



# Engineering High Speed Two

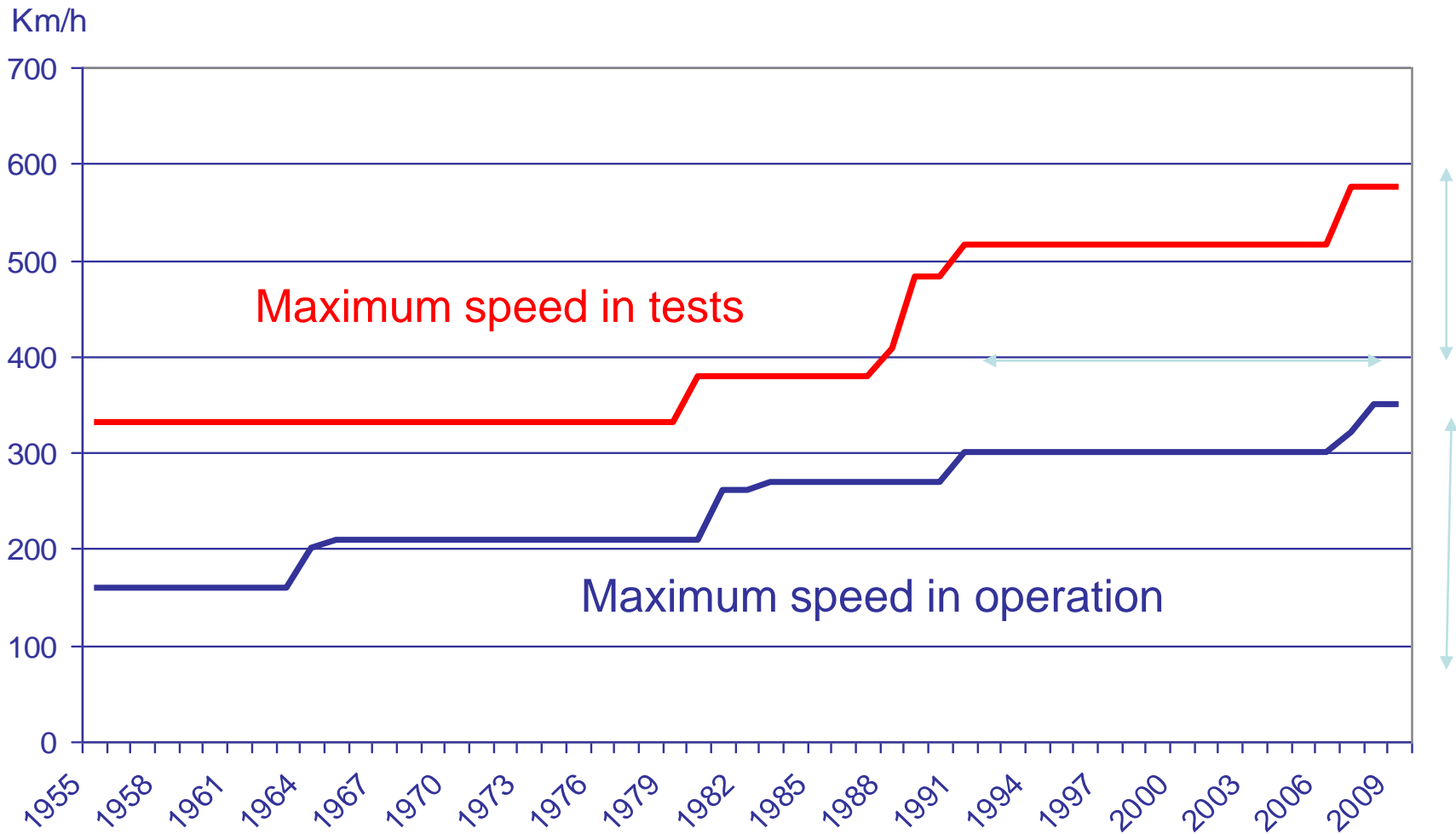
Prof Andrew McNaughton

24<sup>th</sup> February 2011

# High Speed Rail Is 46 Years Old

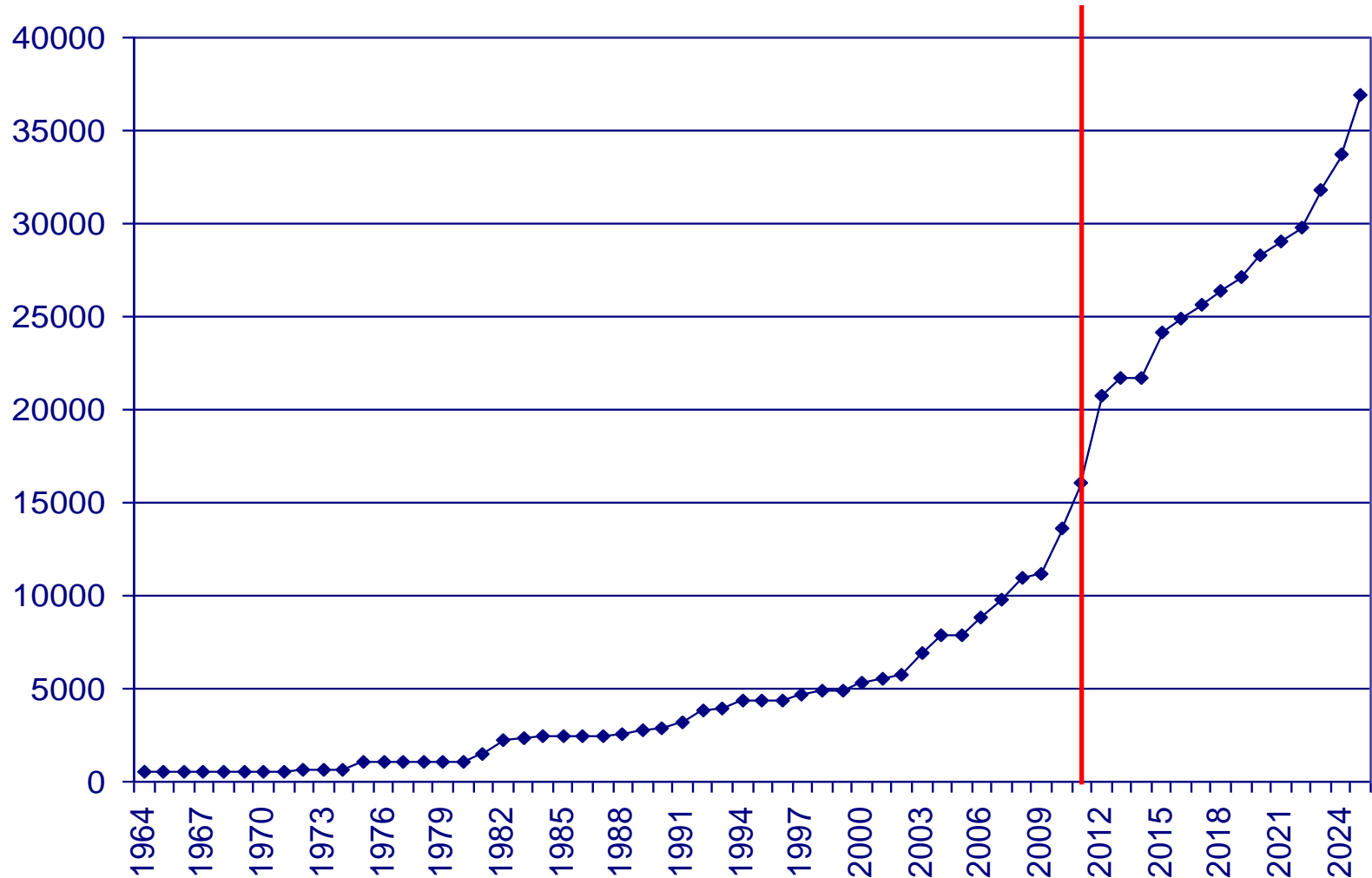


# Evolution of Maximum Speed



# Planned World HSR Development

km



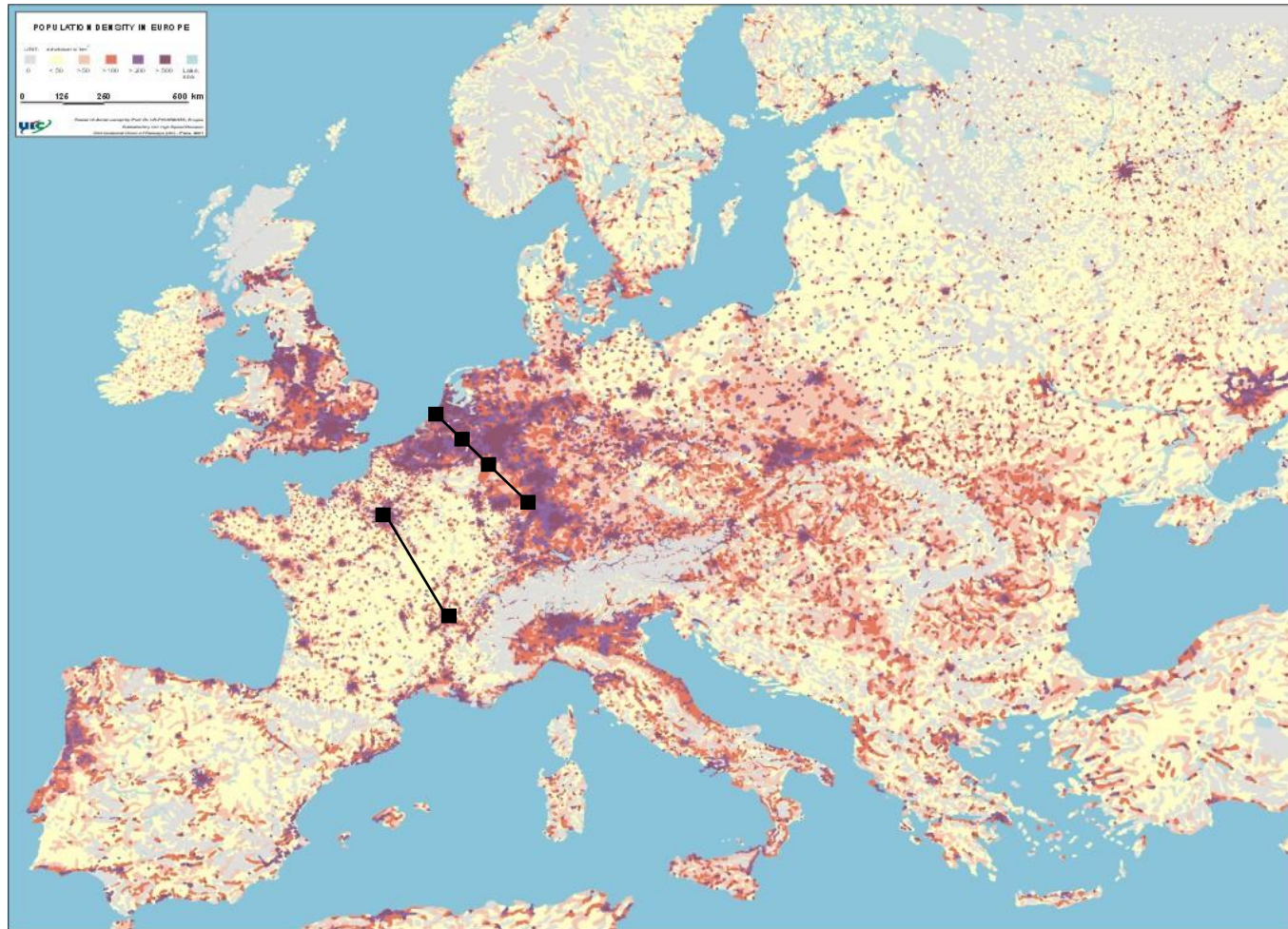


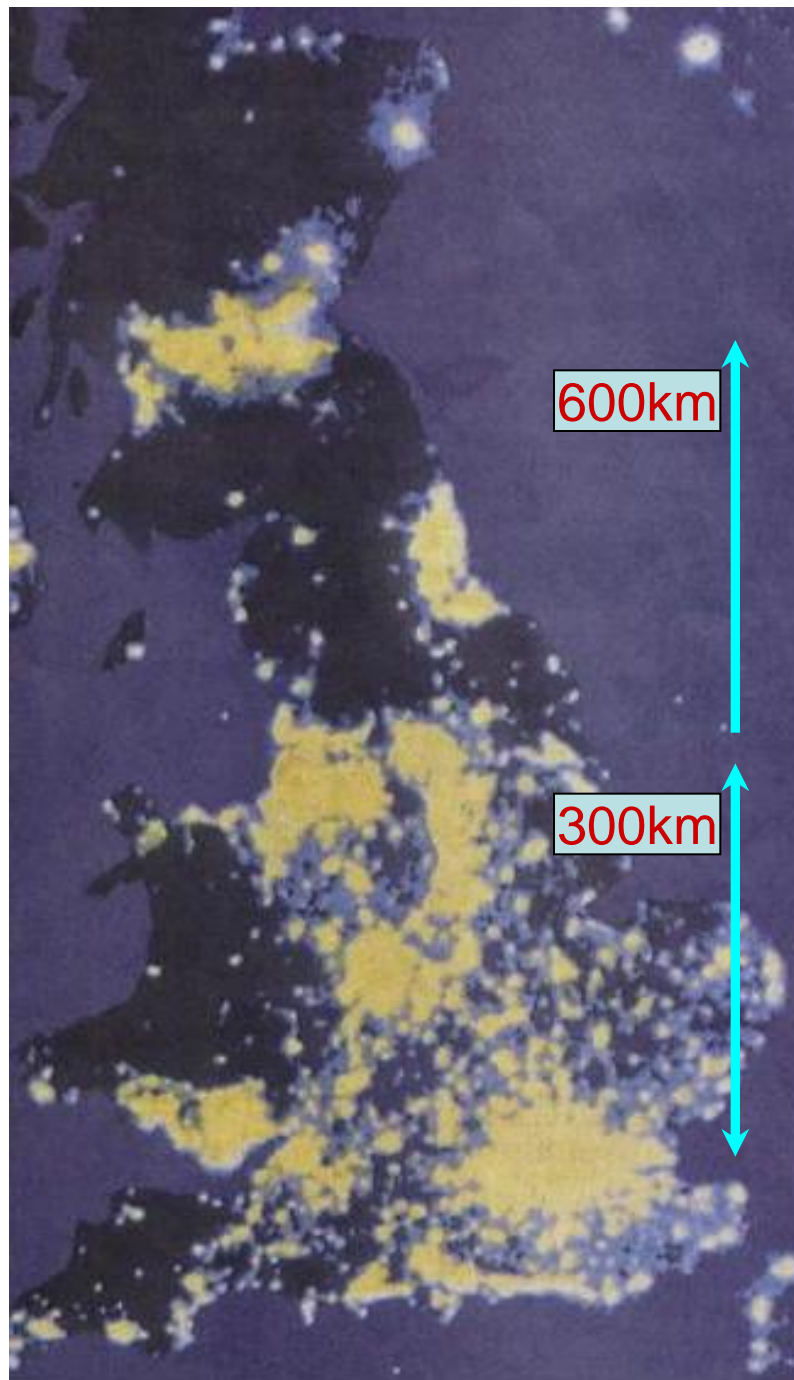
# We Have Upgraded Classic Rail

- Up to 160kph end to end journey times from London
- Dominant mode for city centre travel to Central London (80%+)
- Market share between other cities very low
- At maximum capacity by 2025
- Further upgrading extremely disruptive

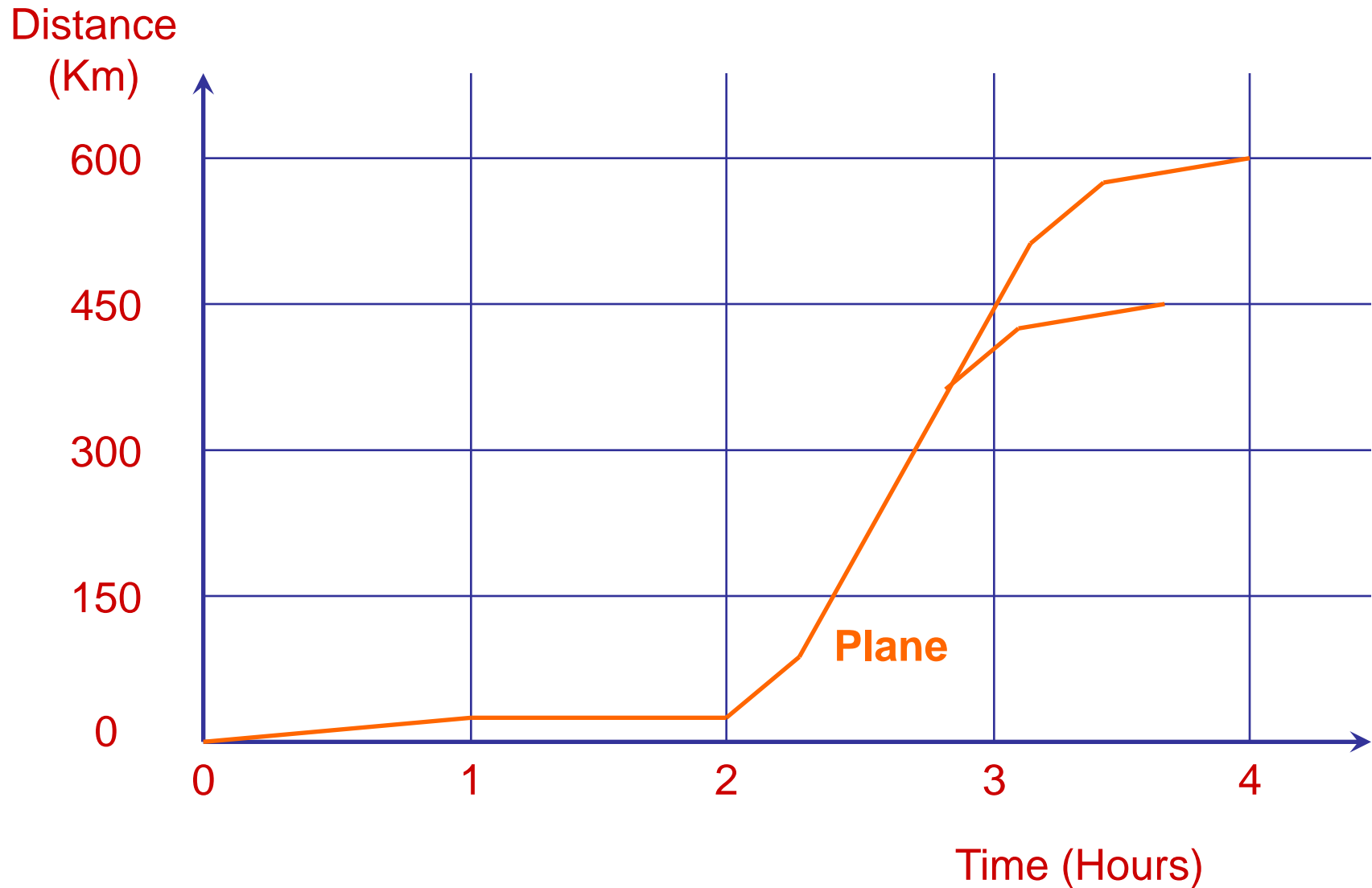


# Population Density



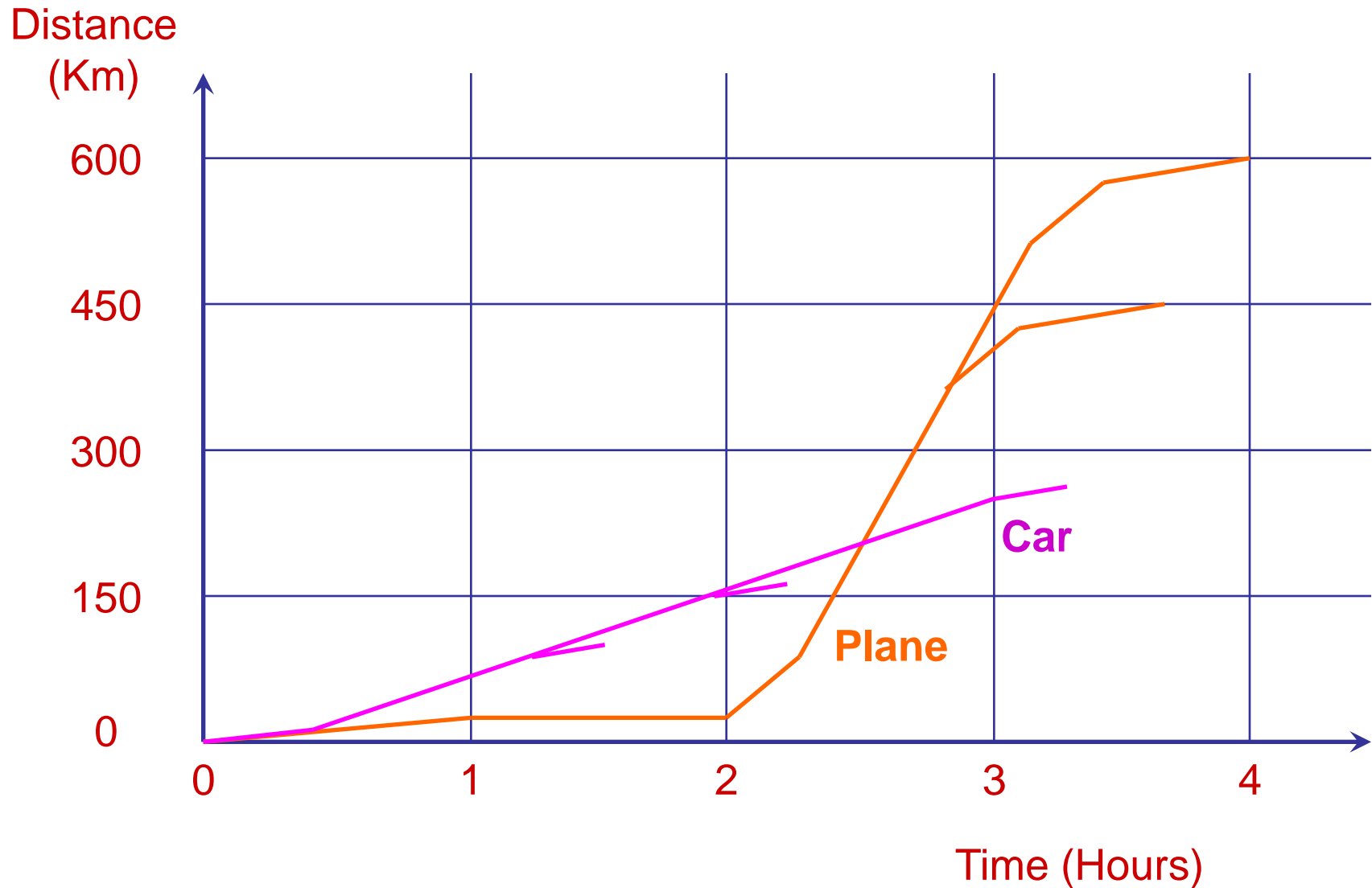


# Door To Door Journey Time

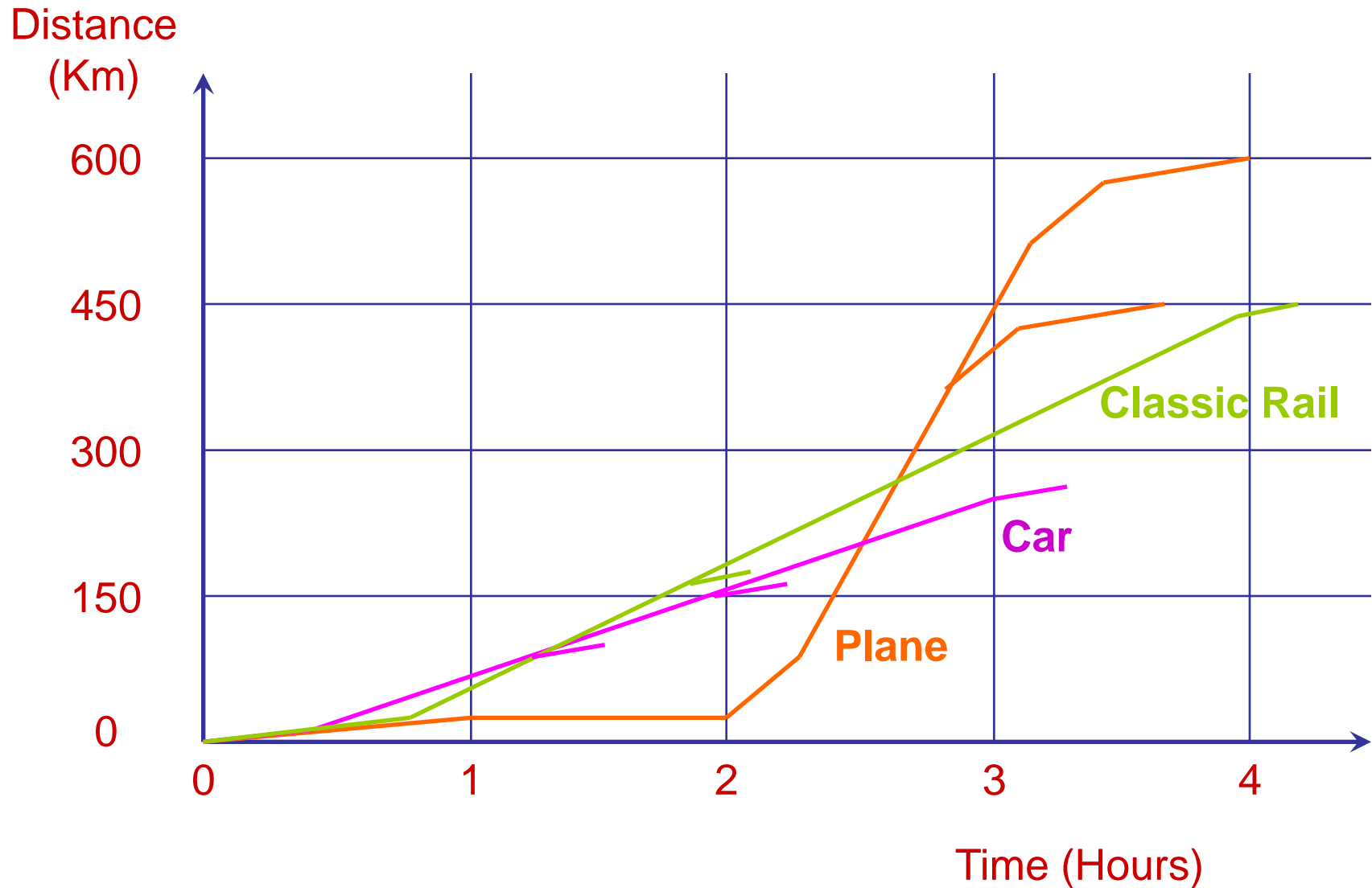




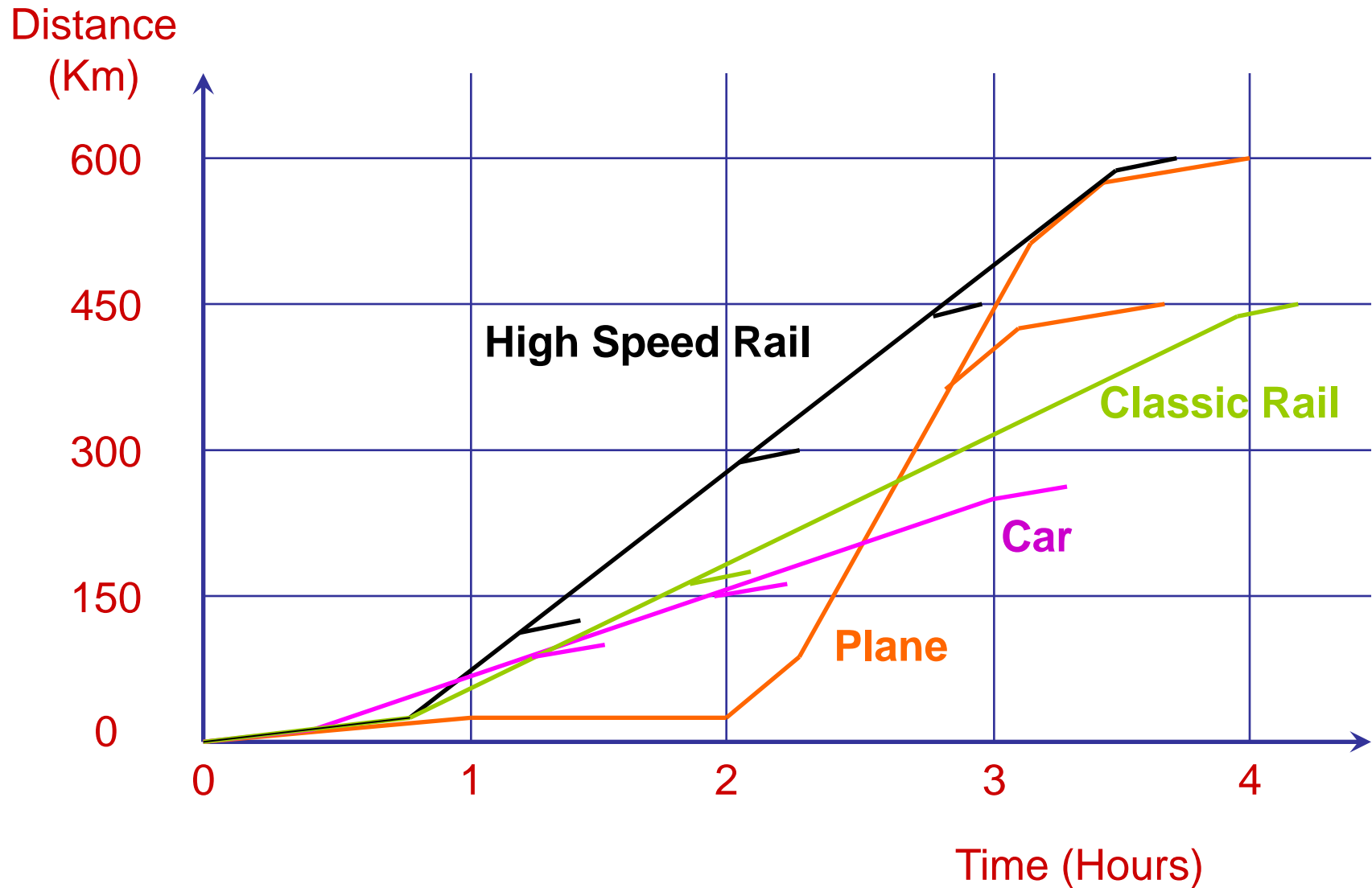
# Door to Door Journey Time



# Door to Door Journey Time

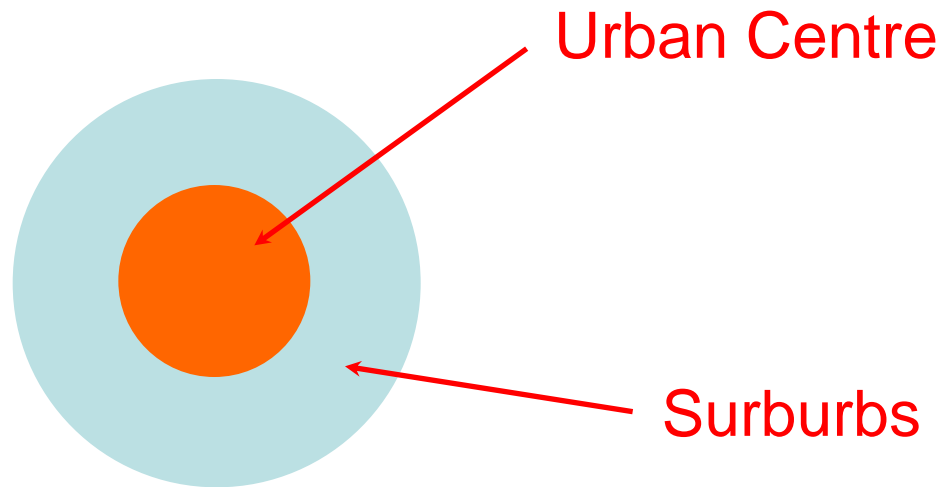


# Door to Door Journey Time



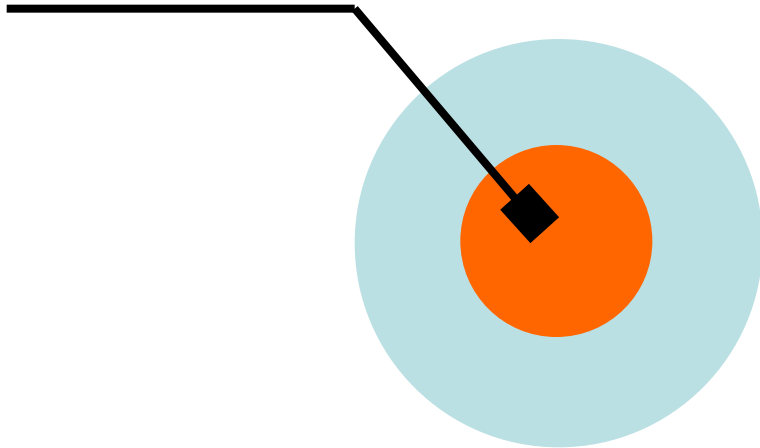
# Siting Of New HSR Terminals

- Large City “A”



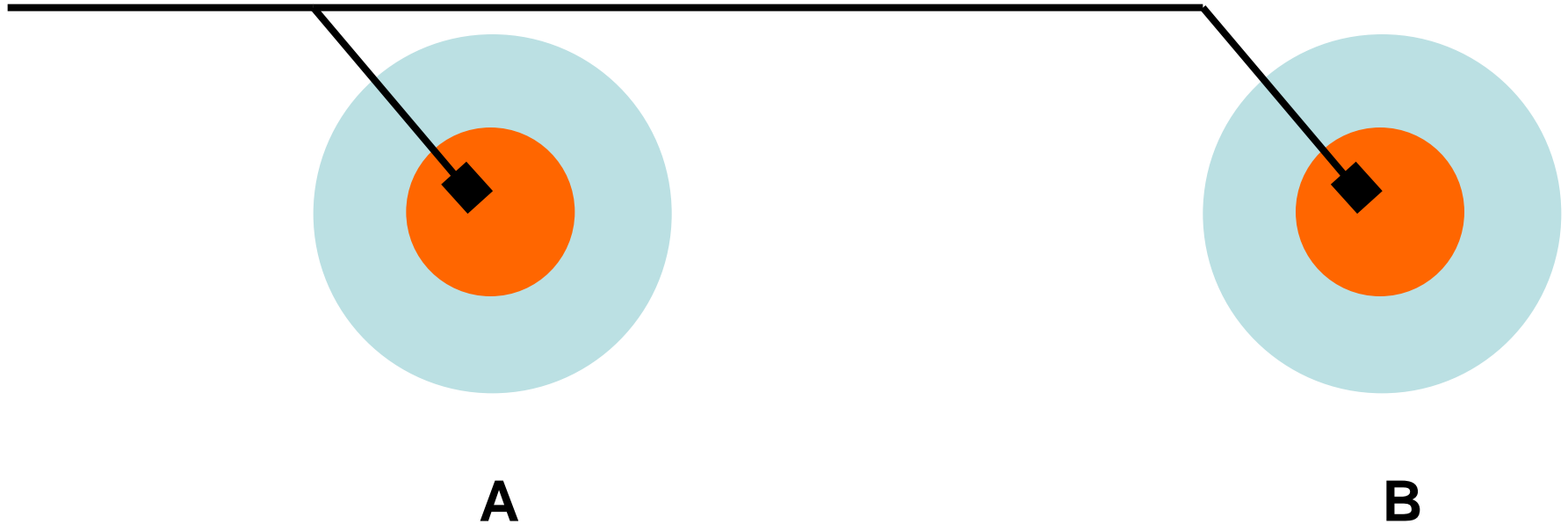


# First Stage

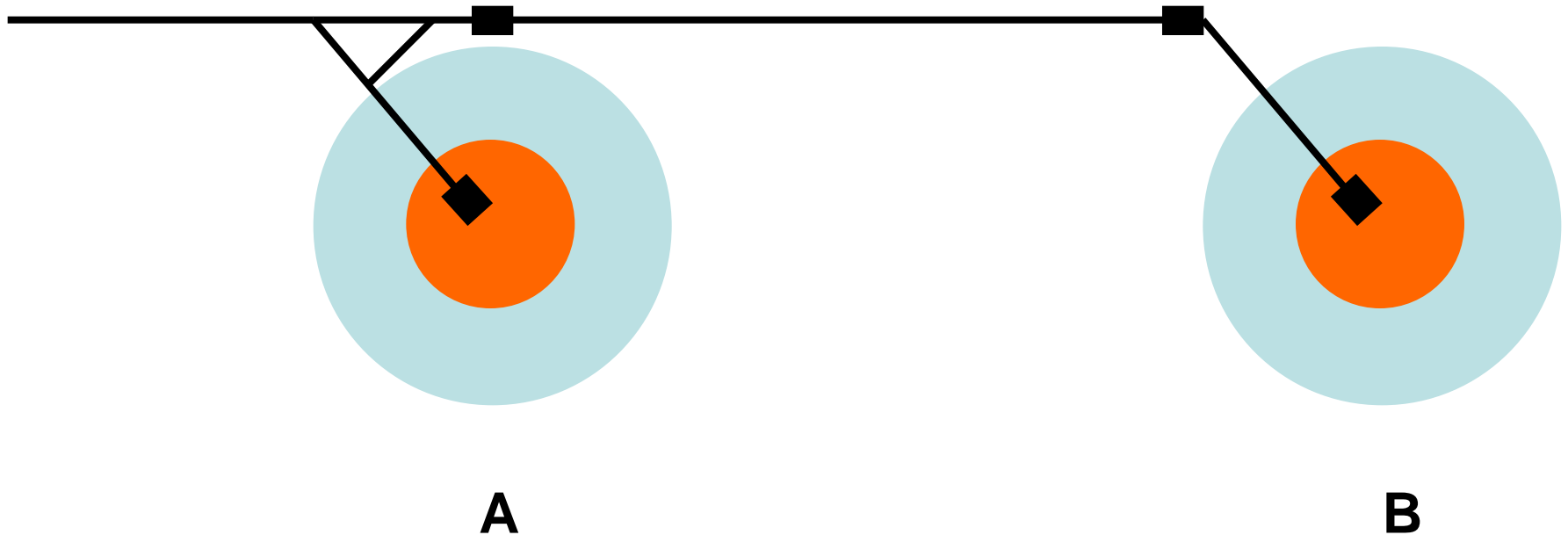


A

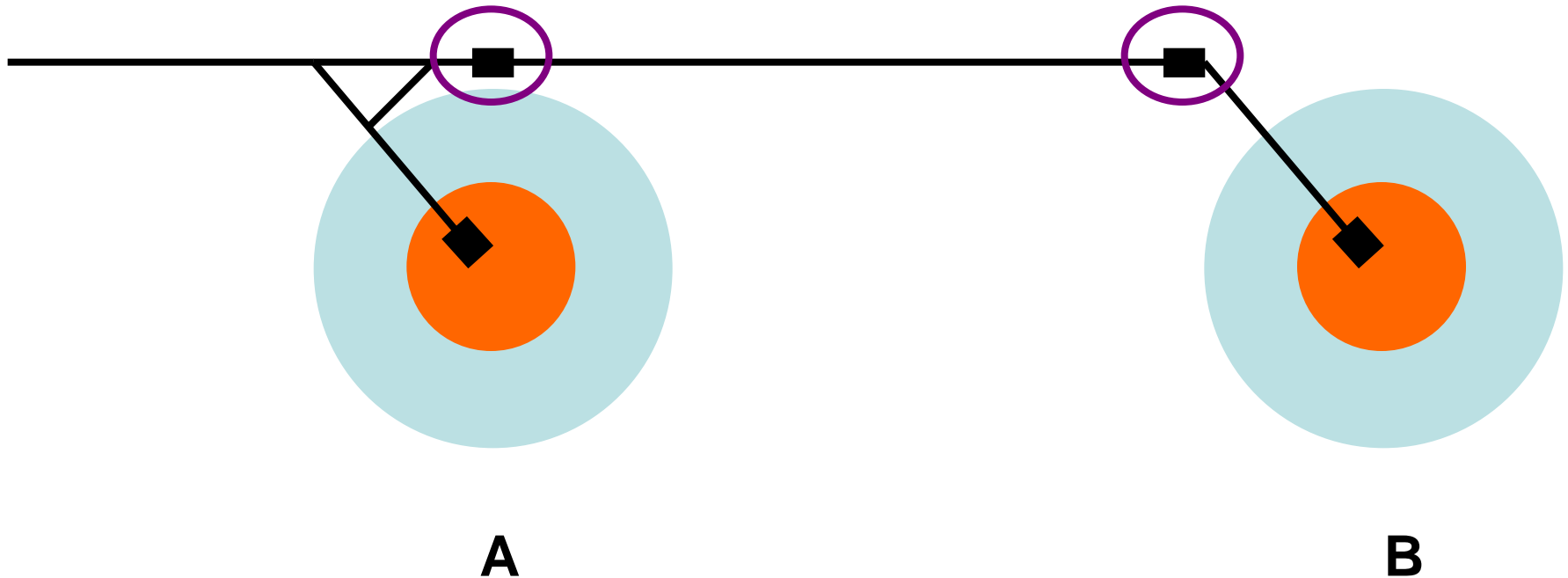
# Extend to Large City B



# Add Well Positioned Parkways

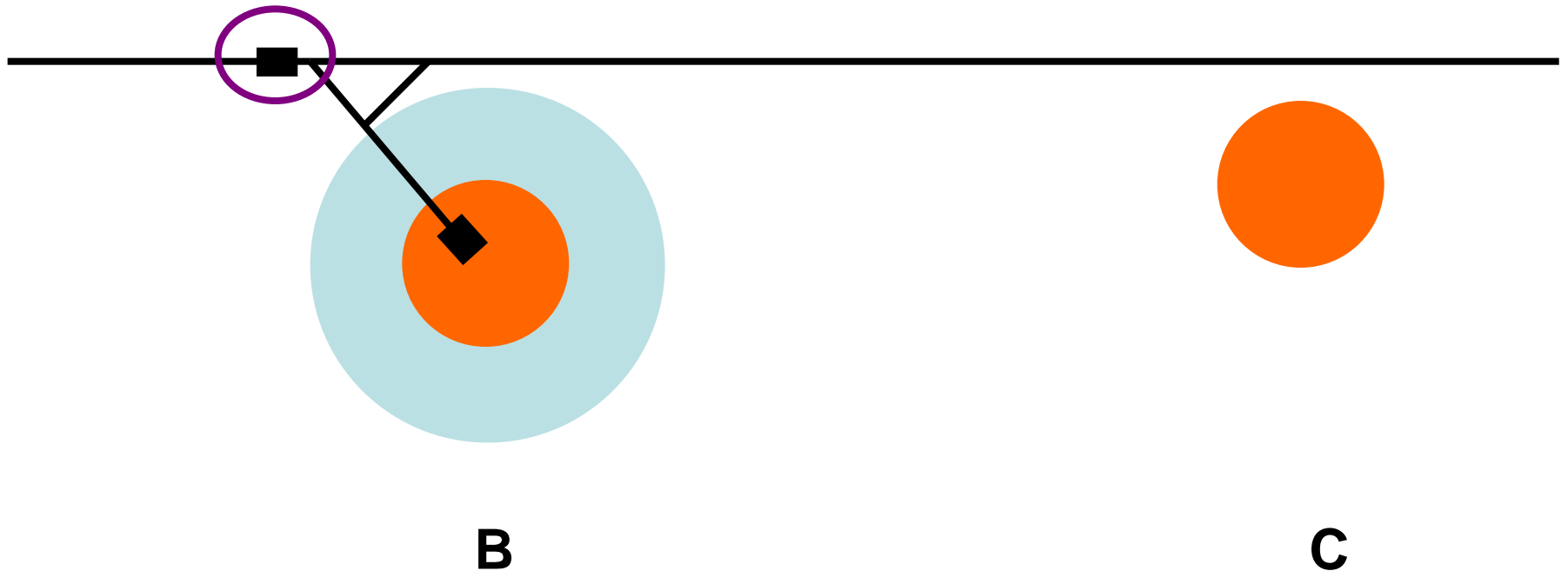


# New Commercial Centres Grow

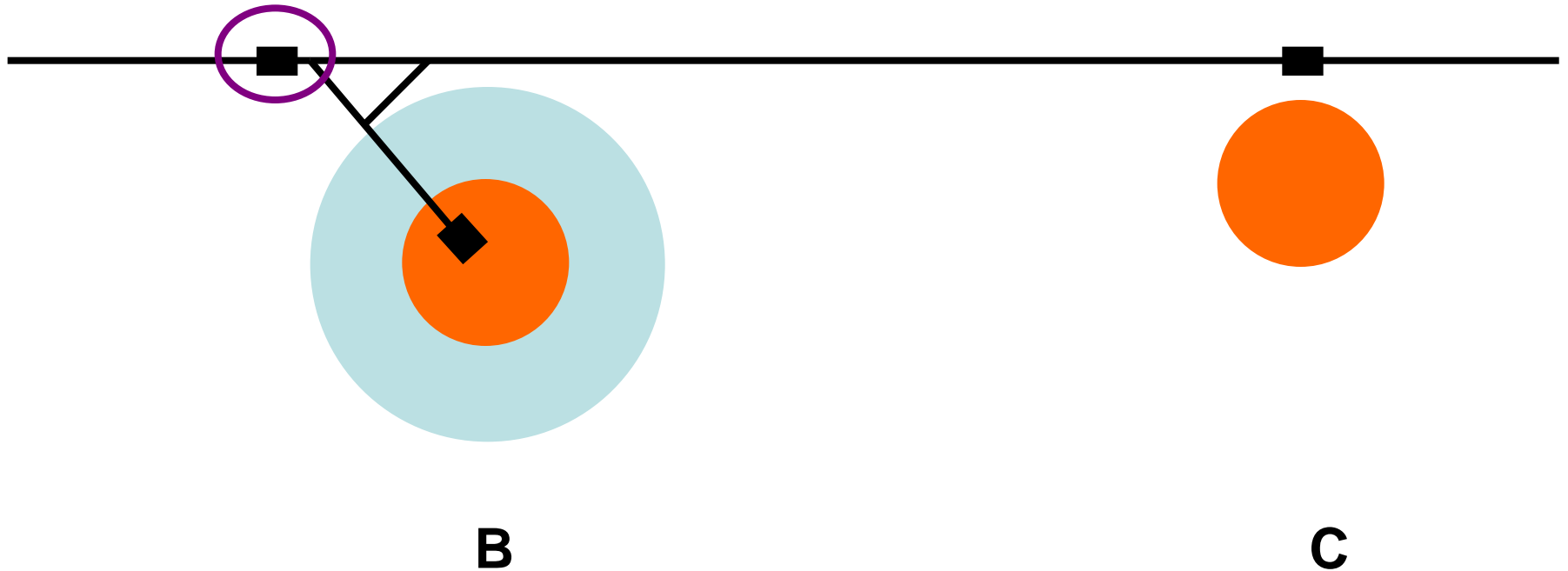




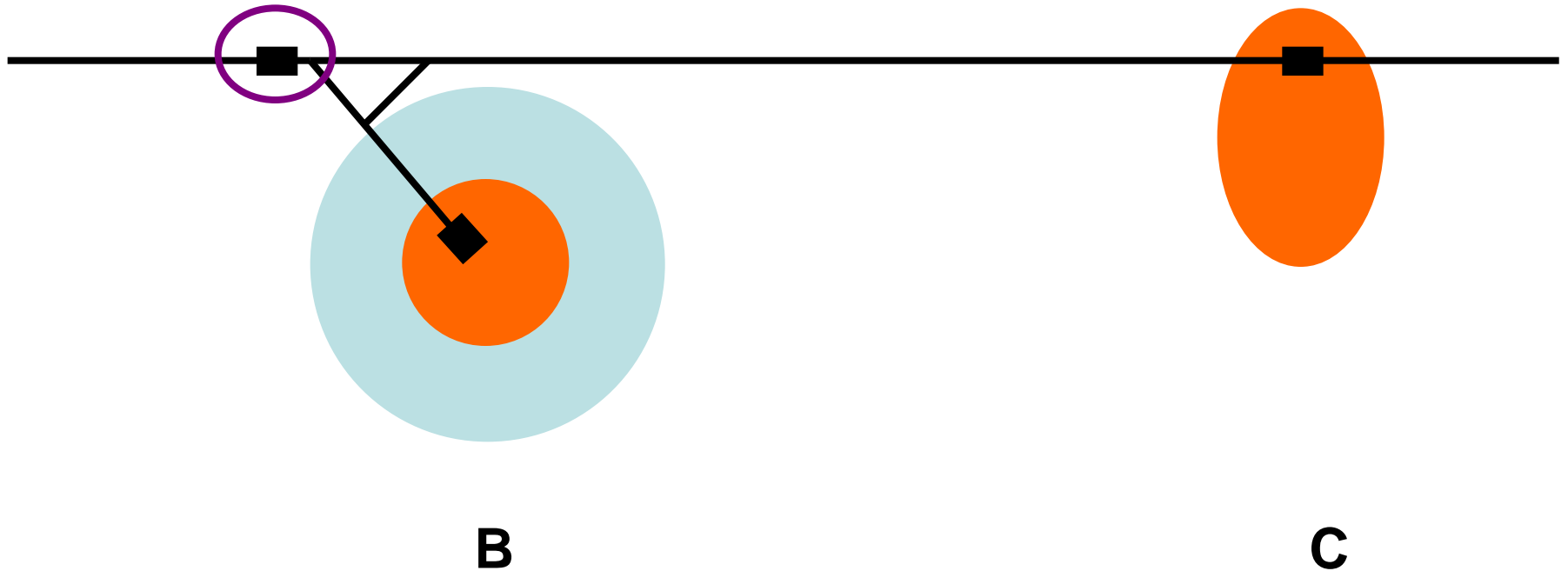
# Continue On Past Medium City C



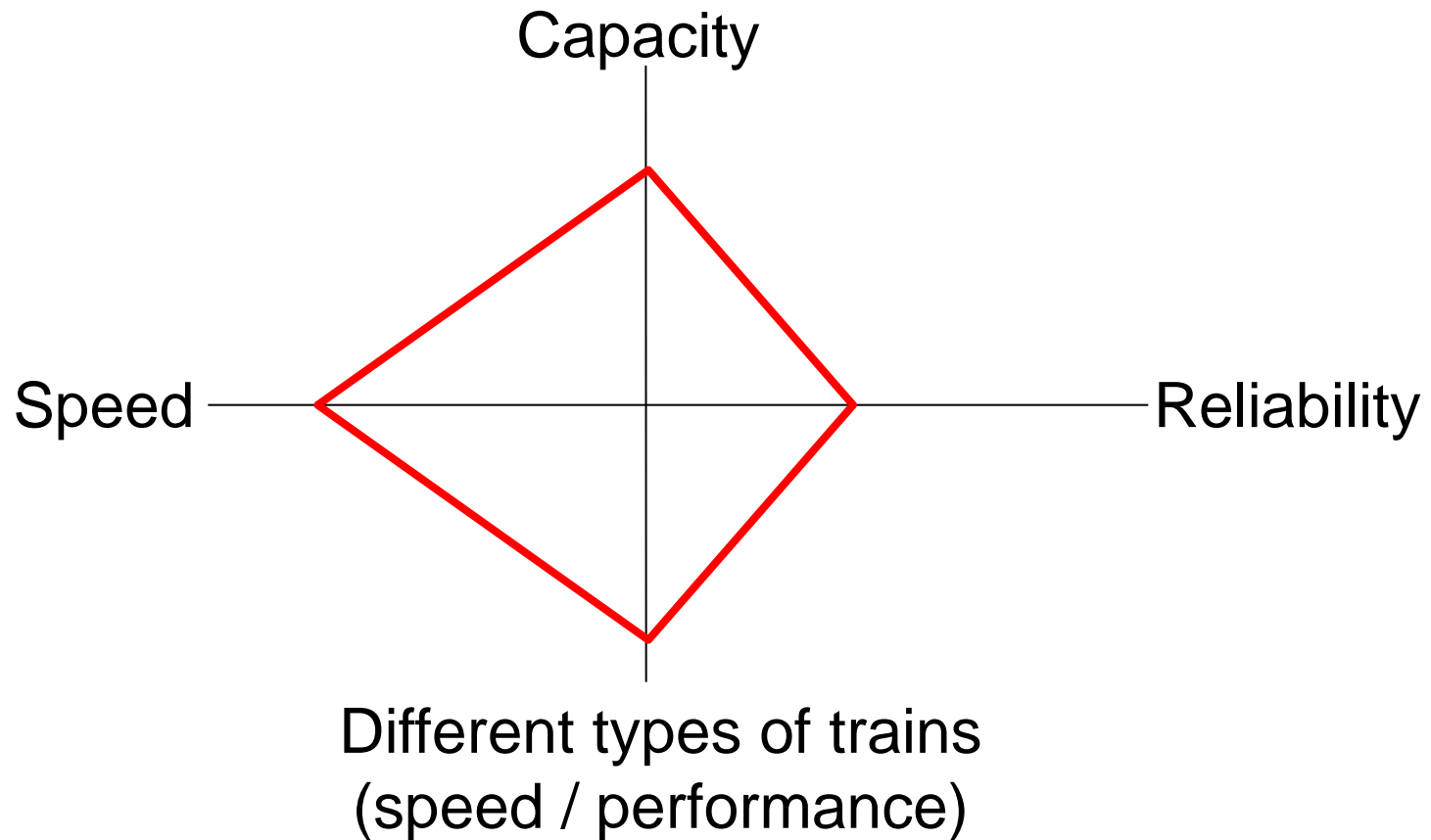
# An Alternative Approach



# City C Develops Towards The HS Line



# Expanding Capacity





# Avoiding Traffic Speed Mixes

North W Midlands

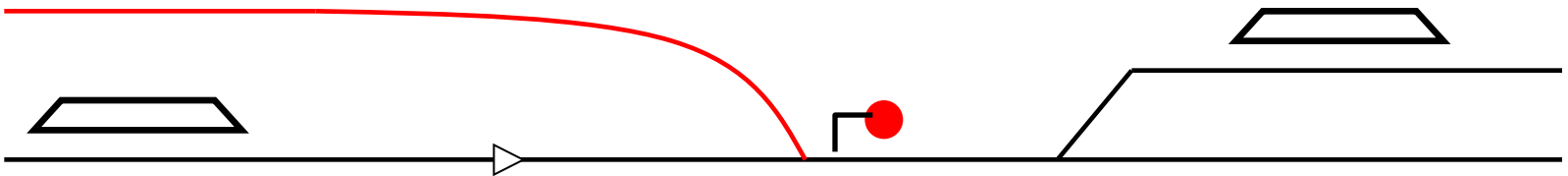
HS at 330kph = 29 mins

One train at 210 km/h =  
5 train paths at 330 km/h

Train at 210kph = 45 mins

NW London

# Reducing Headway



# New Turnout Technologies



# Longer Trains

- Length
  - Classic 245m
  - HS 2 x 200m  
= 400m
- Seats
  - Classic c600
  - HS c1100



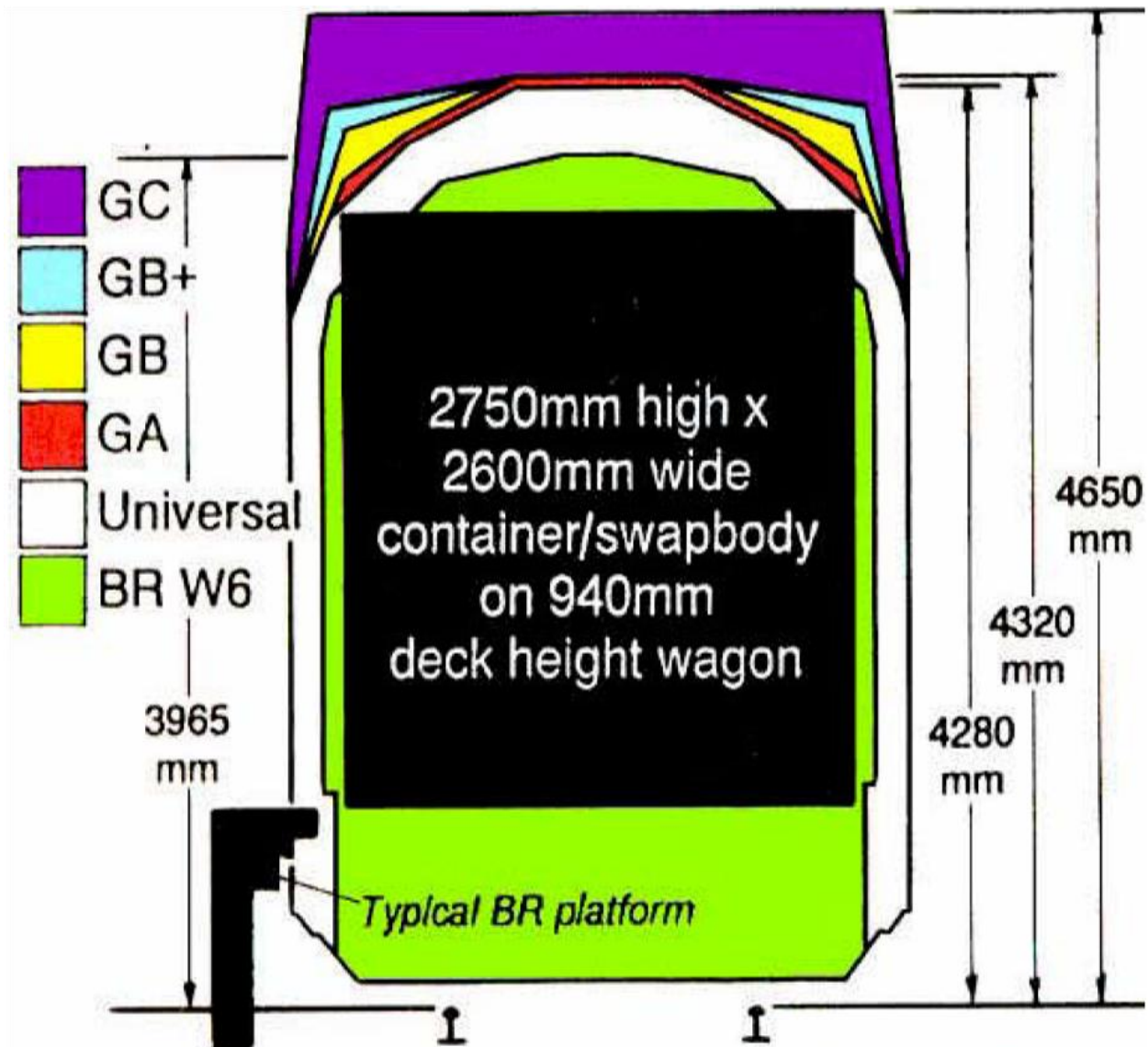


# High Capacity

- Aeroplane:
  - c150 seats
- Coach:
  - c50 seats
- Classic train
  - c500 seats
- HS train:
  - c550 x 2 =
  - **1100 seats**



# Higher, Wider Trains



# Future Capacity

- Largely separate network
- Largely dedicated trains with 2 x 200m capability
- Timetabling headway around 3 minutes
- Diverging / joining at 230kph junctions
- 18 train paths per hour
- Passenger capacity c18,000 seats per hour per line



# Relationship With GB Classic Rail?





# Initial Capacity

- Some dedicated trains – up to 2 x 200m
- Substantial running to / from classic rail network
- Classic compatible trains limited to 200m
- Performance allowance for classic rail impact
- 14 train paths per hour
- Passenger capacity c9,000 seats per hour per line

# Automatic Train Operation



# Radio Bearer Challenges



# Radio Bearer Challenges

- Current standard is GSM-R (essentially “2G”)
  - Capability in urban areas?
  - How long can circuit switched data transmission credibly continue?
- What will commercial communications technology be by 2025?
  - GPRS (2.5G)?
  - EDGE (2.75G)?
  - UMTS (3G) with IP?
  - LTE and Advanced LTE (4G)



# Automated Examination

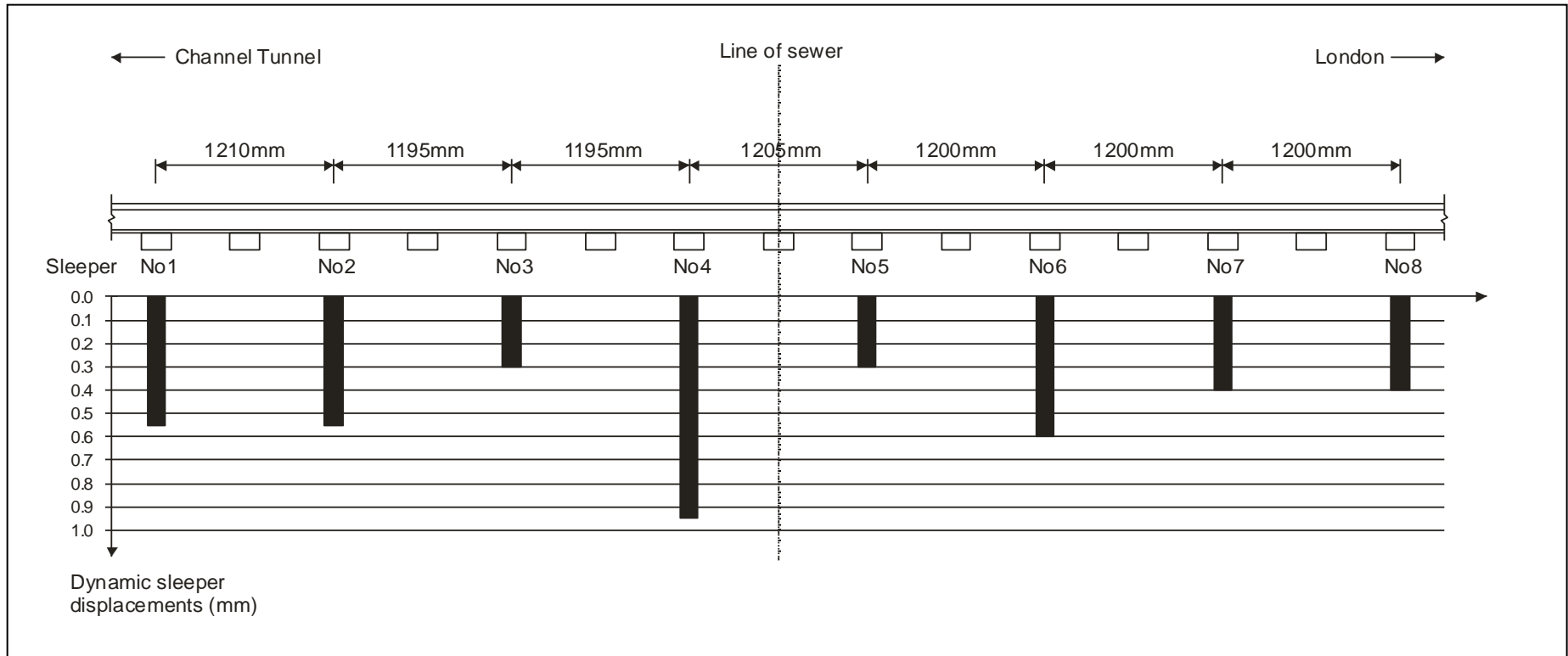




# Re-think Ballasted Track?

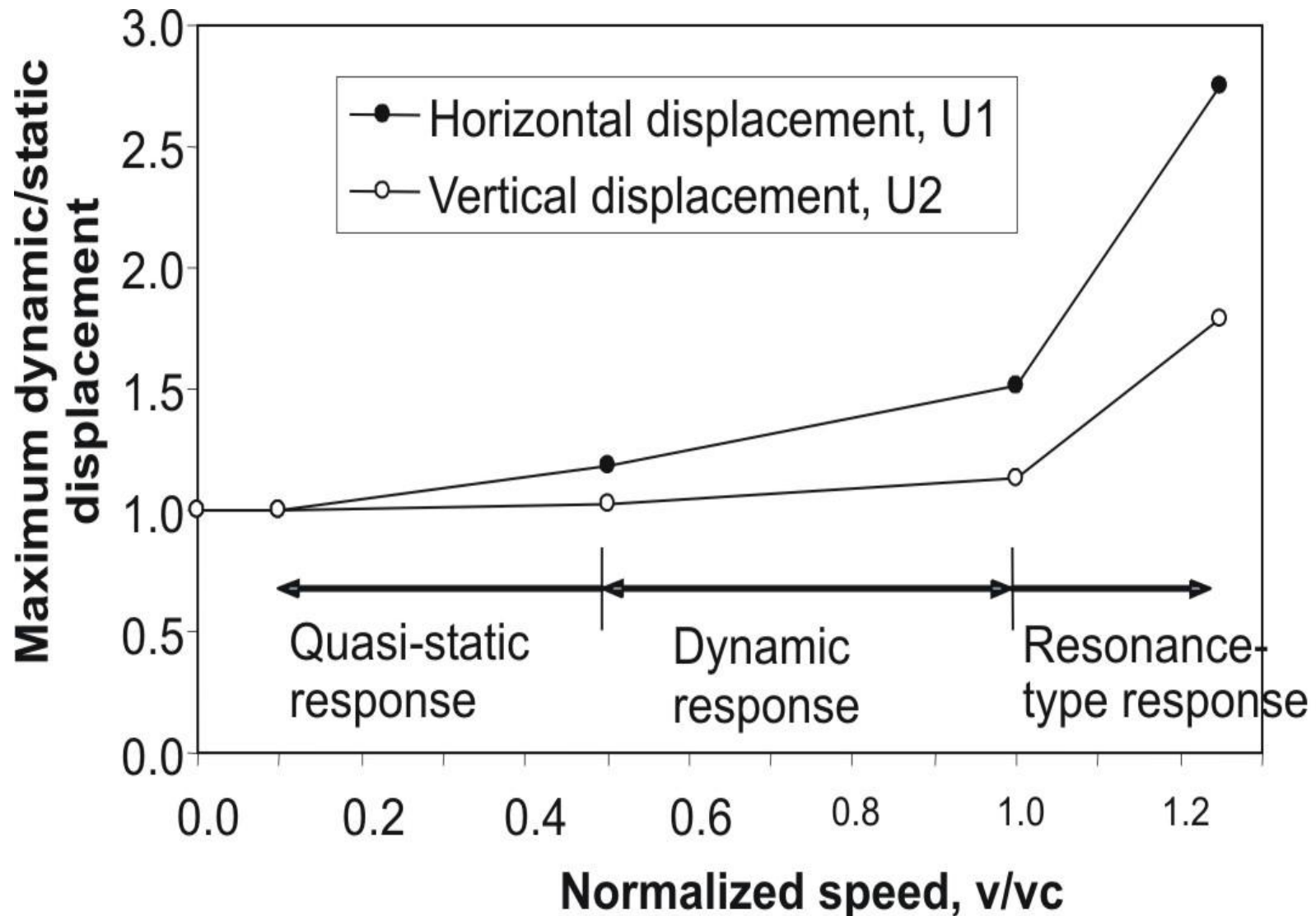


# Variable Ballast Compaction



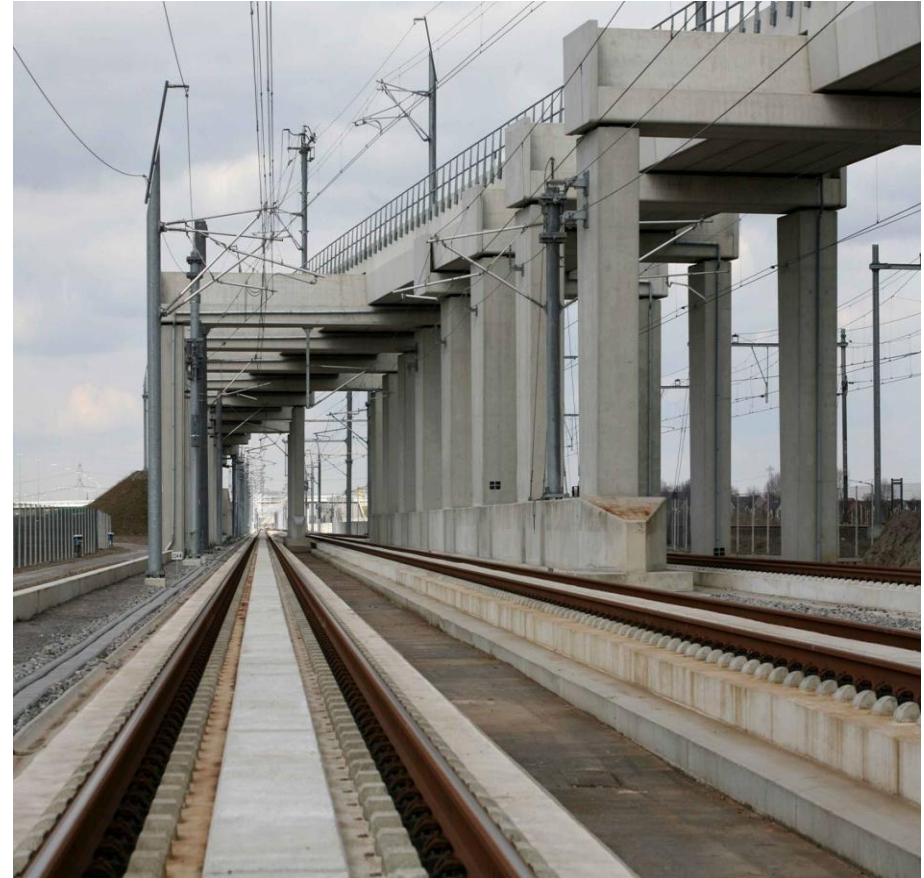
Differing displacements under new track on High Speed 1

# Variation of Displacement with Speed





# Continuous Slab Track Form?



# Stations for High Passenger Flows

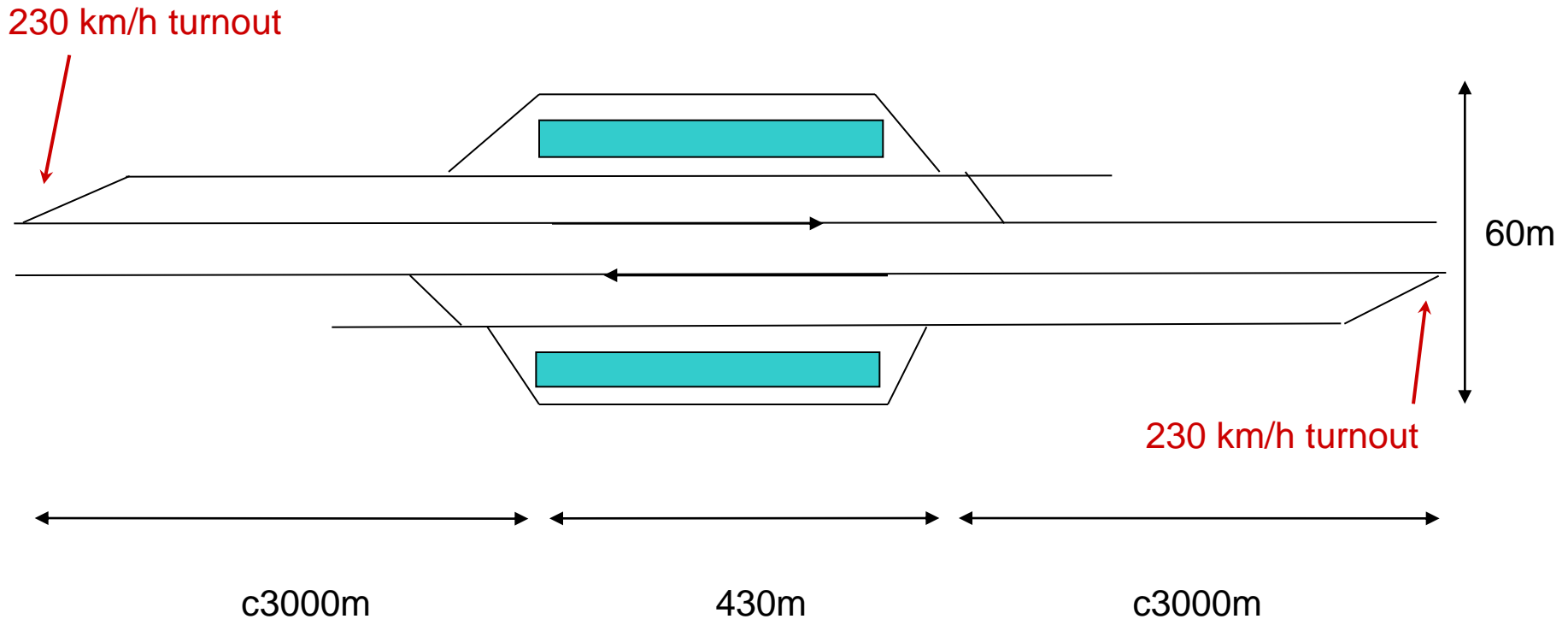




# City Centre Stations?

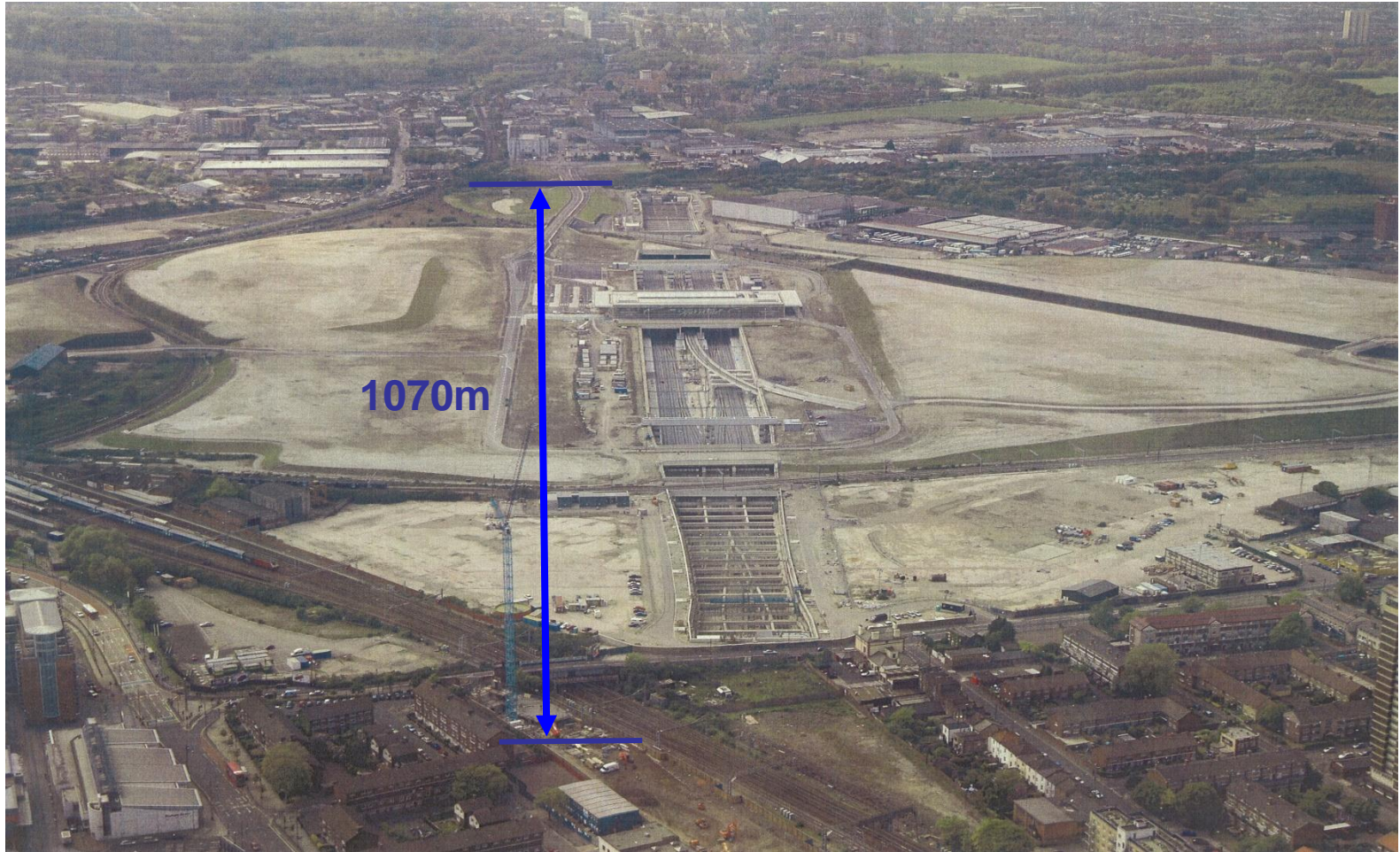


# Simple Intermediate Station





# HS1 Olympic Park Box



# 2 London Stations Give Passenger Dispersal East-West and North-South

