High Speed Two Phase 2b
West Midlands to Leeds
Route engineering report 2016

November 2016

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Department for Transport

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Contents

1 Introduction

1.1 Purpose of this report

1.1.1 This report provides a detailed route description of the Leeds leg of Phase Two of the High Speed Two (HS2) network, including the proposed stations and depots.

1.1.2 The historical work undertaken since the start of the route development in 2010 and presented to the public in a series of Phase Two consultation events in late 2013, can be found on the Department for Transport website (www.gov.uk).

1.1.3 The technical requirements for line of route, stations and depot design are outlined in this report. For further information on the key issues that HS2 Ltd has considered, and the recommended changes since public consultation in 2013, please see the Phase 2b Summary Report 2016.

1.1.4 For potential impacts on communities and the environment please see the High Speed Rail: Phase 2b Preferred Route Sustainability Statement[1].

1.2 Overview of the route

1.2.1 The preferred route from West Midlands to Leeds would run from the Lea Marston junction between Phase One and Phase Two of HS2, north of Water Orton in eastern Birmingham, to a new station in central Leeds. It would also connect to the East Coast Main Line (ECML) railway near Church Fenton, south-west of York. The total route length is 123 miles (198km) and the route would:

- follow the M42 and A42 corridor to Kegworth, near East Midlands Airport;
- pass through Long Eaton, with a new station at Toton;
- follow the M1 corridor from Long Eaton to the M18 junction near Aston;
- have a junction in the South Normanton area, with a spur towards Stonebroom joining to the Midland Mainline near Clay Cross;
- follow the M18 corridor to the east of Rotherham;
- continue in a northerly direction to pass between Conisbrough and Mexborough and to the east of Thurnscoe;
- pass west of South Kirkby and Hemsworth and to the east of Crofton;
- pass between Wakefield and Normanton;

[1] Documents relating to this phase can be found here www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester

- follow the M1 corridor from Swillington, passing north of Garforth;
- continue north east to join the ECML, east of Church Fenton;
- have a junction in the Woodlesford area, with a spur towards central Leeds; and
- have a new station in central Leeds, adjoining the existing Network Rail station.

1.3 Layout and content of this report

1.3.1 This report is laid out as follows:

- chapter 1 (this chapter), is introductory.
- chapter 2 sets out the technical requirements and assumptions underlying our work.
- chapter 3 describes the line of route.
- chapter 4 describes the stations along the route.
- chapter 5 describes the infrastructure maintenance depot and the rolling stock depot.
- chapter 6 discusses ancillary design works.
- chapter 7 is a glossary of terms.

2 Design methodology

2.1 Overview

2.1.1 The route definition and selection process for Phase Two commenced in Autumn 2010 with the engagement of engineering and environmental consultancies to deliver the necessary technical design and appraisal input. The methodology applied was, in large part, the same as that applied to the route selection between London and the West Midlands, taking into account lessons learned during the development of Phase One.

2.1.2 HS2 Ltd were asked by the Government to identify a number of possible route and station options[2]. This involved a process of identification of a longlist with subsequent sifting to reduce the options for consideration to a handful of alternatives that met the remit set by the Government. At each sift, remaining options were developed and refined to a greater level of detail in order to identify the key differences between options. During these final stages, potential locations for the infrastructure maintenance depots (IMDs) and rolling stock depots (RSDs) were also developed and followed a similar sifting process.

2.1.3 The scope for the Leeds leg included city centre station options in Leeds and options for stations in South Yorkshire and the East Midlands, including interchange options and city centre options. Connections to the existing ECML would provide routes to the North East.

2.1.4 In March 2012 HS2 Ltd submitted to the Government its report 'Options for Phase two of the high speed network'. This report was part of a suite of documents produced to provide preliminary advice to the Government on potential options for phase two of the high speed rail network.

2.1.5 In July 2013 the Secretary of State for Transport published proposals for Phase Two of HS2 and initiated a seven-month period of public consultation to gather views on the route and stations proposed in the consultation.

2.1.6 Following public consultation, HS2 Ltd undertook a review of the Phase Two route and proposed a number of refinements. These refinements were informed by consultation responses, lessons learned from the development of the Phase One design, and the developing strategic context as reflected in the reports 'HS2 Plus', 'Rebalancing Britain', 'The Yorkshire Hub' and 'Sheffield and South Yorkshire'. The drivers for changes to the consultation route are considered in greater detail in the Summary of Route Refinements report.

2.1.7 This report provides a detailed route description of the preferred route between the West Midlands and Leeds. For further information on the key issues that

[2] HS2 Ltd's remit is set out in a number of publicly available remit letters from the Government.

HS2 Ltd has considered, and the recommended changes, please see the Phase 2b: Summary of Route Refinements. For potential impacts on communities and the environment, please see High Speed Rail: Phase 2b Preferred Route Sustainability Statement.[3]

2.2 Technical requirements for line of route

2.2.1 HS2 Ltd has developed a series of deliverable approach statements. These specify the engineering operational and performance requirements for the route, and set out the engineering design parameters.

Alignment design assumptions

2.2.2 The alignment development work was generally carried out using Ordnance Survey MasterMap data, supplemented with elevation information from five-metre resolution terrain data and one-metre resolution surface data. This mapping has been used to support the alignment design.

2.2.3 The alignment design was undertaken in accordance with the HS2 Track Alignment Design Specification. Turnouts have been specified in accordance with the HS2 Switch and Crossing Geometric Design Specification.

2.2.4 Key alignment parameters from the Project Specification include the following:

- The mainline alignment shall be designed to support an initial maximum operating speed of 360 km/h, with the alignment footprint capable of supporting a maximum operating speed of 400km/h, where topographical, train performance and sustainability issues permit.
- The line shall be designed to permit trains to maintain consistently high speeds.
- The maximum achievable turnout speed is assumed to be 230km/h.
- The maximum vertical acceleration experienced due to the effect of vertical curvature shall normally be 2.25% of gravitational force; in exceptional circumstances, this can be increased to 4.25% of gravitational force.
- The maximum vertical curve radius shall be 56,000m.

2.2.5 Where possible, low points in cuttings are avoided and minimum gradients provided, to allow tracks to drain by gravity.

[3]For more details please see https://www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester

Width of the railway

2.2.6 For the majority of its length, the new route would be a twin-track railway.

2.2.7 The separation between the centre lines of the pair of tracks would be 5.0m where 400km/h running was required. The track-bed width shall make provision for overhead line equipment (OHLE), walkways, drainage, cable troughs and fencing. The track-bed width would be 18.9m wide. This has reduced from an allowance of 22m in the Consultation Route and is consistent with assumptions made on Phase One of the project.

2.2.8 For cuttings and embankments, at this stage, it is assumed that the side slope of the earthworks would be 1:2.5 (one vertical to two and a half horizontal). As greater detail on ground conditions are established, it may be possible to use steeper cutting slopes. In some areas, shallower cutting and embankment slopes (i.e. a wider footprint) may be required where the ground conditions prove to be less favourable.

2.2.9 Where tracks enter tunnels in two separate tunnel bores, the distance between track centre lines would be dependent on the external tunnel diameter (see 'Tunnelling assumptions'), but would typically be between 16.5m and 19.2m, dependent on tunnel diameter.

2.2.10 As the design develops, the landtake required by the railway is expected to increase in order to accommodate highways crossings, system compounds, access for maintenance, balancing ponds and the diversion of utilities as well as provision for environmental mitigation.

2.2.11 The construction of HS2 would require some additional temporary landtake beyond the corridor footprint, including areas for construction compounds and access. Worksites would also be required at areas of major works, such as entrances to tunnels.

Track formation

2.2.12 At this stage of the design, it is assumed that the track would be on ballast, except in twin tunnels or through stations, where there would be track slab.

Constructability and programming

2.2.13 At this early design stage, consideration of construction issues has generally included identifying risks and opportunities and identifying typical working methods and techniques.

2.2.14 The initial construction phase programme for the works supports the assumption that the West Midlands to Leeds route can be constructed between 2024 and 2033, including the commissioning and testing of the route.

2.2.15 The programme reflects the current known project scope and outlines a sequence in which the scope can be delivered. The programme identifies the key

programme risks and opportunities in project delivery and articulates the basis for associated programme contingencies.

2.2.16 Further information on the typical principles of construction can be found in the draft Code of Construction Practice for Phase One[4].

Geotechnical assumptions

2.2.17 The geological conditions along the route are variable. At this early stage of design, a common side slope has been adopted for earth structures (see 'Width of the railway'). Recent work on earthwork slopes has identified that shallower cutting side slopes, typically 1:3, would probably be required in over 75% of the route where it passes through Lower and Middle Coal Measures Formations. This is similar to cutting slopes on the M1 and M42. Steeper slope angles could be applied locally by using engineering techniques such as soil nailing or retaining structures, thereby reducing the width of the corridor. Further work in this area would be carried out at the next stage of development to confirm these findings.

2.2.18 The following issues are typical of the engineering influences on route selection:

- shallow mine workings occur widely; although primarily for coal mining, there are also shallow mine workings associated with ironstone, sandstone and gypsum. Deep mine workings are limited to coal: significant lengths of the route cross coal mine workings;
- backfilled opencast coal sites are very common in the coalfields of Leicestershire, Nottinghamshire, and South and West Yorkshire. It is common for landfill cells within the backfill to contain significant contamination;
- landfills, both historical and current, often contain contamination and loose tipped material;
- spoil heaps, predominantly emanating from former coal mining activities. Spoil heaps present similar engineering challenges to landfills, with the additional risk that they can include 'tailings lagoons' within the spoil;
- backfilled brick pits and quarries are also common, many of which have been backfilled with industrial and domestic waste. In many cases, accurate records do not exist;
- compressible deposits including alluvium, which poses a settlement risk to loads placed on it; and
- areas with a known history of landslides or unstable ground.

[4] Available at www.gov.uk/government/publications/hs2-phase-one-environmental-statement-volume-5-draft-code-of-construction-practice

Structures assumptions

2.2.19 Sufficient vertical clearance has been provided within the alignment design where HS2 would cross, or be crossed by, roads and other major obstacles, including rivers, canals and other railways. Short bridges, such as those used to carry the railway over local roads, or roads over the railway, are likely to be straightforward single spans. For longer structures, the provision of a viaduct structure has been assumed. In particular, viaducts have been assumed where the designed rail level would be greater than 15m above existing ground level, or where a structure longer than 60m is required to span a feature - for example, where HS2 would cross a flood risk zone.

Tunnelling assumptions

2.2.20 The range of tunnel configurations used is as follows:

- Woodlesford: a twin bore, single track tunnels with cross passages.
- All other tunnels are cut-and-cover or jacked box tunnels.

2.2.21 The tunnelling methods considered are:

- tunnel boring machine (TBM) driven tunnels with precast tunnel linings - the type of machine would depend on the ground conditions;
- sequentially excavated tunnels, generally using sprayed concrete lining for initial ground support;
- cut-and-cover tunnels;
- jacked boxes.

2.2.22 It is assumed that tunnels would be provided where the track alignment is at least two times the external tunnel diameter below existing ground level. The size of tunnel required would be dependent on design speed and length of tunnel. For operational speeds of 360km/h, the internal diameter would be 8.8m for each bore of a twin bore tunnel.

2.2.23 Cross-passages between twin-bore tunnels have been assumed at a spacing of approximately 380m. Cut-and-cover tunnels would have a central wall between tracks, with connecting door at 380m spacing.

2.2.24 The track spacing would widen on the approach to tunnels, to allow for the construction of twin-bored tunnels or the central wall between tracks on cut-and-cover tunnels. This spacing would depend on the alignment approaching the tunnel, and would be a minimum of twice the external tunnel diameter for twin-bore tunnels and a minimum of 8m for cut-and-cover tunnels.

2.2.25 It is assumed that tunnels would be provided where the topography requires them. There is only one bored tunnel, at Woodlesford on the Leeds spur, which has an internal diameter of 8.8m for each bore of a twin-bore tunnel. This is

consistent with the design speed and length, and provides space for the train and ancillary equipment, such as the electrification system, emergency walkways, and drains.

Cut-and-cover tunnels

2.2.26 In some locations, cut-and-cover tunnels are proposed. These would generally be formed by excavating what would be a normal cutting, constructing a box type of structure and then re-filling over its roof slab to restore the original ground level and surface features such as footpaths and roads.

Jacked box tunnels

2.2.27 In certain locations where the route crosses beneath roads or railways, a box tunnel would be formed by constructing a box-type structure alongside its final position and then jacking it into position whilst excavating out material from the face. This technique is frequently used to minimise disruption to key road and rail routes. The final result is the same as a cut-and-cover tunnel.

Interfaces with existing transport infrastructure

2.2.28 Where HS2 would cross the path of an existing highway or railway, the route alignment design would provide sufficient vertical clearance to permit construction of a new bridge.

2.2.29 The route encounters major highways, including motorways. Where HS2 crosses highways, either above or below, there may be a requirement to locally modify the highway to accommodate the HS2 structure. Protection from errant vehicles would also be provided at highway interfaces.

2.2.30 The route would also cross existing railway infrastructure. Where HS2 crosses over this infrastructure a bridge or viaduct carrying HS2 would be provided over the existing railway. If appropriate, allowance would be made to future-proof for electrification of the existing railway when not currently provided. Where HS2 crosses beneath existing railways a jacked box or bridge would be provided to carry the existing line over HS2.

2.2.31 There are locations along the routes where significant modifications to the existing railway network would be required, such as closure and diversion of existing lines or the realignment of tracks, so that HS2 would share an existing and possibly widened corridor.

2.2.32 Where the alignment broadly follows an existing transport corridor, there may be a requirement to permanently realign the corridor so that HS2 would share the existing and sometimes widened corridor.

Interfaces with watercourses

2.2.33 Where HS2 would cross a major watercourse, sufficient clearance would be provided to allow at least a 1m freeboard above 1:1,000 year flood levels. Where

a floodplain is present, the floodplain would be crossed by a viaduct. At later stages of the design process, detailed flood modelling may indicate that some or part of these viaducts can be replaced by embankments. In other cases, a viaduct may be extended. The ability to provide replacement flood plain storage to mitigate any impact would be part of this modelling and design process.

2.2.34 Where HS2 crosses over smaller watercourses, culverts would be provided through the embankment crossing the watercourse. In a small number of instances, the alignment is such that sufficient clearance may not be available to allow a culvert to be provided. In these instances, alternative solutions would be applied, such as diverting the watercourse along the line of route to a location it can be returned to a watercourse, or the provision of drop inlet culverts or inverted siphons. These solutions will be developed at the next stage of the design process.

2.2.35 Where the alignment is in deep cutting, a watercourse would be diverted to avoid the route, or would be designed to cross HS2 in an aqueduct.

Environmental mitigation

2.2.36 Mitigation is inherent within the design through the choice and location of the route. Decision making on the choice of route has included a range of considerations including cost, sustainability, engineering and benefits/business case. Opportunities for environmental mitigation will be identified and proposed following the environmental impact assessment process as part of the next stage of design. This will include surveying, modelling exercises, analysis and engagement with relevant stakeholders.

2.3 Technical requirements for stations

2.3.1 The quality of station design will shape the passenger experience of the HS2 network. The station should promote a positive experience of the network through a design that provides passengers with a smooth, convenient and pleasant passage through the station, with effective management of pedestrian throughput.

2.3.2 The design of stations and their integration with the surrounding built environment should create the opportunity not only to engender positive experiences of the network, but also to act as catalysts for regeneration and economic growth.

2.3.3 There are two station types on the Preferred Route:

- one terminus station, located at Leeds; and
- one 'through' or intermediate station, the East Midlands Hub at Toton.

2.3.4 At this stage of design, the stations have been considered in outline, using the following assessment criteria:

- site availability and fit;
- integration with line of route options and approaches to city centres;
- impact upon and integration with existing transport infrastructure;
- constructability;
- passenger access, circulation and egress, including in emergencies;
- cost;
- demand (insofar as location would affect it); and
- a range of sustainability and environmental considerations, including flooding.

Station design

2.3.5 The station design encompasses a wide range of criteria. This includes designs that enable train dwell times to match service patterns, considerations of passenger comfort and safety, capitalising on commercial opportunities and working within the confines of the budget. Provision for perturbed situations and future growth must also be considered.

2.3.6 Station design and layout would vary across the network depending on station location, operational requirements, land availability, etc., and therefore the design of each station would be unique. However, whilst recognising the constraints of individual sites, all stations on the high speed network should maintain a common style and standard that feels familiar to passengers, regardless of where the station is.

2.3.7 Station design would be developed to address the following factors, which are critical to station functionality:

- accommodation of network operational requirements;
- station capacity planning;
- functional zoning;
- passenger movements, wayfinding and accessibility;
- safety and security;
- interchange with other transport modes; and
- passenger environment.

Technical requirements

2.3.8 The useful length of HS2 station platforms is 415m with an additional 25m for buffers at terminal platforms. The platforms are designed to GC gauge, the height of such platforms being 760mm above rail level.

2.3.9 Where interchange facilities with the national rail networks are provided, the platforms shall be designed to UK national railway standards.

2.3.10 Platform width shall be determined to accommodate expected passengers flows, with reasonable practicable allowances made for perturbation of peak flows. Design shall also comply with relevant design standards for minimum clearances to fixed infrastructure. Minimum width of platforms has been assumed to be 12m for double platforms, and 8m for single-sided platforms.

2.3.11 Tapering at platform ends shall be permitted where there is justifiable reason to do so. Where a taper is applied it should taper from full width to no less than a width of 8m and the radius of platform curvature shall not be less than 1,000m radius. The remaining length of the platform shall be straight to facilitate splitting and joining of trains. Platform obstructions shall be kept to a minimum in the tapered section of the platform.

2.3.12 The number of platforms required at each station is determined by the operational requirements that drive the timetable, including the necessary turnaround time to meet that timetable. It is further influenced by the length of the route sections, demand requirements and loading factors.

Terminal stations

2.3.13 The Leeds terminal station would make provision for five platform faces.

2.3.14 The approach alignment design attempts to maximise entry and exit speeds to permit unimpeded acceleration and braking of trains.

Through or intermediate stations

2.3.15 The East Midlands Hub intermediate station on the Leeds leg would have four platform faces. The station would include two through tracks (one northbound and one southbound) to cater for non-stopping trains travelling through the station at high speed.

2.3.16 The through stations require a facility to slow down and stop a train without impeding the passage of a following non-stopping train, and conversely to enable that train to re-join the railway without being impeded by an overtaking train. The lengths of the acceleration and deceleration lines, or stopping lines, are defined by the speed and frequency of the service. Invariably, these lines are much longer than a platform stopping lane would need to be for a slower railway or a railway with a less intense service pattern.

2.3.17 The interchange station options therefore incorporate two through running tracks. Platform faces serve lines that run parallel to the through running lines. The interchange stations have four platform faces (i.e. two platforms in each direction).

2.3.18 The normal two-track route would widen to four tracks and then to six for a station with four platform faces.

2.4 Technical requirements for depots

2.4.1 The route to Leeds would include provision for a rolling stock depot (RSD) and an infrastructure maintenance depot (IMD).

2.4.2 The RSD would be used to stable trains overnight, for cleaning and maintenance. The IMD would be used as a base from which to carry out engineering activities to inspect, maintain and renew the infrastructure.

2.4.3 The depots would be required to operate for 24 hours, seven days a week.

2.4.4 The depots would ideally provide immediate access to the trunk road network to facilitate access by large goods vehicles. Good transport links would allow for a suitable and relatively local workforce; as such, the potential for access by public transport would be considered.

2.4.5 The IMD would be designed to allow access to both the HS2 route and the existing railway.

Requirements for rolling stock depots

2.4.6 The RSD would be configured for stabling and light maintenance, with heavier maintenance activities carried out at the Washwood Heath depot proposed for Phase One.

2.4.7 The RSD would be positioned with access to the HS2 route, ideally within ten minutes of the terminus station. Access to the existing rail network to facilitate delivery of rolling stock and other materials by rail is desirable, but not essential.

2.4.8 The RSD would be configured to be able to deal routinely with 30 train sets and provide stabling for up to 40 sets in exceptional circumstances. This requirement approximates to a footprint two kilometres in length and up to 250m wide: an area of 35 hectares. Each train set is up to 200m long. Each depot would handle a mixture of 'captive' sets and 'classic compatible' sets.

2.4.9 The depot would provide a large covered maintenance building and a range of facilities to enable rolling stock inspection, repair, cleaning, light maintenance, re-watering and replenishing of consumables.

2.4.10 The maintenance patterns and flow through the depot would be defined to ensure sufficient capacity remains to move trains around the depot and prevent gridlock.

Requirements for infrastructure maintenance depot

2.4.11 The IMD would be configured to support all infrastructure maintenance activities within the route.

2.4.12 The IMD would provide a maintenance, servicing and stabling facility both for HS2 on-track plant (including vehicles up to GC gauge, which would be too large to travel on the national rail network) and for HS2 maintenance rescue and recovery locomotives. It would be capable of acting as an incident control centre in the event of an incident on the HS2 route and occupy an area of approximately 26 hectares.

2.4.13 The IMD would ideally be placed close to the mid-point of the respective leg, with direct access to the HS2 route. Access to the existing rail network to facilitate delivery of rolling stock and other materials by rail would be essential.

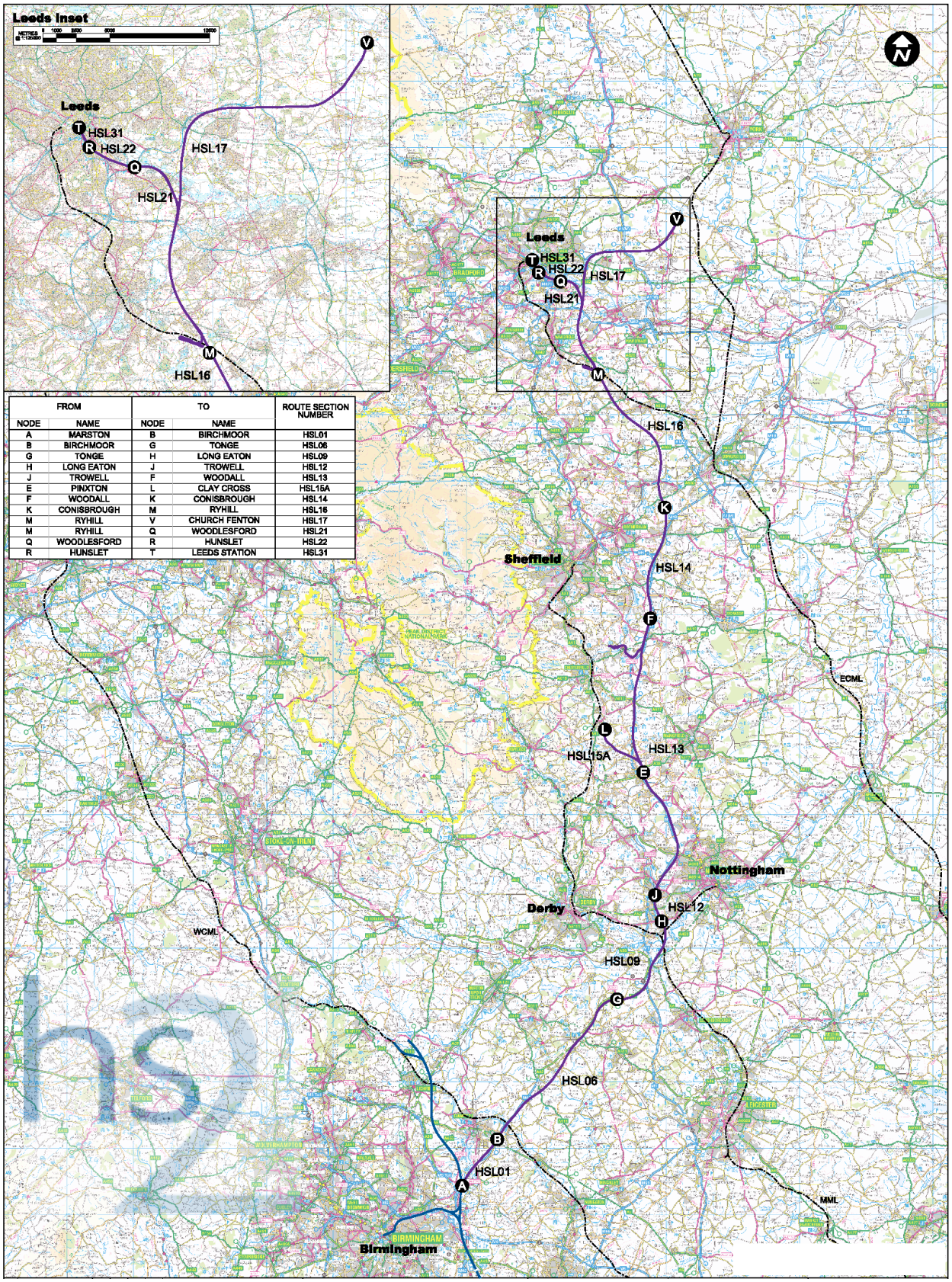
2.4.14 The IMD site would have the potential to be used as a construction compound for the works, thus avoiding additional landtake.

2.4.15 The depot would be designed to serve both the HS2 route and the existing railway in both directions where possible. This would allow engineering trains to arrive at and depart from the depot with maximum flexibility. A switch and crossing assembly area would be provided to enable the pre-assembly of the switch and crossing units to be installed. Areas of storage would be provided with facilities to enable forklift trucks and overhead cranes to handle materials and plant safely. The depot would also store standard components and consumables.

2.4.16 The IMD would stable and service a variety of on-track plant and engineering supply train equipment. It would also provide strategic engineering material stores. HS2 ballast and spoil wagons would need to be able to run on and off the existing rail network, bringing supplies.

2.4.17 It is assumed that engineering trains would only operate on HS2 after the last passenger trains have ceased to run, and would return to the IMD before morning train operations commence.

2.4.18 Provision would be made for ancillary buildings and facilities, such as offices, car parking, incident control rooms, workshops and storage.



FROM		TO		ROUTE SECTION NUMBER
NODE	NAME	NODE	NAME	
A	MARSTON	B	BIRCHMOOR	HSL01
B	BIRCHMOOR	G	TONGE	HSL06
G	TONGE	H	LONG EATON	HSL09
H	LONG EATON	J	TROWELL	HSL12
J	TROWELL	F	WOODALL	HSL13
E	PINXTON	L	CLAY CROSS	HSL15A
F	WOODALL	K	CONISBROUGH	HSL14
K	CONISBROUGH	M	RYHILL	HSL16
M	RYHILL	V	CHURCH FENTON	HSL17
M	RYHILL	Q	WOODLESFORD	HSL21
Q	WOODLESFORD	R	HUNSLET	HSL22
R	HUNSLET	T	LEEDS STATION	HSL31

3 Line of route

3.1 Route sections

3.1.1 This chapter describes a series of individual route sections, which combine to form a continuous route from Marston, east of Birmingham to Leeds and the East Coast Main Line near Church Fenton. The text also makes reference to a station location in the East Midlands.

3.1.2 The main line of Phase One would run north-south to the west of Coleshill in Warwickshire on its way to the West Coast Main Line connection near Lichfield, the 'Handsacre link'. At Coleshill, a 'delta' junction would be provided to include a spur to central Birmingham. The northern apex of this triangular junction is the starting point for the route described in this report.

3.1.3 The key plan on the previous page presents the individual route sections and provides the reader with the guide to the layout of the rest of this chapter. Each route section has a reference number, such as 'HSL01', covering a discrete geographical length. The report describes these sections. The total length of individual route sections is sub-divided in order to allow a piece of text to be read against a map on the opposite page; typically, each map presents approximately 7.5 miles (10-12km) of route.

3.1.4 The plan also shows that the route sections run between 'nodes'. Thus, readers can identify the location that interests them as being (for instance) 'between Node A and Node B'. These node letters appear in the title of the sub-heading. A node defines the beginning (and/or the end) of each of the sections into which the line of route is divided. Each section of line of route, running from one node to another, is uniquely identified with a reference number. The locations of these nodes have been chosen in order to easily appraise the line of route.

3.1.5 The plans show features of interest - each marked as a number in brackets. This allows the reader to study the route and refer to the corresponding section of text.

3.1.6 The route sections are:

- HSL01: Marston (A) to Birchmoor (B)
- HSL06: Birchmoor (B) to Tonge (north of Measham) (G)
- HSL09A: Tonge (G) to Donington Park (W)
- HSL09B: Donington Park (W) to Long Eaton (H)
- HSL12: Long Eaton (H) to Trowell (J)
- HSL13A: Trowell (J) to Tibshelf (X)

- HSL13B: Tibshelf (X) to Woodall (F)
- HSL14: Woodall (F) to Conisbrough (K)
- HSL16: Conisbrough (K) to Ryhill (M)
- HSL17A: Ryhill (M) to Sharlston Common (Y)
- HSL17B: Sharlston Common (Y) to Church Fenton (V)
- HSL21: Ryhill (M) to Woodlesford (Q)
- HSL22: Woodlesford (Q) to Hunslet (R)
- HSL31: Hunslet (R) to Leeds Station (T)
- HSL15A: Pinxton (E) to Clay Cross (L)

Route sections

3.2 HSL01: Marston (A) to Birchmoor (B)

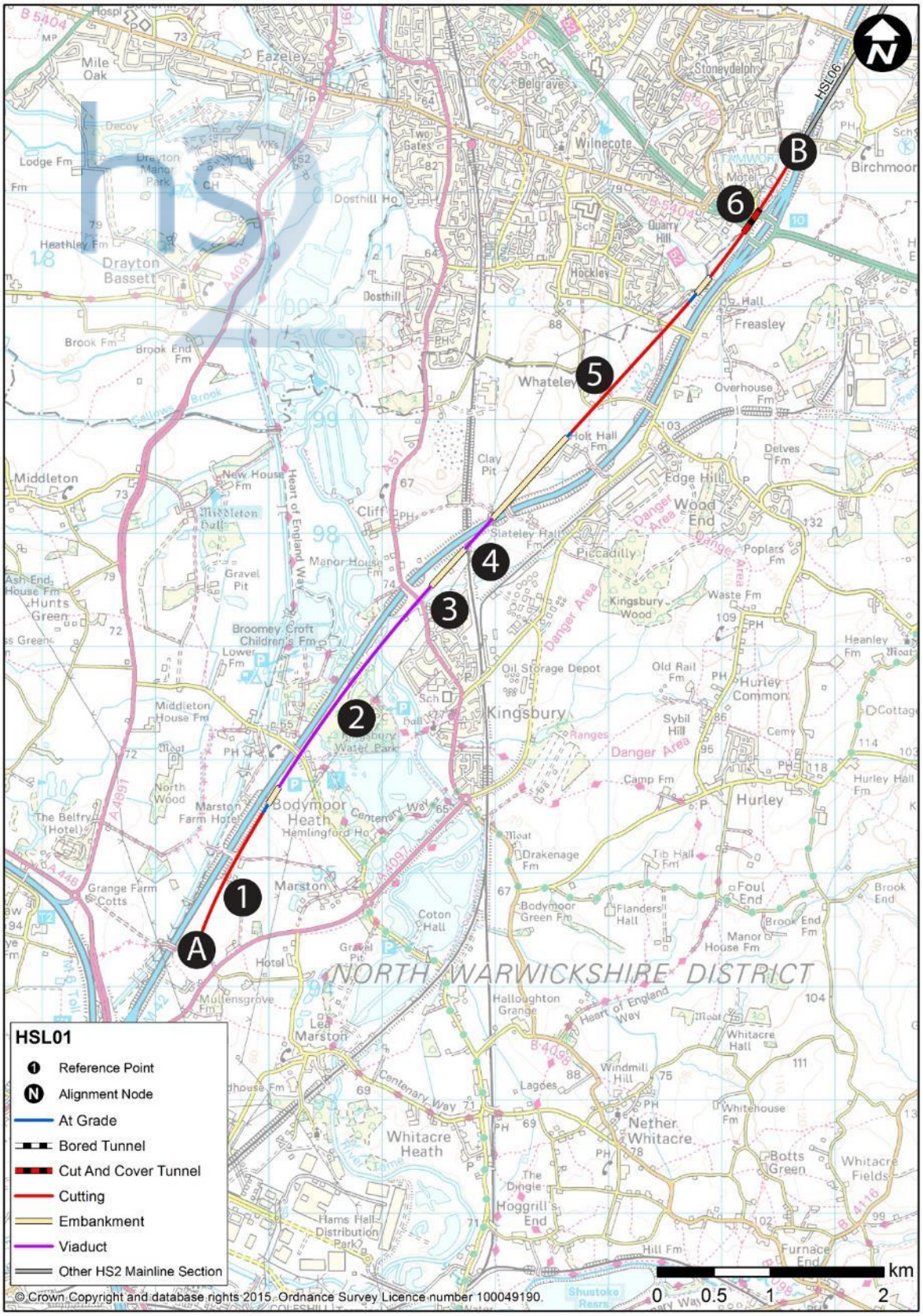
3.2.1 The route between Marston and Birchmoor would be 5.5 miles (8.8km) long and would start the West Midlands to Leeds leg of HS2. The route would connect to Phase One with a grade-separated junction near Water Orton. The Phase 2b connection to Phase One is just north of the delta junction leading to Birmingham city centre. The design speed at the beginning of the Phase 2b route would be 320km/h then rising to 400km/h near the crossing of the A5. The route would commence at Marston Lane **(1)** and run in a cutting up to 9m deep alongside the south side of the M42 before passing underneath a realigned Bodymoor Heath Road. The route then passes over Kingsbury Water Park **(2)**, the River Tame and its floodplain and the A51 **(3)** on a viaduct between 4m and 14m in height with potentially difficult ground conditions. The A51 would be lowered to pass under the HS2 viaduct.

3.2.2 North of the A51, the route would gain height and pass over the M42 close to where the motorway passes over the Derby to Birmingham railway **(4)**. At this point, the route would cross to the northern side of the M42. The construction of the viaduct may require complex temporary works on the motorway, exacerbated by its proximity to the railway. At this multiple crossing point, the route would typically be 16m above ground level.

3.2.3 Now on the north-west side of the M42, the route cannot follow the more sinuous alignment of the motorway, and would head in a relatively straight line through Whateley, towards the easterly fringe of Tamworth and Junction 10 of the M42. At its maximum, the route would be 400m from the motorway.

3.2.4 North from Whateley **(5)**, the route would descend with the terrain, crossing beneath Whateley Lane and Overwoods Road to pass between Tamworth and Junction 10. Junction 10 would have to be extensively rebuilt on the western side of the M42 allowing HS2 to pass beneath the A5 and the junction roundabout in a box-type structure **(6)**. Major temporary motorway and road works would be expected to the north of Junction 10, where the route would enter a deep cutting, of typically 10m-17m depth, alongside the M42.

3.2.5 At Birchmoor the route would continue along section HSL06 to Tonge (section 3.3).


HSL01
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
NORTH WARWICKSHIRE DISTRICT
A
B
1
2
3
4
5
6
N
HSL06
km
0
0.5
1
2
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3.3 HSL06: Birchmoor (B) to Tonge (north of Measham) (G)

3.3.1 The route between Birchmoor and Tonge would be 17.7miles (28.3km) long. The section of route connecting to Birchmoor from the south would be HSL01 from Marston. The design speed would be 400km/h then reducing to 275km/h north of Ashby-de-la-Zouch for the tight radius curve to follow the A42 alignment.

3.3.2 This route section would cross the northern end of the Warwickshire Coalfield, where coal, including worked seams, is expected to be present at relatively shallow depth.

Birchmoor to Appleby Parva

3.3.3 The route would cross the M42 immediately north of Green Lane **(1)**. Green Lane would have to be replaced, involving temporary closure. The route would pass below both Green Lane and the M42 in a box structure. Extensive temporary motorway works are expected. This crossing point would be close to Birchmoor.

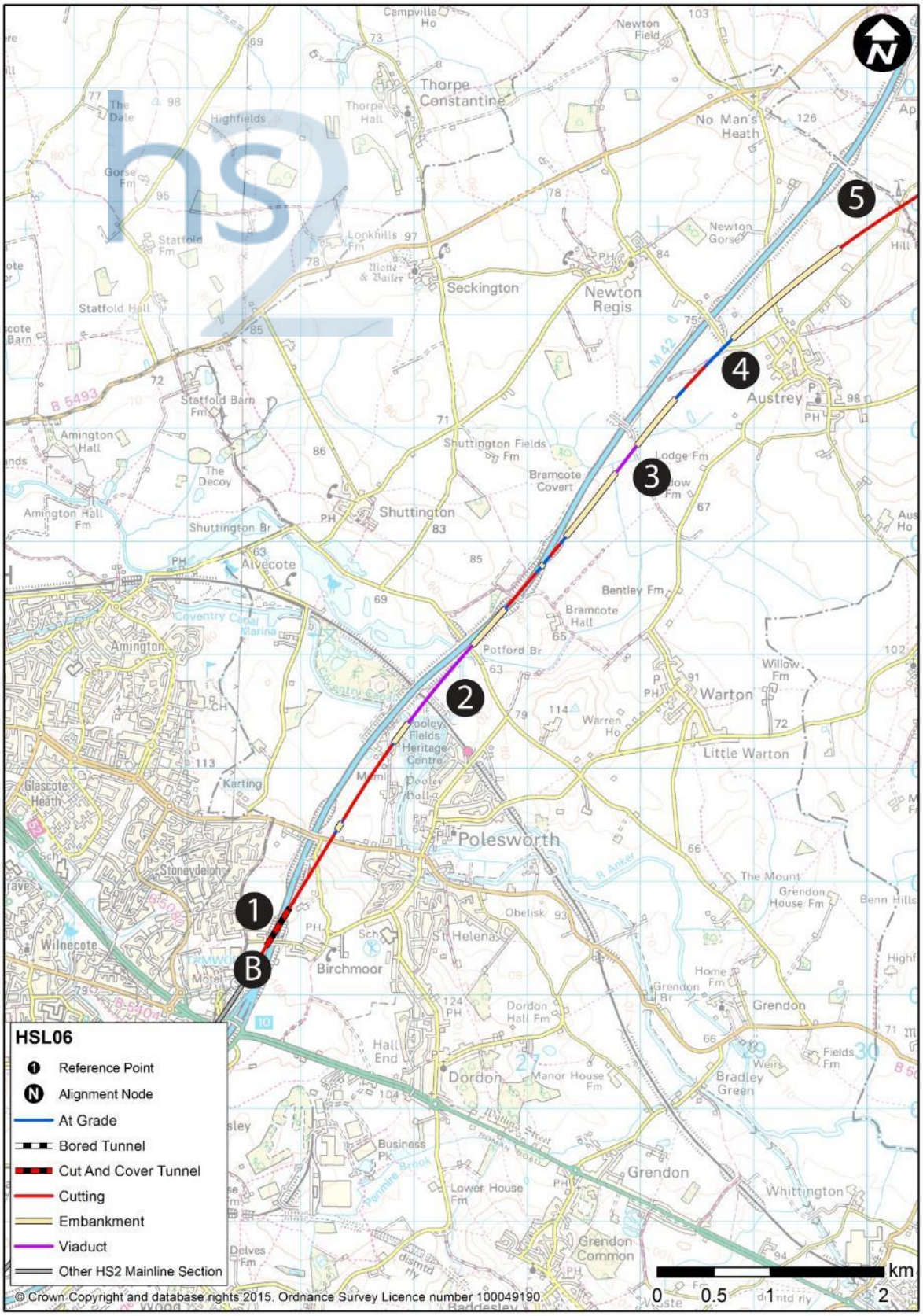
3.3.4 The route would then pass below the B5000, which would have to be raised on its present alignment by approximately 4m to provide clearance. The route would be approximately at existing ground level just north of the B5000.

3.3.5 While still broadly following the M42 corridor, the route would not be able to closely follow its more sinuous course in view of the design speeds required.

3.3.6 North of the B5000, HS2 would enter a shallow cutting, crossing Pooley Lane, before passing onto a 900m long viaduct between 9m and 16m high, over the Coventry Canal, the West Coast Main Line railway **(2)**, the River Anker and Linden Lane.

3.3.7 North of Linden Lane, the route would run onto an embankment followed by shallow cutting where it briefly follows the motorway boundary. The route would then deviate from the motorway, heading towards Austrey Meadows, crossing the Bramcote Brook and its floodplain on a 310m length viaduct **(3)**, approximately 7m above ground.

3.3.8 The route would pass west of the edge of Austrey **(4)**, close to ground level. The route would rise with the terrain, being on embankment and bridging over No Man's Heath Lane. It would then enter a deep cutting at the crest of Appleby Hill **(5)**, to a maximum cutting depth of approximately 20m before running onto a shallow embankment to the east of Appleby Parva, passing beneath the realigned A444.


HSL06
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190
0 0.5 1 2 km
1
2
3
4
5
B
N
Thorpe Constantine
Seckington
Newton Regis
Austrey
Shuttington
Alvecote
Amington
Polesworth
Warton
Little Warton
Birchmoor
Dordon
Grendon
Whittington
Grendon Common
Wilnecote
Glascote Heath
Stonydelphs
Bradley Green

Appleby Parva to Ashby-de-la-Zouch

3.3.9 The route would descend with the landscape, entering into a cutting and passing beneath Snarestone Road to the east of Appleby Magna.

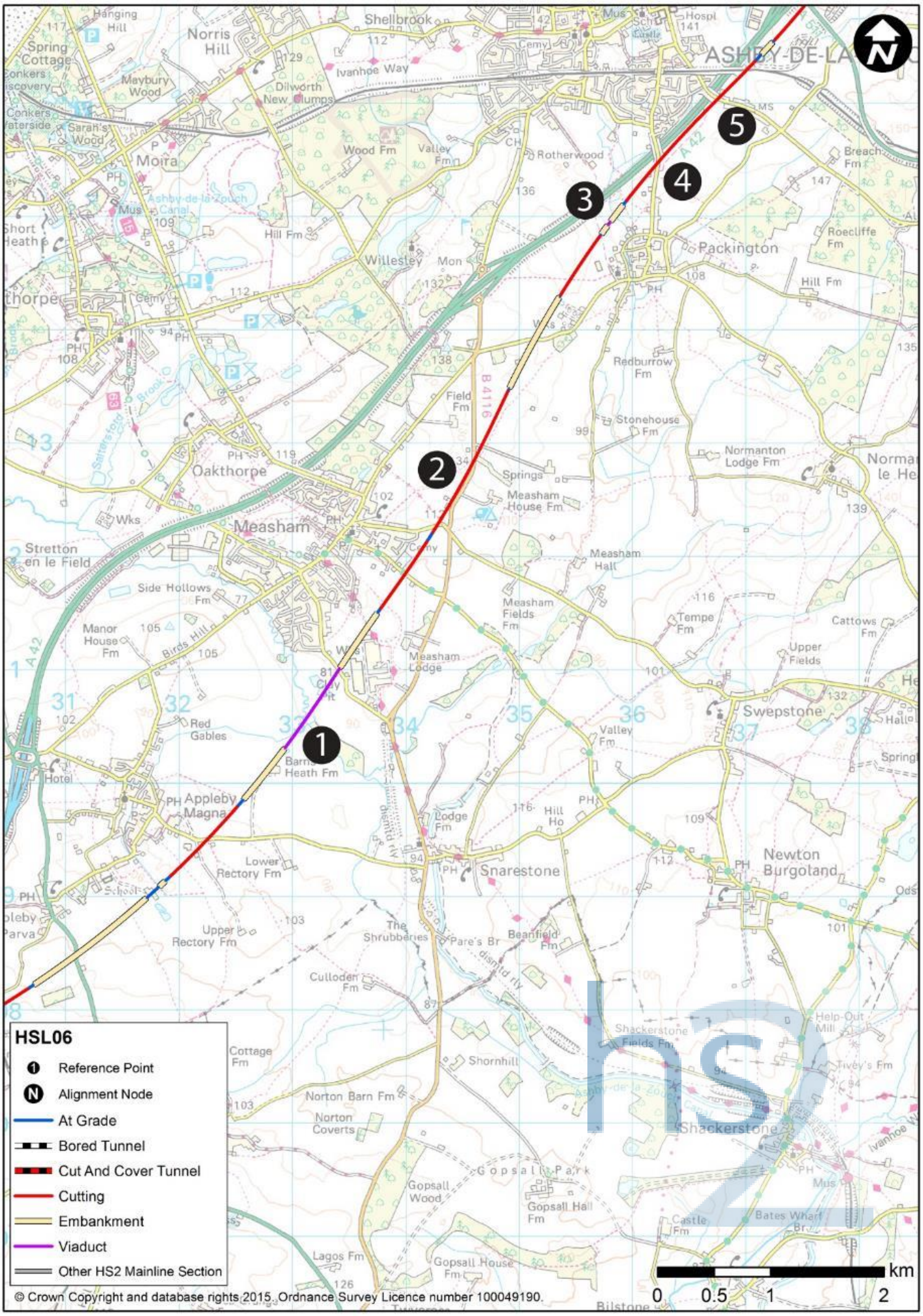
3.3.10 It would then pass onto an 880m long viaduct to cross the River Mease **(1)** and its floodplain at approximately 11m height. The main river channel is between 5m and 7m in width and a designated Special Area of Conservation. The viaduct also passes over the worked brick pits, and Atherstone Road.

3.3.11 The route passes to the east of Measham, rising in a shallow cutting with the terrain. It would pass beneath Bosworth Road, Leicester Road and the B4116 **(2)** before passing onto an embankment and passing over Measham Road.

3.3.12 The route runs to the west of Packington, in a cutting up to 8m deep with a 60m viaduct over the Gilwiskaw Brook and its floodplain **(3)**.

3.3.13 By now closely paralleling the A42 on its eastern side, the route would pass under Ashby Road **(4)**, which would remain at its present level. In shallow cutting, the route would pass under Leicester Road **(5)** and under the Leicester to Burton railway, which would remain at its present level.

3.3.14 This section of the route would cross an area of opencast coal workings, and underground mine workings may be present.


HSL06
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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5
N
km
0
0.5
1
2
ASHBY-DE-LA
Measham
Oakthorpe
Moira
Packington
Snarestone
Swepstone
Appleby Magna
Newton Burgoland
Shackerstone
Norris Hill
Willesley
Measham Lodge
Measham Hall
Measham Fields Fm
Redburrow Fm
Stonehouse Fm
Normanton Lodge Fm
Springs
Measham House Fm
Side Hollows Fm
Manor House Fm
Red Gables
Barn Heath Fm
Lower Rectory Fm
Upper Rectory Fm
Hill Fm
Field Fm
Wood Fm
Rotherwood
Stretton en le Field
Gopsall Park
Gopsall Hall Fm
Gopsall Wood
Norton Barn Fm
Shornhill
Culloden Fm
The Shrubberies
Beanfield Fm
Lodge Fm
Hill Ho
Valley Fm
Tempe Fm
Upper Fields
Cattows Fm
Roecliffe Fm
Breach Fm
Lagos Fm
Gopsall House Fm
A42
B4116
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Ashby-de-la-Zouch to Tonge

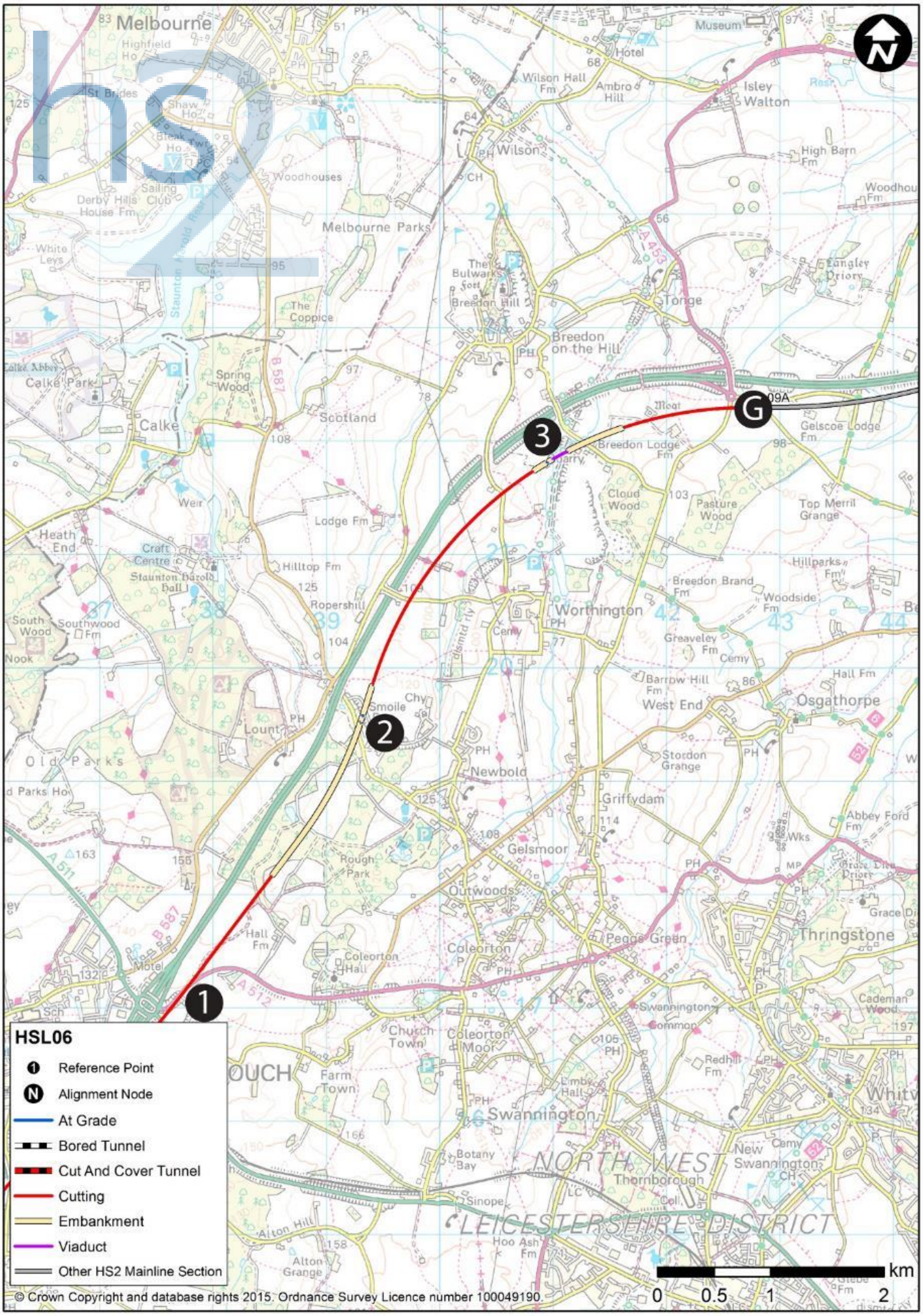
3.3.15 The route would then pass close to the A42 junction with the A511 and the A512, affecting the eastern side of the roundabout **(1)**. The railway would be at a similar level to the A42, in cutting. A new easterly side roundabout junction would be created, involving the realignment of the A512 and the A511.

3.3.16 The route would then run north-eastwards changing from cutting onto an embankment and crossing over Melbourne Road **(2)**. It enters cutting again as it swings east to stay on the south-easterly side of the A42. The route crosses under Long Hedge Lane, which would have to be raised.

3.3.17 Continuing to run broadly parallel to the A42, approximately 300m to its east and then south in a mix of shallow cutting and embankment, the route would pass in cutting under Breedon Lane, which would need to be raised slightly. The route would then pass onto a 170m viaduct **(3)**, up to 8m high, to pass over a Boden Brook floodplain adjacent to Cloud Hill quarry. The route then passes over Stocking Lane and into a cutting of up to 14m deep to pass under Top Brand,close to the roundabout for the A42 junction **(G)**.

3.3.18 Much of this section of the route would cross backfilled opencast coal sites and potentially shallow mineworkings.

3.3.19 At Tonge, the route would continue north along HSL09 to Long Eaton.


HSL06
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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3
G
km
0
0.5
1
2
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3.4 HSL09A: Tonge (G) to Donington Park (W)

3.4.1 The route section HSL09 is split into two. HSL09A runs from node G to node W and HSL09B from node W to node H (Long Eaton).

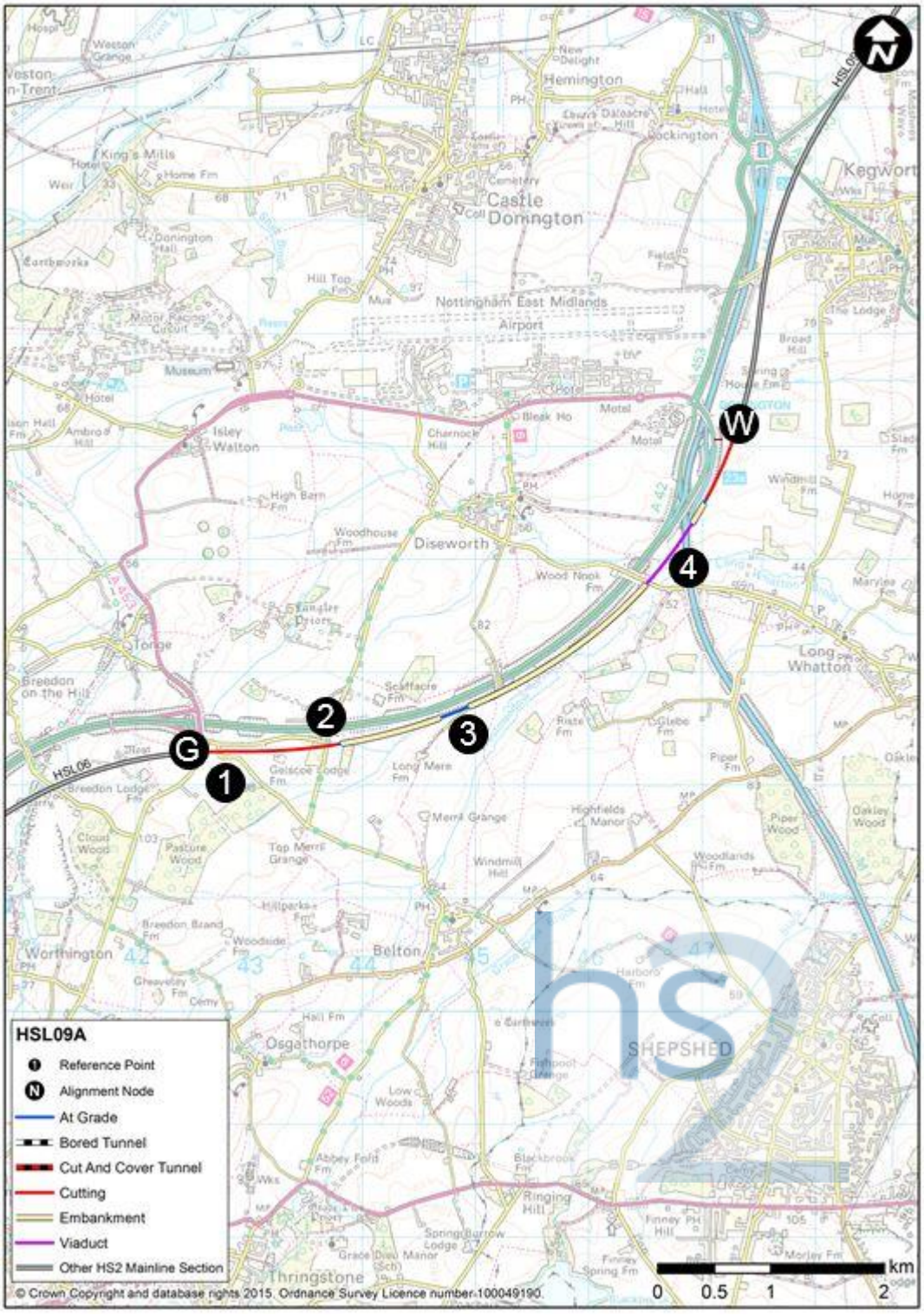
3.4.2 The route between Tonge and Long Eaton would be 9.6 miles (15.4km) long. The section of route connecting to Tonge from the south would be HSL06 from Birchmoor. The design speed of this section of the route would be 275km/h, due to the tight radius curves required as the route follows the A42 towards its junction with the M1, as it crossed the River Soar and River Trent floodplains towards Long Eaton and on the approaches to the East Midlands Hub station. An alternative vertical alignment at the northern end through the Long Eaton area is described at the end of section 3.5.

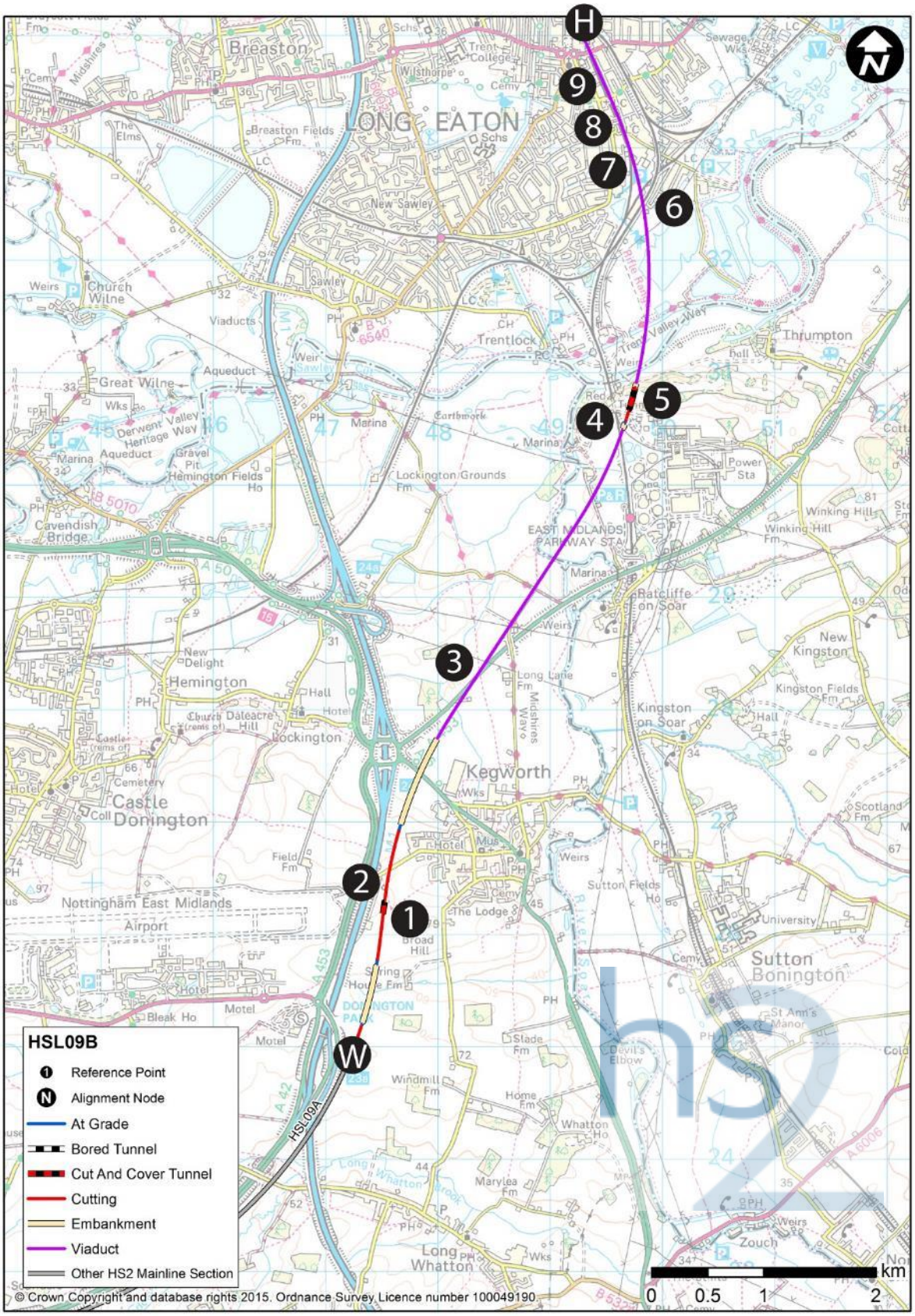
Tonge to Donington Park

3.4.3 From Tonge, the new high speed railway would broadly follow the eastern edge of the A42 corridor at a design speed of 275km/h. Initially, the route would be in a cutting up to 14m deep, and then would run on a mix of at-grade and embankment up to 6m high. At the first crossing of Mill Lane **(1)**, the highway would be realigned to tie into Top Brand, and at the second crossing **(2)** HS2 would pass underneath Mill Lane, which would be raised. HS2 would also pass underneath Long Mere Lane **(3)**, which would also be raised onto a new bridge.

3.4.4 The route would then run onto a viaduct (4) of up to 16m high to pass over The Green, Diseworth Brook and its floodplain, and the M1 and associated slip roads at Junction 23A.

3.4.5 At Donington Park, the route would continue north past Kegworth along HSL09B to Long Eaton.


HSL09A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190.
0 0.5 1 2 km
G
1
2
3
4
W
N
Castle Donington
Hemington
Kegworth
Nottingham East Midlands Airport
Isley Walton
Diseworth
Long Whatton
Belton
Osgathorpe
Thringstone
Worthington
Breedon on the Hill
SHEPSHED


H
9
8
7
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4
3
2
1
W
HSL09B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL09A
LONG EATON
Breaston
Sawley
Trentlock
Thrumpton
Great Wilne
Derwent Valley Heritage Way
Lockington Grounds
EAST MIDLANDS PARKWAY STA
Ratcliffe on Soar
New Kingston
Hemington
Lockington
Kegworth
Castle Donington
Kingston on Soar
Sutton Bonington
Nottingham East Midlands Airport
Long Whatton
Zouch
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190
0 0.5 1 2
km

3.5 HSL09B: Donington Park (W) to Long Eaton (H)

Donington Park to Long Eaton

3.5.1 The route would continue to the east of the M1, running in a mixture of cuttings and then embankments. HS2 would run within a protective structure where it crosses beneath the East Midlands Airport runway approach. The runway approach lights would be supported on the roof of the structure (1).

3.5.2 Passing between the M1 and the western edge of Kegworth, the route would pass underneath Ashby Road (2) before coming out of falling ground levels to run on embankment (including a crossing over the A6 which would remain at its current level) and then on a 2 mile long (3.2km) viaduct of up to 14m high to cross over the A453 **(3)**, Ratcliffe Lane, Long Lane, the River Soar and its floodplain, the Midland Main Line **(4)** and the rail access to Ratcliffe-on-Soar power station. The crossing of the A453 would be at a high skew angle and would require the realignment of the A453 over a length of 0.6 miles (1km) to create space in the central reservation of the A453 for a viaduct support.

3.5.3 The viaduct would be founded in difficult ground conditions and construction access to the site of the viaduct would be constrained.

3.5.4 The route would pass through the escarpment of Red Hill at a depth of 20m. There are beds of gypsum at shallow depth in this area, which may be affected by dissolution and hence could present a subsidence risk. After excavating the cutting, a 200m cut-and-cover tunnel **(5)** would be created to reinstate the ridge of the hill.

3.5.5 Immediately north of the Red Hill escarpment, the route would pass onto a second viaduct of 2 miles (3.2km) length to the end of this route section, to pass over another series of obstacles: the River Trent and its floodplain, the canalised cut-off near Cranfleet Farm, a lake west of Pasture Lane, Trent Lane, the Meadow Lane Junction to Trent South Junction railway (the high-level lines) **(6)**, and the Trent South Junction to Nottingham railway. This viaduct would typically be 15m above ground.

3.5.6 As the route enters Long Eaton, still on viaduct, it would run to the east of the existing two-track railway (the low-level lines) that runs northwards from Trent East Junction towards Toton Yard **(7)**. This would involve consequential widening works and property acquisition together with realignment of 500m length of the existing railway. The proposed works to the existing railway are described in paragraph 3.6.10.

3.5.7 Main Street **(8)** and Station Road **(9)** cross the existing low-level lines at level crossings. The high speed railway would cross over these on the viaduct as well as the A6005 Nottingham Road, which is elevated above the existing low-level railway. North of the A6005, the route would widen from two tracks to four and

then six, with the extra tracks forming deceleration lines to, and acceleration lines from, the proposed East Midlands Hub station at Toton.

3.5.8 At Long Eaton, the route would continue north through the East Midlands Hub station along HSL12 to Trowell.

HSL09B Alternative option

3.5.9 The alternative option provides a lower-level alignment for HS2 through the Long Eaton area towards the East Midlands hub station. The alignment between Donington Park and the crossing of the existing Nottingham to Derby/Leicester railway **(6)** is unchanged. Although at a lower level, the horizontal alignment through Long Eaton is also unchanged.

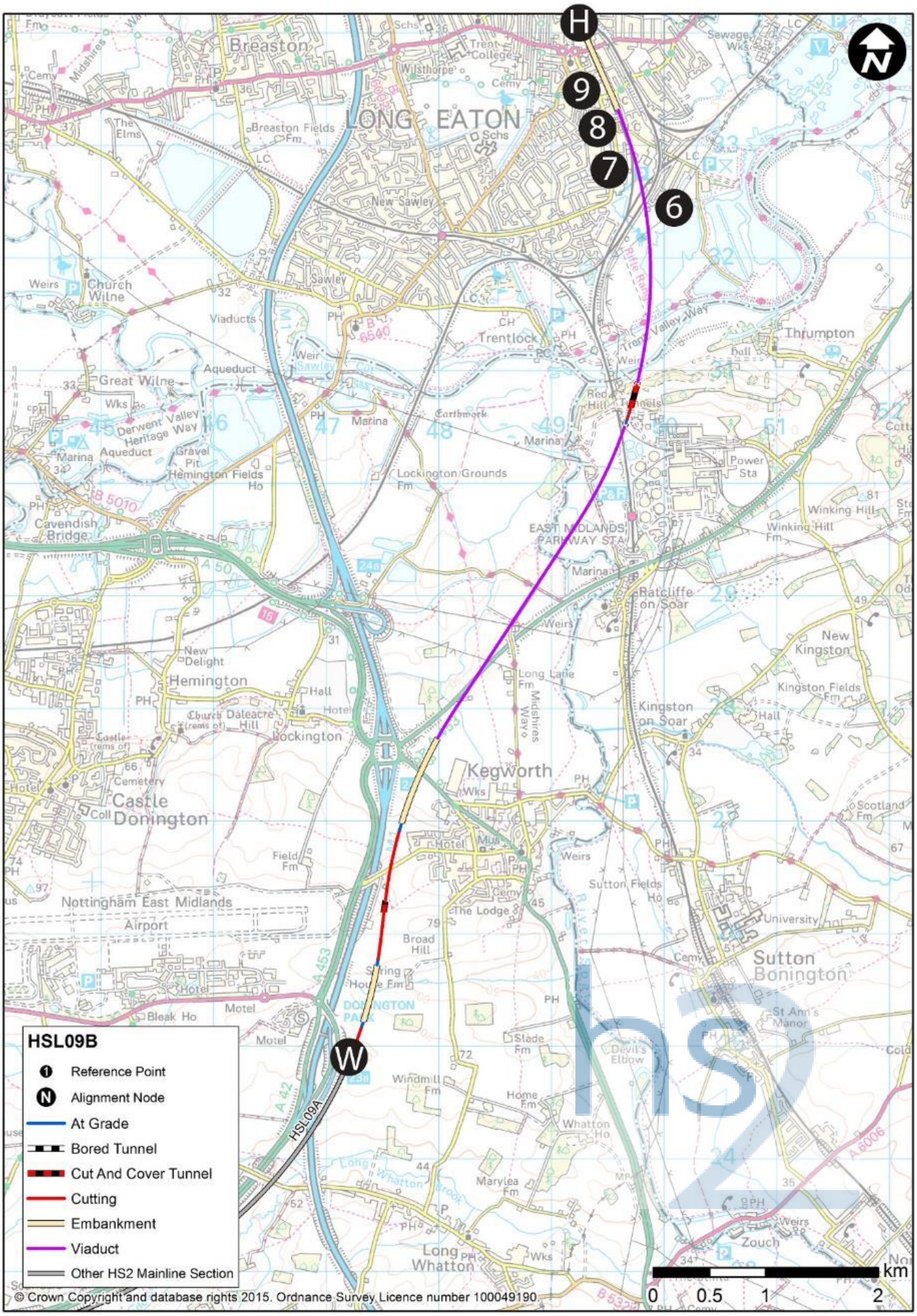
3.5.10 As the route enters Long Eaton, it descends from the 15m high viaduct, passing over Main Street. It then runs on a retained embankment between 2m and 4m high to the east of the existing two-track railway (the low-level lines) that runs northwards from Trent East Junction towards Toton Yard **(7)**. This would involve consequential widening works and property acquisition, together with realignment of 500m length of the existing railway.

3.5.11 A new chord line would be provided on the existing railway to allow freight trains to access the low-level lines from the Nottingham direction in the vicinity of Trent East Junction.

3.5.12 Station Street **(8)** and Nottingham Road, A6005 **(9)** would both be realigned to pass beneath both HS2 and the existing railway in new underpasses. The existing Main Street level crossing would be unaffected, but Station Street level crossing would be closed.

3.5.13 North of the A6005, the route would widen from two tracks to four and then six, with the extra tracks forming deceleration lines to, and acceleration lines from, the proposed East Midlands Hub station at Toton.

3.5.14 At Long Eaton, the route would continue north through the East Midlands Hub station along HSL12 to Trowell.


HSL09B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
H
9
8
7
6
W
HSL09A
LONG EATON
Breaston
Sawley
New Sawley
Trentlock
Thrumpton
Church Wilne
Great Wilne
Cavendish Bridge
Hemington
Lockington
Castle Donington
Kegworth
Ratcliffe on Soar
Kingston on Soar
New Kingston
Sutton Bonington
Nottingham East Midlands Airport
EAST MIDLANDS PARKWAY STA
Long Whatton
0 0.5 1 2 km
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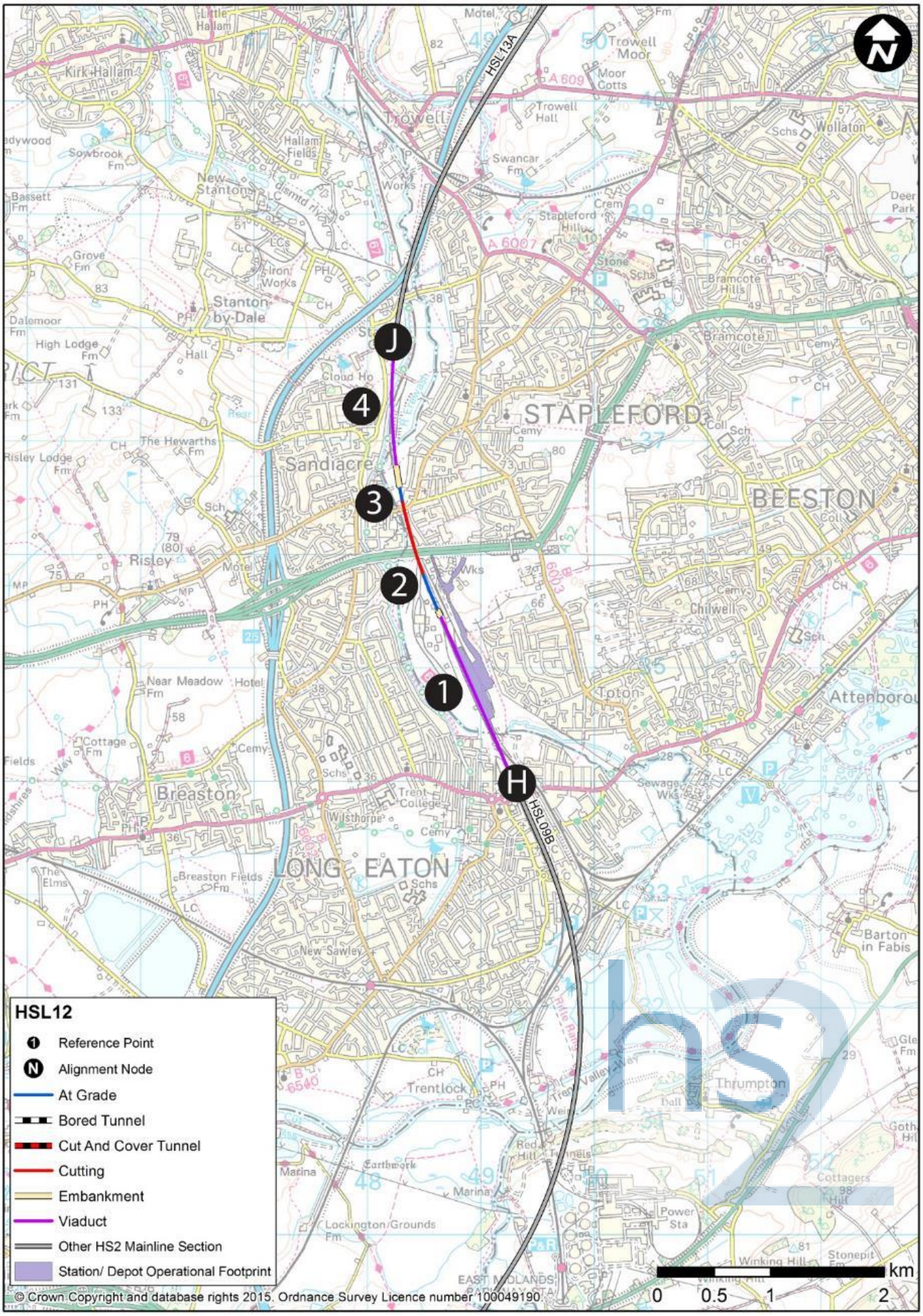
HSL12
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
J
4
3
2
1
H
HSL13A
HSL09B
STAPLEFORD
BEESTON
Sandiacre
LONG EATON
Breaston
Risley
Trowell
Stanton-by-Dale
Kirk Hallam
Wollaton
Bramcote
Chilwell
Toton
Attenborough
Thrumpton
Trentlock
0 0.5 1 2 km
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3.6 HSL12: Long Eaton (H) to Trowell (J)

3.6.1 The route between Long Eaton and Trowell would be 2.6 miles (4.2km) long and would contain the proposed East Midlands Hub station at Toton. The section of route connecting to Long Eaton from the south would be HSL09 from Tonge. The design speed of this section of the route would be 275km/h due to the curves required to follow the M1 alignment towards Stapleford. An alternative vertical alignment at the southern end through the Long Eaton area is described at the end of this section.

The station

3.6.2 Immediately north of A6005 Nottingham Road, the high speed alignment would widen from two tracks to four and then six, with the outside four tracks forming the acceleration and deceleration lines leading into the station platforms. Maintenance loops, for use by engineering plant and trains, would be incorporated into the East Midlands Hub station layout. Both of the loops would be located on the west of the station and would be approximately 800m long. The HS2 tracks through the station area will all be raised between 4m and 8m above ground level supported on a viaduct structure.

3.6.3 The station **(1)** would provide a new transport interchange for the East Midlands. In addition to the four HS2 platforms, four new platforms would be provided to the east of the HS2 platforms on modified existing rail infrastructure to distribute passengers to and from Derby, Leicester, Nottingham and beyond. Details of the station and associated facilities are provided in section 4.1 below.

3.6.4 The station area is located within the River Erewash floodplain and flood protection work would be required.

Toton station to Trowell

3.6.5 North of Toton, the high speed route would reduce from six tracks to four and then two tracks, descending from the viaduct to ground level. It would then pass under the bridge carrying the A52 Brian Clough Way over the current railway **(2)**. The extent of the alteration of the existing lines, as well as the introduction of HS2, would require that the existing bridge be replaced. As the A52 could not be closed for the duration required to achieve these works, either a new permanent off-line bridge would be constructed or a temporary off-line diversion over a length of 400m and associated temporary structure would be needed.

3.6.6 Further north from the A52, B5010 Derby Road / Station Road crosses the existing lines **(3)**. There is insufficient vertical clearance under this structure to accommodate the new high speed lines, and the horizontal positions of the high speed and realigned existing lines would conflict with the supports of the existing structure. The structure would therefore have to be rebuilt approximately 2m higher. This would also involve modification to nearby side roads that connect onto Derby Road.

3.6.7 North of Derby Road, the route would rise in level, climb out of the Erewash Valley, and swing eastwards to run parallel to the M1, north of Stanton Gate. Approximately 550m north of Derby Road, the route would cross the River Erewash, the Erewash Canal and the realigned existing Erewash rail lines, on a 1.7 mile (2.7km) long viaduct **(4)** continuing into the next route section.

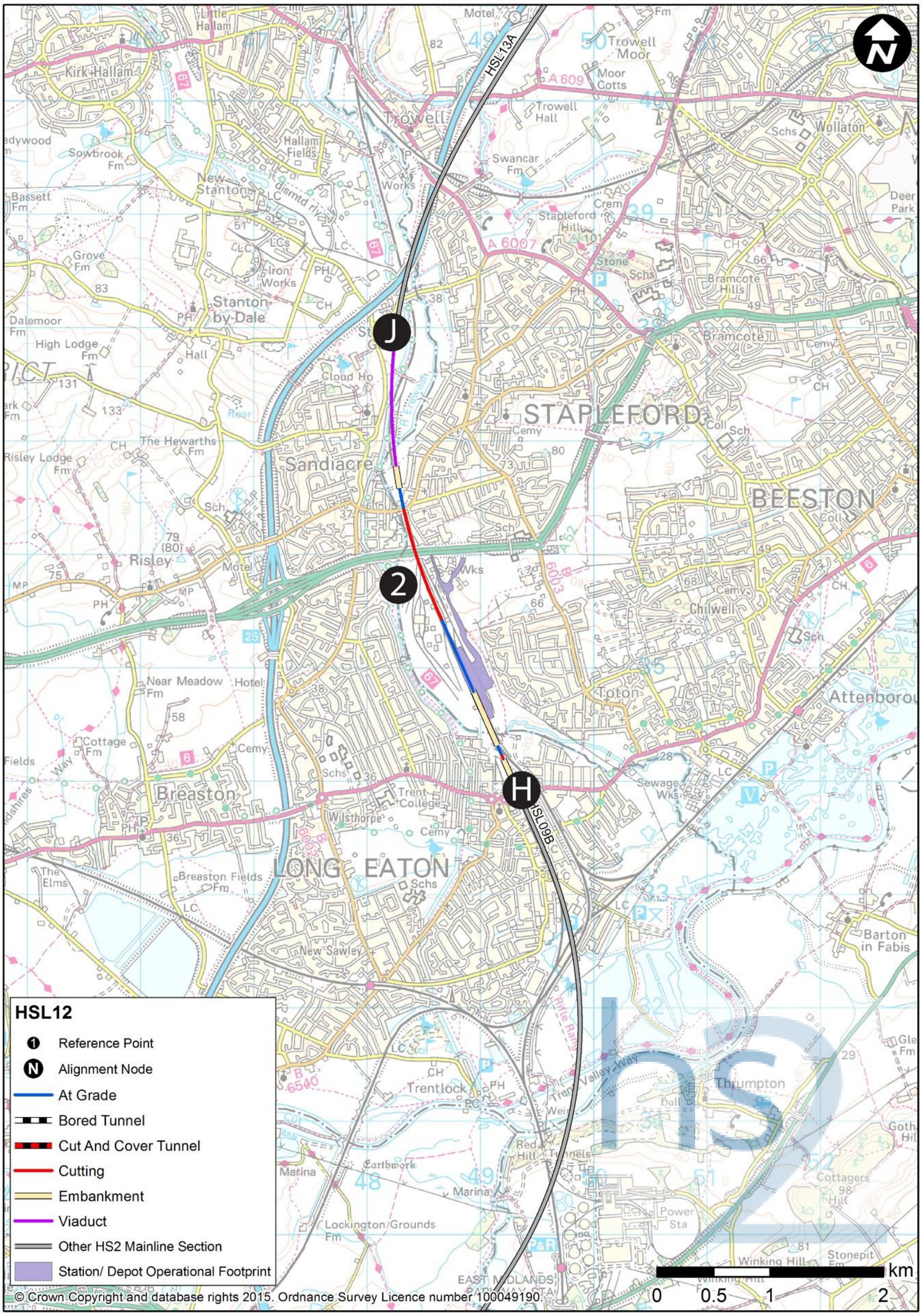
3.6.8 At Trowell, the route would continue north along HSL13 to Woodall. This route would broadly follow the M1 corridor.

Existing rail lines

3.6.9 In the vicinity of the station and Toton Yard, the existing Trent East Junction to Chesterfield (Erewash Valley) 'low-level lines' would be diverted to pass alongside the proposed new station to the west of the HS2 alignment **(1)**. This would provide access into the existing 'Down' yard and the locomotive depot. A new chord line would provide access to the low-level lines from the Nottingham direction.

3.6.10 The Attenborough Junction / Trent South Junction to Chesterfield high-level lines would provide access to the new 'classic' platforms to the east of the HS2 platforms. This would also provide access to the existing 'up' yard. A new connection would provide access to the high-level lines from Sheet Stores Junction for trains from the Derby direction.

3.6.11 The two corridors would continue north, on either side of the HS2 lines, passing beneath the new A52 (2) and Derby Road bridges. The westernmost lines would then pass beneath the HS2 viaduct (4) alongside the Erewash Canal to join the eastern lines in the existing Erewash Valley rail corridor.


HSL12
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
HSL13A
HSL09B
J
2
H
STAPLEFORD
BEESTON
Sandiacre
LONG EATON
Toton
Chilwell
Trowell
Stanton-by-Dale
Risley
Breaston
Trent College
Trentlock
0 0.5 1 2 km
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HSL12 Alternative option

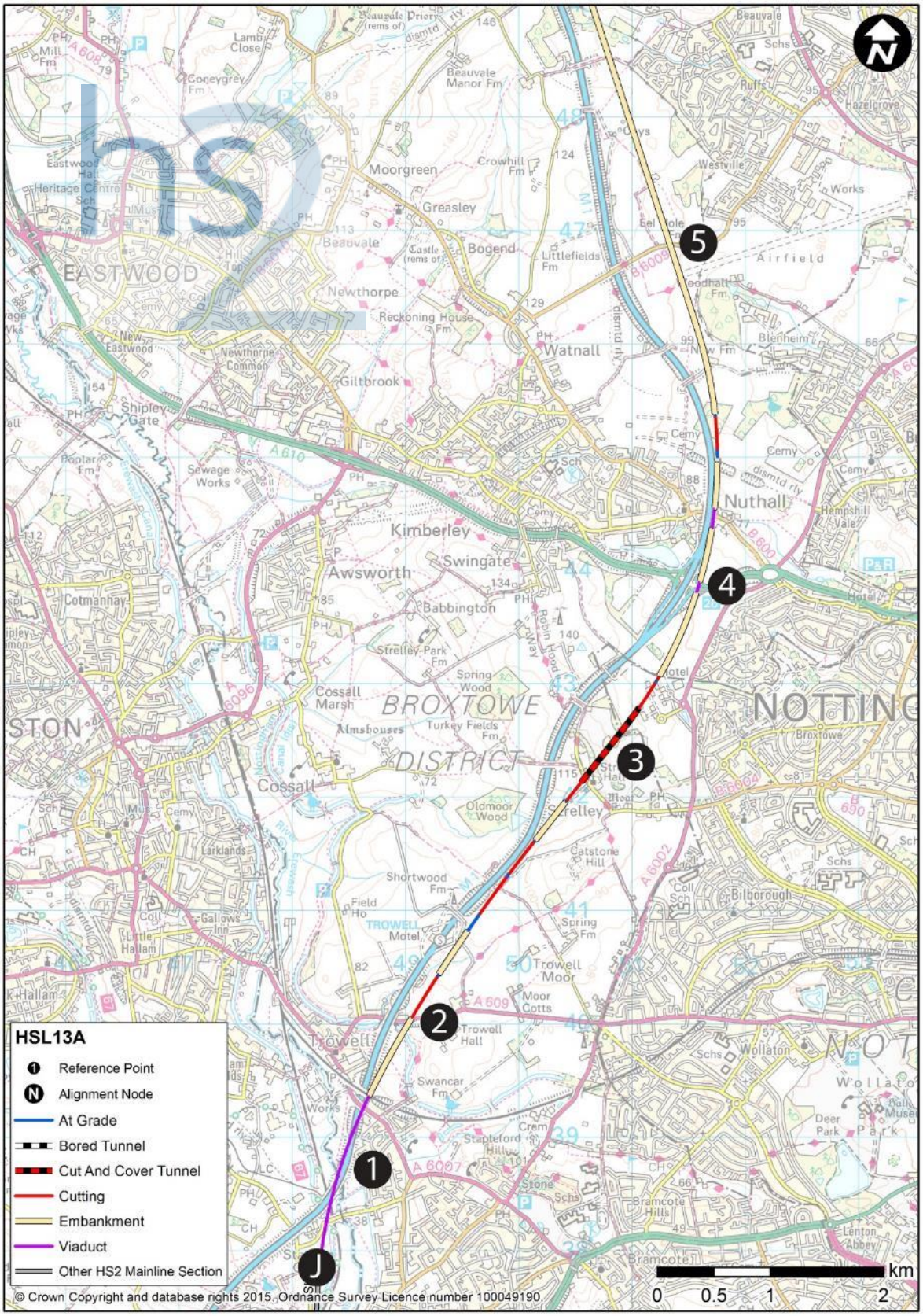
3.6.12 The alternative option provides a lower-level alignment for HS2 through the Long Eaton area and the East Midlands hub station as far as the A52 road bridge **(2)**. The alignment north of the A52 on to Trowell is unchanged. Although at a lower level, the horizontal alignment through Long Eaton and the station is also unchanged.

The station

3.6.13 The station layout would be unchanged in this alternative option with the HS2 platforms and through tracks supported on an embankment up to 2m above existing ground level. The interchange platforms would be unchanged. Flood protection works would still be required.

Toton station to Trowell

3.6.14 North of Toton, the high speed route would descend to ground level, passing beneath the A52 Brian Clough Way and northwards towards Trowell as previously described.


HSL13A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
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3.7 HSL13A: Trowell (J) to Tibshelf (X)

3.7.1 The route section HSL13 is split into two. HSL13A runs from node J to node X and HSL13B from node X to node F (Woodall).

3.7.2 The route between Trowell and Woodall would be 27.7 miles (44.3km) long. The section of route connecting to Trowell from the south would be HSL12 from Long Eaton. This route would broadly follow the M1 corridor towards Woodall. The design speed of this section of the route would be 275km/h at the south end increasing incrementally to 360km/h and then 400km/h north of Tibshelf, except for a short section right at the northern end, which has a design speed of 360km/h.

3.7.3 This section of the route includes the junction onto HSL15A in the vicinity of the A38 crossing, allowing high speed services to run to Sheffield city centre using the existing rail route via Clay Cross (see HSL15A).

Trowell to Nuthall

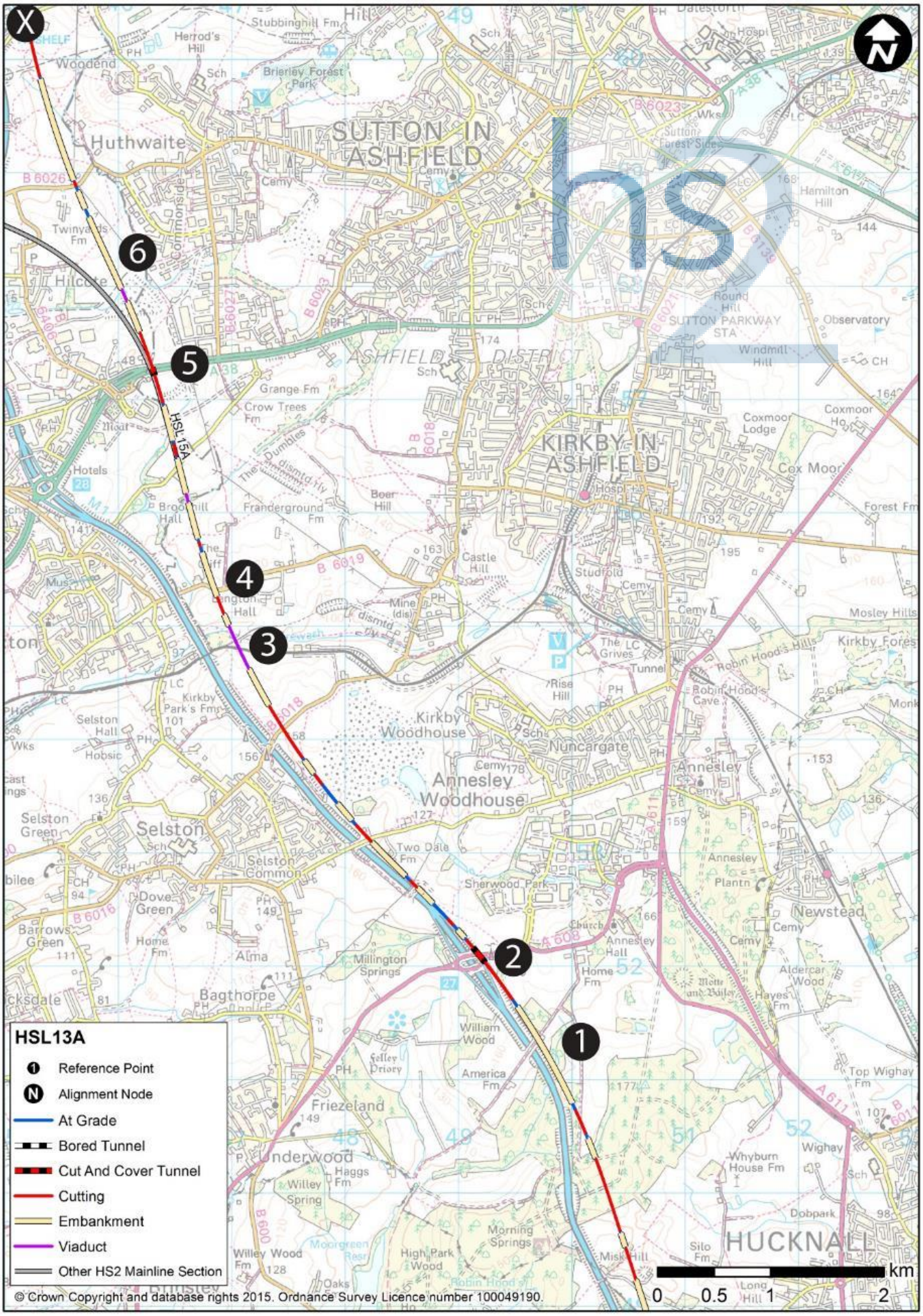
3.7.4 For 3.1 miles (5.0km) until Junction 26 of the M1, the route would broadly follow the south-eastern side of the motorway. The M1 **(1)** would be realigned over a length of 1.3 miles (2.1km), moving approximately 125m west of its present position to accommodate the high speed line.

3.7.5 The route would then cross over the A609 Nottingham Road **(2)**, which would be realigned. The line speed would rise to 300km/h from the 275km/h applied through Toton. The route would enter a cutting up to 5m deep, before following the rising ground levels.

3.7.6 The route would pass under Main Street in Strelley to the west of the church and, in doing so, enter an 810m long cut-and-cover tunnel **(3)** created by enclosing the railway in a box structure and re-filling above the roof to restore the original ground surface. The route would emerge from the tunnel at Nottingham Business Park and bear northwards to run alongside the M1. It would pass over the A610 to the east of Junction 26 of the M1 **(4)**.

3.7.7 For the next 0.7 miles (1.2km), the route would run very closely alongside the M1, requiring sections of retaining wall between the railway and motorway to allow for minor differences in level. It would pass over the B600 Nottingham Road, immediately adjacent to and at a similar level as the M1.

3.7.8 The route would continue northwards and climb out of the valley, passing through New Farm Wood and to the west of Bulwell Wood. The speed would then increase to 360km/h. The route would follow the motorway on its eastern side for approximately 10km on an embankment up to 9m high. The gap between the M1 and the high speed line will vary up to 500m due to the curvature of the motorway corridor. A bridge would be required to pass over the B6009 Long Lane **(5)** which would remain in its present position.


HSL13A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL15A
SUTTON IN ASHFIELD
KIRKBY IN ASHFIELD
ASHFIELD DISTRICT
Huthwaite
Selston
Annesley Woodhouse
Kirkby Woodhouse
HUCKNALL
Newstead
Underwood
Bagthorpe
Friezeland
SUTTON PARKWAY STA
0 0.5 1 2 km
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Nuthall to Tibshelf

3.7.9 The route would continue to rise and follow the M1, passing through two sections of deep cutting at Misk Hill and Park Forest, with local depths of up to 15m and 22m respectively. It would then closely follow the motorway **(1)** again at The Dumbles, approximately 0.8 miles (1.2km) south of Junction 27 of the M1. On the approach to the motorway junction, the route would pass into cutting, up to 12m deep.

3.7.10 Just east of Junction 27 of the M1 **(2)**, the route would pass under the A608.

3.7.11 The route would continue on a mix of cutting (up to 5m) and embankment (up to 8m high), and would then pass under Salmon Lane which would be raised above its existing level. The route would pass through the western edge of Bogs Farm Site of Special Scientific Interest (SSSI).

3.7.12 The route would then diverge from the motorway to the east, as it would be unable to follow the curvature of the motorway at 360km/h.

3.7.13 It would then enter a cutting up to 12m deep, passing under B6018 Park Lane. The route would use a viaduct **(3)**, of 440m length and up to 25m in height, to cross the River Erewash and its floodplain, the railway and the valley bottom, with the new railway being at a similar level to the M1.

3.7.14 There would be a cutting, followed by a bridge over the B6019 **(4)**. There would be a viaduct over Maghole Brook, while Brookhill Lane would be lowered, allowing HS2 to pass above it.

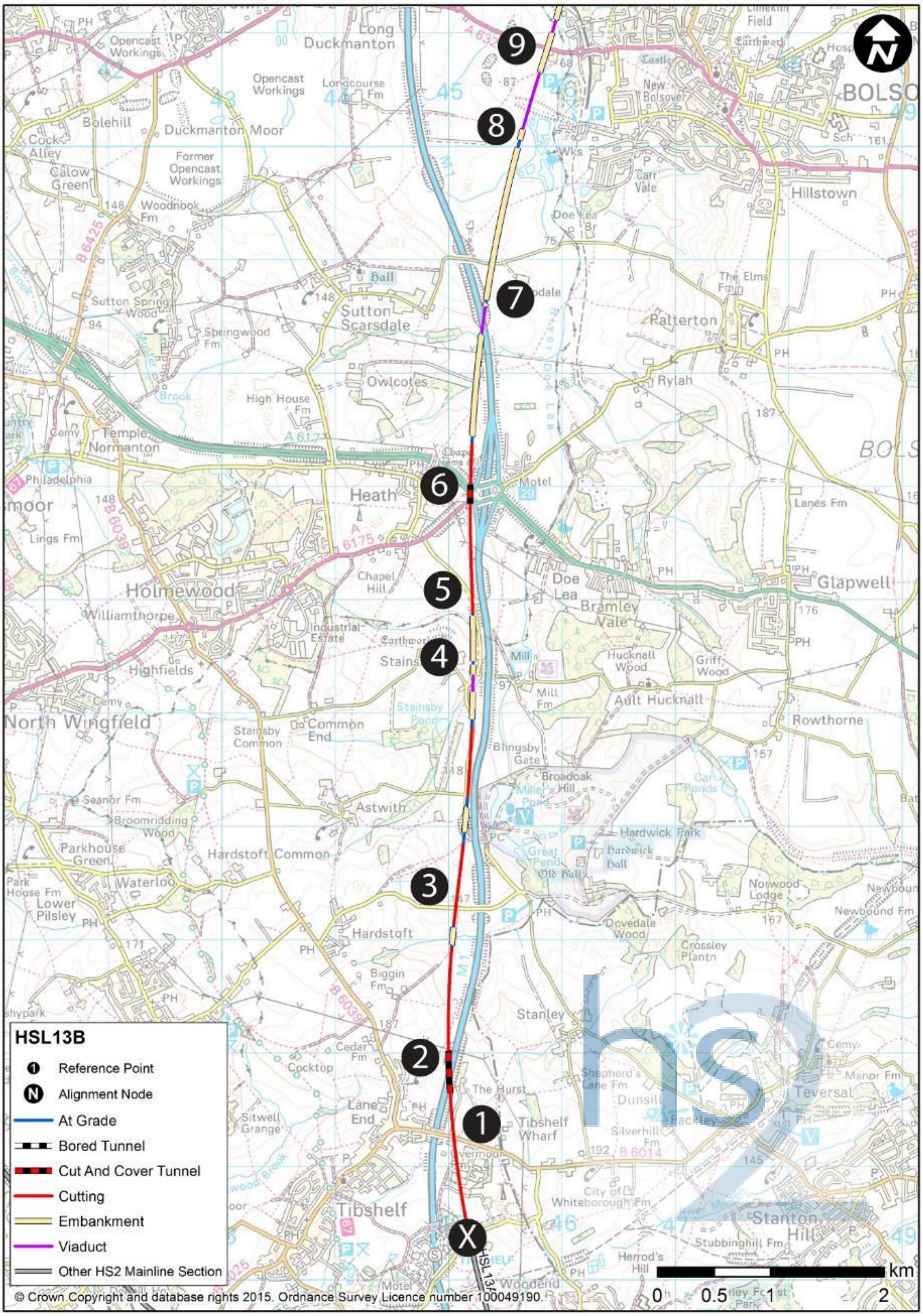
3.7.15 The route would pass in cutting to the immediate east of a large retail unit, before passing below the A38 **(5)** at a depth of 15m. In the vicinity of the A38 there would be the junction with the spur to serve Sheffield via the existing railway at Clay Cross (HSL15A). Beyond this junction, the design speed increases from 360km/h to 400km/h.

3.7.16 The route would pass between the industrial/warehousing areas between Wincobank Farm and Export Drive, and would cross a floodplain and historic landfill site, before passing east of Hilcote **(6)** on embankments and viaduct up to 21m high over Normanton Brook. The route would pass under the B6026 Huthwaite Lane, which would be raised.

3.7.17 The route would rise with the landscape, on embankment up to 14m high, passing to the immediate east of Tibshelf Motorway Services Area **(X)** and under Newtonwood Lane.

3.7.18 Much of this route section would be affected by underground and opencast coal mineworkings.

3.7.19 At Tibshelf, the route would continue north along HSL13B, which continues to follow the M1 corridor passing towards Woodall.


HSL13B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
km
0
0.5
1
2
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3.8 HSL13B: Tibshelf (X) to Woodall (F)

Tibshelf to Bolsover

3.8.1 In a cutting up to 18m deep, at the crest of a vertical curve, the route would pass south of the B6014 Mansfield Road in the Overmoor Farm area **(1)** before passing under the B6014. Saw Pit Lane would be realigned laterally over a length of 600m to avoid the railway corridor.

3.8.2 The route would now cross to the western side of the M1, passing below the motorway **(2)** about 600m north of Mansfield Road. The route would be 11m below the level of the motorway, which would likely be temporarily re-aligned to the west for a length of 0.6 miles (1km). For the next 3.7 miles (6.0km), the route would run relatively close to the M1's western side. Apart from a short length of approximately 100m south of Deep Lane, the route would be in continuous cutting, at depths of between 1m and 26m. The route would then pass under Deep Lane **(3)**, which would remain on its present line and level.

3.8.3 From Deep Lane to Stainsby, the route would partly use the alignment of Mill Lane, running almost north-south along its alignment. Mill Lane would be diverted over a length of approximately 1.2 miles (2km). The route would be at approximately the same level as the M1 along this length. A 150m long viaduct crosses over Mill Lane and the River Doe Lea east of Stainsby **(4)**.

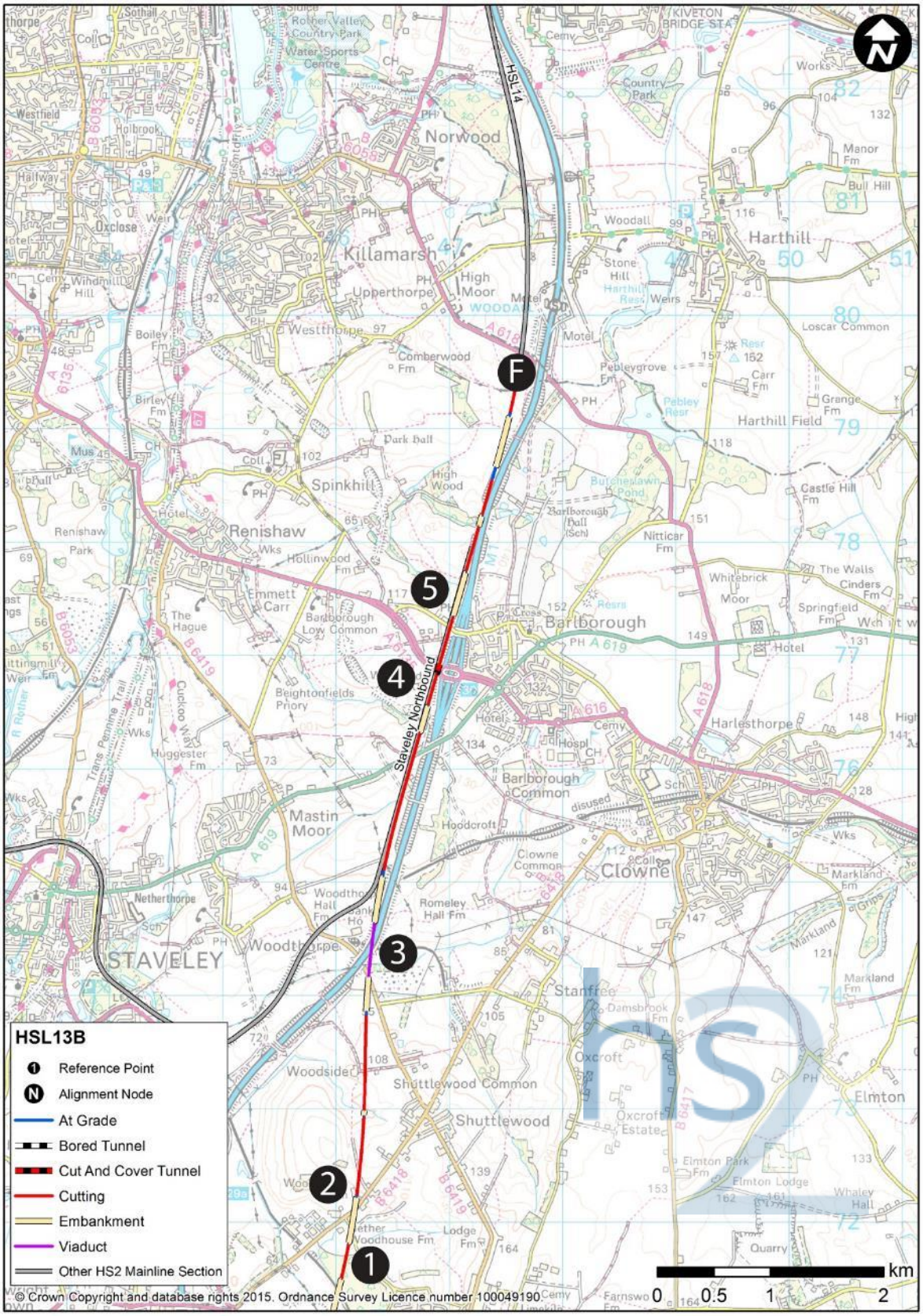
3.8.4 Immediately north of Stainsby **(5)**, the route would enter a cutting as the ground levels rise. It would pass below Junction 29 of the M1 **(6)** which would be extensively but temporarily reconfigured on its western side to incorporate the connections to the A617 and the A6175.

3.8.5 The route would then re-cross to the east of the M1, bridging over it **(7)** on a viaduct 260m long and up to 13m high. The viaduct would require a supporting pier within the central reservation of the M1, needing a realignment of the carriageways to create the additional width.

3.8.6 The route would then cross over Palterton Lane.

3.8.7 North of Sutton Scarsdale, the route would diverge from the M1 and descend on embankment of up to 9m high to follow the falling ground. The route would then start to climb to cross over The Goit floodplain **(8)** on a 540m viaduct, the A632 **(9)** (which would be lowered) and River Doe Lea and its floodplain on a 130m viaduct.

3.8.8 Much of this route section would be affected by underground and opencast coal mine workings.


HSL13B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
F
5
4
3
2
1
Staveley Northbound
HSL14
Norwood
Killamarsh
Harthill
Renishaw
Spinkhill
Barlborough
Clowne
STAVELEY
Woodthorpe
Shuttlewood
Harthill Field
Harlesthorpe
Elmton
Mastin Moor
Barlborough Common
Shuttlewood Common
0
0.5
1
2
km
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Bolsover to Woodall

3.8.9 North of Bolsover, the railway would pass into a cutting up to 17m deep through an area of made ground **(1)**. It would pass over Woodhouse Lane (which would remain at its current level) and B6418 **(2)** and then entering cuttings of up to 22m deep, including a 100m long retaining wall east of Markham Colliery East tip.

3.8.10 The route would then start to rise, running on a 490m viaduct up to 29m high to cross over the B6419 Bolsover Road, River Doe Lea floodplain, mineral railway and the M1 **(3)**. The route would then run along the western side of the M1, rising as it approaches M1 Junction 30.

3.8.11 The route would continue on the west side of the M1, crossing underneath the A619, typically in a cutting of up to 15m deep. This section of the route would have connections to the infrastructure maintenance depot which is described in Section 5.1 below.

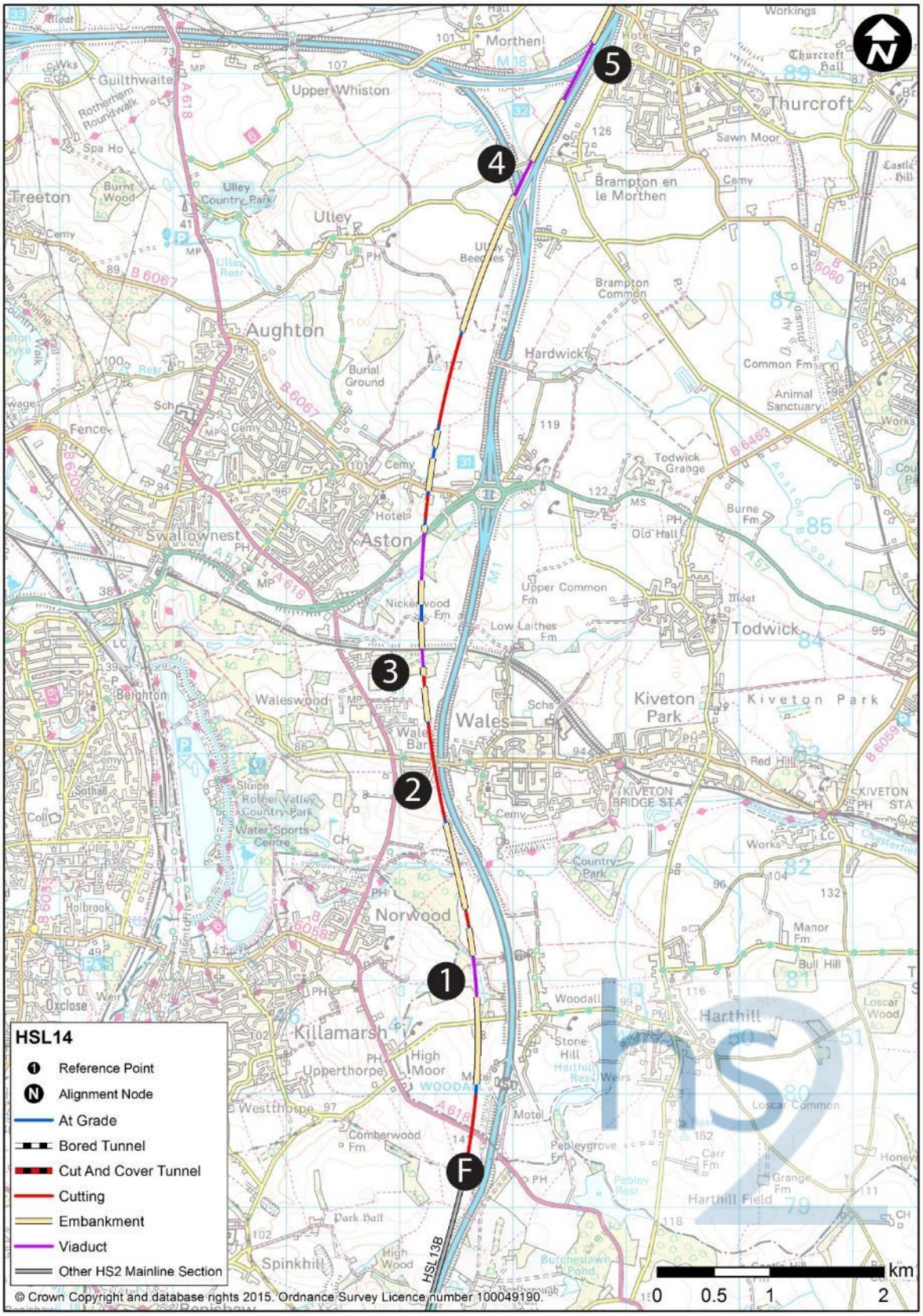
3.8.12 It would then pass beneath the A6135 immediately west of M1 Junction 30 **(4)**. Westfield Lane would be realigned to run to the west of the high speed railway, tying into Sheffield Road **(5)** which would then cross over the railway route.

3.8.13 The railway would continue on the west side of the M1 crossing undulating land in shallow cutting and embankment up to 7m deep. The design speed drops to 360km/h at the northern end of this route section to allow the route to follow the sinuous M1 as it heads north.

3.8.14 At Woodall, the route would continue north along HSL14, which broadly follows the M1 and M18 corridor passing to the east of Rotherham.

3.8.15 This section of the route would have connections to the infrastructure maintenance depot at the north end, which is described in Section 5.1 below.

3.8.16 Much of this route section would be affected by underground and opencast coal mine workings.


HSL14
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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0
0.5
1
2
km
1
2
3
4
5
F
Morthen
Thurcroft
Upper Whiston
Guilthwaite
Treeton
Ulley
Aughton
Hardwick
Brampton en le Morthen
Swallownest
Aston
Todwick
Waleswood
Wales
Kiveton Park
Norwood
Killamarsh
Harthill
Spinkhill
HSL 13B

3.9 HSL14: Woodall (F) to Conisbrough (K)

3.9.1 The route section between Woodall and Conisbrough would be 10.8 miles (17.2km) long. The section of route connecting to Woodall from the south would be HSL13B from Trowell.

3.9.2 All of this route section has a design speed of 360km/h to allow the route to follow close to the M1 and M18 motorway corridors.

Woodall to Brampton

3.9.3 The route would run to the east of Killamarsh, following the west side of the M1 corridor running north towards M1 Junction 31. The route corridor is initially in cutting of up to 18m deep passing underneath the A618, and then on an embankment up to 15m high. The route would continue along a 370m long viaduct **(1)** crossing a pond and tributaries of County Dike.

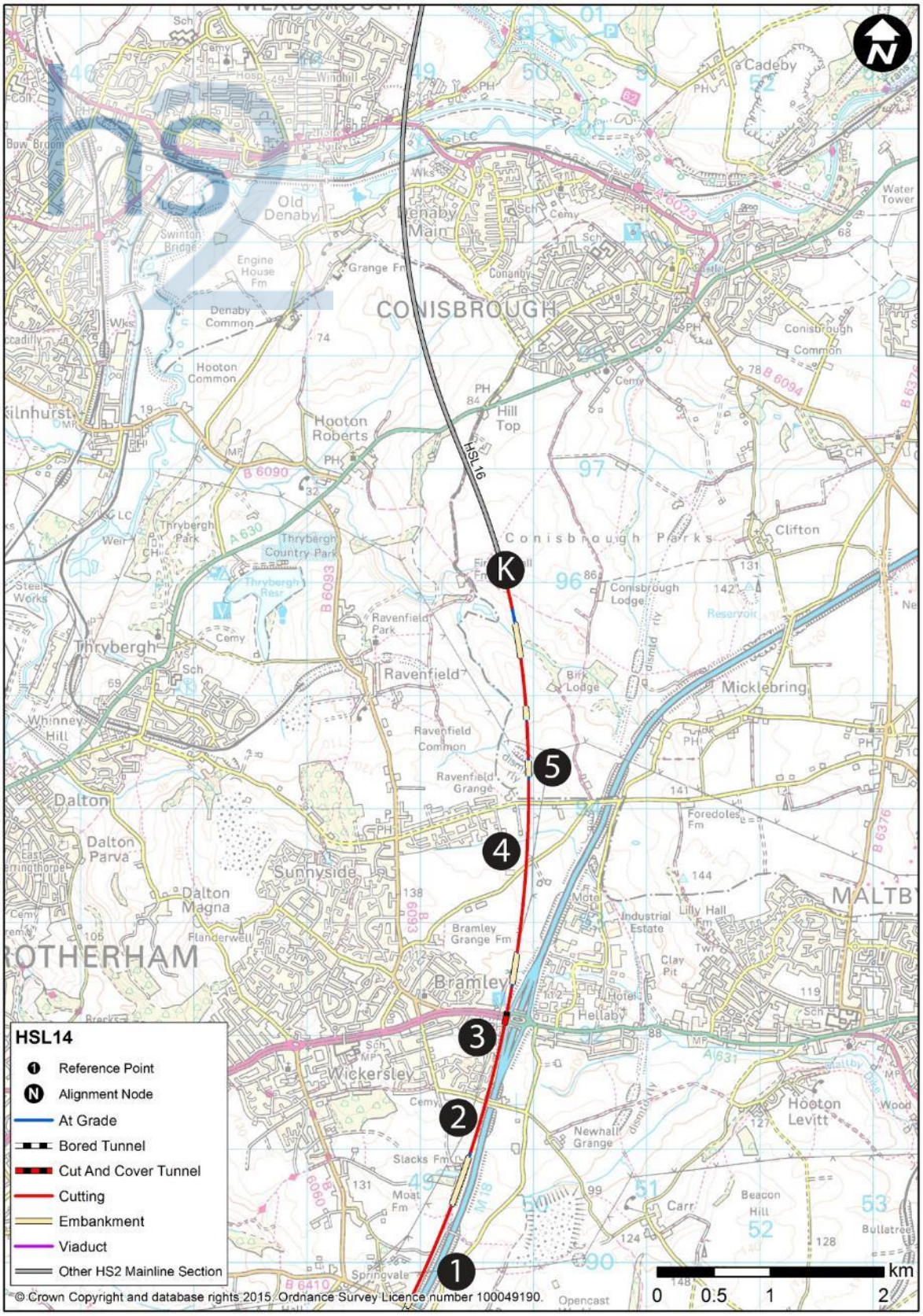
3.9.4 The route would be in a cutting of up to 10m deep, running immediately west of the M1. Retaining walls would be used to minimise the footprint of the route alongside the M1 and properties at Wales **(2)**. HS2 would pass underneath the B6059 School Road running alongside the existing motorway corridor, but due to the proximity of the existing bridge over the M1, a longer replacement bridge over the railway corridor and the M1 may be required.

3.9.5 North of Wales, the route would cross over Pigeon Bridge Brook and its floodplain and the existing Sheffield to Worksop railway **(3)** on a 170m long viaduct. This would be followed by an embankment of up to 14m and a 430m viaduct over a tributary of Pigeon Brook and the A57. The A57 would be realigned to pass under the viaduct. The B6067 would also be realigned to pass under HS2. At this point, the route has diverged from the curving M1, running up to 500m to the west.

3.9.6 The route would then rise gradually towards the M1/M18 interchange, running in a cutting of up to 12m, on embankment of up to 17m. The route would continue along a 360m viaduct over the M1 **(4)** and Wood Lane at the point where the M1 turns westward to head towards Tinsley.

3.9.7 The route would run on embankment to cross the M1/M18 junction carriageways on viaducts. HS2 would be close to the west of the slip roads connecting the M1 northbound to the M18 and the M18 to M1 southbound crossing the main M1 on a 360m long viaduct. The route would then use a 580m viaduct **(5)** to cross over the slip roads connecting the M1 eastbound to M18 and M18 to M1 westbound.

3.9.8 This section would cross areas affected by shallow coal mining.


HSL14
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL16
K
5
4
3
2
1
CONISBROUGH
ROTHERHAM
Conisbrough Parks
Old Denaby
Denaby Main
Cadeby
Hooton Roberts
Ravenfield
Ravenfield Common
Thrybergh
Dalton
Dalton Parva
Dalton Magna
Sunnyside
Bramley
Wickersley
Micklebring
Hooton Levitt
Clifton
Hellaby
Springvale
0 0.5 1 2 km
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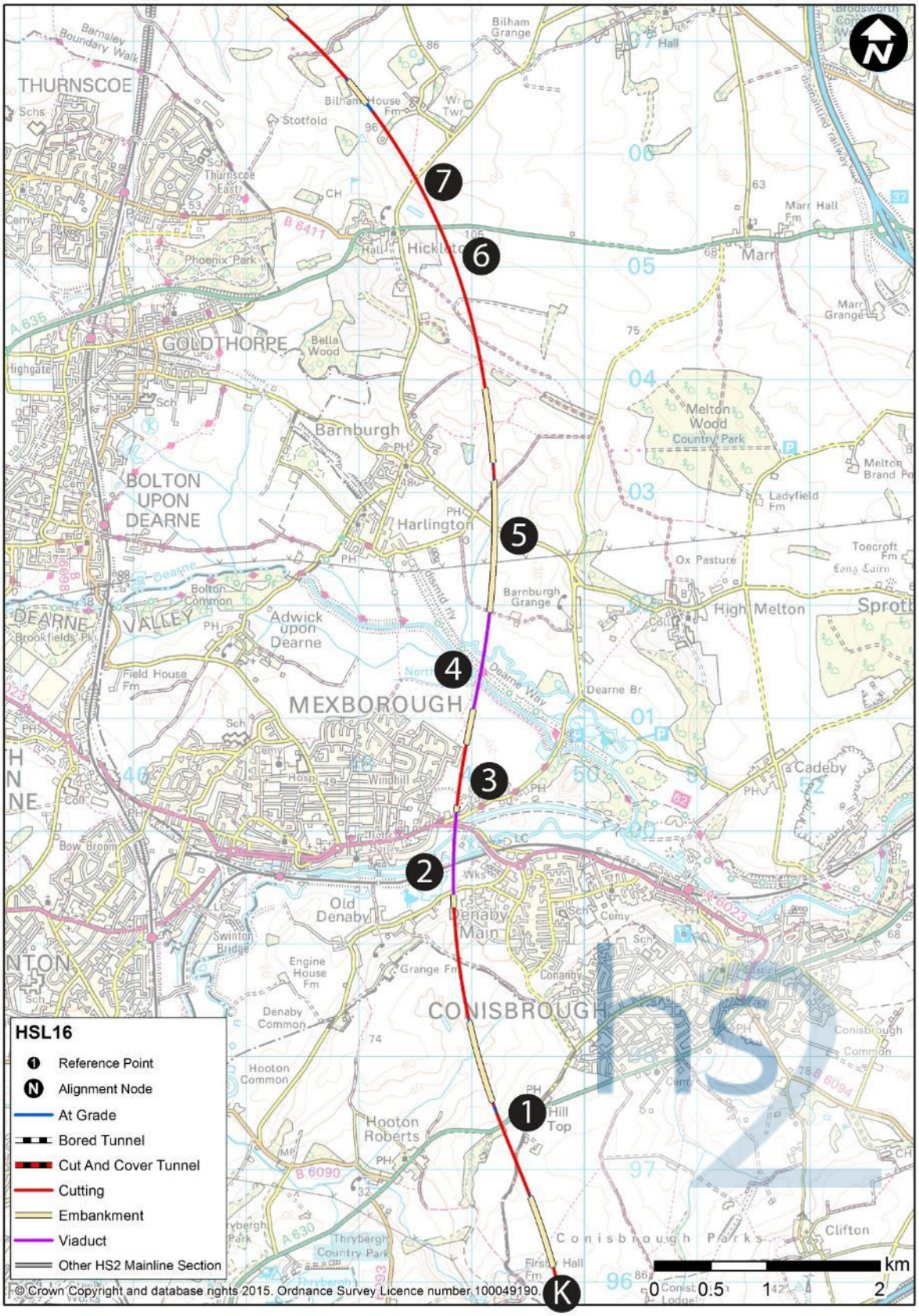
Brampton to Conisbrough

3.9.9 The B6060 **(1)** runs at a similar level to that proposed for HS2. The B6060 would therefore need to be raised significantly above its existing level, crossing HS2 and the M18 on a new bridge.

3.9.10 Approaching Bramley, the route would continue to run on the west side of the M18. It would run in cutting up to 11m deep and then embankment up to 7m high before entering a cutting to pass underneath Sandy Lane **(2)**. Between Sandy Lane and the A631 **(3)** retaining walls would be constructed to minimise the width of the cutting for the high speed railway. The crossing underneath the A631 is immediately west of the M18 Junction 1, and would require temporary reconfiguration of the roundabout junction during the construction works.

3.9.11 The route would then swing away from the M18, heading towards Mexborough and Conisbrough and eventually Leeds. This section of the route would largely be in cutting of up to 19m depth. Lidget Lane **(4)** and Common Lane **(5)** would be raised slightly allowing the railway to pass beneath them. At the northern end of this route section, the route would descend to follow falling ground.

3.9.12 At Conisbrough the route would continue north along HSL16 passing between Conisbrough and Mexborough and then continuing towards Hemsworth.


HSL16
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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0 0.5 1 2 km
THURNSCOE
GOLDTHORPE
BOLTON UPON DEARNE
Barnburgh
Harlington
MEXBOROUGH
Adwick upon Dearne
DEARNE VALLEY
Old Denaby
Denaby Main
CONISBROUGH
Hooton Roberts
Hill Top
Melton Wood Country Park
High Melton
Cadeby
Marr
Conisbrough Parks
Thrybergh Country Park
1
2
3
4
5
6
7
K

3.10 HSL16:Conisbrough (K) to Ryhill (M)

3.10.1 This route section between Conisbrough and Ryhill would be 14.8 miles (23.7km) long. The section of route connecting to Conisbrough from the south would be HSL14 from Woodall.

3.10.2 The design speed is 360km/h at the south end, dropping to 340km/h near Hickleton at the northern part of this route section.

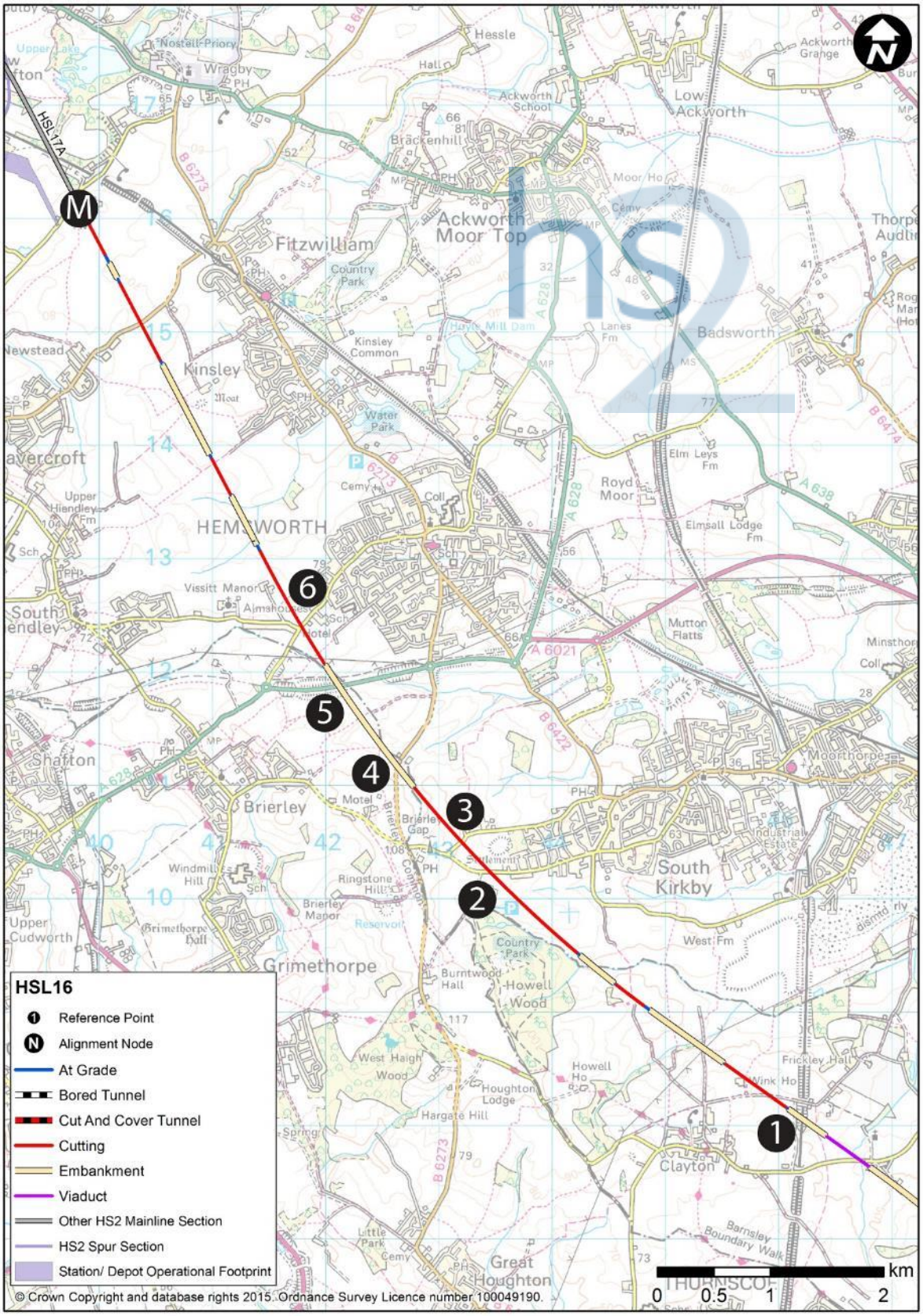
Conisbrough to Hickleton

3.10.3 The route would head north to pass to the west of Conisbrough, reducing in level due to falling ground. This would be on a mix of embankment (up to 15m) and cutting (up to 13m) including crossing under A630 **(1)**.

3.10.4 Between Mexborough and Conisbrough, the high speed railway would cross an existing railway, the River Don and its floodplain, Sheffield and South Yorkshire Navigation, and A6023 on a 740m viaduct **(2)**. Immediately beyond this, the route would enter a cutting through an active landfill site **(3)** which would involve special measures to excavate potentially hazardous material and support the sides of the cutting.

3.10.5 The route would then run on an 880m viaduct **(4)** over the River Dearne and its floodplain and the Dearne Way, which runs in a former railway corridor, before gaining height due to rising ground on an embankment between 9m and 21m high. This would include a crossing over Ludwell Hill **(5)** to the east of Barnburgh.

3.10.6 North from Barnburgh the route would continue to climb until cresting just north of Hickleton. Over this section, the route would be in a cutting of between 5m and 25m, with crossings under the A635 **(6)** and Red Hill Lane **(7)**. The route would pass to the eastern side of Hickleton Hall Registered Park and Garden. In this area, the design speed drops from 360km/h to 340km/h to allow for tighter horizontal curves as the route heads northwest between Thurnscoe and South Kirkby.


HSL16
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HS2 Spur Section
Station/ Depot Operational Footprint
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km
0 0.5 1 2
M
1
2
3
4
5
6
HSL17A
Fitzwilliam
Ackworth Moor Top
Kinsley
HEMSWORTH
Brierley
South Kirkby
Grimethorpe
Shafton
Clayton
Badsworth
Low Ackworth
Moorthorpe
Great Houghton

Hickleton to Ryhill

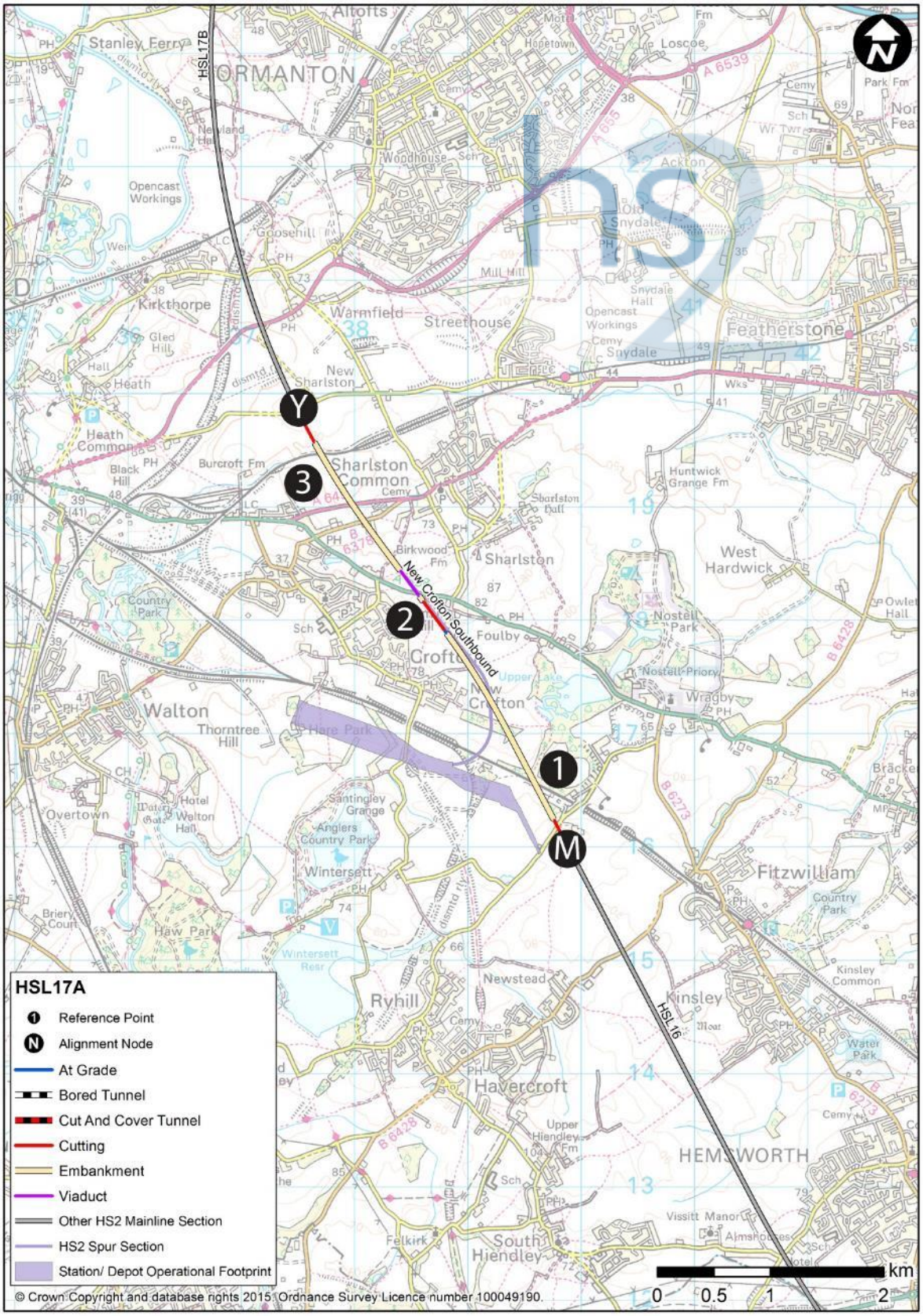
3.10.7 North of Hickleton, the route would emerge from cutting onto embankment of up to 18m and then onto a 490m viaduct over Church Field Road and a tributary of Frickley Beck. It would then cross over the existing Sheffield to York railway **(1)**. There is the possibility of building a north-facing connection between the HS2 mainline and the Sheffield to York railway in this location, enabling trains to run from Sheffield to Leeds and the north via HS2.

3.10.8 Heading towards the west of South Kirkby, the route would be on embankment up to 18m, then climb in a cutting into the rising ground. On the south-west edge of South Kirkby, HS2 would pass underneath Common Road **(2)** and Holmsley Lane **(3)**.

3.10.9 North-west from South Kirkby, the route would run on embankment of up to 16m. The B6273 **(4)** would be realigned to allow HS2 to pass over both it and the A628 **(5)**. Passing west of Hemsworth, the route is in cutting of approximately 10m depth, crossing underneath Barnsley Road **(6)**.

3.10.10 The route then passes over a tributary of the River Went on a short embankment, passing into a short cutting 6m deep. It then gently rises across undulating land, crossing two further tributaries on embankment up to 12m high. A cutting of up to 8m depth includes a crossing under the realigned B6428.

3.10.11 At Ryhill, the route would continue north along HSL17, to York via the ECML (continuation of HSL17 via Garforth), with a spur to Leeds (HSL21 via Woodlesford).


HSL17A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HS2 Spur Section
Station/ Depot Operational Footprint
Y
3
2
1
M
New Crofton Southbound
HSL17B
HSL16
ORMANTON
Altofts
Stanley Ferry
Kirkthorpe
Warmfield
Streethouse
Featherstone
Sharlston Common
Sharlston
West Hardwick
Walton
Fitzwilliam
Ryhill
Havercroft
HEMSWORTH
Kinsley
Crofton
Wintersett
Newstead
South Hiendley
0 0.5 1 2 km
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3.11 HSL17A: Ryhill (M) to Sharlston Common (Y)

3.11.1 The route section HSL17 is split into two. HSL17 runs from node M to node Y and HSL17N from node Y to node V (Church Fenton).

3.11.2 This route section between Ryhill and Church Fenton would be 21.6 miles (32.8km) long. The section of route from the south would be HSL16 from Conisbrough.

3.11.3 This section of route would contain the proposed Rolling Stock Maintenance Depot at New Crofton, as described in section 5.2.

3.11.4 The design speed is 340km/h throughout this section. The route would run north of Garforth and, at its northern end, would connect into the section of existing railway between Church Fenton and Ulleskelf, to provide the onward connection to the ECML.

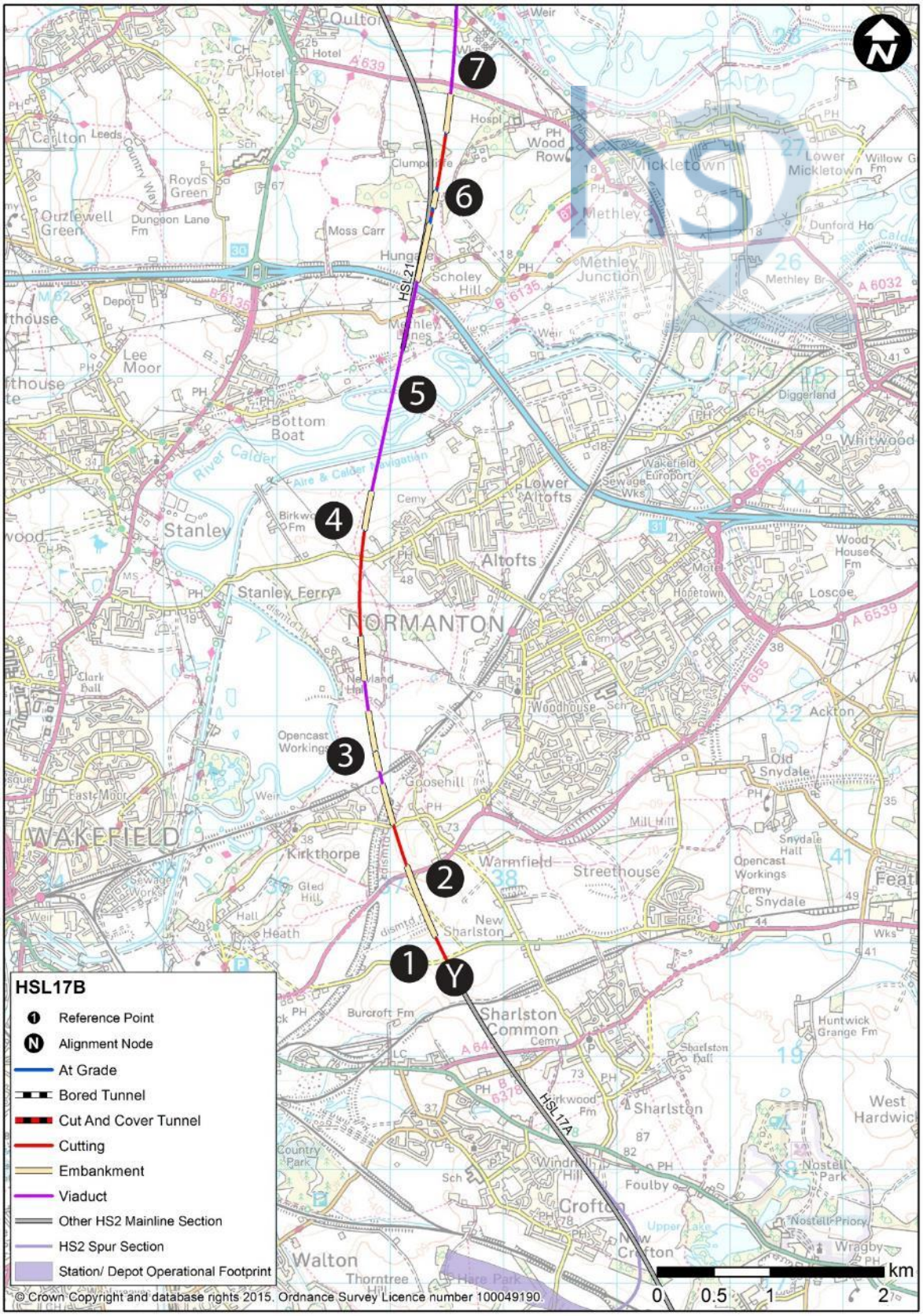
3.11.5 This route would be combined with a spur into Leeds City Centre via Woodlesford (HSL21).

Ryhill to Sharlston Common

3.11.6 North from Ryhill, the route would emerge from cutting onto an embankment of maximum 17m height, crossing over the existing Doncaster to Wakefield rail line **(1)**. North of this, as the route passes to the east of Crofton, would be the spur **(2)** to connect with the rolling stock depot.

3.11.7 The route would then descend in an area of generally falling ground, passing on 300m viaduct over the A638. Continuing on embankment the route crosses over A645 which would be realigned and incorporate the B6378 through route. It would then cross over the existing Pontefract to Wakefield rail line **(3)** which would be unaffected.

3.11.8 All of this section has a reduced design speed of 340km/h.


HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HS2 Spur Section
Station/ Depot Operational Footprint
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0
0.5
1
2
km
HSL17A
HSL21
NORMANTON
WAKEFIELD
Altofts
Stanley
Sharlston
Sharlston Common
Crofton
Walton
Streethouse
Warmfield
Kirkthorpe
Methley
Methley Junction
Mickletown
Whitwood
Ackton
Featherstone

3.12 HSL17B: Sharlston Common (Y) to Church Fenton (V)

Sharlston Common to Methley

3.12.1 At the start of this route section HS2 crosses under Hell Lane **(1)** with HS2 running in a short cutting up to 13m deep. The route would then run on embankment typically 10m high, crossing over A655 Kirkthorpe Lane. Red Lane **(2)** would be realigned over a total length of 500m to run to the east of HS2.

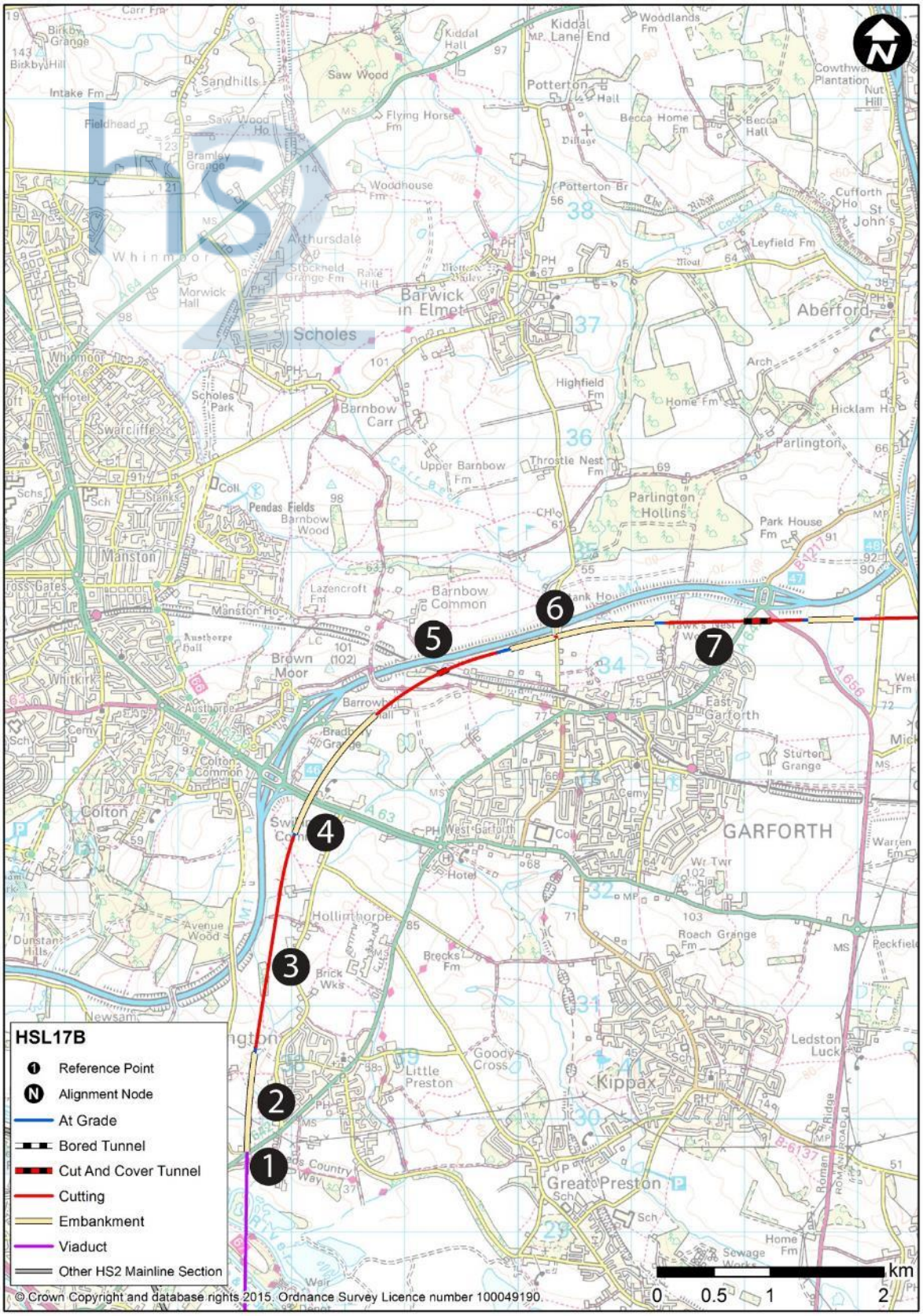
3.12.2 After a short cutting up to 13m deep, the route would cross Warmfield Lane and then pass onto three sections of embankment and two viaducts: crossing over the Wakefield Kirkgate to Normanton railway **(3)** on a 120m viaduct and a disused brickworks on a 270m viaduct.

3.12.3 The route would then pass into a cutting typically 14m deep to pass under Birkwood Road **(4)**. The design speed at this point would drop to 300km/h. The route would lie at the south-western edge of Altofts.

3.12.4 After emerging from cutting just north of Top Farm, the route would use a 1.2 mile (1.9km) viaduct **(5)**, up to 23m high, to pass over the Aire and Calder Navigation, multiple crossings of the River Calder and its floodplain, Bottom Boat Road, B6135 Newmarket Lane, and the M62.

3.12.5 North of the M62, the route would return to ground level at The Rookery, and would then enter a cutting up to 11m deep through Clumpcliffe Covert **(6)**.

3.12.6 The route would use an embankment up to 16m high followed by a 1.4 mile (2.2km) viaduct up to 29m high to pass over A639 Methley Lane (which would remain) **(7)**.


HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
1
2
3
4
5
6
7
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190.
0
0.5
1
2
km

Methley to East Garforth

3.12.7 Continuing on viaduct, the route would pass over Oulton Beck floodplain, Fleet Lane (which would also remain), the Leeds to Normanton railway, the Aire and Calder Navigation, the River Aire and its floodplain, and the A642 Wakefield Road **(1)**, before returning to the rising ground level.

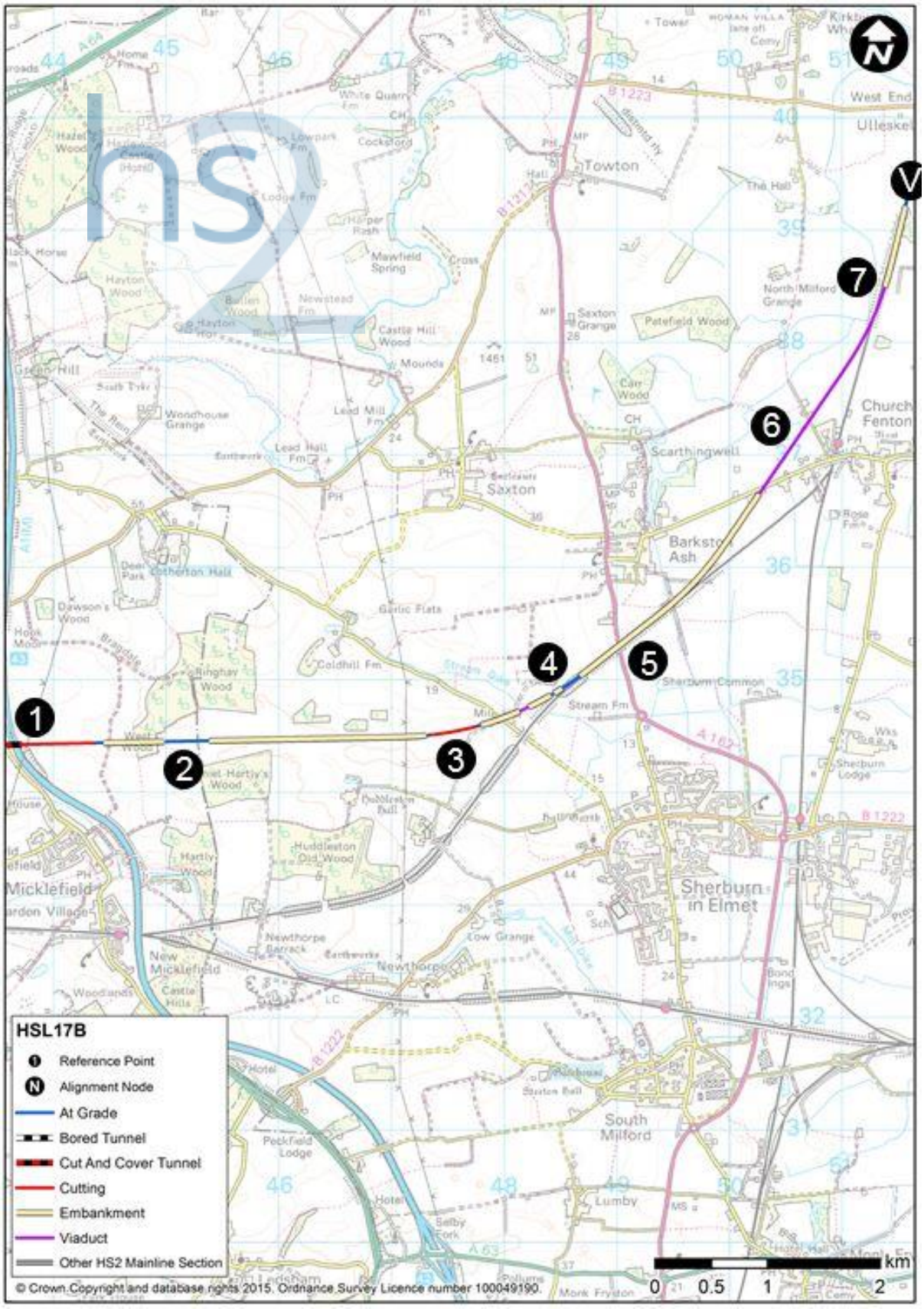
3.12.8 The route would then rise out of the Aire Valley, on a shallow embankment, passing to the eastern edge of Grimblethorpe Farm and to the west of Swillington **(2)**. It would then enter cutting, typically 8m but up to 13m deep, at Woodside Farm. North-west of Swillington, the route would run close to the M1 for 500m close to Hollinthorpe Farm **(3)**.

3.12.9 The route would cross over the A63 Selby Road **(4)**, which would remain at its present level, approximately 200m east of Junction 46 of the M1. The route would then swing eastwards to follow the curve of the M1 in cutting, passing below the Leeds to York railway **(5)**, which would remain at its present level.

3.12.10 The route would run immediately adjacent to the M1's southern boundary, broadly at the motorway's level, between the railway and Barwick Road **(6)**, which would have to be elevated to pass over both HS2 and the M1. Through this section, the route would closely follow the M1 for 2.2 miles (3.5km).

3.12.11 The route would then follow the rising ground towards M1 Junction 47 **(7)**. It would pass immediately to the south of the junction, at the M1's level, so the approaches from the south (A642 and A656) would be bridged over the railway to tie to the existing roundabout, which would remain at its current level.

3.12.12 The design speed along this section would vary between 300km/h, 360km/h and then dropping to 320km/h and 230km/h as it closely follows the M1.


HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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km
0
0.5
1
2
Towton
Saxton
Scarthingwell
Sherburn in Elmet
Micklefield
South Milford
Lumby
Church Fenton
Barkston Ash
Ulleskelf
West End
1
2
3
4
5
6
7
N
V

East Garforth to Church Fenton

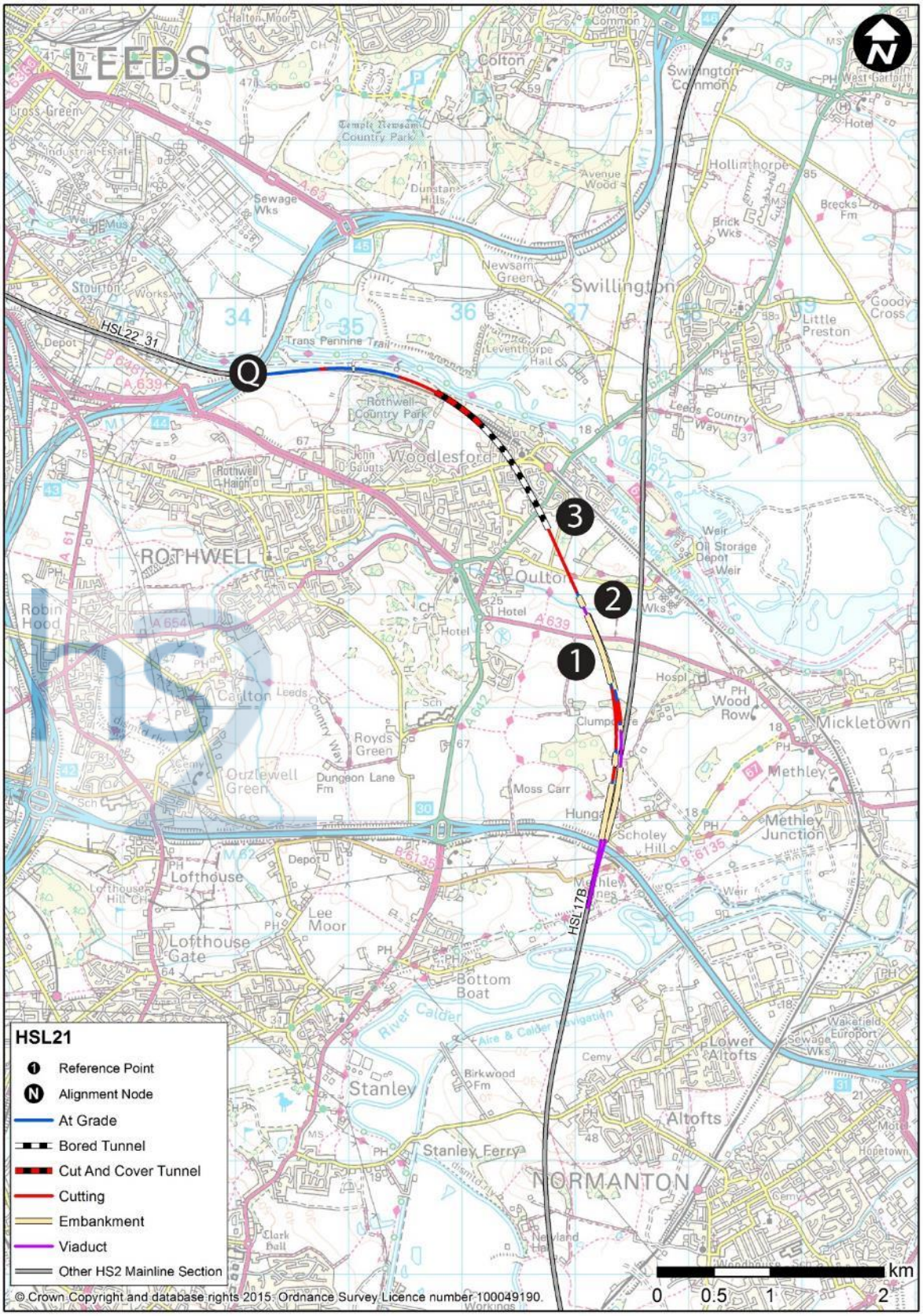
3.12.13 From Garforth the route would then descend to pass below the Roman Road, and below the Great North Road and A1(M) north of Old Micklefield and south of Hook Moor, in cutting. The A1(M) would have to be temporarily realigned during construction of the structure used to carry the railway under the A1(M) **(1).**

3.12.14 The route would then emerge at ground level some 600m east of the motorway, near Weet Wood **(2)**, and would run east for 1.9 miles (3.0km) in a series of shallow embankments and cuttings.

3.12.15 The route would head east, at ground level, crossing over Mile Hill **(3)** and Stream Dike floodplain on viaduct, then on an embankment at a maximum height of 11m, before turning north-east to run parallel to the existing railway between Micklefield and Church Fenton, on its northerly side and at a similar level **(4)**.

3.12.16 It would cross the A162 **(5)** on a localised embankment and bridge, passing south of Barkston. Unable to follow the existing railway through Church Fenton because of curvature, property and the station, the route would pass on a shallow embankment to its west. It would then run onto a 1.4 mile (2.2km) viaduct **(6)**, typically between 9m and 12m high, to pass over Common Lane, Sandwath Lane within 100m of Sandwath Drive, over Dort's Dyke floodplain, and over the Church Fenton to Ulleskelf section of existing railway, in order to return to ground on the railway's eastern side **(7)**. The alignment of the existing railway would have to be altered to accommodate the new route arriving from the west.

3.12.17 Further modifications to the existing railway between the tie-in point and Colton Junction (at the ECML) were described in the report entitled 'High Speed Two Limited, Engineering Options Report, West Midlands to Leeds'.


HSL21
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL22_31
HSL17B
Q
1
2
3
N
LEEDS
ROTHWELL
NORMANTON
Woodlesford
Oulton
Swillington
Stanley
Lofthouse
Methley
Mickletown
Colton
Rothwell Country Park
Trans Pennine Trail
Temple Newsam Country Park
Leeds Country Way
Lofthouse Gate
Lee Moor
Bottom Boat
Stanley Ferry
Altofts
Lower Altofts
Methley Junction
Wakefield Europort
River Calder
Aire & Calder Navigation
0 0.5 1 2 km
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3.13 HSL21: Ryhill (M) to Woodlesford (Q)

3.13.1 The route between Ryhill and Woodlesford would be 10.4 miles (16.8km) long. The section of route connecting to Ryhill from the south would be HSL16.

3.13.2 Between Ryhill and Methley Lane, the route would be identical to HSL17. This route would be combined with a spur to the ECML via Garforth (HSL17B). The route between Ryhill and Methley Lane is described in paragraphs 3.11.1 – 3.12.6.

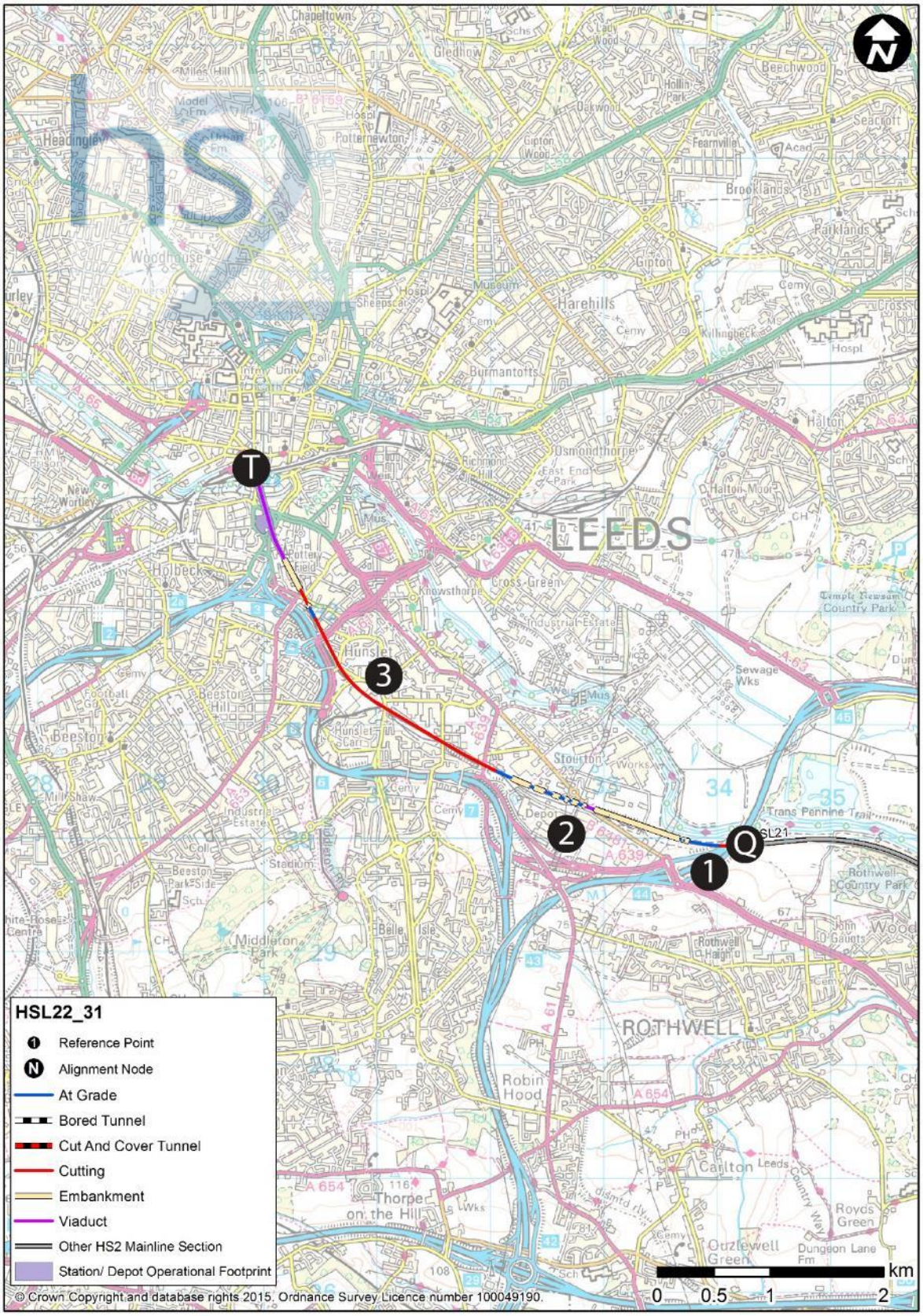
3.13.3 At the M62 crossing, the line speed at the grade separation for Leeds trains would reduce to 230km/h, and there would be a northbound single-track spur towards Leeds diverging west from the main line. A southbound single-track spur, from Leeds, would pass over the main line and merge with it from the east side.

3.13.4 The route would pass over A639 Methley Lane **(1)**, at approximately 9m height. North of this, the route passes over Oulton Beck and its floodplain **(2)**, and then dives into a cutting to pass underneath Fleet Lane and Eshald Lane.

3.13.5 The route would then enter a tunnel **(3)** under Woodlesford, with the southern portal 200m north of the crossing of Eshald Lane. The tunnel would be 1 mile (1.6km) long in total comprising 0.7 miles (1.1km) of bored or mined and 500m of cut-and-cover tunnels. The bored length would be two tunnels, one carrying the northbound track and the other the southbound. This would be followed by a cut-and-cover tunnel which would enable the route to cross under the existing railway.

3.13.6 The route would then run immediately to the south of the Aire and Calder Navigation in the existing railway corridor. The existing railway will require realignment to accommodate both the existing railway to the south and the route into the HS2 Leeds Station to the north of the corridor. Throughout this section, the route would be running linearly along water bodies, with restricted working space, and with difficult construction access. Rothwell Country Park lies to the south of the route.

3.13.7 At Woodlesford, the route would continue north along HSL22 to Hunslet and a new station in central Leeds.


HSL22_31
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
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0
0.5
1
2
km
LEEDS
ROTHWELL
T
1
2
3
Q
N

3.14 HSL22 & HSL31: Woodlesford (Q) to Hunslet (R) and Leeds Station (T)

3.14.1 This route between Woodlesford and Hunslet would be 2.5 mile (4.0km) long. The section of route connecting to Woodlesford in the south would be HSL21 from Cringlesworth.

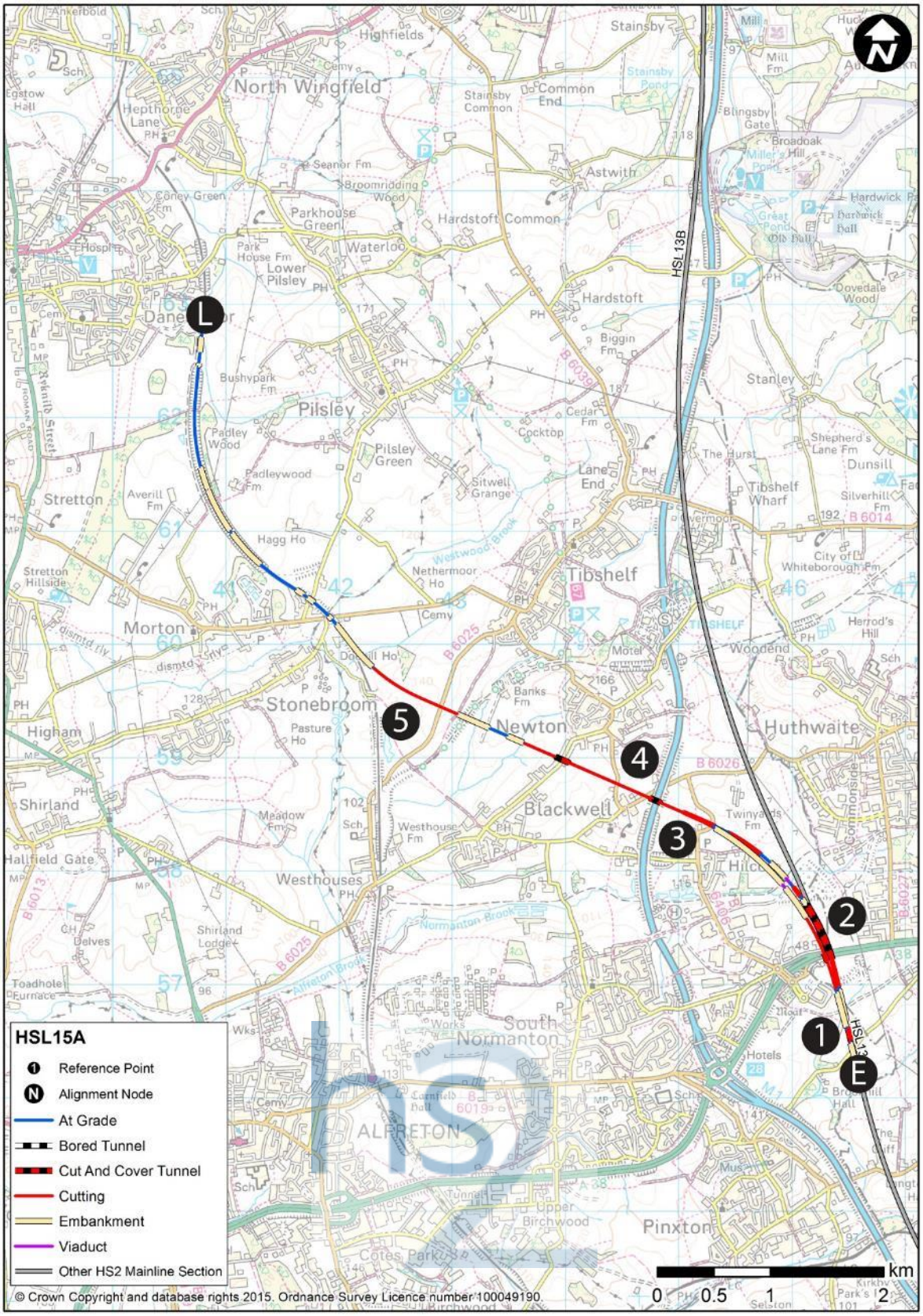
3.14.2 The high speed tracks would pass under the M1 (1) on the formation of, and using the existing bridge span through which it passes, the current Leeds to Castleford railway line. The Network Rail tracks would be realigned, over a total length of 0.7 miles (1.1km), around 60m to the south, requiring their own new crossing beneath the M1.

3.14.3 Immediately west of the M1 crossing, the high speed tracks would move northwards **(2)** and leave the existing railway corridor. At this point, the existing railway alignment would be retained and this would allow the eastern approach to Stourton Freightliner Terminal to be preserved.

3.14.4 For the remainder of the route into Leeds, the high speed tracks would run parallel with the existing railway corridor on the northern side **(3)**. It is not possible for the HS2 route to run at exactly the same elevation as the existing railway corridor due to the additional headroom required for the new rolling stock, and the need for electrification, leading to HS2 being up to 4m lower. The A639 (Wakefield Road), Pepper Road, Balm Road, Beza Street, Hillidge Road and the slip roads from the M621 to the A61 would be rebuilt on their current alignments with new bridges to span both the existing railway corridor and high speed tracks.

3.14.5 With the high speed tracks on the north side of the existing railway corridor, existing access to the railway sidings and facilities on the northern side would be severed.

3.14.6 At Hunslet, the route would continue north for a further mile (1.6km) along HSL31 to Leeds station. As the tracks approach the station, they would diverge from the existing railway corridor. The route approximately follows the former railway approach to Hunslet Goods Yard and then rises up to the station throat and station, at a line speed of 110km/h and then 80km/h. This station is described in section 4.3.


HSL15A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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0 0.5 1 2 km
L
5
4
3
2
1
E
N
North Wingfield
Pilsley
Stretton
Morton
Stonebroom
Higham
Shirland
Hallfield Gate
Westhouses
Tibshelf
Newton
Blackwell
Huthwaite
South Normanton
ALFRETON
Pinxton
Hardstoft
Astwith
Stainsby
HSL 13B

3.15 HSL15A: Pinxton (E) to Clay Cross (L)

3.15.1 The route section between Pinxton and Clay Cross would be 5.8 miles (9.4km) long. This section of the route starts at a junction with HSL13 and provides a link to allow high speed services to access the existing Midland Main Line rail route into Sheffield city centre near Clay Cross.

3.15.2 Most of this route section would be at a design speed of 200km/h, reducing to 160km/h and then 145km/h as it joins the existing railway corridor running towards Sheffield.

3.15.3 The junction with HSL13 would start in the vicinity of Brookhill Lane **(1)**, which is to be lowered to allow HS2 to pass above it. The northbound spur would run initially at a similar level to the HS2 main line, passing in cutting to the immediate east of a large retail unit, before passing below the A38 **(2)** at a depth of approximately 16m. The southbound connection from Sheffield would instead start to reduce in level relative to the HS2 main line, crossing underneath the A38 at a depth of approximately 20m and then crossing underneath the main line to join the northbound track. Both northbound and southbound tracks cross over Normanton Brook on separate 60m viaducts, then run on an embankment maximum 14m high transitioning to cutting north of the B6406. The B6406 **(3)** would be raised and realigned to pass over the spur.

3.15.4 The route would continue in cutting at a depth of up to 7m, before passing under the M1, B6026 Huthwaite Lane and B6026 Cragg Lane **(4)**. Passing to the south-east of Newton, the route would cross under Alfreton Road in a cut-and-cover tunnel. As the ground falls, the railway would emerge from cutting to cross over two tributaries of Morton Brook before passing into cutting. The B6025 would cross over the route on a new bridge.

3.15.5 Immediately east of Stonebroom the route would join the corridor of the existing Erewash Valley railway **(5)**, crossing over B6014 Station Road and Pilsley Road. The existing railway corridor used to accommodate four rail tracks and currently accommodates two main lines with a third loop track. The HS2 route would run parallel to and immediately east of the existing two main lines, resulting in the removal of the existing third track. HS2 would join the existing railway tracks on the approach to Danesmoor, once the tracks are on a straight alignment.

3.15.6 The HS2 trains would then continue on the existing railway into Sheffield city centre via Chesterfield.

4 Stations

4.1 East Midlands Hub station at Toton

East Midlands Hub Station – Artist's impression of aerial view

East Midlands Hub Station – location and footprint

Route overview

4.1.1 Through Long Eaton, the new route would approach the East Midlands Hub station at Toton along the corridor to the east of the existing low-level, two-track railway that runs north from Trent East Junction. HS2 would run on viaduct at a higher level to the east, allowing the existing low-level lines to remain. The existing level crossings at Main Street and Station Road would all remain with HS2 passing over these roads on viaduct up to 17m high. The existing high-level lines to the east would remain with HS2 running between the two separate existing corridors. There would be no connection between the corridors, so new connecting chord lines would be necessary in the Meadow Lane area to allow all trains from the Derby, Leicester and Nottingham direction to access either the high-level or low-level lines.

4.1.2 North of the A6005 overbridge, which would be replaced, the alignment would widen from two tracks to four tracks and then to six tracks, with the extra tracks forming deceleration lines to, and acceleration lines from, the proposed station platforms. Beyond the platforms, the alignment narrows to a two-track configuration, mirroring the southern end of the station layout.

4.1.3 The station is described below, and would involve alterations to Network Rail facilities in the area and the depot connections to the west of the station, as described in section 3.6 above.

4.1.4 A pair of loop tracks to accommodate maintenance plant and trains would also be incorporated into the layout at Toton.

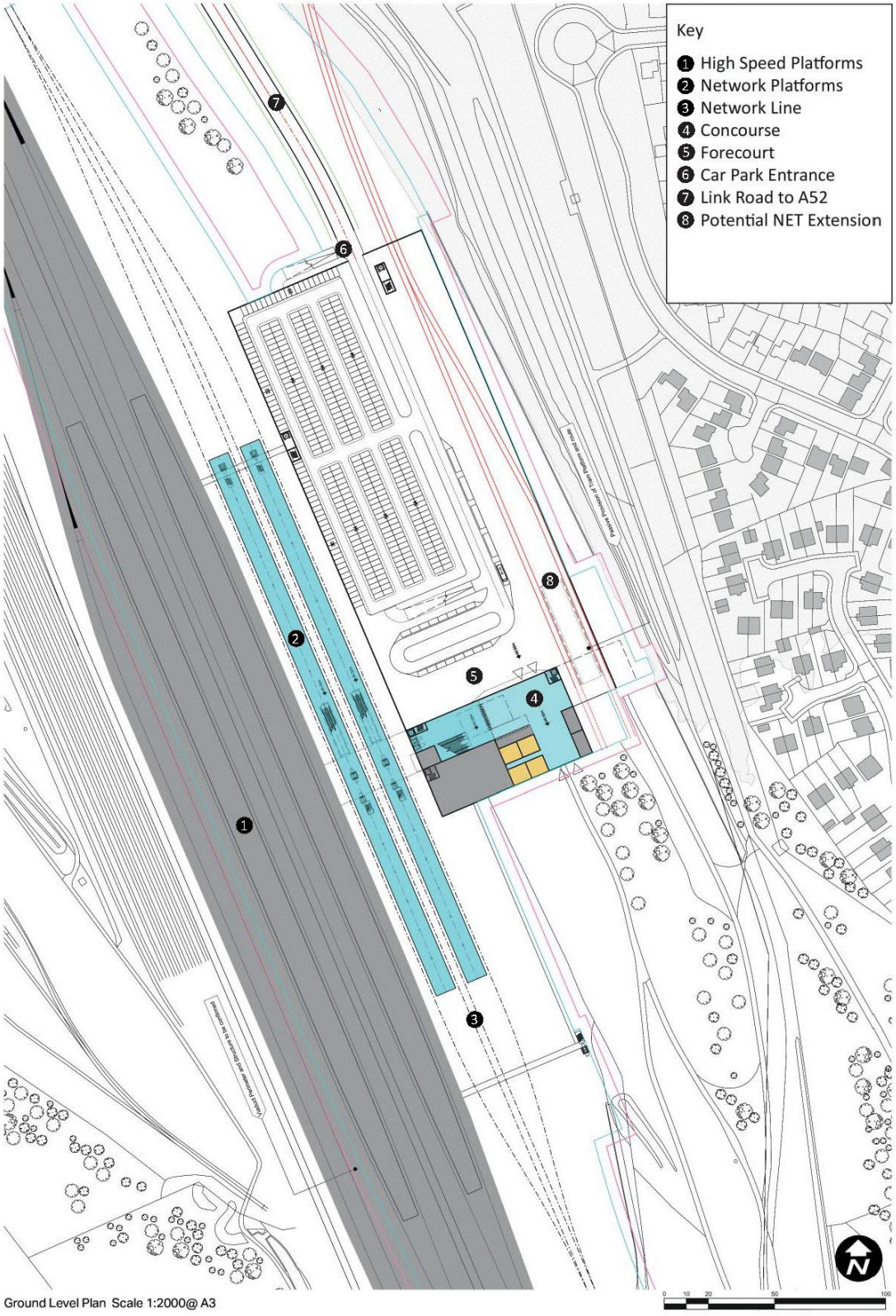
4.1.5 North of Toton, the route would narrow from six tracks, to four, to two, passing under the A52 Brian Clough Way. The existing bridge would be demolished and replaced.

Station location and existing site

4.1.6 East Midlands Hub would be a new station on the site of the Toton Yard, approximately 7 miles (11km) southwest of Nottingham city centre. It would lie to the east of the M1 and north of Long Eaton, 9 miles (14km) east of Derby and 25 miles (40km) north of Leicester.

4.1.7 The site is bounded to the north by A52 Brian Clough Way, by the existing rail facilities to the west and south, and by fields and residential development to the east. Toton Yard is extensive and mostly flat, with a sharp rise in level to the east. Much of the site is designated as Green Belt.

4.1.8 Large parts of Toton Yard are occupied by sidings. The yard also contains the Traction Maintenance Depot and a Network Rail infrastructure maintenance facility. These lie largely to the west of the proposed station and, apart from changes to rail and road access routes, these facilities would largely not be affected.



East Midlands Hub station - ground level plan

Station description

Platforms

4.1.9 In total, the station would have eight platforms. For the high speed route, there would be four platforms for stopping services and two through lines for non-stopping trains. The four platform faces would comprise two island platforms, one for northbound services and one for southbound services. The high speed platforms would be 415m long and 12m wide, and located between approximately 5-8m above existing ground level on viaduct.

4.1.10 To facilitate interchange with the existing rail network, four platform faces would be provided alongside the high speed station, allowing interchange for passengers to reach the wider East Midlands region, including Derby, Nottingham and Leicester via the existing rail network. The Network Rail tracks would be located at existing ground level, lower than the HS2 tracks.

4.1.11 Reflecting the topography of the site, the station entrance, public concourse and forecourt would be raised above the existing ground level to the east of the Network Rail tracks.

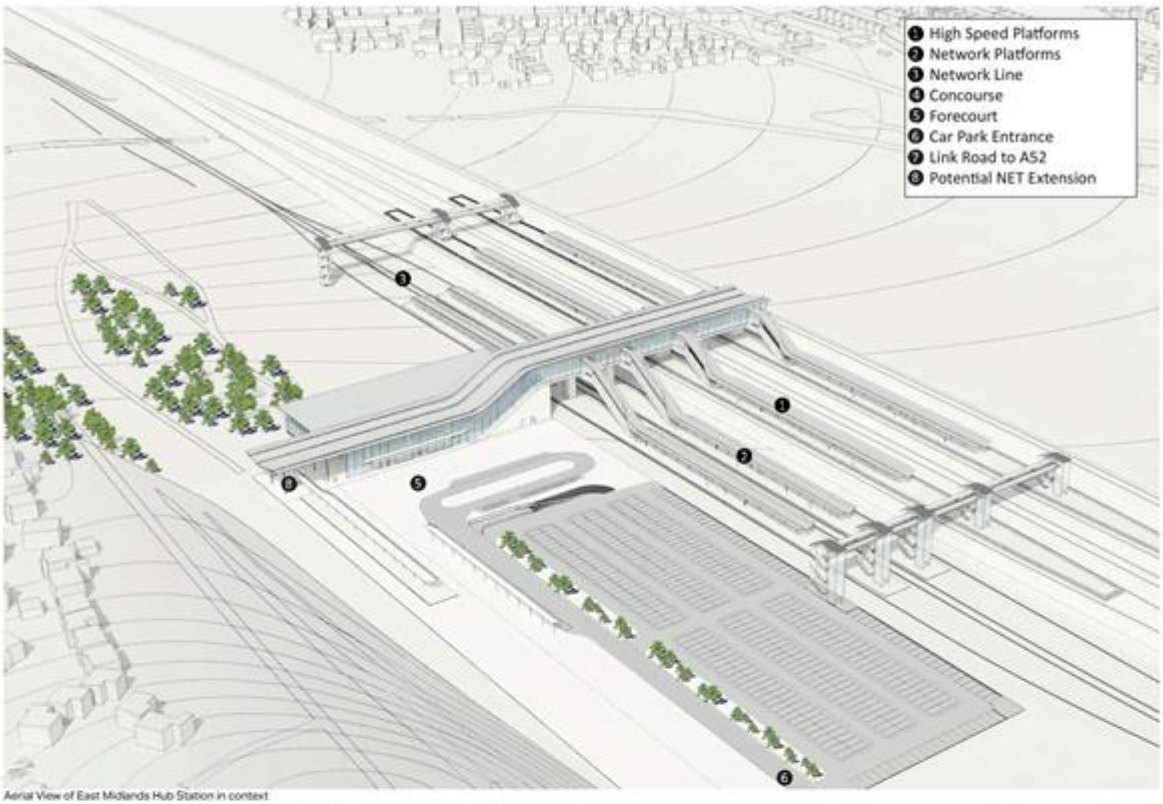
Paid concourse

4.1.12 The station paid concourse would be at an upper level on the link bridge extending over the modified existing network and the high speed lines, and provide access to each platform by escalators and lifts. Escape bridges would be provided at both ends of the platforms.

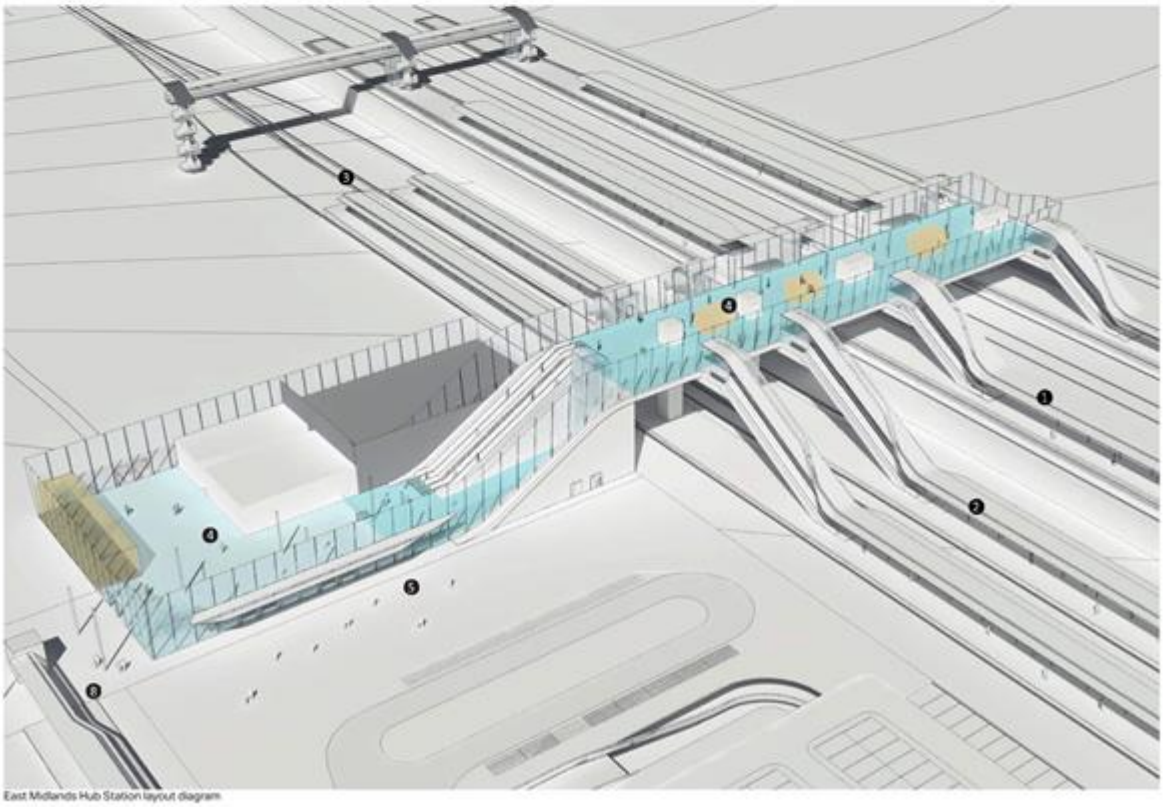
Forecourt and car park

4.1.13 The station site is west of Banks Road. The forecourt would be on top of the car park, next to the concourse and its level. The drop-off for taxis, buses, cars and the planned extension of the Nottingham Express Transit would be at forecourt level.

4.1.14 Due to the proximity of the station to the existing housing, the additional car parking spaces are proposed as a two-level basement car park.



Aerial View of East Midlands Hub Station in context



East Midlands Hub Station layout diagram

Accessibility

4.1.15 Vehicle access to the station would be from a new junction on the A52. The link road to the station would minimise land acquisition by keeping close to the edge of the existing sewage treatment works immediately south of the A52 and east of the yard. A connection to this road would provide access to the commercial properties on Bessell Lane, north of the A52.

4.1.16 Connecting to the A52 would provide a direct link to Nottingham and Derby, as well as to Junction 25 of the M1, which is 1.9km away and would provide highway access to Leicester and the wider region.

Intermodal interchange

4.1.17 The station would have major road access and car parking provision, and would also be well connected to public transport.

4.1.18 In addition to the high speed platforms, the station would include four platform faces to allow direct passenger interchange to services on the existing rail network. While there are currently no passenger services to the site, these platforms (and other changes to the rail infrastructure in the area) would mean that the station could be served by trains to and from the East Midlands region, including Derby, Nottingham and Leicester.

4.1.19 It is likely that the Nottingham Express Transit Line 3, Phase II scheme would be extended by 1.0km across Toton Lane to the station site. This would provide a direct interchange between the high speed rail station, Nottingham city centre, the residential areas of Beeston and Chilwell, the University of Nottingham and the Queen's Medical Centre. The tram stop would be located in the forecourt, connecting directly to the concourse.

4.1.20 Modifications to the local and regional bus network would be required in order to provide an expanded service to a station at Toton. Bus bays would be incorporated into the station forecourt layout. Pick-up and drop-off bays for taxis and private vehicles would also be located in the forecourt directly outside the station entrance. The site would have space for provision of short-term and long-term parking in a multi-storey configuration beneath the forecourt.

Site constraints

4.1.21 Constraints at the East Midlands Hub would include:

- maintaining the operation of existing lines, including the freight and maintenance facilities at Toton Yard;
- providing infrastructure with sufficient capacity to allow new passenger services to operate from the existing rail network to access East Midlands Hub station, while minimising residential impacts in Long Eaton;
- achieving an adequate design speed (up to 275km/h) for the high speed tracks, while following the existing rail corridor through Long Eaton and Sandiacre;
- minimising the impact of the station and railway on the adjoining suburban areas; and
- consideration of flood protection for the station facilities and the provision of rainwater attenuation on the site.

Constructability

4.1.22 As well as the high speed line and station works, there would be changes to access arrangements to the Toton Yard facilities to the west, with realignment of the existing network's through lines accommodate the four new platform faces for interchange to services on the modified existing network. It is assumed that access to existing facilities would be required at all times.

4.1.23 It is proposed that East Midlands Hub station be constructed in three phases over a six-year period, as outlined below.

4.1.24 Phase 1: Preparatory Work to allow temporary closure of low-level lines

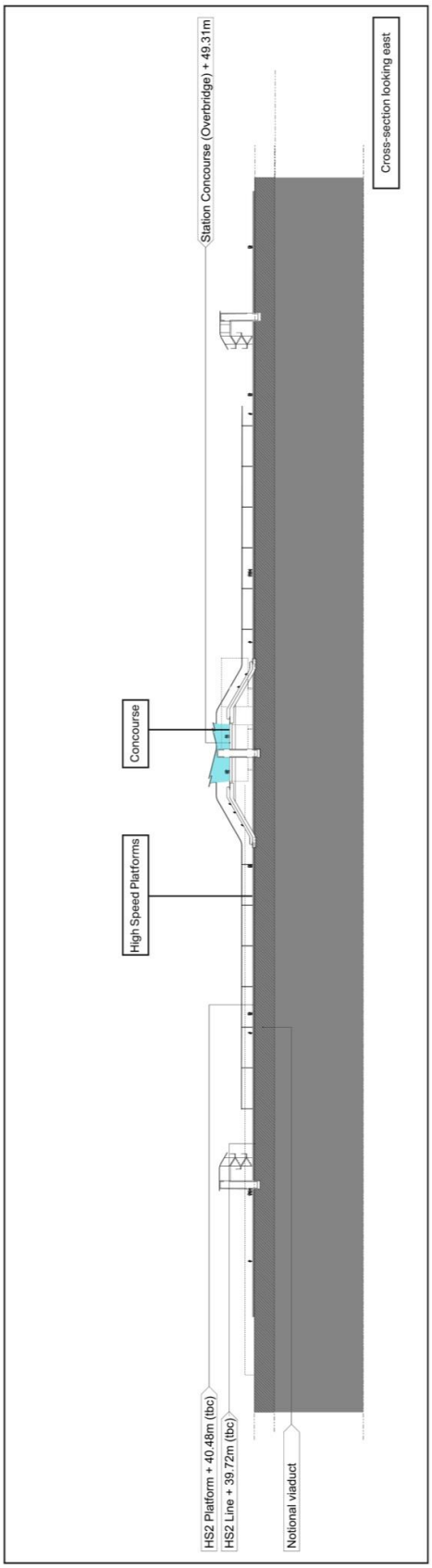
- Construct new chord line from Trent East Junction to high-level lines for trains to/from Derby direction; and
- Install temporary connections from high-level route to western side of Toton Yard, possibly using the old freight flyover connection or flat junction to North.

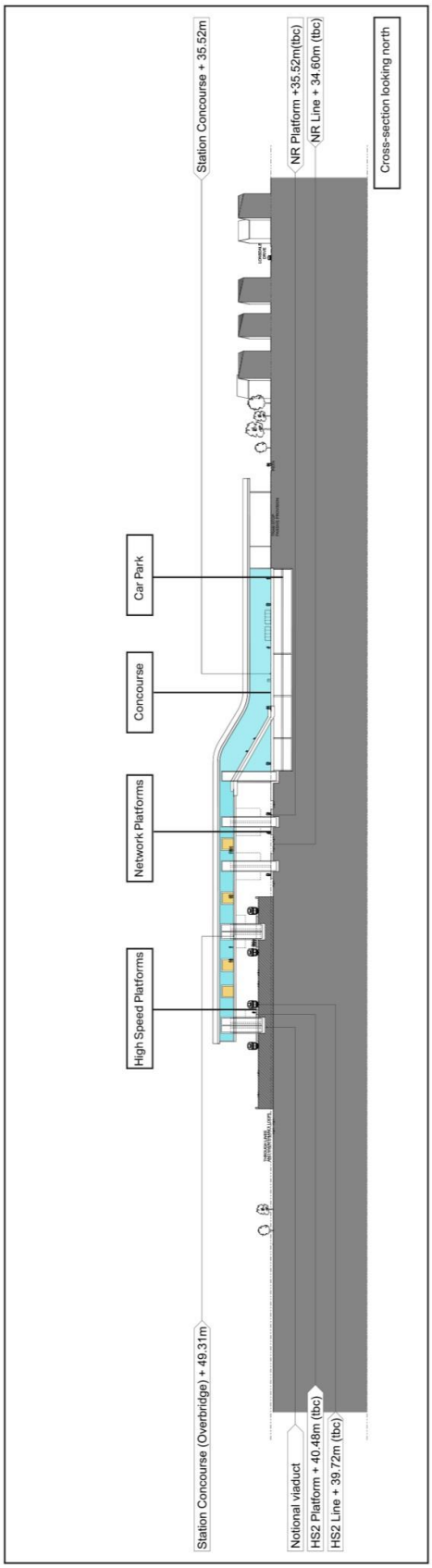
4.1.25 Phase 2: Temporary closure of low-level lines

- Construct new HS2 viaduct through Long Eaton;
- Construct new chord line from Attenborough to low-level lines for trains to/from Nottingham direction;
- Construct new alignment for western pair of Erewash Valley lines to North of Toton yard, beneath A52, Station Road and tie into existing lines on final alignment;
- Commence construction of new alignment for eastern pair of lines to North of Toton yard beneath A52, Station Road.

4.1.26 Phase 3: Re-open low-level lines

- Construct new HS2 station viaduct;
- Complete construction of new alignment for eastern lines from high level, including 'classic' station tracks and platforms and tie into existing Erewash lines to North;
- Complete construction of new hub station including station building and access routes;
- Construct new HS2 through alignment including viaduct over the western pair of Erewash lines approaching Stapleford.


Cross-section looking east
Station Concourse (Overbridge) + 49.31m
Concourse
High Speed Platforms
HS2 Platform + 40.48m (tbc)
HS2 Line + 39.72m (tbc)
Notional viaduct

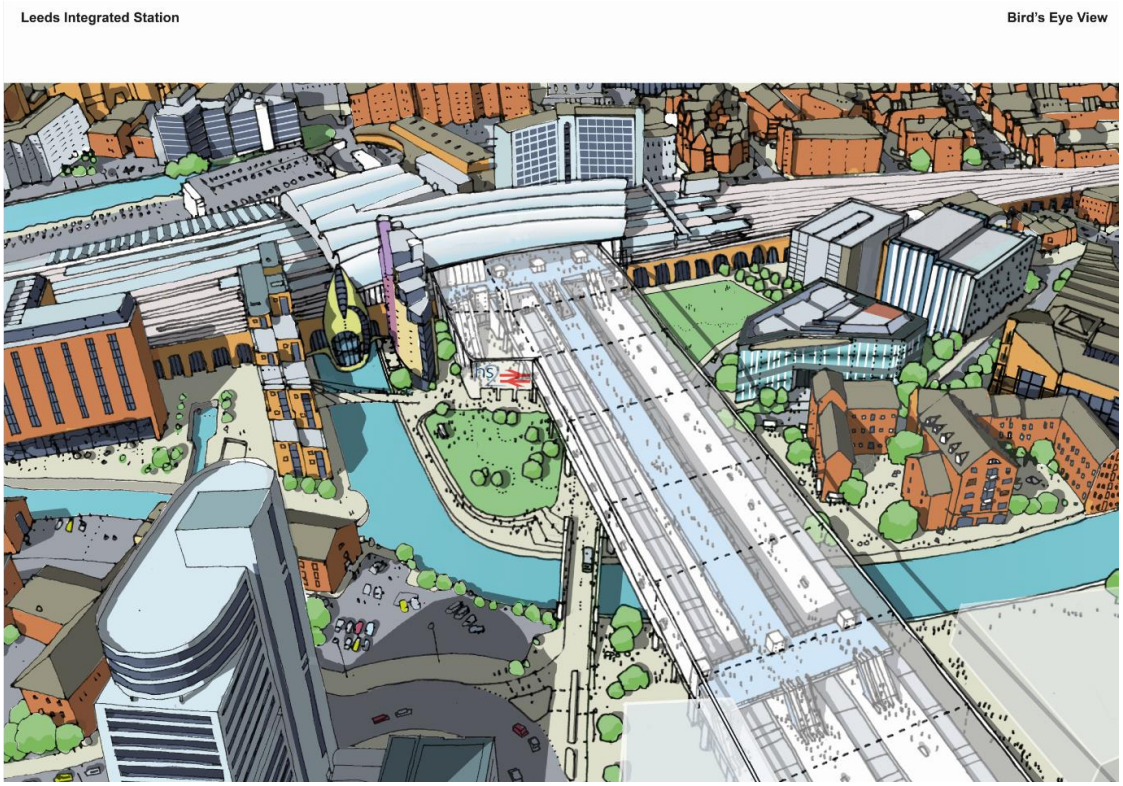

Cross-section looking north
Station Concourse + 35.52m
NR Platform +35.52m(tbc)
NR Line + 34.60m (tbc)
Car Park
Concourse
Network Platforms
High Speed Platforms
Station Concourse (Overbridge) + 49.31m
Notional viaduct
HS2 Platform + 40.48m (tbc)
HS2 Line + 39.72m (tbc)

Access and site compounds

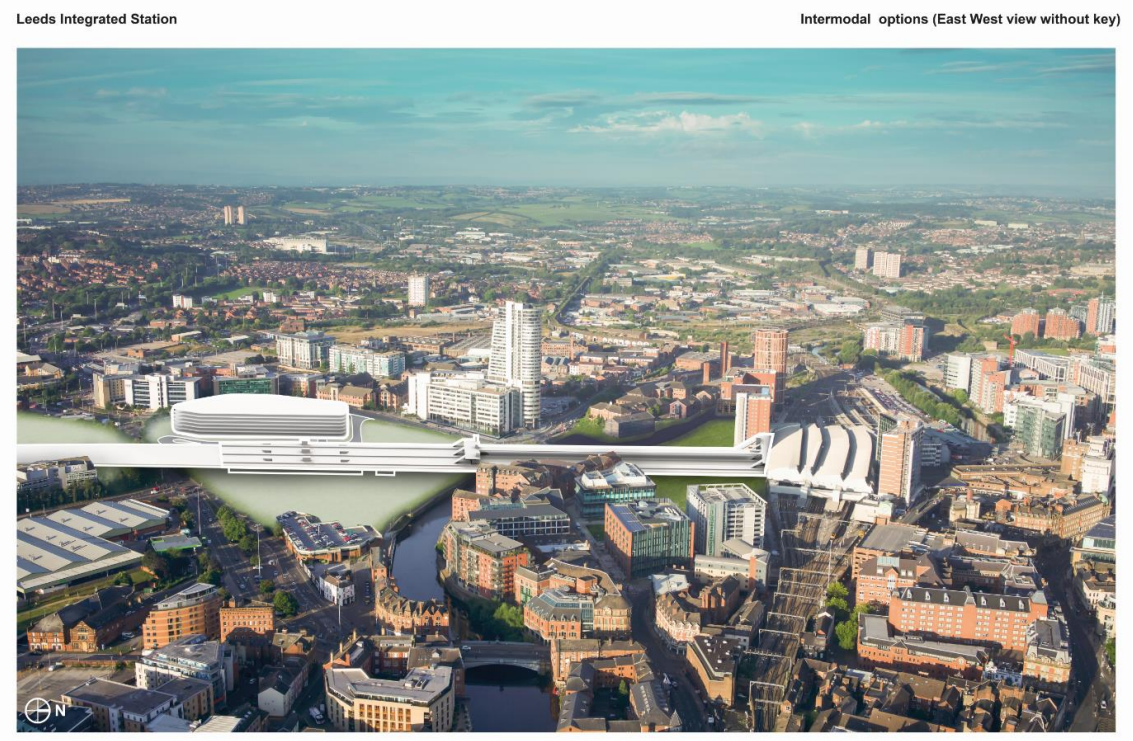
4.1.28 The new junction on the A52 would allow direct access to the site from the trunk road network and, if constructed early, would allow for construction traffic access. On the west side, use could be made of the existing access road to the traction maintenance facility and Toton Yard, provided that any necessary enabling works were carried out. To the north, use could be made of Bessell Lane, but the size and frequency of construction vehicles would be limited by road geometry and the presence of residential properties. The site could also be accessed from the east from Toton Lane.

4.1.29 Construction compounds could be established on the east side, using the land available here. It might also be possible to use the site of the scrap yard on Bessell Lane for the reconstruction of the A52 viaduct. Providing a sizeable compound on the west side of the rail corridor is likely to be more difficult, as this land is occupied by the Toton Yard.

4.2 Leeds station



FArtist's impression of aerial view



Leeds integrated station – location and footprint

Route overview

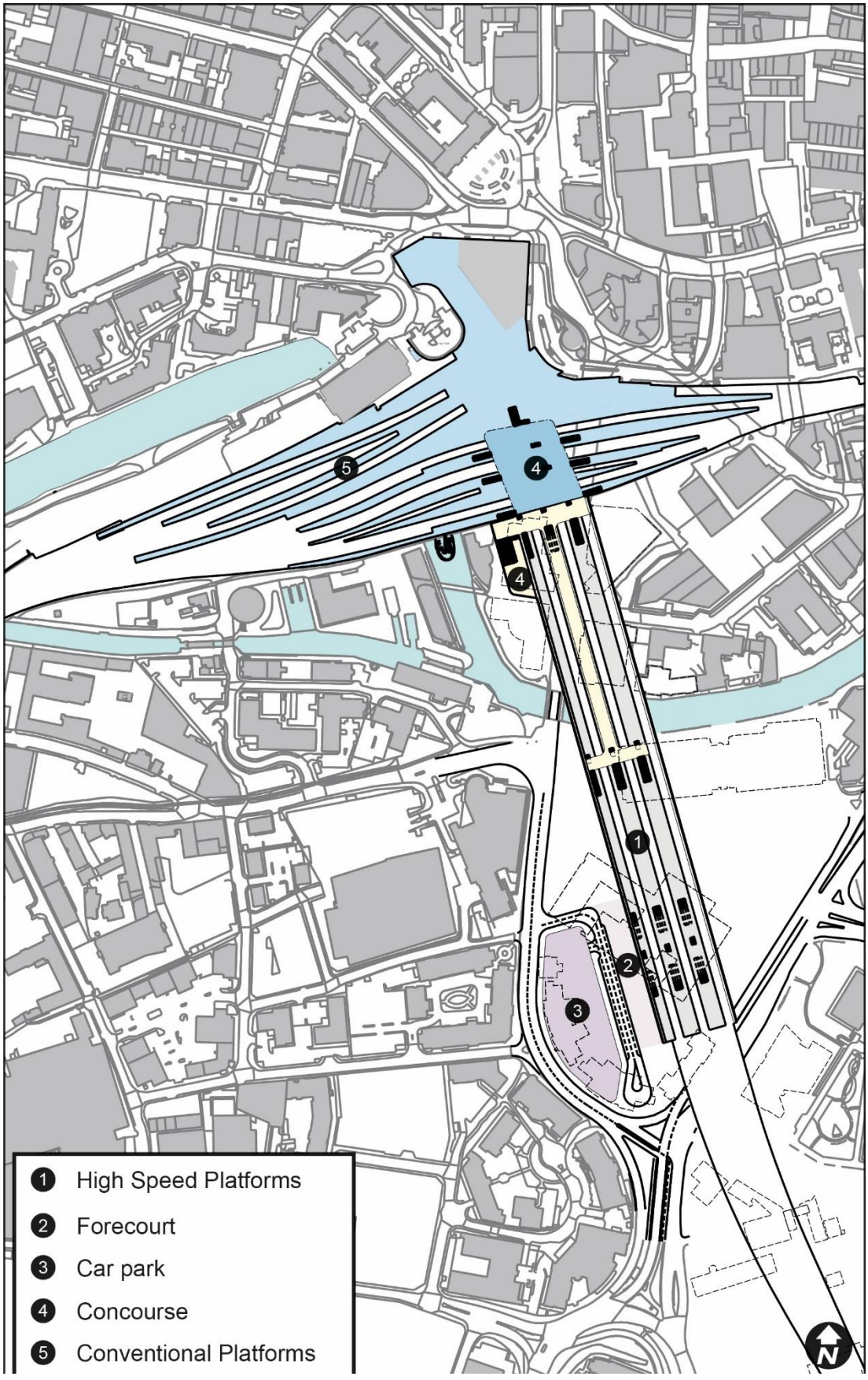
4.2.1 The route would widen sequentially from a twin-track railway to three, four and five tracks, to allow access to and from all the proposed five platform faces. It would rise from below ground level up onto a retained structure. The widening commences where HS2 passes beneath Jack Lane within a retained cutting. The station approach layout would then pass from the cutting onto retained embankment and then the elevated structure on which the station would be situated. For further details, see section 3.14 (HSL22).

Station location and existing site

4.2.2 Leeds station would be a new station, located directly to the south of the existing Leeds station, spanning over the River Aire and Neville Street, and would be aligned approximately north-south. This would provide a direct interchange with the existing Leeds station.

4.2.3 The site would stretch from the southern side of the existing station, between Little Neville Street and Sovereign Square, crossing south of the River Aire and aligned to the east of Victoria Bridge and Bridgewater Place. The station and associated facilities would be built on the sites of Hilton Hotel, BT offices, former KPMG offices, Direct Line Group offices and the Asda headquarters building. To the south, it would pass to the west of Leeds City Office Park and, further south, to the east of Dewsbury Road. To the north of the station, Neville Street leads under the existing Leeds station to the city centre.

4.2.4 The station would be positioned so as to end directly on the south side of the existing Leeds station, with a small pedestrian plaza to the west (in between the station concourse and the river) and a forecourt for vehicular access to the south. The station would be elevated above Neville Street, River Aire, Great Wilson Street and Meadow Lane to offer public facilities at ground-floor level and minimise east-west severance of adjacent transport routes, communities and facilities.



Leeds station plan

Station description

Platforms

4.2.5 The station would comprise five straight platform faces, arranged as two island platforms (440m long, including buffer zone, and 14m wide) providing four platform faces and a single 8m-wide side platform.

4.2.6 The platforms would be elevated above Neville Street and Meadow Lane in order to accommodate the existing road. Access would be from the north and south ends of the platforms.

Concourse

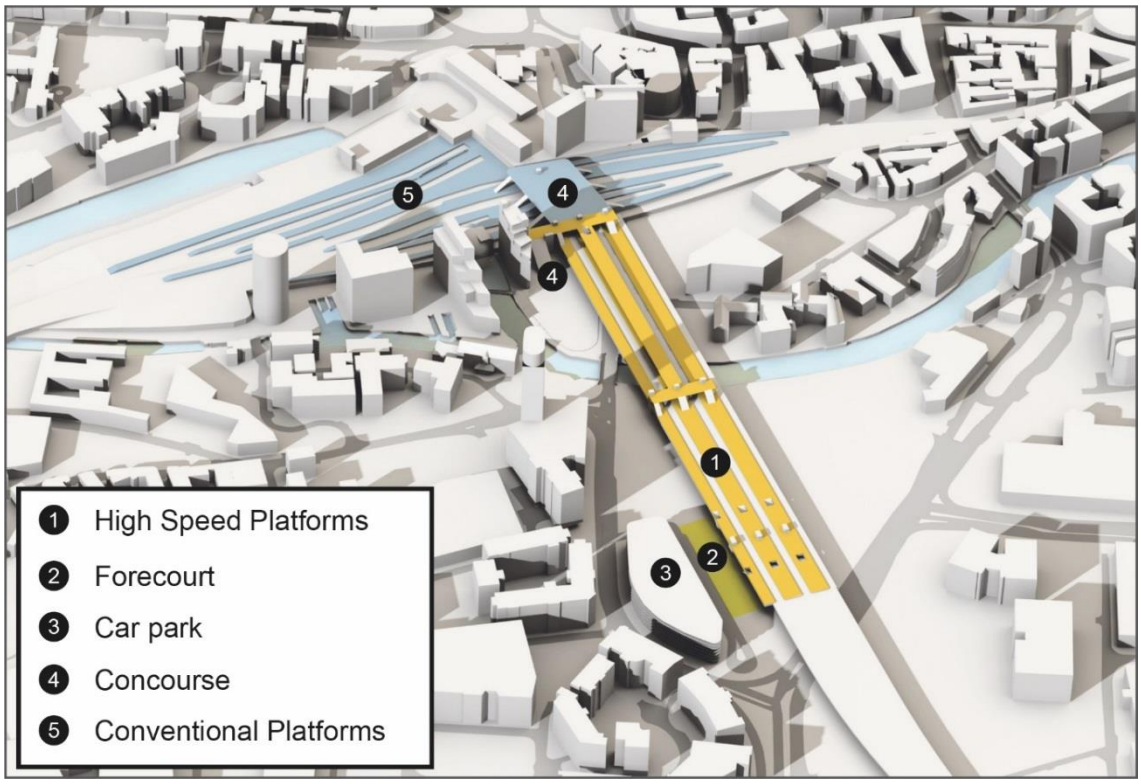
4.2.7 The station would have two concourses. The north concourse would be accessed on the north side of the river for pedestrians for the city centre, bus, and rail interchange. The south concourse, to the southern end of the station, would provide access for passengers from suburban locations, arriving or departing by car via the M621, for drop-off or pick-up and for long-term parking. There would be a dedicated link bridging over the platforms between the south concourse and the north concourse, and passengers would be able to access the platforms from both station entrances.

4.2.8 A direct link would be provided for passenger interchange with Leeds station. This would be a bridge leading from the high speed station to the existing platform via a proposed concourse elevated above platforms at Leeds station.

Forecourt and car park

4.2.9 The south vehicular forecourt and entrances for passengers arriving and departing by taxi, bus and private car would be on the west side of the station off Victoria Road. To accommodate this arrangement, Great Wilson Street would be occupied by the station and vehicular forecourt, with changes required to the local road network. East-west permeability would be provided through opening up pedestrian routes at ground level, under the station platforms.

4.2.10 A car park would be located next to the southern end of the station, adjacent to Victoria Road. The close proximity of this car park to the M621, the Inner Ring Road and the wider motorway network would provide convenient access for passengers from the Leeds suburbs and the wider West Yorkshire region.



Leeds station – layout diagram

Leeds station intermodal options

Accessibility

4.2.11 Pedestrian access to the north concourse would primarily be from the north of the river via Neville Street. Neville Street would be remodelled as an improved pedestrian route with vehicular access restricted to public transport only, to improve links to the city centre and the existing Leeds station.

4.2.12 The station would also be well placed for easy access from other destinations on the south of the river, such as the Holbeck Urban Village and other developments in the vicinity of the station.

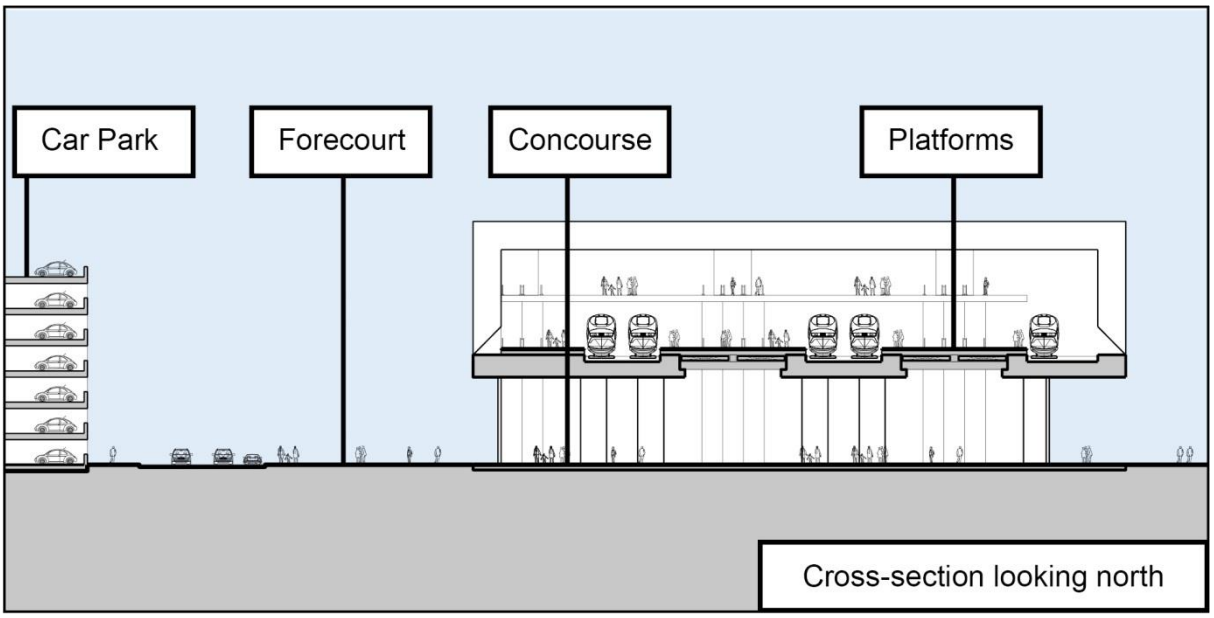
4.2.13 Access to the south vehicular forecourt would be off Victoria Road. This would require local highway modifications, including the closure of the western end of Great Wilson Street as already described.

4.2.14 The south station entrance would provide good access for passengers and car parking to the south of the station from the A653 gyratory (Meadow Road and Dewsbury Road), which would need to be remodelled, and from the M621 and the Inner Ring Road, leading to the suburbs and the motorway network, for destinations in the West Yorkshire region.

Intermodal interchange

4.2.15 Direct interchange with the existing Leeds station would be via bridge link from the high speed station to the proposed concourse elevated above platforms at Leeds station. Alternatively, passengers could access the station by walking along Neville Street.

4.2.16 Bus, taxi and vehicle access to the south concourse would be from the forecourt sited on the west side of the station for passengers arriving from the suburbs.



Leeds station – cross-section

Site constraints

4.2.17 The range of constraints for this station option would include:

- maintaining east-west permeability and suitable local road network;
- minimising impacts to the River Aire, Canal Wharf Conservation Area, Neville Street, the Grade 2 listed Victoria Bridge and other developments;
- creating a combined HS2 and Network Rail concourse while minimising impacts to the existing Leeds Station services.

Constructability

4.2.18 The site is naturally split into parcels by the River Aire and the highways which pass underneath the elevated station structure. As access would be available to all parcels, this would be not a major issue. Traffic management would be required where the construction work crosses over streets. There is also a major interface with the existing station as the elevated concourse would require demolitions of the southern façade and a new structure to be completed above the operating station platforms.

4.2.19 The construction of Leeds station would be carried out in two broad phases. Phase One would cover the construction of the station sub-structure. Phase Two would cover the construction of the station superstructure and the erection of the platforms.

4.2.20 Phase One:

- Clear the site and divert utilities;
- Carry out ground remediation – the extent of required ground remediation

is unknown at this time, but the site history suggests that provision should be made;

- Construct the foundations and piers for the approach viaduct; and
- Install piles and sub-structure for platforms and car park.

4.2.21 Phase Two:

- Install the deck of the approach viaduct;
- Construct the superstructure for platforms;
- Install the platform deck structures and station enclosure;
- Construct the station building and forecourts – the station building would be constructed in parallel to the platform construction works, and pedestrian link to existing station;
- Install railway systems – lay track, install OHLE and signalling, etc; and
- Commission and open the station.

Access and site compounds

4.2.22 Access to the site parcels south of the river is relatively straightforward from Junction 3 of the M621 via Dewsbury Road, Meadow Lane and New Lane. The works north of the river mean encroaching into the city centre area via the one-way system. Traffic planning would be implemented to minimise traffic on the north side to only essential requirements.

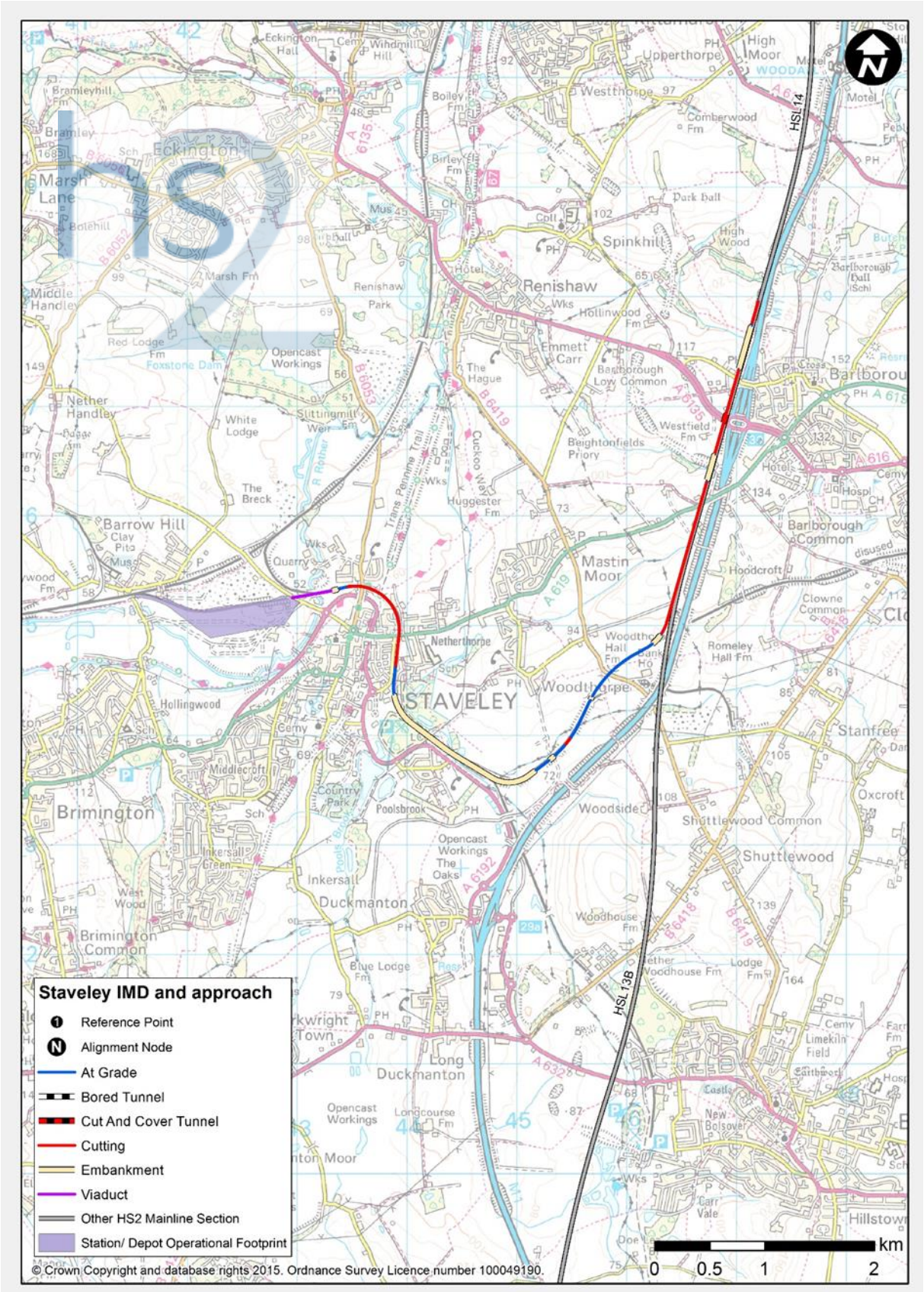
4.2.23 The construction of Leeds Station would require land and property acquisitions near the site. As not all of this land would be occupied by the permanent works, it is anticipated that sufficient space would be available in the immediate vicinity of the station for contractors' compounds and laydown areas.

Programme

4.2.24 It is estimated that it would take approximately five years to construct the station. This period is made up of:

- Year 1 – enabling works, including site set-up, utility diversions, decontamination activities and demolitions;
- Years 2 and 3 – construction of the station structure and the pedestrian link to existing station;
- Years 4 and 5 – fit-out and commissioning of the station.

4.2.25 The station would be ready for installation of railway systems (track, signalling, OHLE, etc.) at the end of Year 3, with the station available for full commissioning in Year 5 and available for full train operations towards the end of Year 5.


Staveley IMD and approach
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
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km
0
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1
2
STAVELEY
Brimington
Duckmanton
Renishaw
Spinkhill
Barlborough Common
Shuttlewood
Mastin Moor
HSL 14
HSL 13B

5 Depots

5.1 Introduction

5.1.1 Two depots would be required for the operation of the Birmingham to Leeds section of HS2. One would be an infrastructure maintenance depot (IMD) as a base from which to carry out engineering activities to maintain and renew the track and other elements of fixed infrastructure, such as electrification systems. The other would be a rolling stock depot (RSD) as a base where the trains for the route would be stabled overnight, for cleaning and maintenance.

5.2 Infrastructure maintenance depot

5.2.1 Staveley IMD would be located south of the existing Chesterfield to Rotherham railway which passes the site. This line forms the principal freight route between the Midlands and the North of England and has a junction with an out-of-use branch to Seymour Junction.

5.2.2 The depot would occupy 26 hectares of the southern part of the brownfield site, where an ironworks formerly stood.

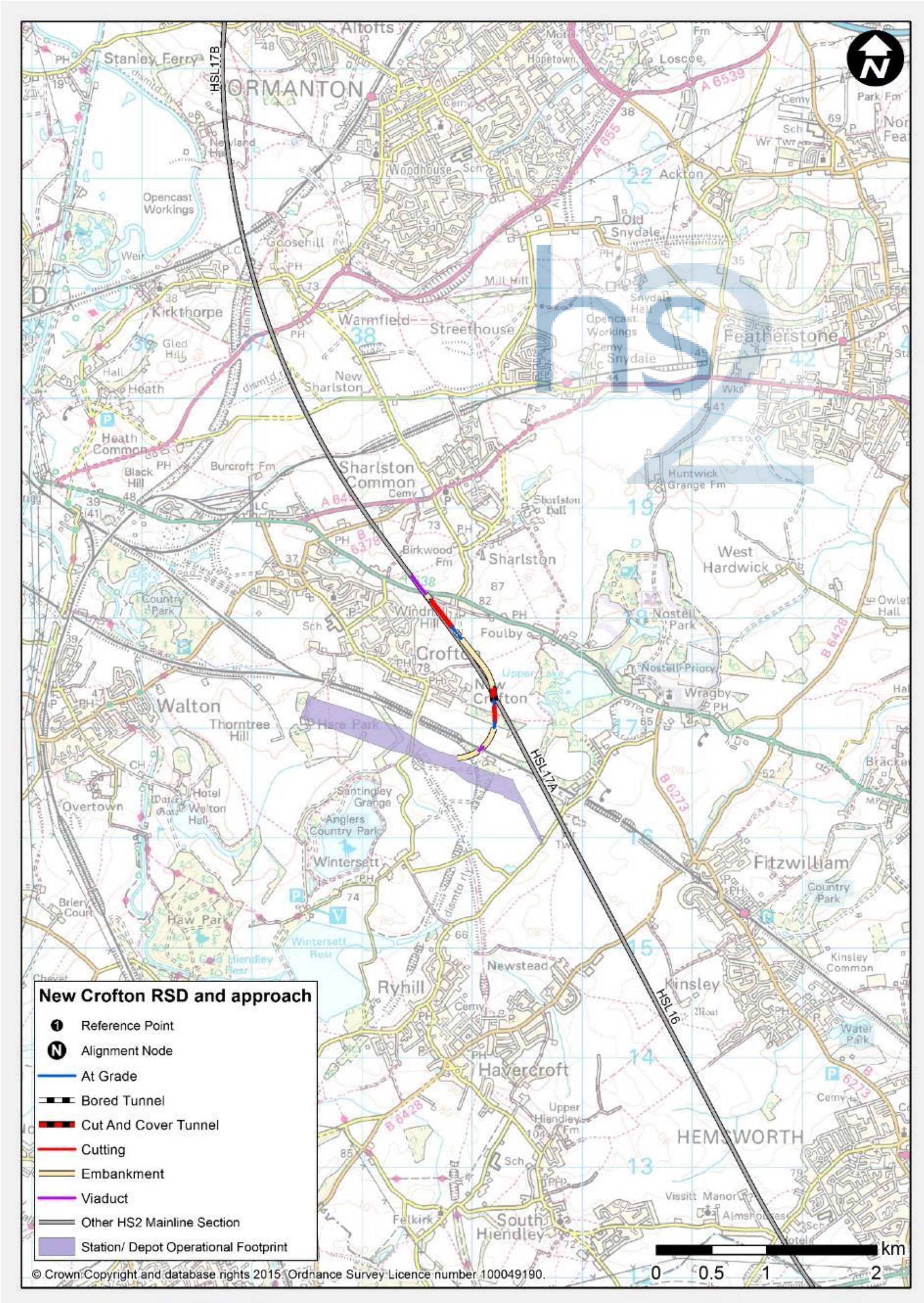
5.2.3 High speed rail access would be via flat junctions off the mainline (HSL13) along an 8.3km long approach into the eastern end of the depot. Two reception sidings allow access north and south. The eastern approach line would descend to cross underneath the mainline before joining the western approach line to run in a former mineral railway corridor through Staveley.

5.2.4 Access from the existing rail network would be near the existing sidings at Barrow Hill, using Seymour Junction for access into the depot. Road access to the site would be off Hall Lane, which previously provided heavy goods vehicles access to the site; therefore, road upgrades are unlikely to be required.

5.2.5 The depot would be single-ended, facing the high speed route, and it would be laid out in accordance with HS2 Ltd's report 'Options for Phase Two of the high speed rail network: Approach to design'.

5.2.6 The IMD would be used to stable and service/maintain a variety of on track plant and engineering supply train equipment. It would also provide strategic engineering material stores. There would be storage for ballast and rail at the IMD, with the ability to deliver supplies via the existing rail network.

5.2.7 The brownfield site may include contaminated land, which would need to be dealt with as part of the proposals. Other than this contaminated land issue, construction of the depot would use standard methods.


New Crofton RSD and approach
Reference Point
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Other HS2 Mainline Section
Station/ Depot Operational Footprint
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5.3 Rolling stock depot

5.3.1 A rolling stock depot would be required for the operation of the West Midlands to Leeds section of HS2 as a base at which the trains for the route would be stabled overnight, for cleaning and maintenance.

5.3.2 New Crofton RSD would be located approximately 14 miles (22km) south of Leeds and 4 miles (6.0km) south-east of the centre of Wakefield. The site would be on a disused coal disposal plant adjacent to the existing Doncaster to Leeds line. The village of New Crofton lies approximately 200m north of the proposed site on the opposite side of the Network Rail line.

5.3.3 The site's location, south of the Leeds junction, would provide access to both Leeds and to the spur to the ECML. It would occupy approximately 39 hectares alongside the existing Wakefield to Doncaster railway.

5.3.4 High speed rail access to the depot from the main route would be via a north-facing grade-separated junction on the north-eastern side of Crofton, south of the Leeds delta junctions. This would enable direct connections from and to Leeds and the ECML. A number of crossovers would be provided on both the arrival and departure connections to enable trains to stand and allow other trains to enter or leave the depot without adversely affecting train operations. The approach line connects into a mid-point of the depot to make the best use of the available land.

5.3.5 Road access to the site would be proposed off Swine Lane, which connects to the main A638 Doncaster Road.

6 Ancillary design works

6.1 Tunnel portals

6.1.1 Tunnel portals are required to fulfil a number of purposes. These include:

- providing a structure to retain the surrounding local topography at the tunnel entrance;
- providing emergency intervention access to the tunnels from the surface;
- providing emergency passenger evacuation where evacuation through the portal is part of the emergency strategy; and
- reducing noise and air pressure effects as trains enter or exit the tunnel.

6.1.2 Tunnel portals would incorporate some or all of the following features:

- portal hoods (tapered, perforated, reinforced concrete structures, up to 150m long);
- building housing services such as power, telecommunications, water supply, fire safety, drainage and ventilation equipment to service the tunnel, in what is known as a 'headhouse';
- parking for service vehicles.

6.1.3 Tunnel portals would take different forms, depending on ground conditions, local topography and train speeds. In rural locations, portals would typically be constructed in open excavation, with soil and rock slopes benched (i.e. cut in steps) and reinforced as necessary, and reinforced concrete headwalls and wing walls around the tunnel entrances. In urban locations and where space is restricted, portals would use earth retaining structures.

6.1.4 Where excavation is relatively shallow, tunnel portals would be constructed by open cut. For deeper excavations, diaphragm wall or contiguous bored pile techniques would be used, requiring support by propping beams or a cover slab for the deepest excavations.

6.1.5 In general, a minimum 'rescue' area of 550m^2 for emergency services would be provided at both portals for tunnels longer than 1.0km and at one portal for those shorter than 1.0km.

6.1.6 The function of the headhouse is to accommodate ventilation fans, lift winding gear and other plant, together with emergency access doors. The headhouse structure would generally be a single-storey building of 4m-5m in height, depending on whether air intakes to fans are required.

6.2 Maintenance loops

6.2.1 Maintenance loops are a series of sidings used to provide stabling for maintenance trains required for operational maintenance work, and failed trains which that cannot readily be pushed through to the next station, so allowing the line to be cleared with limited delay. Depots can be used for this purpose but, due to the nature of the lengths between depots and stations on the proposed high speed network, it is necessary to provide loops between these locations to allow quick start-up of work when the limited engineering hours commence. Assessment of requirements in this respect indicate that such berthing facilities should be supplied on the network, be they stations depots or loops, at no more than approximately 60km intervals along the route.

6.2.2 Ideally, the layout of maintenance loops would comprise two loops or sidings, one either side of the mainline. Each of these loops would be approximately 800m long. Crossovers would also be provided at either end of the maintenance loops to allow for operational movements.

6.2.3 Road access and parking would be provided to these maintenance loops on one side as a minimum. A road rail access point would also be incorporated into the spur siding adjacent to the car park.

6.2.4 Maintenance sidings are available on the Phase One route at Washwood Heath RSD. Based on these, loops would be located at Toton, incorporated into the East Midlands Hub station layout.

6.2.5 Maintenance sidings / loops are also available at Staveley IMD (see section 5.2) and New Crofton RSD (see section 5.3).

Glossary

At-grade – at ground level.

Classic compatible trains – a European high speed standard train which can also run on existing UK rail lines, also known as the 'classic network'.

Concrete trough – a concrete structure in which the route would cross a floodplain at a level below flood level and which would prevent water affecting the route.

Conservation area – designated areas of special architectural and historic interest.

East Coast Main Line (ECML) – Intercity railway route in the UK connecting London, Doncaster, Leeds, York, Newcastle, and Edinburgh.

Engineering hours – the hours during the night when passenger services are not running and engineering work can be carried out on the tracks.

Floodplain – area of land surrounding a watercourse which will be subject to flooding.

GC gauge – gauge is the shape beyond which a vehicle is not to be built, or within which a structure is not to intrude. GC gauge is an intermediate shape between a vehicle gauge and a structure gauge, defining limits to which a vehicle should conform in a limited range of operating conditions.

Grade-separated junction – a junction where one or more routes cross other routes at a different level by being raised above or below them. This could apply to either to railways or highways.

Grade I listed building – a listed building of exceptional interest, sometimes considered to be internationally important.

Grade II listed building – nationally important buildings that are of special interest.

Grade II* listed building – a listed building of particular importance, of more than special interest.

Green tunnel – where earth is built up around and over a section of the rail line to reduce its environmental impacts.

Intermodal interchange – interchange between different forms of transport, for example between rail and tram or bus.

Infrastructure maintenance depot – base for maintenance of infrastructure associated with the proposed high speed rail line, including track, signalling equipment, cuttings and embankments.

Listed buildings - a building of special architectural and historic interest brought under the consideration of the planning system by English Heritage.

Maintenance loop – sidings to allow the berthing of engineering or failed trains alongside the mainline.

Network Rail – owner and operator who runs, maintains and develops Britain's rail tracks, signalling, bridges, tunnels, level crossings, viaducts and selected rail stations. Network Rail owns and manages Birmingham New Street station, Liverpool Lime Street station and Manchester Piccadilly station.

Overhead line equipment – the cables above the trains which carry the electricity supply for the trains.

Rolling stock depot – depot used to service and maintain trains operating on the proposed route.

Sprayed concrete lining – a method for the construction of tunnels, by spraying concrete immediately on the exposed ground to retain it.

Spur – a railway line which branches off the main through route.

Switch and crossing – a rail junction (or set of points) allowing a train to pass from one set of tracks to another, i.e. where a single set of railway tracks split into two sets of tracks.

Tunnel boring machine – used to construct tunnels.

Tunnel portal – the entrance to a tunnel.

Twin tunnel – two tunnels constructed side by side, spaced slightly apart, one of which would take the northbound track and one the southbound track.

West Coast Main Line – Intercity railway route in the UK connecting London, Birmingham, Manchester, Liverpool and Glasgow.

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www.gov.uk/hs2