managed by port trusts which are regulated by the central government. They come under the purview of the Major Port Trusts Act, 1963. The minor ports are regulated by the respective state governments and many of these ports are private ports or captive ports. The total amount of traffic handled at the major ports in 2005–2006 was 382.33 Mt.

Inland Waterways Authority of India

India has an extensive network of inland waterways in the form of rivers, canals, backwaters and creeks. The total navigable length is 14,500 kilometres (9,000 mi), out of which about 5,200 km (3,231 mi) of river and 485 km (301 mi) of canals can be used by mechanised crafts. Freight transport by waterways is highly underutilised in India compared to other large countries. The total cargo moved by inland waterways is just 0.15% of the total inland traffic in India, compared to the corresponding figures of 20% for Germany and 32% for Bangladesh.

Cargo that is transported in an organised manner is confined to a few waterways in Goa, West Bengal, Assam and Kerala. The Inland Waterways Authority of India (IWAI) is the statutory authority in charge of the waterways in India. It does the function of building the necessary infrastructure in these waterways, surveying the economic feasibility of new projects and also administration and regulation. The following waterways have been declared as National Waterways:

- National Waterway 1: Allahabad–Haldia stretch of the Ganga – Bhagirathi – Hooghly River system with a total length of 1,620 kilometres (1,010 mi) in 27 October 1986.
- National Waterway 2: Saidiya–Dhubri stretch of the Brahmaputra river system with a total length of 891 kilometres (554 mi) in 26 Oct 1988.
- National Waterway 3: Kollam–Kottapuram stretch of the West Coast Canal along with Champakara and Udyogmandal canals, with a total length of 205 kilometres (127 mi) in 1 Feb 1991.
- National Waterway 4: Bhadrachalam–Rajahmundry and Wazirabad–Vijaywada stretch of the Krishna–Godavari river system along with the Kakinada–Pondicherry canal network, with a total length of 1,095 km (680 mi) in 24 Nov 2008.
- National Waterway 5: Mangalgadi–Paradeep and Talcher–Dhamara stretch of the Mahanadi–Brahmani river system along with the East Coast Canal, with a total length of 623 km (387 mi) in 24 Nov 2008.

Pipelines

Oil and gas industry in India imports 82% of its oil needs and aims to bring that down to 67% by 2022 by replacing it with local exploration, renewable energy and indigenous ethanol fuel.

Length of pipelines for crude oil is 20,000 km (12,427 mi).

Length of Petroleum products pipeline is 15,000 kilometres (9,300 mi).

Logistics

Logistics in India ranking moved up to 35th place in 2016 from 54th in 2014 on World Bank's Global Logistics Performance Index. Government strategy aims to raise the share of global trade in India's GDP (US\$2.7 trillion in FY 2017–18) to 40%, including half of it (20% of GDP) from exports. Cost of logistics in India is 14% of GDP, which is higher than the developed nations, and government reforms aim to bring it down to 10% of GDP by 2022. Ministry of Commerce and Industry has created a new dedicated centralised Logistics division in collaboration with Singapore and Japan to handle the logistics which was earlier handled by several different ministries, such as railways, roads, shipping and aviation. To boost exports, each state will have exports and logistic policy and Nodal officers will be appointed at district level. There are 64 transactions and 37 government agencies in the end-to-end production-to-export process. To further improve the ranking, improve speed of logistics, ease of doing business and reduce the cost of logistics, India is creating a "common online integrated logistics e-marketplace portal" that will cover all transactions in production and export, connect buyers with logistics service providers and government agencies such as the customs department Iccgate system, Port Community Systems, Sea and Air Port terminals, Shipping lines, Railways, etc.

As part of the US\$125 billion port-led development project Sagarmala, government will define the regulatory framework for the Indian logistics operational standards by benchmarking India's 300 dry ports logistics parks (inland container depots or ICDs) to the top 10 logistics international best practices nations to boost exports, remove supply chain bottle necks, reduce transaction costs, optimise logistics mix, set up new hub-and-spoke dry ports (c. Jan 2018). To reduce the logistics costs by 10% and CO2 emissions by 12%, the government is also developing 35 new "Multimodal Logistics Parks" (MMLPs) on 36 ring roads, which will facilitate 50% of the freight moved in India. Land has been earmarked and pre-feasibility study is underway for 6 of these MMLPs.
