



TGV

The **TGV** (French: [teʒev][ⓘ]; *train à grande vitesse*, [tʁɛ̃ a ɡʁɑ̃d vitɛs][ⓘ], 'high-speed train')^[a] is France's intercity high-speed rail service. With commercial operating speeds of up to 320 km/h (200 mph) on the newer lines,^[1] the TGV was conceived at the same period as other technological projects such as the Ariane 1 rocket and Concorde supersonic airliner; sponsored by the Government of France, those funding programmes were known as *champion national* ('national champion') policies. In 2023 the TGV network in France carried 122 million passengers.^[2]

The state-owned SNCF started working on a high-speed rail network in 1966. It presented the project to President Georges Pompidou in 1974 who approved it. Originally designed as turbotrains to be powered by gas turbines, TGV prototypes evolved into electric trains with the 1973 oil crisis. In 1976 the SNCF ordered 87 high-speed trains from Alstom. Following the inaugural service between Paris and Lyon in 1981 on the LGV Sud-Est, the network, centred on Paris, has expanded to connect major cities across France, including Marseille, Lille, Bordeaux, Strasbourg, Rennes and Montpellier, as well as in neighbouring countries on a combination of high-speed and conventional lines. The success of the first high-speed service led to a rapid development of *lignes à grande vitesse* (LGVs, 'high-speed lines') to the south (Rhône-Alpes, Méditerranée, Nîmes–Montpellier), west (Atlantique, Bretagne-Pays de la Loire, Sud Europe Atlantique), north (Nord, Interconnexion Est) and east (Rhin-Rhône, Est). Since it was launched, the TGV has not recorded a single passenger fatality in an accident on normal, high-speed service.

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TGV 2N2 at Gare de l'Est in Paris, 2013

Overview

Locale

- France, with services extending to Belgium, Luxembourg, Germany, Switzerland, Monaco, Italy, Spain and the Netherlands
- Technology exported for Al Boraq in Morocco
- Derivative versions operated by Eurostar and national companies in South Korea, Spain and the US

Dates of operation

1981–present

Technical

Track gauge

1,435 mm (4 ft 8½ in) (standard gauge)

Other

Website

www.groupe-sncf.com/en (<https://www.groupe-sncf.com/en>)

A specially modified TGV high-speed train known as Project V150, weighing only 265 tonnes, set the world record for the fastest wheeled train, reaching 574.8 km/h (357.2 mph) during a test run on 3 April 2007.^[3] In 2007, the world's fastest scheduled rail journey was a start-to-stop average speed of 279.4 km/h (173.6 mph) between the Gare de Champagne-Ardenne and Gare de Lorraine on the LGV Est,^{[4][5]} not surpassed until the 2013 reported average of 283.7 km/h (176.3 mph) express service on the Shijiazhuang to Zhengzhou segment of China's Shijiazhuang–Wuhan high-speed railway.^[6] During the engineering phase, the transmission voie-machine (TVM) cab-signalling technology was developed, as drivers would not be able to see signals along the track-side when trains reach full speed. It allows for a train engaging in an emergency braking to request within seconds all following trains to reduce their speed; if a driver does not react within 1.5 km (0.93 mi), the system overrides the controls and reduces the train's speed automatically. The TVM safety mechanism enables TGVs using the same line to depart every three minutes.^{[7][8]}



The TGV system itself extends to neighbouring countries, either directly (Italy, Spain, Belgium, Luxembourg and Germany) or through TGV-derivative networks linking France to Switzerland (Lyria), to Belgium, Germany and the Netherlands (former Thalys), as well as to the United Kingdom (Eurostar). Several future lines are under construction or planned, including extensions within France and to surrounding countries. The Mont d'Ambin Base Tunnel, part of the LGV Lyon–Turin that is currently under construction, is set to become the longest rail tunnel in the world. Cities such as Tours and Le Mans have become part of a "TGV commuter belt" around Paris; the TGV also serves Charles de Gaulle Airport and Lyon–Saint-Exupéry Airport. A visitor attraction in itself, it stops at Disneyland Paris and in southern tourist cities such as Avignon and Aix-en-Provence as well. Brest, Chambéry, Nice, Toulouse and Biarritz are reachable by TGVs running on a mix of LGVs and modernised lines. In 2007, the SNCF generated profits of €1.1 billion (approximately US\$1.75 billion, £875 million) driven largely by higher margins on the TGV network.^{[9][10]}

History

The idea of the TGV was first proposed in the 1960s, after Japan had begun construction of the Shinkansen in 1959. At the time the Government of France favoured new technology, exploring the production of hovercraft and the Aérotrain air-cushion vehicle. Simultaneously, the SNCF began researching high-speed trains on conventional tracks. In 1976, the administration agreed to fund the first line. By the mid-1990s, the trains were so popular that SNCF president Louis Gallois declared that the TGV was "the train that saved French railways".^[11]

Development

It was originally planned that the TGV, then standing for *très grande vitesse* ('very high speed') or *turbine grande vitesse* ('high-speed turbine'), would be propelled by gas turbines, selected for their small size, good power-to-weight ratio and ability to deliver high power over an extended period. The first prototype, TGV 001, was the only gas-turbine TGV: following the increase in the price of oil during the 1973 energy crisis, gas turbines were deemed uneconomic and the project turned to electricity from overhead lines, generated by new nuclear power stations.

TGV 001 was not a wasted prototype:^[12] its gas turbine was only one of its many new technologies for high-speed rail travel. It also tested high-speed brakes, needed to dissipate the large amount of kinetic energy of a train at high speed, high-speed aerodynamics, and signalling. It was articulated, comprising two adjacent carriages sharing a bogie, allowing free yet controlled motion with respect to one another. It reached 318 km/h (198 mph), which remains the world speed record for a non-electric train. Its interior and exterior were styled by French designer Jacques Cooper, whose work formed the basis of early TGV designs, including the distinctive nose shape of the first power cars.

Changing the TGV to electric traction required a significant design overhaul. The first electric prototype, nicknamed Zébulon, was completed in 1974, testing features such as innovative body mounting of motors, pantographs, suspension and braking. Body mounting of motors allowed over 3 tonnes to be eliminated from the power cars and greatly reduced the unsprung weight. The prototype travelled almost 1,000,000 km (621,371 mi) during testing.

In 1976, the French administration funded the TGV project, and construction of the LGV Sud-Est, the first high-speed line (French: *ligne à grande vitesse*), began shortly afterwards. The line was given the designation LN1, *Ligne Nouvelle 1* ('New Line 1'). After two pre-production trainsets (nicknamed *Patrick* and *Sophie*) had been tested and substantially modified, the first production version was delivered on 25 April 1980.

Service

The TGV opened to the public between Paris and Lyon on 27 September 1981. Contrary to its earlier fast services, SNCF intended TGV service for all types of passengers, with the same initial ticket price as trains on the parallel conventional line. To counteract the popular misconception that the TGV would be a premium service for business travellers, SNCF started a major publicity campaign focusing on the speed, frequency, reservation policy, normal price, and broad accessibility of the service.^[13] This commitment to a democratised TGV service was enhanced in the Mitterrand era with the



Europe's high-speed rail system, including TGV lines in France



TGV Sud-Est (left), the first equipment used on the service; and TGV 2N2 (right), the newest equipment used on the service, at Gare de Lyon, 2019