

HS2 Technical Specification  
Session 2

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RP. ✓

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[No Jim Steer]

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**HS2 TECHNICAL SEMINARS**  
Meeting Room 4, 2<sup>nd</sup> floor, 55 Victoria Street, London, SW1H 0EU

**HS2 Technical Specification**  
**12:30-14:30**

12:30 – 12:40	Welcome & Introduction of the Seminar	Professor Andrew McNaughton (chair)
12:40 – 13:00	<b>Technical standards and specifications</b>	Sarah Hunter
13:00 – 13:15	Comments and Questions	
13:15 – 13:35	<b>Applications of standards to HS2 route design</b>	Sarah Hunter
13:35 – 13:50	Comments and Questions	
13:50 – 14:00	<b>Construction logistics development</b>	Sarah Hunter
14:00 – 14:10	Comments and Questions	
14:10 – 14:20	<b>Next steps and consultation</b>	Andrew McNaughton
14:20 – 14:30	Any other comments and questions	
	<b>ENDS</b>	



## HS2 Technical Specification

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## HS2 Technical Specification

- Technical standards and specifications
- Applications of standards to HS2 route design
- Construction logistics development

*Specific local detail will be covered during the line of route consultation process next year*

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## **Technical standards and specifications**

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## **Our Approach**

- Recognise various models of high speed rail operation and established proven technologies
- HS2 Ltd has sought to tailor an approach fit for now and also in the future
  - Longer distance city to city journeys
  - High speed lines used only by high speed trains
  - Initially some trains run on to classic network
  - Over time increasing segregation
  - Well-integrated with other transport networks

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## Key features

- Route alignment designed for up to 250 mph ultimately
- Initial technologies and trains designed for up to 225 mph
- Adoption of proven European standards, technology and practice
- Capacity for 400m long (as Eurostar) European-sized trains carrying up to 1,100 people
- Initial capacity 14 trains per hour
- Ultimate capacity up to 18 trains per hour with largely segregated running and expected technology advances
- Sustainable development principles adopted

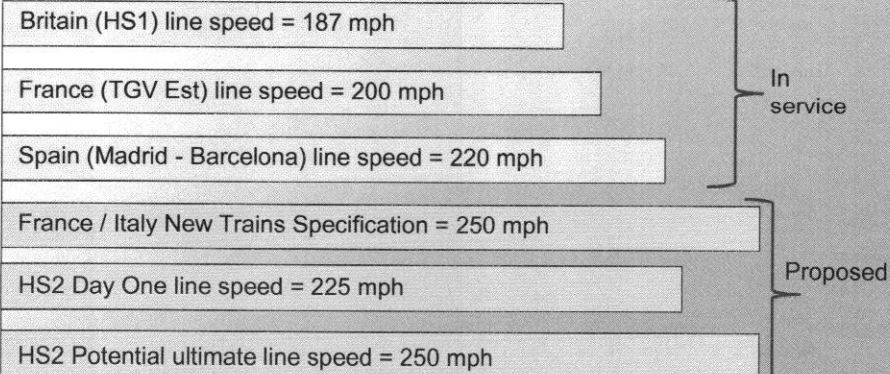
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## Linespeed

*Achieving and maintaining high linespeeds enables journey time reduction*

### Comparison of line speeds of some European high speed routes



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## Technical Standards 1

- Many of the standards used to develop our specification are defined within the Technical Specifications for Interoperability (TSIs). Interoperability is the ability of different systems to work together irrespective of national borders
- These have been developed from all the existing European experience of high speed
- As a result we can specify standard high speed rail technologies with proven safety, reliability and performance levels
- The international supply community continues to develop and improve these systems and provides a competitive supply market
- The UK supply industry can market products it develops in the world-wide high speed rail market
- The potential for services to operate internationally is maximised
- High Speed 1, whilst pre-dating the TSIs, was built to the French standards on which they were substantially based and conforms in principal respects
- The TSIs, brought into force by EU legislation, have been adopted by UK Government

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## Technical Standards 2

The principal effects for HS2 design at this stage are:

- Train size (hence structure gauge, platform and clearances)
- Train length (hence station platform length)
- The signalling control system
- The overhead electrical power system
- Route geometry (maximum gradients and also track spacing and curve radii for any speed)
- Tunnel air pressures and safety measures
- Access for persons of reduced mobility

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EACH DIRECTION



## Train operations

*The number of trains per hour in each direction on HS2:*

Day One maximum = 14 trains per hour

*(today's proven technology; significant classic network through running)*

Ultimate future maximum = 18 trains per hour

*(technology development; operation over largely dedicated high speed network)*

*Hours of operation:*

Start of service – first departure no earlier than 05.00 Mon – Sat, 08.00 Sun

Close of service – last arrival no later than 23.59

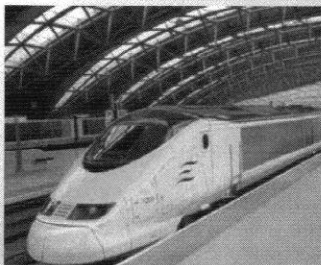
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French precedent for reduced speed after midnight - this may be a consultation element.



## Train length

*Up to 400m long - similar length to a Eurostar train*



200m

200m



HS2 400m train will carry up to 1,100 people

Platforms on the classic network can currently accommodate one 200m section

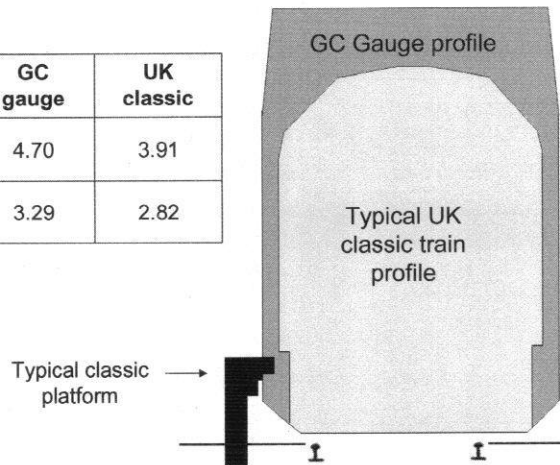
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## Train size

Like HS1, HS2 infrastructure will accommodate 'GC' gauge trains

	GC gauge	UK classic
Maximum height (m)	4.70	3.91
Maximum width (m)	3.29	2.82



## QUESTIONS?

- o EIA standards incorporated but derogation is allowed.
- o Speed - criteria? [surely this is journey time] ✓
- o 1. unit = HSR to minimize journey time.
- o 2. speed increases demand [and improves business case]

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Max speed N. of B'ham = 230 km c 150 mph.

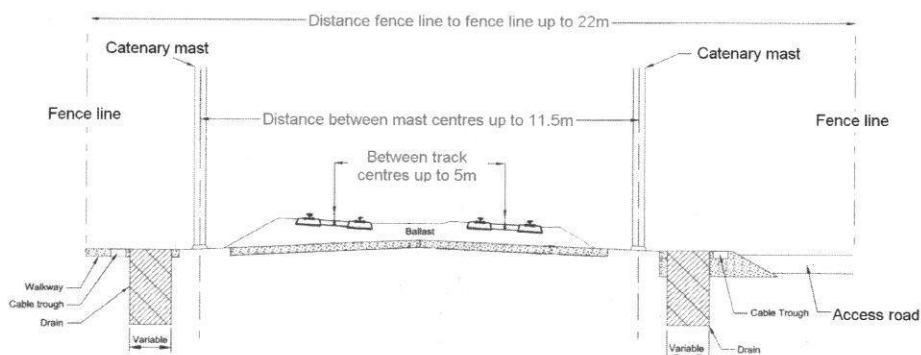
Current 'target' train is Alstom FR/Italy model due 2011

4-tracks? Not possible on routes already identified  
Demand if it emerged would be better served with a different alignment

## Applications of standards to HS2 route design

## Line of route width

*In open country the line of route width is about 22 metres*



*This diagram shows a typical cross-section of the track plus the catenary masts which are used to support the overhead line power system*



## Line of route width

The line of route trace width will vary for sections in cutting and on embankments



Example of railway in cutting  
High Speed 1



Example of railway on embankment  
Rome - Naples

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*Do not know how wide these examples are!*



## Line of route

Additional considerations

Approaches into city centres:

- Lower line speeds
- Use of existing rail corridors where possible
- Reduced width subject to safety and maintenance access case

Vegetation management:



HS1 and the M20 from Thurnham Lane

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*Engineering concern is just for keeping tracks clear (not environmental reasons)*



## Track Curvature

*The higher the line speed, the straighter the track*



High Speed 1 (Arup)

Minimum desirable radius of curvature:

- 200 kph: 1800m
- 300 kph: 4050m
- 360 kph: 5900m
- 400 kph: 7200m

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## Stations Designed for Passenger Flows and Connectivity

- HS2 stations will be used by very high number of passengers
- Stations have been sized (platforms and concourse areas) to deal with such volumes of passengers safely and speedily
- Ultimately good spatial design will be key to customers moving around the station easily and also joining and alighting trains efficiently
- Passenger access and connectivity factors have heavily influenced station selection and initial design considerations
- Ease of connection with other transport modes including by foot, tube, taxi, bus, car, conventional rail and air have all been considered

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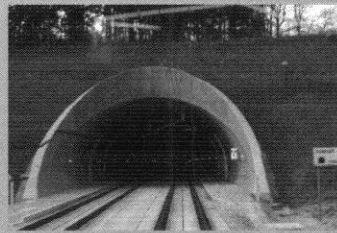
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## Tunnels

Pros: Solution where no viable surface route due to topography or population density

Cons: High cost, <sup>(x6)</sup> provision of access and ventilation shafts, complexity of design, construction and operation and maintenance

"No detectable noise or vibration"  
is a design objective.



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## Use of bridges and viaducts

- Use where ground features and topography require
- Recognise and seek to minimise length and height to mitigate impact
- Sensitive design to sit in specific environments



Arsta viaduct (Arup)

6m 'target' height

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## Safety

- HS2 will be specified to deliver a safe and reliable railway system throughout its design, construction, operation and maintenance
- Design out risk as far as reasonably practicable
  - Proven standards (including train control and protection)
  - No mixed traffic operation
  - Isolation of HS2 trains from other hazards e.g. no level crossings, appropriate fencing and active security monitoring
  - Design standards at road bridges
  - Automation of inspection and mechanisation of maintenance

= no freight

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## Maintenance and inspection

- Separation between operations and maintenance activities
- Frequent automated inspection regimes for infrastructure and stock
- Planned preventative infrastructure maintenance cycles



Automated train inspection –  
Network Rail's New Measurement Train

- 3 month insp.  
- 3 yr maint.  
- 7-10 yr replacement of track.

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## QUESTIONS?

- Tunneling: extra dimension of spoil removal is a factor
- Passenger turnaround in full train - all out of 20 minutes then filled up and away
- Similar to East London pattern.  
↳ intention is to put tunnels & cuts etc: on maps @ consultation
- Footpaths/livestock strategy? ROW will not be all shown on consultation.

No policy to maintain or extinguish rights of way,  
Case by case basis --

- National Noise levels do not exist in UK.

- Maintenance access re: HST. Desire is that a lot more rail-based  
provision rather than road-based.

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- Consultation will include details of:  
maintenance depot - track  
" " - rolling stock  
electricity infrastructure - access points  
also telecommunications

## Construction logistics development

- 14 per hour each way is theoretical maximum with today's technology
  - Japan runs up to 13
  - France gets close but run on mixed lines near cities.



## Construction logistics

### Introduction

- The impacts of construction work will be minimised as far as possible and subject to planning law and permissions
- Construction along the route will be phased over a number of years
- The longest construction phases will occur at stations and tunnels
- Proposals regarding logistics and temporary construction effects are being developed for the public consultation in early 2011

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## Construction logistics

### Developing our initial proposals for consultation

- We are developing our guiding principles for the delivery of construction, for example
  - Maximisation of use of rail for materials and excavated spoil movements
  - Use of line of route access road where possible rather than local public roads
- The contract packaging of construction work will influence the phasing of work and the proposed number / location of work sites

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hope to include some details for consultation

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## Construction logistics

### *Key considerations*

- Options for movement of materials
- Excavated material re-use
- Excavated spoil disposal

Once proposals have developed and been informed through the consultation process, procedures relating to construction works along with associated environmental standards will be described in the Code of Construction Practice for HS2 to be embedded in contracts

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## Conclusion

- Standard high speed rail technical specifications supporting adoption of proven technology with proven safety, reliability and performance levels
- Sustainable design principles to translate the specifications into sensitive appropriate designs for the route and stations
- HS2 designed to be the core of a wider high speed network built in stages

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## QUESTIONS?

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- Chiltern Tunnel will be slurry methodology (Bentelite)
  - Primrose Hill - London Clay will be similar to HSI/Crossrail - it is "good tunneling material" "well understood" "high experience"
  - When will design of road bridges be known - not at consultation - sh. be @ hybrid bill stage.
  - Height of gantries will be provided in Q & A
  - 18-24 months design after consultation prior to development of hybrid bill
- III
- Routes 2.5 & 4 have had no further work done since March 2010.
  - Normal practice would be to 'lock' on the route and then make no further changes up until consultation.
  - Follow-up questions should be emailed to hs2enquiries - indicating question from Technical Seminars. [from all 3 sessions] - end of next week.