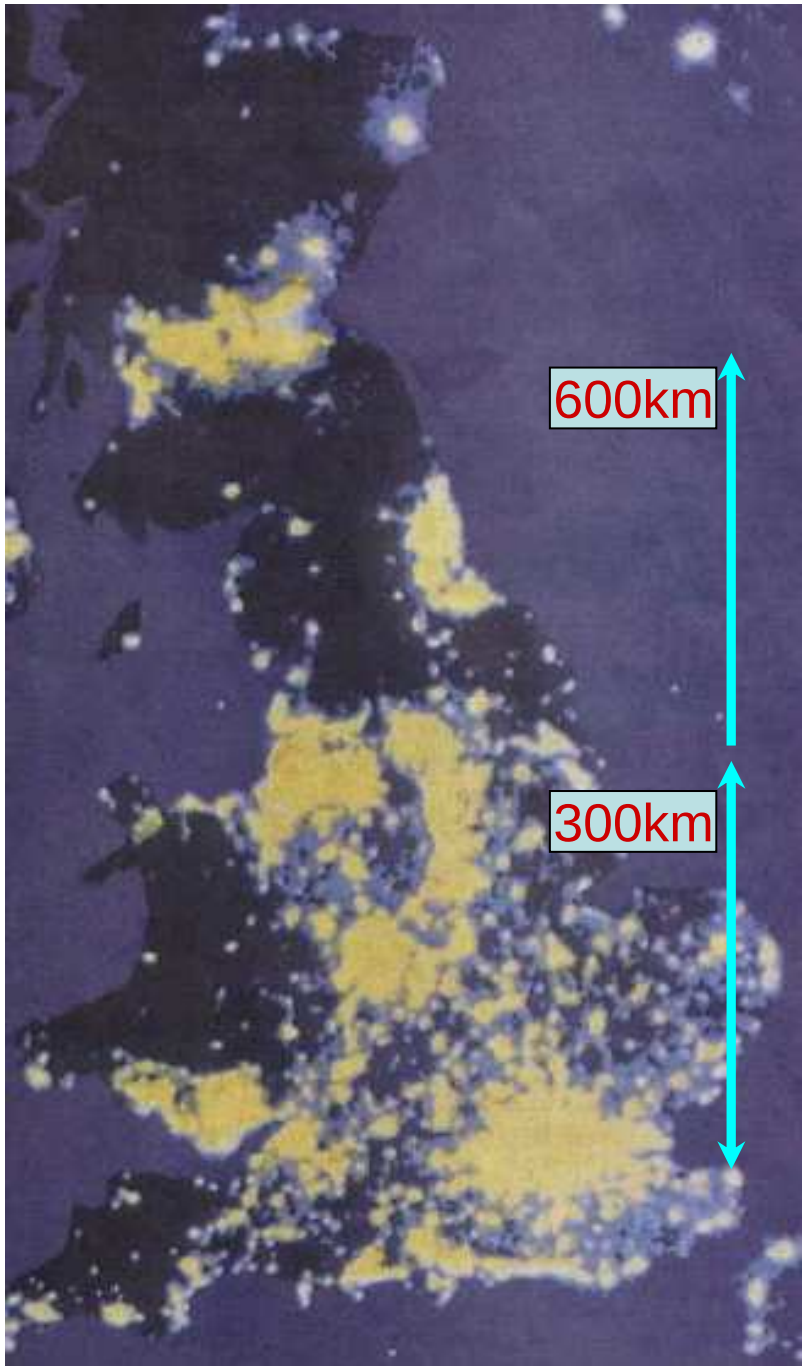
Great Britain’s High Speed Rail Plans

Prof Andrew McNaughton

Chief Engineer, High Speed Two Ltd

Japan 1964

This was Britain…


600km
300km

Classic Heritage Infrastructure

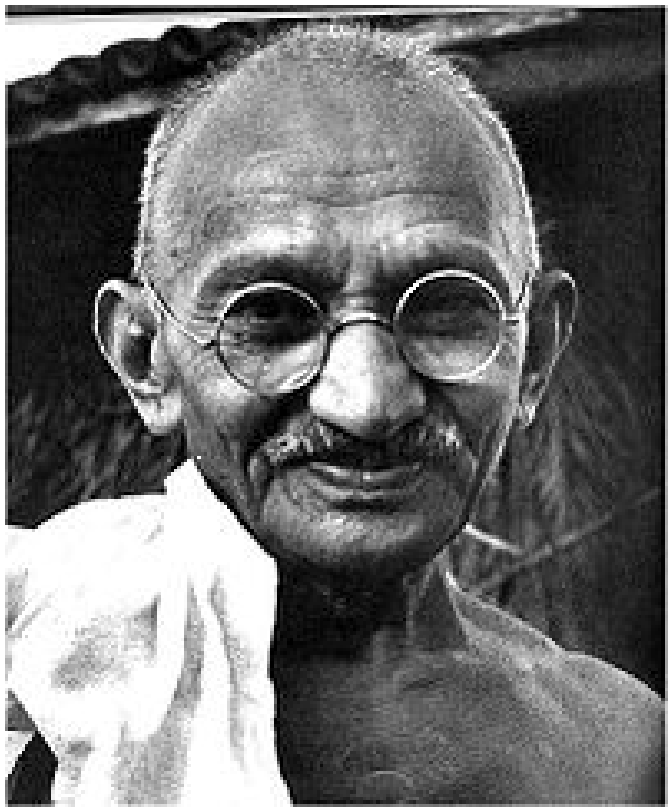
We Have 150kph Average Speeds

But Upgrading Is Hard Work

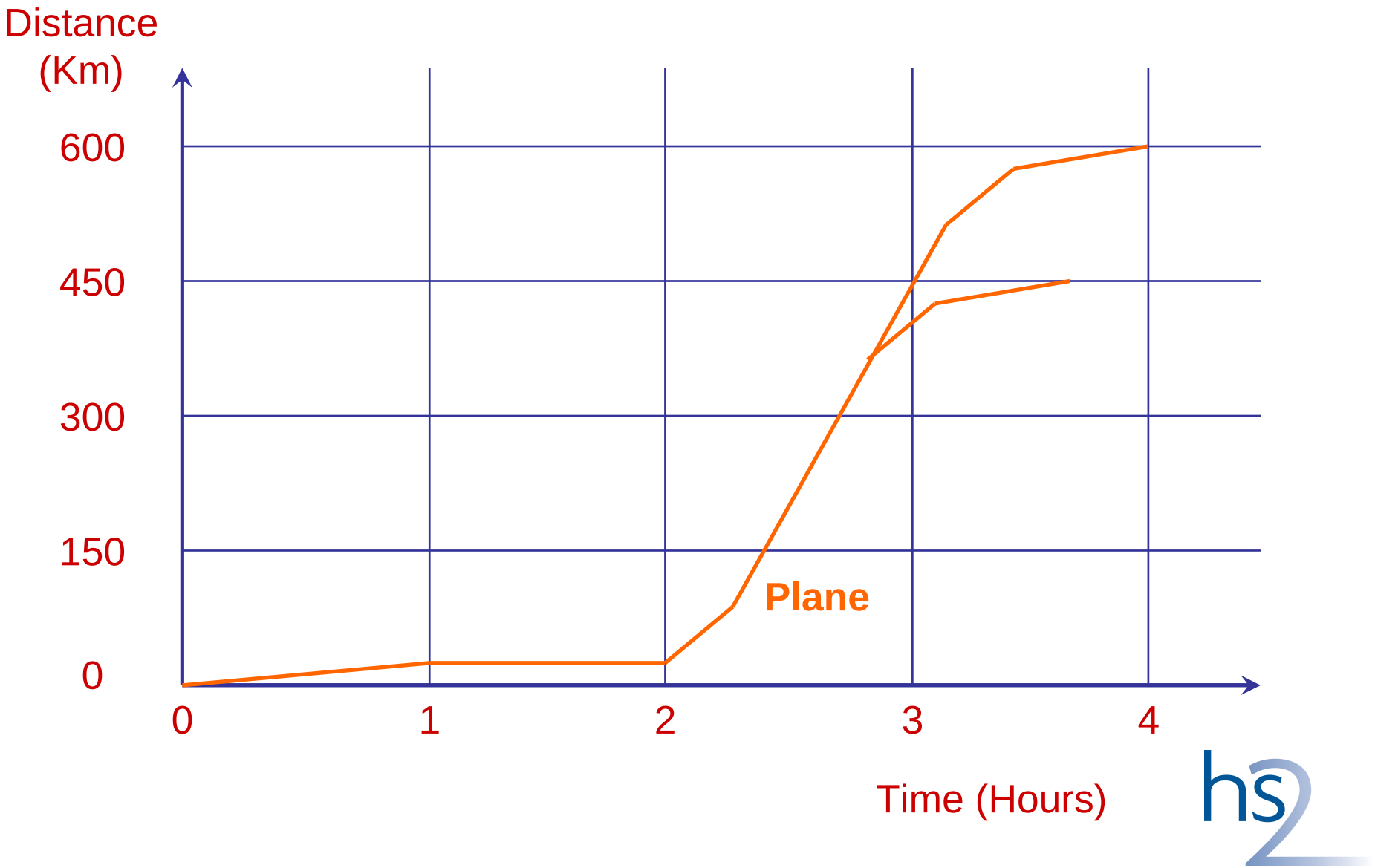
Why High Speed Rail…?

"There is more to life than increasing its speed"

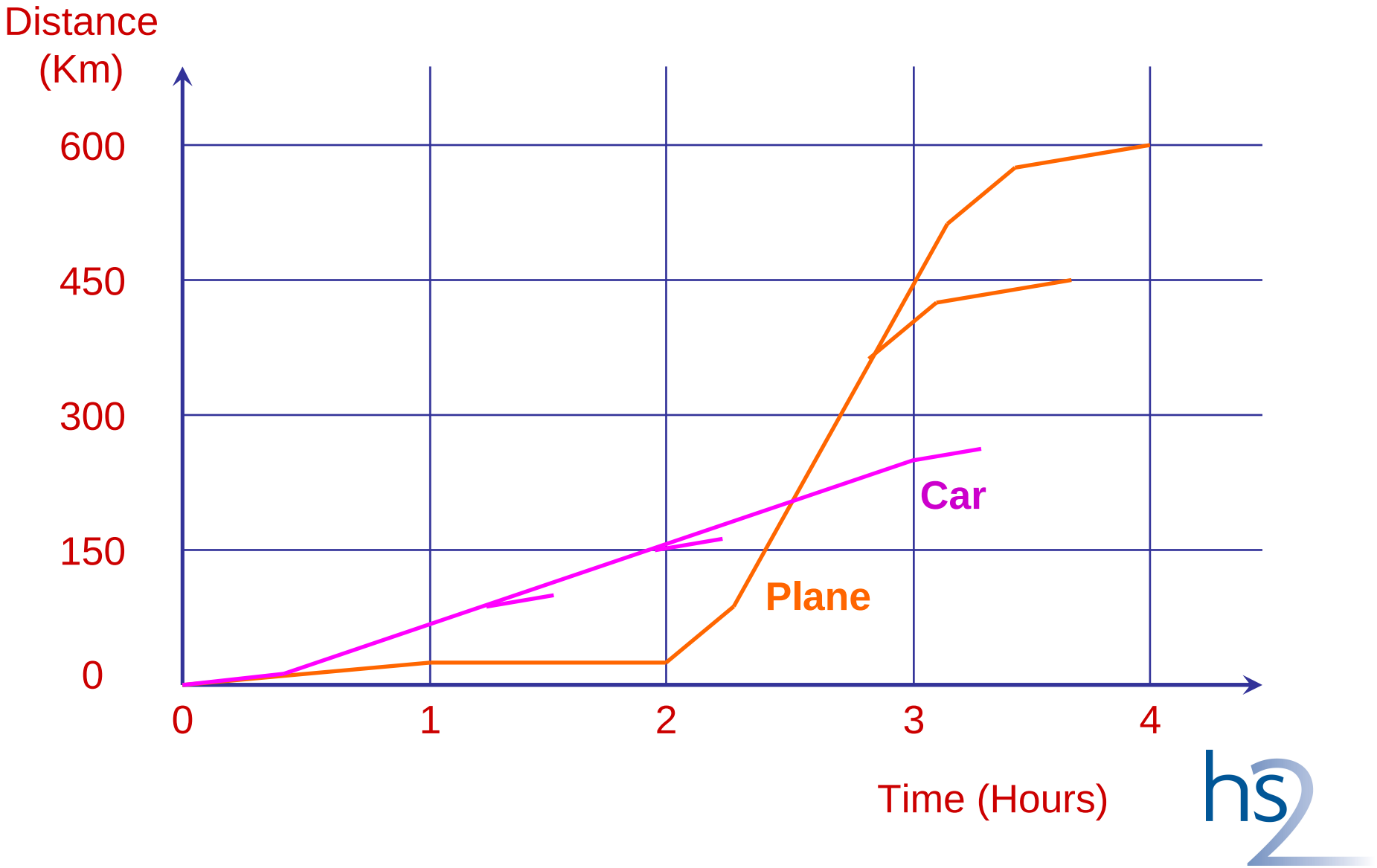
– Mahatma Gandhi



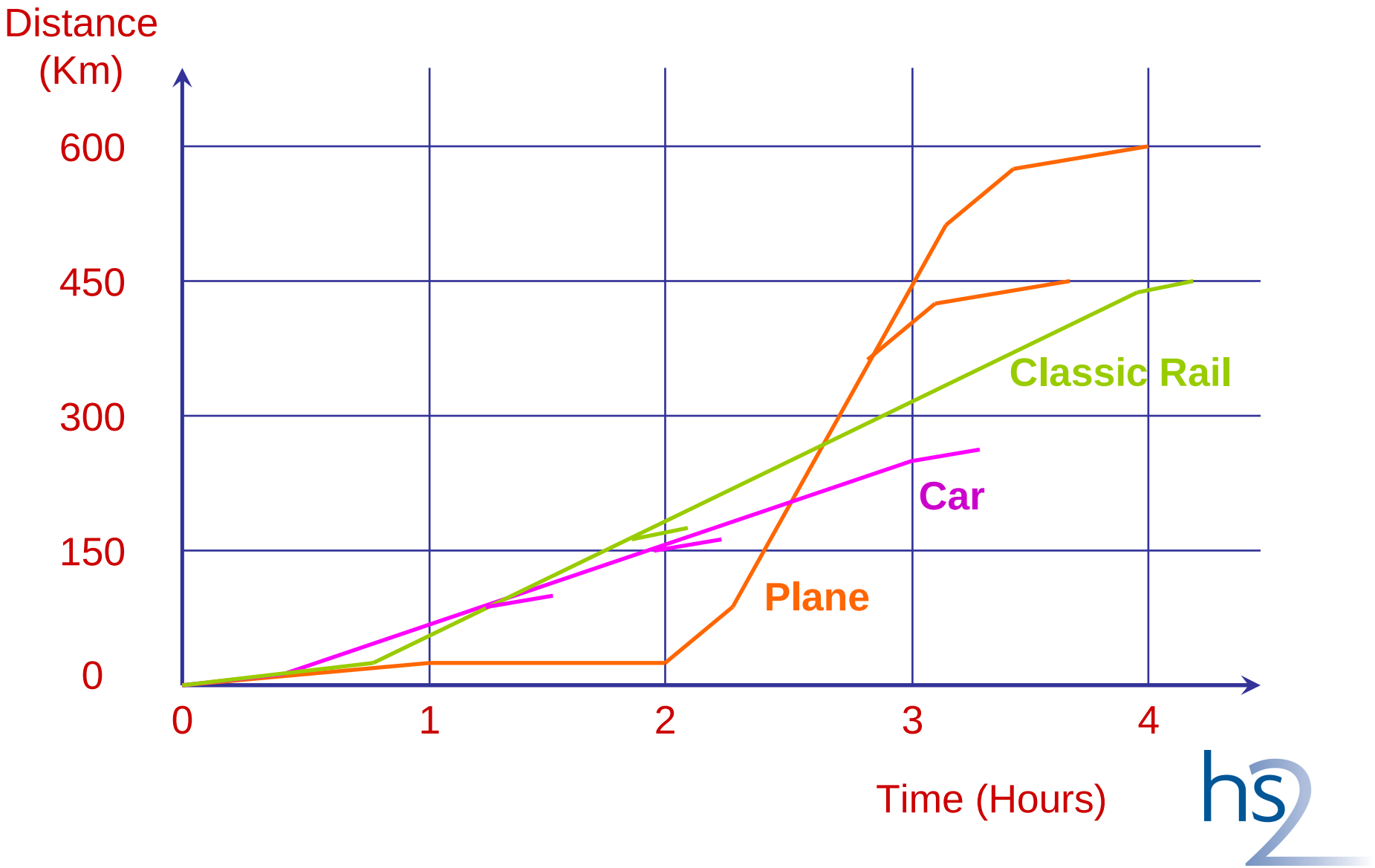
Door To Door Journey Time



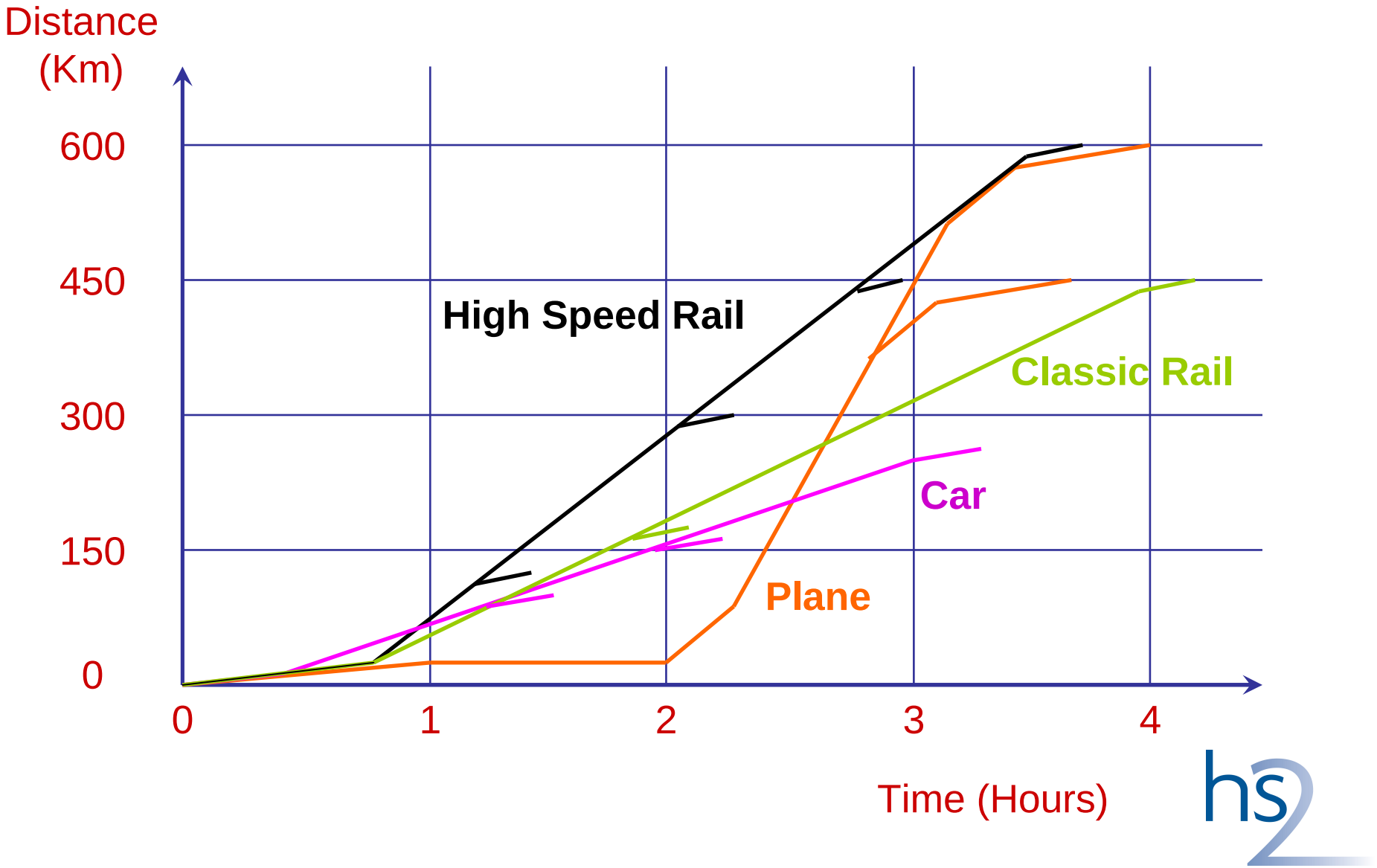
Door to Door Journey Time



Door to Door Journey Time



Door to Door Journey Time



HSR vs Car

HSR vs Car

- W Midlands to Manchester is 120km
- Road / Rail journey time 1½hr
- Need to better 3/4 hr
- We need 300kph+
- Or we build new motorways

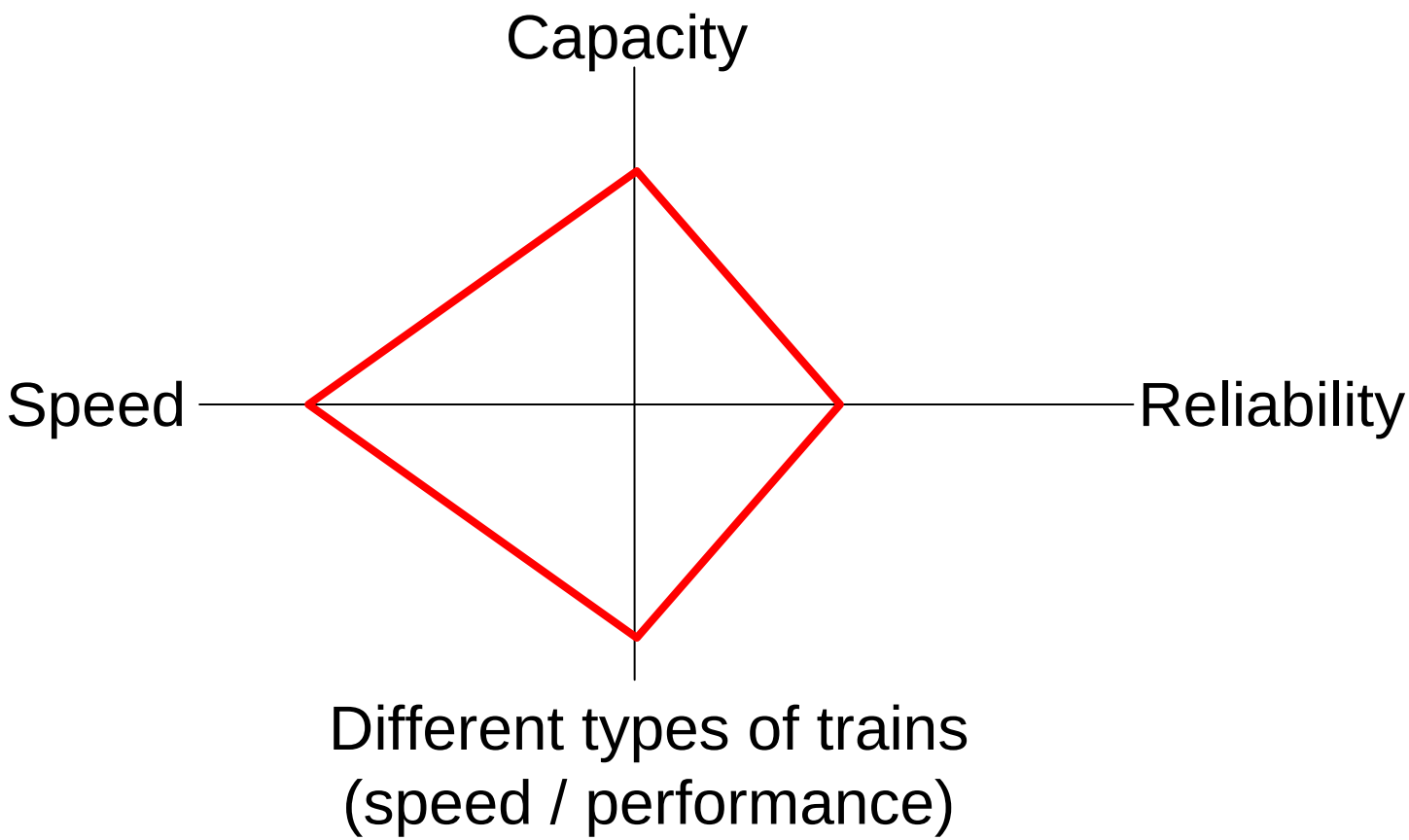
Speed is not enough…

“L’enfers c’est les autres”

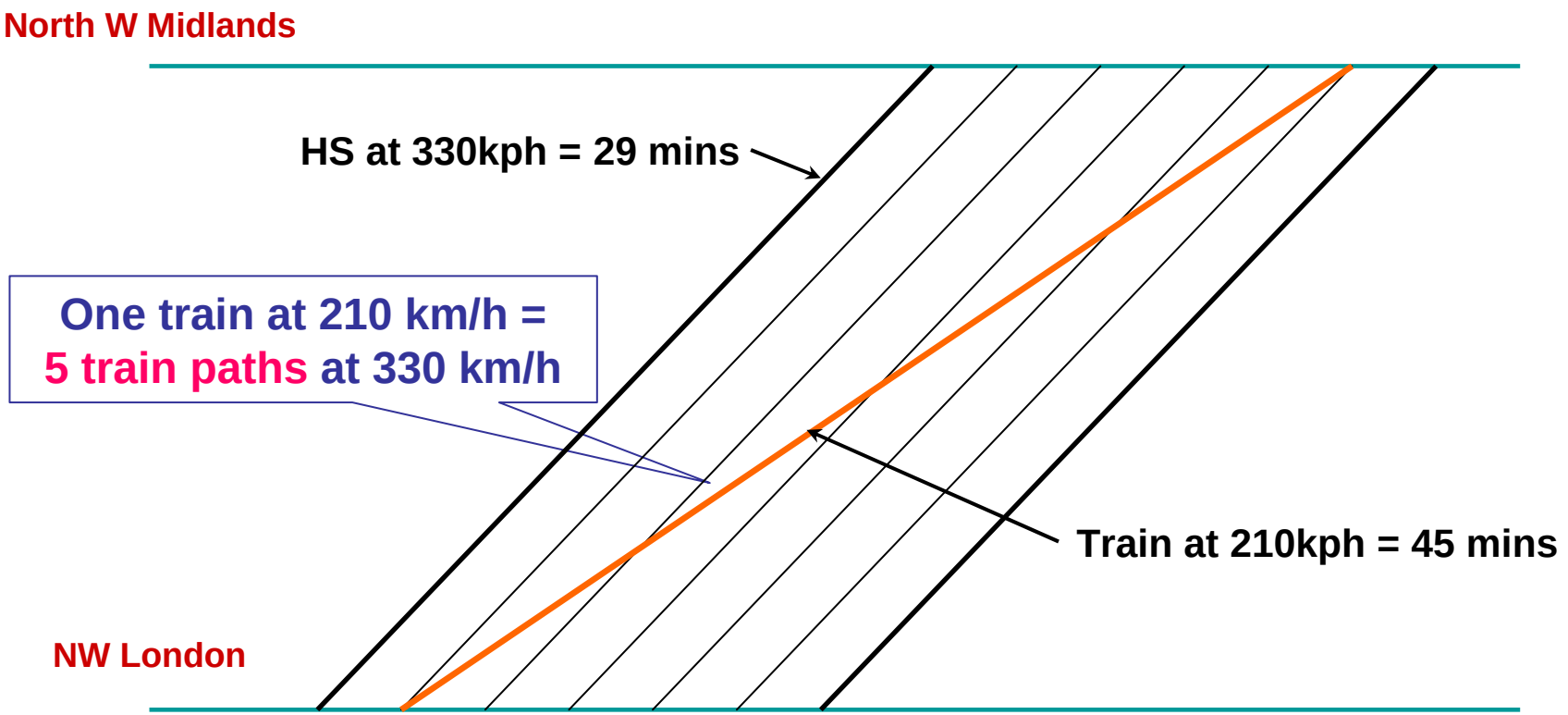
– Jean Paul Sartre

Next Generation Trains

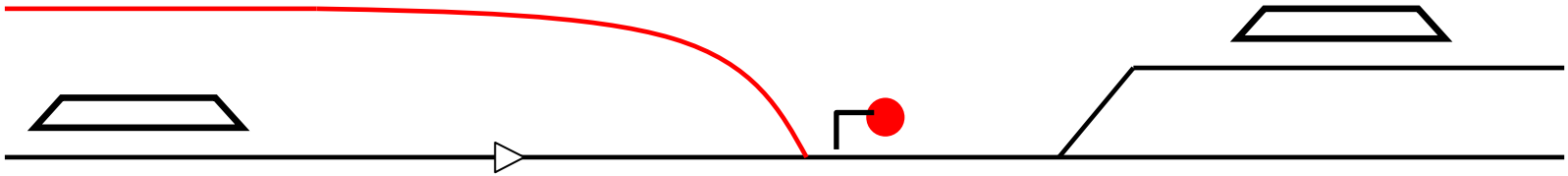
Balancing Capacity



Mixing Traffic Speeds



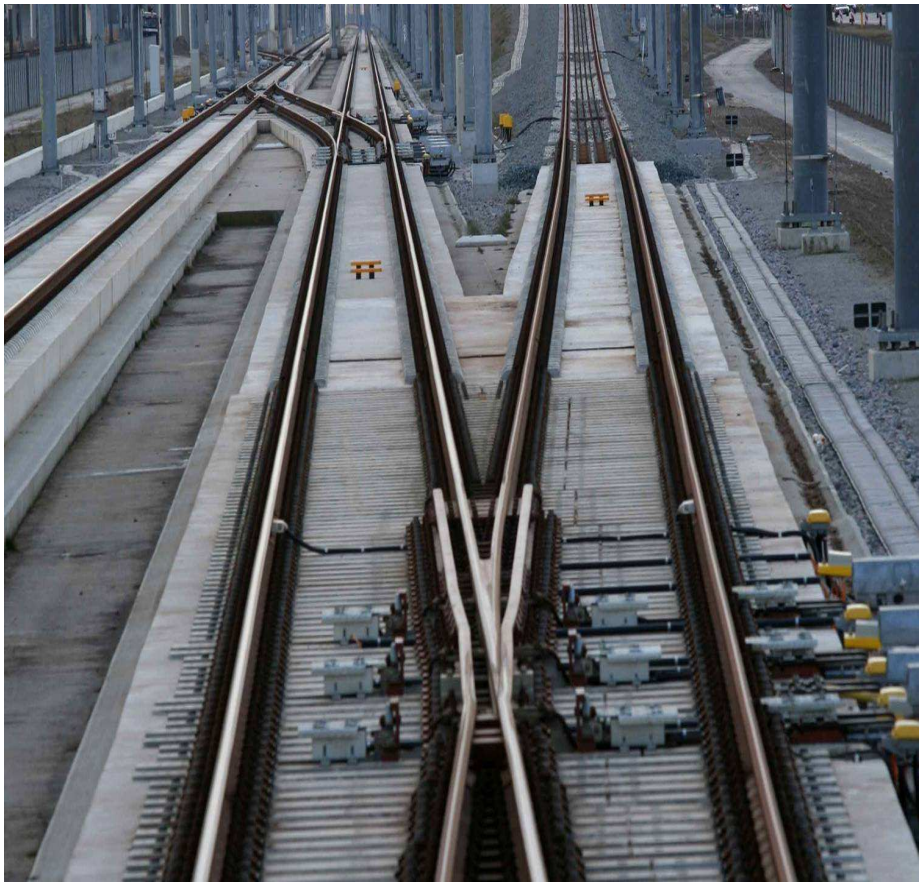
Reducing Headway

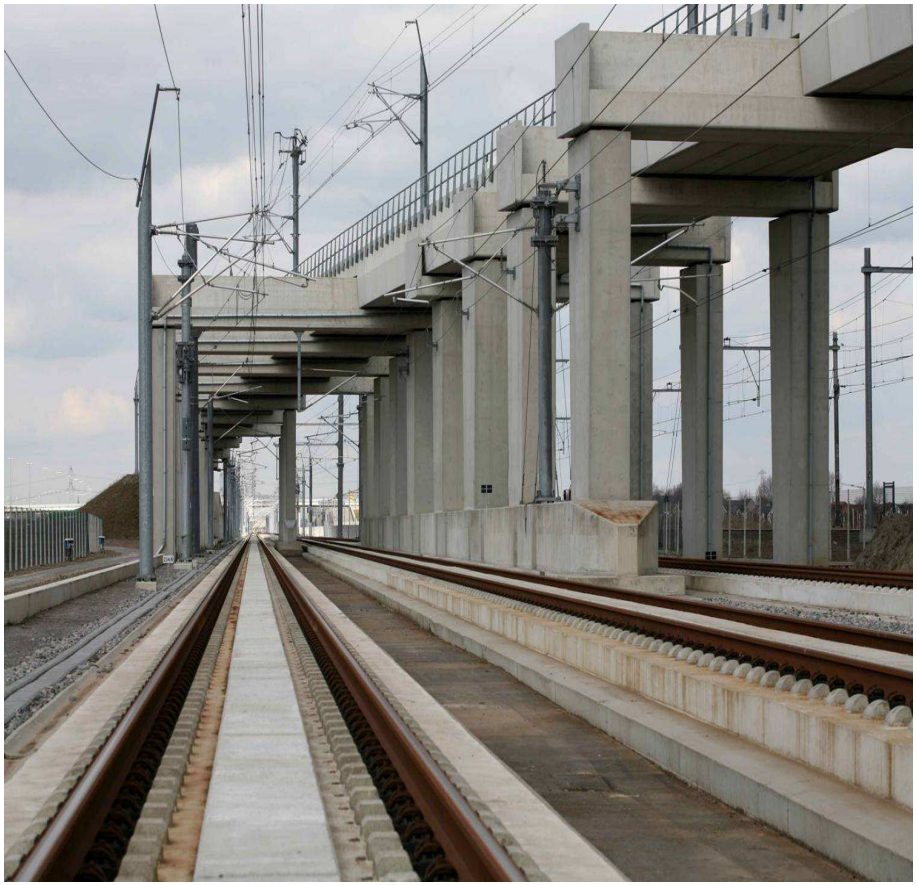


Automatic Train Operation?

Automated Examination

Continuous Slab Track?



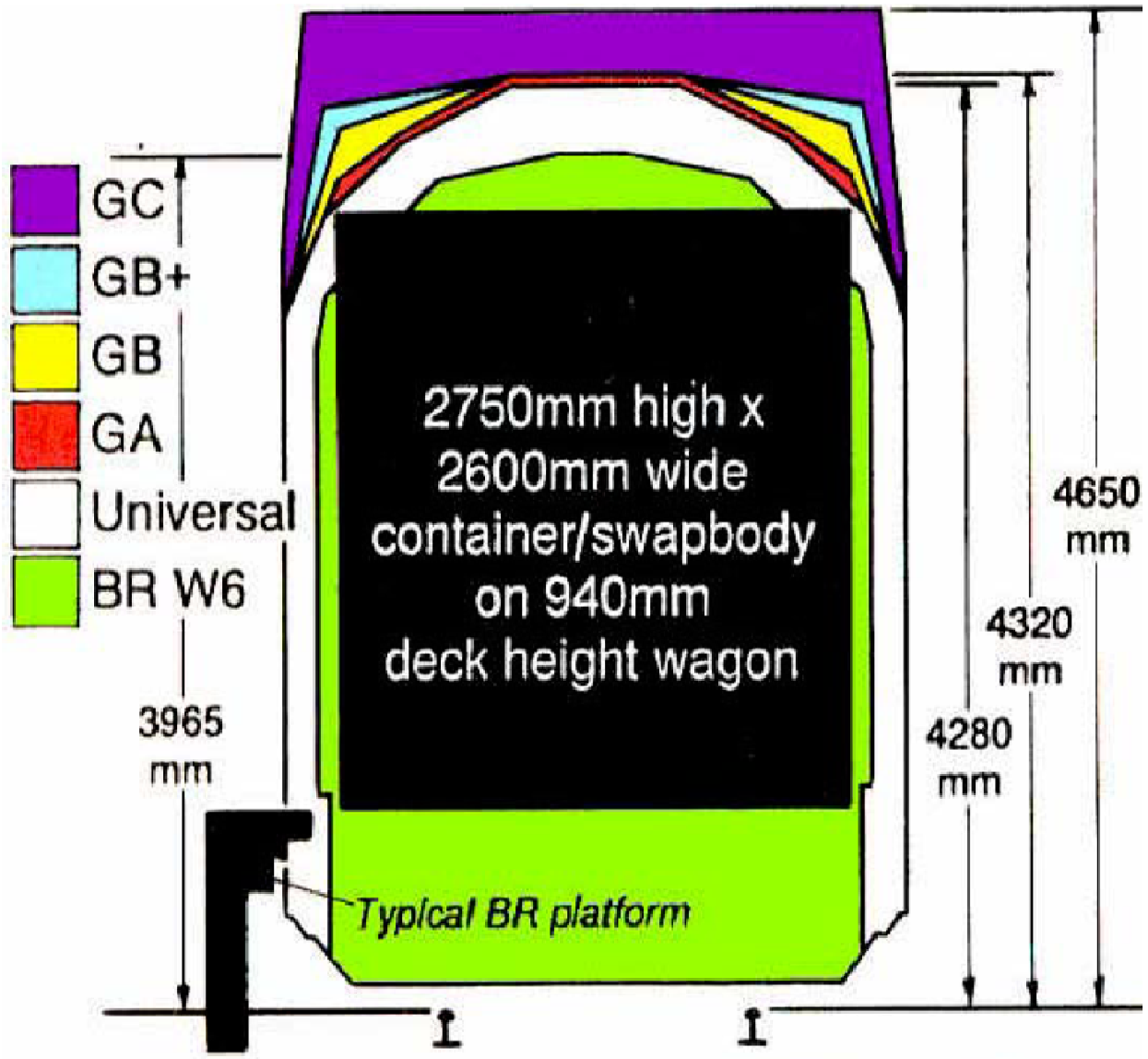


Relationship With GB Classic Rail?

Trains

- Length
  - Classic 245m
  - HS 2 x 200m
    = 400m
- Platform Height
  - Classic 915mm
  - HS 760mm

Gauge


GC
GB+
GB
GA
Universal
BR W6
2750mm high x
2600mm wide
container/swapbody
on 940mm
deck height wagon
3965
mm
4280
mm
4320
mm
4650
mm
Typical BR platform

Initial Capacity

- Timetabled headway 3 mins
- Running to / from classic rail network
  - Only dedicated trains can be full length
  - Performance allowance for classic rail
- c14 train paths per hour
- Passenger capacity c9,000 seats per hour per line

Future Capacity

- Largely separate network
- ERTMS Level 3 and Automatic Train Operation
- Timetabled headway 2.5 mins
- Headway at 230kph junctions 3.5 mins
- 18 train paths per hour
- Passenger capacity c18,000 seats per hour per line

HS2 Study

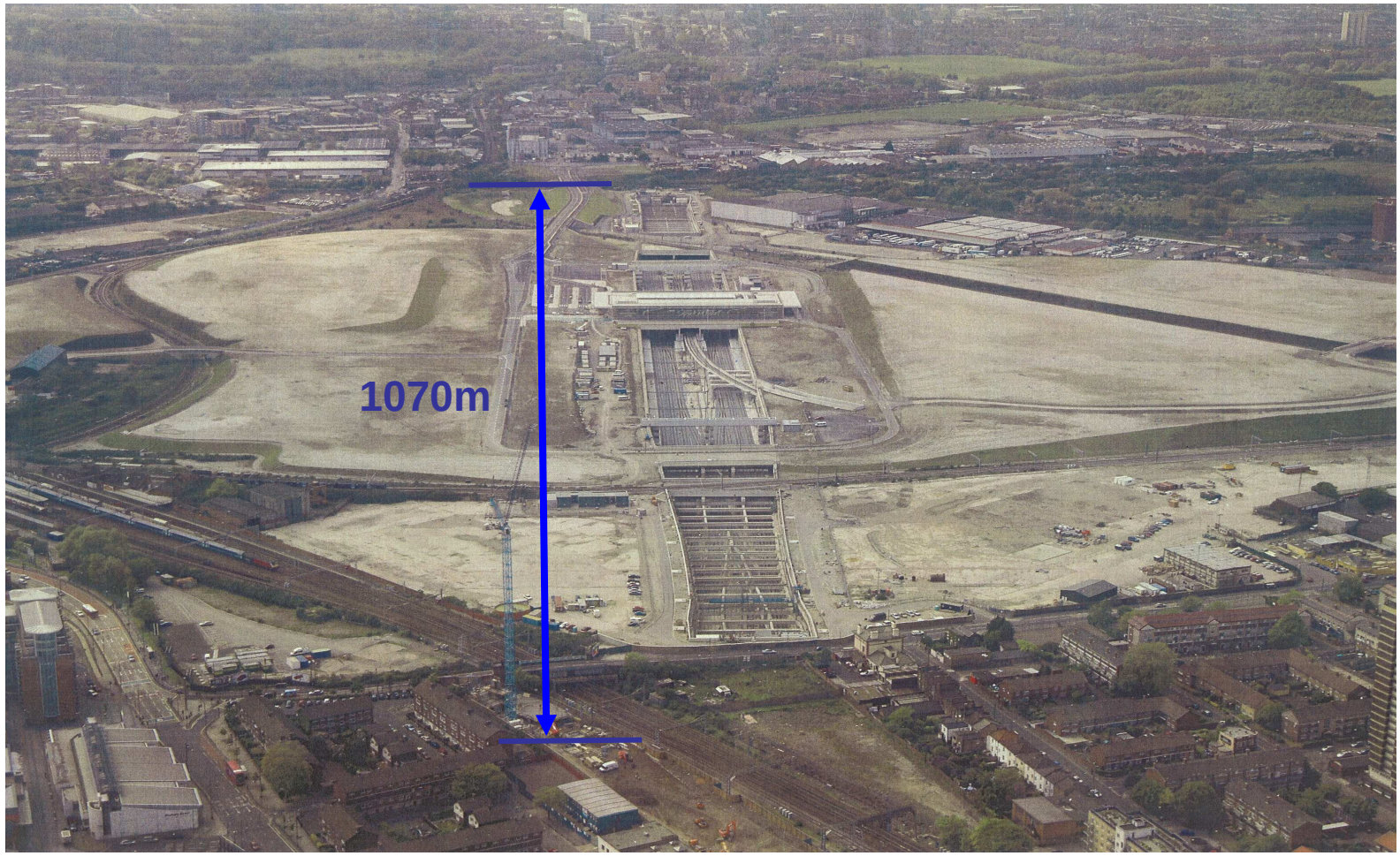
- London – West Midlands and then a future network
  - Demand modelling
  - Operational and technical specification
  - The best route
  - Strategic environmental assessment
  - Costs
  - Full business case
  - Funding and risk assessment
- In 11 months

Detailed Demand Modelling

- No premium on fares
- Journey times based on 360kph trains
- Included wider economic benefits
- A jumbo jet into Central London every 75 seconds

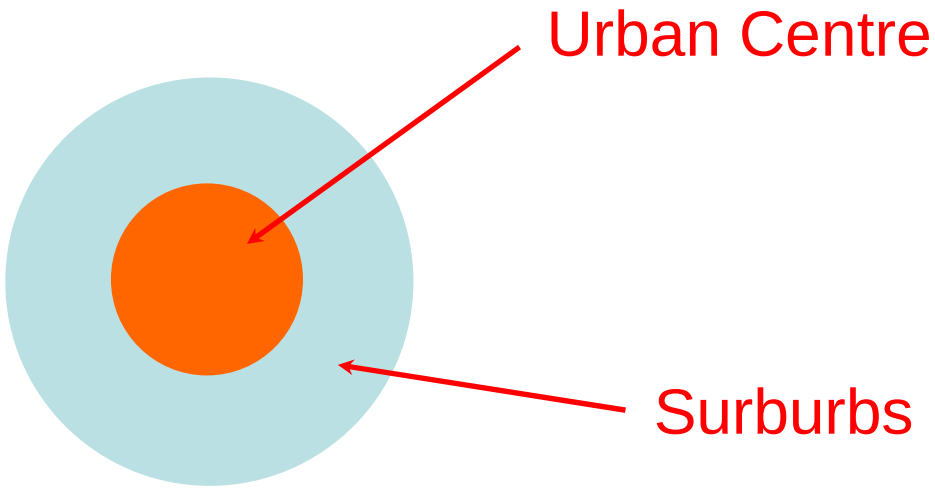
Stations for High Passenger Flows

HS1 London Olympic Box

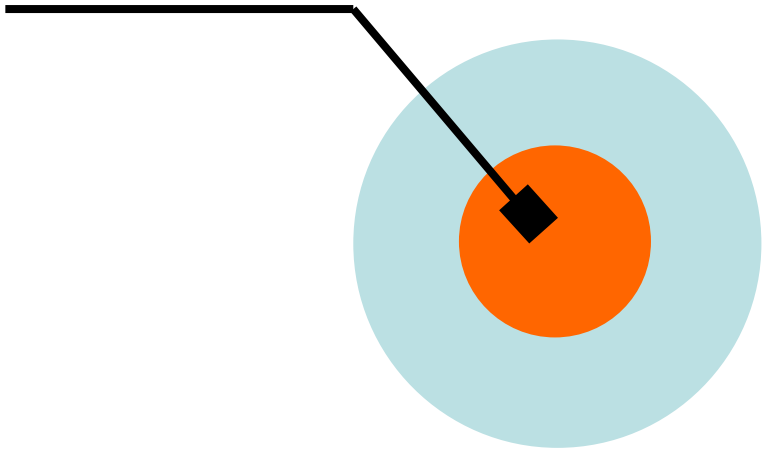


Siting Of New HS Terminals

- Large City “A”

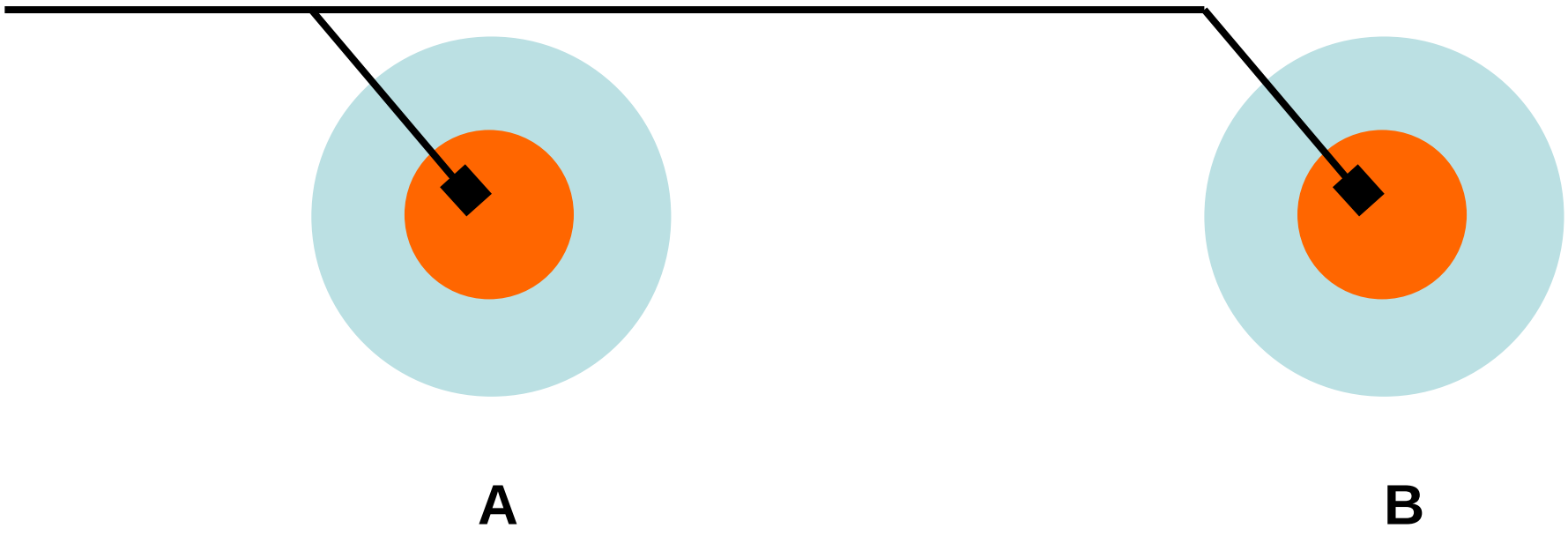


First Stage

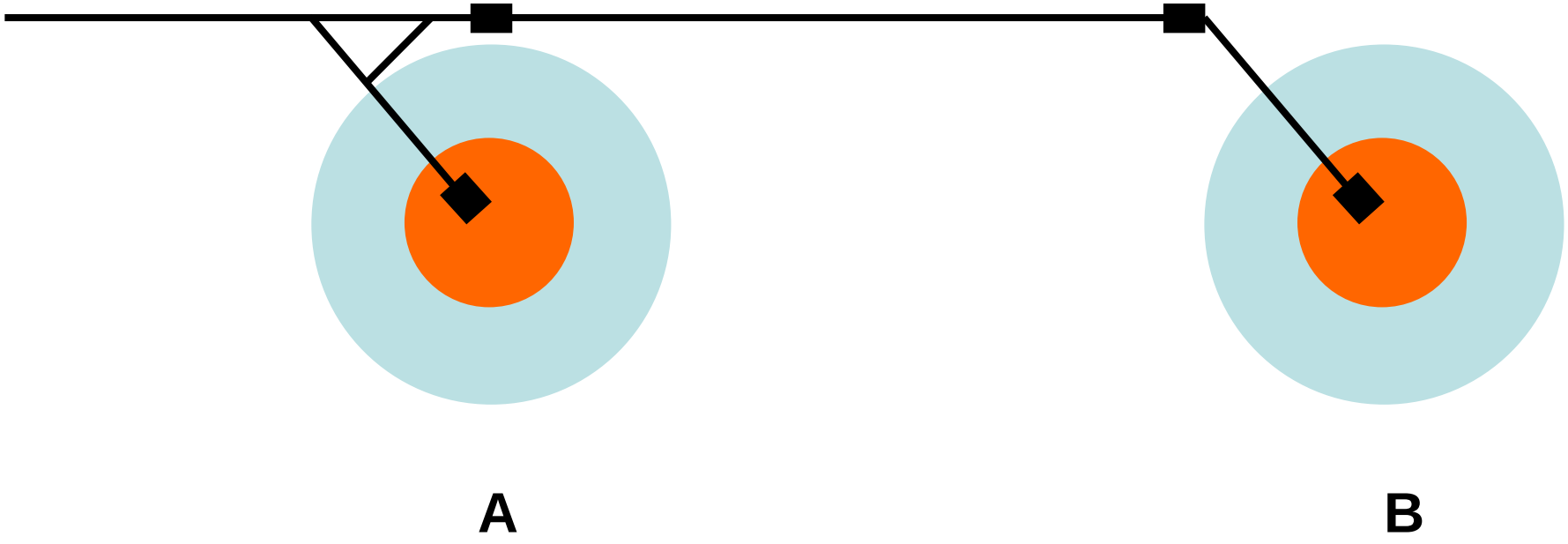


A

Extend to Large City B

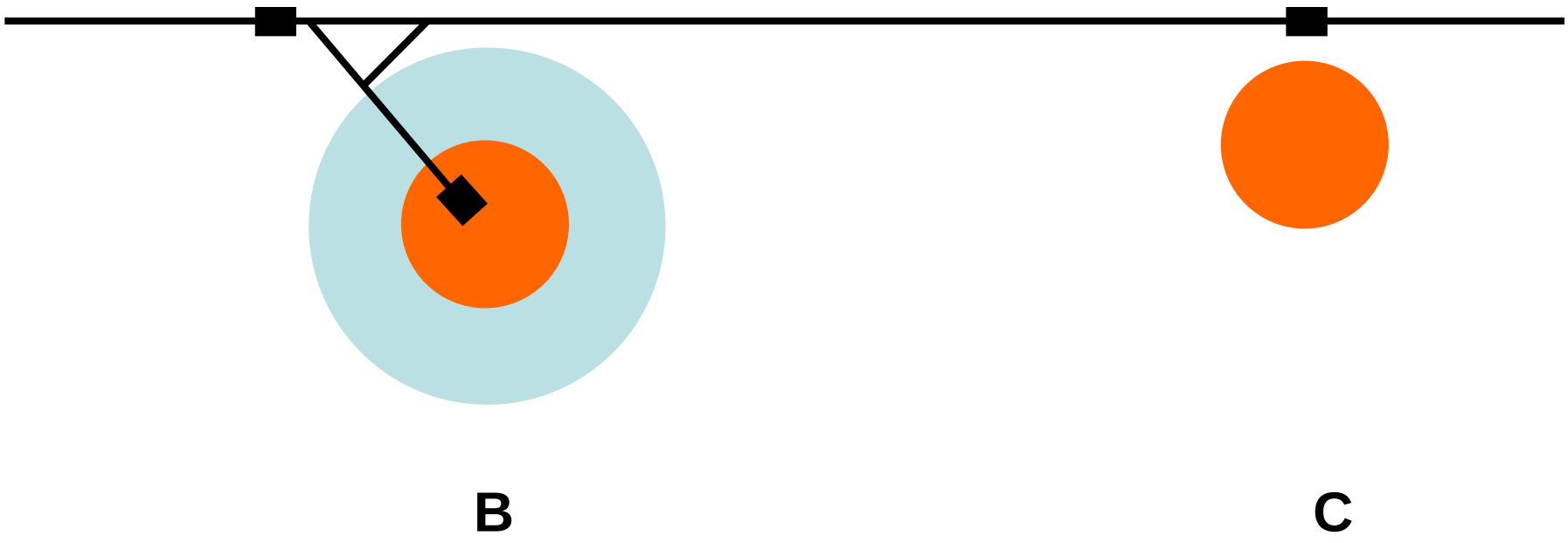


City Centre AND Parkway Stations



Go Near Smaller City C

Go Near Smaller City C

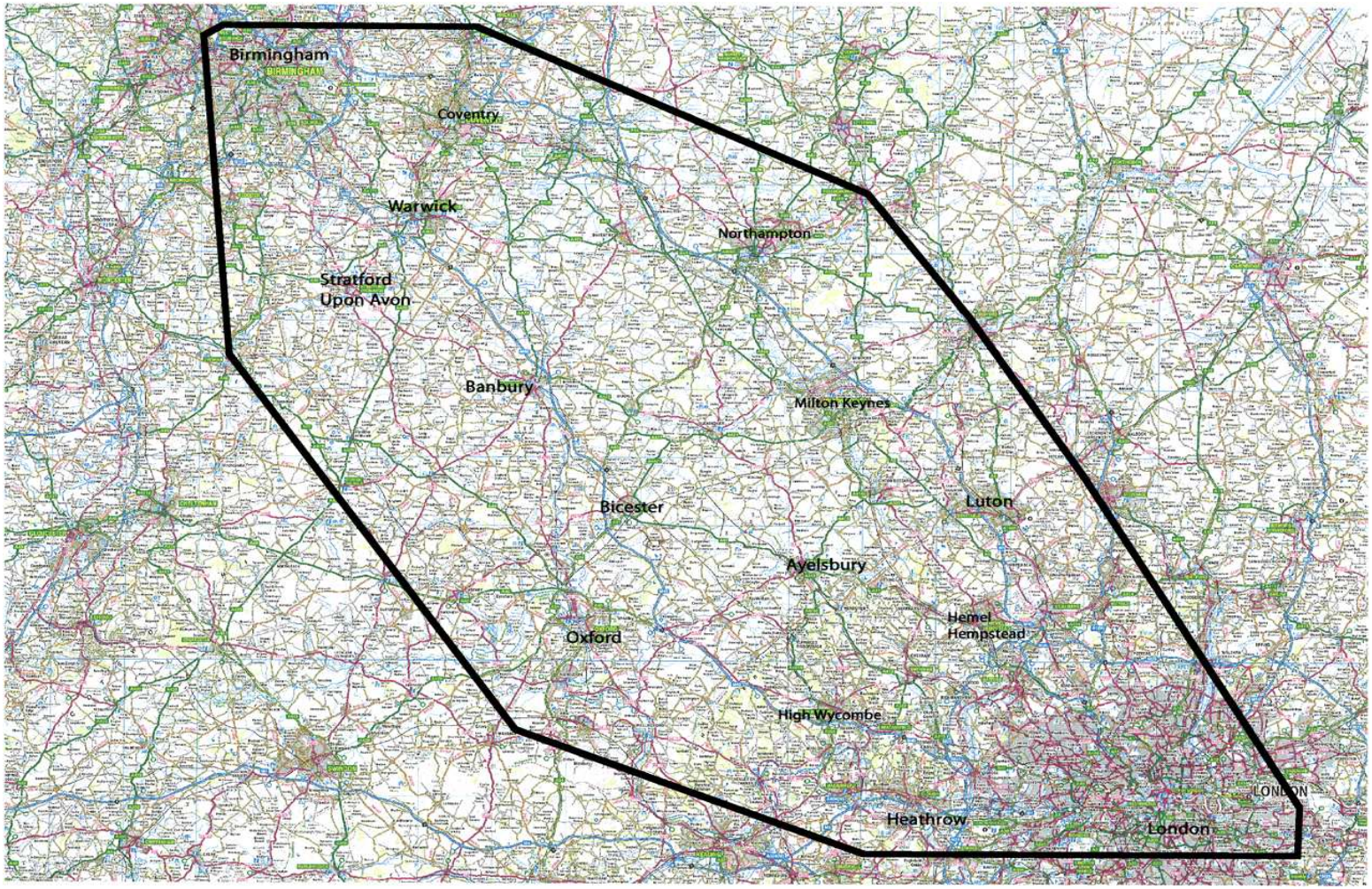


City C Develops Towards The HS Line

Business Case Led Specification

- Fully TSI compliant
  - GC Gauge
  - 400kph ultimate design speed
  - 2.5% max gradients
  - 360kph High Speed Trains only
- Meet all UK sustainability requirements
  - Protected historic sites
  - National and international environments
  - Biodiversity
  - Equalities assessments
- Detailed Costs and Risks
  - International benchmarking
  - Including operational and construction carbon estimates

Some Challenges



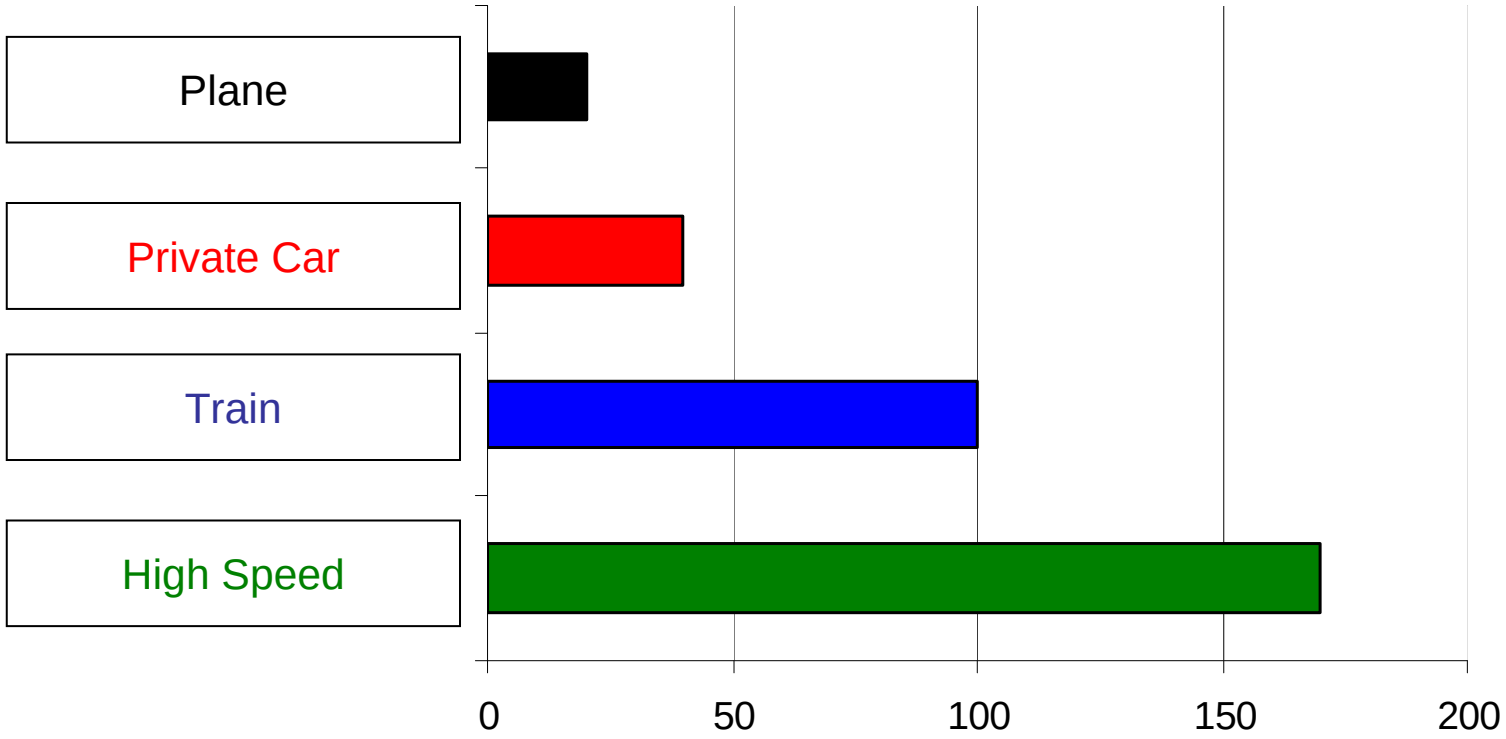

Wendover C. C.
Ellesborough
For
2 miles
KH54 PJX

Impact


40

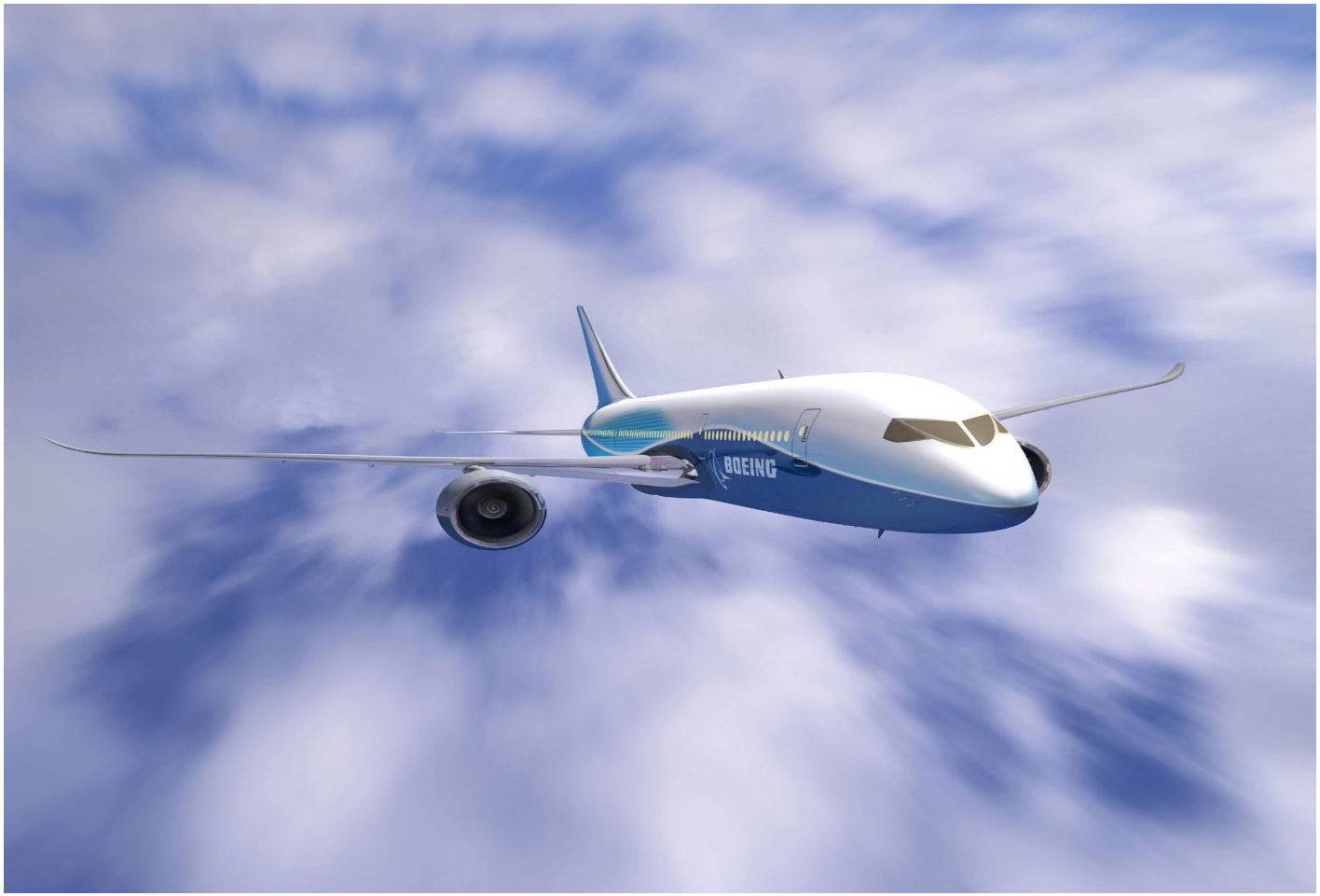
Follow Existing Transport Corridors?

Energy Efficiency



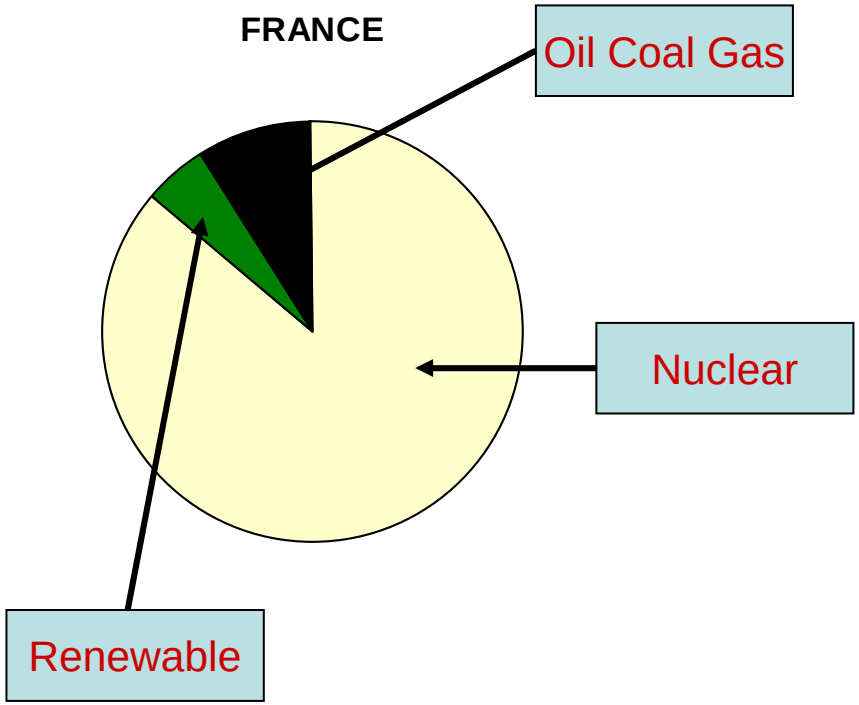
Passenger km per kilo equivalent petrol

New Lower Impact Designs

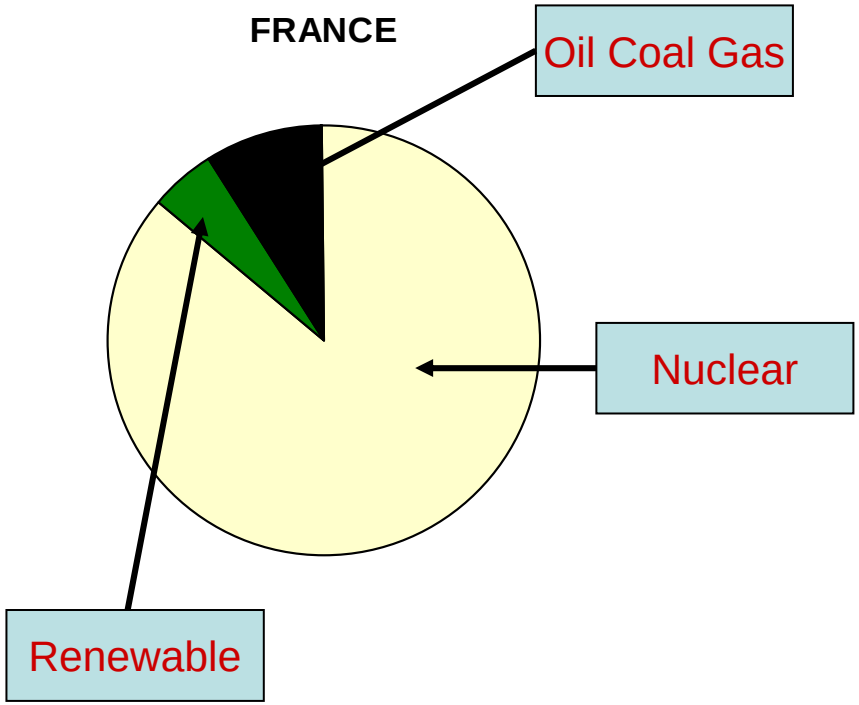


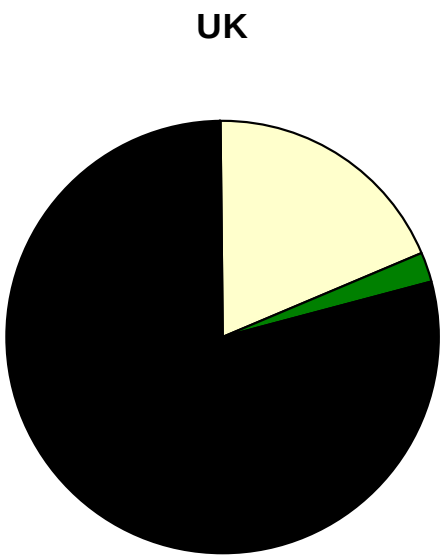
Cars Too

Power Generation Mix



Power Generation Mix





Construction Carbon

Future Network

Future Network

Future Network

- All lines lead to London?

Future Network

- But if you are in the West Midlands…

Future Network

- Or Scotland…

Future Network

Journey Times of 45 mins

Future Network

- Bringing the Northern Cities together

Our Report

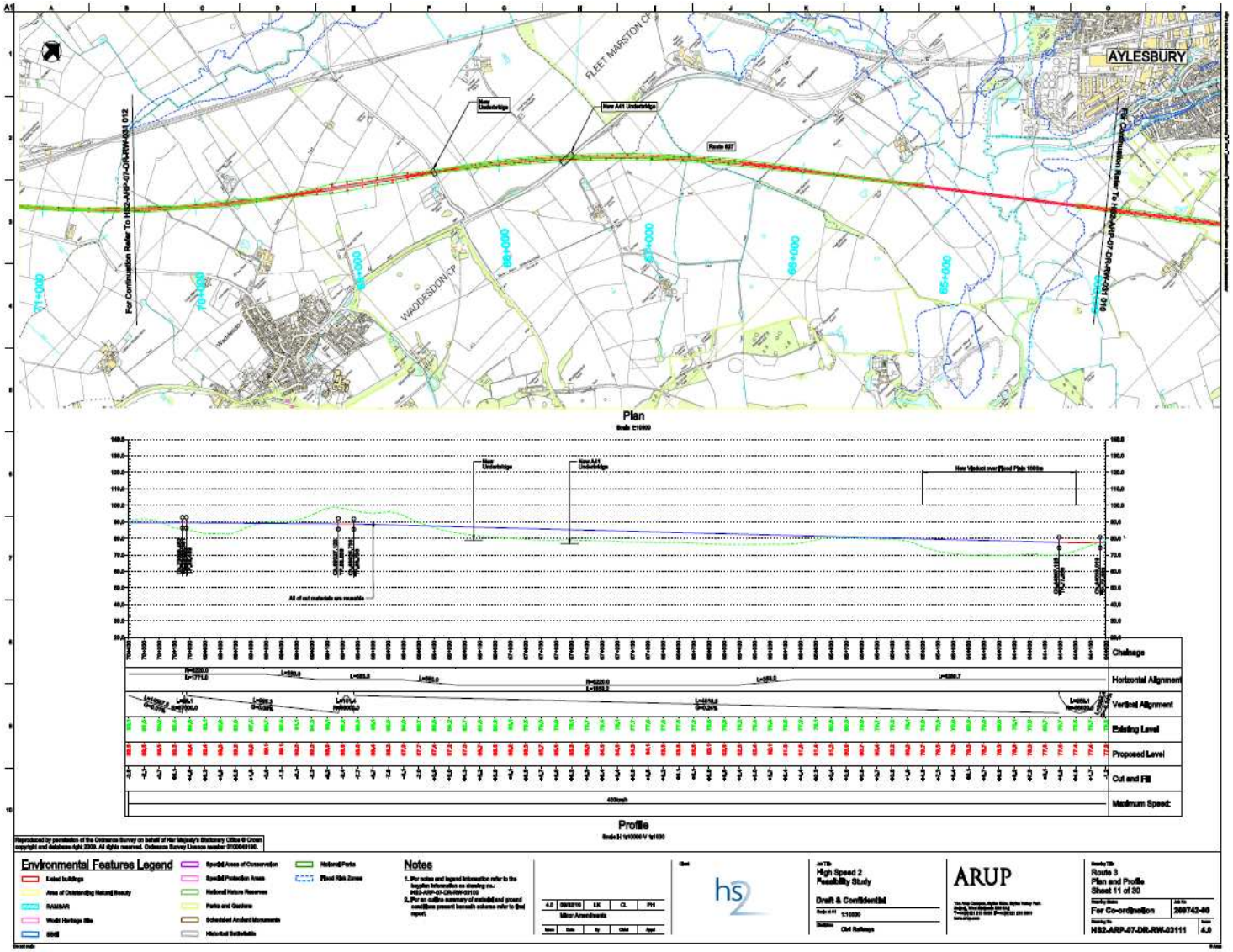
High Speed Rail
London to the West Midlands and Beyond

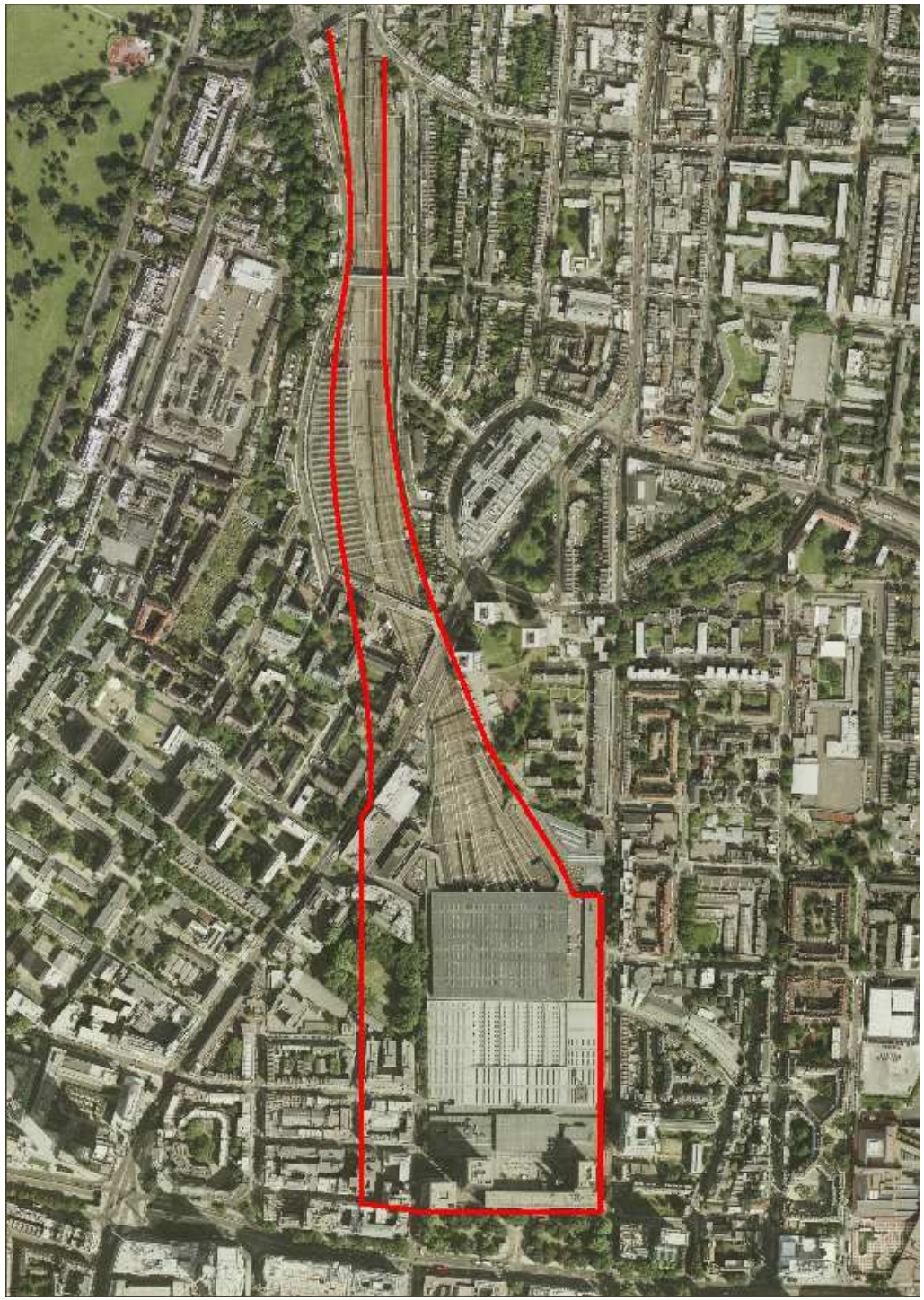
A Report to Government
by High Speed Two Limited

HS2 Initial Route

- London – West Midlands
- The optimum engineered route
  - +/- 25m horizontally
  - +/- 0.5m vertically

An Engineered Route

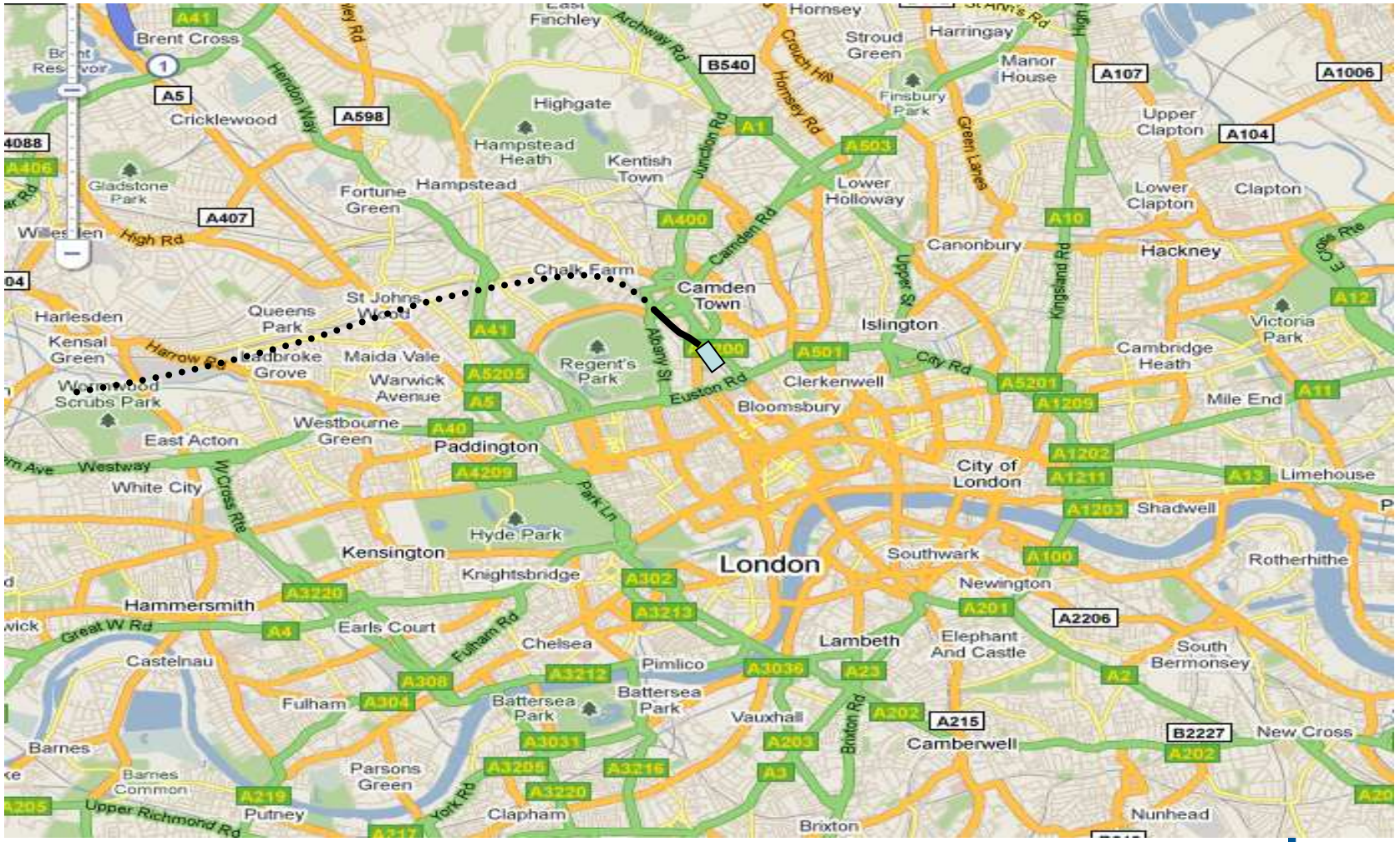




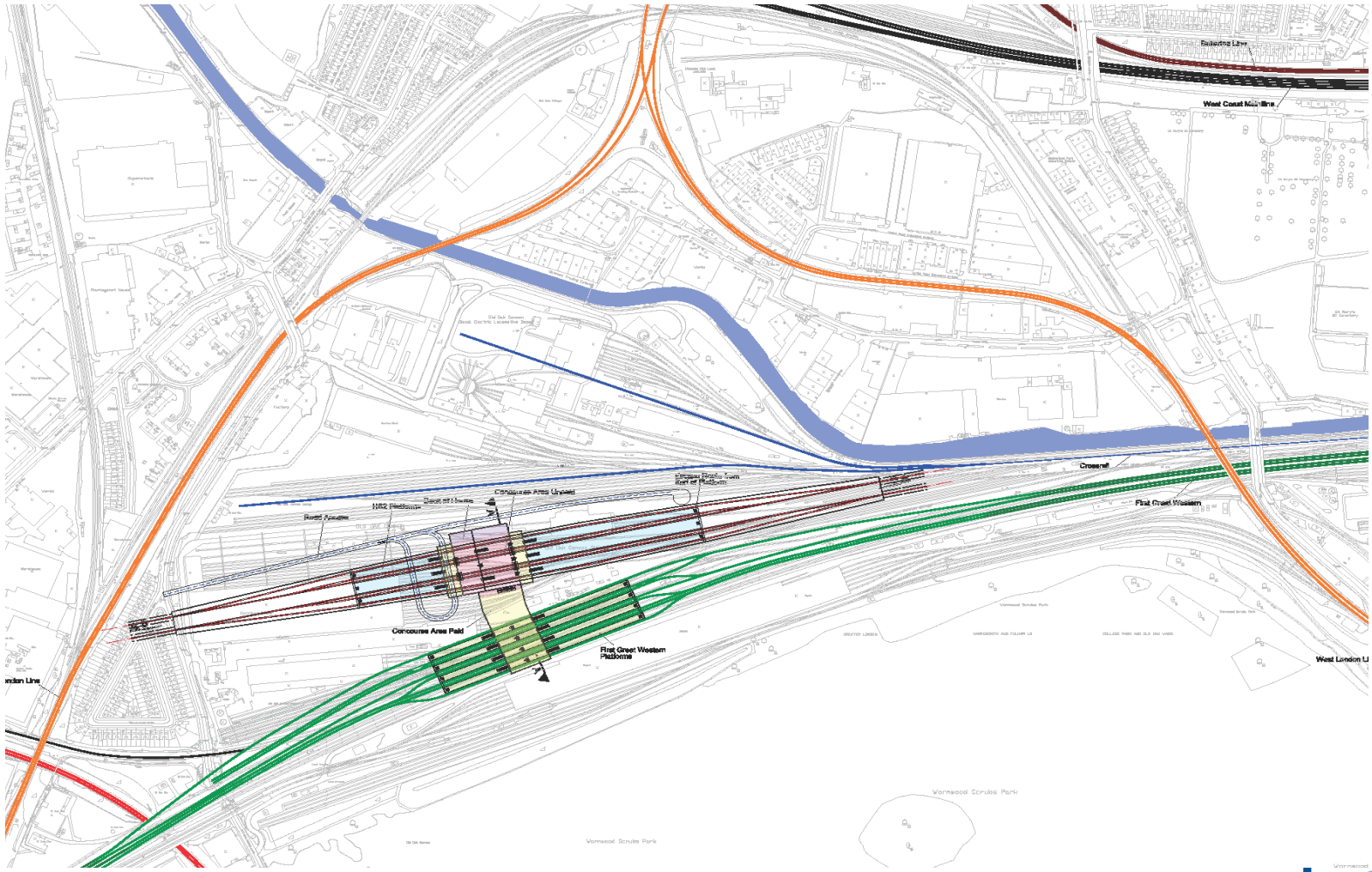
London Euston

London Euston

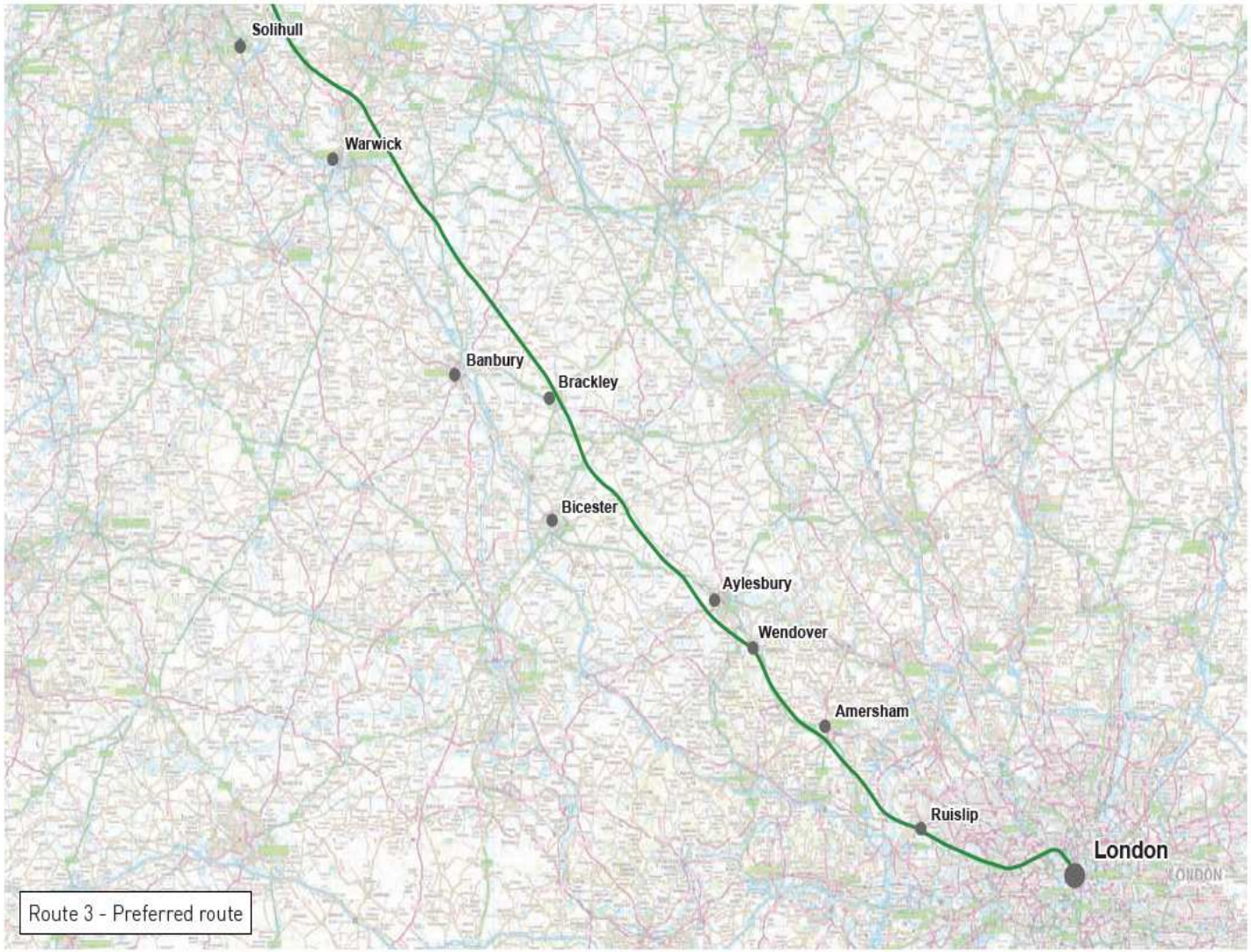
Tunnel To Second London Station



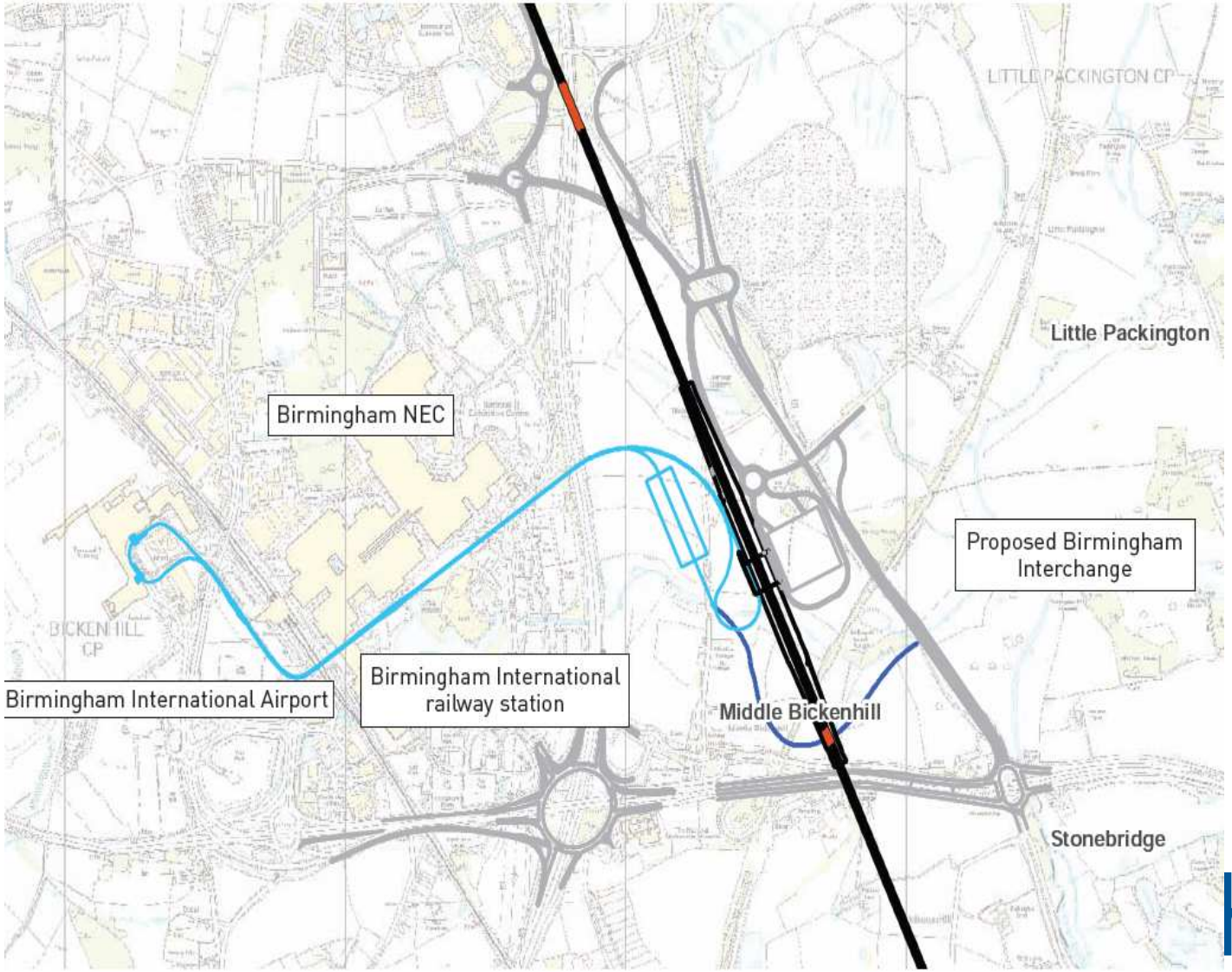
West London Crossrail Interchange



London to West Midlands

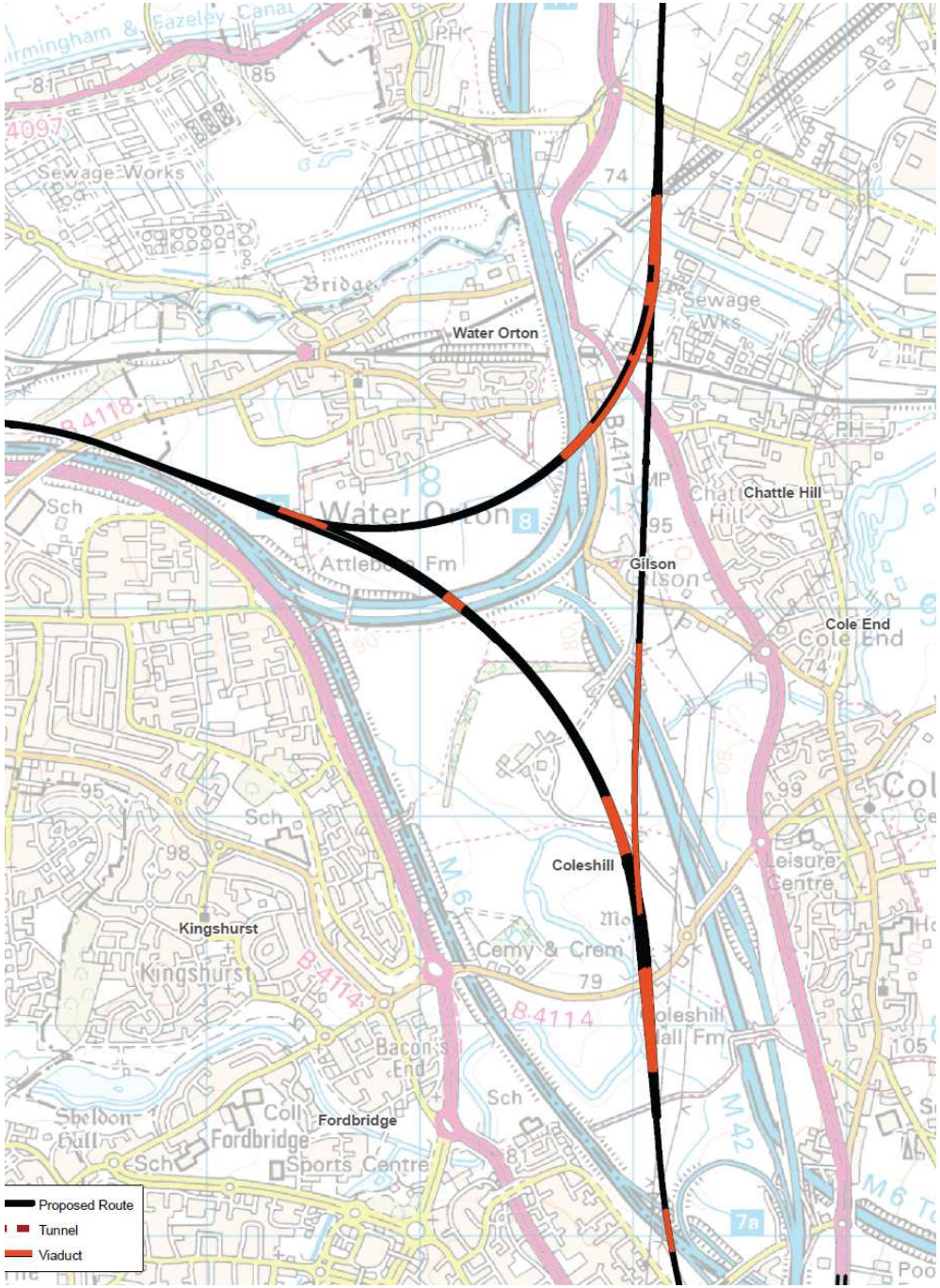


Birmingham Airport Interchange

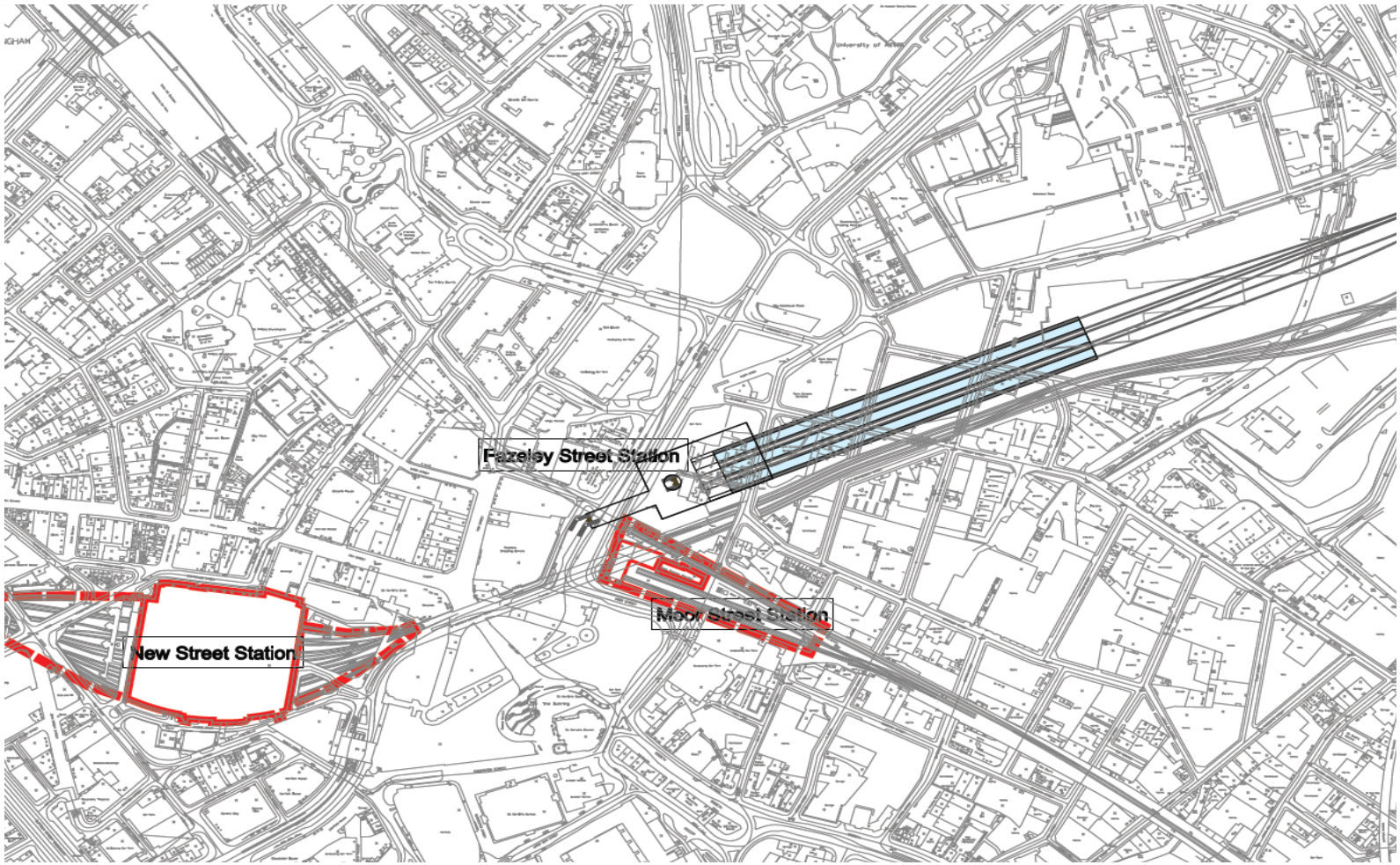


Delta Junction

- High speed junction to Birmingham City Centre
- Weave through motorway system
- Retain through speed of 400 km/h



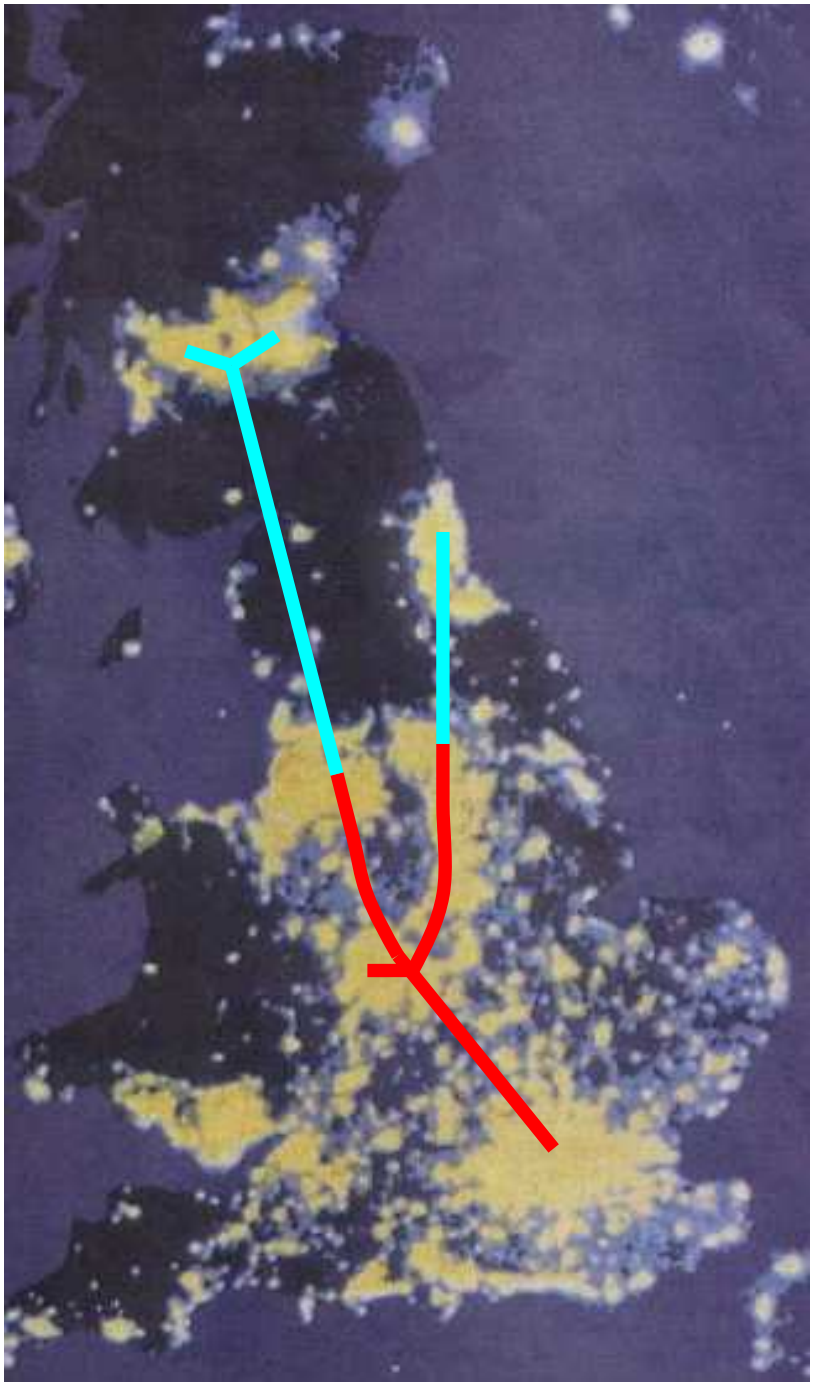
New Birmingham Station



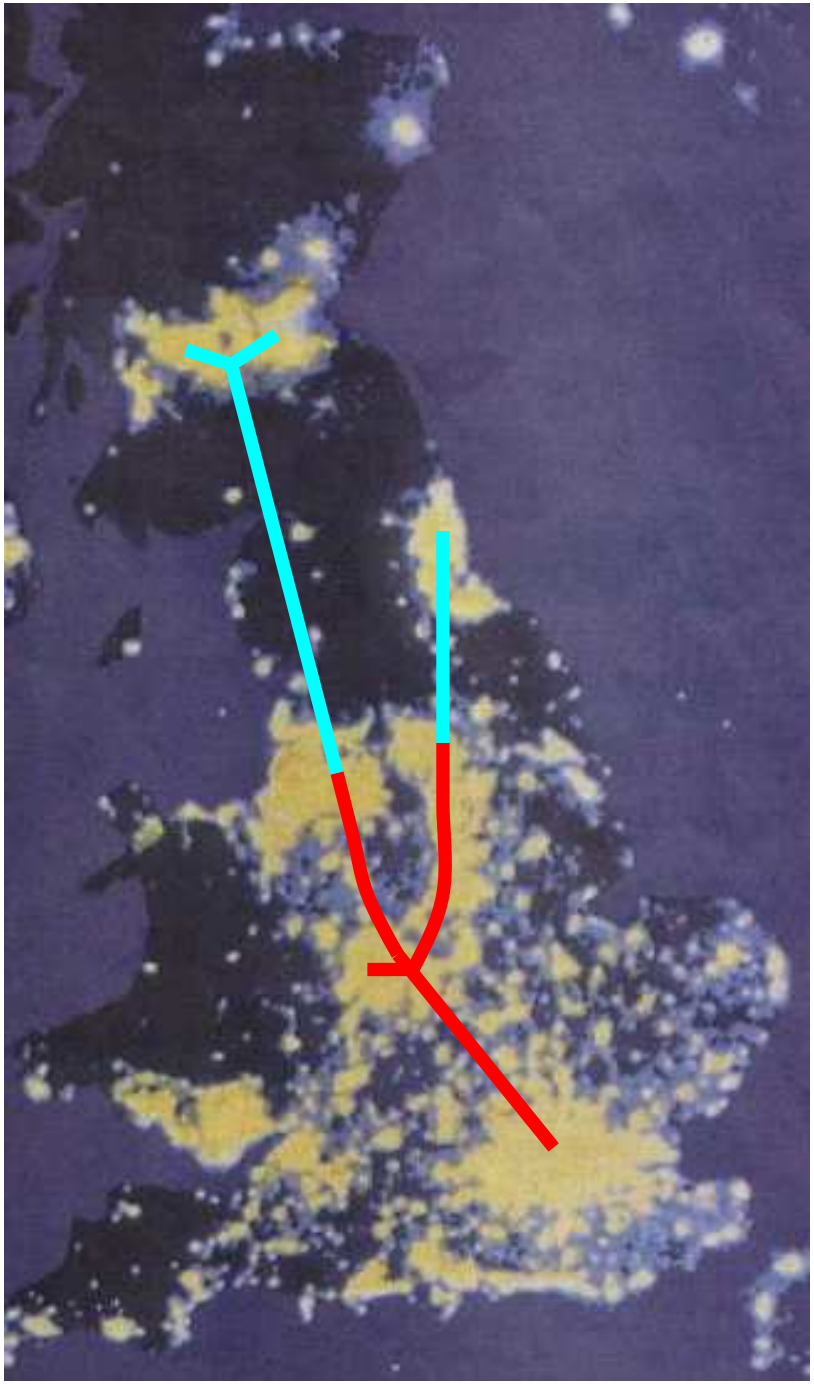
New Birmingham Station

Future Network

- Extending to
  - Newcastle 3-00 to 2-00
  - Scotland 4-20 to 2-40



HS2 Initial Network



HS2 Initial Network

- London to
  - Birmingham 1-24 to 0-49
  - Manchester 2-08 to 1-15
  - East Midlands 1-40 to 0-55
  - Leeds 2-15 to 1-20

- Birmingham to
  - Manchester 1-34 to 0-40
  - Leeds 2-00 to 1-05

HS2 Initial Network

- Length
  - 540km
- Costs
  - London – Birmingham £16.5bn
  - The full "**Y**" c£30bn
- Benefit/Cost Ratios
  - London – Birmingham 2.7
  - Birm'ham – Manchester 2.2
  - Birm'ham – Leeds Huge

HS2 Initial Network

- Timing
  - 2012 Strategic Consultation
  - 2014 Start Act of Parliament
  - 2018 Start Work
  - 2026 Open to Birmingham
  - 2030 The “**Y**” Complete

Great Britain's High Speed Rail Plans

Prof Andrew McNaughton

15th March 2010