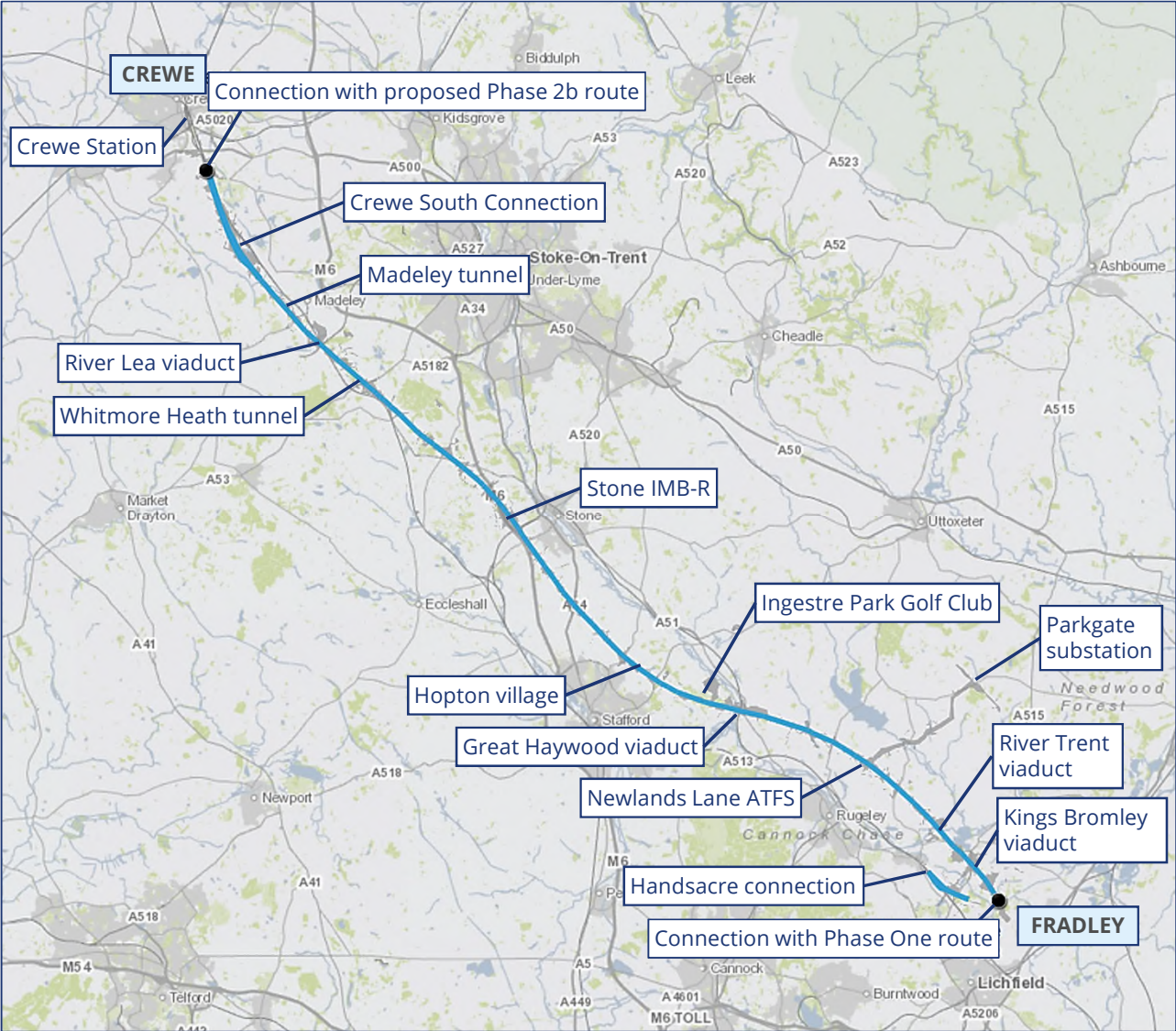


# HS2 Phase 2a

Engineering Briefing

Tim Smart, Phase 2 Managing Director, HS2 Ltd.

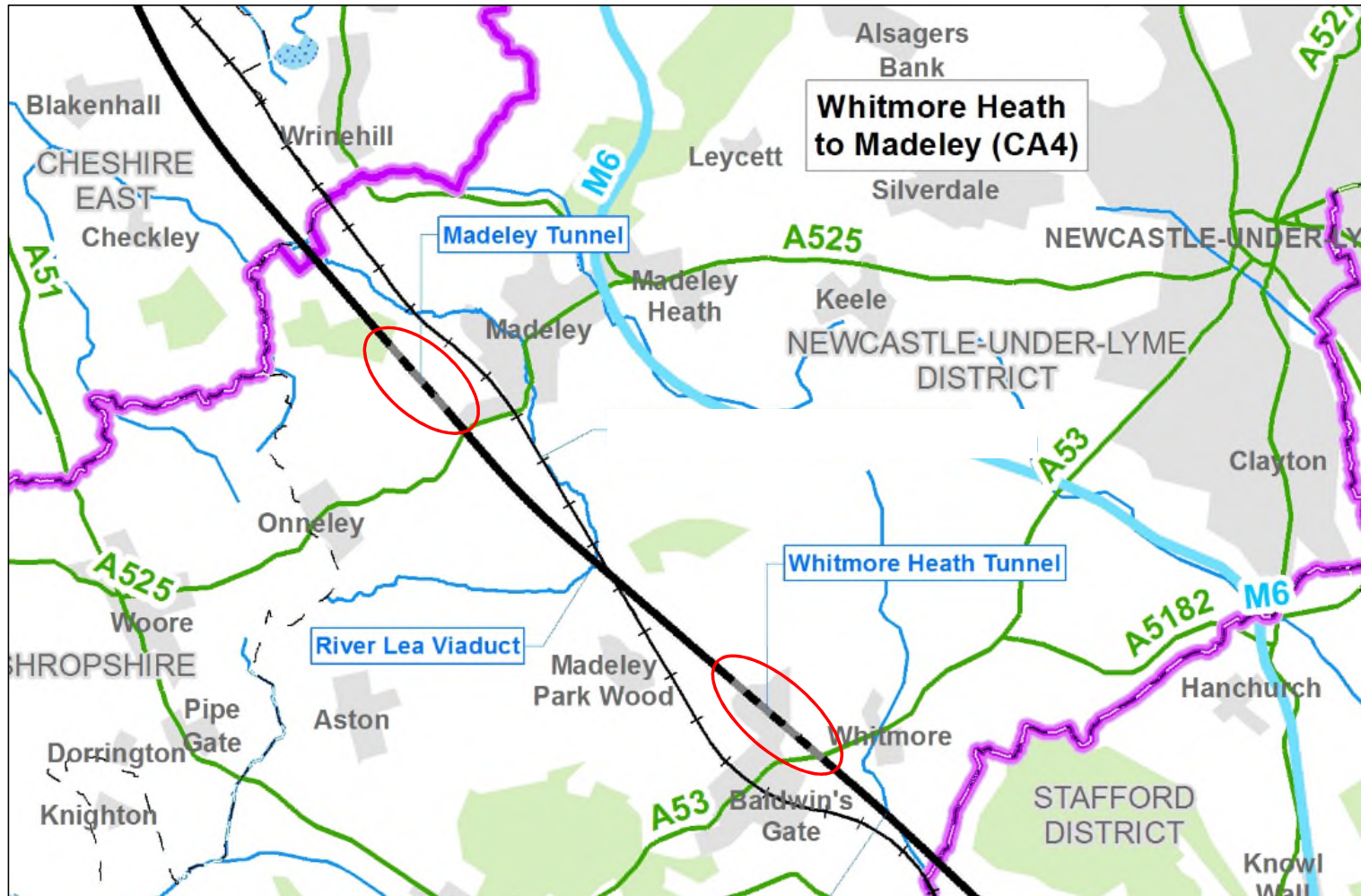
# Route map - Phase 2a



# Tunnelling

## Phase 2a

# Tunnel Locations



# Construction – Tunnelling Techniques

## Bored Tunnels

- Shield type machines with precast segmental tunnel lining
- Used when surface access is very limited at depths typically below one tunnel diameter
- Longer tunnel lengths where economical to use machine

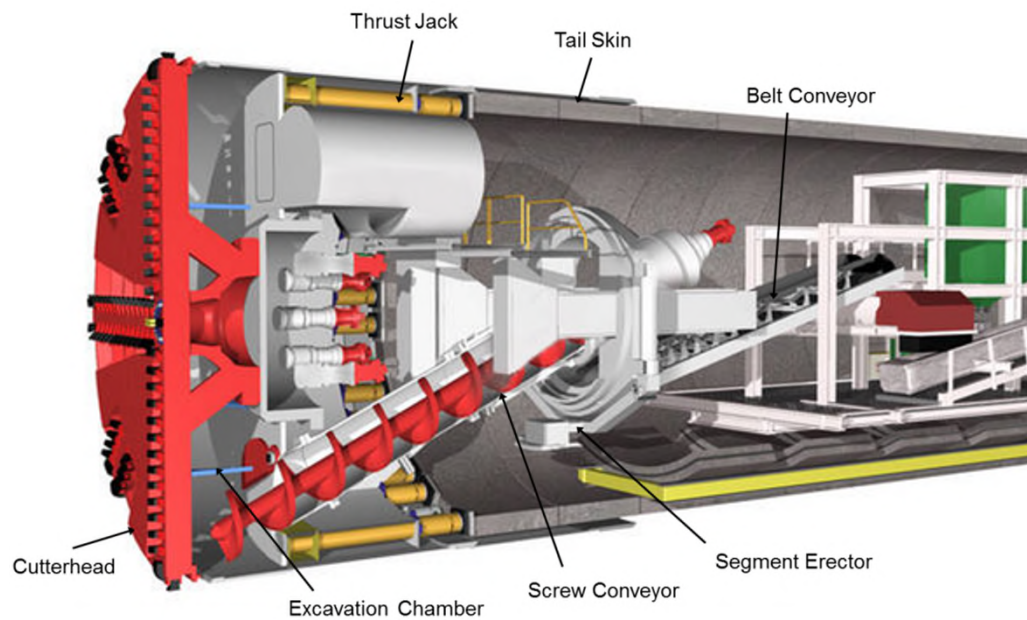
## Mined/Sprayed Concrete Lining Tunnels

- Mechanically excavated with sprayed concrete lining in suitable ground conditions
- Used in shorter drives and cross passages

## Cut and Cover Tunnels

- Typically concrete box structures constructed in excavated ground
- Used at shallower depths where there is good surface access

# Bored Tunnels

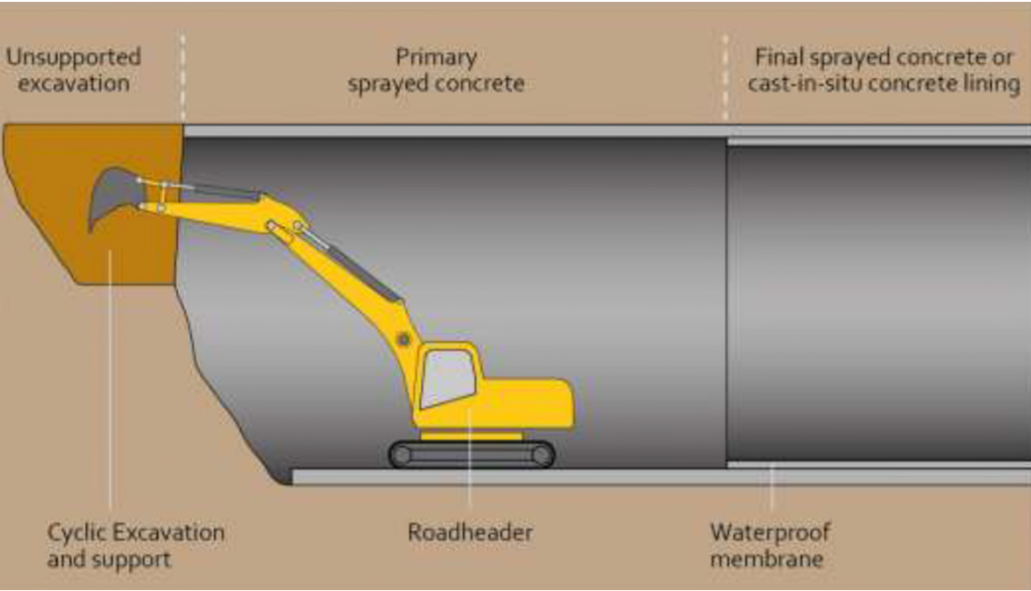


**Earth Pressure Balance Tunnel Boring Machine (EPBM)**

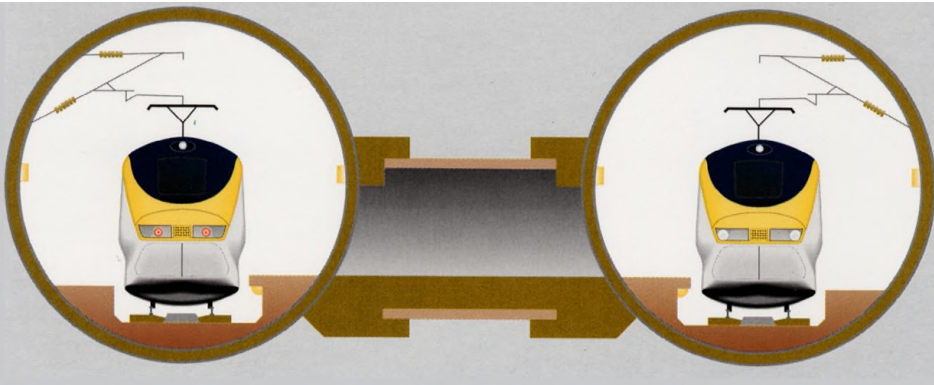


**Open Face Tunnel Boring Machine**

# Mined/Sprayed Concrete Lining Tunnels



# Place of Safety - Tunnel Cross Passage





# Costs of Tunnelling

## Fixed Costs

- Tunnel Boring Machine typically £15m to £25m
- Back up material handling similar cost order
- Power supply
- Mechanical and Electrical systems

## Linear Costs

- Labour
- Lining materials
- Excavated material disposal
- Ground monitoring
- Ground treatment
- Tunnel logistics

## Incremental Cost increases

- Surface arrangements for drive sites, reception sites, tunnel logistics
- Introduction of shafts
- Increase in number of cross passages
- Introduction of shafts and increase in tunnel Mechanical and Electrical systems.

# HS2

## Ground Investigations (GI)

Phase 2a

# Ground Investigations (GI)

- The design of the Proposed Scheme to date is based on a geotechnical desk study. The desk study uses existing geological mapping, historical GI results and knowledge gained from previous projects to ascertain likely ground conditions on the site of the railway and to identify the likely geotechnical risks.
- Leading up to the delivery of the Proposed Scheme, HS2 Ltd conducts site-specific GI to inform the later stages of design. This GI is targeted at the geotechnical risks identified by desk study. Site specific GI for the proposed scheme has commenced.
- It is standard practice to improve the understanding of ground conditions progressively through several phases of GI as the design matures.

# Ground Investigations (GI)

- A number of methods are used to obtain samples and to monitor and test them;
  - In-ground investigations: boreholes, cone penetration testing, dynamic probing, pits and trenches
  - Geophysical surface testing: ground penetrating radar and other techniques
- Laboratory tests are also carried out on many of the samples to supplement the information gathered on site.
- The sample data and test results are subject to a process of due diligence, which includes analysis and reporting by suitably qualified specialists, to produce factual information which can be used for the purposes of engineering decision making.

# Traffic and Transport

Phase 2a

# Introduction

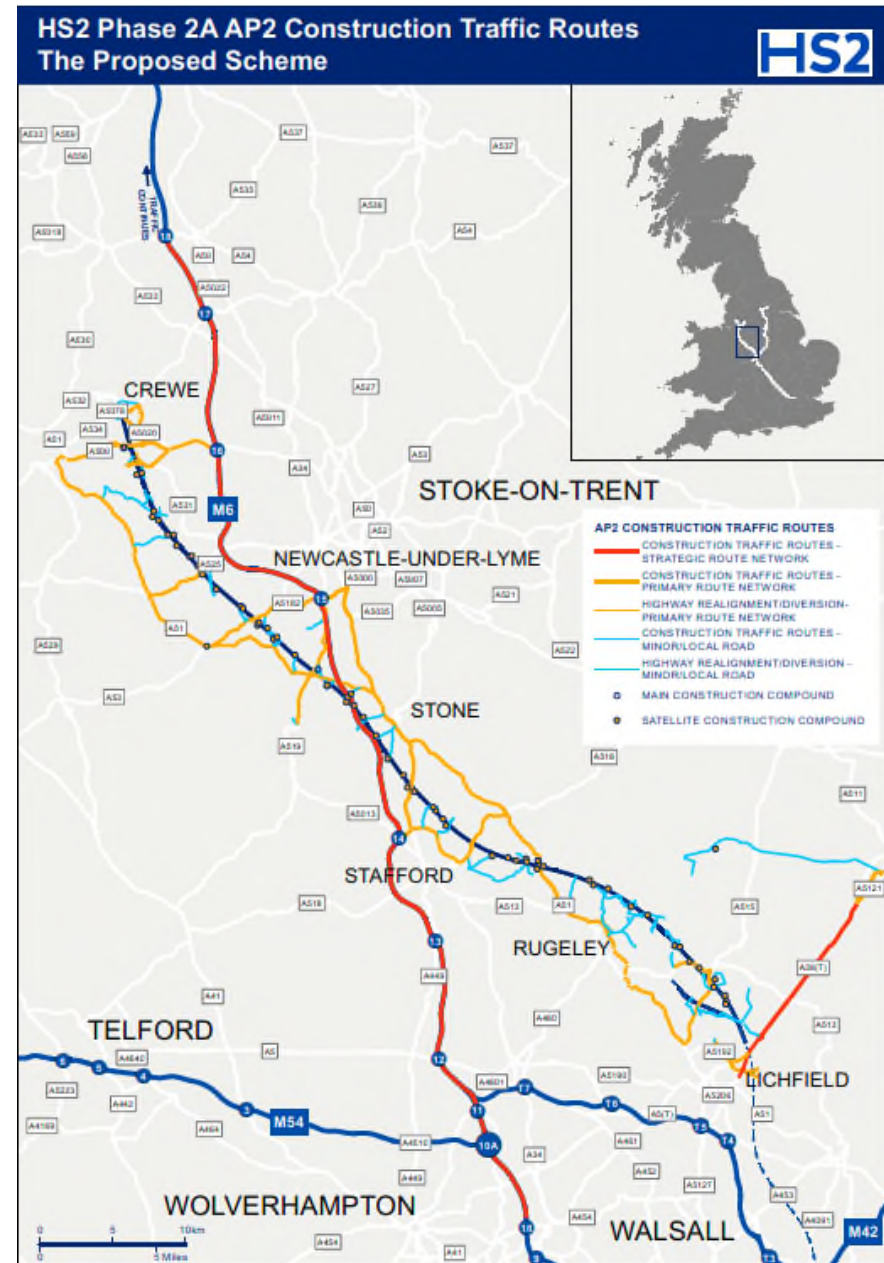
- The Transport Assessment forms part of the Environmental Assessment.
- It identifies traffic and transport impacts in both construction and operation.
- The Environmental Statement reports any significant residual traffic effects.
- Traffic data also informs assessments on air quality, noise, community, health and equality.

# Mitigation of impacts during construction

- Use of the HS2 railway trace as a haul road where reasonably practicable
- Use of borrow pits to reduce the need to import material by road
- Temporary highway measures (e.g. slip roads from M6 to Stone compounds)
- Specific highway improvements to address potential delays or road safety issues
- Roads kept open, where reasonably practicable, including the provision of off-line diversions
- Provision of overnight workforce accommodation at three main construction compounds
- Local placement of surplus excavated material to reduce the export by road

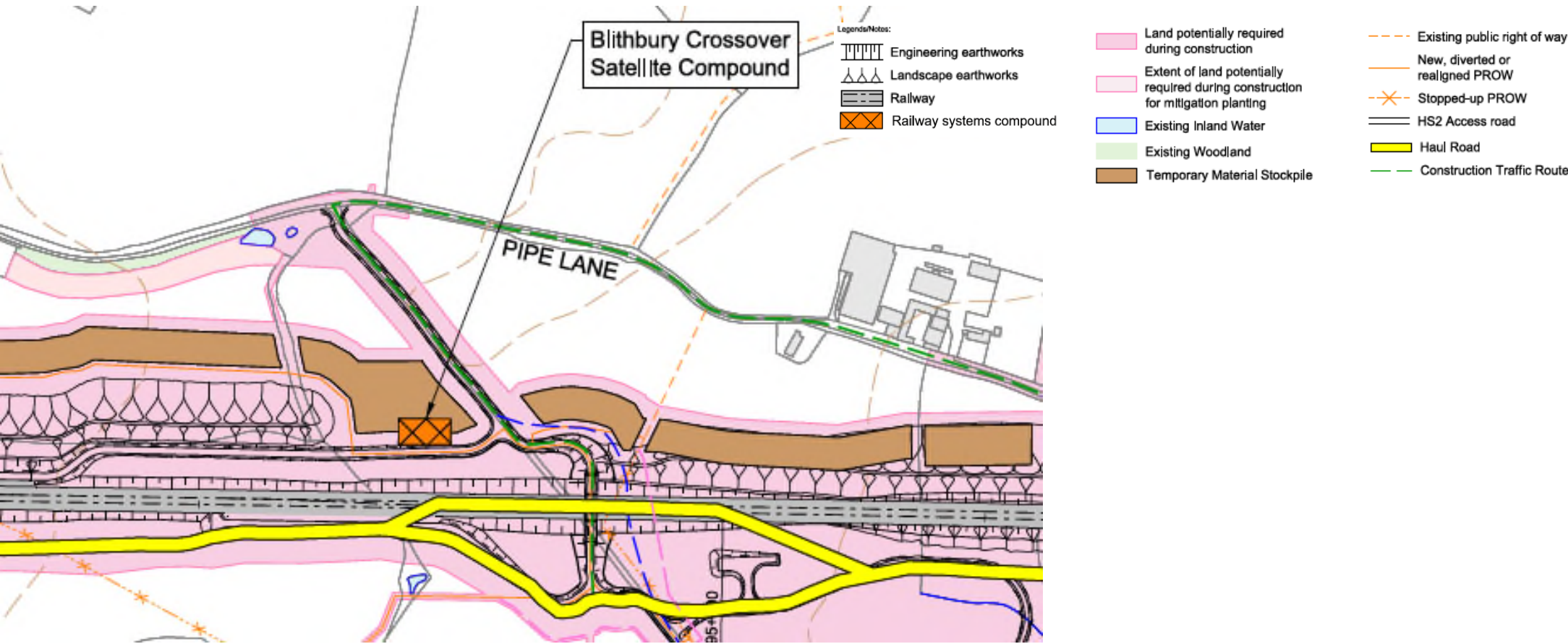
# Traffic & transport considerations

- Access to/from the Strategic Road Network, and;
- Reducing, as far as is reasonably practicable, traffic on local roads.





# Mitigation of impacts during construction – Haul Routes



# Mitigation of construction impacts – Borrow Pits

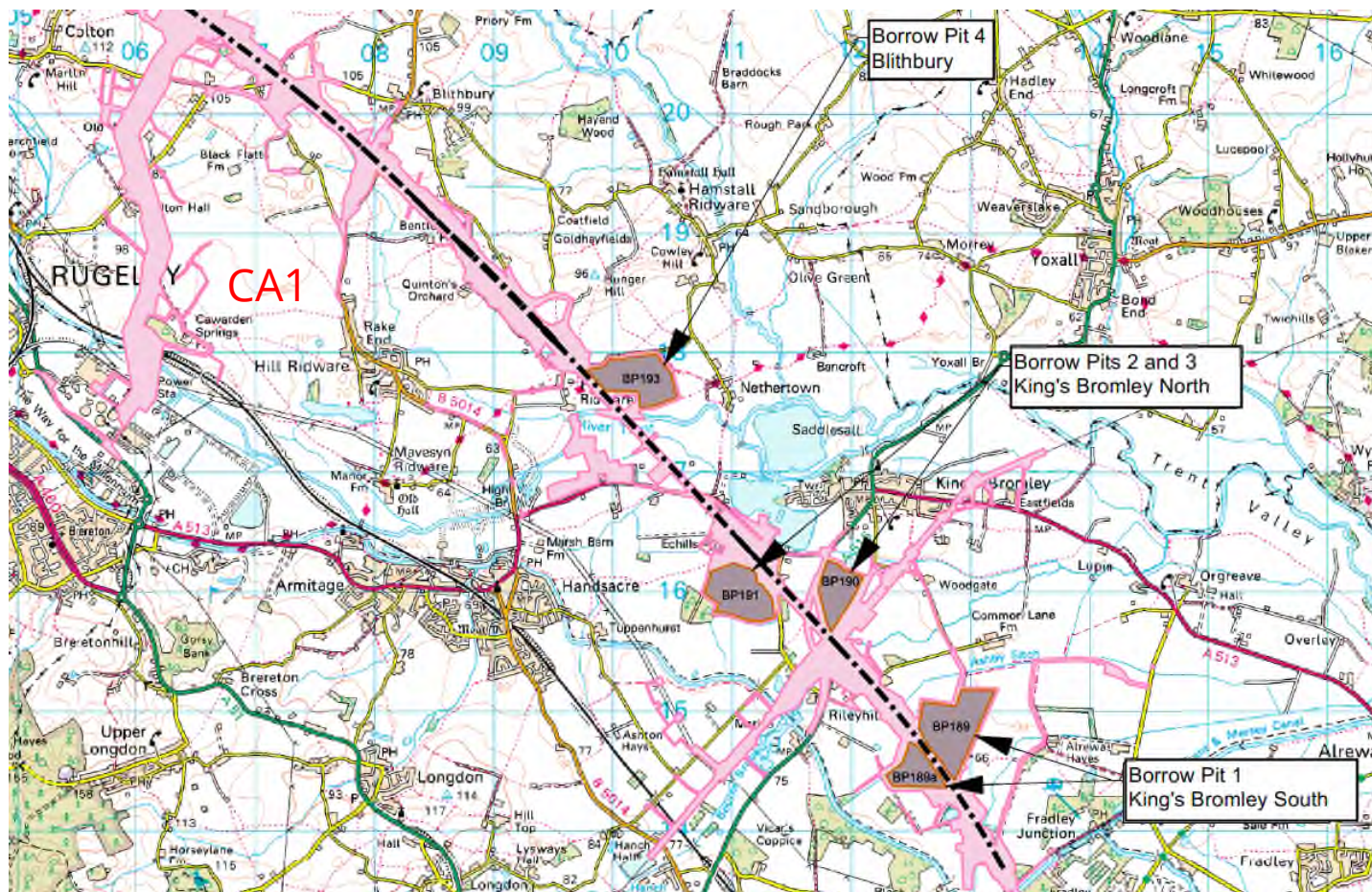
There is a shortfall in high quality aggregate (sand and gravel) required for construction of the Proposed Scheme.

Borrow Pits:

- Will provide the high quality aggregates needed for the construction of the railway.
- Allow extracted aggregate to be transported to construction locations largely via site haul routes within the construction boundary of the Proposed Scheme.
- Allow backfilling with excavated materials from the construction of the Proposed Scheme largely via site haul routes within the construction boundary of the Proposed Scheme.
- Significantly lower levels of HGV movements on local roads than importation of aggregate from commercial quarries.
- Reduce cost risks arising from importation from commercial quarries and land fill disposal.

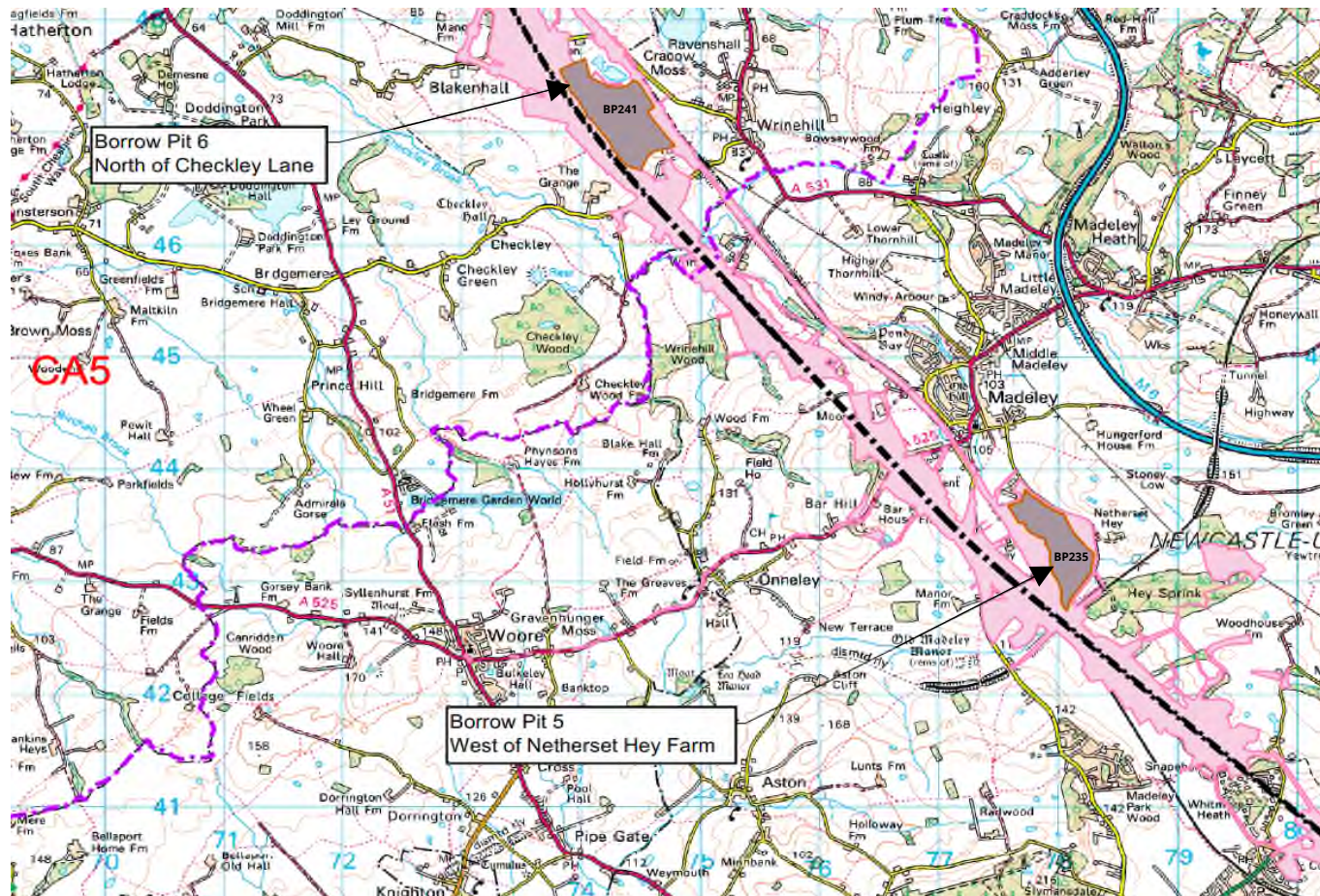
# Borrow Pits 1-4 Location

Each borrow pit is located on land that falls within an area of search that has been identified by the Mineral Planning Authority for future potential mineral extraction.

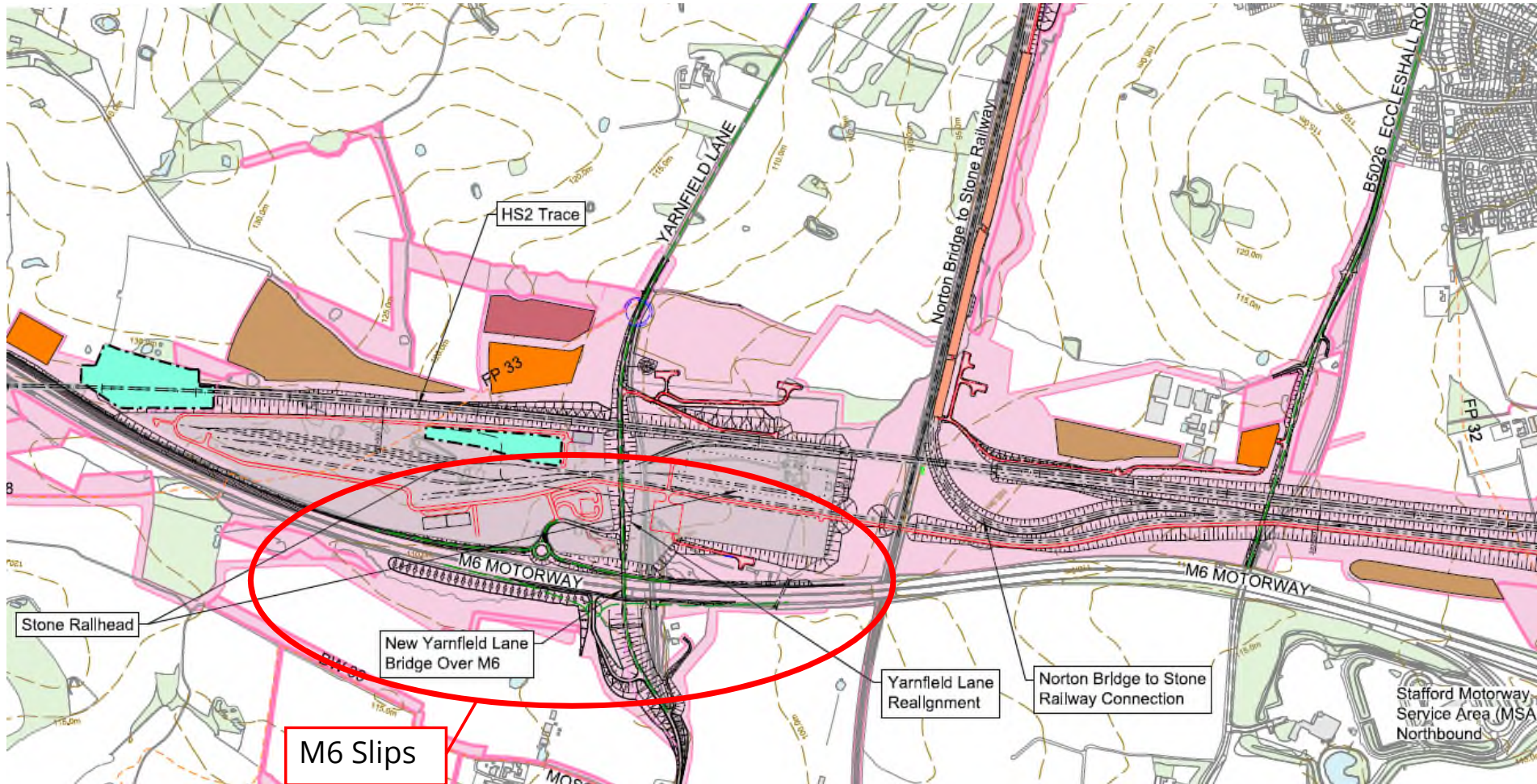


# Borrow Pits 5-6 Location

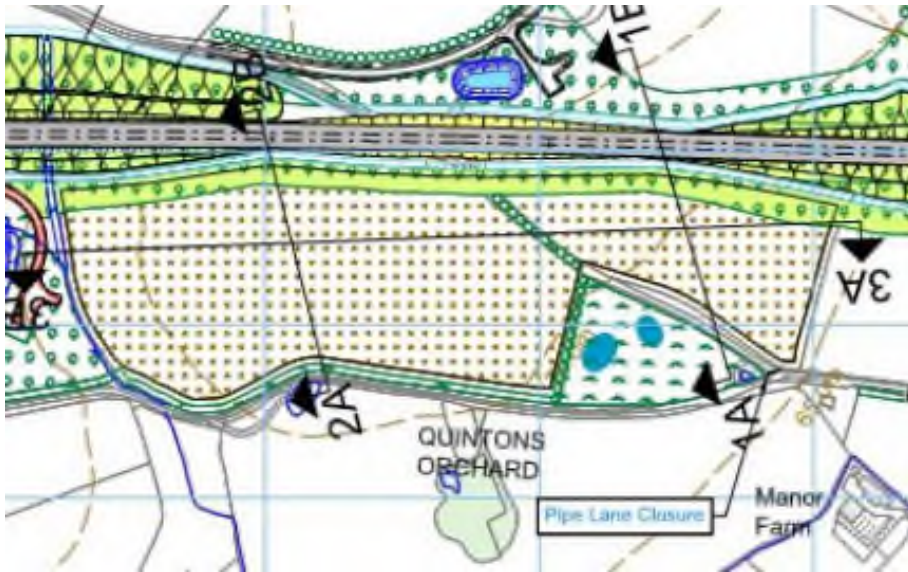
Each borrow pit is located on land that falls within an area of search that has been identified by the Mineral Planning Authority for future potential mineral extraction.



# Mitigation of impacts during construction – Stone Railhead

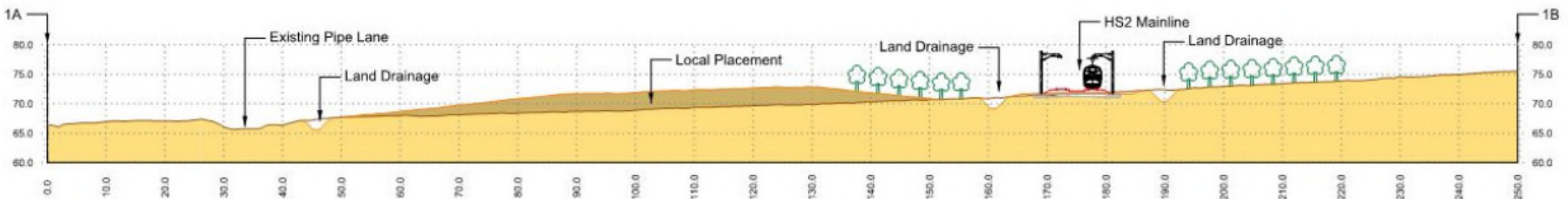


# Mitigation of impacts during construction – local placement



The sites for local placement were introduced in AP2 and were considered against criteria including:

- land only already required for construction.
- sites close to where surplus material is generated.
- avoiding habitat creation and above source protection zones or major utility diversions.



# Mitigation of impacts during construction - Draft Code of Construction Practice

Measures to manage traffic impacts set out in the draft CoCP address:

- phasing of works
- timing of operations
- road traffic management, layouts and signage
- parking controls
- a list of roads that may be used as construction routes by large goods vehicles, including any restrictions to the use of these routes
- monitoring of vehicles arriving and leaving construction compounds
- monitoring for deviation from authorised routes
- measures for highway reinstatement
- emergency access protocols
- proposals for transport of construction workforce and measures to ensure safe access to and from site
- arrangements for liaison with the relevant highway authorities and emergency services

# Mitigation of impacts during construction – Construction traffic routes

- Construction routes submitted to planning authority for approval under the Bill
  - Use of routes with direct access to the strategic road network and use of local roads limited, where reasonably practicable
  - Construction routes used by large goods vehicles (over 7.5t) will require the approval of the local planning authority (Schedule 17) – except Motorways and Trunk Roads and access to compounds with less than 24 two-way trips per day



# Transport assessment

- The Transport Assessment assesses traffic and transport impacts during both construction and operation.
- The assessment makes a number of precautionary assumptions based on a reasonable worst case scenario, such as lengths of working days, and workforce arrival times and patterns.
- HS2 impacts are assessed against a future baseline – an estimate of the level of future travel demand without Phase 2a – derived using local models of local plan projections, planning data in the area of the Proposed Scheme, and DfT's transport forecasting Trip End Model Presentation Program (TEMPro).
  - Peak level of construction traffic impacts assessed against a common future baseline (2023).
  - Operational traffic impacts assessed against opening year (2027) and design year (2041).

# Traffic and transport standard exhibits

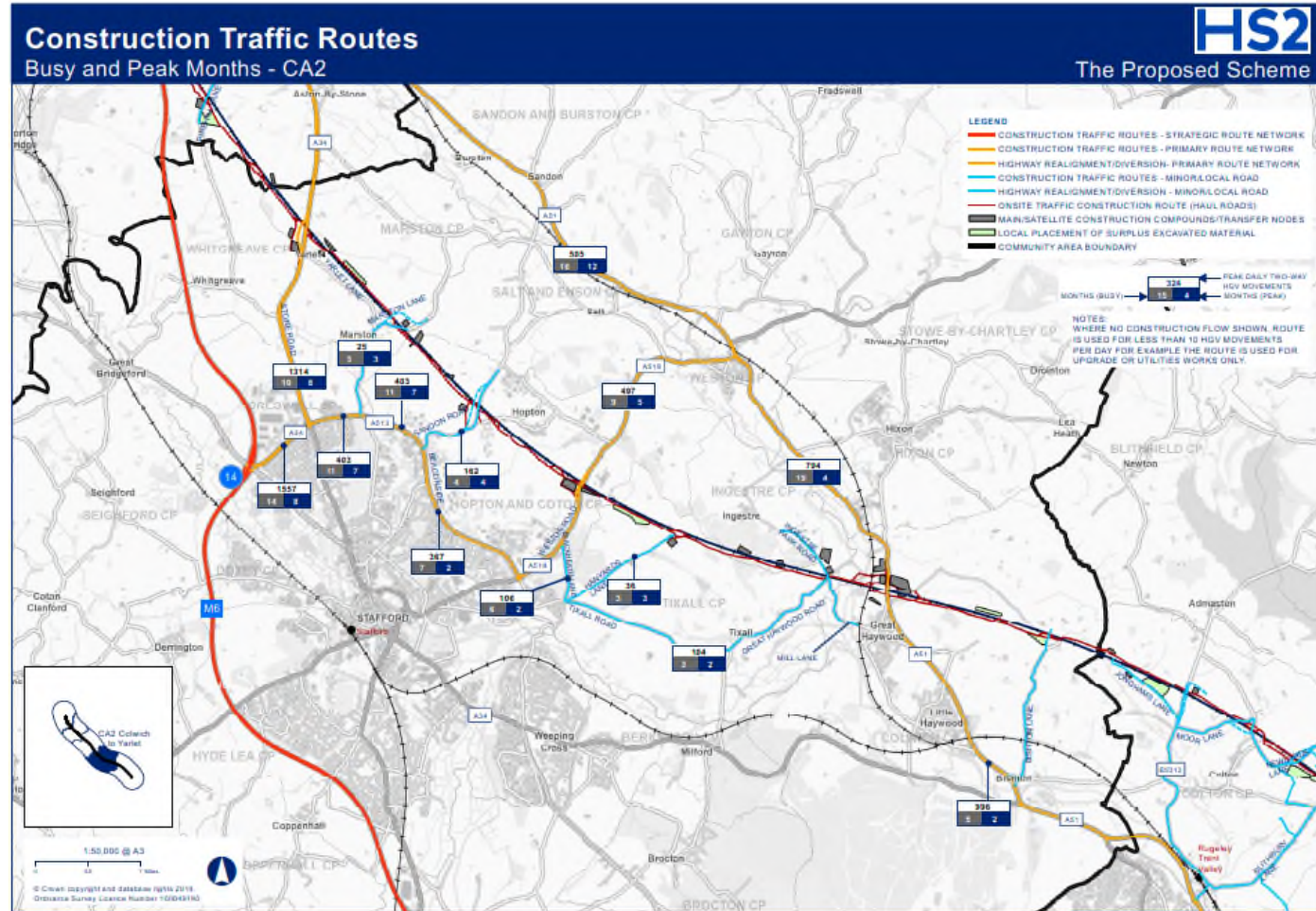
The standard traffic exhibits comprise:

- construction traffic routes and vehicle numbers maps
- construction traffic histograms
- daily weekday construction traffic flow maps (alphabet maps)

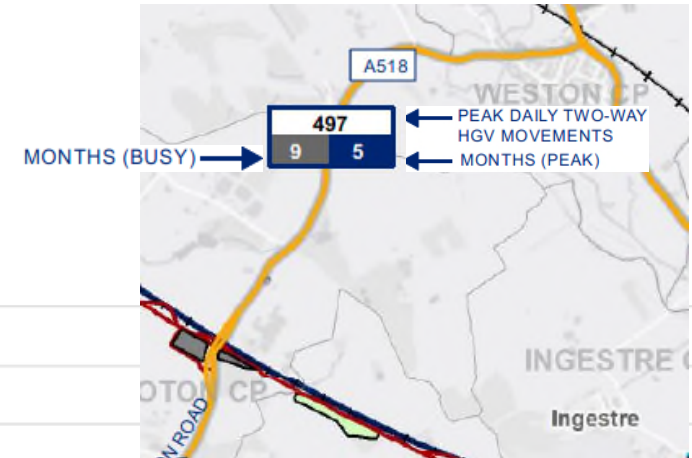
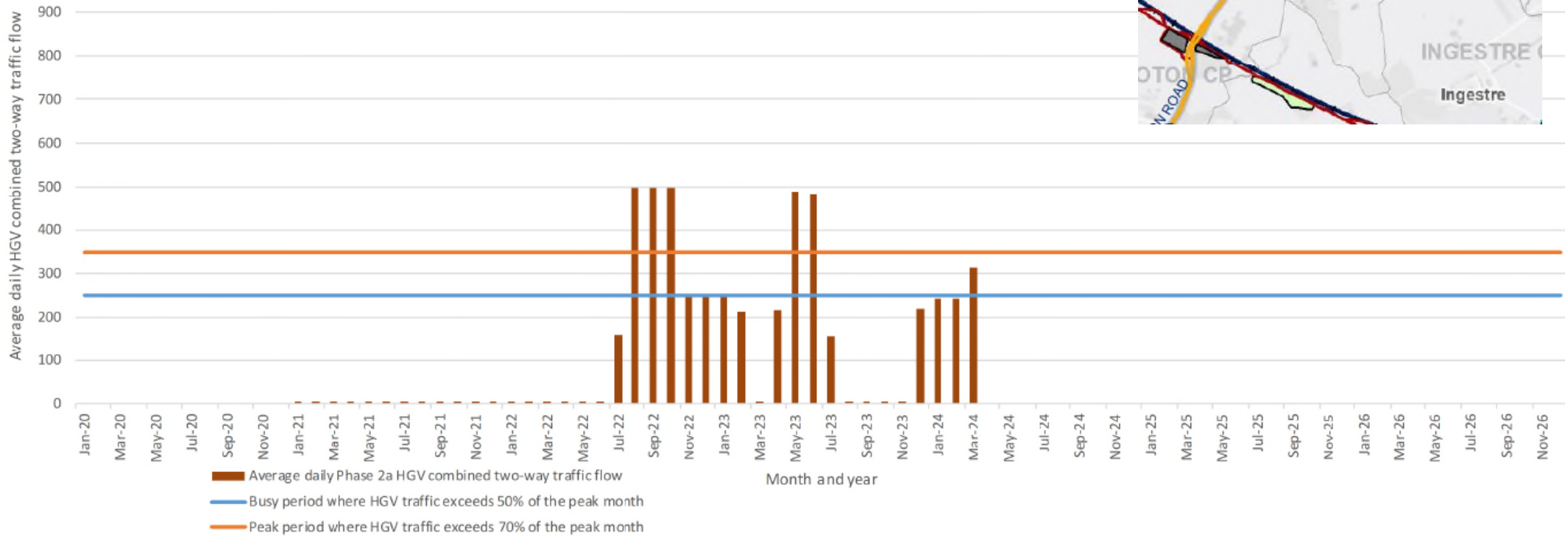
# Construction traffic routes

Shows:

- All construction routes
- Average daily two-way (both directions combined) HGV flows in peak month
- Flows are presented as a daily average for each month
- Duration of busy period when flows greater than 50% of peak month flows
- Duration of peak period when flows greater than 70% of peak month flows

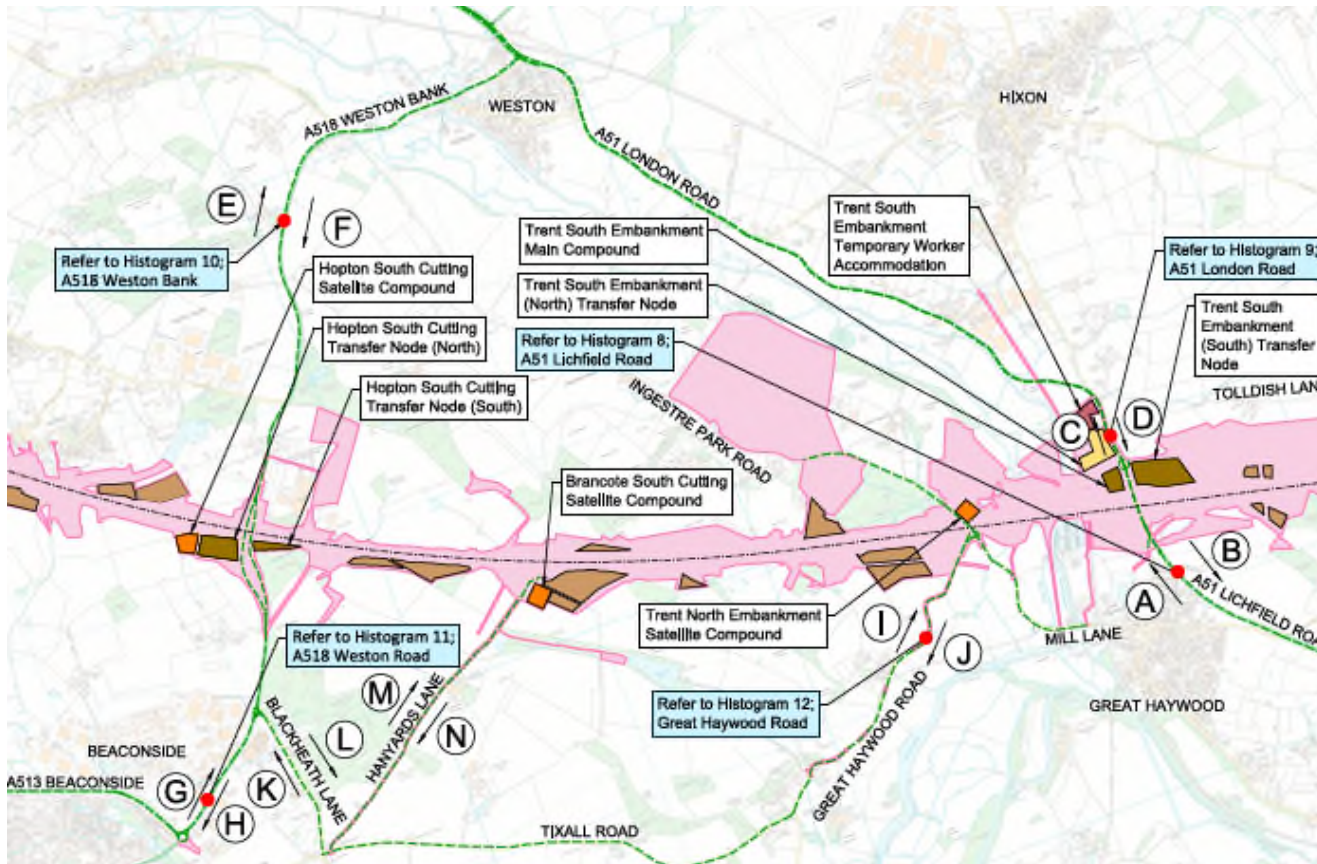


# Construction traffic histogram



# Daily weekday construction traffic flows

## GREAT HAYWOOD AND TIXALL AVERAGE DAILY WEEKDAY TRAFFIC FLOWS IN PEAK MONTH THE PROPOSED SCHEME



A51 Lichfield Road (between Little Tixall Lane and Toldish Lane) - Northbound							
A	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	6330	363	6%	749	498	12%	12%

A51 Lichfield Road (between Little Tixall Lane and Toldish Lane) - Southbound							
B	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	6984	444	6%	749	498	11%	12%

A51 Lichfield Road (between Hoo Mill Lane and HS2 Route) - Northbound							
C	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	6457	365	6%	1026	539	16%	12%

A51 Lichfield Road (between Hoo Mill Lane and HS2 Route) - Southbound							
D	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	7525	509	7%	1026	539	14%	12%

A518 Weston Bank (between Within Lane and Willowmore Banks) - Northbound							
E	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	5605	362	7%	311	249	5%	10%

A518 Weston Bank (between Within Lane and Willowmore Banks) - Southbound							
F	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	6357	323	5%	311	249	5%	9%

# Alphabet maps explained

They present the assessed traffic flow information for key locations, as follows:

A518 Weston Bank (between Within Lane and Willowmore Banks) - Northbound							
E	2023 future baseline			HS2 Traffic		2023 future baseline plus HS2	
	All Vehs	HGVs	%HGV	All Vehs	HGVs	% Increase in all vehicle traffic	%HGV
	5805	382	7%	311	249	5%	10%

- Construction traffic flows are based on the average daily (12hr) flows over the peak month for each location – depending upon programme the peak months may vary between locations
- % HGV represents the proportion of total traffic that is HGVs without and with HS2
- % increase in vehicle traffic represent the change from baseline flows resulting from the introduction of HS2 construction traffic