HS2: Vision into Reality

Britain will be a nation of some 70m people by 2050. Bringing the Midlands and the North in closer proximity to London and mainland Europe, HS2 will help to rebuild and rebalance the British economy, placing Birmingham at the centre of our rail network and connect eight out of ten of Britain’s largest cities. Intercity rail travel has never been more popular in this country. The number of people travelling between cities has more than doubled in the last 15 years and will continue to grow.

The improved connectivity which HS2 will deliver in Britain mirrors that found already, enjoyed and perhaps taken for granted in mainland Europe. The distance between London and Birmingham is similar to that of Frankfurt to Cologne, London to Manchester/Leeds with that of Paris to Brussels.

Despite an enviable track record in repairing, maintaining and developing our Victorian railway system, additional network capacity is essential to satisfy predicted future growth in population and passenger numbers and ensure the continued longevity of our existing 200 year-old network.

Engineering Britain’s second high speed rail network will strengthen the regional economies and make a huge contribution to creating the world-class transport infrastructure this country needs.

Building on the success of the London to Channel Tunnel Rail Link, HS2 heralds significant investment in Britain’s rail network over the next 20 years. It will be one of the largest and most ambitious transport engineering projects ever undertaken in the UK.

Britain’s population is growing. By way of example, the number of people living in London has increased by over a million in the space of a few short years. The additional capacity, connectivity and infrastructure which HS2 will create will be vital to satisfy further, predicted yet unprecedented population growth.

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Happy half-century HSR

2014 marks the fiftieth anniversary of the world’s first high speed network, Japan’s Shinkansen railway. Today, Japan’s high speed rail (HSR) network is the major mover of people between the principal population centres. It’s a dedicated system which brings those centres closer together, offering a level of reliability and safety which is unparalleled in the world of transport. The Shinkansen has inspired HSR networks the world over. Whilst Britain is a relative newcomer to HSR, the challenge presented to British engineers is, in many ways, very similar to that which the Shinkansen pioneers faced, over half a century ago. HS2 is about creating a connected Britain in much the same way that the Shinkansen brought Japan’s major cities closer together.

JR East, Japan’s largest passenger railway company, owns and manages a track network of 4,669 miles, carries 17 million passengers and generates revenues of £17.7bn per annum (70% from transport / 30% from retail, property and related services). 30% of its £11bn per annum rail passenger business comes from HSR. Connecting the Greater Tokyo region with cities such as Takasaki and Kanazawa to the west and Fukushima, Shinjo, Akita and Shin-Aomori to the north, JR East carries 241,000 passengers daily, on 415 trains across its 882-mile HSR network.

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On the construction side, low levels of direct employment have meant very low investment in skills and training on the railways. Over the next five years, there is a need to increase the CP5 qualified workforce by 20,000.

The Rail Supply Chain Forum has brought Government and industry together around this target but that’s just the next five years. We have to plan much further into the future to address the skills needed for a project such as HS2.

Celebrating success
As the name suggests, HS2 is not Britain’s first but second HSR network project. HS1 delivered a HSR connection between London and the Channel Tunnel. Lengthy public and parliamentary consultations, 645 undertakings and assurances and over 1,000 detailed planning consents paved the way for the creation of the 67-mile route.

Built in two phases - on time and on budget - at a cost of £5.2bn, HS1 delivered significant economic benefits along the Thames Gateway, not least enabling developments at Ebbsfleet, Stratford and St Pancras.

Less than a decade on from its completion, the lessons and success of HS1 are being applied to both Crossrail and HS2, notably in engineering environmental impacts which are lower than those created by the infrastructure required for other modes of transport.

By way of example, the 14-metre trace used for HS1 is less intrusive than the land grab needed to build a motorway. Lowering the track deeper into the landscape significantly reduces vibration, noise and the visual impact of the trains. Landscaping, recycling and sourcing of materials and rolling stock selection are among the added strategies deployed to further reduce environmental impacts.

HS2 will be delivered using a Systems Engineering approach. This has proven to reduce costs by some 10-20% and deliver greater certainty. Systems engineering considers the whole project lifecycle, applies lessons from other projects and manages disparate elements. It’s all about delivering step change for customers, seamlessly from street to seat.

Large conurbations along the HS2 route will have, not one but, two stations – one in a central location, the other serving the periphery and giving rise to associated urban and economic development.

London’s main station will be Euston with a second station located at Old Oak Common. In Birmingham, a new Central Station will be augmented by a West Midlands Interchange at the NEC. In smaller cities, it makes sense to locate the stations outside the city centre (e.g. Toton, Nottingham).

HS1 created £4bn of regenerative benefit along its route. This figure will be significantly higher under HS2. Indeed, in a recent KPMG 100 Report, the benefit to the UK economy is estimated to be £15bn per annum with regions in the north faring better (twice as good) than those in the south.

What next?
As part of the IET’s continued regional programme of knowledge dissemination on high speed rail across the UK, in collaboration with Parsons Brinckerhoff and HS2 Ltd, there will be further seminars taking place in Manchester, Derby and Leeds.

Further information
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Up-skilling for HSR
A recent report by the National Skills Academy for Railway Engineering reveals that barely 17% of the UK’s 82,000 rail workers have higher level academic qualifications (above A level).

There’s currently a shortage of the type of engineering and technical staff which a project such as HS2 will require. Accordingly, the industry needs to take rapid remedial action to address this challenge.

Less than 5% of the railway workforce is female, a similar figure to other walks of engineering. There’s an urgent need for the industry to communicate with schools, parents and pupils to promote the opportunities and roles needed in the future.
Putting passengers at the heart of HS2 brings with it the realisation that rail is only part of a whole journey. In order to deliver an enhanced passenger experience, we need to understand what the passengers who are going to use it will want from the service. This creates opportunities for stations, for town centres and out-of-town centres along the route. Once again, there are plenty of examples on mainland Europe from which we can learn (Lille, for example).

We need to understand why people might want to travel on HSR. They will want to feel that using HSR is quick, comfortable and easy. In short, it has to be attractive. Along their journey, they will want to use technology in a connected way to secure the information, choices and certainty they need.

We must also consider the subtle and gradual changes brought about by the digital age. Predicting the future is never easy. But will technology obviate our need for travel quite as much as we do today? Will smart devices rather than the car, the train or the plane provide us with the freedom we seek, in the future?

It's all about the people

HS2 will take the very best of world-proven technologies and configure them for Britain. It will use tried and tested international standards and a systems engineering approach which will carefully balance the interaction of all the constituent elements (trains, track). That whole systems approach is led by an overall business requirement and will create a network which will stand the test of time, for the next 100 years.

Essentially, HS2 is all about the people, the passengers, their needs, safety and comfort. It's also about the people, the teams of engineers who will physically deliver these new services.

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Its HSR trains travel at 200mph and run, very reliably, 15 to the hour (with less than a minute’s delay, daily). Each train can carry up to 1,600 passengers. Long-nose leading car design, single-arm insulated pantographs, full bogie covers, smooth panels, and dampeners between cars have been engineered over many years to reduce noise.

The Company does not receive any Government subsidy yet owns and operates the rail and power infrastructure, manufactures its own rolling stock and has its own micropayment ticketing system ‘Suica’ (since adopted by Japan’s nine other rail companies, now with some 80m card holders combined).

California – connecting north and south
In California, work is starting on a HSR network. The Golden State has six of America’s Top 30 ‘most congested’ urban areas, its busiest short-haul flight market (Los Angeles to San Francisco) and a population which will grow from 38m to 50m people by 2050.

Inspired by the Shinkansen, the California High Speed Rail Authority is creating a new 520-mile rail link which will connect San Francisco with LA and Anaheim in under three hours. Due for completion in 2029, this fast track will be extended through an ambitious second phase across 800 miles of relatively undeveloped terrain in the Central Valley to Sacramento and San Diego.

Much of the planning has centred on passenger experience and the safety, reliability and performance of the system. Collaboration with state and city authorities is creating opportunities for transit oriented development. Vibrant new communities based around new stations set in safe and secure environments are being developed, informed by design guidelines and backed by matched funding. US infrastructure projects thrive on ‘bottom up’ funding from states and cities.

California’s HSR trains will travel at 220mph and provide passengers with a smooth, comfortable ride. The experience will be similar to travelling on a plane but without the turbulence. Managing the lateral and vertical alignment to ensure that smooth ride will be a major engineering challenge, one which the Authority has well within its sights. Passengers will also enjoy a fantastic view of the passing landscape from their seats through large windows in each car.

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Essential Engineering Intelligence for Transport

Proposed HS2 route