The HS2 Design

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High Speed Rail is 49 Years Old
World High Speed Rail Expansion

Km

0 5000 10000 15000 20000 25000 30000 35000 40000
International Technical Standards
Technical Principles

- International standards
- Compliant with EU Interoperability Directive
- Latest proven technology
With Multiple Interactions

- Noise
- Track
- Structures
- Earthworks
- Power
- EMC
- Control Systems
- Comms
With the Human at its Heart

- Designer
- Constructor
- Operator
- Maintainer
Designed for Individual Passengers
And Whole Life

• Construct
• Commission
• Operate
• Maintain
• Renew
Business Requirements
Maximising Capacity, Connectivity, Availability and Reliability
Operational Specification

- Safety
  - EU Common Safety Method (CSM)
- Capacity
  - Up to 18 services per hour each way on the core
  - Up to 1100 passengers per service
- Availability
  - Operational hours 0500 – 2400 (0800 - 2400 Sunday)
- Reliability
  - Average delay less than 30 seconds per service
- Connectivity
  - Journey times based on up to 360km/h maximum speed – balanced with environment impact
  - Whole-journey time reduction – station design / service frequency
Northbound Timetable
Open Line Headway

- Train Running @ 360kph
- Train System (TS) Response
- Driver Response (DR)
- Train Protection (TP)
- Braking Distance (BD)
- Train Location Section (TLS) Cleared
- Train Detection (TD) System Response
- Issue Movement Authority (IMA)
- Train Length (TL) (400m)
- Brakes
- Signalling Control
- Transmission
Reference Train – AGV In Service with NTV
200m Trains Capable of Running in Pairs

Classic Compatible

Captive
Transmission Based Control (ETCS Level 2)

- Voice comms
- On board train detection
- Movement authority
- Advisory speed

Control Centre

Intelligent Traffic Management
Station Design for Capacity

Roll-in roll-out principles
Two minute dwell times

230 km/h turnouts

c3000m  430m  c3000m 

230 km/h turnouts
Automatic Train Operation
“Japanese” Operational Precision
Maintenance Specification

- Preventive servicing
- Automation of examination / conditions monitoring
- Mechanisation of maintenance (replace not repair)
- Largely rail based
- Standardised elements
- “Factory” approach throughout
Route and Station Development For The Bill
Britain is Densely Populated
Current Train Sound (360km/h)

Image based on SNCF 1/3 Octave Noise Map of TGV at 360km/hr modified to represent $L_{pAeq}$ using output from TWINS modelling.
Sound Reduction at Source

- Bogie shrouds
- Spoiler
- Aerodynamic nose
- Inter-car seals
- Pantograph Screens
- Low noise pantograph
Position in Landscape is Key
HS2 Design Principles
Outline Design of Major Elements
Design Components Include

- Stations, buildings & associated public realm
- Earthworks including for visual/ noise screening
- Structures, bridges, viaducts and tunnel portals
- Retaining structures
- Boundary & security fencing
- Noise barriers
- Lighting (urban and rural)
- Planting for visual screening
- Tunnel ventilation & sire safety
- Diverted watercourses/ balancing ponds
- Footpaths and highway infrastructure
- Operational compounds, substations etc.
EIA / Environmental Statement

• Comprehensive mapping

• Key Policies
  ▪ Sustainability Policy – sets HS2 Ltd’s approach towards environment – balanced, proportionate and practicable
  ▪ Environmental Design Aims
  ▪ Code of Construction Practice – set out the measures to protect people and natural environment during construction

• Technical Annexes – assessment of the scheme under 14 topic areas
  ▪ From Air Quality to Waste Materials
Example: Birmingham Interchange

People mover to National Exhibition Centre and the Airport

‘Parkway’ feeder for the metropolitan area

Highway connections to trunk network
Example of Landscaping
Land Acquisition for Habitat Replacement – HS1 Example
Example of Construction Options

Figure 2. (above) shows Park Village East during construction.

Figure 3. (above) shows Park Village East after construction.
Earthworks and Mass Haul
Quality of Structural Earthworks

Photo Courtesy Balfour Beatty
Construction Programme & Mass Haul Sites
Integrated Programme
Cut to BIM, Ops & Mtce and Passenger Experience

Big Pictures

Placeholder
Judged By Future Generations

Prof Andrew McNaughton