HS Transpennine Routes and Service Plans

(HS8 and HS9)

HS8/HS9 Routes Mk2

HS3 Mk2 proposes significant enhancement in capacity, to enable further, desirable services to be run. The transpennine routes HS8 and HS9 are intimately linked with HS3 and also with HS7, and several of the proposed new services use HS8 or HS9 for part of their journey. This causes the capacity of the original design to be exceeded, so further capacity is required. No changes in the routes are necessary, but the section between Broughton and Guide Bridge HS Junctions needs to be 4-track. The only change required to the initial implementation is to make passive provision for this.

As few changes have been made to the existing article as are essential, to cover the new situation.

Extra service plans are provided to illustrate the introduction of and the benefits enabled by the 4 track section.

The Purpose, Background and Method

This article refers to and should be read in conjunction with my article 'Towards a High Speed **Network**'. That article sought to make the case for developing a network plan for all the HS routes which will eventually be needed, and, as a contribution to getting the discussion started, gave my own thoughts of what such a network could look like. Naturally, this involved describing a number of routes, in varying but superficial detail. This lays me open to the charge, something on the lines of 'That's all very easy to say, but how would you actually go about doing it?' Accordingly, a decent respect to the opinions of the interested public requires that I should go into more detail on the individual routes. The present article deals with HS8, the Southern Transpennine route, whose core section is from Liverpool and Preston to Sheffield, and HS9, the Northern Transpennine route, whose core section is from Liverpool and Preston to Leeds and York, sharing the route of HS8 west of Guide Bridge.

The general route is decided on strategic and business grounds, thus which locations are to be served. This gives the general alignment, at a very high, superficial level. I plan the detailed route using Ordnance Survey maps, taking careful account of the shape of the landscape, from the contours. I note the location of all significant infrastructure, thus tunnels (generally, over about a quarter mile in length), viaducts and major river crossings. I simultaneously make a virtual tour of the route from my computer, via satellite maps, to make sure, as far as possible, that there is actually room for my lines where I wish to put them, and that, for example, a housing estate has not materialised in an inconvenient location since the (paper) map was published. (I understand that the images used by satellite maps are up to a maximum of three years old, so not exactly real-time, but still pretty good.) I make a great effort to avoid any housing. I'm blasé about demolishing warehouses – after all, all that's required there is to build a (better) new one nearby, and the owners will be very happy. But I regard demolishing housing (or even getting very close to it) as a thoroughly bad idea; people just don't like it, and I understand their feelings. If ever I must (knowingly) propose to demolish housing, I will point out the fact.

In general I try to follow an existing alignment, railway or motorway, (or, very occasionally, of a non-motorway road,) if there is a suitable one available, simply because it's there already, in the right place, with good layout, (somebody else has done all the hard work!) and, except in a very few places, there's plenty of room available adjacent to it. (In this context, motorways are particularly helpful. Nobody wants to live close to one, so house builders don't develop new estates at the side of motorways, leaving plenty of space available for new railways.) Also, most importantly, it minimises disruption, and so I (optimistically, perhaps) expect it to maximise public support and minimise opposition.

When I am following an existing alignment, (this obviously includes taking over the route and trackbed of a former railway, now closed,) I don't generally worry about gradients, confident that they will be well within the capacity of HS trains. Very occasionally, when following a motorway or (more likely) non-motorway road, the contour pattern suggests that there might be a problem, and then I do check the gradients, (and state what these are, in the route plan). When I am obliged to design a completely new alignment, then the gradient profile forms part of the design, and will be stated, (unless, from the contours, it's obviously essentially level, or undulating but with no significant underlying change of level). HS8 has an entirely new alignment across the Pennines between Glossop and Sheffield, and between Ladybower and Huddersfield; complete gradient profiles are provided. (It likewise has a largely new alignment between near Melton Mowbray and Ely, but this is essentially level.) For HS9, an alternative route is offered on an entirely new alignment approaching Huddersfield, also the section between Huddersfield and Leeds has a largely new alignment; gradient profiles are provided.

I believe that this approach gives a route which in general terms is practicable and satisfies the requirements, though obviously a lot of work, especially detailed surveying on the ground, would be needed to turn it into an implementable design. Specifically, I can say nothing about cuttings and embankments, though I may note that a particular piece of landscape is strongly undulating, so cuttings and embankments will be required. Also, when I take the route alongside an existing railway or motorway alignment, I don't attempt to design it in any detail around (particularly motorway) junctions, although I do note on which side it runs, and wherever it is necessary to cross over to the other side.

The Maps

Naturally, the chosen route must be illustrated with maps. I briefly describe the route, giving the map reference of all significant points (invariably of tunnel end points and significant river bridges), but the accompanying maps are the real definition. Mapping software can be very expensive, but fortunately the Ordnance Survey makes available, free of charge, the OS OpenData product suite, of which I use two components, the 1:250000 Scale Colour Raster data set and the Strategi Dataset. The former comes as a set of TIFF files, each containing one of the standard National Grid 100km Reference squares. These are easily converted into Microsoft Paint files and edited. These are, in other words, pure graphics, and are the basis of the detailed maps in the 'Route' section. The maps reproduced in the text all represent an area 20km in width (unless noted otherwise) and 10 km high (if the detail I wish to show will fit within that, but otherwise as high as necessary). They do actually contain contours, but not many; the scale is too small for contours to be really informative. For the present purposes, this scale is adequate; if you need more detail, use them as an index to the corresponding 1:50000 Landranger or 1:25000 Explorer maps.

The Strategi Dataset contains GIS (Geographical Information Systems) data, which has to be processed by special software; I have used the Open Source QGIS product. This has been used to produce an overall

map of HS8/HS9, including sections of other routes over which HS8/HS9's services run. These overall maps come at the end of the 'Route' description, and also show HS8/HS9's classic compatible services on classic lines (these are shown as dotted lines). Also included there are maps of the overall HS Network.

In all the maps I use the following colour scheme for the various routes:

As the various route plans have been developed, the maps have been updated, so now they show all routes, as relevant. The maps in the present article are thus not limited to HS8/HS9.

The Service Plans

The Route section of this document describes the complete lines in their final, full configuration (as far ahead as the plans consider). The service plans explain how that final state is reached: the order in which sections are opened, and the services which run on these partial configurations. The aim is always to get useful services running as soon as possible, to maximise return on the investment.

The service plans deliberately envisage maximum frequencies, to give an impression of just how much the system **could** accommodate. Initial services would certainly not be so intensive, probably no more than half of the frequencies quoted.

A standard HS station has two island platforms, thus two platformed tracks in each direction. If some of the services passing through the station are non-stop, then the main line must pass through the layout without adjacent platforms, either through the centre of the alignment, in tunnel below or on viaduct above, or the station must be on a branch loop off the main line, which thus bypasses it completely. In fact, all HS8/HS9 stations are served by all services, so don't need overtaking/avoiding lines.

Several service plans are developed, reflecting the piecemeal development of the network. As new sections open, further services come into operation. In all cases, consideration is given to maximum

loadings – which section(s) are fully loaded and thus determine the maximum service frequencies. In general I take 16tph as the maximum throughput; if this is ever exceeded, the fact will be highlighted.

Two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic compatible) which travel on HS8/HS9 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS3, to York and Preston. It's all rather arbitrary, at present. Provided that there are no difficult technical issues in running double deck trains at 250mph, and that public reaction to them is favourable, I would like to see all GC gauge services run with double deck trains. (The Swiss like them.)

It is important always to bear in mind that the HS network is **not** a separate, stand-alone system, but an integral part of the complete railway network, hence the importance I attach to showing precisely how HS services interact with classic (RM) ones. (In this context it is worth pointing out that if, when HS lines come into service, the current ridiculous and illogical franchising system is still in operation, it will be necessary to include the corresponding classic route(s) in the same franchise as a HS route, with a strict contractual obligation on the franchisee to ensure close integration of HS and classic services. It certainly won't happen otherwise.)

Estimated Journey Times

Following the service plans, estimated journey times are produced for all GC-gauge services. The assumptions and approximations made are explained.

HS8/HS9 Route – Introduction and Assumptions

HS8 follows classic alignments much of the way in Lancashire, but from Glossop to Sheffield, together with the Huddersfield branch and the crossing of Manchester, the alignments are completely new.

Two route versions are provided for HS9 between Guide Bridge and Huddersfield, using existing alignments and a largely new alignment. The original route was 4 track throughout, and HS9 could readily use two tracks, but it wouldn't be particularly high speed; it would on the other hand be much cheaper than a completely new route. Between Huddersfield and Leeds, a completely new alignment (though in some parts using old alignments) is proposed in either case.

The maximum speed for HS8 and HS9 is 300kph, 187.5mph, throughout; the non-stop runs are not long enough to take advantage of a higher speed, and 300kph is adequate, with no detriment to the service provided, and with significant savings in construction costs. (The limit of 300kph applies throughout on HS8, except where it shares route with HS3, from Beighton Junction to Nottingham, and with HS2, between Liverpool and Kenyon West Junction – the 360kph continues to Victoria LL, and between

Preston and Gibb Farm Junction – the 360kph continues to Bolton.) HS8 and HS9 in their entirety have the characteristics of a HS metro.

HS8 Route – Junctions

There are various junctions on the route of HS8, enabling connections with other HS and classic routes. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

- Gibb Farm SD627107 Connection to HS2 diverges (joins HS2 at Bamfurlong Junction, and enables GC-gauge services between Preston and London).
- Bamfurlong SD600016 HS8 joins HS2, as noted above.
- Kenyon West SJ628961 Connections to HS2 diverge (joins HS2 at Kenyon South Junction enabling GC-gauge services between Liverpool and London, and at Kenyon North Junction, enabling CC services between Liverpool and Scotland).
- Kenyon South SJ399955 Connection from HS8 and Liverpool joins HS2 main line to south.
- Kenyon North SJ634968 Connection from HS8 and Liverpool joins HS2 main line to north.
- Broughton SJ826994 Preston branch joins main line (underground).
- Guide Bridge HS SJ928975 HS9 diverges from HS8.
- Ladybower SK201864 Huddersfield branch joins main line.
- Woodhouse HS SK433850 Enables HS8 classic-compatible services to join classic route to Gainsborough.
- Beighton SK447838 HS8 joins HS3.
- Nuthall North SK514469 HS7 diverges from HS3.
- Nuthall South SK509425 Nottingham branch diverges from HS3 main line (*).
- Strelley SK512423 Connects HS7 to HS3 Nottingham branch (*).
- Manvers St. SK588393 HS3 Nottingham branch diverges from classic route east of Nottingham station (*).
- Edwalton SK601347 HS8 diverges from HS3 Nottingham branch.
- Asfordby SK711199 Classic route to Melton Mowbray diverges from HS8.
- Pellett Hall TF148042 Connection from classic ECML.
- Thurlby TF084168 HS10 joins HS8.
- Ely HS:
  - North TL554820 HS8 branch to Ely HS South Junction diverges from HS8 main line to Ely HS East Junction (for Norwich)
  - South TL559809 HS8 joins HS6 to Ely station
  - East TL573808 HS8 joins HS6 to Norwich

(*) These junctions are on HS3, on the section shared with HS8, but appear in the route loading tables.

There are various other links between HS8 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context.

HS9 Route – Junctions

Likewise for HS9:

- Guide Bridge HS SJ928975 HS9 diverges from HS8.
- Paddock SE124161 HS8 branch from Ladybower Junction joins HS9.
- Gelderd Rd. North SE282322 HS3 joins HS9 west of Leeds New Lane station.
- Garforth West SE387342 Spur to HS3 diverges from HS9.
- Garforth East SE395341 Spur from HS9 joins HS3 main line to York.
- Micklefield HS SE439327 HS9 joins classic route to York at relocated and expanded Micklefield station.

There are various other links between HS8/HS9 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context.

There now follows the definition of the actual route, in several logical sections.

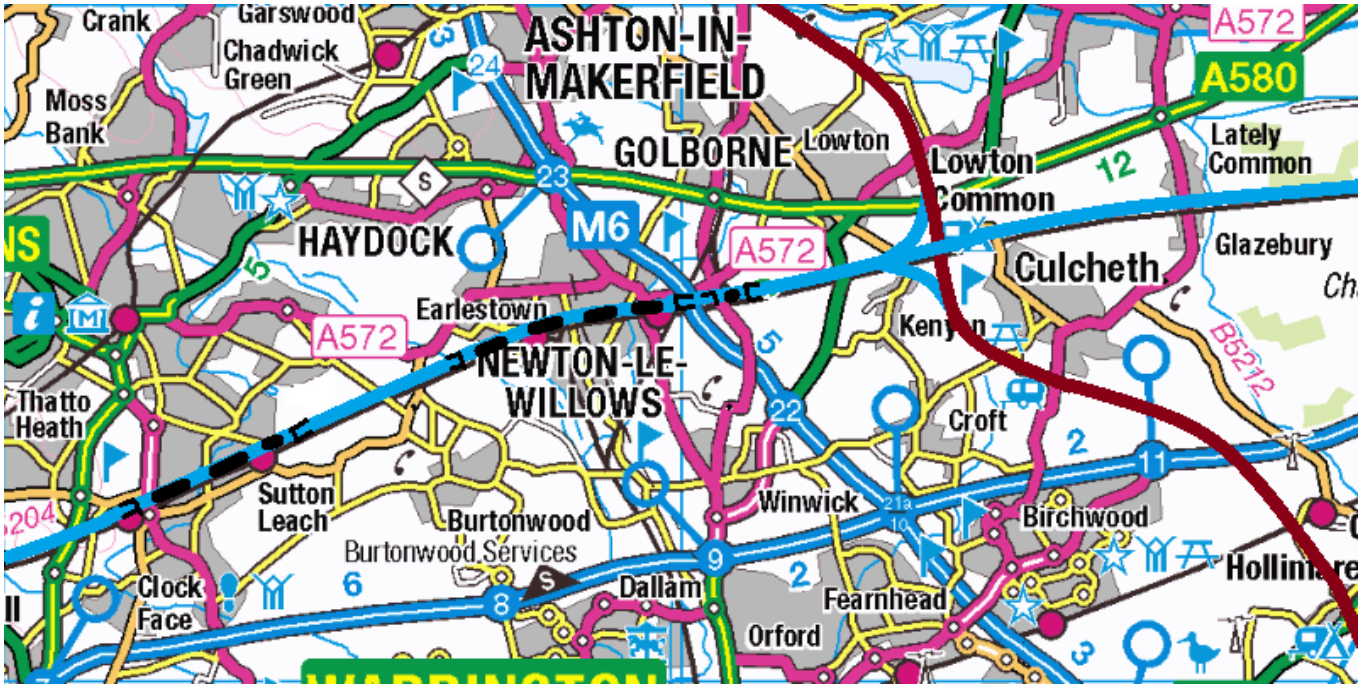
1. *HS8 Liverpool – Manchester*

HS8 begins at Liverpool Lime Street station, with 3 new HS island platforms (6 faces) on the north side of the existing station. (4 islands – 8 faces – would be even better, if there's room.) The area between the station and Lord Nelson St. seems ripe for redevelopment – a lot of it is car parks, and there are a couple of office buildings which could be replaced by office development above the HS station.

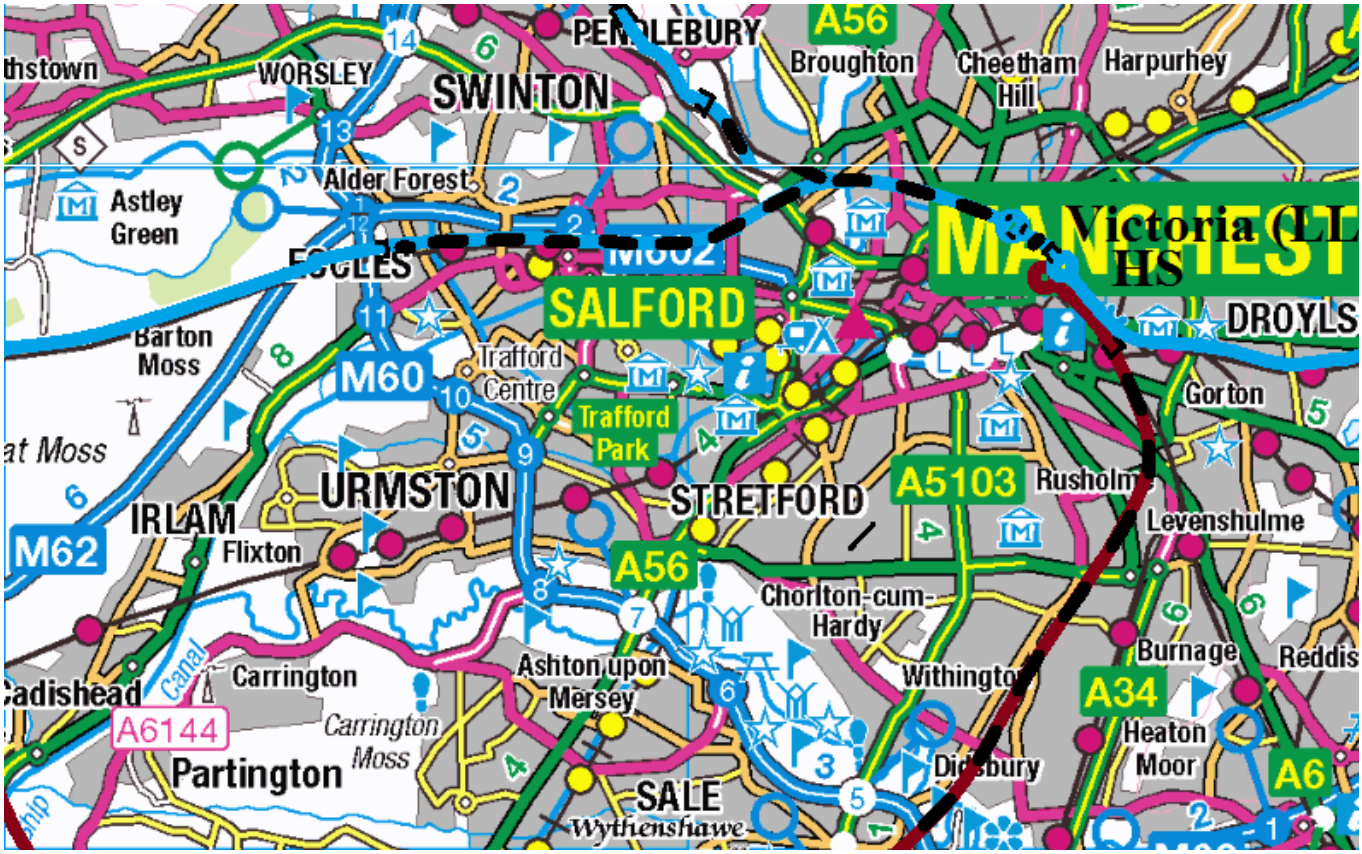
1.1 Liverpool – Rainhill Contains Ordnance Survey data © Crown copyright and database right 2013

The route starts in an easterly and slightly northerly direction for a short distance, until it meets the disused Waterloo tunnel, which it takes over (enlarged to GC gauge) and thus reaches Edge Hill. It then follows the north side of the alignment of the Chat Moss route all the way to Manchester (Patricroft, actually). There were originally 4 tracks out as far as Huyton. The HS tracks will have to climb over the junctions for the docks branch in Olive Mount cutting. A ¾ mile tunnel under Broad Green station is required between SJ399903 and SJ410903, to avoid housing. Further tunnels are required under Whiston and Rainhill, 2½ miles between SJ454908 and SJ496915, under St. Helens Junction, 2 miles between SJ518924 and SJ540932, and under Newton le Willows, 2 miles between SJ570948 and SJ598953, for the same reason. A further short tunnel (½ mile) or cutting passes under Parkside East and West Junctions. At Kenyon West Junction, SJ628961, spurs link to HS2, at Kenyon South and North Junctions, allowing GC gauge services between Liverpool and London and classic-compatible to Scotland. There is nothing further of note until Patricroft. At SJ754987 HS8 enters a 5½ mile tunnel to Manchester HS station, curving gently to the north to Broughton (underground) Junction, at SJ826994, where the line from Preston joins, following the arc of the Irwell round to Manchester Victoria (Low Level), at right

angles to the surface station, then under Shudehill, Thomas St. and Dale St., and under the Rochdale canal.



1.2 St. Helens Junction – Glazebury Contains Ordnance Survey data © Crown copyright and database right 2013



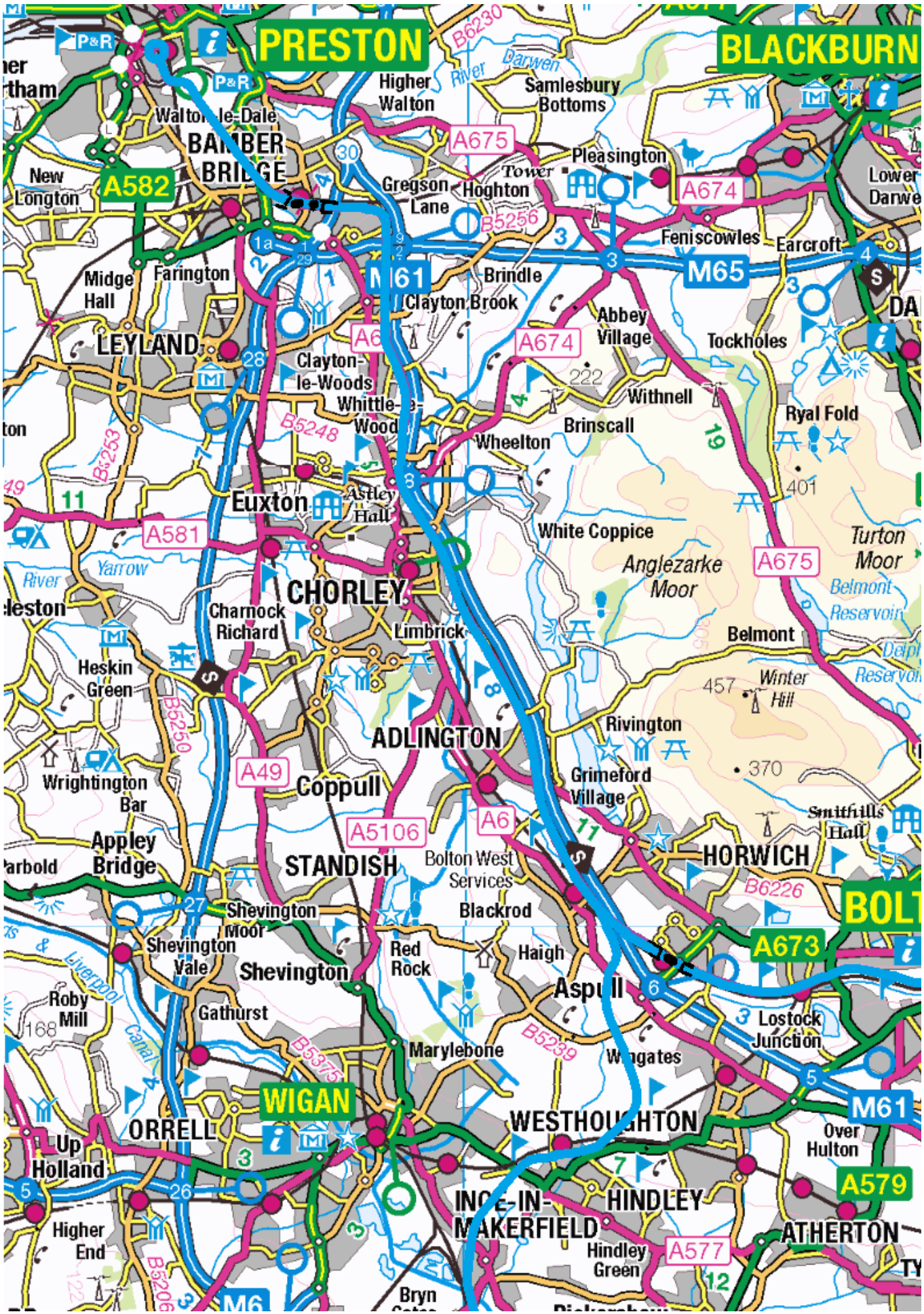
1.3/2.3 Chat Moss – Manchester Contains Ordnance Survey data © Crown copyright and database right 2013

2. HS8 Preston – Manchester, including Connection to HS2

There is a currently disused (for passenger traffic) island platform on the west side of Preston station, and room for another beyond that. This is the obvious place to locate the HS platforms. The existing viaduct over the Ribble has a section on the west side currently only partly used – one track is in place across it, with room for two; again, just right for the HS tracks (the rest of the bridge already having 4 tracks). HS8 diverges from the WCML alignment immediately south of the Ribble Viaduct, at SD535282, and curves round to pass under the WCML using the existing former alignment at SD535278, and following this round to join the north side of the alignment of the current line from Preston to Blackburn, before Bamber Bridge. It tunnels under Bamber Bridge station, from SD563258, emerging ½ mile later on the south side of the alignment at SD570257. This it follows to SD580257 where it diverges to join the west side of the alignment of the M61 motorway at SD584254. This it follows all the way to Horwich, encountering no obstructions. There are a number of new housing developments along the way, but they all very conveniently keep well clear of the motorway (perhaps noise screens may be appropriate in some locations). At Horwich, HS8 diverges from the M61 at SD627107, Gibb Farm Junction, where the branch to HS2 south of Wigan diverges (see later), and joins the north side of the alignment of the Preston – Bolton line at SD630100. A short tunnel is needed under Horwich Parkway station (since the station buildings and car park are on this side. After which there are no further obstructions until SD700086, where it enters a 1 mile tunnel to Bolton station. There is a large space on the east side of the station, between the station and the Manchester Rd., currently occupied by a supermarket or some other retail outlet which would provide an ideal location for the HS platforms; some mutually advantageous arrangement could doubtless be reached.

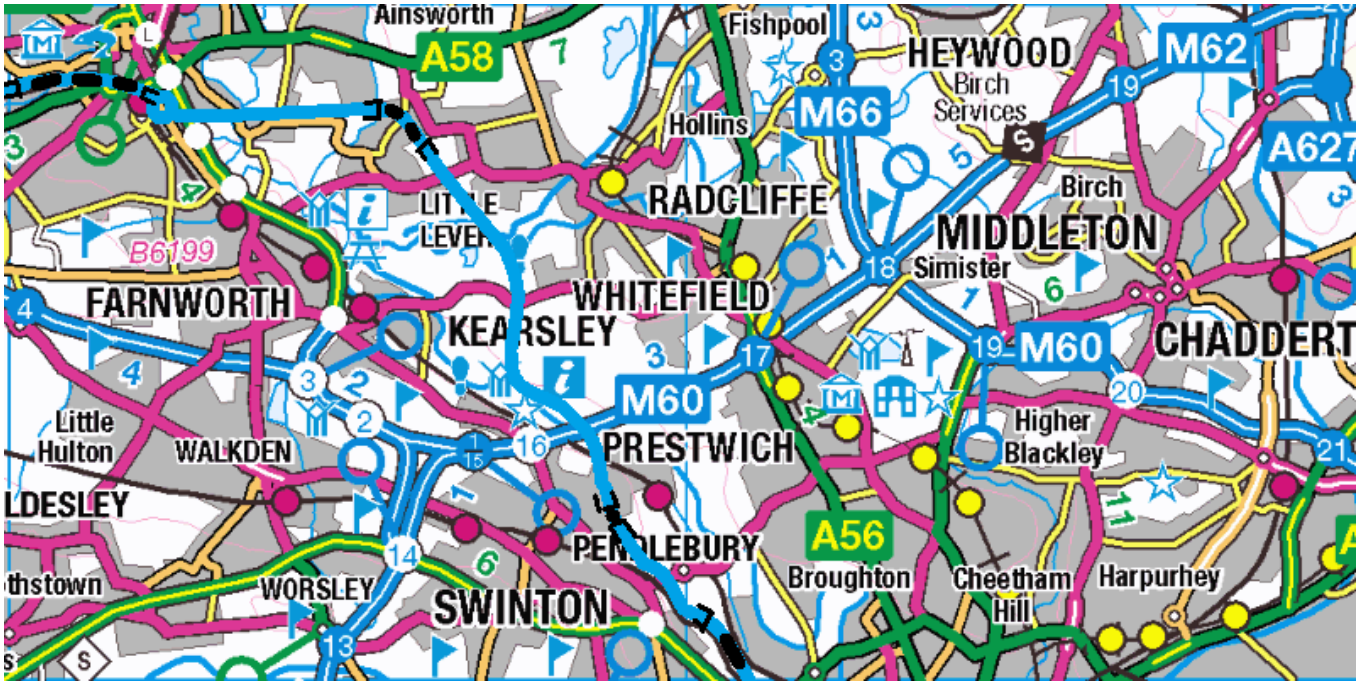
The HS2 branch diverges at Gibb Farm Junction, and continues alongside the M61 alignment until that crosses the Preston – Bolton classic line, and HS8 also, at SD633098. It then itself diverges from the M61, and takes over the trackbed of a long disused line from Horwich Fork Junction to Hindley (Crow Nest Junction). The only obstruction on this entire section occurs as SD630090, where is crosses the A6. A hotel has been built at precisely that point. However, by slewing the alignment few yards to the south east, there is a space for it to cross the A6 at SD632089. It crosses just west of Crow Nest Junction, at SD628053, and follows the south side of the alignment of the line past Hindley station, diverging at SD607047, immediately after crossing the A577. From here, a new alignment crosses Amberswood Common, crossing the A573 at SD600032, finally joining the east side of the WCML alignment at SD597028, continuing along that until it meets the HS2 Wigan arm at Bamfurlong Junction.

From Bolton, HS8 follows the trackbed of the former Bury line to SD753083, where it enters a ½ mile tunnel, curving to the south and emerging at SD760080, on a new alignment. It crosses the A6053 at SD766075, passing Harper Fold at SD769072, crossing the Manchester, Bolton and Bury canal at SD773068 and the Irwell at SD773067, and joining the alignment and taking over the trackbed of the former line from Radcliffe Junction to Clifton Junction and Patricroft, at SD775060. It follows this route a little way past Clifton Junction (crossing over the classic line from Bolton to Manchester), diverging at SD794023 and passing under Pendlebury in a ¼ mile tunnel between SD797015 and SD798013, joining the east side of the Wigan – Salford alignment for a short distance and diverging at SD806006 and entering a 1½ mile tunnel to Broughton (underground) Junction, where it joins the HS8 line from Liverpool.



2.1 Preston – Bolton / Haigh – HS2 branch

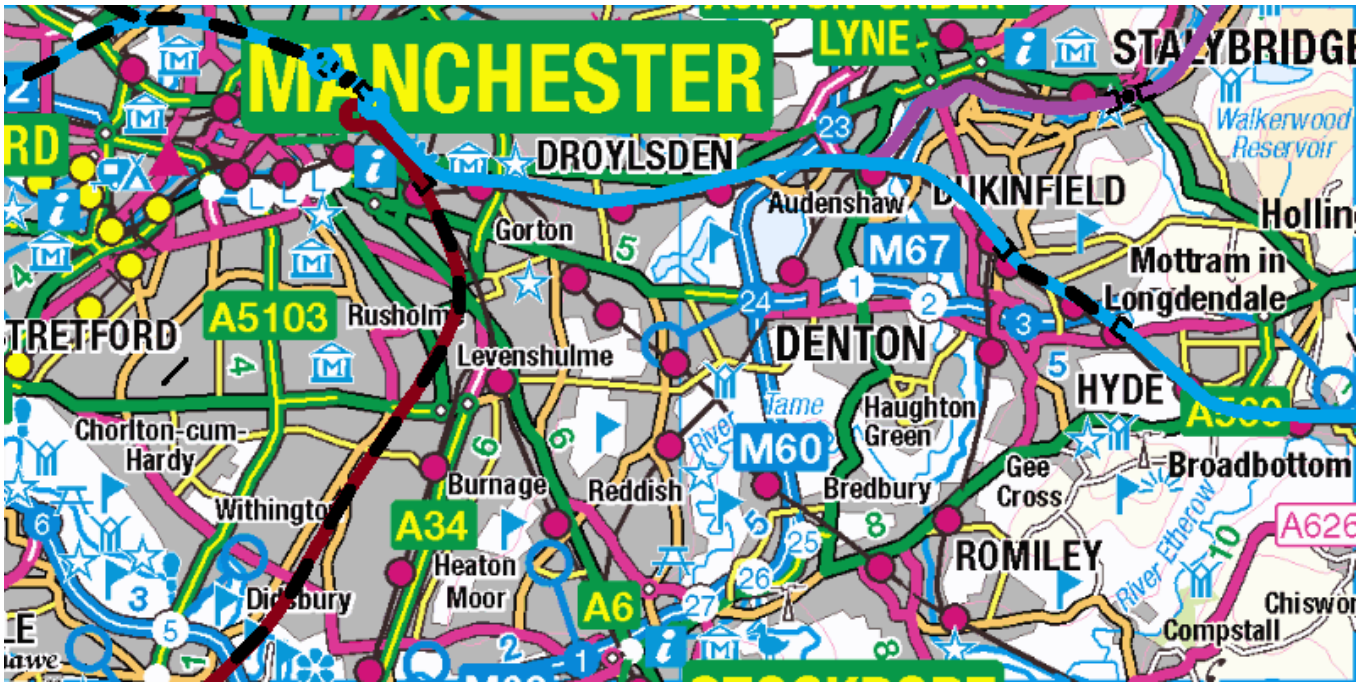
Contains Ordnance Survey data © Crown copyright and database right 2013



2.2 Bolton – Pendlebury Contains Ordnance Survey data © Crown copyright and database right 2013

3. *HS8 Manchester – Beighton Junction*

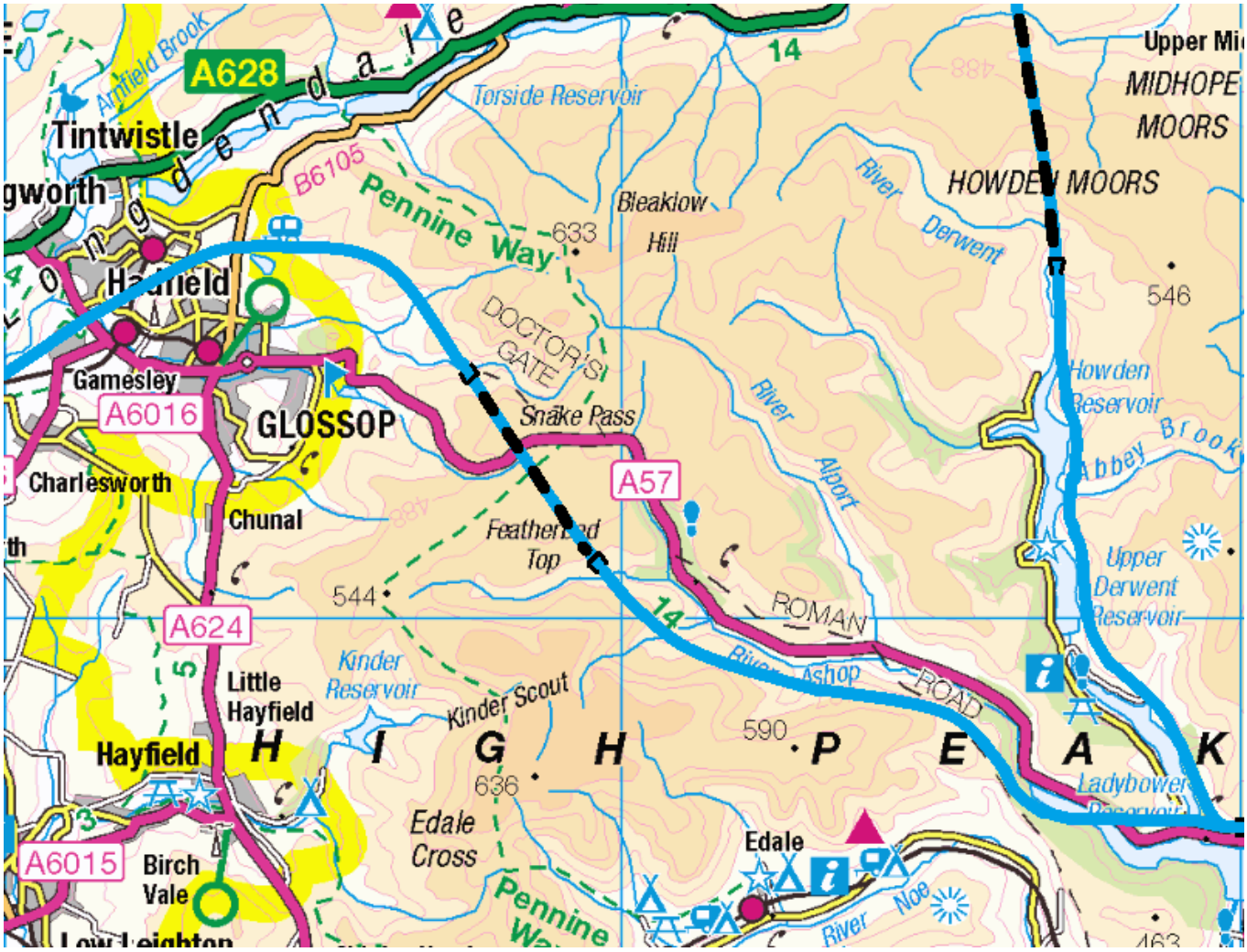
HS8 leaves Manchester HS station and follows the north side of the alignment of the Woodhead route. This originally had 4 tracks as far as Hyde North. At Guide Bridge HS Junction (SJ928975) HS9 diverges for Huddersfield and Leeds. From Hyde North to Godley a 1½ mile tunnel is required, between SJ945964 and SJ964951. HS8 diverges from the Woodhead route at SJ994938, immediately before the Etherow viaduct, passing over the Etherow and Dinting Vale, and crossing the Woodhead route at Dinting station.



3.1 Manchester – Broadbottom Contains Ordnance Survey data © Crown copyright and database right 2013

From Higher Dinting (SK023949, 600ft altitude) HS8 climbs to the 750ft contour near Old Glossop (SK045958), 150ft in 1½ miles – 1 in 53. The route ascends along the side of the hill, reaching the

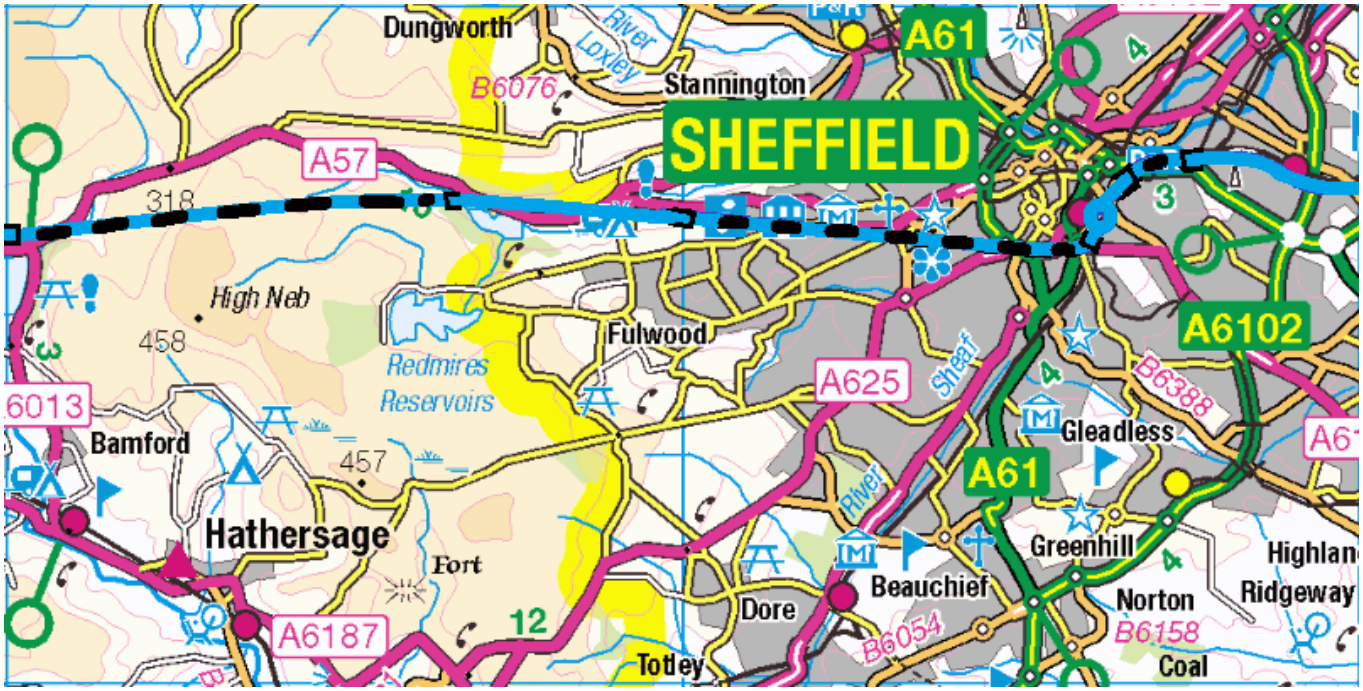
entrance to the Snake Pass Tunnel, altitude 1000ft, at SK076941, 250ft in 2¼ miles – 1 in 47. The Snake Pass Tunnel is 2¼ miles long, emerging at SK093907, altitude 1250ft, 250ft in 2¼ miles – 1 in 47. This is the summit of the line. It descends Ashop Clough, turning right opposite the Snake Inn, then descends along the south side of Woodlands Valley to reach the 750ft contour at SK176867, 500ft in 6 miles – 1 in 63.



3.2/7.1 Glossop – Ladybower Junction Contains Ordnance Survey data © Crown copyright and database right 2013

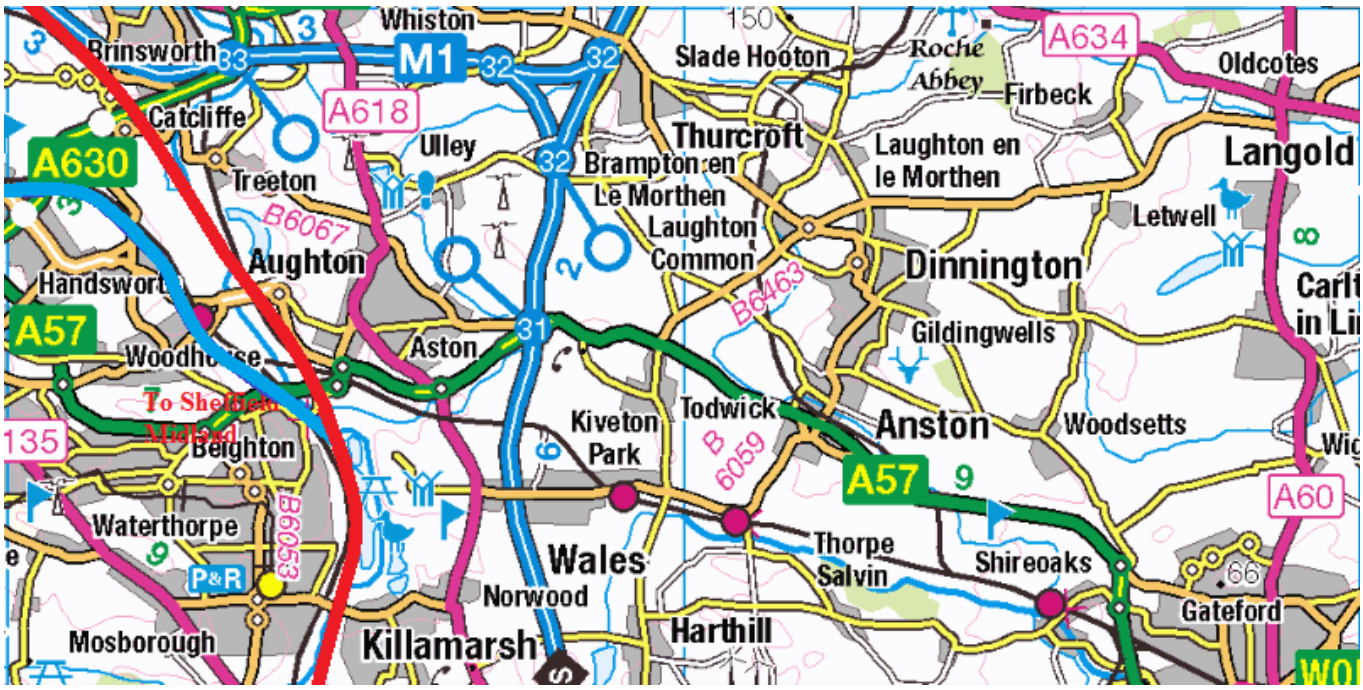
It holds to the 750ft contour, or to that height in tunnel, for the next 6 miles. From SK176867 it crosses to the north bank of the reservoir at SK180867, which it follows to SK190866, where it crosses the north arm of the reservoir, alongside the road bridge. At Ladybower Junction (SK201864), the branch from Huddersfield merges, and immediately afterwards the route enters a 4 mile tunnel under Hallam Moors, emerging at SK267872, still at 750ft. The route now resumes its descent, past the Rivelin Dams, to SK300872, altitude 500ft, 250ft in 2 miles – 1 in 42. Here it enters a 3 mile tunnel under Sheffield, emerging (after a sharp left-hand curve) at SK359866, immediately to the south of Sheffield HS station, at an altitude of 200ft, 300ft in 3 miles – 1 in 53. Immediately before emerging, it has to pass below the classic Midland tracks, and also the former diveunder where the line from London passed below the Hope Valley tracks (just in case we need it in the future).

Sheffield HS station is immediately behind (to the east of) and above the existing Midland station (at the level of the current Supertram alignment), at the bottom of Park Hill. There are minor variations in position possible, determining precisely how much excavation of Park Hill is required and how heavy the retaining walls. My preferred solution has it extending partly over the eastern island platform of Midland



3.3 Ladybower – Sheffield Contains Ordnance Survey data © Crown copyright and database right 2013

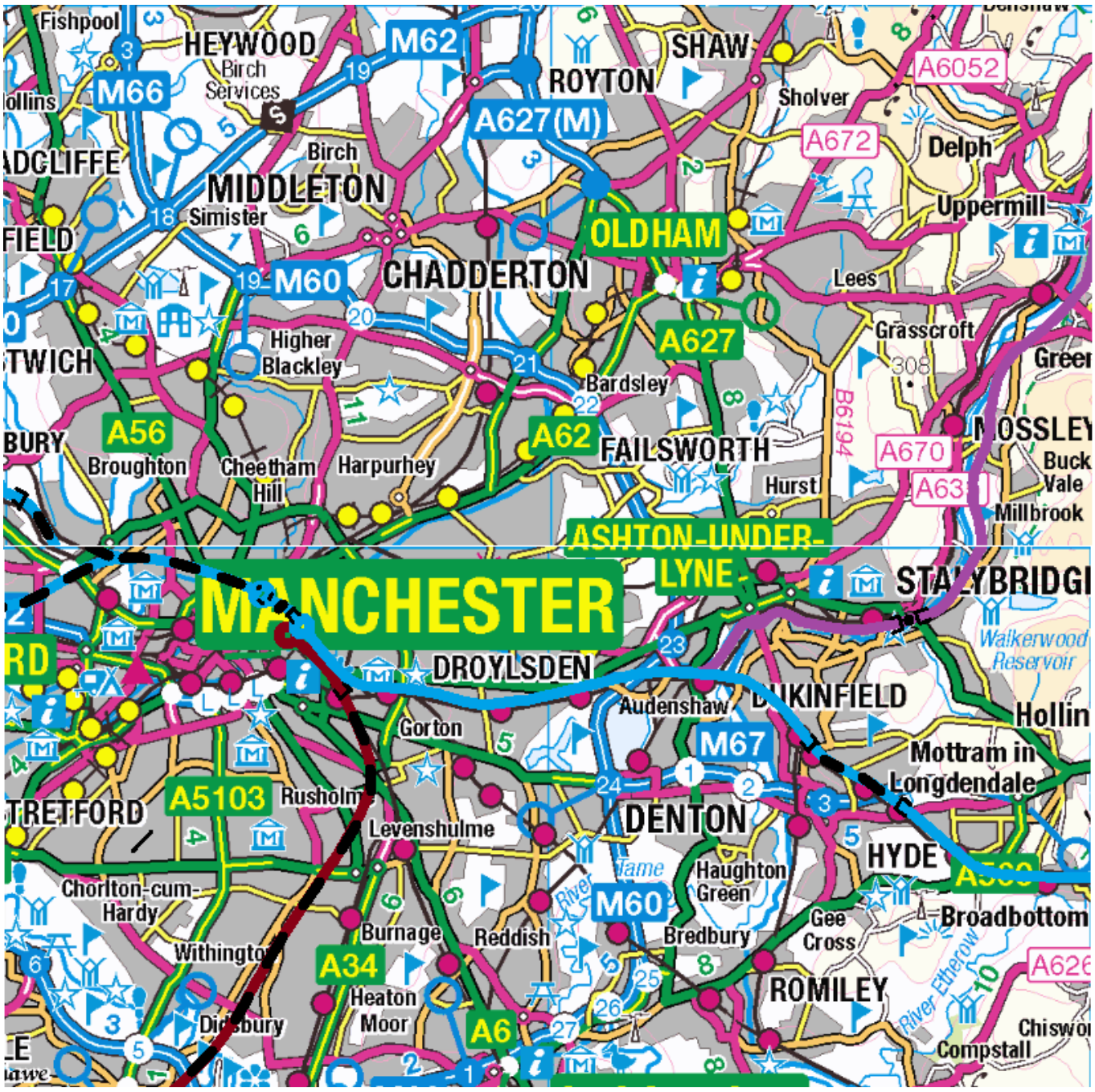
station, (platform 6 and 8, and bay 7,) involving more structural work but less excavation. To the north of the station, HS8 is in cutting following closely the classic route, but at a higher level. It joins the south side of the alignment of the classic line to Retford at SK370878, and follows that all the way to Beighton Junction, where it joins HS3. There are no significant obstructions. Shortly before Beighton Junction is Woodhouse HS Junction, SK433850, where a connection is made from HS8 to the classic tracks to Retford, allowing HS8 classic-compatible services from Liverpool and Preston to proceed to Hull and Cleethorpes, via Gainsborough. Note that Beighton Junction was originally a connection from HS3 to the classic tracks, allowing a classic-compatible service from Pancras Cross to Sheffield Midland, but with the opening of HS8, the connection is with HS8 itself.



3.4 Handsworth – Killamarsh Contains Ordnance Survey data © Crown copyright and database right 2013

4. *HS9 Guide Bridge HS Junction – Huddersfield*

HS9 diverges from HS8 at Guide Bridge HS Junction (SJ928975) and follows the alignment of the line to Stalybridge, initially on the north / west side, switching to the south side at SJ938985. It passes on the south side of Stalybridge station, then takes the currently disused southern tunnel immediately east of the station, enlarged to GC gauge, and follows the trackbed of the currently disused eastern alignment up to Diggle.

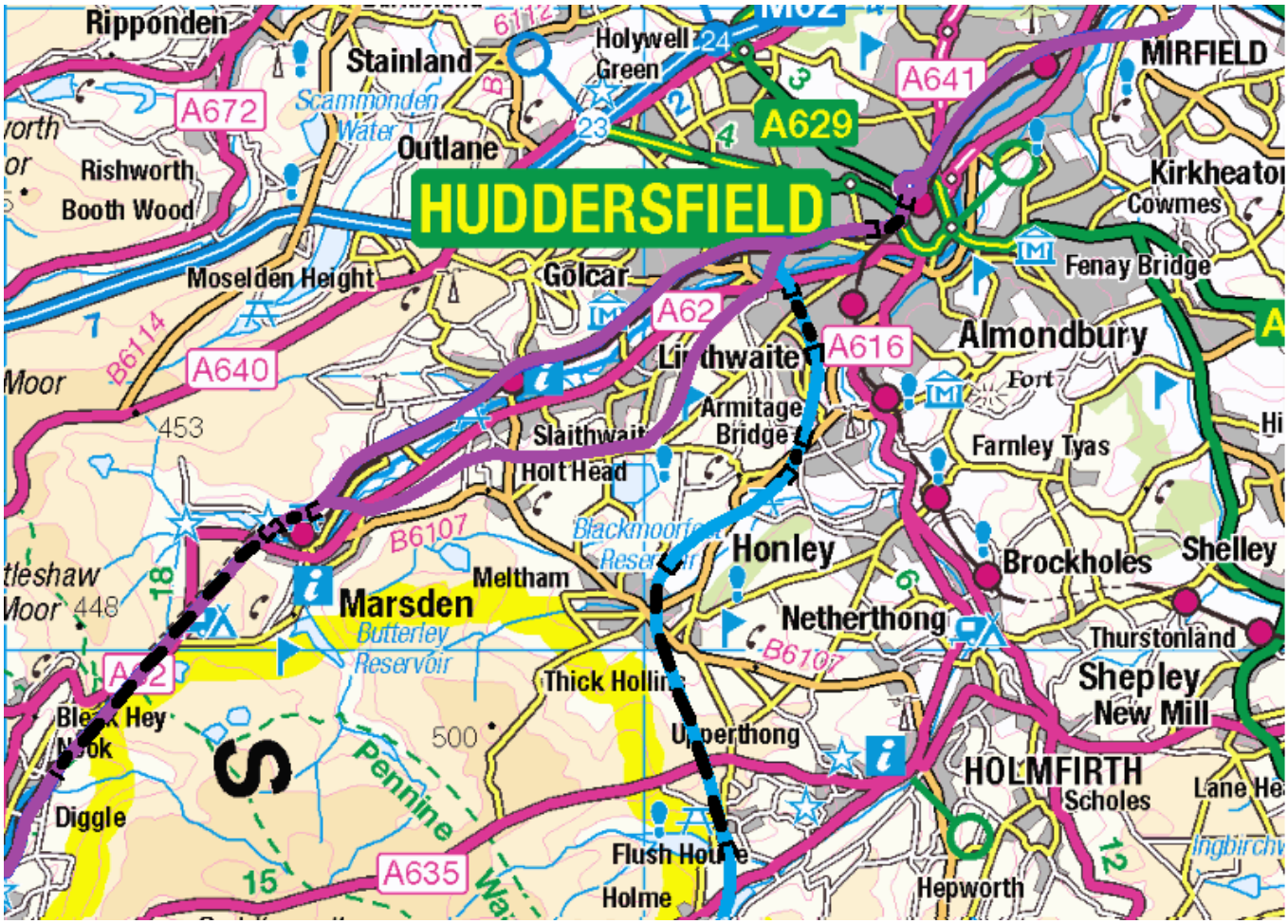


4.1 Manchester – Greenfield

Contains Ordnance Survey data © Crown copyright and database right 2013

Between Stalybridge and Diggle, two viaducts are missing, in Stalybridge and in Mossley, and will have to be rebuilt. The route is otherwise unobstructed. Various overbridges will have to be rebuilt, to GC gauge. The two original single bores of Standedge tunnel will likewise need to be enlarged to GC gauge.

An alternative is a 1¾ mile tunnel under Mossley, between SD976002 and SD981028. This straightens out several curves and avoids having to rebuild the viaduct at Mossley; it is on a gradient of 1 in 92. This is highly recommended.



4.2/5.1 Diggle – Mirfield Contains Ordnance Survey data © Crown copyright and database right 2013

Between Marsden and Huddersfield there are likewise no obstructions. The HS lines occupy the north / west side of the alignment, except that, using the original tunnels, they emerge at Marsden on the wrong side. The first requirement is thus a flyover for the HS tracks, which cross the classic tracks and enter a short, ½ mile tunnel at SE043119, emerging at SE052122, and joining the northern side of the alignment at SE053126. This circumvents the housing to the north of Marsden station. The classic tracks will need to be slewed at various locations, where they have been laid to take advantage of a 4-track alignment. The overbridges will generally need to be enlarged to GC guage – in fact there aren't many; I count 11, many of which can probably be demolished and not replaced. The tunnels into Huddersfield station present more of a problem.

An alternative alignment between Marsden and Huddersfield (shown on the map) diverges from the above immediately on leaving the short tunnel behind Marsden station at SE052122, and crosses the valley to SE057123, then follows roughly the 700ft contour to SE097135, above Clough and Linthwaite. A couple of short viaducts will be needed in this section across side valleys. From this point there is a superb, clear descent along the hillside, right down to the valley floor, gently curving, completely unobstructed and requiring no tunnel. At the bottom it crosses the A62 at SE123157, at altitude 400ft, 300ft in 2¼ miles – 1 in 40. It crosses the valley floor, under the classic route and joins it on the north side of the alignment at Paddock Junction (SE124161), and into Huddersfield station, as above.

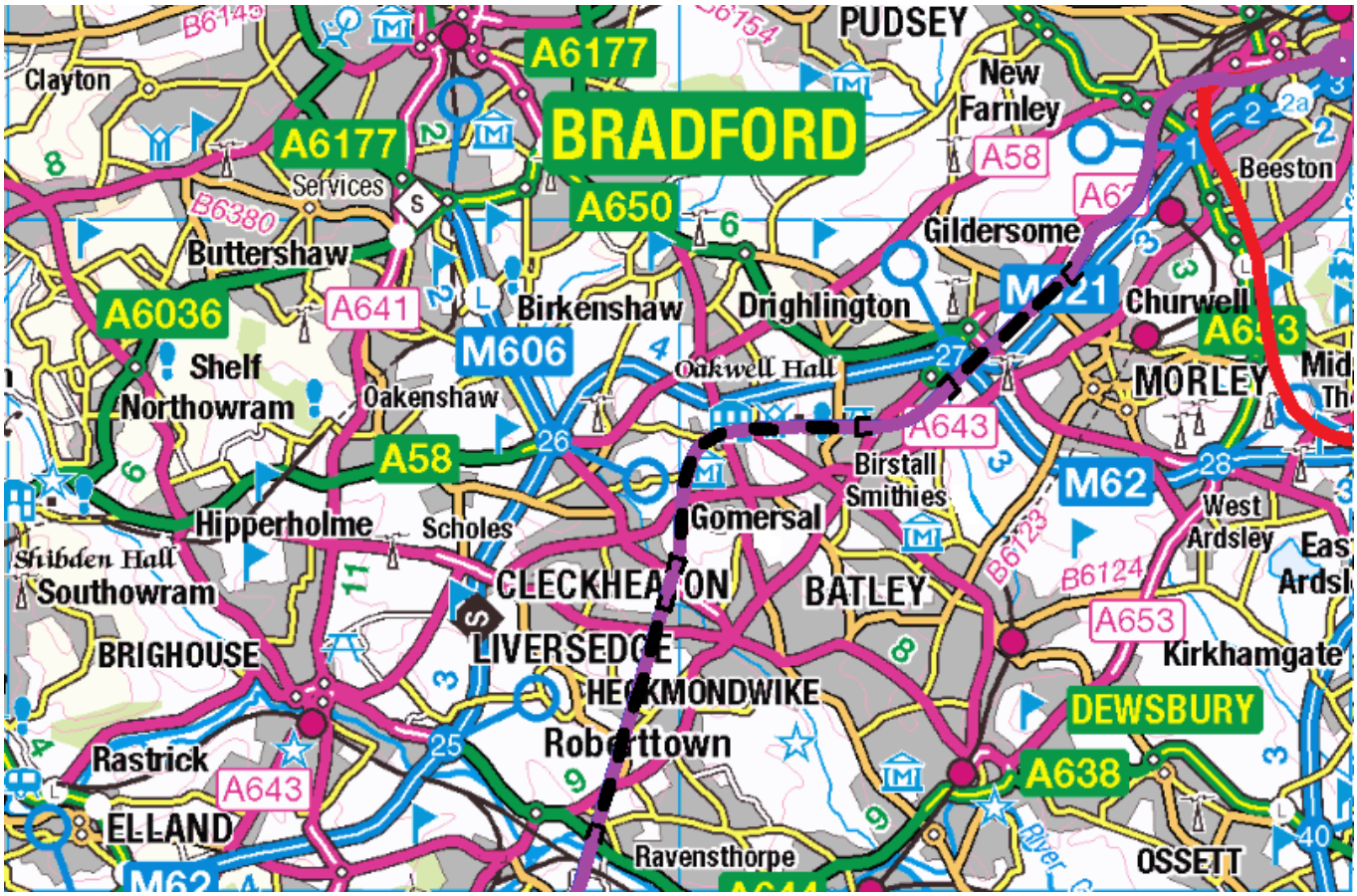
(If local passenger traffic develops satisfactorily from Huddersfield up to Marsden – Colne Valley Metro? – there could well be justification for both routes.)

There's plenty of room behind Huddersfield station for two HS island platforms, currently used for parking (a multi-storey will need to be relocated).

5. *HS9 Huddersfield – Leeds*

This is a completely new alignment, but some parts use sections of old, closed alignments.

From Huddersfield to the Calder Valley the route was also 4 track. HS9 continues on the North / West side of the existing alignment for the first 2 miles, to SE162190, where it diverges to the left taking over the alignment of the old Midland Huddersfield branch. This climbs and crosses the existing line, and HS9 follows the route only to SE183202 from where it crosses the Calder Valley on a viaduct to Battye Ford, at SE188207. The altitude is 250ft. HS9 enters a 2½ mile tunnel at SE188207, emerging at SE196245, in Heckmondwike, still at 250ft, so this last section has been completely level. It crosses the A638 at SE197248, and enters a further tunnel at SE198250, from which it emerges at SE225268, in Birstall, where it joins and takes over the alignment of the former Leeds New Line, and follows that to Leeds. This tunnel is 2 miles by crow-length, but on a wide curve, to keep it underground, so probably 2¼ miles. It climbs 250ft in this distance so a crow-gradient of 1 in 42, and an actual one of about 1 in 47. The section of Leeds New Line has no obstructions, and very conveniently itself has a tunnel, which takes it underneath an extensive motorway junction which would otherwise have obliterated it.



5.2 Ravensthorpe – Leeds

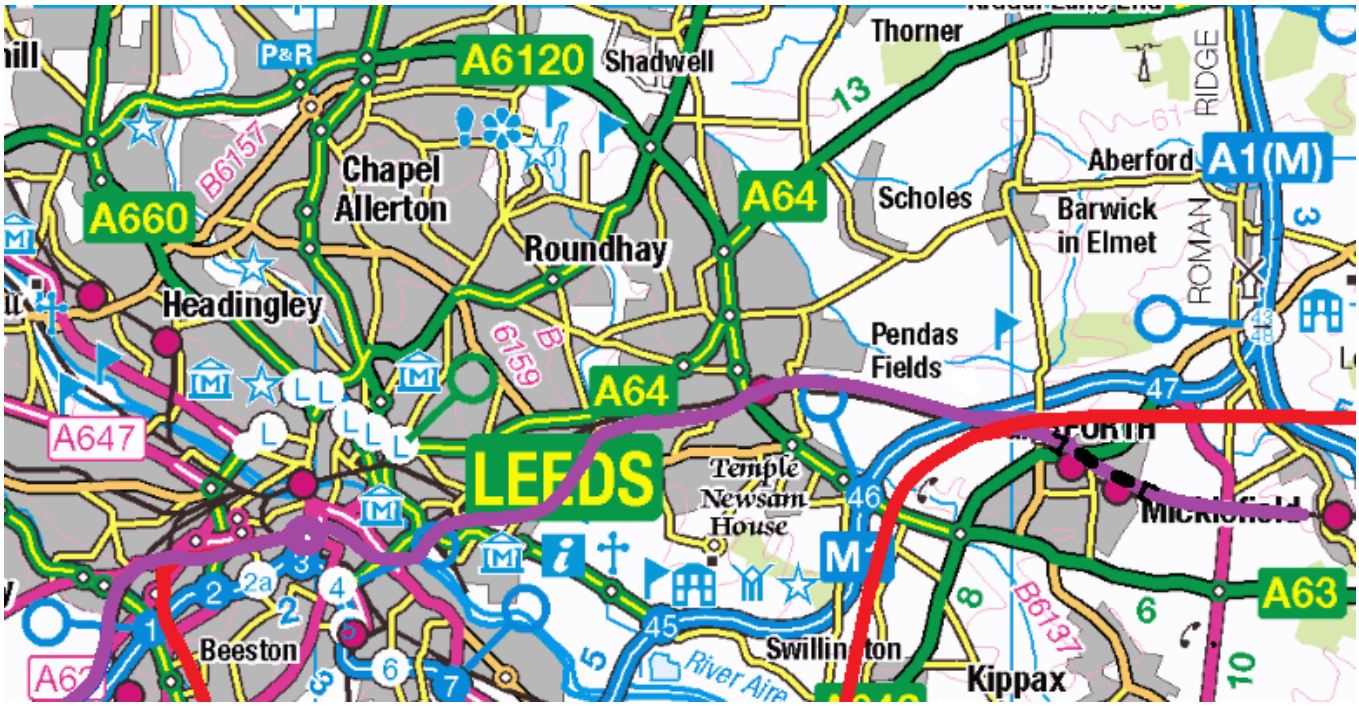
Contains Ordnance Survey data © Crown copyright and database right 2013

This route crosses a complicated and quite densely populated area, without encountering a single obstruction. My first idea was a single (straight) tunnel from Battye Ford to Copley Hill, joining the Leeds New Line a mile or so closer to Leeds. But on examining the contours, I found there are a couple of quite deep valleys in the way. The line has to emerge for a short distance in Cleckheaton, but manages to stay underground the rest of the way. (My original route would indeed be possible, but at the cost of a couple of quite major viaducts, which I tend to avoid unless they're completely inevitable.)

7. Leeds New Lane – Micklefield

This is actually, as far as Garforth, a very early instalment of HS9, provided in advance of all the rest to allow services initially terminating at Leeds to proceed on to York, and terminate there. It also allows HS7 services to York and Newcastle to travel via Leeds, instead of proceeding directly to York.

I propose an unashamedly grandiose design to get across Leeds. New Lane Station is an elevated structure, with a long approach viaduct. The continuation (as HS9) eastward continues on viaduct, first along the south side of Great Wilson Street (A653) then Hunslet Lane (A61) and later Hunslet Road. From SE304328 the route crosses, still on viaduct, into the centre of the A61 dual carriageway (there's plenty of room between the carriageways) as far as SE309323, then turning east (it's still the A61), still on viaduct along the centreline. It crosses to the north side of the road when the South Accommodation Road comes in on a flyover. It crosses to the south side of the road just after the river bridge (at SE315324), and finally descends to ground level, to join the Hunslet East branch at SE316325, following this round to join the south side of the Leeds and Selby line at Neville Hill. This all sounds very extensive, but in fact it's barely a mile from New Lane station to joining the Hunslet East branch. The area traversed is warehousing / industrial, emphatically not residential, and has experienced a lot of new road building in recent years, so clearly it is not regarded as environmentally sensitive! I think that New Lane station and its approach from the west will be a splendid enhancement for Leeds, and this magnificent eastern approach even more so. I don't often make spectacular proposals, but this is definitely one.



6.1 Leeds – Micklefield

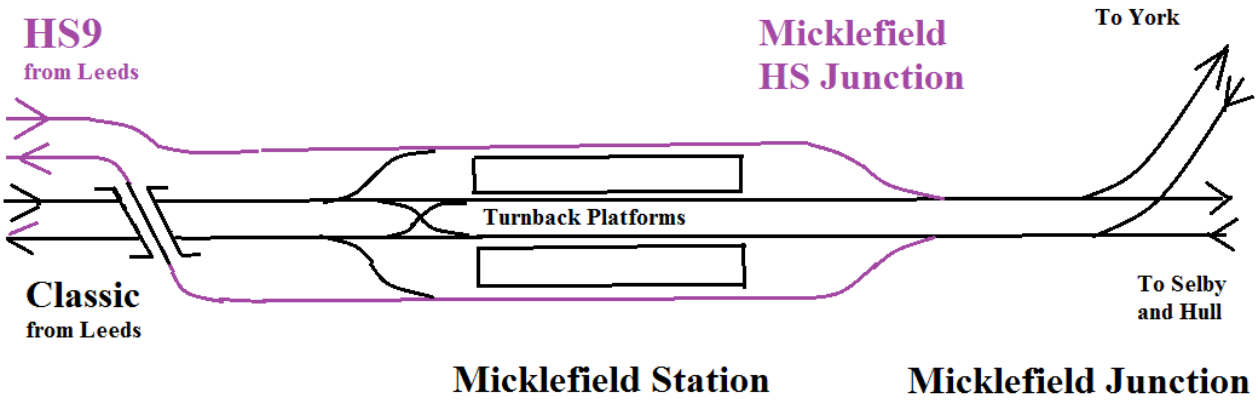
Contains Ordnance Survey data © Crown copyright and database right 2013

The Strategi maps, at the end of the Route sections, contain a large scale map of the traverse of Leeds. This should clarify the above description.

After the Lord Mayor's Show … HS9 then proceeds boringly along the south side of the Leeds and Selby route, crossing to the north side of the alignment just before Cross Gates station, and follows that until Garforth West Junction, at SE387342, where a spur diverges to the HS3 main line to York (which it joins at Garforth East Junction, SE395341). The main line of HS9 passes in a ¾ mile tunnel under Garforth, between SE403338 and SE420329, and continues to Micklefield HS Junction , SE439327, where it joins the classic route to York / Hull, immediately before the relocated Micklefield ststion.

It is currently planned to use Micklefield as a turnback for local services from west of Leeds City. This needs a station with two island platforms, the outer platform faces used by through services, and the inner pair by terminating services. The existing Micklefield station could be extended, at the cost of demolishing perhaps 4 houses, or a new station provided a short distance to the west, as noted above, where there is plenty of room on the north side of the alignment. Note, however, that a road, Phoenix Avenue, has been built on the south side, presumably in anticipation of an extension to the nearby Peckfield Business Park, but which hasn't happened yet, according to the satellite map. This would provide access to the new station, but this needs to be incorporated in the local plans.

Here's an appropriate configuration for Micklefield:

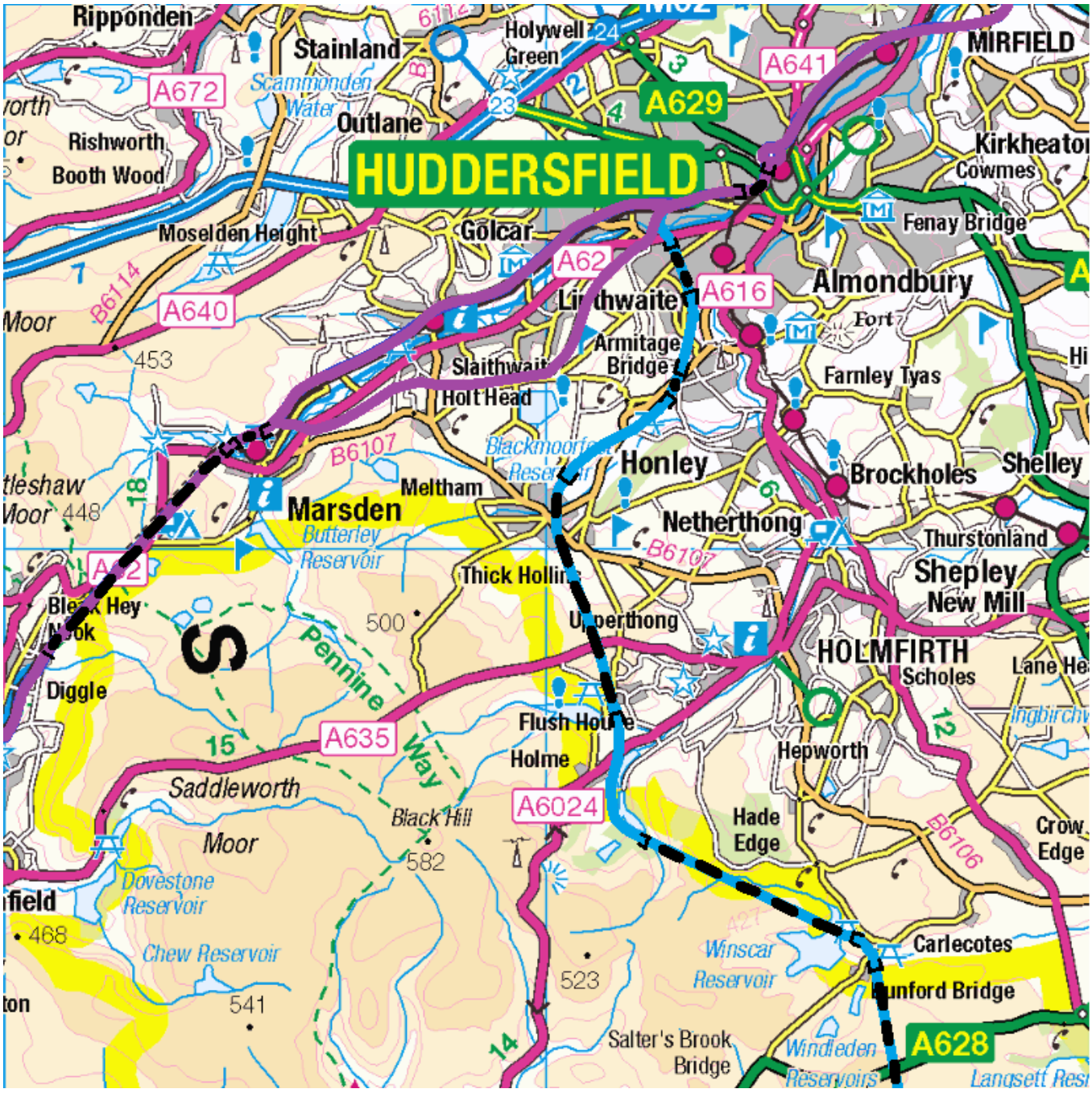


The outer platform faces are for **all** through trains – the HS ones are all classic-compatible.

7. HS8 Ladybower Junction – Paddock Junction

The Huddersfield branch of HS8 diverges from the main line at Ladybower Junction (SK201864), at an altitude of 750ft, and follows the eastern side of Derwent Dale, alongside three reservoirs, and reaches the 1000ft contour at SK170961, 250ft in 6½ miles – 1 in 137. At that point it enters a 4 mile tunnel to Dunford Bridge, emerging at SE156021, still at 1000ft, so the tunnel is level. Crossing above the east portal of Woodhead tunnel, it enters a 3 mile tunnel at SE156025, emerging at SE113052, at the southern tip of Ramsden Reservoir, altitude 820ft, 180ft in 3 miles – 1 in 88. It follows the western edge of the reservoir, followed by Brownhill Reservoir, descending to 700ft at SE113069, just west of Holmbridge, 120ft in 1¼ miles – 1 in 55. At this point it enters a 2½ mile tunnel, emerging at SE107113, east of Meltham, and there takes over the alignment of the long-closed Meltham branch, altitude 450ft, 250ft in

2½ miles – 1 in 53. It follows the alignment to Beaumont Park, this section being essentially level. The short tunnel at Netherton is widened to GC gauge and a second bore provided (this very conveniently passes under a quite extensive area of housing). Between SE124133 and SE126142 a new, straight alignment is provided to ease a serious curve (and to avoid a row of 4 houses which have, most inconsiderately, been built directly along the old alignment). From Beaumont Park, is enters a 1 mile tunnel at SE126144, emerging in the Colne Valley at SE125157, (the tunnel is essentially level,) and joining the classic alignment at Paddock Junction, SE124161 (the alternative route of HS9 also joins here). [See map 3.2/7.1 Glossop – Ladybower Junction for the first section.]

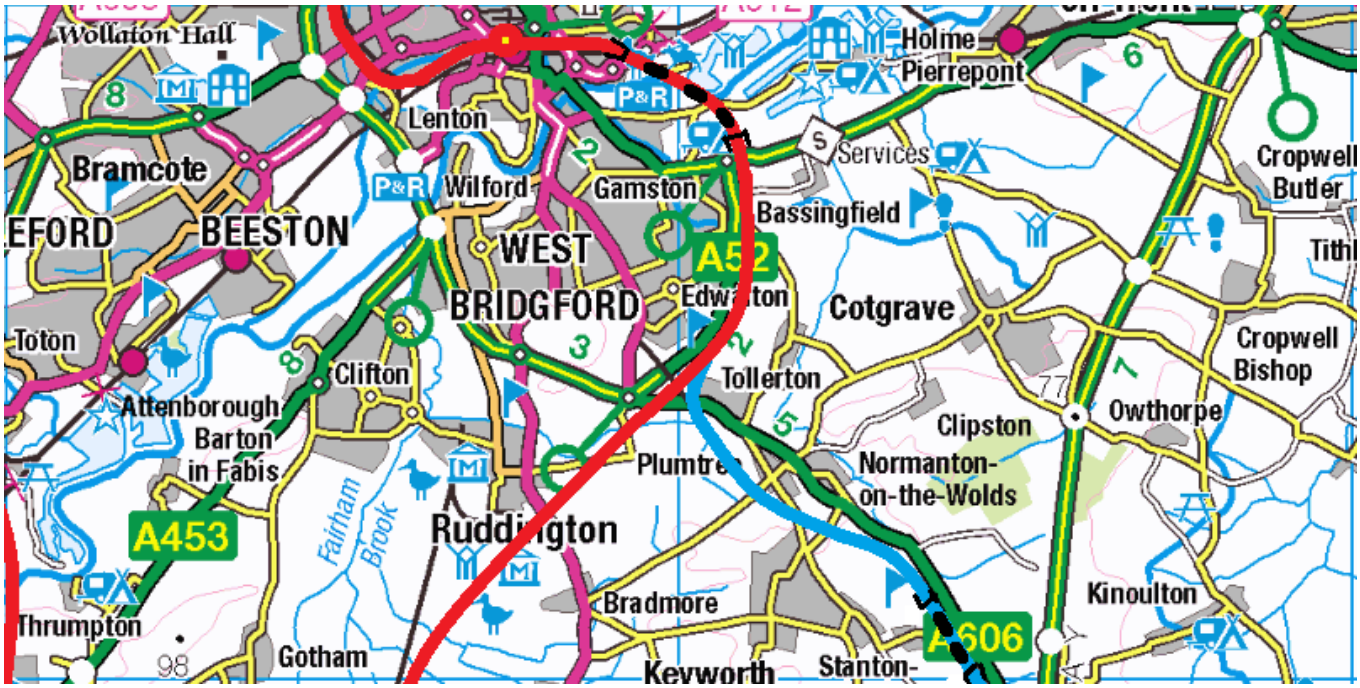


7.2 Dunford Bridge – Huddersfield Contains Ordnance Survey data © Crown copyright and database right 2013

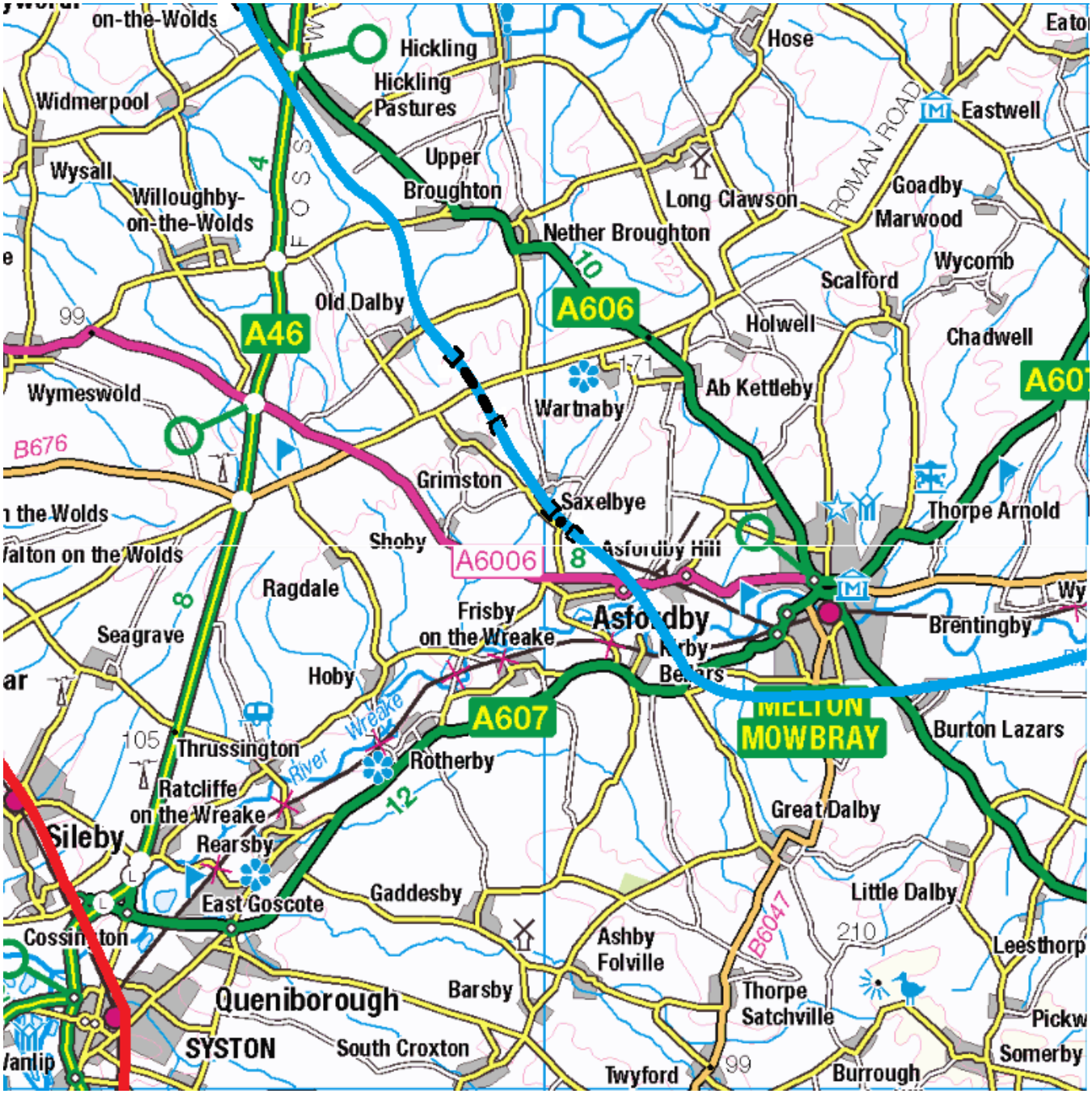
From Dunford Bridge on, this has been an extraordinarily difficult route to plan. It's not at all obvious where to bring it out. The seemingly obvious destination in the Holmfirth area, then down the Holme Valley, proved completely impracticable on a number of grounds, without surprisingly extensive demolitions and some pretty major viaducts – the levels are simply wrong.

8. *HS8 Edwalton Junction – Peterborough*

Between Beighton Junction and Edwalton Junction, HS8 shares the route of HS3, including the Nottingham branch. From Edwalton Junction to Asfordby Junction (below), HS8 takes over the alignment of the Midland route from Nottingham to Melton Mowbray, enlarged to GC gauge. At Asfordby Junction, (SK711199,) the classic route to Melton Mowbray diverges from HS8 (or, more correctly, HS8 diverges from the classic route to Melton Mowbray). It passes round the south of Melton Mowbray on a completely new alignment, crossing the A6006 at SK717191, the A607 at SK728177, the A606 at SK763173, across the top of Stapleford Park, crossing the Midland route at SK823187, and joins the alignment and takes over the trackbed of the long closed line from Saxby to Bourne at SK830189. This it follows until TF045179, where it diverges onto a completely new alignment; in this section there are no obstructions at all (no buildings, that is; most of the bridges have disappeared since the line closed, including the particularly important one over the ECML). It crosses the A6121 at TF073174, curving to the south to cross Swallow Hill (a very minor road) at TF084168 to reach Thurlby Junction, where HS10 from Lincoln joins (eventually; it won't be there yet). It crosses Macmillan Way (another v. minor road) at TF099159, King Street (Roman road) at TF107132, Stow Road (Langtoft) at TF113116, the A1175 at TF120097 and High Street (Maxey) at TF118079, joing the east side of the ECML alignment at TF132055. It crosses to the west side shortly afterwards, at TF155035, sharing the bridge with the mainly freight line from Spalding (which no longer joins the ECML at Werrington Junction, but, after crossing, immediately joins the Midland lines on the west side). HS8 itself enters a 3 mile tunnel at TF162028, emerging at TL184992, immediately before Peterborough station. The HS platforms are on the west side of the station, where there is plenty of room (lots of car parks).

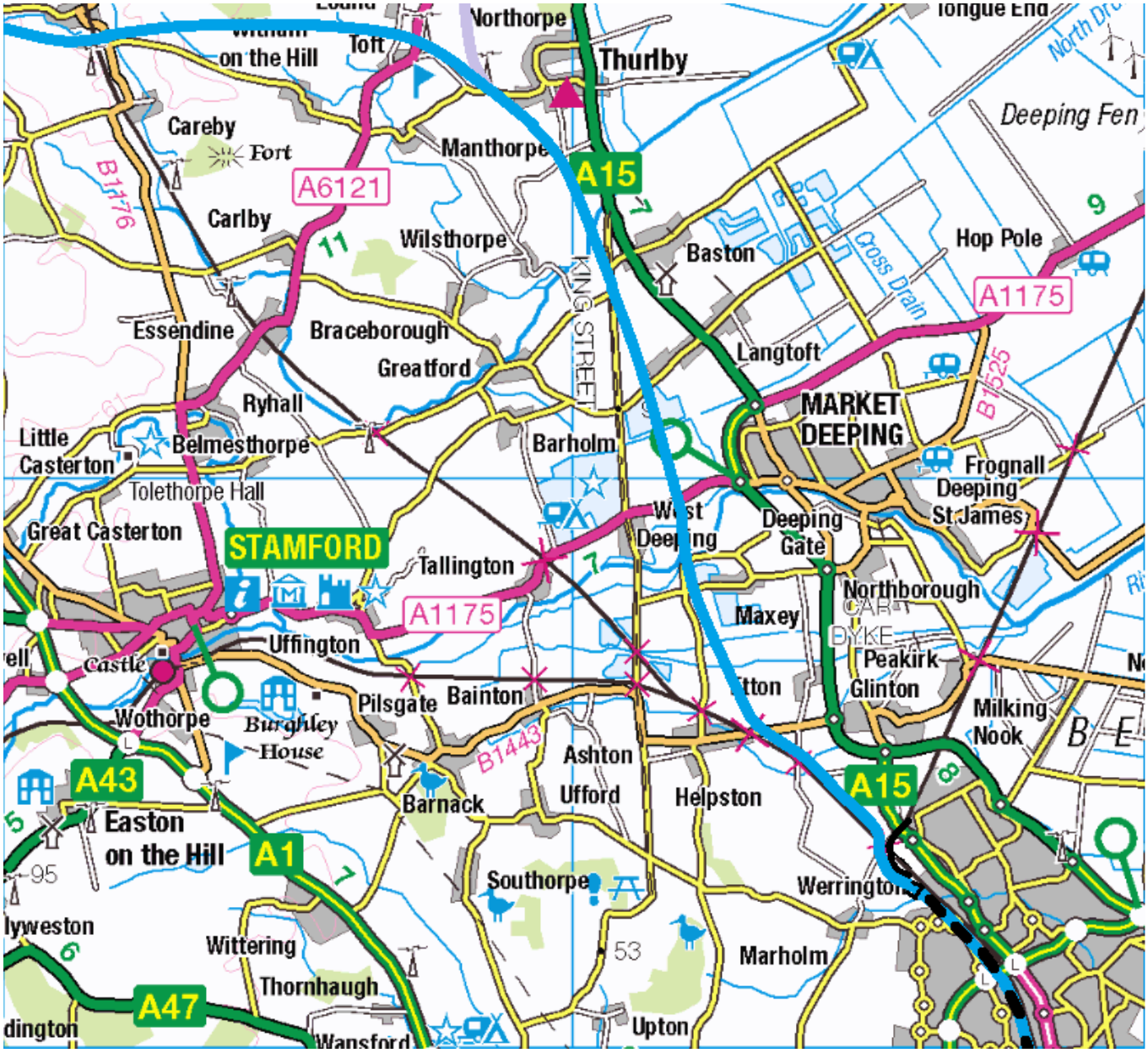


8.1 Nottingham – Stanton-on-the-Wolds Contains Ordnance Survey data © Crown copyright and database right 2013



8.2 Hickling Pastures – Brentingby Contains Ordnance Survey data © Crown copyright and database right 2013

8.3 Stapleford – Castle Bytham Contains Ordnance Survey data © Crown copyright and database right 2013



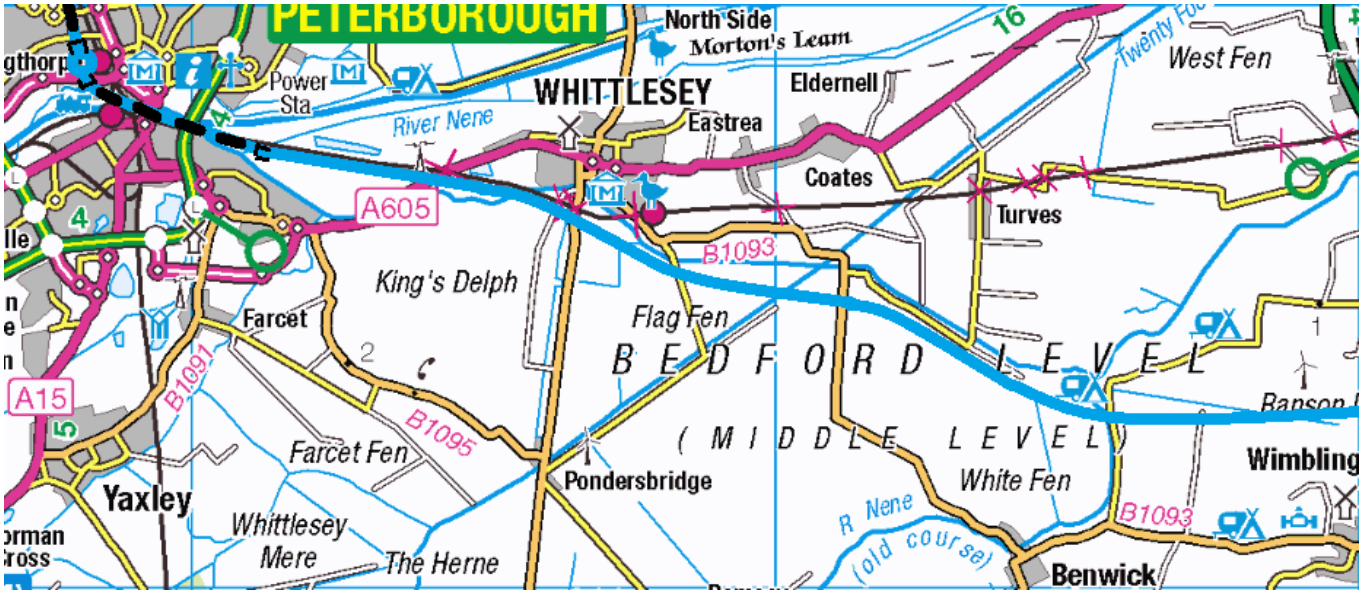
8.3 Stapleford – Castle Bytham

Contains Ordnance Survey data © Crown copyright and database right 2013

9. *HS8 Peterborough – Ely*

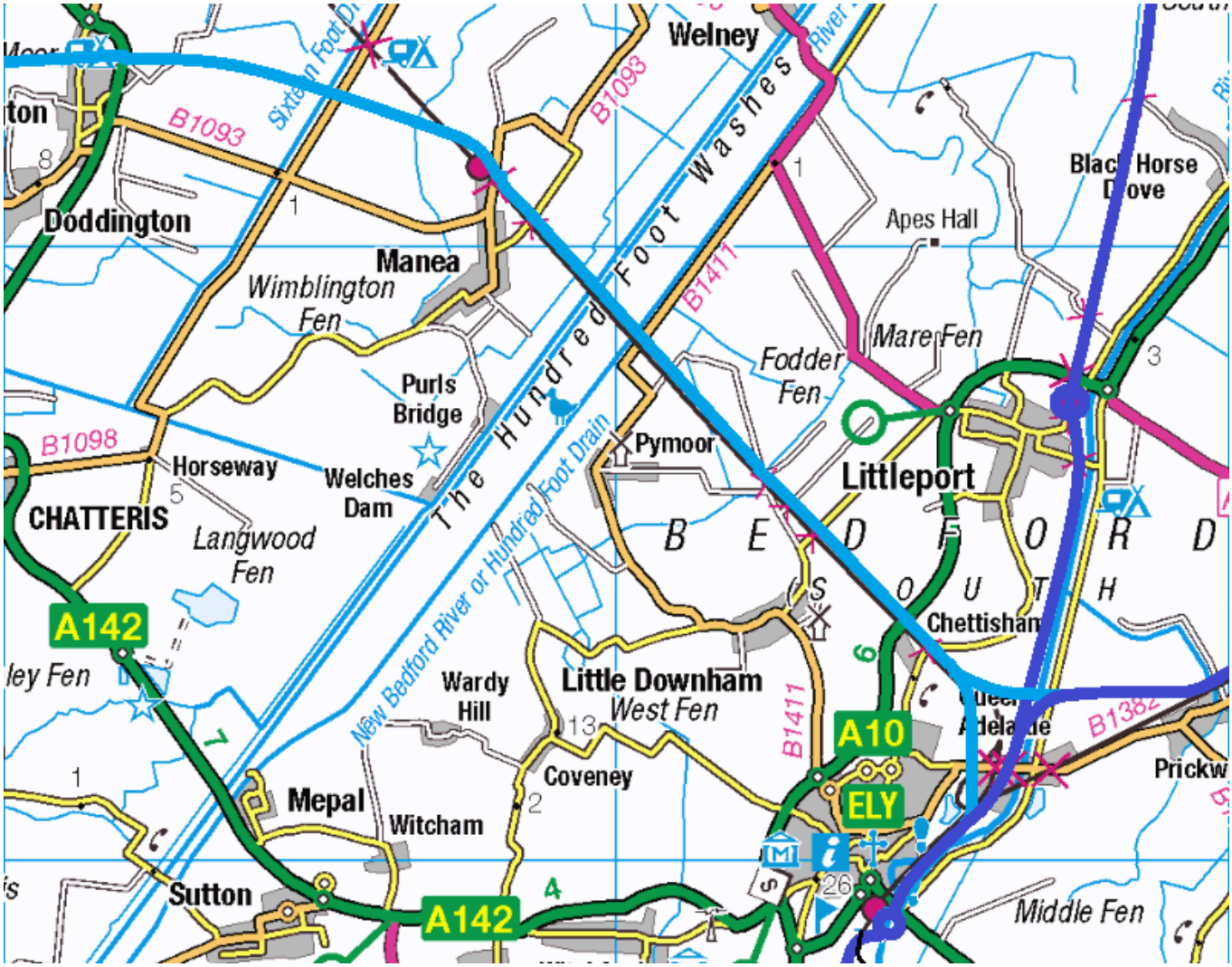
HS8 enters a 1 mile tunnel immediately south of the station, at TL187987 and emerges at TL202987, on the south side of the classic alignment. It follows this to Whittlesey, but diverges at TL268963, and takes a direct line to Manea, initially following (roughly) the course of the Whittlesey Dike to Flood's Ferry (TL357938), then straight to Wimblington, crossing the B1093 at TL413928 and the A141 at TL420930. From there it heads straight to join the north east side of the classic alignment just above Manea station, crossing at TL479912 (because that side of the alignment is empty, and the other is heavily built-up). This it follows until Ely HS North Junction, just past the former Chettisham station, at TL554830. The branch to HS6 at Ely HS South Junction (and to Ely station) diverges from the main line to Ely East Junction, and crosses to the south west side of the classic line. It veers due south on a new alignment, reaching the Ely avoiding loop line at TL557815, which it crosses, and then crosses again at (the classic) Ely North Junction to the south east side of the alignment, joining HS6 at Ely HS South Junction (TL559809), following that into Ely station – HS platforms on the east side. The HS8 main line proceeds, crossing the

line to King's Lynn, and joining HS6 at Ely HS East Junction (TL573808), and following that to Norwich.

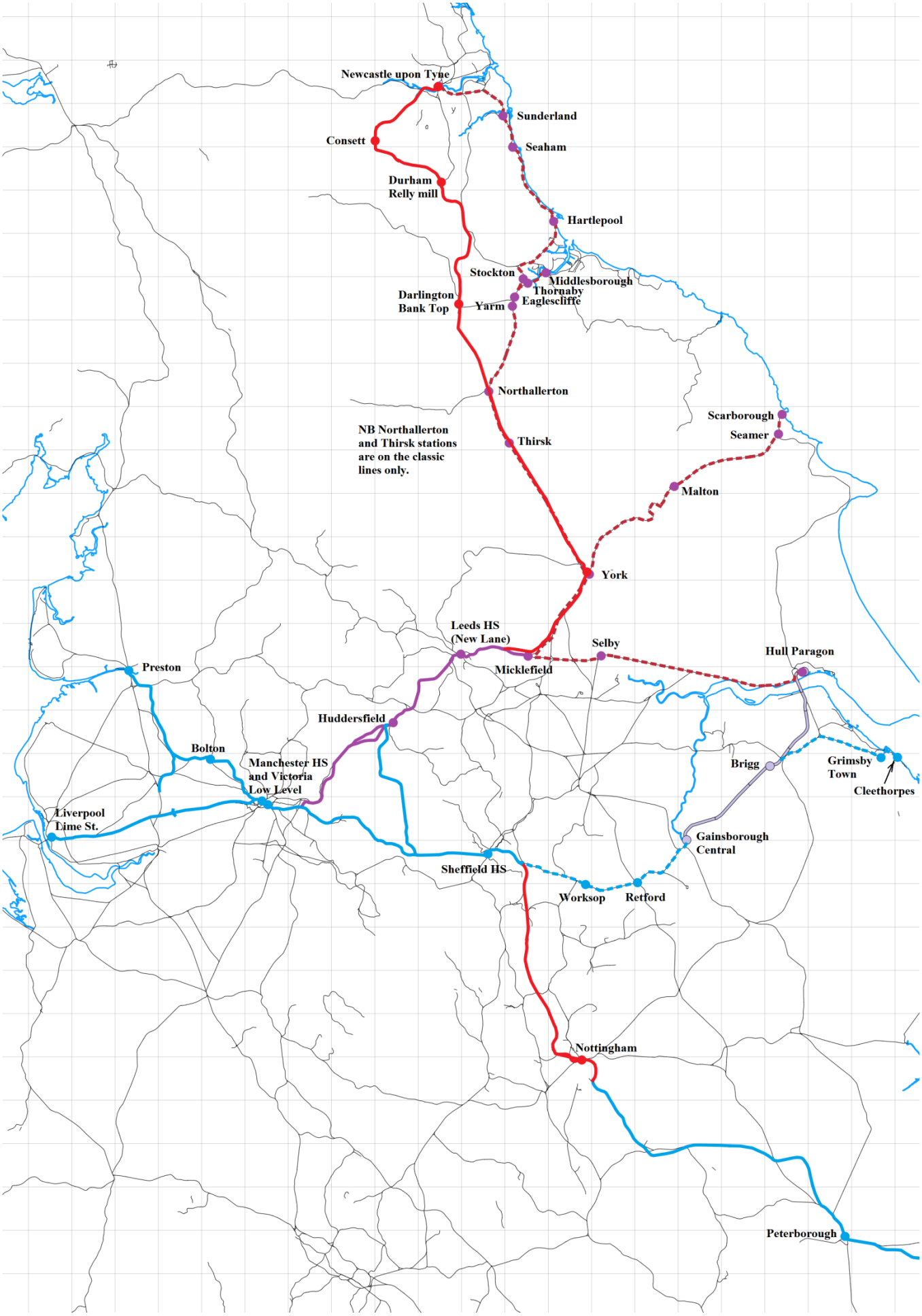


9.1 Peterborough – Wimblington Contains Ordnance Survey data © Crown copyright and database right 2013

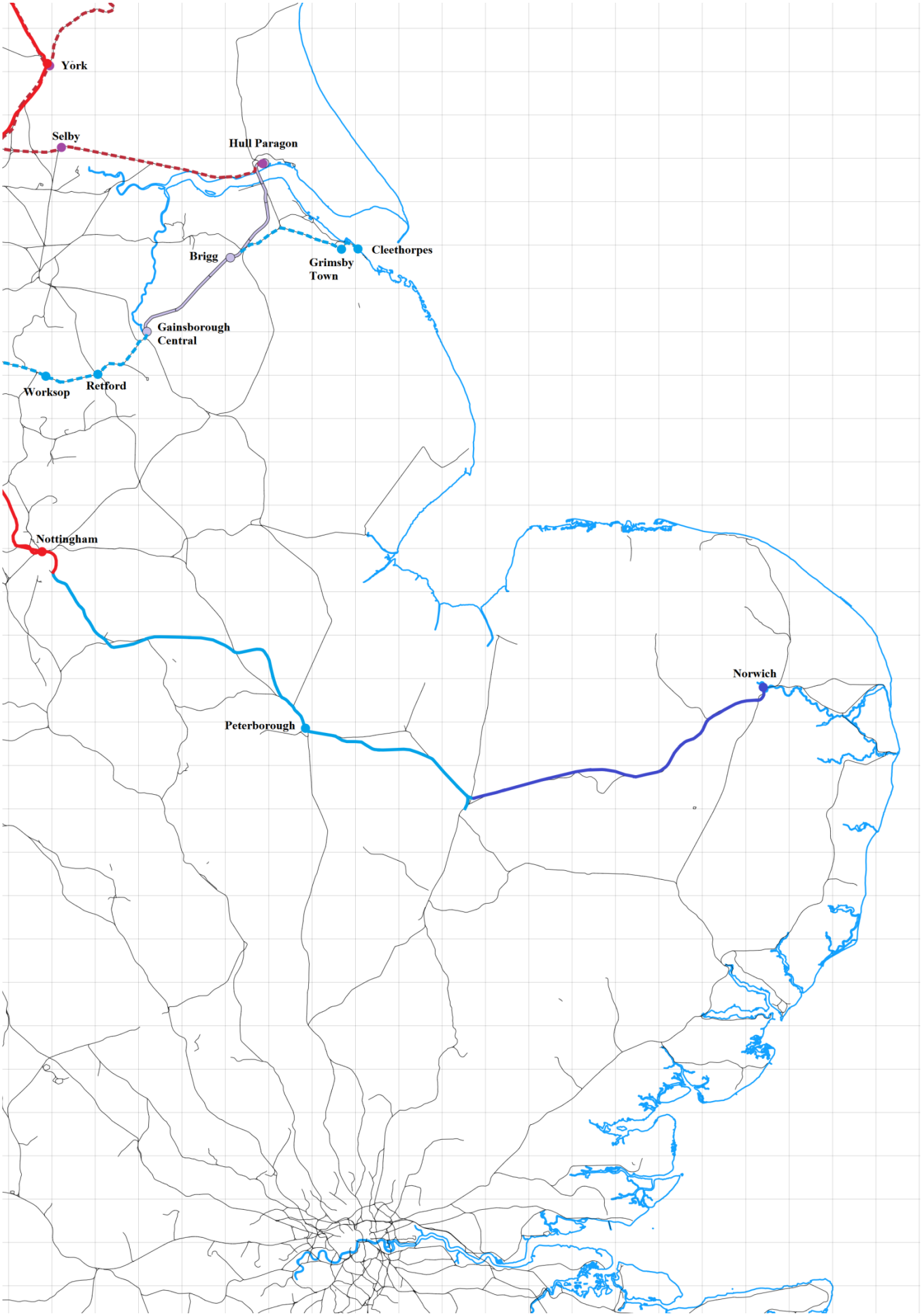
Note that this map is slightly wider than 20km (c21.3km)



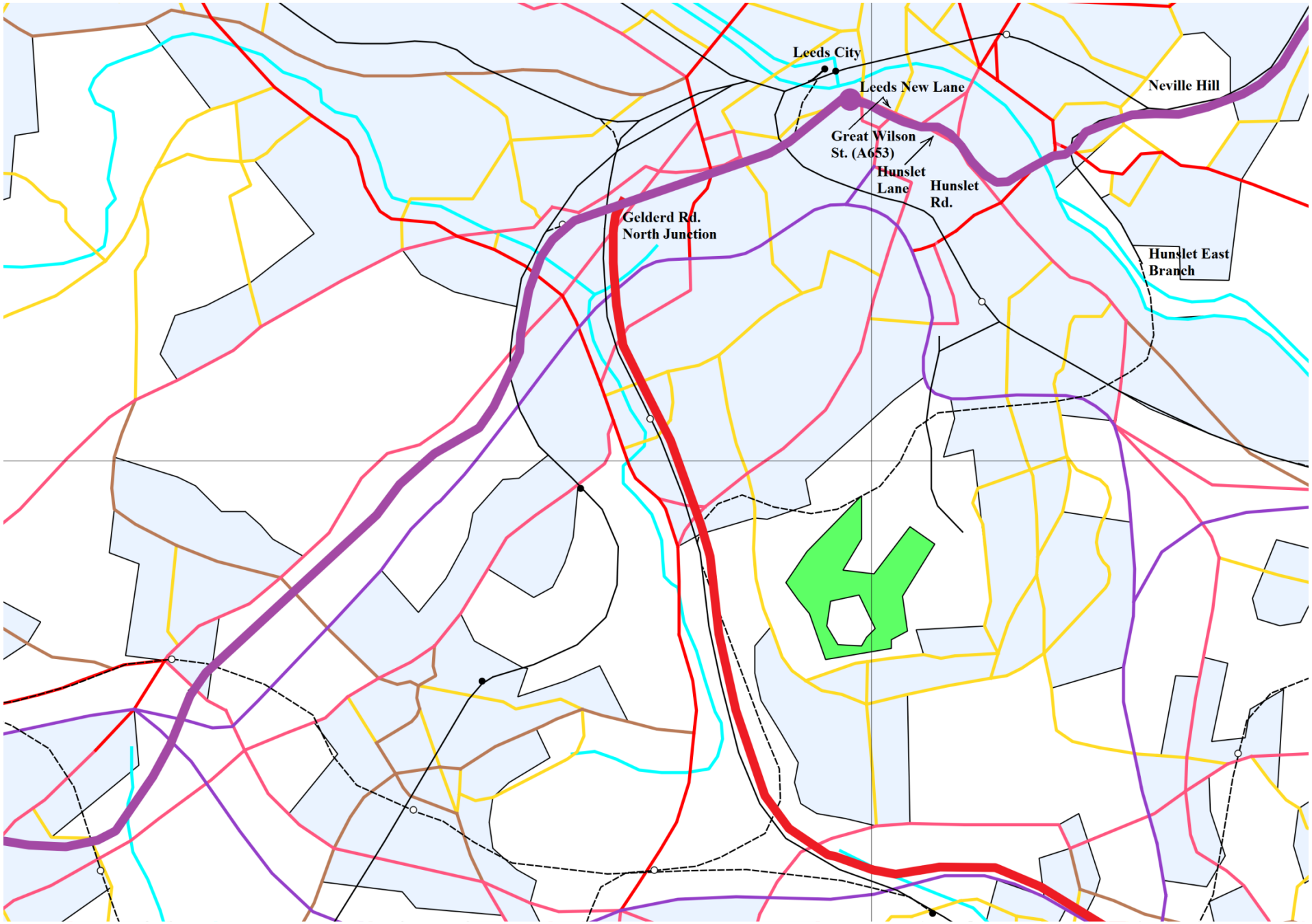
9.2 Wimblington – Ely Contains Ordnance Survey data © Crown copyright and database right 2013



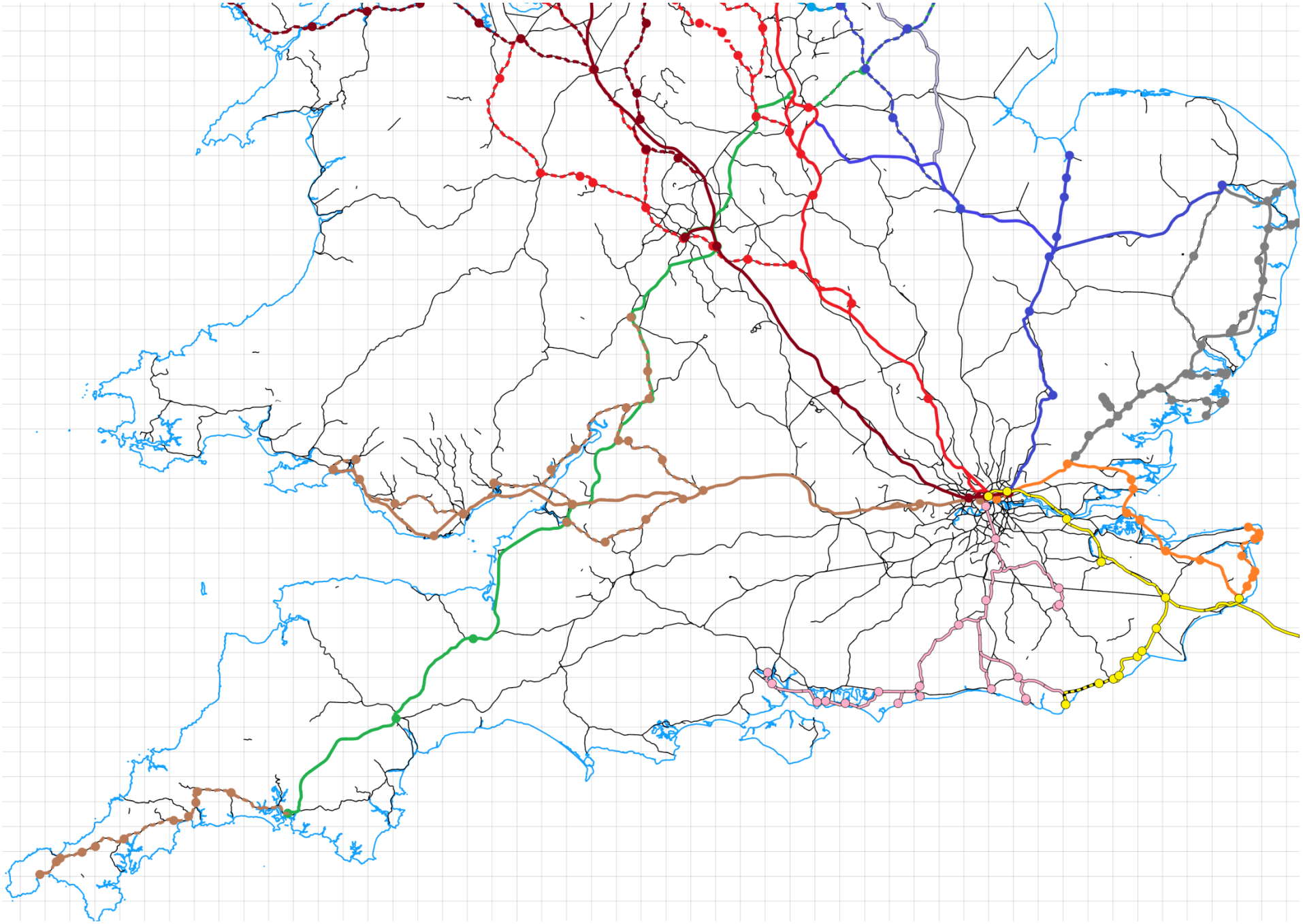
 Contains Ordnance Survey data © Crown copyright and database right 2011



 Contains Ordnance Survey data © Crown copyright and database right 2011

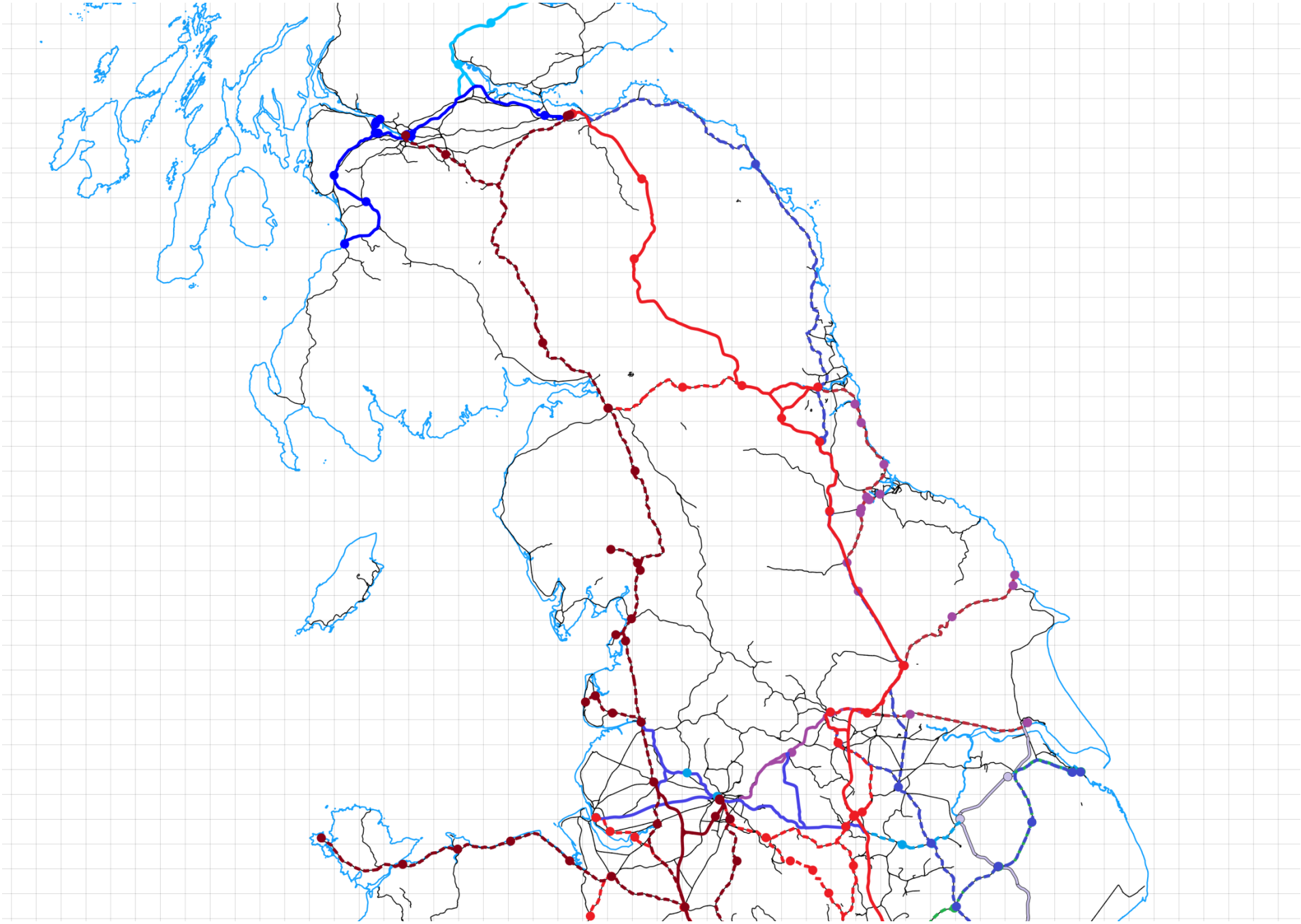


Contains Ordnance Survey data © Crown copyright and database right 2011



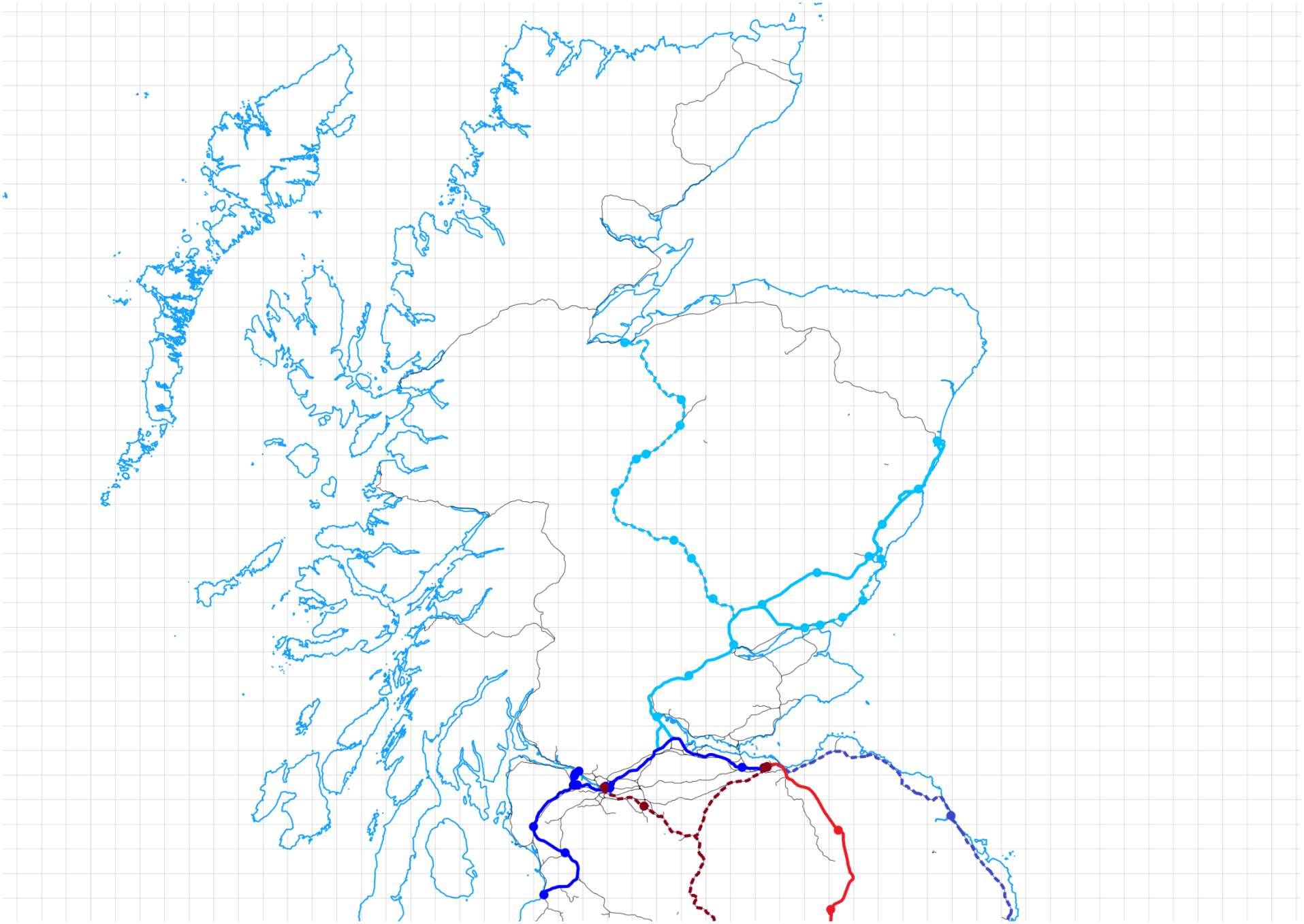
Complete HS Network, South Sheet

Contains Ordnance Survey data © Crown copyright and database right 2011



Complete HS Network, Central Sheet

Contains Ordnance Survey data © Crown copyright and database right 2011



Complete HS Network, North Sheet

Contains Ordnance Survey data © Crown copyright and database right 2011

The Service Plans

A new service plan comes into effect when some significant change takes place which causes a change to the service loadings of one or more sections of HS8/HS9 itself. This most commonly occurs when a new section of HS8/HS9 opens, but it may also be a consequence of a change on some other HS route.

The service plans use the following notation:

- tph trains per hour
- G GC gauge train
- GG GC gauge, double deck train
- C classic-compatible train
- R Regional Metro train, semi-fast service
- RS Regional Metro train, stopping service (all stations)

Occasionally other notations are used; these will be defined when used.

As was mentioned earlier, the service plans deliberately envisage maximum frequencies. The results may thus seem, at least initially, somewhat optimistic.

Service Plan 0

This isn't really a service plan at all – as far as HS8/HS9 are concerned. The very first instalment of HS8 – between Kenyon West Junction and Liverpool Lime St., together with the connections to HS2 north and south – is delivered as part of HS2 phase 2B – SP3. The initial services are:

- 2tphG Liverpool Lime St. – Crewe – Old Oak Common – Euston Cross [–> Hastings]
- 1tphC Liverpool Lime St. – Wigan North Western(*) – Preston (splits/joins) –:
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central
- 1tphC Birmingham HS – Crewe – Wigan North Western(*) – Preston (splits/joins) –:
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central

(*) Initially the CC services from Liverpool and Birmingham to Scotland travel via Kenyon North Junction and join the WCML at Bamfurlong Junction, calling at Wigan North Western. This changes at SP1, when HS8 opens from Bamfurlong Junction to Preston via Gibb Farm Junction, and they then travel directly to Preston via HS8, not stopping at Wigan.

Service Plan 0A

This likewise isn't really a service plan at all – as far as HS8/HS9 are concerned. The very first instalment of HS9 – between Gelderd Rd. North Junction (where the classic route from Ardsley Junction – upgraded to GC-gauge by HS3/HS7 – joins HS9, just before Leeds New Lane station) and Garforth East Junction / Micklefield Junction – opens at the same time as HS7 opens to Leeds and York. This allows HS7's

services to travel from York to Birmingham and points south via Leeds. (These sections are common with HS3, but initially only HS7 services use them.) The initial services are:

- 2tphG York – Leeds HS – South Yorkshire – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth.
- 2tphGG York – Leeds HS – South Yorkshire – Derby – Birmingham HS.

Service Plan 1

The first service plan comes into effect as soon as the core sections from (Liverpool –) Kenyon West Junction / Preston to Guide Bridge HS Junction, then on to (HS8) Beighton Junction and (HS9) Gelderd Rd. North Junction open. In addition, HS3/HS7 opens from York to Newcastle.

The following service is introduced on HS8:

- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham

and on HS9 the services:

- 2tphGG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – York – Darlington – Durham (Relly Mill) – Consett – Newcastle
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland – Newcastle
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – Selby – Hull
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Malton – Seamer – Scarborough

There is also the new HS2 service:

- 2tphG Preston – Crewe – Old Oak Common – Euston Cross [–> Hastings]

It imposes the following loadings on HS8 (the section shared with HS3/HS7 includes all the other services using that section):

- Liverpool Lime St. – Kenyon West Junction 9tph
- Kenyon West Junction – Broughton Junction 6tph
- Kenyon West Junction – Kenyon South Junction 2tph
- Kenyon West Junction – Kenyon North Junction 1tph
- Preston – Gibb Farm Junction 8tph
- Gibb Farm Junction – Broughton Junction 4tph
- Gibb Farm Junction – Bamfurlong Junction 4tph

- Broughton Junction – Guide Bridge HS Junction 8tph
- Guide Bridge HS Junction – Ladybower Junction 2tph
- Paddock Junction – Ladybower Junction 0tph
- Ladybower Junction – Woodhouse HS Junction 2tph
- Woodhouse HS Junction – Beighton Junction 2tph
- Beighton Junction – Nuthall North Junction 6tph
- Nuthall North Junction – Nuthall South Junction 2tph
- Nuthall South Junction – Strelley Junction 2tph
- Strelley Junction – Nottingham station 2tph
- Nottingham station – Manvers St. Junction 0tph
- Manvers St. Junction – Edwalton Junction 0tph
- Edwalton Junction – Asfordby Junction 0tph
- Asfordby Junction – Thurlby Junction 0tph
- Thurlby Junction – Pellett Hall Junction 0tph
- Pellett Hall Junction – Ely HS North Junction 0tph
- Ely HS North Junction – Ely East Junction 0tph
- Ely HS North Junction – Ely South Junction 0tph

It likewise imposes the following loadings on HS9 (the section shared with HS3/HS7 includes all the other services using that section):

- Guide Bridge HS Junction – Paddock Junction 10tph
- Paddock Junction – Gelderd Rd. North Junction 10tph
- Gelderd Rd. North Junction – Garforth West Junction 14tph
- Garforth West Junction – Micklefield HS Junction 8tph
- Garforth West Junction – Garforth East Junction 6tph
- Garforth East Junction – York HS station 6tph
- York HS station – Derwent Hill Junction 6tph
- Derwent Hill Junction – Paradise Junction 6tph
- Paradise Junction – Newcastle station 6tph

Service Plan 2

This service plan comes into effect when HS3 opens from Nuthall South Junction to Leicester, from Nottingham station to Stanford Junction, and from West Hampstead Junction to Pancras Cross. HS8's Huddersfield branch also opens from Paddock Junction to Ladybower Junction.

The following new services are introduced on HS8 (and HS3):

- 2tphG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Pancras Cross (UHS)
- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham – Leicester – Northampton – Luton & Dunstable Parkway – Pancras Cross (HS Metro)

In addition, the services:

- (HS3) Pancras Cross – York (HS Metro)
- (HS7) Plymouth – Newcastle
- (HS7) Birmingham HS – York

– are all rerouted between Beighton Junction and Gelderd Road North Junction to travel via Sheffield HS and Huddersfield instead of via South Yorkshire.

There are no changes on HS9 as such, but the above rerouting means we can now consider the Northern Transpenning Interchange Pattern at Huddersfield. Note that of the services on HS9 (refer back to SP1), 4 are GC gauge (calling at Leeds HS then York HS) and 4 are classic compatible (calling at Leeds HS then Micklefield), a circumstance that is taken advantage of in the interchange arrangements at Huddersfield, below.

The following Regional Metro services run on the Northern Transpennine classic route (note that **all** of them have the stopping pattern: Salford Central – Manchester Victoria – Stalybridge – Diggle – Marsden – Huddersfield – Mirfield – Dewsbury – Batley – Leeds City, which will not be repeated; the point of the stops at Diggle and Marsden is to connect with stopping services either side of Standedge Tunnel):

- 2tphR Chester – Helsby – Warrington Bank Quay – Newton le Willows – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland – Newcastle
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
- 2tphR Liverpool Lime Street – St. Helen's Junction – Newton le Willows – Salford Central —> Leeds City – Micklefield – York – Strensall – Malton – Rillington (NYMR) – Seamer – Scarborough
- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Salford Central —> Leeds City –Micklefield – Selby – Brough – Hull

These services all connect at Huddersfield. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Liverpool – Newcastle
C Preston – Scarborough
R Blackpool – Hull

07GG HS3 Pancras Cross – York (HS Metro)
C Liverpool – Newcastle (via Stockton)
R Southport – Middlesborough

15G HS7 Plymouth – Newcastle
C Preston – Hull
R Liverpool – Scarborough

23GG HS7 Birmingham HS – York
C Liverpool – Middlesborough
R Chester – Newcastle (via Stockton)

Service Plan 2A

This service plan comes into effect when HS8 opens from Nottingham to Ely HS North and South Junctions. HS6 from Ely to Norwich opens simultaneously (allowing HS8 services to reach Norwich). The service from Preston to Nottingham is extended to Norwich. The HS4/HS7 service from South Wales to Nottingham is likewise extended to Norwich. (HS5 has also opened prior to or simultaneously with these developments, and all Pancras Cross services now pass through London to Sussex / West Kent / South Hampshire destinations.)

Representative Hourly Cross-Platform Interchange Pattern at Nottingham:

00GG Preston – Norwich (no connection)

07GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
C HS7 Birmingham HS – Cleethorpes
R York – Melton Mowbray – St. Pancras
R Morecambe – Norwich / Stansted Airport

23GG HS3 Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
G HS7 Cardiff – Norwich

– repeating at 30, 37 and 53 minutes past.

Service Plan 2B

This service plan comes into effect when HS10 opens and HS4 is extended from Cardiff to Swansea. The following services are introduced:

- 2tphG [HS5 Southampton – >] Pancras Cross – Stansted Airport – Cambridge – Ely – Peterborough – Lincoln – Gainsborough Central – Brigg – Hull Paragon
- 2tphG Norwich – Peterborough – Lincoln – Gainsborough Central – Brigg – Hull Paragon

The following Regional Metro services run on the Southern Transpennine classic route (note that **all** these services have the stopping pattern: Manchester Oxford Rd. – Manchester Piccadilly – Stockport – Chinley – Sheffield Midland, which will not be repeated):

- 2tphR Morecambe – Lancaster – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland (reverse) – Chesterfield – Alfreton and Mansfield Parkway – Langley Mill – Nottingham – Melton Mowbray – Oakham – Stamford – Peterborough – March – Ely (split/joins) –:
  – (reverse) Thetford – Wymondham – Norwich
  – Cambridge – Stansted Airport

- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne South – Scunthorpe – Barnetby – Grimsby Town - Cleethorpes
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne North – Goole – Brough – Hull
- 2tphR Liverpool Lime St. – Liverpool South Parkway – Widnes – Warrington Central – Manchester Oxford Rd. —> Sheffield Midland – Worksop – Retford (LL) – Gainsborough Lea Road – Lincoln – Sleaford – Boston – Wainfleet – Skegness

These services all connect at Sheffield HS/Midland. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Preston – Norwich
00GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
R Liverpool – Skegness

07C Liverpool – Hull
(no cross-platform connection)
R Blackpool – Cleethorpes

15GG HS3 Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
GG HS7 York – Birmingham HS
R Morecambe – Norwich / Stansted Airport

23G HS3 Liverpool – Pancras Cross [HS5 –> Tunbridge Wells] (UHS)
(no cross-platform connection)
R Southport – Hull

– repeating at 30, 37, 45 and 53minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Nottingham:

00GG Preston – Norwich (no connection)

07GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
C HS7 Birmingham HS – Cleethorpes
R York – Melton Mowbray – St. Pancras
R Morecambe – Norwich / Stansted Airport

23GG HS3 Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
G HS7 Swansea – Norwich

– repeating at 30, 37 and 53 minutes past.

Adding the new services (and diversions) introduced in the several stages of service plan 2 imposes the following loadings on HS8:

- Liverpool Lime St. – Kenyon West Junction 11tph
- Kenyon West Junction – Kenyon South Junction 2tph
- Kenyon West Junction – Kenyon North Junction 1tph
- Kenyon West Junction – Broughton Junction 8tph
- Preston – Gibb Farm Junction 12tph
- Gibb Farm Junction – Bamfurlong Junction 4tph
- Gibb Farm Junction – Broughton Junction 8tph
- Broughton Junction – Guide Bridge HS Junction 16tph
- Guide Bridge HS Junction – Ladybower Junction 6tph
- Paddock Junction – Ladybower Junction 6tph
- Ladybower Junction – Woodhouse HS Junction 12tph
- Woodhouse HS Junction – Beighton Junction 12tph
- Beighton Junction – Nuthall North Junction 18tph
- Nuthall North Junction – Nuthall South Junction 14tph
- Nuthall South Junction – Strelley Junction 6tph
- Strelley Junction – Nottingham station 10tph
- Nottingham station – Manvers St. Junction 10tph
- Manvers St. Junction – Edwalton Junction 10tph
- Edwalton Junction – Asfordby Junction 6tph
- Asfordby Junction – Thurlby Junction 4tph
- Thurlby Junction – Pellett Hall Junction 8tph
- Pellett Hall Junction – Ely HS North Junction 14tph
- Ely HS North Junction – Ely East Junction 6tph
- Ely HS North Junction – Ely South Junction 8tph

It likewise imposes the following loadings on HS9 (the section shared with HS3 includes all the other services using that section):

- Guide Bridge HS Junction – Paddock Junction 10tph
- Paddock Junction – Gelderd Rd. North Junction 16tph
- Gelderd Rd. North Junction – Garforth West Junction 18tph
- Garforth West Junction – Micklefield HS Junction 8tph
- Garforth West Junction – Garforth East Junction 10tph
- Garforth East Junction – York HS station 14tph
- York HS station – Derwent Hill Junction 8tph
- Derwent Hill Junction – Paradise Junction 6tph
- Paradise Junction – Newcastle station 10tph

Service Plan 2 Summary

It's worth summarising the full set of services at service plan 2, as this represents the final, complete state of these plans, and the services have so far been introduced piecemeal, at the various stages.

Non-Transpennine Services:

- 2tphG Liverpool Lime St. – Crewe – Old Oak Common – Euston Cross [–> Hastings]
- 2tphG Preston – Crewe – Old Oak Common – Euston Cross [–> Hastings]
- 1tphC Liverpool Lime St. – Preston (splits/joins) –
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central
- 1tphC Birmingham HS – Crewe – Preston (splits/joins) –
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central

Southern Transpennine Services:

HS8:

- 2tphG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Sheffirld HS – Pancras Cross [HS5 –> Tunbridge Wells]
- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham – Leicester – Northampton – Luton & Dunstable Parkway – Pancras Cross [HS5 –> Brighton]
- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham – Peterborough – Norwich

Regional Metro:

(Note that **all** these services have the stopping pattern: Manchester Oxford Rd. – Manchester Piccadilly – Stockport – Chinley – Sheffield Midland, which will not be repeated):

- 2tphR Morecambe – Lancaster – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland (reverse) – Chesterfield – Alfreton and Mansfield Parkway – Langley Mill – Nottingham – Melton Mowbray – Oakham – Stamford – Peterborough – March – Ely (split/joins) –:
  – (reverse) Thetford – Wymondham – Norwich
  – Cambridge – Stansted Airport
- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne South – Scunthorpe – Barnetby – Grimsby Town - Cleethorpes
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne North – Goole – Brough – Hull
- 2tphR Liverpool Lime St. – Liverpool South Parkway – Widnes – Warrington Central – Manchester Oxford Rd. —> Sheffield Midland – Worksop – Retford (LL) – Gainsborough Lea Road – Lincoln – Sleaford – Boston – Wainfleet – Skegness

The Southern Transpennine services, HS and RM, all connect at Sheffield HS / Midland. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Preston – Norwich
GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
R Liverpool – Skegness

07G HS7 Newcastle – Plymouth
(no cross-platform connection)
R Blackpool – Cleethorpes

15GG Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
GG HS7 York – Birmingham HS
R Morecambe – Norwich / Stansted Airport

23G Liverpool – Pancras Cross {HS5 –> Tunbridge Wells] (UHS)
(no cross-platform connection)
R Southport – Hull

– repeating at 30, 37, 45 and 53minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Nottingham:

00GG Preston – Norwich (no connection)

07GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
C HS7 Birmingham – Cleethorpes
R York – Melton Mowbray – St. Pancras
R Morecambe – Norwich / Stansted Airport

23GG HS3 Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
G HS7 Swansea – Norwich

– repeating at 30, 37 and 53 minutes past.

Northern Transpennine Services:

HS9:

- 2tphGG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – York HS – Darlington – Durham (Relly Mill) – Consett – Newcastle
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland - Newcastle
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – Selby – Hull

- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Malton – Seamer – Scarborough

Regional Metro:

(Note that **all** these services have the stopping pattern: Salford Central – Manchester Victoria – Stalybridge – Diggle – Marsden – Huddersfield – Mirfield – Dewsbury – Batley – Leeds City, which will not be repeated):

- 2tphR Chester – Helsby – Warrington Bank Quay – Newton le Willows – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland – Newcastle
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
- 2tphR Liverpool Lime St. – St. Helen's Junction – Newton le Willows – Salford Central —> Leeds City – Micklefield – York – Strensall – Malton – Rillington (NYMR) – Seamer – Scarborough
- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Salford Central —> Leeds City –Micklefield – Selby – Brough – Hull

The Northern Transpennine services, HS and RM, all connect at Huddersfield. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Liverpool – Newcastle
C Preston – Scarborough
R Blackpool – Hull

07GG [HS5 Brighton –>] HS3 Pancras Cross – York (HS Metro)
C Liverpool – Newcastle (via Stockton)
R Southport – Middlesborough

15G HS7 Plymouth – Newcastle
C Preston – Hull
R Liverpool – Scarborough

23GG HS7 Birmingham HS – York
C Liverpool – Middlesborough
R Chester – Newcastle (via Stockton)

Estimated Journey Times

The conditions governing acceleration, deceleration, behaviour at junctions and line capacity of high speed lines are dealt with exhaustively in appendix B of the article ‘Same Speed Railways’. Technically-minded readers, who want all the hard details, should look there. Only the required results are quoted here.

The following calculations are only approximate. Distances, to the nearest km, are derived from my own maps. However, comparing my estimated distances with actual distances, where these are appropriate, (thus York – Darlington my estimate 70km, actual 70.4km, Darlington – Durham Relly Mill, my estimate 33km, actual Darlington – former Relly Mill Junction 33.6km,) leads me to believe they are accurate to well within 2%.

The crudest approximation, usually, is the assumption that, once line speed has been reached, that speed (300kph) is maintained until it becomes necessary to decelerate for a junction or a station stop. Given the generally difficult landscape of the central portions of these particular routes, that generalisation is unlikely to be very good, though on the outer sections, to the North East, to the Yorkshire coast and to East Anglia, and also on the western side in Lancashire, the results should be significantly better.

The results are, in any case, valuable in giving a **feel** for the journey times possible.

My estimated distances (between stations) are:

- Liverpool Lime St. – Victoria LL 49km
- Victoria LL – Manchester HS 0.5km
- Manchester HS – Huddersfield 39km
- Huddersfield – Leeds New Lane 24km
- Leeds New Lane – York 39km
- York – Darlington 70km
- Darlington – Durham Relly Mill 33km
- Durham Relly Mill – Consett 20km
- Consett – Newcastle 22km
- Preston – Bolton 32km
- Bolton – Victoria LL 17km
- Victoria LL – Manchester HS 0.5km
- Manchester HS – Sheffield HS 54km
- Huddersfield – Sheffield HS 53km
- Sheffield HS – Nottingham 60km
- Nottingham – Peterborough 85km
- Peterborough – Norwich 121km

Acceleration/deceleration distances and times (taken from ‘Same Speed Railways’ appendix B) are:

- Acceleration from stationary to 300kphtakes 11.57km and 278 seconds
- Deceleration from 300kph to stationary takes 6.945km and 167 seconds
- Time to travel from Bolton to Victoria LL (start to stop) is 426 seconds
- Time to travel from Victoria LL to Manchester HS (start to stop) is 73 seconds

The final two times need elucidation. When the distance between stations is less than 18.5km, and the line speed is 300kph, a train accelerating from the first station is not able to reach line speed, before it has to begin decelerating for the next station. ‘Same Speed Railways’ contains a table of times taken to travel between adjacent stations, for inter-station distances of up to 18.5km, and the above times are taken from this.

The procedure in calculating journey times between station stops is to take the two values of acceleration / deceleration distance, and the two times, as given in the first 2 lines of the above list, and sum them, thus acceleration / deceleration takes 11.57 + 6.95 = 18.52km and 278 + 167 = 445 seconds at line speed 300kph. The appropriate distance value is subtracted from the inter-station distance, and the remaining length is assumed to be travelled at line speed, taking time = distance / speed. This time is then added to the acceleration / deceleration time to obtain the actual journey time between the stations. This is all very laborious (error-prone, too!) to perform manually, so I have developed spreadsheets to do the work and present the results. For those sections less than 18.5km in length, the time-calculating formula in the spreadsheet cell is replaced by the actual value, as given in the above list. The various section times are accumulated to obtain the overall journey times. One further refinement: a standard wait time of 3 minutes is assumed at stations, and this is added into the accumulated time at each stop.

Certain sections of the route incur time penalties because of junctions. (Refer to the ‘Same Speed Railways’ article, specifically the sections ‘The Effect of Junctions’ and ‘Adjacent Junctions’. These penalties apply only at junctions which are taken at high speed, and not those on the approach to stations. Specifically:

- Leeds – York incurs a double junction penalty of 30 seconds at Garforth East and West Junctions, where it diverges from the main line of HS3, and joins the main line of HS9, Northern Transpennine. (NB 30kph line speed.)
- Sheffield – Nottingham incurs a double-junction penalty of 28 seconds at Nuthall South and Strelley junctions, where the Nottingham station loop of HS3 diverges from the main line.

The time penalties are simply added in as explicit amounts to the spreadsheet formula for the section time.

Liverpool – Newcastle and Preston – Norwich are the only GC-gauge services, but there are CC services to several other destinations on the eastern side, specifically Hull, Cleethorpes, Middlesborough and Newcastle via Sunderland, from Liverpool, and Hull and Scarborough from Preston. There is of course a HS Metro service to London from Preston, but this is a service of HS3, and is dealt with there.

As noted earlier, these are the routes where the assumption of constant line speed between acceleration and deceleration is likely (certain!) to be least accurate, because of the significant curvature of the routes, at least in the central, actual trans-pennine, sections. Accordingly I provide alternative calculation, taking a line speed of 200kph, 125mph, over the central sections, between Manchester and Leeds and between Manchester and Sheffield. For line speed 200kph, the following values apply:

Line Speed	200kph = 125mph = 55.55m/s
Train/Platform Length	400m
Average Acceleration	$0.3m/s^2$
Deceleration	$0.5m/s^2$
Acceleration Distance	5.1km = 3.2miles
Acceleration Time	185 sec = 3min 5sec
Service Brake Distance	3.1km = 1.9miles
Service Brake Time	111 sec = 1min 51 sec
Buffer Zone	100m
Train Separation Distance	3.6km = 2.2miles
Turnout Limit Speed	160kph = 100mph

As previously, the procedure in calculating journey times between station stops is to take the two values of acceleration / deceleration distance, and the two times, as given in above list, and sum them, thus acceleration / deceleration takes 5.14 + 3.09 = 8.23km and 185 + 111 = 296 seconds at line speed 200kph. The appropriate distance value is subtracted from the inter-station distance, and the remaining length is assumed to be travelled at line speed, taking time = distance / speed. This time is then added to the acceleration / deceleration time to obtain the actual journey time between the stations. There are no special effects (such as stations close together) to take into account between Manchhester, Leeds and Sheffield.

1. Liverpool Lime St. – Newcastle (8 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Liverpool, inc. Station Wait Times
Liverpool Lime St. - Victoria LL	49	49	12.6	12.6	12.6
Victoria LL - Manchester HS	1	50	1.2	13.8	16.8
Manchester HS - Huddersfield	39	89	11.5	25.3	31.3
Huddersfield - Leeds New Lane	24	113	8.5	33.8	42.8
Leeds New Lane - York	39	152	10.9	44.8	56.8
York - Darlington	70	222	16.1	60.9	75.9
Darlington - Durham Relly Mill	33	255	10.3	71.2	89.2
Durham Relly Mill - Consett	20	275	7.7	78.9	99.9
Consett - Newcastle	22	297	8.1	87.0	111.0

Current fastest time (minutes) from Liverpool [and the above values] to:

- Manchester 47 [17]
- Huddersfield 83 [32]
- Leeds 107 [43]
- York 133 [57]
- Darlington 176 [76]
- Durham 199 [100]
- Newcastle 207 [111]

2. Preston – Norwich (6 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Preston, inc. Station Wait Times
Preston - Bolton	32	32	9.8	9.8	9.8
Bolton - Victoria LL	17	49	7.1	16.9	19.9
Victoria LL - Manchester HS	1	50	1.2	18.1	24.1
Manchester HS - Sheffield HS	54	104	14.5	32.6	41.6
Sheffield HS - Nottingham	60	164	15.7	48.3	60.3
Nottingham - Peterborough	85	249	20.7	69.0	84.0
Peterborough - Norwich	121	370	27.9	96.9	114.9

Current fastest time (minutes) from Preston [and the above values] to:

- Bolton 21 [10]
- Manchester 40 [24]
- Sheffield 107 (1 change) [42]
- Nottingham 161 (1 change) [61]
- Peterborough 204 (2 changes) [84]
- Norwich 315 (3 changes) [115]

3. Liverpool Lime St. – Newcastle (8 stops) Central Line Speed 200kph:

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Liverpool, inc. Station Wait Times
Liverpool Lime St. - Victoria LL	49	49	12.6	12.6	12.6
Victoria LL - Manchester HS	1	50	1.2	13.8	16.8
Manchester HS - Huddersfield	39	89	14.2	28.0	34.0
Huddersfield - Leeds New Lane	24	113	9.7	37.6	46.6
Leeds New Lane - York	39	152	10.9	48.6	60.6
York - Darlington	70	222	16.1	64.7	79.7
Darlington - Durham Relly Mill	33	255	10.3	75.0	93.0
Durham Relly Mill - Consett	20	275	7.7	82.7	103.7
Consett - Newcastle	22	297	8.1	90.8	114.8

Current fastest time (minutes) from Liverpool [plus 300kph times] {and 200kph times} to:

- Manchester 47 [17] {17}
- Huddersfield 83 [32] {34}
- Leeds 107 [43] {47}
- York 133 [57] {61}
- Darlington 176 [76] {80}
- Durham 199 [100] {104}
- Newcastle 207 [111] {115}

Over the relatively short distance between Manchester and Leeds a 50% higher line speed saves precisely 4 minutes (16.7% of 24 minutes) compared with a line speed of 125mph, with which we're all very familiar. (The **percentage** saving over that particular section is significant, but the **absolute** saving trivial as the section is so short.) Most people (including me) would regard it as hardly worth the effort and extra expense. A 125mph Northern Trans-Pennine route (the central section at least) is entirely satisfactory.

4. Preston – Norwich (6 stops) Central Line Speed 200kph:

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Preston, inc. Station Wait Times
Preston - Bolton	32	32	9.8	9.8	9.8
Bolton - Victoria LL	17	49	7.1	16.9	19.9
Victoria LL - Manchester HS	1	50	1.2	18.1	24.1
Manchester HS - Sheffield HS	54	104	18.7	36.7	45.7
Sheffield HS - Nottingham	60	164	15.7	52.5	64.5
Nottingham - Peterborough	85	249	20.7	73.2	88.2
Peterborough - Norwich	121	370	27.9	101.1	119.1

Current fastest time (minutes) from Preston [plus 300kph times] {and 200kph times} to:

- Bolton 21 [10] {10}
- Manchester 40 [24] {24}
- Sheffield 107 (1 change) [42] {46}
- Nottingham 161 (1 change) [61] {65}
- Peterborough 204 (2 changes) [84] {88}
- Norwich 315 (3 changes) [115] {119}

Over the relatively short distance between Manchester and Sheffield a 50% higher line speed saves precisely 4 minutes (21% of 19 minutes) compared with a line speed of 125mph, with which we're all very familiar. (The **percentage** saving over that particular section is significant, but the **absolute** saving trivial as the section is so short.) Most people (including me) would regard it as hardly worth the effort and extra expense. A 125mph Southern Trans-Pennine route (the central section at least) is entirely satisfactory.

HS8/HS9 Mk2 Enhancements

All the preceding service plans are as proposed for the original 2-track HS8/HS9. The provision of 4 tracks over all the section of route between Broughton and Guide Bridge HS junctions enables several new services to be introduced, all involving HS3.

Service Plan 3

The following new services are introduced:

UHS:

- 2tphG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Pancras Cross – Victoria (LL) – East Croydon – Tonbridge – Tunbridge Wells – Tunbridge Wells West

HS Metro:

- 2tphC Liverpool Lime St. – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Worksop – Retford (LL) – Gainsborough Central – Brigg – Hull Paragon
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Worksop – Retford (LL) – Gainsborough Central – Brigg – Grimsby Town – Cleethorpes

The full service plan is:

Non-Transpennine Services:

- 2tphG Liverpool Lime St. – Crewe – Old Oak Common – Euston Cross [–> Hastings]
- 2tphG Preston – Crewe – Old Oak Common – Euston Cross [–> Hastings]
- 1tphC Liverpool Lime St. – Preston (splits/joins) –
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central
- 1tphC Birmingham HS – Crewe – Preston (splits/joins) –
  – Oxenholme – Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
  – Lancaster – Penrith – Carlisle – Lockerbie – Glasgow Central

Southern Transpennine Services:

HS8:

- 2tphG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Pancras Cross [HS5 –> Tunbridge Wells] (UHS)
- 2tphG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Pancras Cross [HS5 –> Tunbridge Wells] (HS Metro)
- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham – Leicester – Northampton – Luton & Dunstable Parkway – Pancras Cross [HS5 –> Brighton] (HS Metro)
- 2tphGG Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham – Peterborough – Norwich

- 2tphC Liverpool Lime St. – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Worksop – Retford (LL) – Gainsborough Central – Brigg – Hull Paragon
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Worksop – Retford (LL) – Gainsborough Central – Brigg – Grimsby Town – Cleethorpes

Regional Metro:

(Note that **all** these services have the stopping pattern: Manchester Oxford Rd. – Manchester Piccadilly – Stockport – Chinley – Sheffield Midland, which will not be repeated):

- 2tphR Morecambe – Lancaster – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland (reverse) – Chesterfield – Alfreton and Mansfield Parkway – Langley Mill – Nottingham – Melton Mowbray – Oakham – Stamford – Peterborough – March – Ely (split/joins) –:
  – (reverse) Thetford – Wymondham – Norwich
  – Cambridge – Stansted Airport
- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne South – Scunthorpe – Barnetby – Grimsby Town - Cleethorpes
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Manchester Oxford Rd. —> Sheffield Midland – South Yorkshire – Rotherham – Mexborough – Doncaster – Thorne North – Goole – Brough – Hull
- 2tphR Liverpool Lime St. – Liverpool South Parkway – Widnes – Warrington Central – Manchester Oxford Rd. —> Sheffield Midland – Worksop – Retford (LL) – Gainsborough Lea Road – Lincoln – Sleaford – Boston – Wainfleet – Skegness

The Southern Transpennine services, HS and RM, all connect at Sheffield HS / Midland. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Preston – Norwich
GG HS3 York – Pancras Cross [HS5 –> Brighton] (HS Metro)
R Liverpool – Skegness

07G Preston – Pancras Cross [HS5 –> Tunbridge Wells] (*)
G HS7 Newcastle – Plymouth (*)
C Liverpool – Hull (*)
R Blackpool – Cleethorpes

15GG Preston – Pancras Cross [HS5 –> Brighton]
GG HS7 York – Birmingham HS
R Morecambe – Norwich / Stansted Airport

23G Liverpool – Pancras Cross {HS5 –> Tunbridge Wells]
C Preston – Cleethorpes
R Southport – Hull

– repeating at 30, 37, 45 and 53minutes past. (*) What this means is that Preston – Tunbridge Wells and Newcastle – Plymouth have a full cross-platform interchange, then Preston – Tunbridge Wells departs and Liverpool – Hull arrives and has a full cross-platform interconnection with Newcastle – Plymouth. Liverpool – Hull does not connect into Preston – Tunbridge Wells.

Representative Hourly Cross-Platform Interchange Pattern at Nottingham:

00GG Preston – Norwich
C Bournemouth – Newcastle

07GG York – Pancras Cross [HS5 –> Brighton] (HS Metro)
C HS7 Birmingham – Cleethorpes
R York – Melton Mowbray – St. Pancras
R Morecambe – Norwich / Stansted Airport

23GG Preston – Pancras Cross [HS5 –> Brighton] (HS Metro)
G Swansea – Norwich

– repeating at 30, 37 and 53 minutes past.

Northern Transpennine Services:

HS9:

- 2tphGG Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – York HS – Darlington – Durham (Relly Mill) – Consett – Newcastle
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
- 2tphC Liverpool Lime Street – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Thirsk – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland - Newcastle
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – Selby – Hull
- 2tphC Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Huddersfield – Leeds HS – Micklefield – York – Malton – Seamer – Scarborough

Regional Metro:

(Note that **all** these services have the stopping pattern: Salford Central – Manchester Victoria – Stalybridge – Diggle – Marsden – Huddersfield – Mirfield – Dewsbury – Batley – Leeds City, which will not be repeated):

- 2tphR Chester – Helsby – Warrington Bank Quay – Newton le Willows – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Stockton – Hartlepool – Seaham – Sunderland – Newcastle
- 2tphR Southport – Wigan Wallgate – Bolton – Salford Crescent – Salford Central —> Leeds City – Wetherby – Harrogate – Ripon – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough

- 2tphR Liverpool Lime St. – St. Helen's Junction – Newton le Willows – Salford Central —> Leeds City – Micklefield – York – Strensall – Malton – Rillington (NYMR) – Seamer – Scarborough
- 2tphR Blackpool North – Poulton le Fylde – Kirkham – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Salford Central —> Leeds City –Micklefield – Selby – Brough – Hull

The Northern Transpennine services, HS and RM, all connect at Huddersfield. The HS services have cross-platform interchange and the RM services have longer stops to allow for platform change. The Representative Hourly Pattern is:

00GG Liverpool – Newcastle
C Preston – Scarborough
R Blackpool – Hull

07GG York – Pancras Cross [HS5 –> Brighton] (HS Metro)
C Liverpool – Newcastle (via Stockton)
R Southport – Middlesborough

15G Plymouth – Newcastle
C Preston – Hull
R Liverpool – Scarborough

23GG York – Birmingham
C Liverpool – Middlesborough
R Chester – Newcastle (via Stockton)

Service plan 3 imposes the following loadings on HS8:

- Liverpool Lime St. – Kenyon West Junction 13tph
- Kenyon West Junction – Kenyon South Junction 2tph
- Kenyon West Junction – Kenyon North Junction 1tph
- Kenyon West Junction – Broughton Junction 10tph
- Preston – Gibb Farm Junction 16tph
- Gibb Farm Junction – Bamfurlong Junction 4tph
- Gibb Farm Junction – Broughton Junction 12tph
- Broughton Junction – Guide Bridge HS Junction 22tph
- Guide Bridge HS Junction – Ladybower Junction 12tph
- Paddock Junction – Ladybower Junction 6tph
- Ladybower Junction – Woodhouse HS Junction 18tph
- Woodhouse HS Junction – Beighton Junction 14tph
- Beighton Junction – Nuthall North Junction (main) 12tph
- Beighton Junction – Nuthall North Junction (relief) 12tph
- Nuthall North Junction – Strelley Junction 8tph
- Strelley Junction – Nottingham station 14tph
- Nottingham station – Manvers St. Junction 14tph
- Manvers St. Junction – Edwalton Junction 14tph
- Edwalton Junction – Asfordby Junction 6tph
- Asfordby Junction – Thurlby Junction 4tph
- Thurlby Junction – Pellett Hall Junction 8tph
- Pellett Hall Junction – Ely HS North Junction 14tph
- Ely HS North Junction – Ely East Junction 6tph
- Ely HS North Junction – Ely South Junction 8tph
- Ely HS East Junction – Norwich 8tph

It likewise imposes the following loadings on HS9 (the section shared with HS3 includes all the other services using that section):

- Guide Bridge HS Junction – Paddock Junction 10tph
- Paddock Junction – Gelderd Rd. North Junction 16tph
- Gelderd Rd. North Junction – Leeds HS 20tph
- Leeds HS – Garforth West Junction 16tph
- Garforth West Junction – Micklefield HS Junction 8tph
- Garforth West Junction – Garforth East Junction 8tph
- Garforth East Junction – York HS station 14tph
- York HS station – Derwent Hill Junction 10tph
- Derwent Hill Junction – Paradise Junction 8tph
- Paradise Junction – Newcastle station 12tph