



UNDER THE HIGH PATRONAGE OF HIS MAJESTY KING MOHAMMED VI



# HIGH-SPEED RAIL

*The Right Speed For Our Planet*



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## WHY A WORLD CONGRESS ON HIGH SPEED RAIL ?

The UIC chose the Kingdom of Morocco to host the UIC World Congress on High Speed Rail in 2023, reflecting its position in the field of high speed rail in Africa and the Middle East.

The 11th edition of the Congress, to be held from 7 to 10 March 2023 at the Palais des Congrès in Marrakech, Morocco, under the aegis of the UIC and the ONCF, will bring together all the global players in high-speed rail.

Adopting the slogan High-speed rail: the right speed for our planet, the Congress will focus on the contribution of rail to the fight against climate change and its role in territorial development.

### What is the UIC World Congress on High Speed Rail ?

- World's largest congress on high-speed rail ;
- More than 1500 m<sup>2</sup> of exhibition presenting the best of the railway industry ;
- A four-day event : three days of conferences bringing together experts, researchers and rail professionals from around the world and a day of exceptional technical visits ;
- Cultural and entertainment events.

### Why is the UIC World Congress on High Speed Rail unique ?

- The event brings together more than 1,500 participants from 40 countries ;
- It provides a forum for high-speed rail policy makers ;
- It takes place in the prestigious city of Marrakech in Morocco.

### Marrakech, the magic of a place !

Marrakech, jewel of the most ancestral imperial cities of the Kingdom of Morocco, has more than ten centuries of history. Born in 1062 of the will of the valiant king Almoravid, Youssef ben Tachafine and his sweet and brilliant wife Zaynab Nafzaouia, she sees succeeding dynasties Almohades, Bénimérines, Wattassides until the advent of the Alawites. Nestled at the foot of the Atlas Mountains, draped in a shimmering ochre colour, Marrakech has seduced its visitors since the dawn of time with its subtle fragrances of jasmine, verbena, orange and almond blossoms. Writers, artists, intellectuals of all kinds and from all horizons find in the charms of the ochre city unparalleled sources of inspiration.

A veritable treasure trove of atmospheres conducive to the world of the arts, several celebrities have made it their home while giving birth to a beautiful work or living a beautiful chapter of their life : Henri Matisse, Jacques Majorelle, Colette, Joséphine Baker, Edith Piaf... Marrakech the « beloved », as Winston Churchill called it, knows how to welcome everyone, in the pure tradition of the Moroccan art de vivre and offer him a parenthesis of sweets and dreams to the flavors of the thousand and one night.



Marrakech is also, the « Venice of Morocco, a place out of time » as the famous couturier Yves St Laurent liked to call it is also the crossroads of a thousand flavors, between a glorious past and a promising future, both authentic and cosmopolitan, it fills with lush beauty the dreams of adventure and the deepest desires of life. Combining modernity and historical heritage, Marrakech succeeds with great pride in Philadelphia, Tokyo and Ankara to warmly welcome the participants of the next UIC congress on high speed rail.

### **An exceptional event**

The World Congress on High Speed Rail is an UIC event held every 2-3 years. The Congress has been successfully held ten times since its first edition in 1992, and it is now recognized worldwide as the world's largest high-speed rail event. It targets both the operation of high-speed rail and technological issues.

Participants include representatives of international railway organizations, government officials, leaders of leading railway companies, experts, senior managers specialized in high-speed rail, researchers, academics, etc. The congress will examine the current development of high-speed trains in the world and the latest technologies in this field. This event will also be the ideal place for dialogue and exchange between the countries concerned by high-speed rail and will define the direction of future research and development on this subject.

The congress will be structured around three main blocks : round tables and parallel sessions, where participants can have in-depth discussions and exchanges on the latest technologies and achievements in planning, construction, technology and equipment, operational management and safety of high-speed trains, etc. One full day will be devoted to technical visits.

### **A FEW WORDS ABOUT UIC (WORLD RAILWAY ORGANIZATION)**

The UIC is the world organization for the promotion of rail transport and the collaborative development of the rail system. It brings together some 200 members from 5 continents, including railway operators, infrastructure managers, railway service providers, etc. The UIC maintains close cooperation links with all players in the iron transport sector throughout the world, in particular industrialists, other railway associations, public authorities and other stakeholders outside the railways whose experience can be beneficial for rail development. The main purpose of the UIC is to understand the operational needs of the railway community, to develop innovation programmes to identify solutions to these needs, to prepare and publish documents such as reports, specifications, recommendations and IRS to facilitate the implementation of innovative solutions.

The Intercity and High Speed Committee is part of the Global Passenger Forum and is responsible for co-organizing the World Congress on High Speed Rail with the ONCF.



## A FEW WORDS ABOUT THE HOST COUNTRY COMPANY, THE MOROCCAN RAILWAYS (ONCF)

Created by Dahir n°1- 63 - 225 of 05 August 1963, the ONCF is a Public Industrial and Commercial Establishment (EPIC), endowed with civil personality and financial autonomy. Placed under the supervision of the Ministry of Equipment, Transport, Logistics and Water, its mission is to ensure the mass transport of passengers and goods by rail in the best conditions of security, safety, comfort, regularity, cost and sustainability. Accordingly, in accordance with Article 2 of the aforementioned Directive, the Office's purpose is to:

- Operation of the national rail network ;
- Carrying out studies, construction and operation of new railway lines ;
- The operation of all undertakings directly or indirectly related to the object of the Office.

This means that the ONCF is primarily responsible for managing railway infrastructure and operating services related to passenger and freight rail transport, and plays the role of integrator of the supply chain. Its ancillary role concerns its contribution both to the activities of urban rail transport and to complementary service undertakings likely to reinforce its main role.

To properly fulfill the ONCF's mission and satisfy its stakeholders, the NEB's employees rely on the following five values: Safety, Excellence, Transparency, Rigour and Commitment.

By 2025, the ONCF Group aims to become the national leader in sustainable mobility serving public policy, which reinvents itself in the face of its new strategic challenges.

As regards its production equipment, the ONCF has a workforce of more 7,700 employees. It manages and operates a network of approximately 2300 km of lines, including almost 200 km of high-speed line, 672 km of double track, 100 km of triple track and 1287 km of electrified conventional line (3000 Volts continuous), covering most of the most stressed axes. In addition to the high-speed line between Tangier and Kenitra, this network, which allows speeds of 160 km/h, is in the form of a corridor linking the South (Marrakech) to the East (Oujda) with antennas to Tangier, Safi, Oued Zem, El Jadida and Bou Aârf. It serves the major cities and ports of the Kingdom with the exception of Agadir and Ayoun in the south. It is also connected to the Algerian network, with similar technical characteristics to ensure the circulation of trains in good operating conditions.

Although small in size, the network has benefited in recent years from a modernization program that makes it today an efficient network: 100% Long Rail Welded (LRS), 75% electrification, 85% upgraded signalling, etc.



With respect to rolling stock, the rejuvenation efforts over the past few years, through the acquisition of new units and the rehabilitation of the existing fleet, have enabled the ONCF to build an efficient and diversified fleet. The network consists of 242 traction locomotives, 37 self-propelled locomotives, 12 Al Boraq high-speed trains, 585 passenger cars and 5,500 freight cars to run 210 passenger trains and 80 freight trains per day.

The construction of a high-speed line (HSL) has enabled Morocco to achieve significant improvements in terms of spatial planning, increased mobility, improved quality of service to passengers, and shorter distances.

As the first country on the African continent to benefit from a high-speed train, it is only natural that Morocco will host today the UIC congress on high-speed rail. WHAT ARE WE REALLY TALKING ABOUT.

## WHEN WE TALK ABOUT HIGH SPEED RAIL ?

The definition of high-speed train (TGV) remains that of a low-adhesion, based and guided transport system : it could be considered as a railway subsystem. The most important change comes from speed.

Since it was necessary to reduce travel times for commercial purposes, speed became the main factor. The TGV means a commercial speed jump and that is why the UIC considers that a commercial speed of 250 km/h is the main criterion for the definition of the TGV.

However, a secondary criterion is accepted on average distances without air competition, where it may not be relevant to drive at 250 km/h, since a speed lower than 230 or 220km/h or at least more than 200 km/h (since under this speed conventional trains can do) is enough to capture as much market share as a public transport mode can. This also applies to very long tunnels whose construction cost depends on the diameter linked to the square of the speed, at least.

For such speeds above 200 km/h, the infrastructure can be classified as «high speed» if the system in operation complies with: the track equipment, the rolling stock (generalisation of the trains), the signalling systems (abandonment of ground signals), operation (long-distance control centres), geographical or temporal separation of freight and passenger traffic, and more generally high-speed standards.

This definition is consistent with the definition of high speed rail provided by European Directive 96/48/EC. Although the increase in speed has led to many technical and operational changes, high-speed rail still meets the same quantitative and qualitative requirements as conventional rail: Ability to adapt to different contexts and cultures Interoperability, reliability, safety and security, and sustainability.

This evolution has also allowed many other innovations to be taken advantage of beyond those that simply increase speed, as there is no point in improving one aspect of the travel chain (travel time) if the other links in the chain remain weak. In addition, a thorough review of all interfaces between system components and all operating and maintenance procedures is required, because the time saved by the passenger thanks to the increase in speed can be cancelled by a ticket price too high.

## HISTORY OF MAJOR WORLD SPEED RECORDS

High Speed Rail was born in Japan in 1964... The first Japanese railway, between Shimbashi and Yokohama, opened on 12 September 1872 and was designed by British engineers with a gauge of 1.067m or 3 feet 6 inches. The Japanese railway network developed with this narrow gauge standard which considerably limits the speed of trains.

In the first part of the 20th century, the project to create a second line between Tokyo and Osaka, a section of the busiest rail network, emerged. This project was not really undertaken until after the Second World War with the idea of adopting the standard gauge. Progress in rolling stock, which is contemporary with the construction of the line, also made it possible to consider running passenger trains much faster.

Before the new line was completed, it appeared that the density of passenger traffic attracted by faster trains would be incompatible with the freight traffic to be divided between the old and new infrastructure. It was then decided to devote the whole of the new route to passenger traffic. In 1964, the standard gauge line, entirely dedicated to passenger traffic, was inaugurated with traffic reaching a record commercial speed of 210 km/h

High-speed rail was born. It had a new infrastructure, specialized in passenger traffic. It also offered a larger template than the standard template. This explains why Japanese high-speed trains rank 5 places in front compared to 4 in other countries.

Thus, high-speed rail has been associated with the specialization in infrastructure passenger traffic.... developed in Europe.

We can consider that the Direttissima Rome-Florence was the first new line project in Europe built with the will to accelerate the trains while offering more capacity. Unlike in Japan, its initially mixed operation prohibited very high speeds. Its subsequent adaptation allowed it to be classified as a high-speed line in 1988.

In 1981, the French New Line Paris-Lyon began to specialise in passenger traffic, adopting geometric characteristics incompatible with those required by freight, such as ramps and slopes of 3.5%. The idea was, since only highly motorized trains would use it, to reduce the distance travelled between Paris and Lyon by moving away from the valleys. In addition, the Commission will continue to work with the Member States to ensure that the Community and the Member States of the European Community have access to the necessary infrastructure.

This line, which was fully commissioned in 1983, covers 425 km and has no tunnel and the works of art (bridges and viaducts) represent only 2% of its length, as the allowed slopes allow to stick to the natural ground. The initial commercial speed was 260 km/h. It was rapidly increased to 270 km/h in 1985 and 300 km/h about ten years later.

Most high-speed lines have similarly adopted this principle of specialising infrastructure for high-speed passenger traffic only. In Germany, however, the first new lines were built for passenger and freight trains, but these trains never really ran simultaneously on these lines, being respectively confined in separate time intervals.

### THE WORLD'S VARIOUS HIGH-SPEED LINES

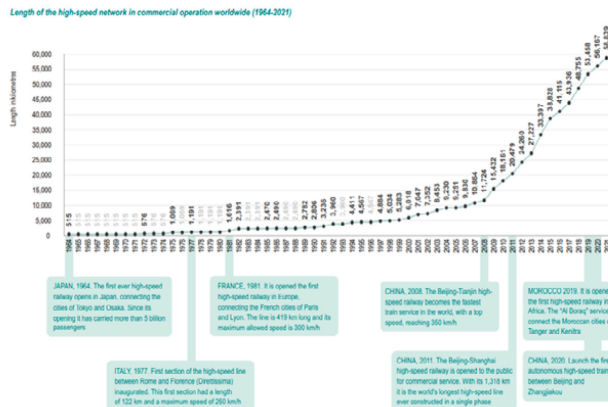
The development of High Speed Rail, which started in 1964 in Japan, was mainly driven by Japan, France, Spain, Italy and Germany until the 2000s. In 2008, thanks to heavy investments in China, the size of the entire network changed. Today, almost three-quarters of high-speed lines are in Asia.

Some countries, regions or corridors, such as Belgium, the Netherlands and Taiwan, have fully completed their high-speed networks. Some countries are still developing but have already achieved most of it, such as Spain, Italy, France, Germany and Japan.

Some countries are still planning significant extensions, such as the United Kingdom, South Korea and China.

Countries such as Saudi Arabia, Morocco, the United States and Russia have just started their development.

Finally, other countries are considering implementing high-speed rail in the future, such as several states in Eastern Europe, Africa and Asia.



## WHAT ARE THE MAIN CHALLENGES OF THE HIGH-SPEED SYSTEM TODAY ?

### High speed rail : the right speed for our planet

This slogan has a strong environmental connotation. It implies that the speed to be adopted is not necessarily the highest speed permitted by the current state of technology, but perhaps a more moderate speed that would be more environmentally friendly or more adapted to certain territories or economies.

Common sense could lead to admitting too quickly that there is an opposition between speed and respect for nature : going a little slower would save energy so it would be good for the planet.

The idea of slowing down can, moreover, appear in contradiction with the history of the railway. Every time it has been put at risk by the emergence of new competition, whether in the car or aviation sector, it is often by speeding up that it finds and sometimes develops its place on the market.

Also, this concept of “good speed” is neither intuitive nor obvious.

“The right speed for our planet” is bound to be a valid compromise at some point, in a given market, in given global economic, environmental and technological contexts. What is adapted today may not be adapted tomorrow or less. This is why the high-speed strategy must take into account the foreseeable changes in these contexts in order to make the long-term decisions that will positively guide investments made for decades and avoid false manoeuvres which would result from a too narrow vision of the future.

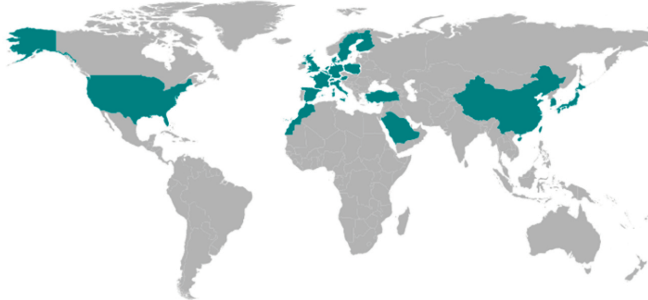
More precisely, the situation has changed and will continue to evolve because of new developments in consumer choices whose reasoning, by rational hypothesis, takes the following successive trade-offs :

- Between consuming and saving ;
- Between moving and another type of consumption ;
- Between physical and virtual displacement ;
- Between public transport, individual or private transport and semi-private transport (car sharing) ;
- Between the different means of public transport: plane, bus or train ?



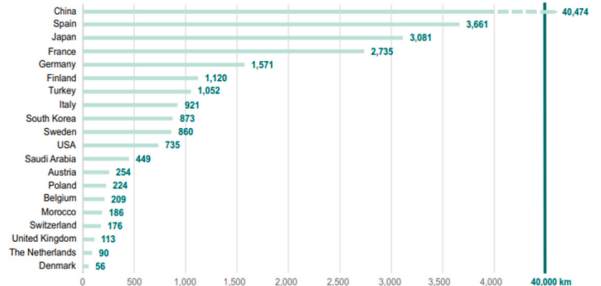
## key facts and figures

Countries with a high-speed rail network in commercial operation



Source: compiled by authors based on International Union of Railways, 2022

Length of the high-speed network in commercial operation by country



Source: compiled by authors based on International Union of Railways, 2022

Length of the high-speed network in commercial operation by UIC Regions



Source: compiled by authors based on International Union of Railways, 2022

Length of the high-speed network under construction by UIC Regions



Source: compiled by authors based on International Union of Railways, 2022

## THE FUTURE OF THIS MODE OF TRANSPORT

Faced with the competition between air, road, and ever-changing rail, the high-speed train retains its advantages linked to speed over medium and long distances. Autonomous car service can even become an ally to facilitate the first and last kilometers of a transit trip.

More generally, it is likely that the mobility market will become increasingly multimodal and digital.

Finally, in order to better understand the functioning of the medium- and long-distance mobility market, numerous surveys have been conducted to identify the parameters of modal choice and their importance in the decision taken by the traveller. The price and total journey time largely dominate and together account for more than 40% of citations. If we consider that there is a correlation between price and distance, then speed, which is the division of distance by time, in a way, sums up or condenses these two major criteria of time and price.