

# TRANSPORTATION

## Speed and efficiency through technological advancement



### The Shinkansen bullet train

The "Hayabusa" bullet train, which runs between Tokyo and Aomori, has a top speed 320km/hr. (Photo courtesy of Railman Photo Office)

## Railways

Passenger service began in 1872, with a steam locomotive that linked Shimbashi station, in Tokyo, to the nearby city of Yokohama, thereby setting the stage for what was to become a nationwide rail network. It took 17 more years to link by rail the main cities along the old Tokaido (Eastern Sea Route), so that in July 1889 one could travel the entire way from Tokyo to Osaka by train. A single departure per day made the 515-kilometer (320-mile) journey in 20 hours. The successive introduction of diesel and electric trains shortened the time on this heavily traveled

route to under 7 hours, and the Shinkansen (bullet train) eventually reduced the journey to under 3 hours.

Until it was privatized and split into separate regional companies in 1987, the Japan National Railways (JNR) operated a nationwide passenger and freight rail network. Successors of JNR presently include the six passenger railway companies of the JR (Japan Railway) group, a freight railway company, and several affiliated companies.

The total rail system, including the JR group and other railway companies, comprises 27,603 operation kilometers. In 2013, the system transported 23.04 billion passengers.



Japan's four main islands were at last joined by railway in 1988 when the undersea Seikan Tunnel linked Honshu to the northern island of Hokkaido and the Seto Ohashi Bridge linked Honshu to the island of Shikoku.

Along with the development of automobile and air transportation, important railway services have gradually shifted to long-distance intercity transport, such as the Shinkansen, and commuter lines. Commuter lines carry people from their homes in the suburbs back and forth to work and school. Because of high land prices, many people have moved to the suburbs in search of affordable housing. More than 70% of office workers now commute aboard trains, and those trains are often packed to overflowing, although the level of congestion at peak commuter hours on the principal lines in the Tokyo area has fallen to 180% of normal capacity since peaking in 1965.

Nine cities in Japan currently operate subway systems. The total length of Japan's subway lines in operation stood at 857 km as of March 2011. The first to be constructed, a section of Tokyo's Ginza line, began operation in 1927. There are 13 subway lines in Tokyo, and they currently carry more than 7 million passengers per day. Many of the subway lines also link up with commuter lines and extend their service to the suburbs.

Japan continues to recognize the many advantages of rail transport, including its convenience, energy efficiency, low pollution, and safety. In large metropolitan areas railways play a major transportation role and have an extremely large passenger population. Consequently, JR and the private railway companies continue to build new lines and increase capacity by adding tracks to existing lines. Railway system expansion is also being promoted through system diversification, with the addition of monorails and other types of railway technology. Railway companies are making a strong effort to increase the convenience of transfers and to improve station access for elderly and handicapped persons through the installation of elevators and escalators.

## The Shinkansen

The Shinkansen is a high-speed railway system consisting of six regular lines: the Tokaido Shinkansen, Sanyo Shinkansen, Tohoku Shinkansen, Joetsu Shinkansen, Hokuriku Shinkansen (currently travels as far as Nagano), and Kyushu Shinaksen, for which trains run only on special Shinkansen tracks; as well as two lines usually referred to as "mini-Shinkansen" lines, where the trains run both on Shinkansen tracks and standard local tracks: the Akita Shinkansen and Yamagata Shinkansen. This extensive network of high-speed trains exceeding 300 kilometers per hour (186 MPH) connects Japan's major cities, stretching from Aomori on the northernmost point of the island of Honshu all the way down to Kagoshima on the southernmost point of Kyushu. The addition of several other Shinkansen lines has been planned since 1973, and construction continues on some sections of those lines.

The Tokaido Shinkansen serves the 500-kilometer (311-mile) Tokyo-Osaka corridor that has long been considered the main artery of Japan. This line runs at a maximum speed of 270 kilometers per hour, and the minimum trip time between Tokyo and Osaka is now 2 hours 25 minutes. Since it was inaugurated in 1964, the Shinkansen has had a remarkable record of high-speed operation, safety, volume of transport, and punctuality. As many as 14 trains every hour run in each direction on a single line, while train delays average between just 0.6 and 1.0 minutes. Moreover, not a single fatal accident has occurred from a collision or derailling on a Shinkansen line since operations began, setting an amazing record for safety.

Development has also been proceeding on a new type of Shinkansen based on linear motor technology. This train levitates above its track using magnetic energy and is capable of reaching maximum speeds over 550 kilometers per hour (342 MPH).



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## Motor Vehicles

As of April 2012 Japan had 1,212,660 kilometers of roads. It was in 1899 that Japan imported its first automobile. Motor vehicle production by Japanese manufacturers began in 1902. Although commercial vehicles and public transport crowded the nation’s city streets following their introduction, it was not until the 1960s that private car ownership began to increase rapidly. Three factors made this possible: rapid growth in income brought on by economic development, the emergence of a domestic automotive industry geared to the specific needs of the local market (small-sized, fuel-efficient vehicles), and improvement in roads. Between 1960 and 2000, the number of registered motor vehicles grew from 1.9 million to over 52 million. Two-car families have become common, and the number of trucks in use by commercial transport and delivery services has continued to increase.

Construction of expressways (toll roads) began in the 1960s. The first to be completed was the Meishin Expressway, linking Nagoya to Kobe, in 1965. It was soon linked to Tokyo via the Tomei Expressway.

The Kan’etsu, Tohoku, Joban, and other long-distance expressways have followed over the past several decades. A 162 km expressway portion between the Gotemba and Mikkabi junctions was opened to traffic on April 14, 2012. It was the longest stretch opened to traffic at one time in Japanese road history. Tokyo and other major urban areas maintain a comprehensive and ever-expanding network of expressways linking downtown areas to the suburbs.

Expressway construction in Japan has faced many challenges: the nature of the terrain, high concentrations of factories and housing, high land prices along the routes, and added reinforcement needed to withstand earthquakes. Construction costs are the world’s highest, and for this reason expressway tolls are proportionately high. Nevertheless, expressways are in extensive use. During fiscal 2012, the average daily traffic flow between Tokyo and Komaki (near Nagoya in Aichi Prefecture), was 422,788 automobiles.

The frequent traffic jams on metropolitan roads are a major problem. In Tokyo, an extensive system of expressways and roads radiates out from the center of the city, but delays in the building of loop lines have contributed to chronic traffic congestion.

Traffic safety has been a national issue since the 1960s. In 1970, the year the Traffic Safety Act went into effect, more than 16,000 people died in road-traffic accidents. However, by 2012 the number had fallen to 4,411, less than one-third of the 1970 total.

Air pollution from motor vehicle emissions, including both exhaust gasses (nitrogen oxide, etc.) and the particulate matter emitted by diesel engines, is a serious problem in large metropolitan areas. Consequently, the government has placed strict legal controls on vehicle emissions and the sulfur content of fuels.

## Air Transportation

From the end of World War II until 1951, the Japanese government was deprived of its authority to permit passenger airlines by SCAP (Supreme Commander of the Allied Powers). International and domestic airlines, therefore, didn't start until 1953.

Currently, there are nearly 100 airports nationwide, of which the Tokyo International Airport, commonly referred to as Haneda Airport, boasts of the greatest number of passengers in Japan. Haneda Airport opened in 1931 as Japan's first commercial airport. It served as both as a domestic and an international airport until 1978, when the New Tokyo International Airport opened in Narita. From that time Haneda Airport was mainly used for domestic flights, but in 2010, after a fourth runway came into use, it began offering a variety of flights to foreign destinations as well, including not only Asian cities such as Seoul, Shanghai, and Hong Kong, but also major cities in Europe and the United States such as Los Angeles, New York, and Paris.

New Tokyo International Airport, also known as Narita Airport, is located some 66 kilometers (41 miles) east of Tokyo. Since its opening in 1978, Narita Airport has been the embarkation point for many overseas passengers. The number of the airport's flights is set to increase after the extension of a runway in 2010. And the airport is more convenient than ever now that the new Sky Access train makes it possible to travel from Narita to the center of Tokyo in just 36 minutes.

Osaka International Airport is also called Itami Airport. It handled most domestic and all international flights to the Kansai region until the opening of Kansai International Airport in September 1994. It is now used mainly for domestic flights.

Kansai International Airport is on an artificial island in Osaka Bay. In addition to providing expanded service and access by a greater number of international carriers, this airport is Japan's first 24-hour facility.

The number of landings and departures totaled 128,729 in 2012. The airport is equipped with state-of-the-art technology, including a system to automatically turn off air conditioning when travelers are not in the building, as well as a "jack-up system" that gauges the settlement of the building and then makes height adjustments to prevent unequal settlement.

Chubu Centrair International Airport opened in February 2005. Located on an artificial island in Ise Bay, it is the principal airport for the city of Nagoya. The airport is designed to be easily accessible by everyone, regardless of age or physical disability, incorporating universal design elements such as a design that allows travelers to proceed from the train platform to the arrival or departure lobby without changing floors.

In 2012, three Japanese low-cost carriers (LCCs) began to operate domestic flights after having operated international flights for some time.

## Maritime Transportation

In order to boost the competitiveness of ports in Japan, six ports (Tokyo, Yokohama, Nagoya, Yokkaichi, Osaka, and Kobe) were designated as "super-hub ports" in 2004. Efforts are being made to improve services and cut costs, while equipping the ports with container terminals and innovative logistics systems.

Ports in Japan are also focusing on environmental measures, and in 2011, 22 ports nationwide have been designated "recycle ports" with an aim to efficiently circulate recyclable resources using bulk transport ships that have a low impact on the environment. The designated ports have made it possible, in an integrated manner, to receive recycled materials, process them, and dispose of the residue.

Nine ports in Japan, such as the Kagoshima and Beppu ports, have been equipped with passenger terminals to attract more international cruise ship lines.