



Some Principles and Some Lessons from Britain

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High Speed Rail is 53 Years Old

- It established some key HSR characteristics
 - New line not constrained by historic limitations
 - Optimised to inter-city passenger traffic
 - Very high capacity
 - Very high reliability
 - Bringing cities “closer together” changing the way both the economy and people work



What is HSR capable of technically?

- **Capacity**
 - A two track HS2 line is capable of carrying more people than two 3-lane motorways
 - Or the equivalent of a jumbo jet a minute
- **Reliability**
 - Typically under 1 minute delay per train – less on closed networks
- **Speed**
 - Up to 350-380km/h today
 - Up to c420km/h ultimately
- **Safety**
 - No passenger life has been lost in a HS train on a HS line

HSR “shrinks a country”

- Distance measured by journey time rather than kilometres... but...
- HSR needs high demand to be viable
- Large flows between major cities are the foundation for a high speed route (60-90 minutes)
- Very long distance / international services are glamorous but low volume
- Shorter distance fast regional services can use spare route capacity



The 3 isochrones of time

Business dynamic

30 minutes

Behaves as a single city

60 minutes

Common pool of skilled people
Merged supply and technology market

120 minutes

Ready access to occasional specialist
resource eg finance and legal

Human dynamic

30 minutes

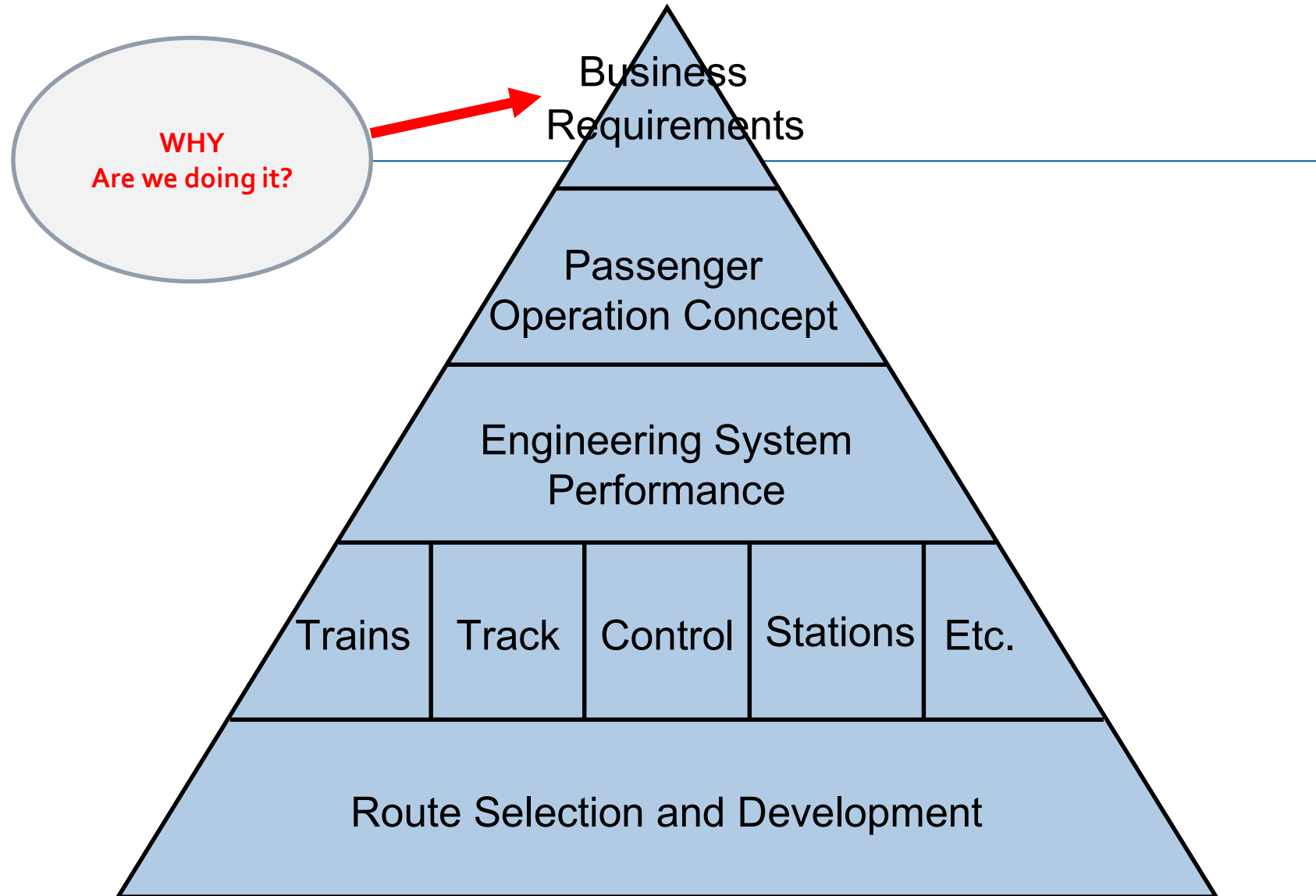
Spontaneous meeting, cultural and social
circles

60 minutes

Practical commuting without re-locating
Easy maintenance of relationships

120 minutes

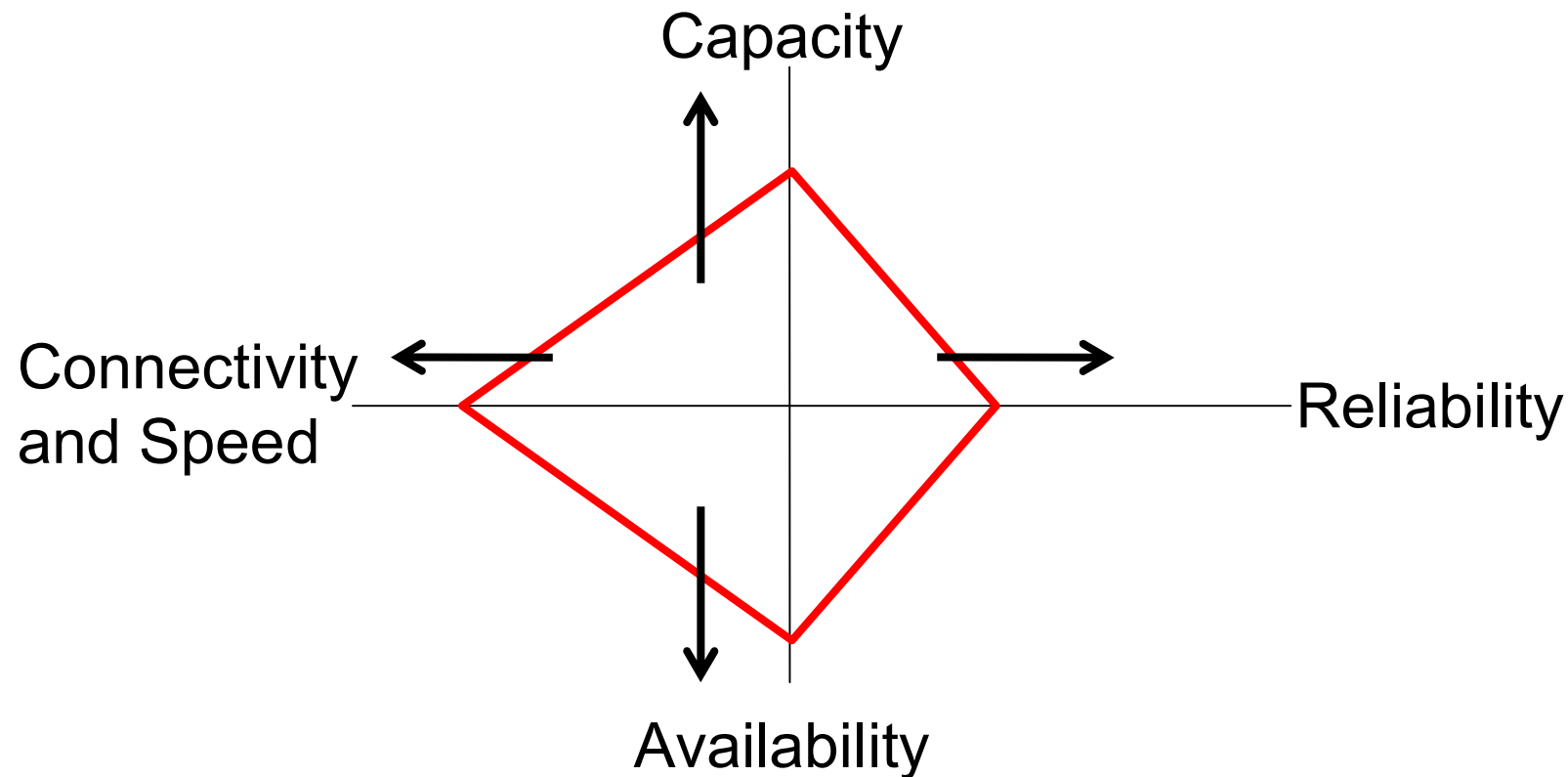
Practical for regular leisure expeditions
and easy visits to friends and relations



HSR technology is increasingly standardised around international technical standards



But with differing objectives for capacity, connectivity and speed – with reliable operation



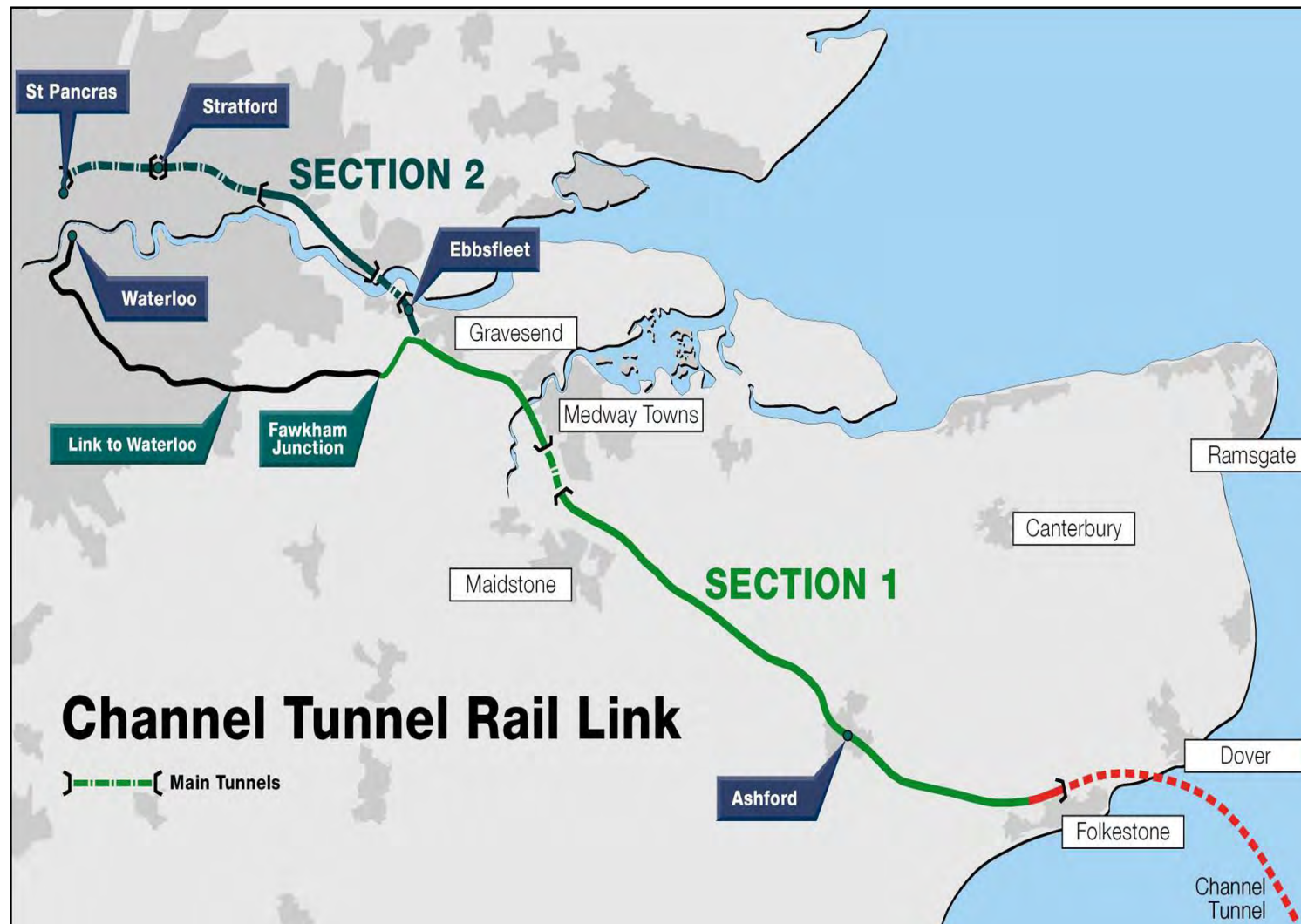
Clear trend towards 3 types of HSR

- Highest demand
 - HS trains only on HS line - potentially continuing onto conventional lines
 - Very high capacity to meet demand
 - Very high speed to maximise benefit
- Strong demand
 - HS trains on HSR line – potentially continuing onto conventional lines
 - Fast conventional trains using spare capacity
- Less demand or difficult geography
 - Mixed HS and conventional trains, possibly even freight
 - Low capacity reflecting limited demand
 - Typically engineered for 230-250km/h

UK examples

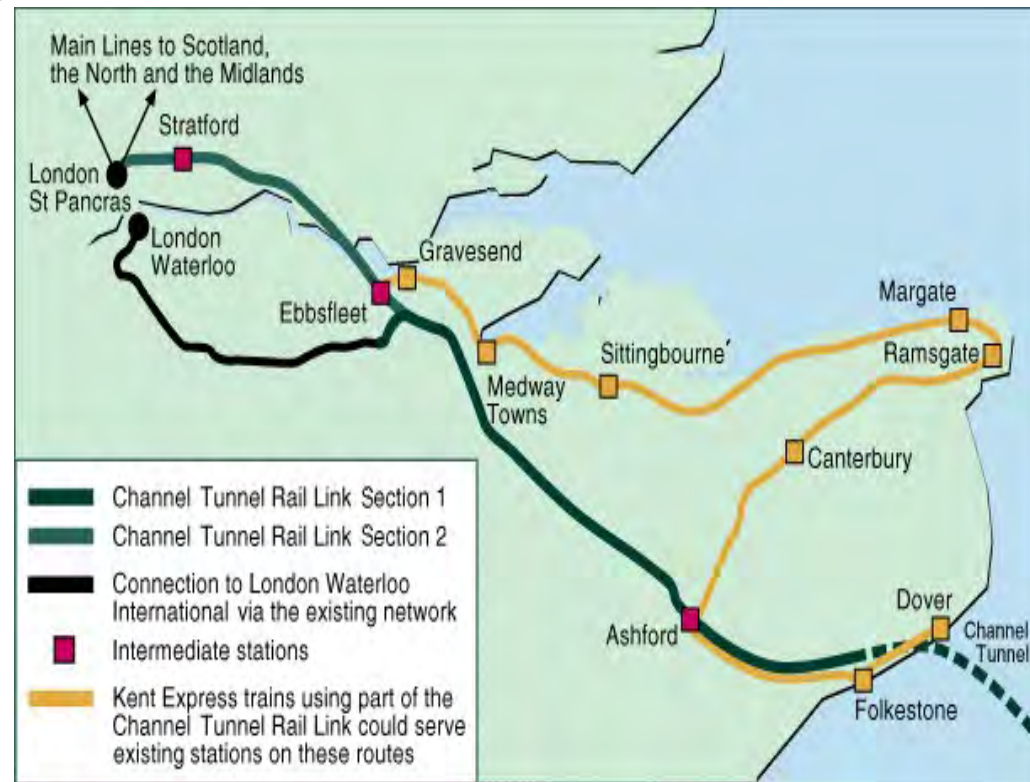


HS1 – Britain's link to mainland Europe



230km/h commuter trains introduced

- 1 or 2 International services per hour
- 6+ commuter trains per hour
- London to Ashford halved to 36 mins
 - East Kent brought within commuting distance
 - Land values rose 60%
- £5bn initial capital cost
 - Regional economic development worth £10bn over first 10 years



HS1 – 109km link to mainland Europe (2007)



HS2 initial network connects 8 of the 10 biggest city regions

- Journey times are before and **after** HS2 (in hours-minutes)
- Based on operation at up to 360km/h
- London to
 - Birmingham 1-24 to **0-49**
 - Manchester 2-08 to **1-08**
 - Leeds 2-12 to **1-22**
- Birmingham to
 - Manchester 1-34 to **0-41**
 - Leeds 2-05 to **0-49**

Note

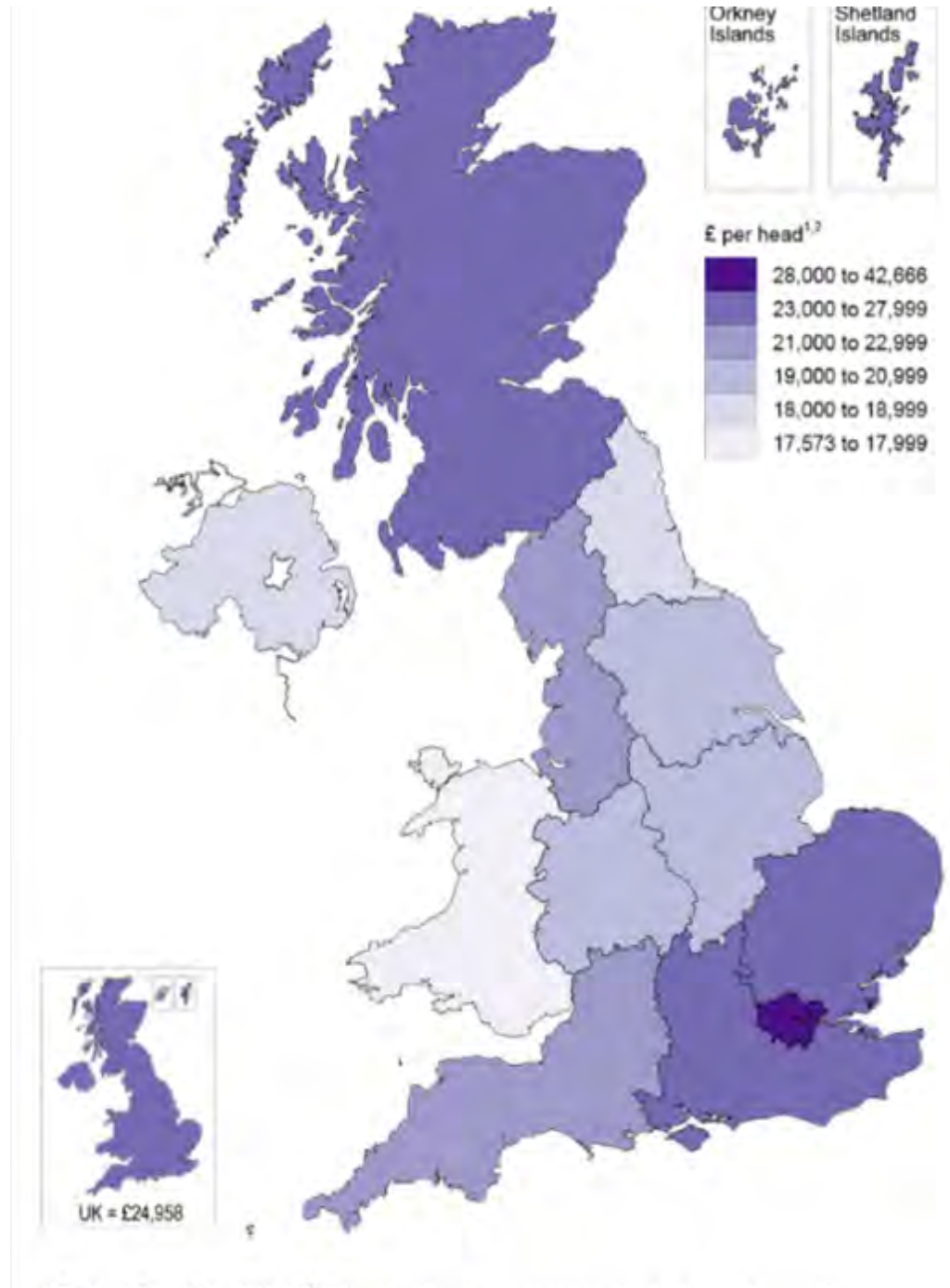
Red is HS2 new HS line

Blue is through services on existing lines



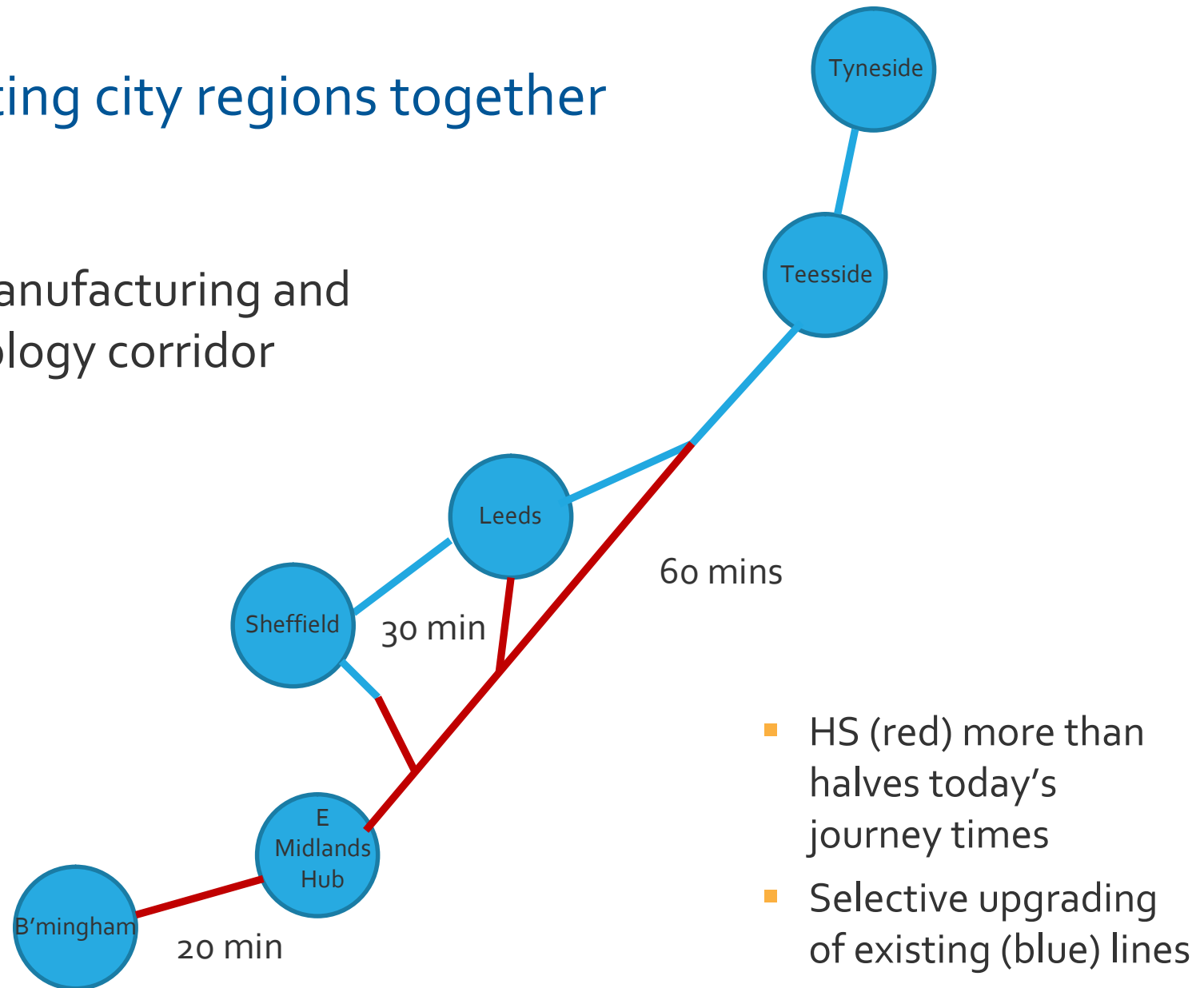
HS2: a catalyst for growth

Regional Productivity in the
UK
(GVA per head, 2014)

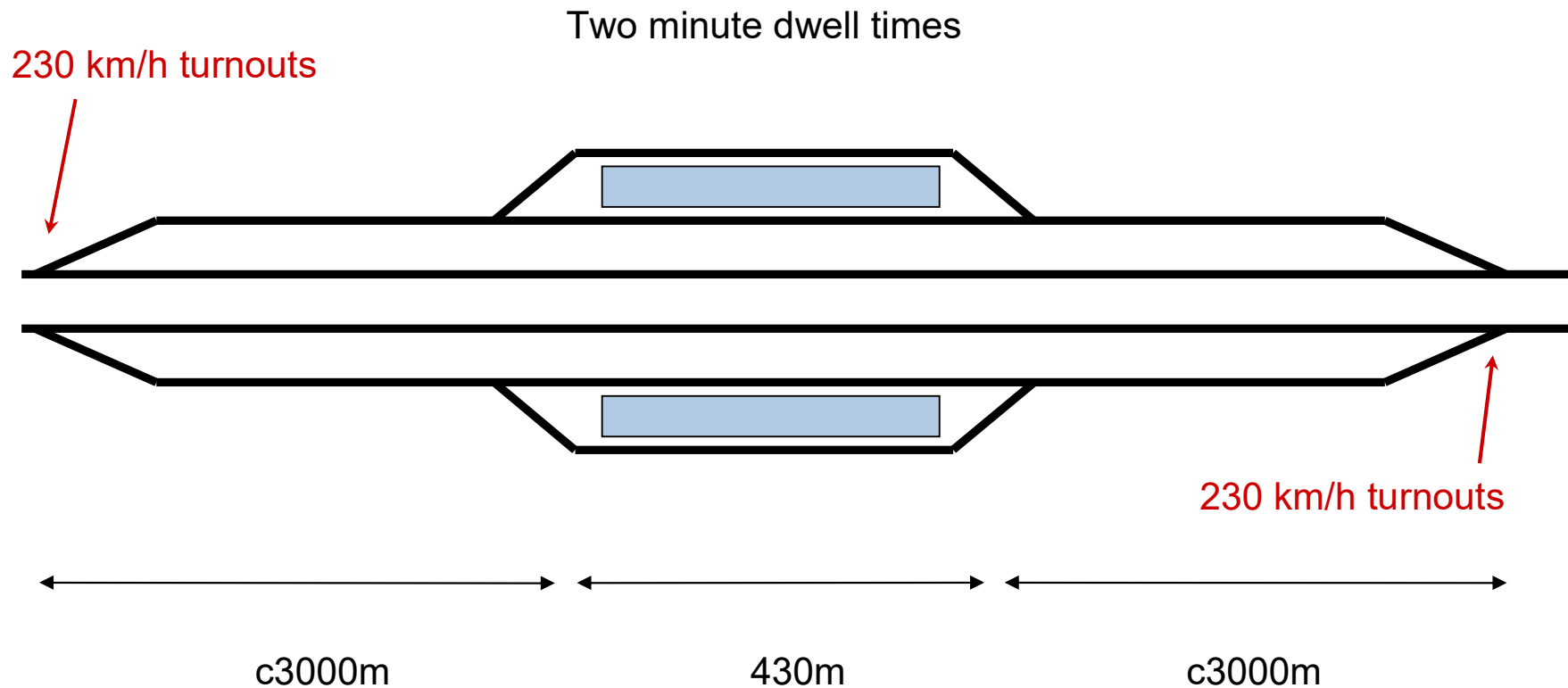


Connecting city regions together

- The manufacturing and technology corridor



Whole system design for capacity

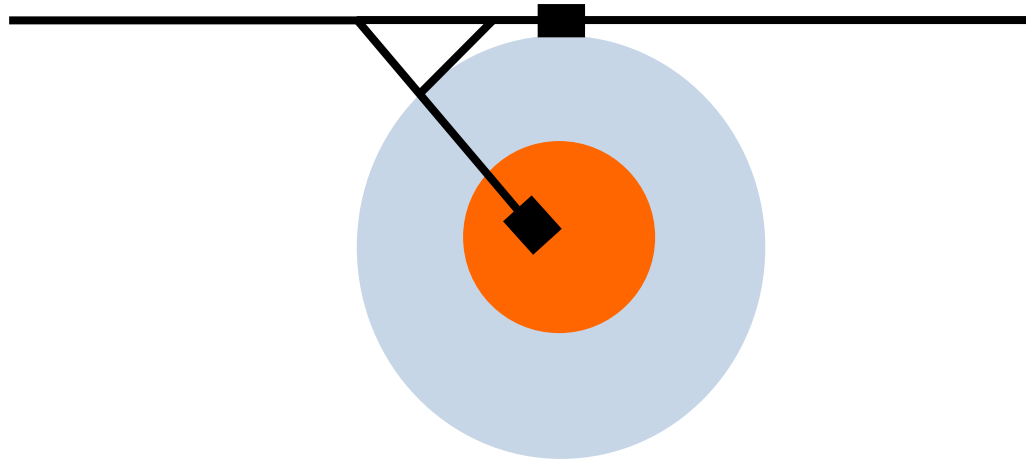


Station location is very important



Large cities generate strong demand from city centre stations

But many passengers in suburbs prefer to use stations on the city fringe where they are quicker and more convenient to access

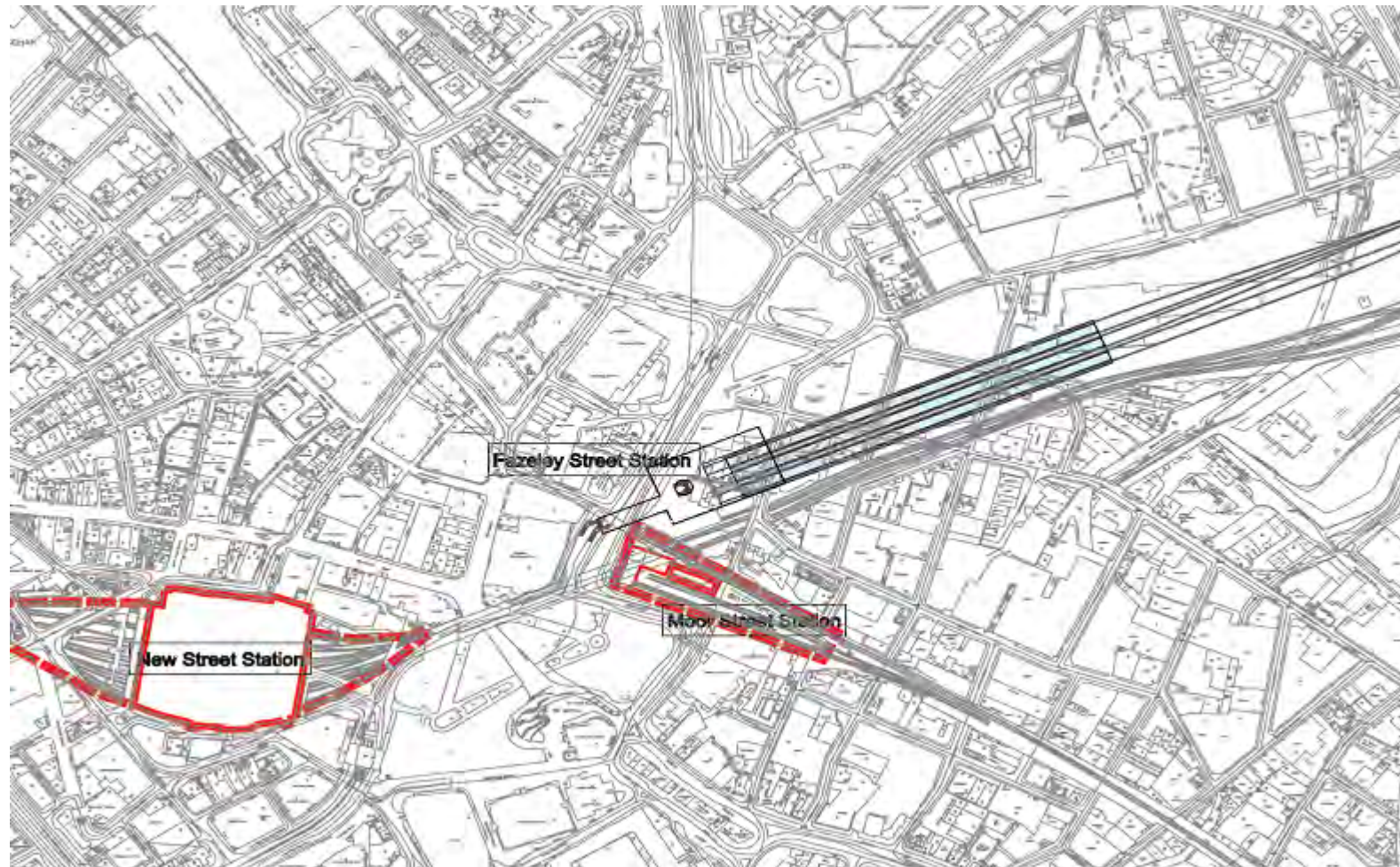


Growth at and around stations

- Creating new business quarters
 - Lyon
 - Shinagawa
 - Old Oak Common
 - Birmingham
- Distance of high value development limited to around 500m by “10 minute” rule
- Extend benefit with good connecting local transport
 - Eg Lille, Kassel
- Second order wider benefits to support service economy



New Central Birmingham Station

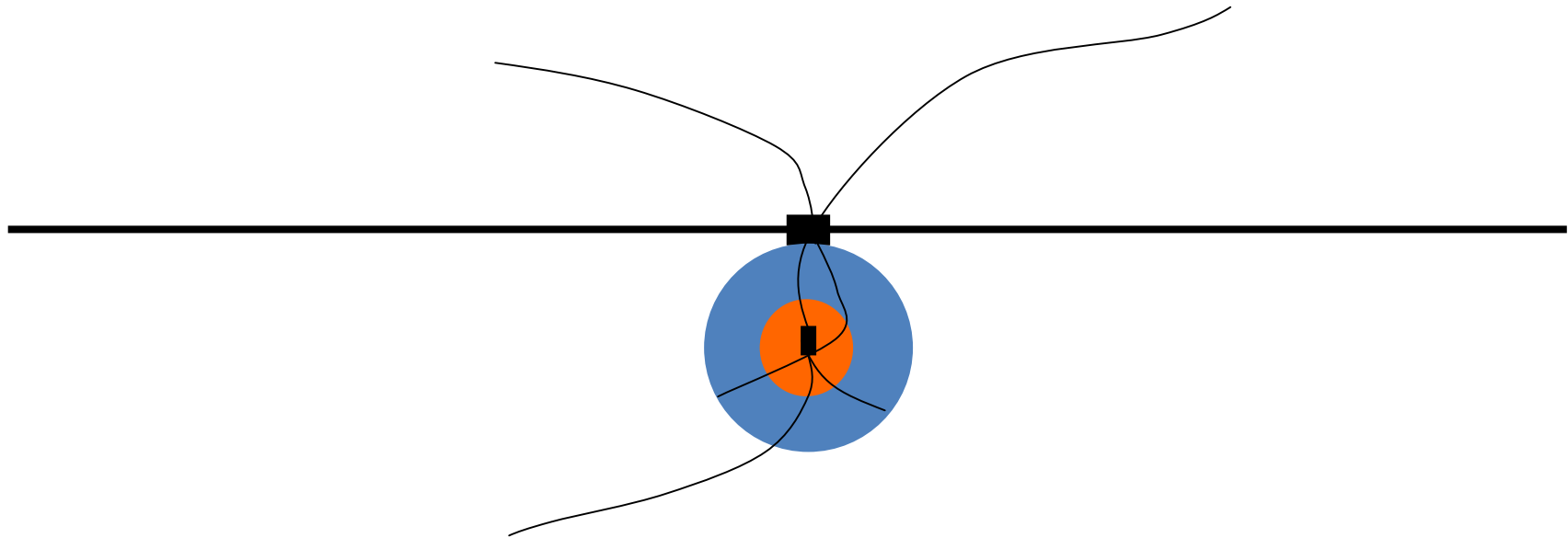


Central Birmingham

- HS2 is at the centre of a masterplan
- Potential for:
 - 36,000 jobs
 - 5m sq ft of employment space
 - 4,000 new homes
 - £1.4bn of economic benefit

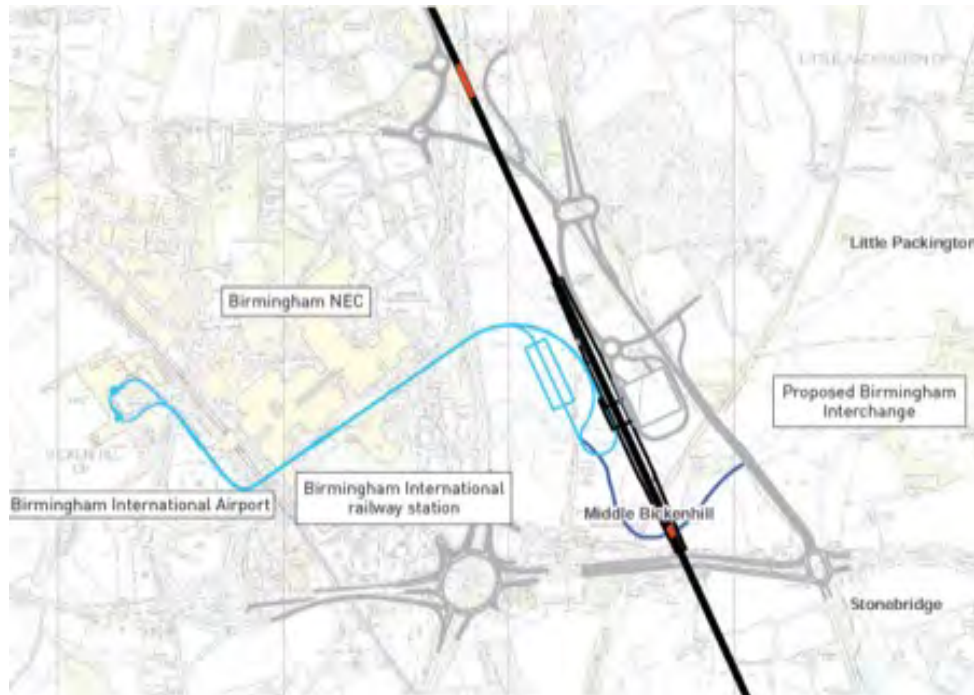


City fringe stations can be successful if there are good local transport links

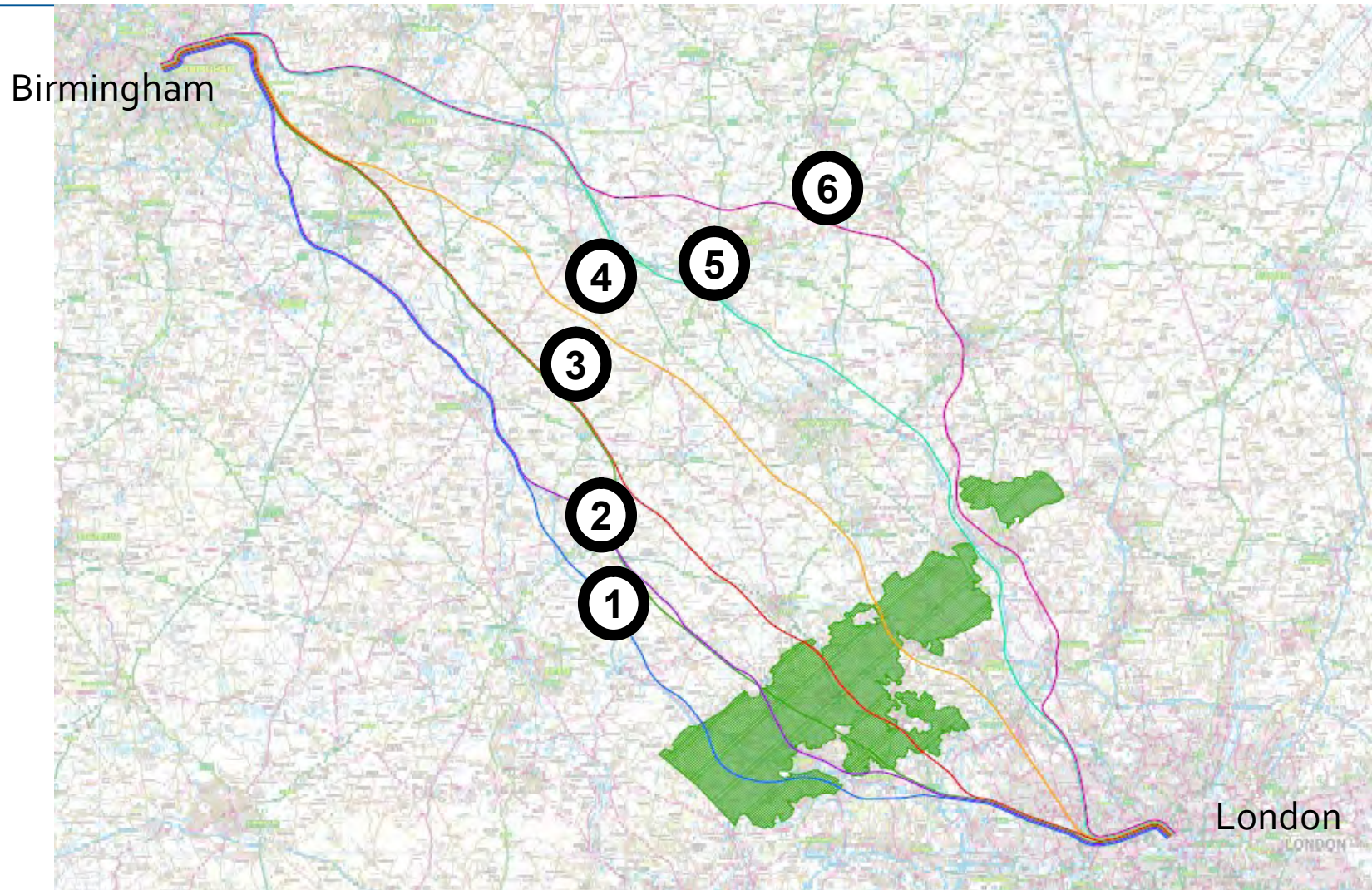


Birmingham Interchange serving the wider city region

- Plans for new Sustainable City “UK Central”



Evidence base for route selection – benefits, costs and impacts



A significant challenge is noise reduction

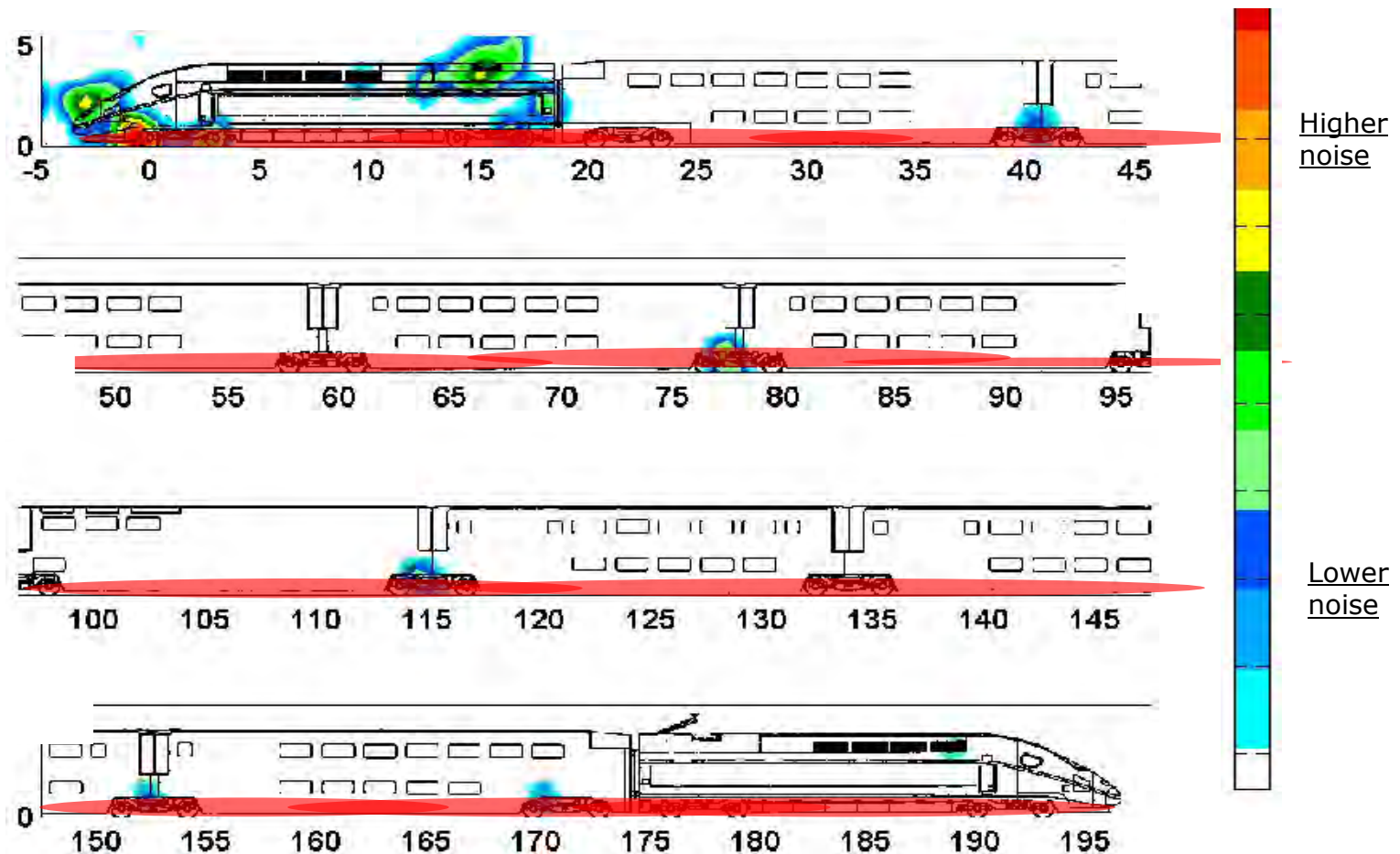


Image based on SNCF 1/3 Octave Noise Map of TGV at 360km/hr
modified to represent L_{pAeq} using output from TWINS modelling

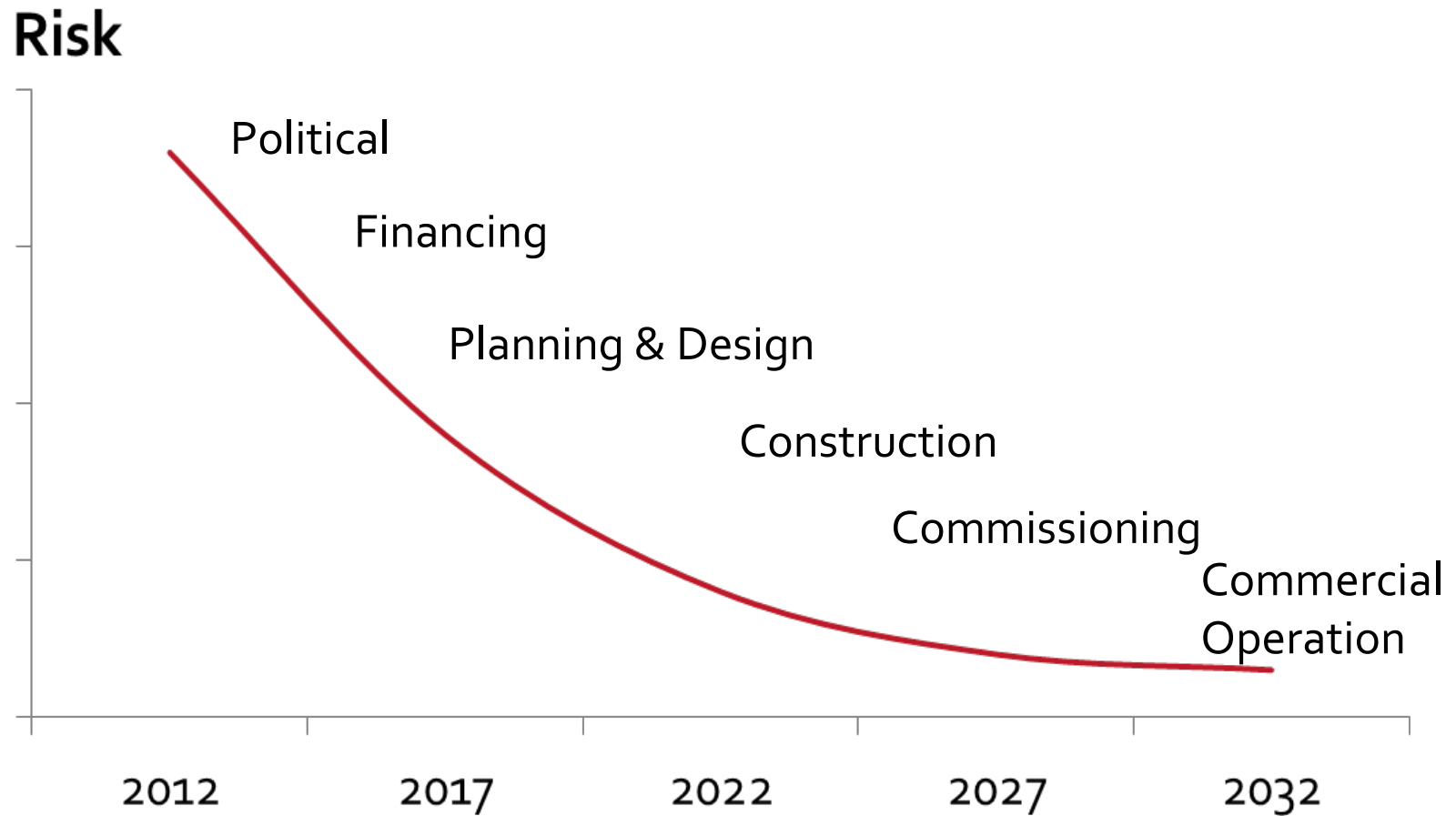
Defending the evidence in public consultation



Virtual design, construction and operation through BIM



Project risk reduces over time





Judged By Future Generations