Europe needs a high-speed masterplan

A study commissioned by Europe's Rail, CER, AllRail and Unife says a masterplan is needed for high-speed rail in the European Union if it is to achieve its potential to become the dominant mode of long-distance transport. **Robert Preston** reports.

"AT the moment we do not have a high-speed network in Europe," says Mr Carlo Borghini, the outgoing executive director of the Europe's Rail joint research undertaking (p42). "We have a series of islands." Borghini made his remarks on January 23 as he joined his counterparts at the Community of European Railway and Infrastructure Companies (CER), the Alliance of Passenger Rail New Entrants in Europe (AllRail) and the European Railway Industry Association (Unife) to present the findings of a study commissioned by the four organisations.

The report entitled *Smart and affordable rail services in the EU: a socio-economic and environmental study for high speed in 2030 and 2050* says that joining up these islands to create a comprehensive 49,400km network by 2050 has the potential to increase high-speed rail's market share to 54% by 2070. At the same time, investing in a network that connects all urban centres with over 250,000 inhabitants and serving a total population of 216 million would deliver added value to society and massively reduce the environmental impact of passenger transport in Europe, creating "sustainable and equitable mobility."

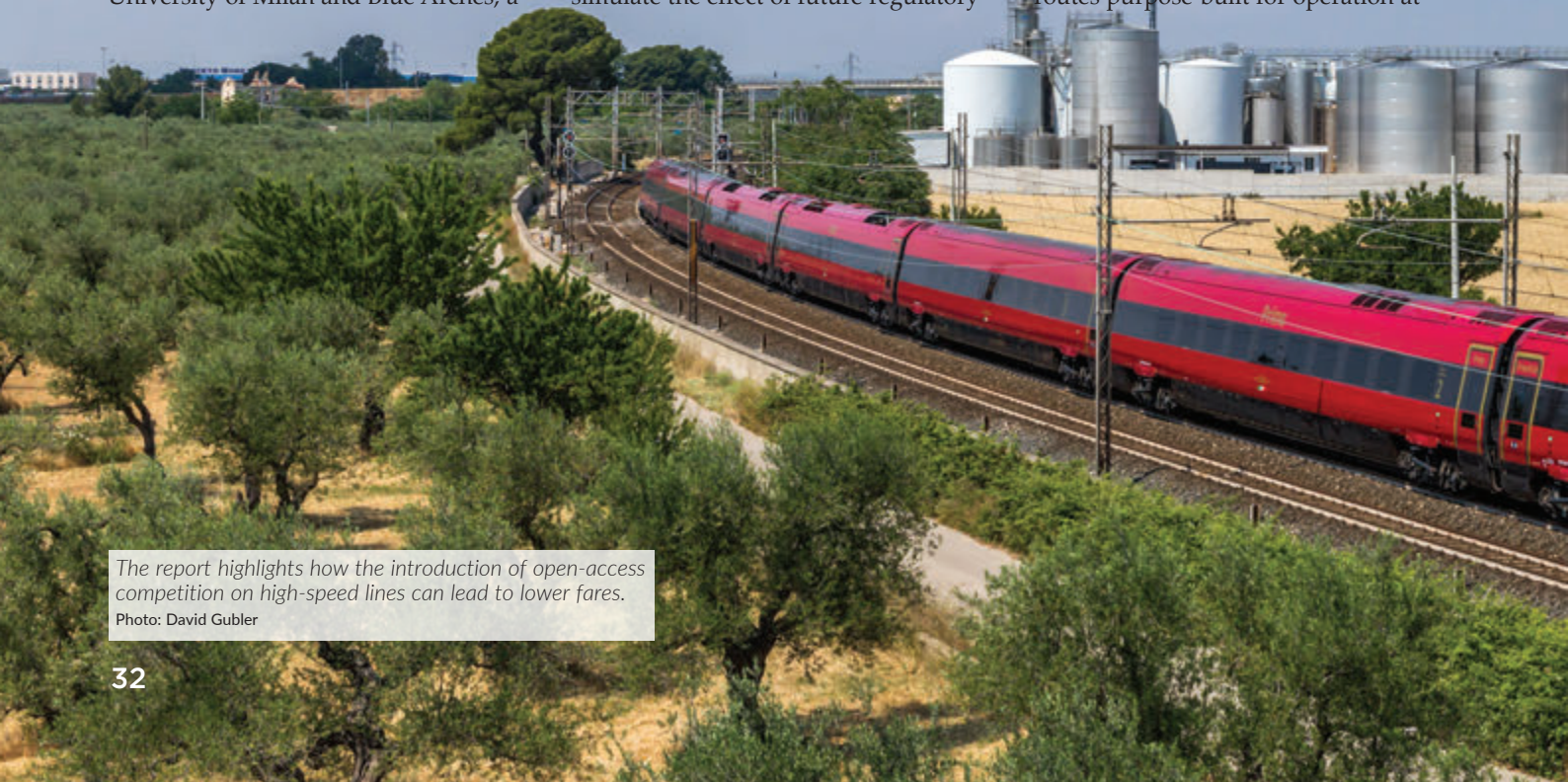
The study was undertaken by Ernst & Young in collaboration with Bocconi University of Milan and Blue Arches, a consultancy that specialises in sustainable projects in the transport and energy sectors. Four key principles underpin the study, including comparative analysis of high-speed rail and its competing modes, namely conventional long-distance rail, car and coach travel over 100km and short-haul aviation with flight times of up to three hours. This sought to determine the market potential and impact of investment in high-speed rail. The study also considered the socio-economic and environmental benefits of expanding the network, and used methodology based on robust evidence from recent academic studies.

Three network scenarios were considered by the study. Throughout, market assessment and impact assessment were undertaken, the market assessment using a demand-shock model to forecast demand in the market in which high-speed rail competes. This defined a baseline scenario for total transport demand in the period up to 2070, expressed in passenger-km and differentiated by mode, based on GDP, population growth forecasts and the historic development of traffic across the competing modes.

A combination of 10 individual demand "shocks" were applied to simulate the effect of future regulatory and technological developments on passenger demand by mode. These shocks included the development of high-speed rail infrastructure, competition between high-speed and conventional rail, car-sharing and coach competition. Also taken into account were the taxation of airline tickets and aviation fuel, policies to ban short-haul flights, highway toll tax, the increase in the price of petrol and new technology being developed under the Shift2Rail programme.

The impact assessment was based mainly on cost:benefit analysis derived from European Commission (EC) guidelines. This compared the cost of building new high-speed lines against the benefits of cutting journey times and inducing modal shift to reduce external costs linked to CO_2 emissions, air pollution, road safety and congestion. For the three network scenarios, both a net present value (NPV) and a benefit:cost ratio (BCR) were calculated, the NPV representing the sum of total social benefits and costs.

The study took as its baseline scenario the current European high-speed network as defined by the revised maps of the European Union's (EU) Trans-European Transport Network (TEN-T) programme, comprising 15,200km of routes purpose-built for operation at



The report highlights how the introduction of open-access competition on high-speed lines can lead to lower fares.
Photo: David Gubler

250km/h and above and upgraded infrastructure with a maximum speed of 200km/h to 250km/h. The baseline scenario considers the impact of no new high-speed or conventional rail infrastructure, and that infrastructure for other modes will continue to increase in line with forecast demand.

Three network scenarios

Without new investment, the study says that demand for high-speed rail and its modal share are expected to increase slowly, with the result that the targets of the EU's Smart and Sustainable Mobility Strategy to double high-speed traffic by 2030 and treble it by 2050 will only be achieved by 2040 and 2058 respectively. High-speed rail's modal share would rise from around 7% in 2021 to 9% in 2030 and only 13% in 2050. "This will leave other, more polluting, forms of transport as the only alternatives for travellers across the continent," the study report says.

The second scenario for 2030 adds to the baseline 5300km of high-speed and upgraded infrastructure scheduled to be completed by this date as part of the TEN-T Core Network. Serving an additional population of 86 million, the resulting 20,500km would lead to a limited increase of about 16 percentage points in the modal share of high-speed rail, more than doubling the baseline 2021 figure. Market share would then grow to reach 32% in 2070, when 958 billion passenger-km are forecast. "More crucially for the environment, demand for short-haul aviation would reach an 8% share by 2070," according to the report.

To calculate the NPV and BCR of the 2030 scenario, the study used three values to estimate construction cost. The lowest figure of an average of €12m per km, taken from a 2021 high-speed study by the United Nations Economic Commission for Europe, gives a total construction cost of €63bn, resulting in an NPV of €447.5bn and a BCR of 10. Taking the €16.5m per km that was the completion cost of the Paris - Strasbourg high-speed line in France increases the construction cost of the 2030 scenario to €87bn, reducing the NPV to €431.5bn and the BCR to 7.6. Finally, using the figure of €25m per km that was identified as the average final construction cost in an audit by the European Court of Auditors (ECA) in 2018 produces a construction cost of €132bn, an NPV of €400.7bn and a BCR of 5.

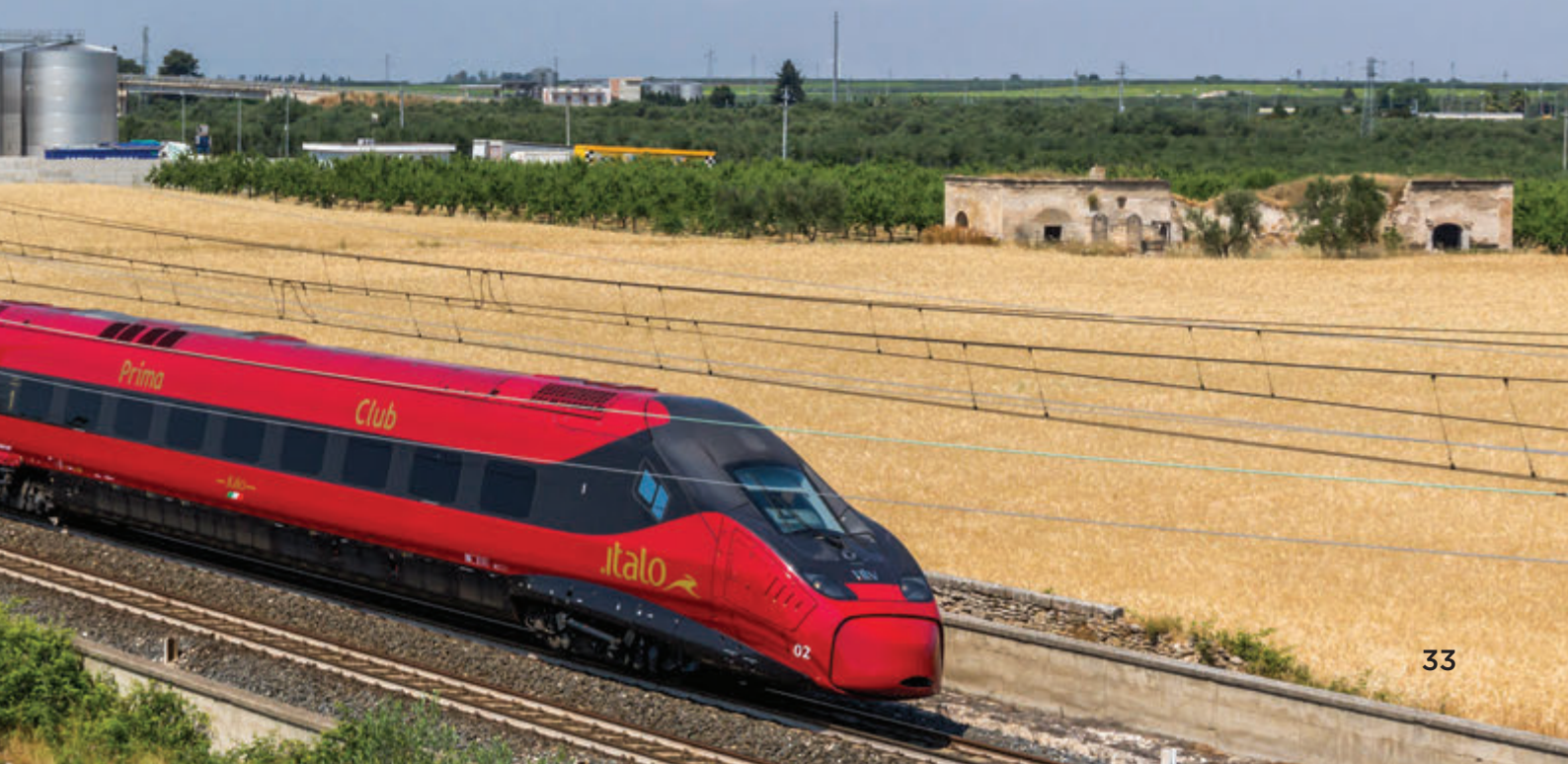
> "Railway investment requires a long-term commitment and sufficient funding. Alberto Mazzola

The "ambitious" investment programme that forms the basis for the 2050 scenario would see all "functional urban areas" in Europe with over 250,000 inhabitants connected to the high-speed network, with a station within a 20km radius. The study defines a functional urban area as a city core and its commuting zone. Serving a total population of 216 million, this high-speed network would include the TEN-T Extended Core Network due for completion by 2040 and the Comprehensive Network to be completed by 2050, as well as lines outside the TEN-T programme, including HS2 in Britain.

Taking the total high-speed route length to 49,400km, the 2050 scenario also envisages significant expansion in eastern Europe compared with the baseline, adding Hungary, Romania and Bulgaria, as well as Moldova and Ukraine, to the European high-speed map. EU accession countries are likely to add 4300km to the network, bringing high-speed services to an additional 40 million people.

The 2050 scenario has a construction cost of €410bn at an average of €12m per km, giving an NPV of €836.7bn and a BCR of 4. Applying the figure of €16.5m per km increases construction cost to €546bn, reducing the NPV to €748.6bn and the BCR to 3. The maximum estimated average construction cost of €25m per km gives a total cost of €855bn, an NPV of €561.4bn and BCR of 2.

"The positive cost:benefit ratio of the study shows why Europe needs a high-speed masterplan as a response to the ongoing energy and sustainable mobility crisis," says CER executive director, Mr Alberto Mazzola. "Railway investment requires a long-term commitment and sufficient funding," he adds, calling for the ongoing revision of the EU's TEN-T Regulation to recognise this. According to Mazzola, with the creation of an interoperable high-speed



network, reducing journey times between EU capitals and major cities to between four and six hours on "affordable and comfortable" trains, "rail will certainly become the preferred mode of transport. This is why it is essential to invest in high-speed rail," he says.

The report says that accelerated investment in a complete European high-speed network, as envisaged under the 2050 scenario, "will elicit a considerable response" from passengers, as the total length of high-speed infrastructure in service has a major effect on modal choice and resulting passenger traffic. It forecasts traffic of over 2089 billion passenger-km in 2070 when the market share for high-speed rail would be 54%, while generating "considerable socio-economic benefits for European society" worth up to €750bn over the same period. The 2050 scenario would also almost triple the amount of CO_2 saved compared with 1.5 billion tonnes that would be saved under the 2030 scenario.

As well as building new infrastructure, of the other "shocks" that are expected to contribute to growing high-speed rail's modal share, the report highlights the significant increase in this and passenger-km that is forecast around 2030 when new technology developed under the Shift2Rail programme is expected to be deployed. "The positive potential effect of Shift2Rail technology indicates that increased investment in railway research and development is needed to deliver a modal shift," the report says.

Increased competition in the railway market is also forecast to have a positive effect on demand, by improving service quality and bringing down the cost of rail travel. At the same time, policies disincentivising air travel "will virtually eliminate short-haul aviation," the report says. The positive features of high-speed rail in terms of the quality of the journey, door-to-door journey times and its low environmental impact will outcompete alternative modes when all European regions are connected to the high-speed network.

Capacity and costs

A series of assumptions were applied in the study, aimed at simplifying "the already complicated process" of estimating long-term market development and calculating the resulting economic and socioeconomic costs and benefits. To simplify the market and impact assessment models, the study assumes that there will be no capacity constraints on the high-speed network, given that additional capacity will be provided by construction of new lines under the 2030 and 2050 scenarios, whereas certain upgraded routes in the baseline scenario are shared with conventional passenger services and freight trains.

Four assumptions are based on the underlying premise that, in line with EU rail policy, operators will be competing in an open market. The study assumes that operators will break even or achieve "equilibrium between revenue and costs," and that any financial surplus is passed on to the passenger in the form of lower ticket prices. Operators are also expected to cover investment costs from their revenue; the study does not take into consideration rolling stock procurement to match the growth in demand.

"Infrastructure alone is not enough," says AllRail secretary general, Mr Nick Brooks. "High-speed trains must be made attractive," he adds, before explaining this means combining a high capacity of 1000 seats per train with frequent departures and attractive fares.

Similarly, the cost of infrastructure maintenance is assumed to be fully covered by track access charges, in alignment with European regulations. The underlying assumption is that, thanks to market efficiency, both infrastructure managers and operators will break even, meaning that rising or falling maintenance and operating costs are directly translated into increasing or decreasing track access charges and ticket prices. While noting that it will be an important factor in the growth in demand for high-speed rail, the study does not take into account how fares will change over time, apart from applying the "shock" of increased on-rail competition. "As seen on other lines, where open-access competition exists, prices decrease," the report says.

"Independent passenger operators enthusiastically support the fast growth of high-speed rail in Europe," Brooks says. "We want to see it displace the private individual motor car as a product for the masses, for everyone from the budget-conscious to very affluent travellers." Making high-speed rail more attractive will require a level playing field both within the rail sector, enabling operators to compete fairly, he says, as well as in the wider transport market. Brooks says there must be fair taxation for rail "versus less sustainable transport modes." Nevertheless, AllRail

Proposed European high-speed network