HS2 Route and Service Plans

HS2 Route Mk1A

Following the referendum on EU membership and the decision to disengage from the EU, several changes have been made to the plans for HS rail, most importantly, abandoning GC-gauge, and building all new infrastructure to standard UK loading gauge. This has very little impact on the routes proposed, but significant impact on the service plans. In certain cases it is now proposed to include sections of classic route in the HS route, rather than building exclusively new throughout. (Note that this is different from the previous proposals to run classic compatible services on classic lines, **beyond** the HS route; this actually incorporates classic sections, upgraded as appropriate, in the HS route itself.) The proposals for Mk1A omit all the new infrastructure above Crewe, incorporating sections of classic route. Appendix H lists all specific changes of route, for HS2 and associated routes, which are also, of course, incorporated in the various route sections, following. A new station at Calvert is proposed for Mk1A. This is a two-level station, providing interchange with East-West Rail, and also with Crossrail 4 (eventually!).

Because of the significant changes introduced at Mk1A, the latest versions of all the Mk1 plans (v8.8 in the case of HS2) have been preserved, available in an archive section on the website. (For the avoidance of confusion, note that the Mk3 plans for HS2, below, were actually written before Mk1A, but of course describe much later developments. They thus appear in v8.8, but are not there designated as Mk-anything!)

HS2 Route Mk2

Mk2 is merely implementation of the new infrastructure above Crewe, including the tunnel under Crewe, avoiding the station, as and when extra capacity becomes desirable. In addition, sections of HS8 are used to provide exclusive HS connections to Liverpool and Preston (as was also included in the original Mk1).

HS2 Route Mk3

Mk1 also included some very futuristic stuff, further ideas for what could come next, once all the original Mk1 proposals, as revised in Mk1A versions, for all the various proposed routes had been implemented. We're looking at least 50 years into the future. Since we're now talking of a Mark structure for the proposals, this is clearly Mk3.

Mk3 comes in two stages, Mk3.1, otherwise known as HS2 – the Coventry Variant, (HS2-CV,) and Mk3.2, the Scottish Extension. HS2-CV proposes capacity enhancements in the West Midlands, and gives Coventry a proper HS service at last. It is also intimately related to HS3 Mk2, and proposes interconnections between the two routes. HS2-CV is described in part 3 of the Route section of the present article, and in Service Plan 6. The Scottish Extension is exactly what it says, and is described in part 4 of the Route section, and in Service Plan 7.

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 makes 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, gives my own thoughts of what such a network could look like. Naturally, this involves 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 HS2, the route from London to the West Midlands and the North West, also North Wales.

Unlike the other articles in this series, the route here is that planned by HS2 Ltd. (except for Euston Cross!) I have reproduced the maps, to the usual standards, but not changed them in any way. What I have changed are the service plans, and also the whole purpose and timing of phase 2 of the project.

As a piece of extreme futurology, (and for fun,) I have also considered possible additions to HS2, specifically the Coventry Variant (HS2-CV), which is an extra section of route serving Rugby and Coventry, which HS2 in its original form (HS2-orig) completely ignores and bypasses, and an extension along the west coast to Scotland. It is considered highly unlikely that Scottish traffic will ever justify a completely separate second HS route to England; HS2 will therefore join HS3 at Riccarton North Junction, and share the route to Edinburgh (and the apotheosis of the Waverley route will thus be complete).

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 HS2, including sections of other routes over which HS2's services run. These overall maps come at the end of the 'Route' description, and also show HS2'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 HS2.

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. The only relevant stations in phase 1 of HS2 are Birmingham Interchange and Calvert, and these have avoiding lines through the centre. In phase 2B, Crewe is on a loop. Everywhere else (Preston, Carlisle) has all services stopping.

The point of insisting on two platforms in each direction is **either** to enable cross-platform interchange between different services, (both HS or HS and RM,) **or** to maximise capacity, (especially when all services stop at the station,) by allowing a second train to arrive at the station before the preceding train has departed. (It also promotes resilience, if a failing train can make it at least as far as the next station, to

be taken out of service.) Note that Birmingham Interchange is an example of the former type, with interchange between HS2 and HS7.

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. I used to take 16tph as the maximum throughput, but, following new capacity calculations (expounded in appendix B of the article 'Same Speed Railways', which do include the effect of junctions,) I am now considerably more relaxed on this, and will countenance loadings of up to 24tph. (The quoted appendix contains my justification for this choice.) As stated above, the service plans deliberately quote maximum frequencies; initial services will almost certainly be to lower frequencies.

Two types of services are contained in the plans, those featuring High Speed trains, which all travel on HS2 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).

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 services. The assumptions and approximations made are explained.

The estimates are produced for the initial line speed of 360kph, 225mph, but since HS2 Ltd.'s plans assert that the design is suitable also for a line speed of 400pph, 250mph, estimates are provided for this speed also.

HS2 Route – Introduction and Assumptions

HS2's long-term HS-Classic services (mostly) begin at Euston, and the UHS and HS Metro services are all cross-London inter-regional, via Euston Cross. This is an underground station with 6 platforms, (with passive provision for 8,) located on a west-east axis between Euston and St. Pancras / King's Cross stations, the precise location, horizontal position and depth, to be determined by the configuration of all the other tunnels in that area. Euston Cross and its approaches are shared by HS2 and HS4, HS services only. It is a through station; nothing starts or terminates there. HS2's services via Euston Cross continue into Kent and West Sussex, as route HS1. Appendix A gives full details of Euston Cross and its

approaches. Full details of the services on HS1 are contained in the article 'HS1 Route and Service Plans'. Summary details of the inter-regional services are in the service plans of the present article.

The maximum speed for HS2 is 360kph , 225mph, (but supposedly okay for 400kph, 250mph, also,) throughout (for new infrastructure, of course).

Phase 1 of HS2 begins at Euston and extends to Birmingham and Handsacre Junction on the WCML.

Phase 2A of HS2 begins at Streethay Junction and extends to Crewe HS South Junction (as recommended in the HS2 Plus report).

In addition, the section from Old Oak Common North Junction to Euston Cross and on to join HS1 (for details of which see Appendix A)

These three phases constitute Mk1A.

Phase 2B of HS2 begins at Crewe HS South Junction and extends to Manchester and Wigan (including the first instalment of HS8, from Kenyon Junctions to Liverpool),. In addition, a later section of HS8 provides a HS connection throughout to Preston. These phases constitute Mk2.

As noted above, Euston accommodates most of the long-term HS-Classic services of HS2, and the rest, together with the HS-throughout services use Euston Cross. There is a connection between classic and HS lines, diverging from the WCML at Queens Park Junction and joining HS2 at Old Oak Common North Junction (full details in Appendix A).

HS2 Route – Junctions:

There are various junctions on the route of HS2, enabling connections with other HS and classic routes. It is convenient to list them here, together with map references and identifying remarks, since when discussing the capacity/loading of the different sections of route, the end points are usually junctions (occasionally stations). The junction names are (mostly) my suggestions. The following list is complete, but several of the junctions are relevant only to the two extra-highly-speculative extensions of HS2; those marked (*) in the list apply to the Coventry Variant, and those marked (#) to the Scottish extension. In addition, the section between Birmingham Interchange and Streethay Junction is recommended to be at least 4-track from the outset, and to share the outer tracks with HS7 (south of Marston Junction). Refer to appendix B, which contains several layout diagrams, including this one, for a full elucidation.

One feature of the following list needs clarification: certain of the junctions are given as north / south (could equally well be east / west, but in fact they're all north / south). These are all the junctions of station loops, and are where the services stopping at that station diverge from / rejoin the main line. Their location is precisely defined by the acceleration / deceleration rates of the trains. (They decelerate more rapidly than they accelerate, which is probably just as well.) The junction where a service rejoins the main line, having accelerated up to the turnout limit speed from a stop is thus further from the station than the junction where trains diverge, at the turnout limit speed, and decelerate to standing at the platform. (**Very** roughly the acceleration distance is about 50% greater than the stopping distance.) Note that this **only** applies to station loops; for a genuine route junction, where one route diverges from another, and no station is involved, junctions in both directions can be and usually are at the same location.

• Queens Park	TQ229827	Allows classic-compatible services from Euston to join HS2, diverging from the WCML (despite the name) immediately to the west of Kensal Green tunnels
• Old Oak Common East	TQ220821	HS4 diverges from HS2, with which it has shared tracks from Euston Cross, immediately east of Old Oak Common (Low Level). (The given location is **approximate** – it's underground!)
• Old Oak Common North	TQ219821	Allows classic-compatible services from Euston to join HS2, even-more-immediately east of Old Oak Common (Low Level) station. (The given location is **approximate** –it's underground!)
• Ashendon(*) (Mk3)	SP693133	Branch to Grendon Underwood diverges from the Princes Risborough – Banbury route.
• Grendon Underwood (*) (Mk3)	SP727200 SP706222	(South) HS2-CV (southbound) joins HS2-orig. (North) HS2-CV (northbound) diverges from HS2-orig. The line from Ashendon Junction joins the HS2-CV tracks – no connection with HS2-orig. (Refer to track diagram 1 of appendix B, to understamd precisely what happens between Grendon Underwood and Brackley junctions.)
• Chetwode(*) (Mk3)	SP649280 SP634301	(South) Southbound services (HS-Classic) stopping at Calvert diverge from HS2-orig. (North) Northbound services (HS-Classic) having stopped at Calvert re-join HS2-orig.
• Brackley(*) (Mk3)	SP595388	HS2-CV diverges from HS2-orig. This is a route, but not a track, junction
• Banbury(*) (Mk3)	SP462423	Branch to Culworth Junction diverges from the Banbury – Leamington route.
• Culworth(*) (Mk3)	SP555500	The line from Banbury joins the main line of HS2-CV.
• Watford Gap(*) (Mk3)	SP589697	The HS3 (south) interconnection diverges from HS3.
• Onley(*) (Mk3)	SP517723	The HS3 (south) interconnection joins the main line of HS2-CV.
• Rugby HS(*) (Mk3)	SP525753	The HS3 (north) interconnection diverges from the main line of HS2-CV.
• Cotesbach(*) (Mk3)	SP546820	The HS3 (north) interconnection joins HS3.
• Warwick Road(*) (Mk3)	SP325782	Westbound connection between HS2-CV and the Coventry – Birmingham classic route, just west of Coventry station.
• Mount Pleasant(*) (Mk3)	SP244777 SP221796	(South) Southbound services having stopped at Birmingham Interchange (re-)join HS2-orig (North) Northbound services stopping at Birmingham Interchange diverge from HS2-orig. (Refer to track diagram 2 of appendix B, to understand precisely what happens between Mount Pleasant and Streethay junctions.)
• Birmingham Interchange	SP203831	HS7 (south) joins HS2-CV just south of Birmingham Interchange, and scissors crossovers are provided at both ends of the island platforms. HS7 trains normally use the outermost tracks at the

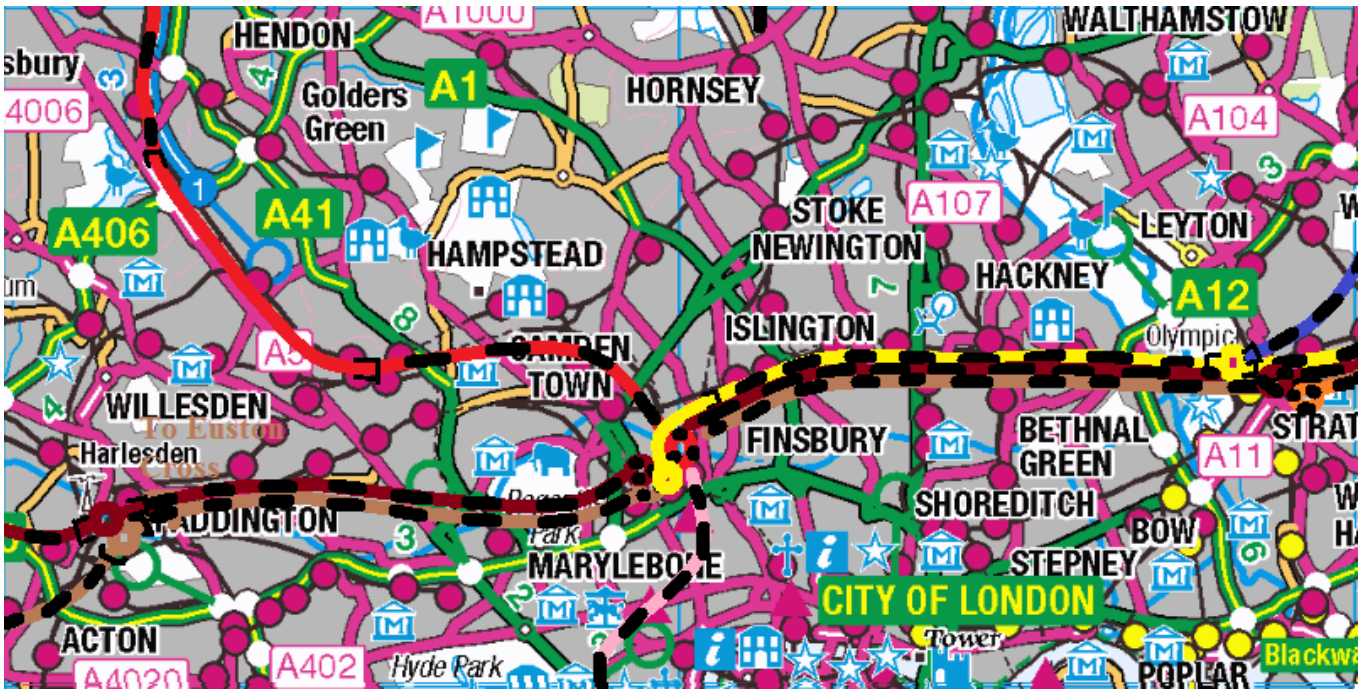
		station. Trains sort themselves by route, normally via the north end crossovers. (There are 6 tracks between here and Water Orton S.
• Water Orton:		
– South	SP192892	Birmingham Curzon Street south branch diverges from HS2-CV main line to Water Orton North Junction. This is a route, but not a track, junction; trains have been sorted by route from B'ham I'chg.
– West	SP172904	HS2 Birmingham Curzon Street routes north and south join.
– North	SP190913	Birmingham Curzon Street north branch joins HS2-CV main line to Streethay Junction.
• Marston	SP190943	HS7 (north) diverges from HS2-CV. This is a route, but not a track, junction.
• Streethay	SK139138	HS2-CV rejoins HS2-orig (route **and** track junction). HS2 Phase 2 route diverges from Phase 1 (which last section is now HS2-CV).
• Handsacre	SK103143	HS2-CV / HS2 Phase 1 route joins WCML
• Crewe HS South	SJ717530	Connection from HS2 to WCML south of Crewe
• Crewe HS North (Mk2)	SJ698586	Connection from WCML to HS2 north of Crewe
• Rostherne (all Mk2):		
– South	SJ718828	Manchester branch diverges from main line to Rostherne North Junction and Wigan
– East	SJ740847	HS2 Manchester routes join
– North	SJ721864	Manchester north branch joins main line to Wigan
• Kenyon South (Mk2)	SJ639955	Connection to HS8 and Liverpool diverges from HS2 main line
• Kenyon West (Mk2)	SJ628961	Connections from HS2 (south and north) join HS8 route to Liverpool
• Kenyon North (Mk2)	SJ634968	Connection from HS8 and Liverpool joins HS2 main line to north
• Bamfurlong	SD600016	HS2 main line joins WCML south of Wigan. Becomes redundant and WCML connection removed at Mk2, when HS8 opens from Bamfurlong to Gibb Farm Junction and Preston.
• Gibb Farm (Mk2)	SD627107	Connection from HS2 joins HS8/HS9 route to Preston
• Galgate(#) (Mk3)	SD487543	Connection from HS2 to WCML, to allow for classic-compatible services to Lancaster etc.
• Oxenholme WCML(#) (Mk3)	SD533905	At this point, immediately beyond where the Windermere branch (and new WCML via Kendal) diverges, HS2 takes over the existing route of the WCML over Shap. A connection between old and new WCMLs is provided, but purely for out-of-course use.
• Penrith WCML(#) (Mk3)	NY520272	HS2 diverges from the former WCML here, and follows the M6 thence to just south of Carlisle (where it rejoins the west side of the WCML at NY432506).
• Eden Bridge (#) (Mk3)	NY510275	The new section of WCML, via Kendal, re joins the original route just south of Penrith. There is a connection between Penrith WCML and Eden Bridge junctions, but only for out-of-course use.

• Westlinton(#) (Mk3)	NY392624	(South) Southbound services (HS-Classic) having stopped at Riddings and, possibly, Longtown, re-join HS2 (Waverley).
	NY386650	(North) Northbound services (HS-Classic) stopping at Longtown, (possibly,) and Riddings, diverge from HS2 (Waverley).
• Watleyhirst (#) (Mk3)	NY440774	(South) Southbound services (HS-Classic) stopping at Riddings diverge from HS2 (Waverley).
	NY460797	(North) Northbound services (HS-Classic) having stopped at Riddings re-join HS2 (Waverley).
• Kershopefoot (#) (Mk3)	NY470809	(South) Southbound services (HS-Classic) having stopped at Newcastleton re-join HS2 (Waverley).
	NY477835	(North) Northbound services (HS-Classic) stopping at Newcastleton diverge from HS2 (Wasverley).
• Leahaugh(#) (Mk3)	NY500904	(South) Southbound services (HS-Classic) stopping at Newcastleton diverge from HS2 (Wasverley).
	NY508940	(North) Northbound services (HS-Classic) having stopped at Newcastleton re-join HS2 (Waverley).
• Riccarton North(#) (Mk3)	NY531988	Joins HS3 route to Edinburgh
• Ravenswood (#) (Mk3)	NT575339	HS3 diverges from the classic Waverley route
• Birkenside(#) (Mk3)	NT562412	(South) Southbound services (HS-Classic having stopped at Lauder re-join HS3.
	NT555438	(North) Northbound services (HS-Classic) stopping at Lauder diverge from HS3.
• Wiselawmill (#) (Mk3)	NT513510	(South) Southbound services (HS-Classic) stopping at Lauder diverge from HS3.
	NT503536	(North) Northbound services (HS-Classic) having stopped at Lauder re-join HS3.

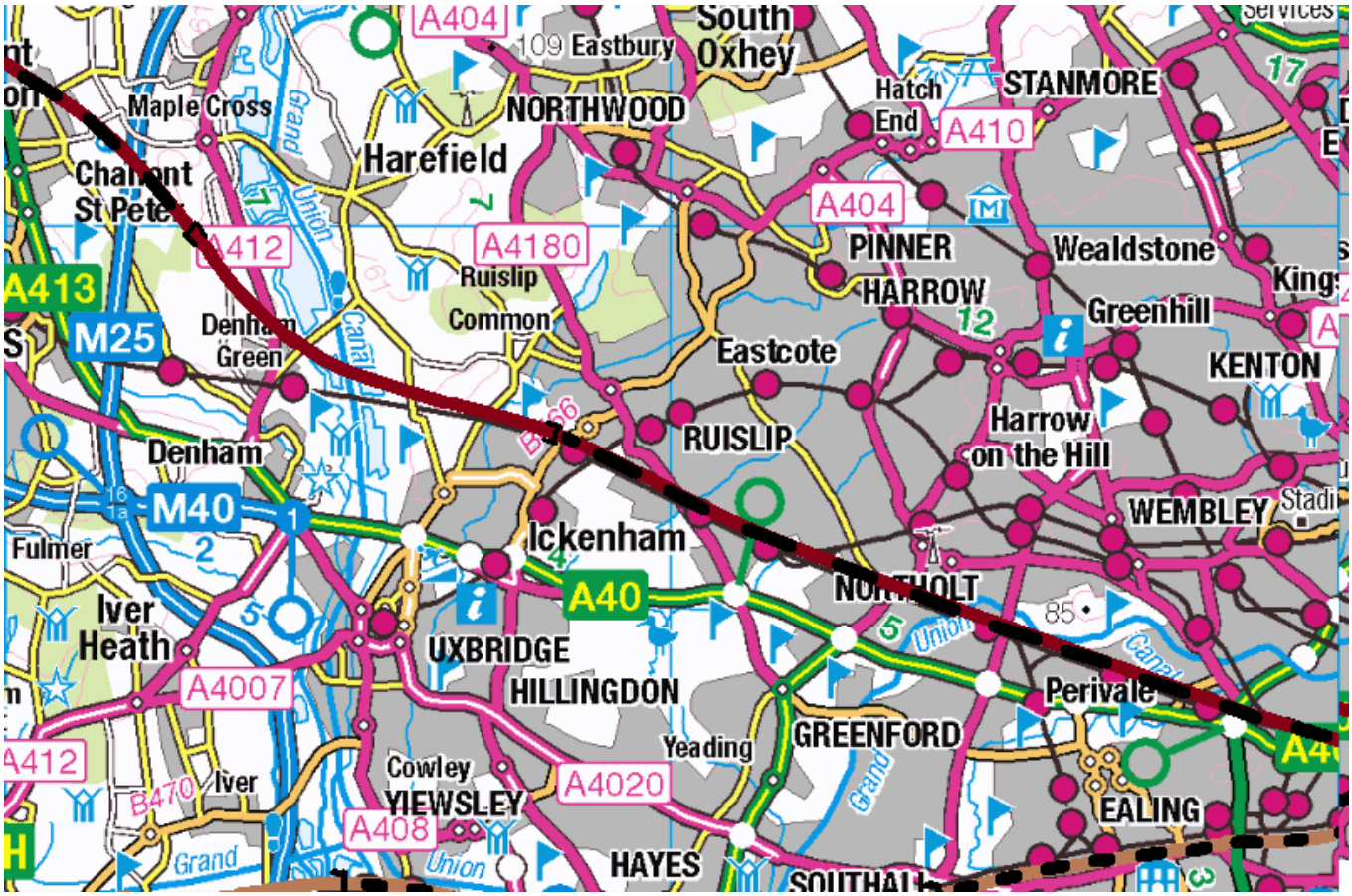
There are various other links between HS2 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context.

There now follows the definition of the actual route, in several logical sections. Note that section 1 describes the full Mk1 route, including the section above Crewe, which is now Mk2. Section 2 describes the associated lines in central Lancashire, which constitutes the rest of Mk2. Section 3 describes the Coventry Variant, and section 4 the Scottish extension, which together constitute Mk3.

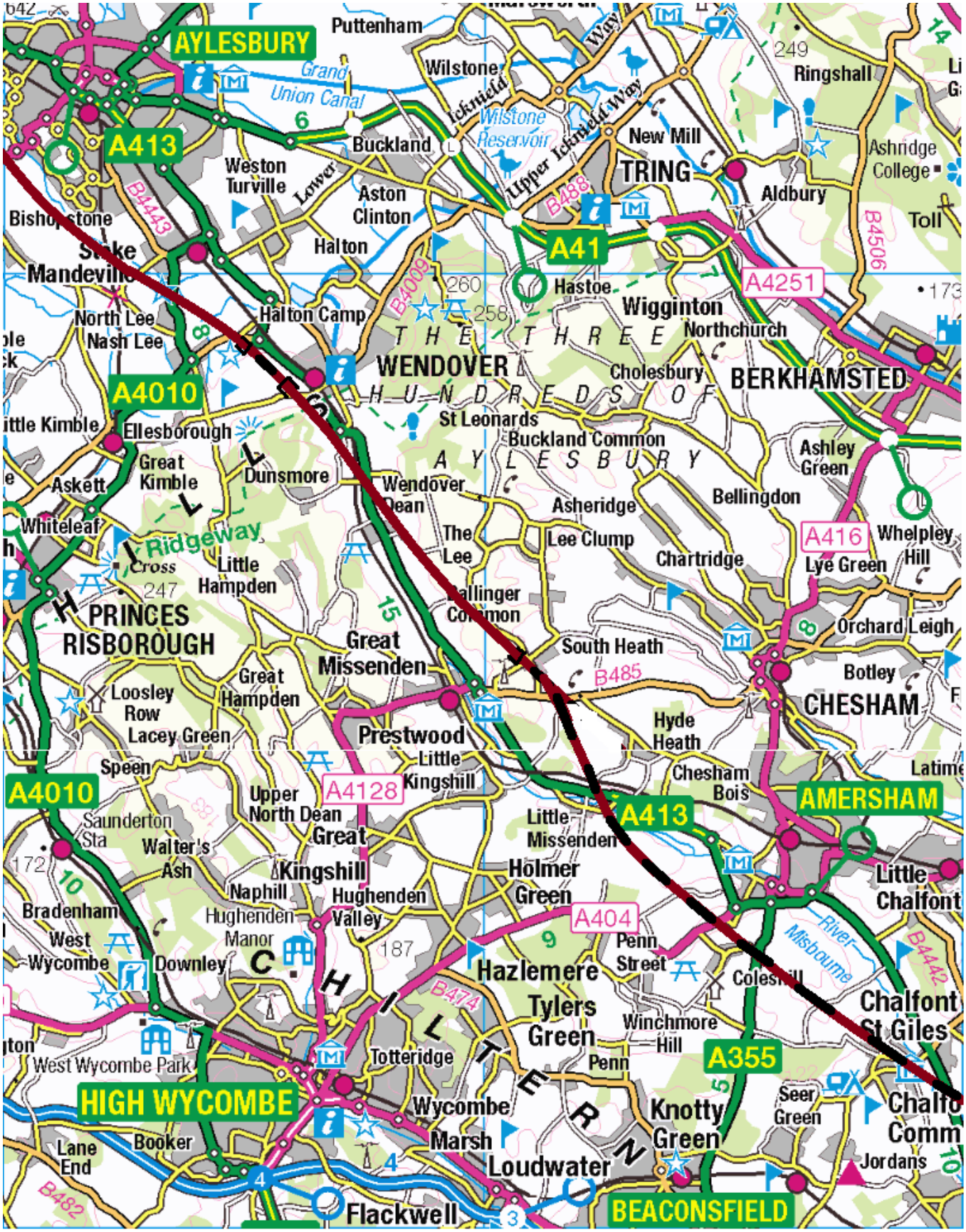
1. *HS2 Route to Manchester and Wigan – Courtesy of HS2 Ltd.:*



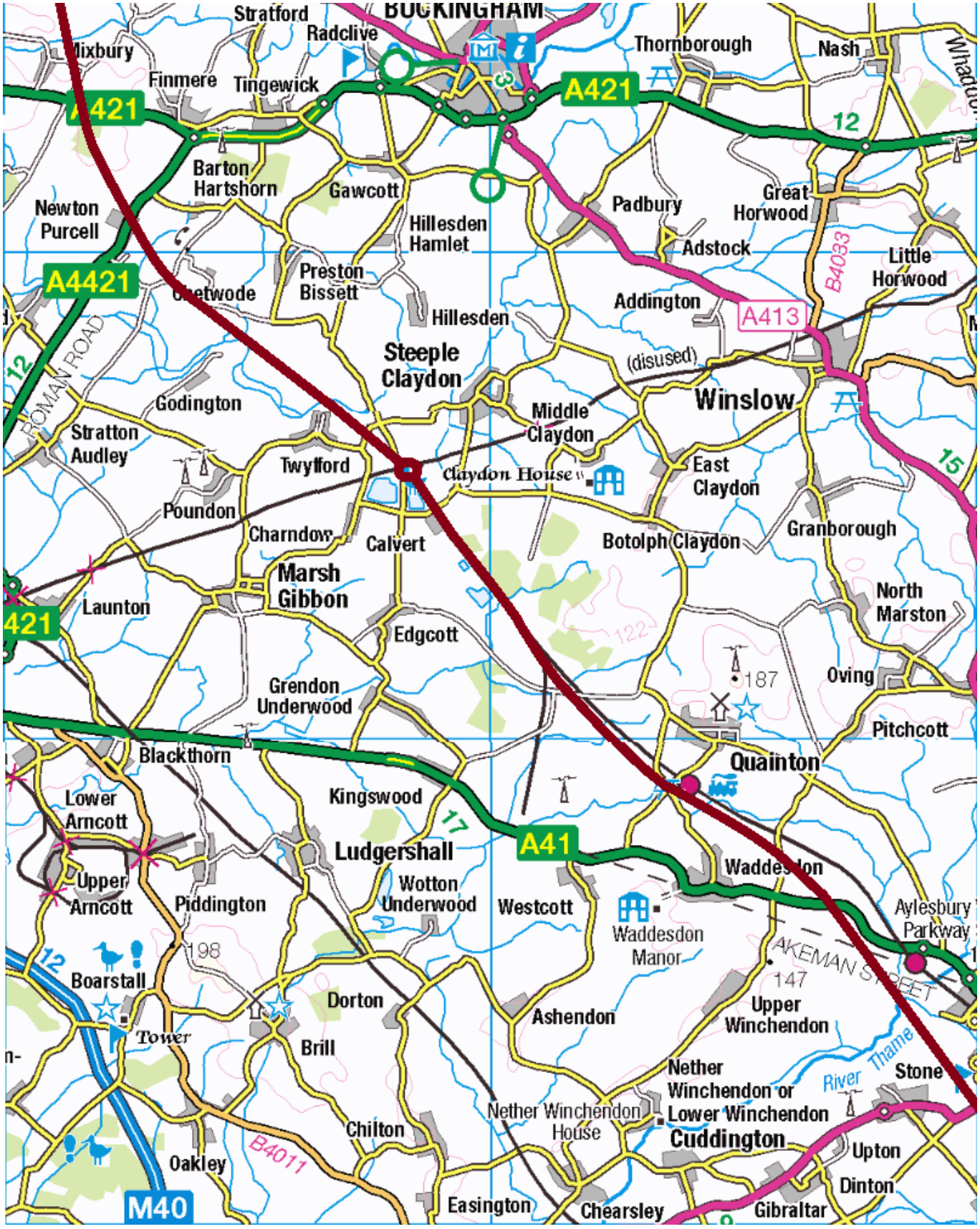
1.1 Euston – Old Oak Common Contains Ordnance Survey data © Crown copyright and database right 2013



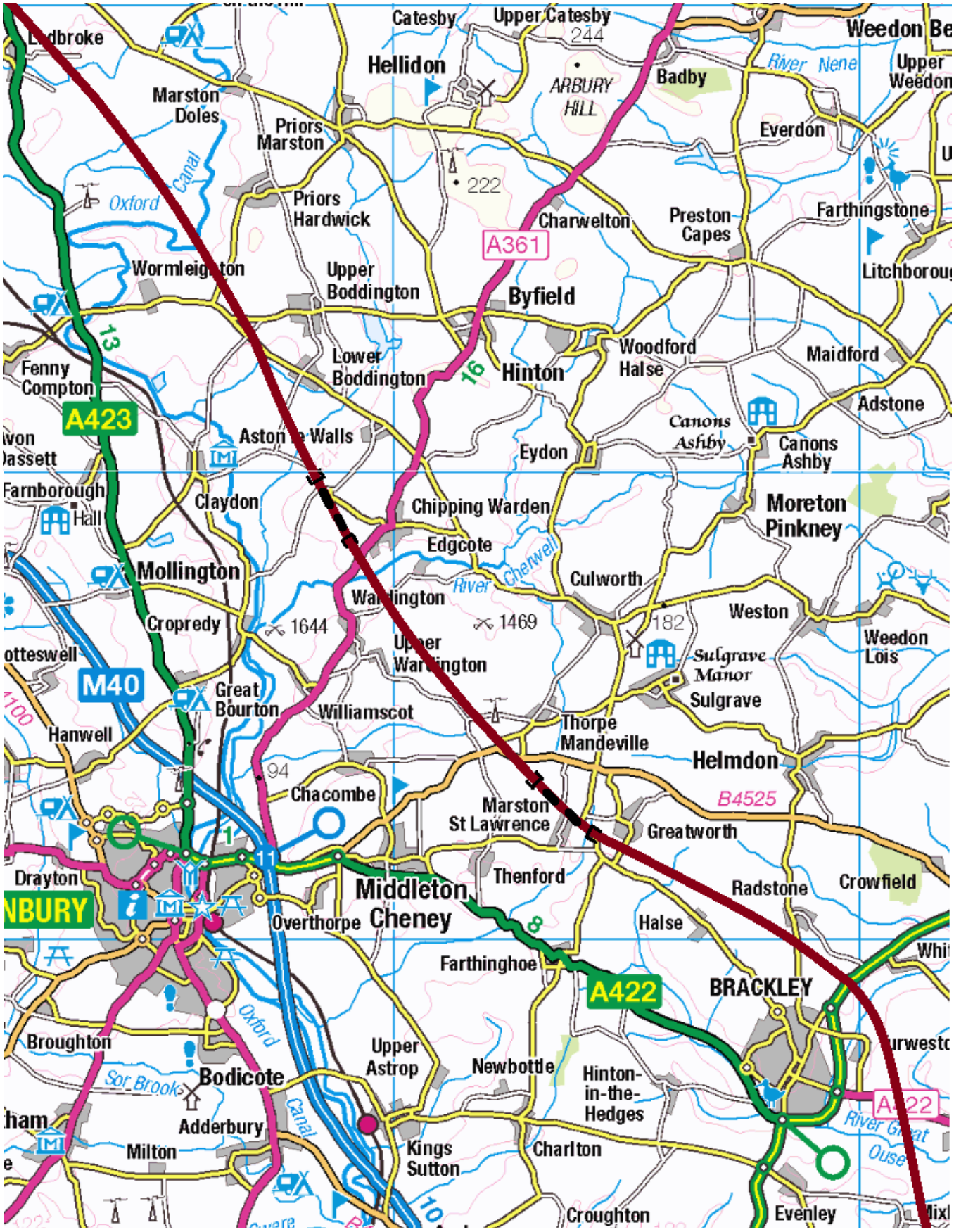
1.2 Perivale – Chalfont St. Peter Contains Ordnance Survey data © Crown copyright and database right 2013



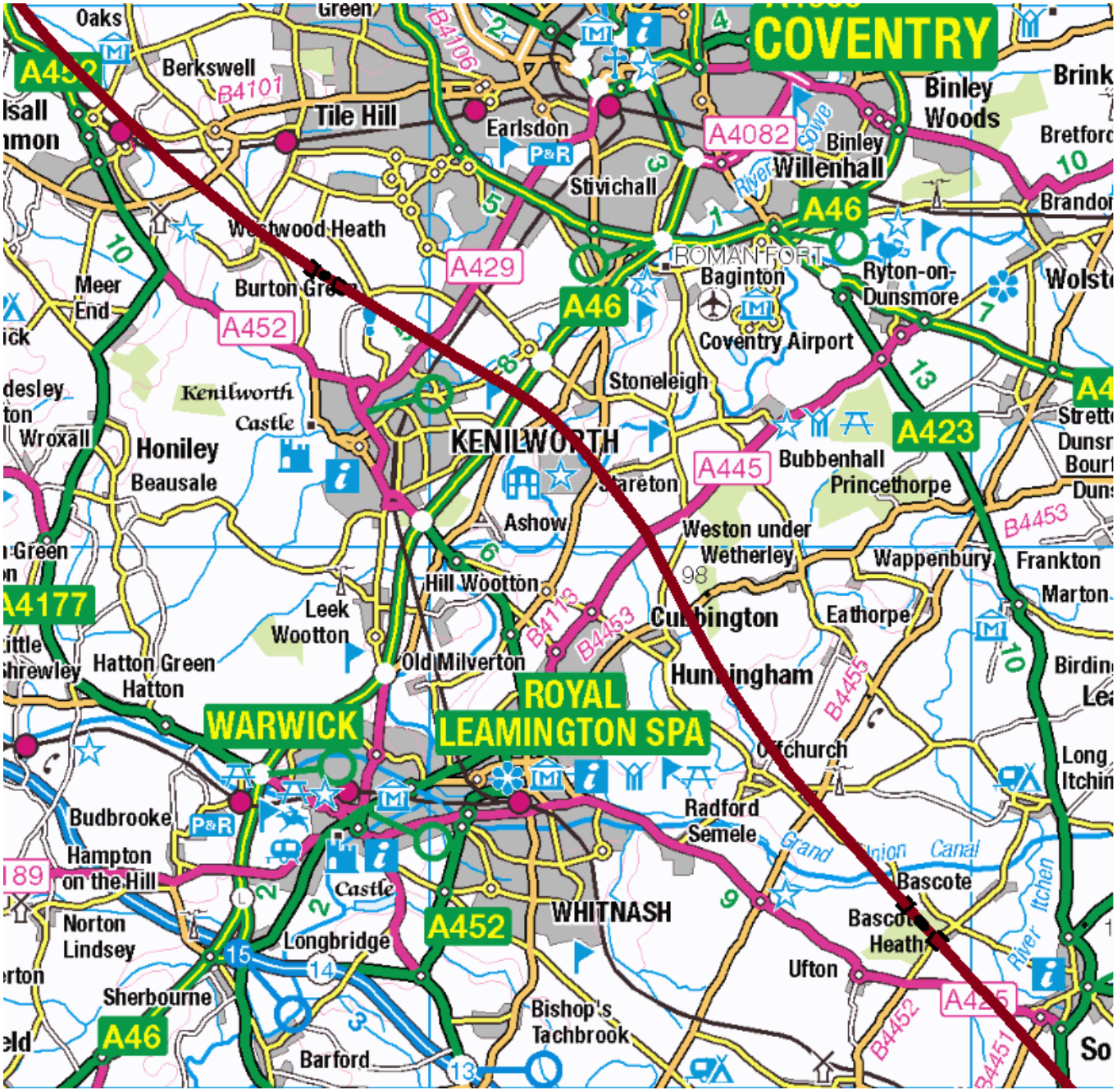
1.3 Chalfont St. Giles – Aylesbury



1.4 Aylesbury – Finmere

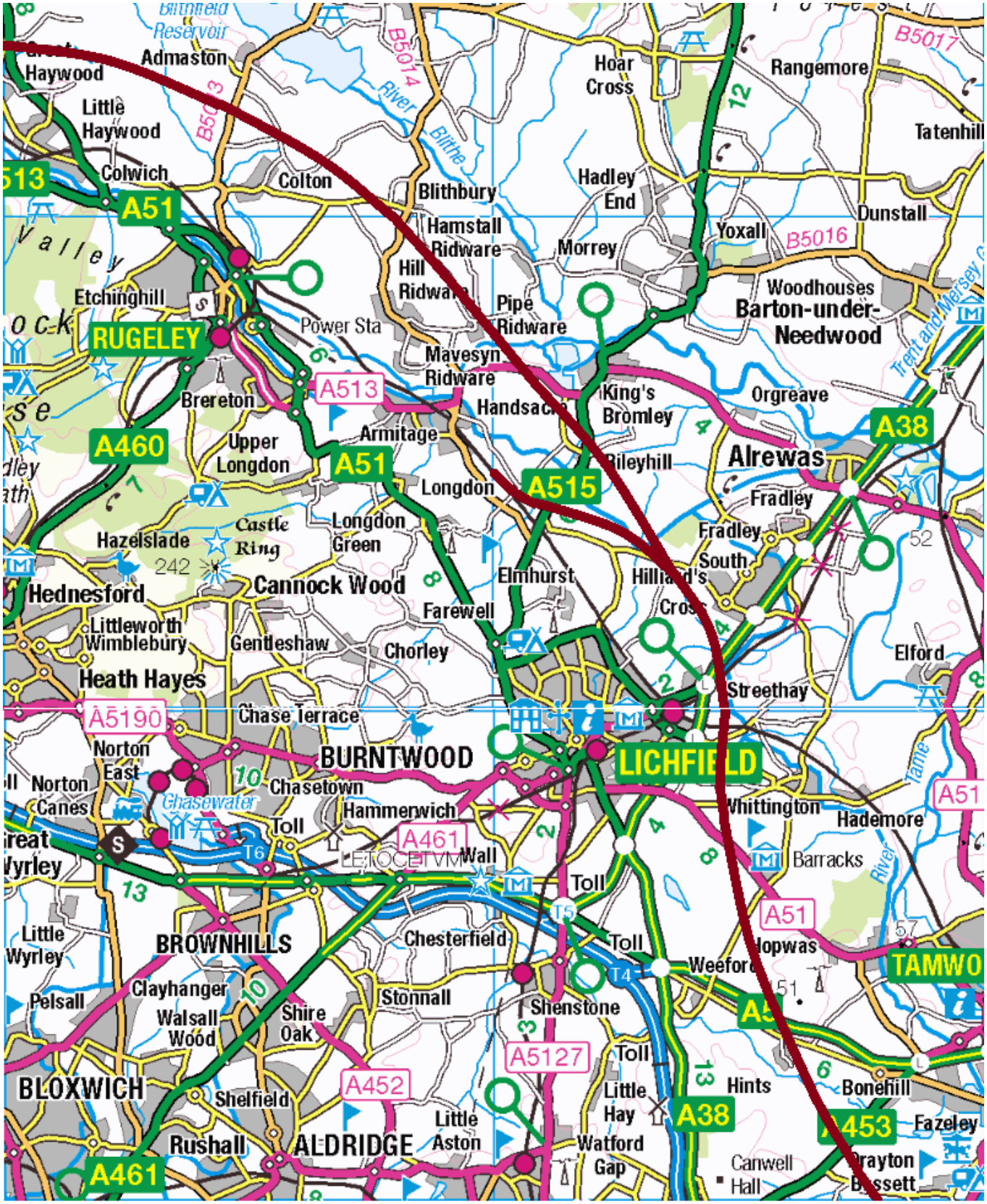


1.5 Brackley – Ladbroke

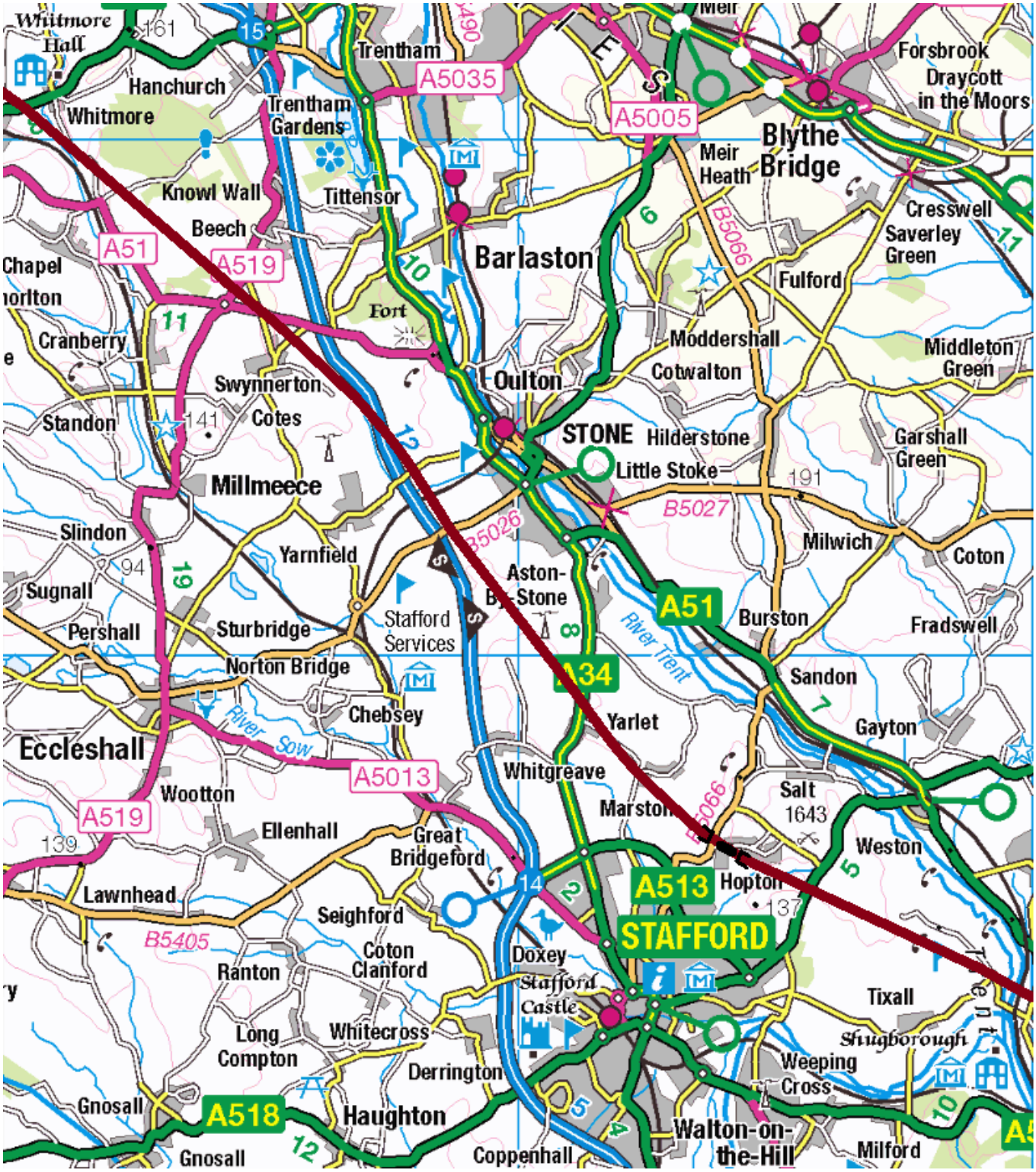


1.6 Southam – Balsall Common

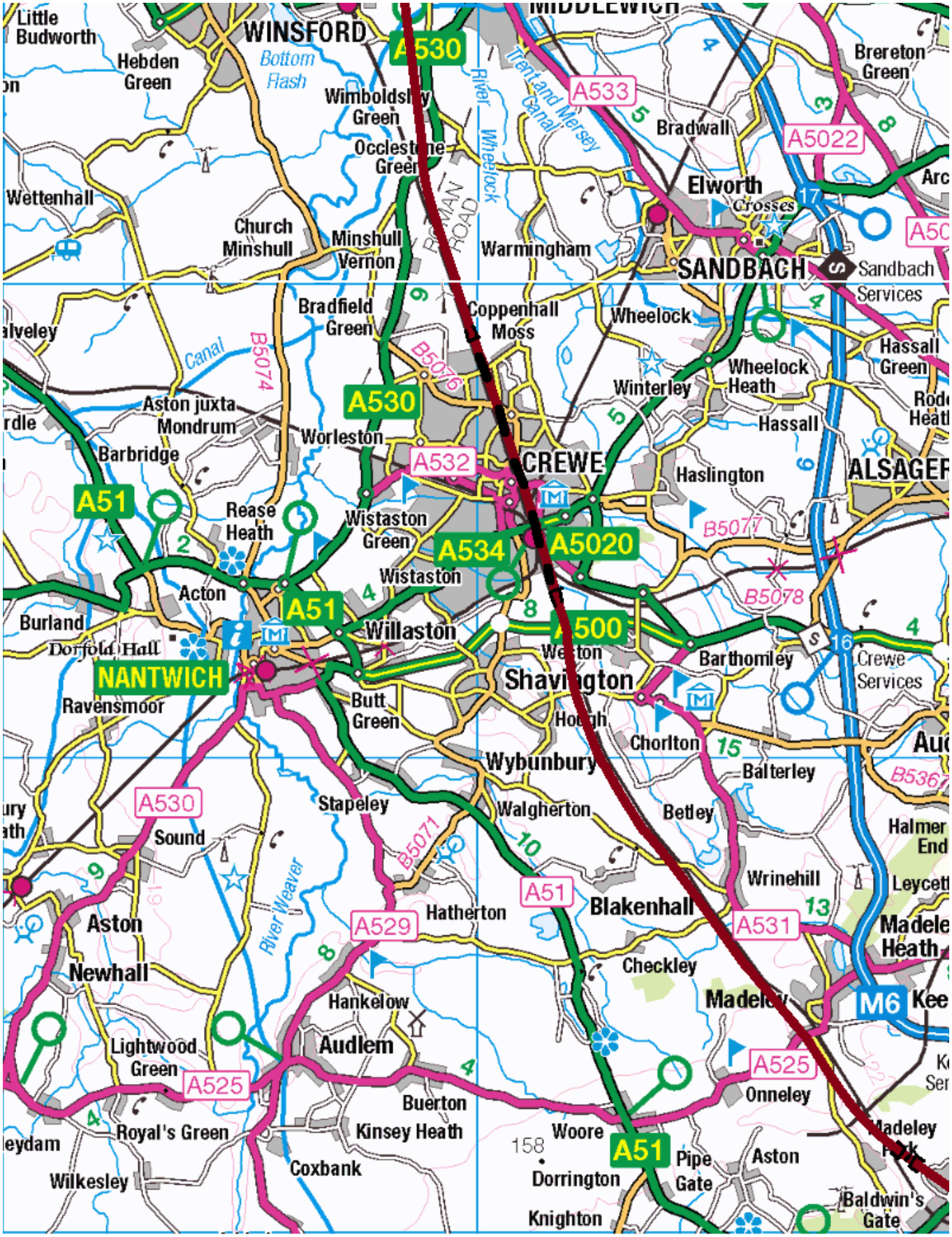
1.7 Hampton in Arden – Birmingham



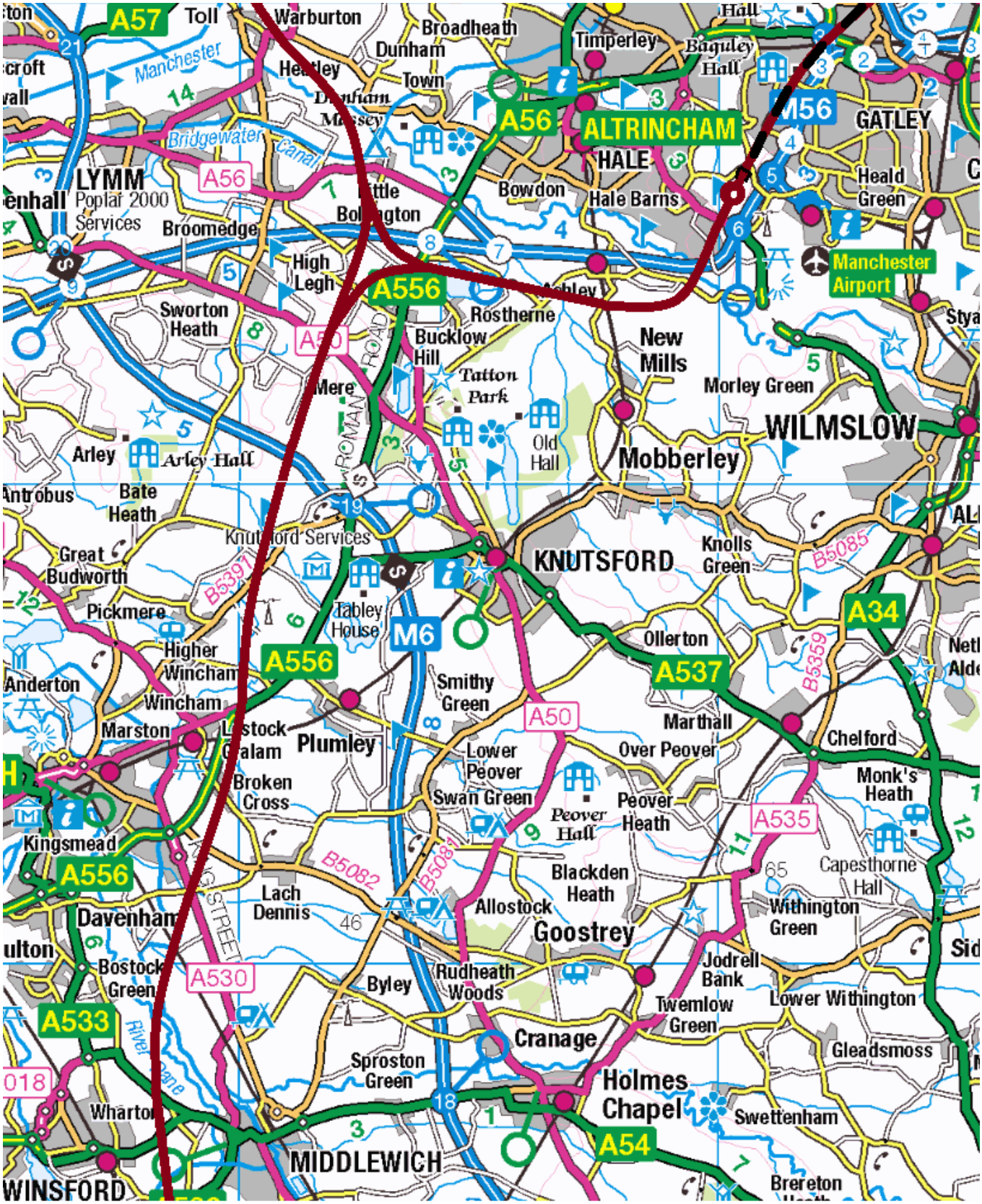
1.8 Drayton Bassett – Great Haywood



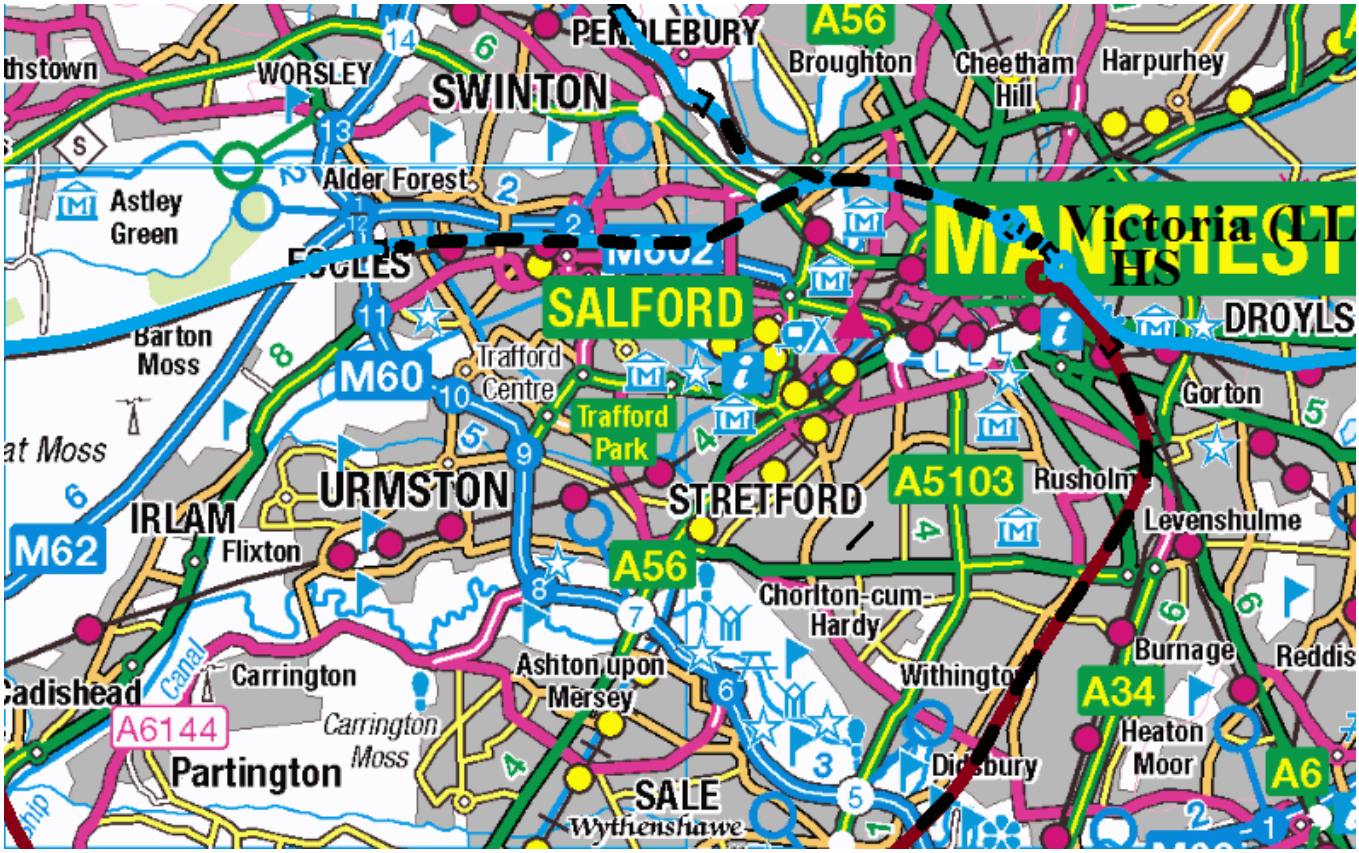
1.9 Shrugborough – Whitmore



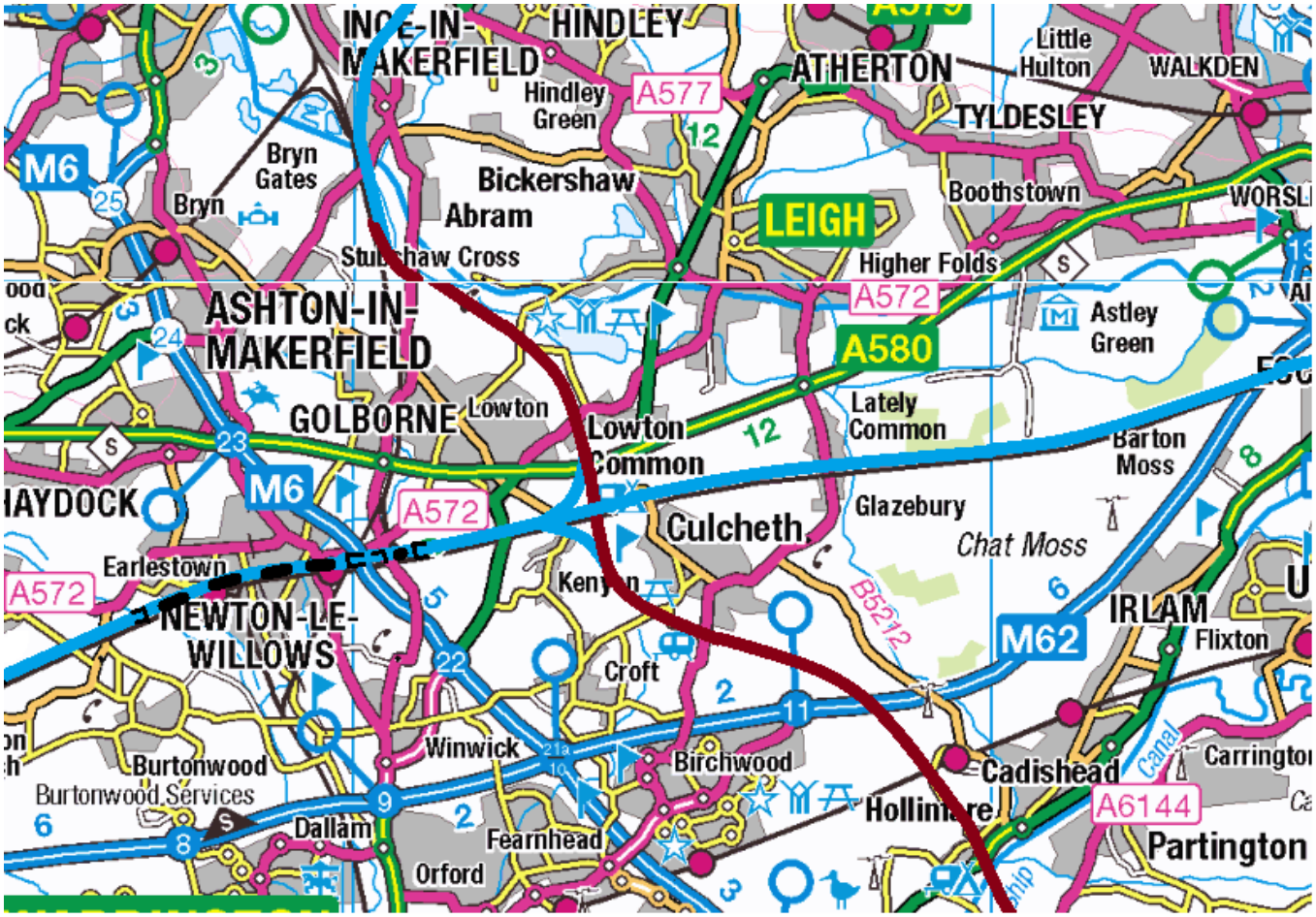
1.10 Madeley Park – Winsford



1.11 Winsford – Warburton



1.12 Didsbury – Manchester



1.13 Partington – Abram

2. HS2-Associated Lines in Central Lancashire:

A highly desirable addition to HS2 Phase 2B is the initial section of the transpennine routes HS8/HS9, from Kenyon West Junction into Liverpool Lime Street, with connections from HS2 Kenyon South and North Junctions. These are shown in map 1.13 above, and allow UHS services from Liverpool to London, and HS-classic services from Liverpool to Scotland.

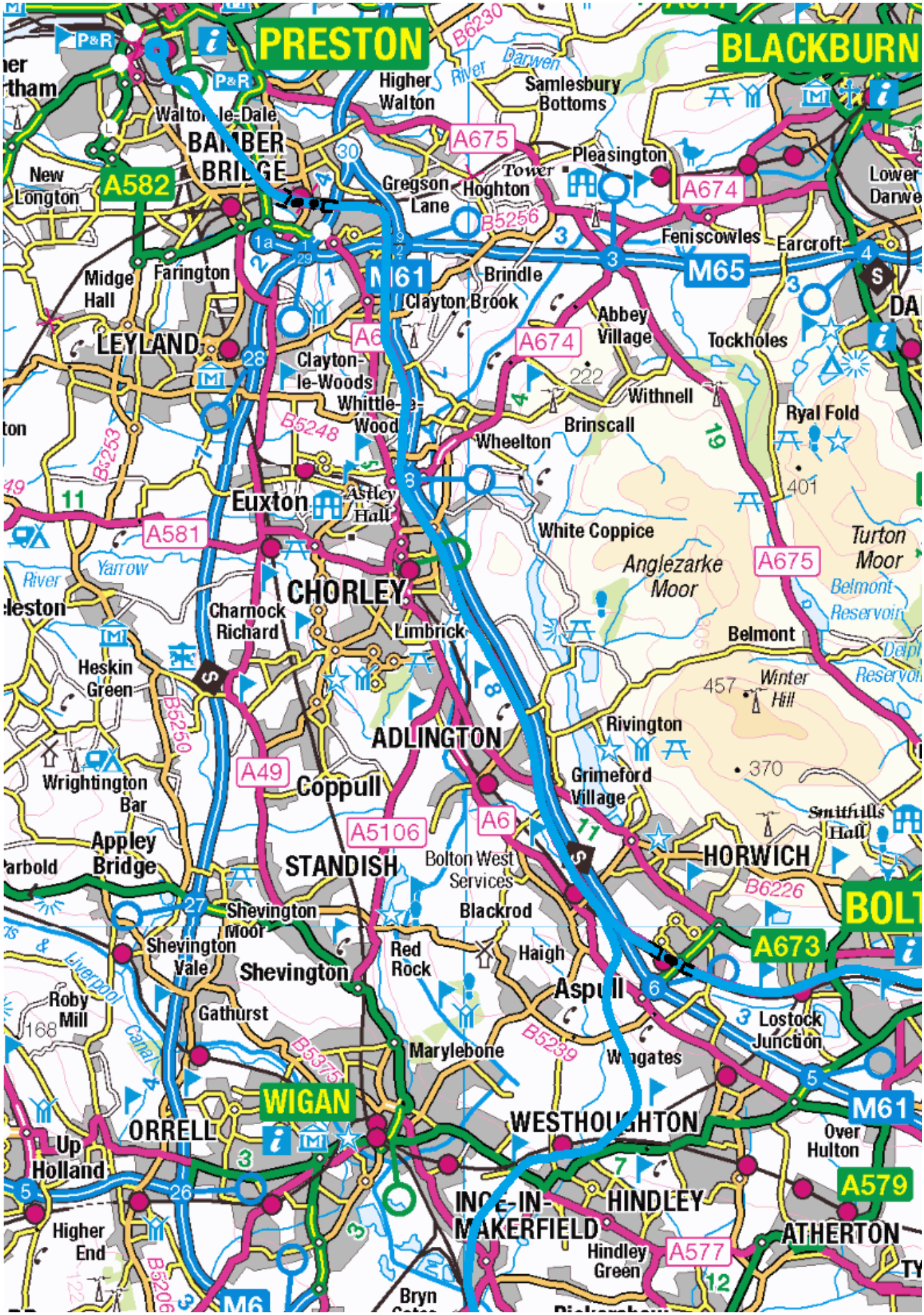
Above Bamfurlong Junction(*), HS2 shares the route of the HS8/HS9 branch to Gibb Farm Junction, then on to Preston. This is fully described in the HS Transpennine Routes and Service Plan article, and will not be repeated here, but the map is reproduced as 2.1. The HS-C services from Euston to Scotland are routed via HS8 directly to Preston, and join the WCML there. (Eventually, with the Scottish extension, they join the WCML at Galgate Junction, south of Lancaster.)

(*) In these revised plans, Bamfurlong is no longer even a junction with the WCML, but, from its inception, an end-on junction with the HS8 branch to Gibb Farm Junction, and on to Preston, allowing some HS2 services to travel
non-stop between Crewe and Preston on new infrastructure, at full line speed.

It was originally the intention that the Scottish services from Euston be withdrawn on the opening of HS3 to Edinburgh, with the introduction of UHS services by that route. But this has been reconsidered, and the Euston services are continued, since they now make important connections from and to Staffordshire locations, (above all, Stoke-on-Trent,) at Crewe. The services from Birmingham and Liverpool continue, as was always the intention, since they serve quite different markets..

The descriptions of the preceding sections constitute the original plan for HS2 (HS2-orig). Service Plans 1-4 describe how the various sections are implemented, and the partial services running on them.

The next sections describe two extra-highly-speculative extensions, the Coventry Variant (HS2-CV) and the West Coast HS Route to Scotland. These are, very definitely, extras; they do not replace any part of HS2-orig.



2.1 Ince – Preston

3. HS2 Route Mk3.1 – the Coventry Variant:

3.1 General

With the (devastating) exception of the Euston plans, and the serious but readily fixed deficiencies at Manchester HS station, also the need to serve Liverpool with UHS trains from the outset, HS2 Ltd.'s plans for phase 1, phase 2A and phase 2 (western arm only), are generally good. As an intellectual exercise, I considered how I personally would have designed the route, and concluded that I could not improve on it. Considered in purely engineering terms, I do indeed accept that it is the best (and certainly the fastest) route available. However, engineering considerations are not the only, nor necessarily the most important ones. Considered in terms of business requirements, to ignore a city of such major importance as Coventry is simply crazy. (And Birmingham Interchange is **not** an acceptable station for Coventry, any more than Toton is for Nottingham and Derby, or Meadowhall would have been for Sheffield, before better sense prevailed.)

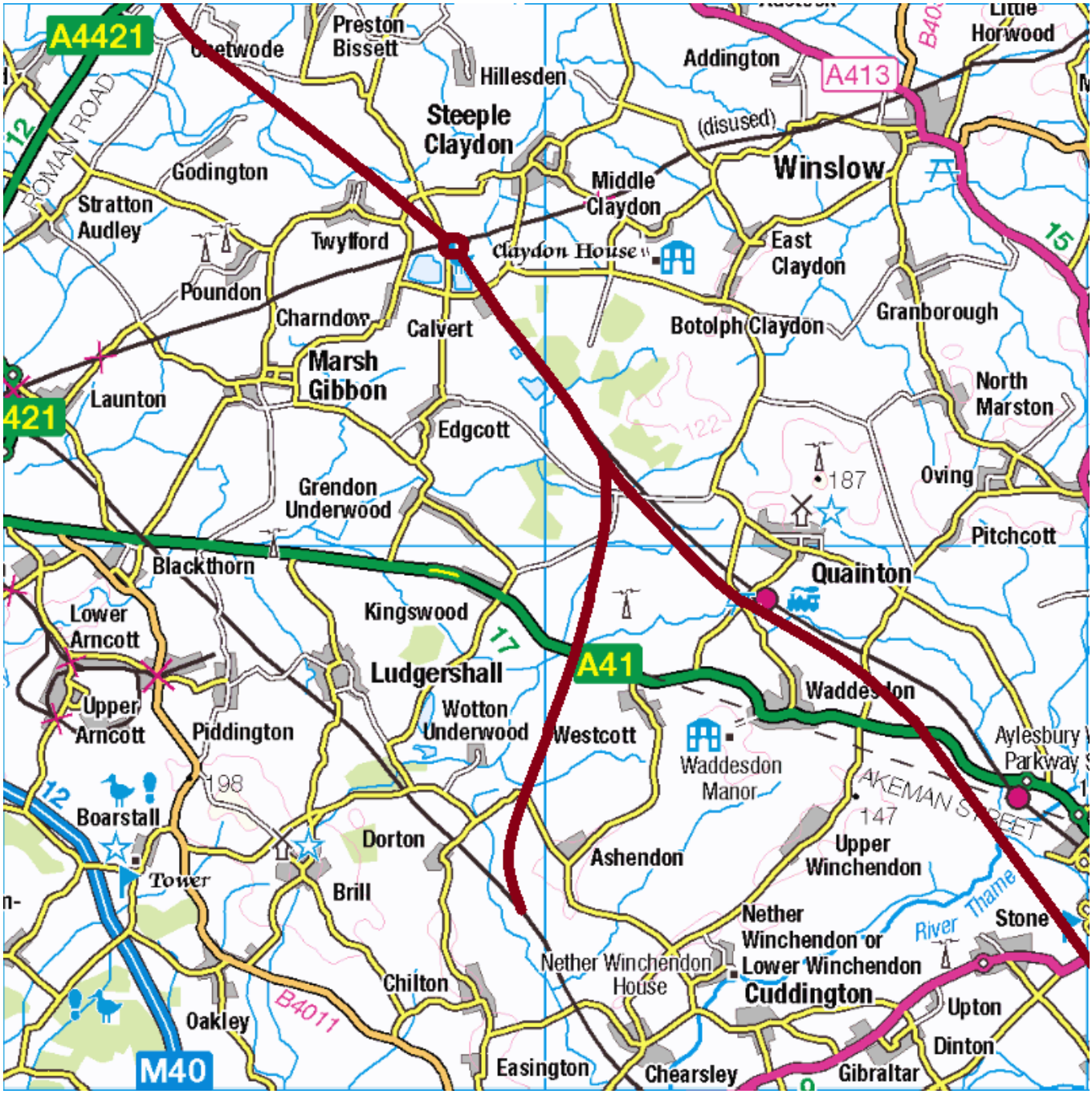
Accordingly I considered how the route could be varied to allow Coventry to be served, and this, the Coventry Variant (HS2-CV), is the subject of this section. (I originally considered whether this should in fact be a **variant** of the existing proposal, thus replacing the section of HS2-orig between Brackley and Birmingham Interchange, hence its name, but very quickly came to the conclusion that it made sense only as an addition.) It is readily possible, with amazingly little difficulty, and doing so enables certain other serendipitous benefits, in enabling each-way connections between HS2 and HS3, which wasn't an aim of the exercise, but is nonetheless very welcome. It cannot be pretended that the Coventry variant would be as fast as the original route, so the case is for building both, and using the original route (HS2-orig) for the long-distance, ultra-high-speed stuff. I certainly recommend both, since HS2-CV provides valuable extra capacity.

In brief, HS2-CV continues along the former route of the Great Central beyond Brackley, as far as Rugby. (Indeed a branch of HS2-CV continues all the way through and beyond Rugby to join up with HS3.) Initial thinking envisaged a station for Brackley, but this (together with Calvert) imposed such a time penalty that Coventry would see no acceleration on its current service, which rather spoils the whole idea. (But see appendix E for a possible suggestion here, to mollify Brackley's quite understandable outrage.)

The main line of HS2-CV tunnels under the centre of Rugby, with an (underground) station adjacent to the classic station, emerging from tunnel on the south side of the classic Rugby – Birmingham alignment. This it follows all the way to Berkswell, (on the north side beyond Coventry,) where it rejoins the route but not the tracks of HS2-orig. There are, amazingly, effectively no obstructions at all along the south side of the Rugby-Coventry alignment, nor on the north side of the Coventry-Berkswell alignment. In the very centre of Coventry it is very desirable to enter tunnel and locate the HS station immediately beneath the classic station. There now follows a detailed description of the route, with maps.

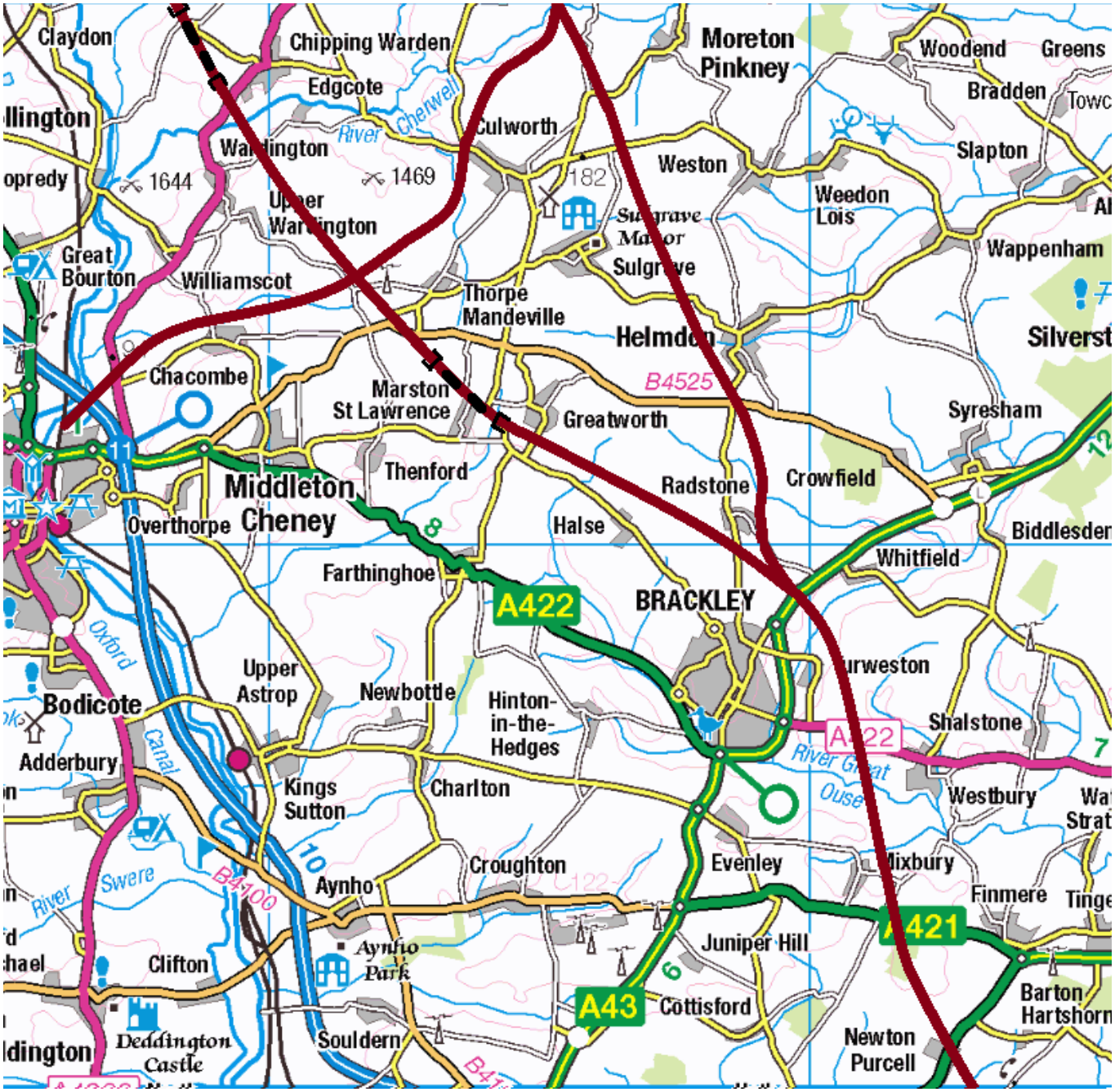
3.2 Brackley – Rugby

HS2-CV actually begins at Grendon Underwood Junction (SP706222) where the northbound line diverges from HS2-orig. The southbound line of HS2-CV joins HS2-orig at SP727200. As noted earlier, these very precise locations for the junctions, different in each direction, are determined by the configuration of station loops, and are for a turnout / turnin speed of 230kph (143.75mph). These considerations are expounded in detail in appendix B of the article 'Same Speed Railways'; only the



3.2.1 Chearsley – Chetwode

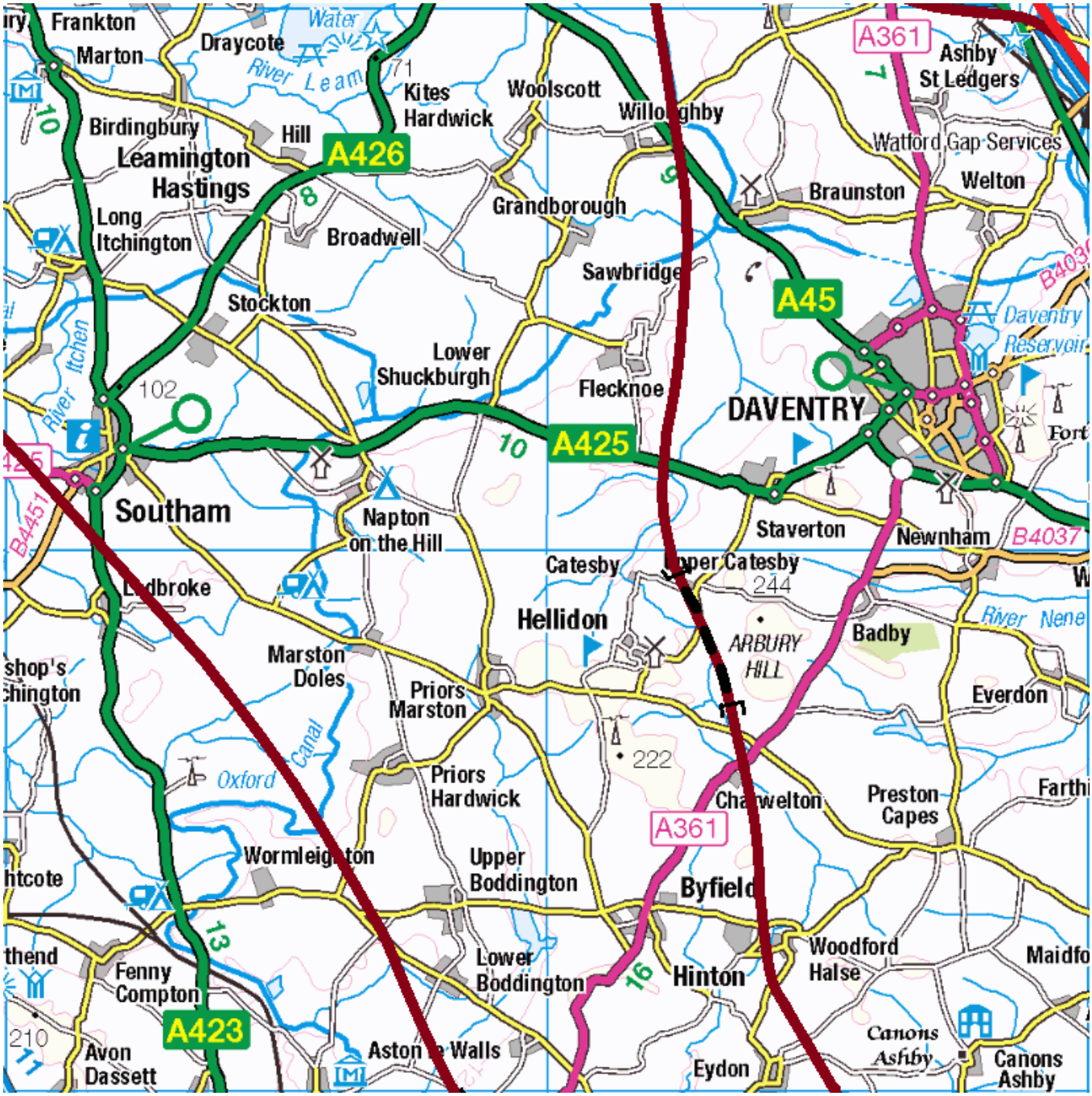
results are used here. The restored line from Ashendon Junction to Grendon Underwood Junction also joins (the HS2-CV tracks) here. There are connections back to HS2-orig at SP634301 northbound and SP649280 southbound (Chetwode North and South junctions) to allow services (specifically the HS-C services to Manchester via Stoke and to Preston and Blackpool / Windermere) to rejoin the main line after calling at Calvert. HS2-CV itself does not rejoin HS2-orig until (finally!) Streethay Junction. Between Grendon Underwood and Brackley Junctions, and between Mount Pleasant and Streethay Junctions, it occupies the outer two tracks of a 4 track alignment, while HS2-orig occupies the inner two tracks. HS2-CV has a line speed of 360kph as far as the outskirts of Rugby (where services are slowing in any case for the Rugby stop, and the curvature on the approaches). A line speed of 300kph or even 200kph is adequate from Rugby all the way to Streethay Junction. Appendix B of the current article contains a layout diagram illustrating this configuration.



3.2.2 Newton Purcell – Moreton Pinkney

HS2-CV diverges from the route of HS2-orig at SP595388, just after crossing the A43(T). This is Brackley Junction, a route junction although there are no links between the (HS2-CV and HS2-orig) tracks (at least for normal use). In effect the station loops extend from Grendon Underwood Junction to Brackley Junction, at which point they simply become the main line of HS2-CV. HS2-CV rejoins the GC alignment at SP590393, and follows it to Rugby. The viaduct to the west of Helmdon is still in place, and might be reusable. There has been some encroachment on the alignment at Westgate Farm (SP564484) but there's plenty of room on the west side to slew the line slightly, to avoid it. Commercial premises ('Main Line Timber') have been built directly on the alignment at Woodford Halse (SP540254); these will need to be relocated. The line from Culworth Junction, south of Woodford Halse, to Banbury Junction is also restored.

Catesby tunnel is a significant piece of infrastructure, and Catesby viaduct is still in place, and perhaps reusable, but the smaller Staverton viaduct, a little to the north, has disappeared, as has Willoughby viaduct.



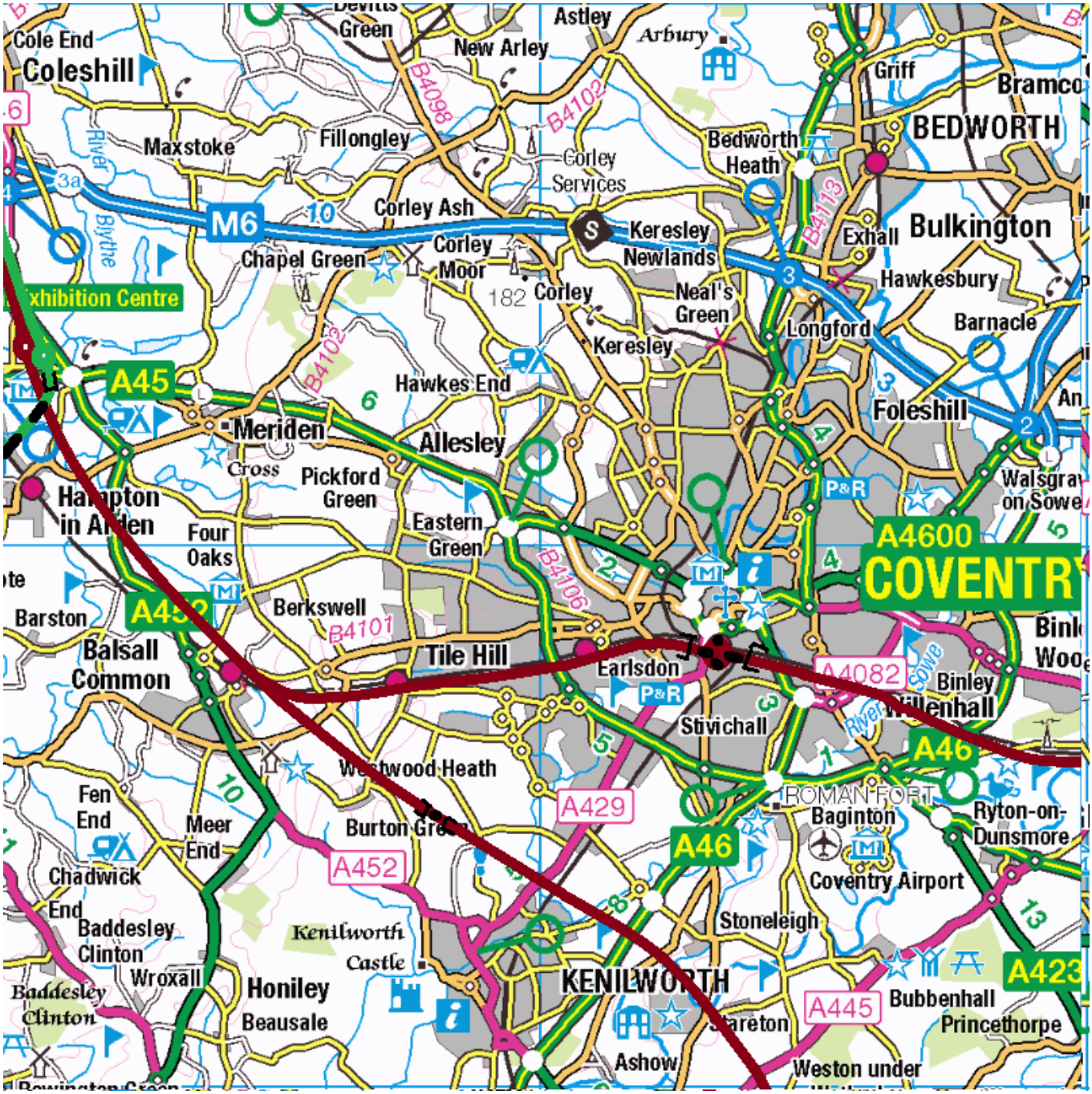
3.2.3 Eydon – Willoughby

The alignment is completely unobstructed on the approach to Rugby, certainly as far as Clifton Rd., (it's in a cutting, of course, which helps prevent encroachment). At SP525753, Rugby HS Junction, shortly after the site of the GC's Rugby station, HS2-CV diverges from the GC alignment and enters a 2-mile tunnel curving round via the underground Rugby HS station (SP 508760), adjacent to the classic station, emerging from tunnel at SP488757, just west of the A4071, on the south side of the classic Rugby – Birmingham alignment.

3.2.4/3.3.1/3.4.1 Barby – Wolston

3.3 Rugby – Berkswell

HS2-CV continues along the south side of the alignment all the way to Coventry. There are no obstructions, though noise screens will probably be desirable in a few locations. It enters a very short (less than ½ mile) tunnel at SP336781, immediately before the Quinton Rd. bridge, and the junction of the Kenilworth route. Just to the west of the A429, at SP325782, immediately following Coventry North Junction, where the Nuneaton line diverges, there is a junction with the classic route, (Warwick Road Junction,) with the connecting lines emerging from tunnel on each side of the classic lines. Immediately after that, HS2-CV itself energes, on the **north** side of the alignment. In the section following, the classic tracks will need to be slewed to the south for the next mile or so, to make room for the HS tracks. HS2-



3.3.2 Coventry – Birmingham Interchange

CV follows the north side of the alignment all the way to Berkswell, where it joins the HS-orig route (but not tracks) at SP258775, Mount Pleasant Junction.

The ideal mainline station has two island platforms, each allowing for two platform faces in the same direction, to enable cross-platform interchange. Coventry has four platforms, but only one island, in the middle, with trains either side travelling in opposite directions. This is very unsatisfactory. I recommend adding a fifth platform face, on the south side, so the southern platform is also an island, with two platform faces serving the westbound direction. The two HS island platforms would be directly underneath the classic ones, allowing for excellent interconnection between classic and HS services. Classic platform 1 would be reversibly signalled, and used by services between Nuneaton and Leamington, in both directions, passing onto the Kenilworth line ideally by a flyover, also available to southbound cross-country services on the main line. Several track diagrams, including the Coventry layouts for classic and HS2-CV, are also provided later in appendix B.

3.4 HS2-CV / HS3 Interconnections

The HS2-CV branch to HS3 continues along the GC alignment north of Rugby HS Junction. It **seems** to be unobstructed right up to the WCML. A substantial viaduct would be required here, as indeed there used to be. On the north side of the WCML the alignment has been built over by some industrial-type buildings at SP517759; these would need to be relocated. Very surprisingly, the alignment through the residential area following (SP518767 to SP521774), and indeed all the way to Cotesbach Junction with HS3 (SP546820) is completely unobstructed, but would doubtless need sound barriers in some locations. Note that services using this connection would not be able to serve Rugby HS station; perhaps a minimal station on the GC station site could be provided, for these services only.

The connection from HS3 to HS2-CV begins at Watford Gap Junction (SP589697). Originally the connection was from HS3 to the classic route, in Northampton Castle station to allow for the HS3 service to Birmingham, Wolverhampton and Liverpool/Chester. It now has a HS connection instead, with the line to HS2-CV, diverging from the HS3 main line at Watford Gap Junction. This crosses the M6 and joins the south side of the M45, (south side because there's housing close to the north side, at Kilsby,) at SP580702. It follows the M45 to Wood Bridge (SP525714), crosses the motorway and joins HS2-CV at SP517723, (Onley Junction,) on the approach to Rugby.

These interconnections I find irresistible, but I have to admit that they are, to some degree, a solution looking for a problem. In fact, the HS3 to HS2-CV connection would carry the HS3 service to Birmingham New Street, Wolverhampton (splitting/joining) and on to Liverpool and Chester. The RM service from St. Pancras to Worcester would become HS-C also, travelling via HS3 rather than via Bedford. These would travel along HS2-CV as far as Warwick Road Junction, there joining the classic route on to Birmingham International and New St.

The HS2-CV to HS3 connection has less obvious uses. However, a HS-C service could be run from Paddington via Heathrow, the Marlow branch and the restored link between Ashendon and Grendon Underwood Junctions to Leicester, continuing on to Melton Mowbray, Nottingham and Derby. There is (from the GWML Service Plans article) a free slot of 2tph on the Marlow branch, between Maidenhead and High Wycombe. A further service could be from the Oxford area via Banbury Junction and the restored branch to Culworth Junction, and on to Leicester and Nottingham. In the reworked HS3 plans, this is envisaged as a HS service between Bournemouth and Newcastle / Middlesborough, additional to the XC service between Bournemouth and York, which currently (and for many years past) travels via Birmingham New St. with a reversal. It would in effect be a reversion to its original route via the GC between Banbury and Sheffield.

One situation in which the interconnections would undoubtedly be valuable is in each route providing the other with an alternative route to and from London in case of emergencies, or, more regularly, when the normal route is closed for engineering work. Whether this would, by itself, justify their provision is an open question. On the other hand they're not very long – 5 and 4 miles respectively.

4. HS2 Route Mk3.2 – the Scottish Extension:

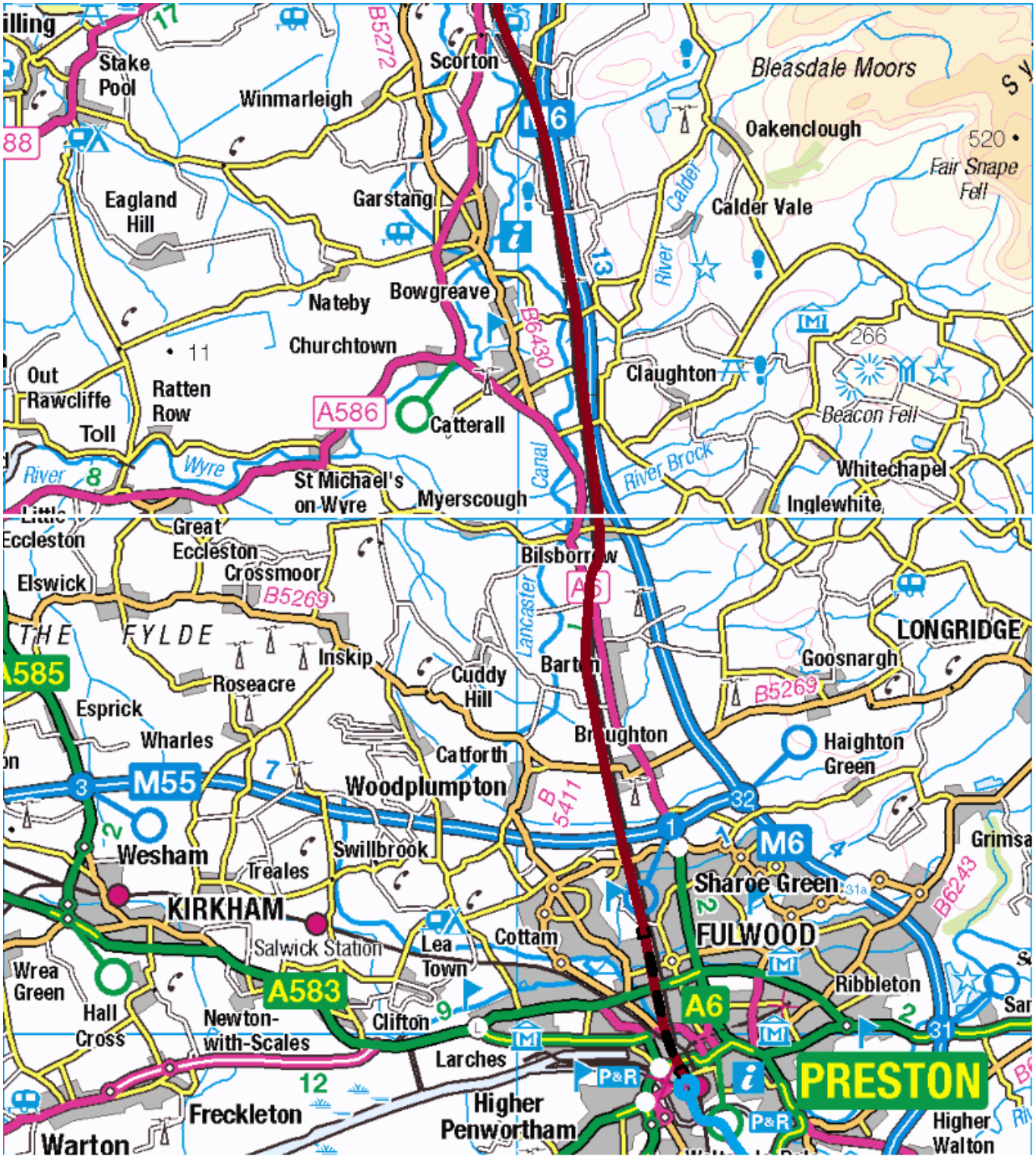
4.1 Preston – Carlisle:

HS2 enters a 1 mile tunnel immediately north of Preston station, at SD534296, emerging at SD525317, on the west side of the WCML alignment. This it follows for 5 miles, before switching to the east side of the alignment at SD514390. This it follows for a further 9 miles, before diverging at SD487543, Galgate Junction, (where there is a connection to the WCML, to allow HS-C services to join the classic route,) and joining the west side of the M6 at SD488549. It follows the motorway alignment past Lancaster and Carnforth, and not forgetting to provide adequate bridges over the Lancaster Canal at SD520752 and SD530804, rebuilding the motorway bridges at the same time (as part of the same structures). It diverges from the M6 at junction 36, and joins the south side of the A590, following this until it passes under the WCML, and rejoining the east side of the WCML alignment at SD513854. This it follows to Oxenholme, tunnelling under Oxenholme itself for 1 mile between SD526892 and SD533905. At this point it takes over the WCML alignment over Shap and on to Penrith.

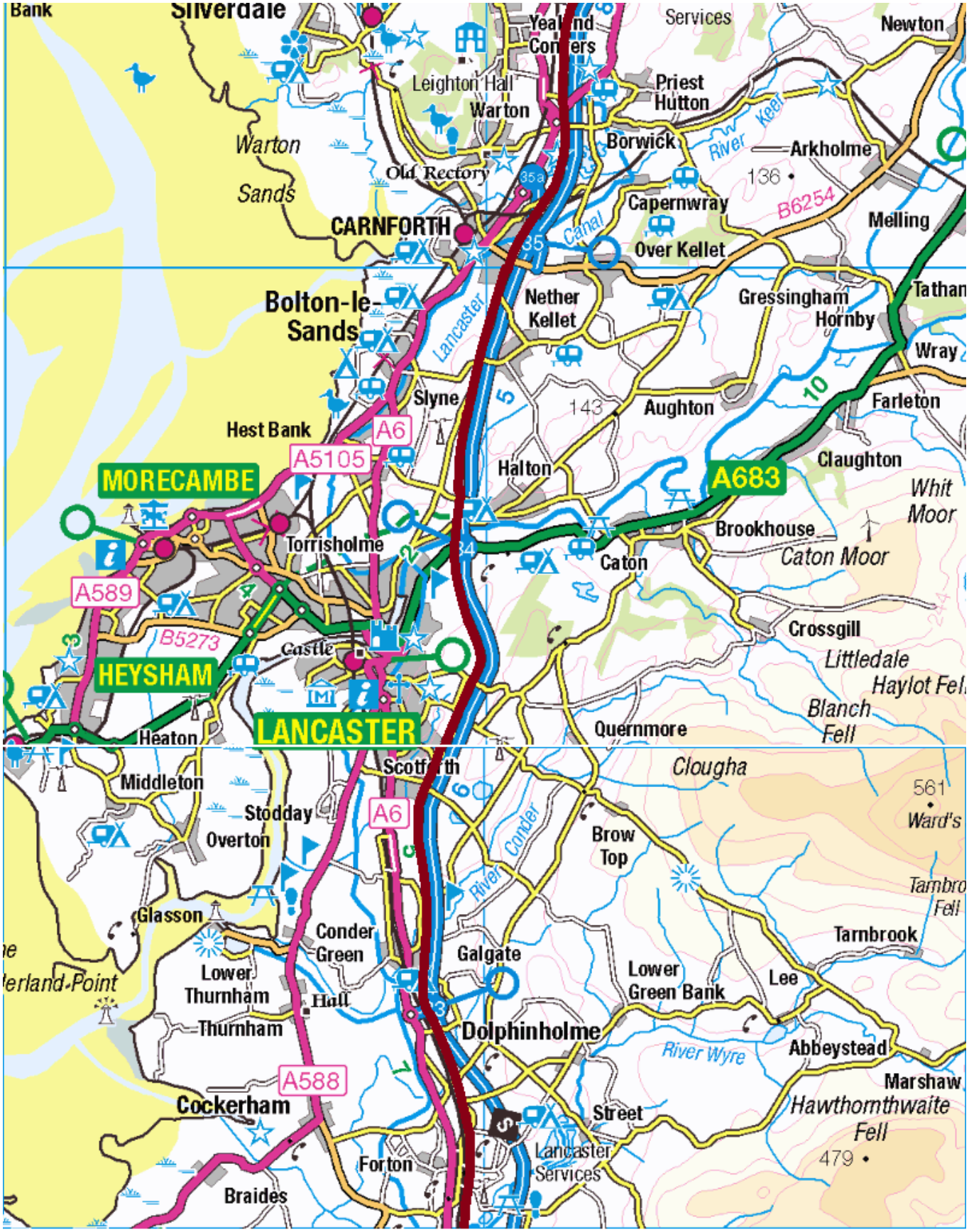
HS2 diverges from the classic route just before Penrith, at NY520272, and joins the west side of the M6 alignment at NY514286. It follow the M6 until it is recrossed by the WCML, shortly before Carlisle; it diverges at NY432502 and joins the west side of the WCML at NY432506, and follows it to Carlisle Citadel station, where there is ample room on the west side for the HS platforms. It has encountered no obstructions between Penrith and Carlisle.

The WCML itself is rerouted between Oxenholme and Penrith, via Kendal, diverging from the Windermere line just after Kendal station, at SD517933 and following the west side of Long Sleddale to NY480071, where it enters a 2¼ mile tunnel to Hawes Water, emerging at NY468105. Average gradient from Kendal to the tunnel is 1 in 80. It crosses the top of Hawes Water, the follows the western bank, (level for 4 miles, of course,) then along the side of Bampton common, passing west of Bampton, Helton and Askham, roughly following the 750’ contour all the way, so essentially level all the way from the tunnel to Askham (NY509246), then rejoining the original course of the WCML at Eamont Bridge, NY510275, at 500’, thus descending 250’ in 2 miles, at 1 in 42 (which could very easily be made less steep by starting the descent sooner – but why bother: that’s not particularly step anyway?). It is shown on the maps as a narrow orange line.

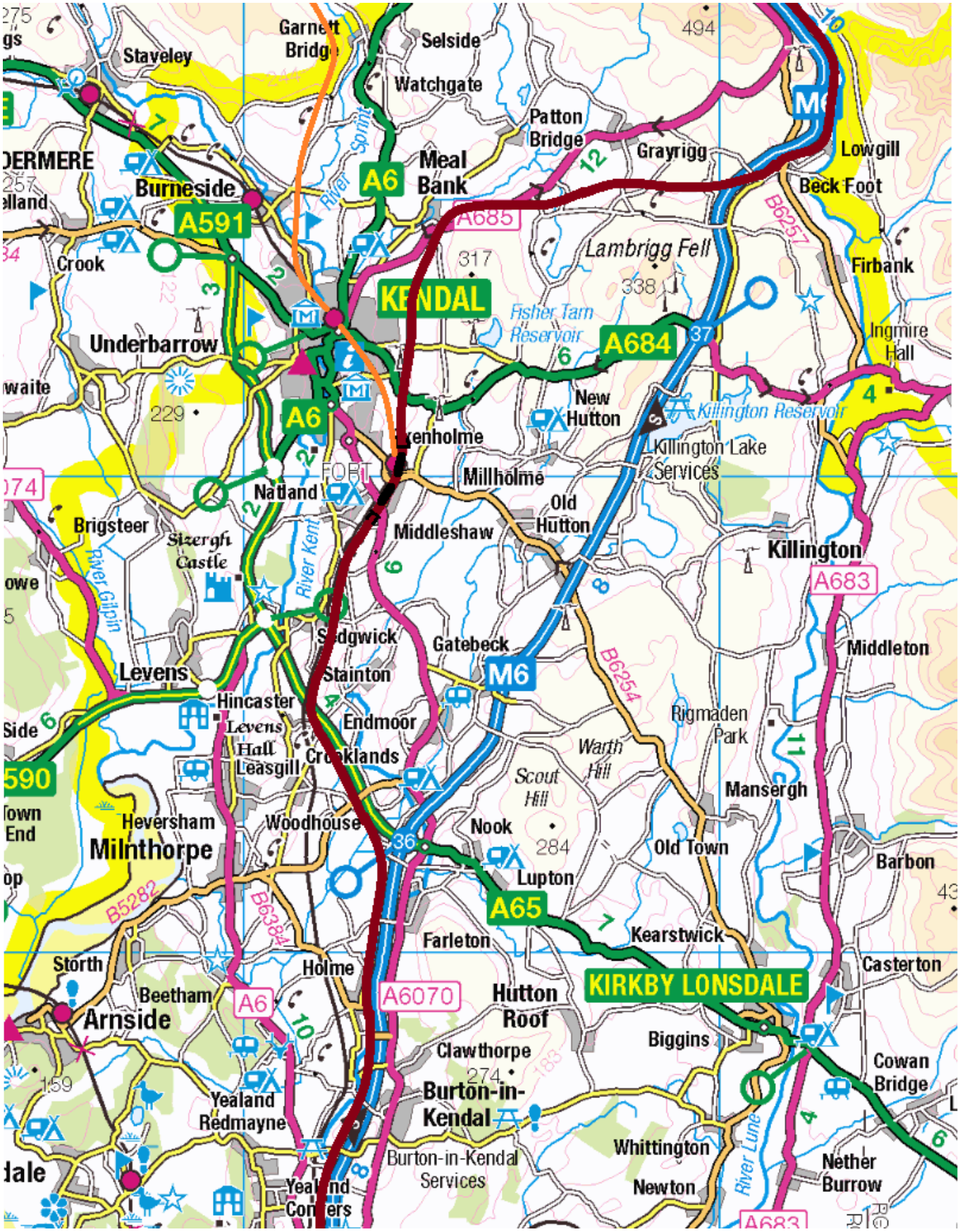
I had always thought that this route was George Stephenson’s design for the Lancaster and Carlisle Railway. It seems I was mistaken. There was indeed such a proposal, but it was produced by a local, Kendal surveyor, to the instruction of various civic notables who were much miffed by Joseph Locke’s proposal to bypass Kendal – as indeed actually happened. I have always thought the Kendal route much preferable to Shap, so it pleases me greatly to propose it as the correction of an historical mistake, albeit 170 years late. George Stephenson did indeed produce a design – it crossed Morecambe Bay and went along the coast all the way, never more that 40ft above sea level. That would certainly have been fun, but hardly suitable for a main line railway.



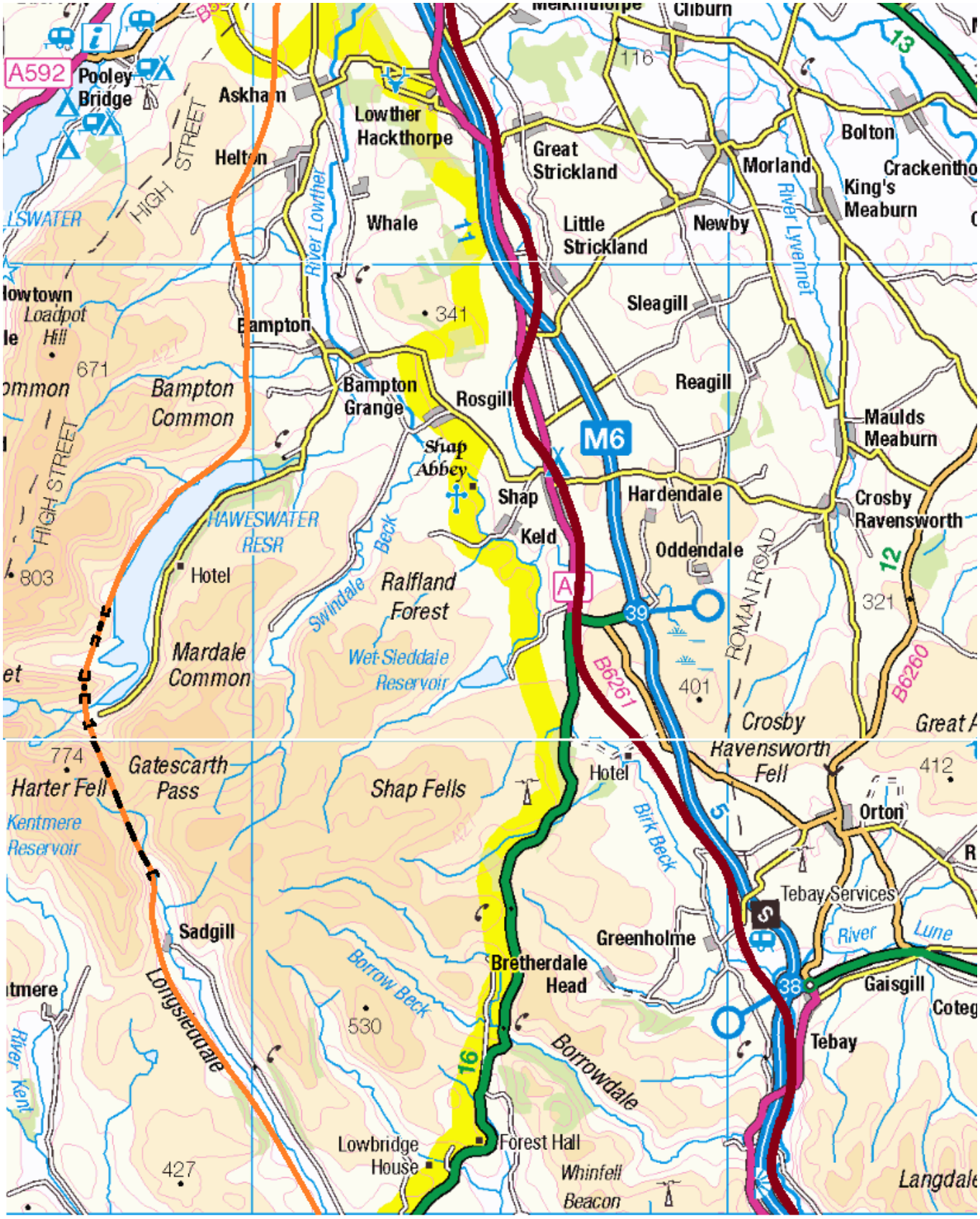
4.1 Preston – Scorton



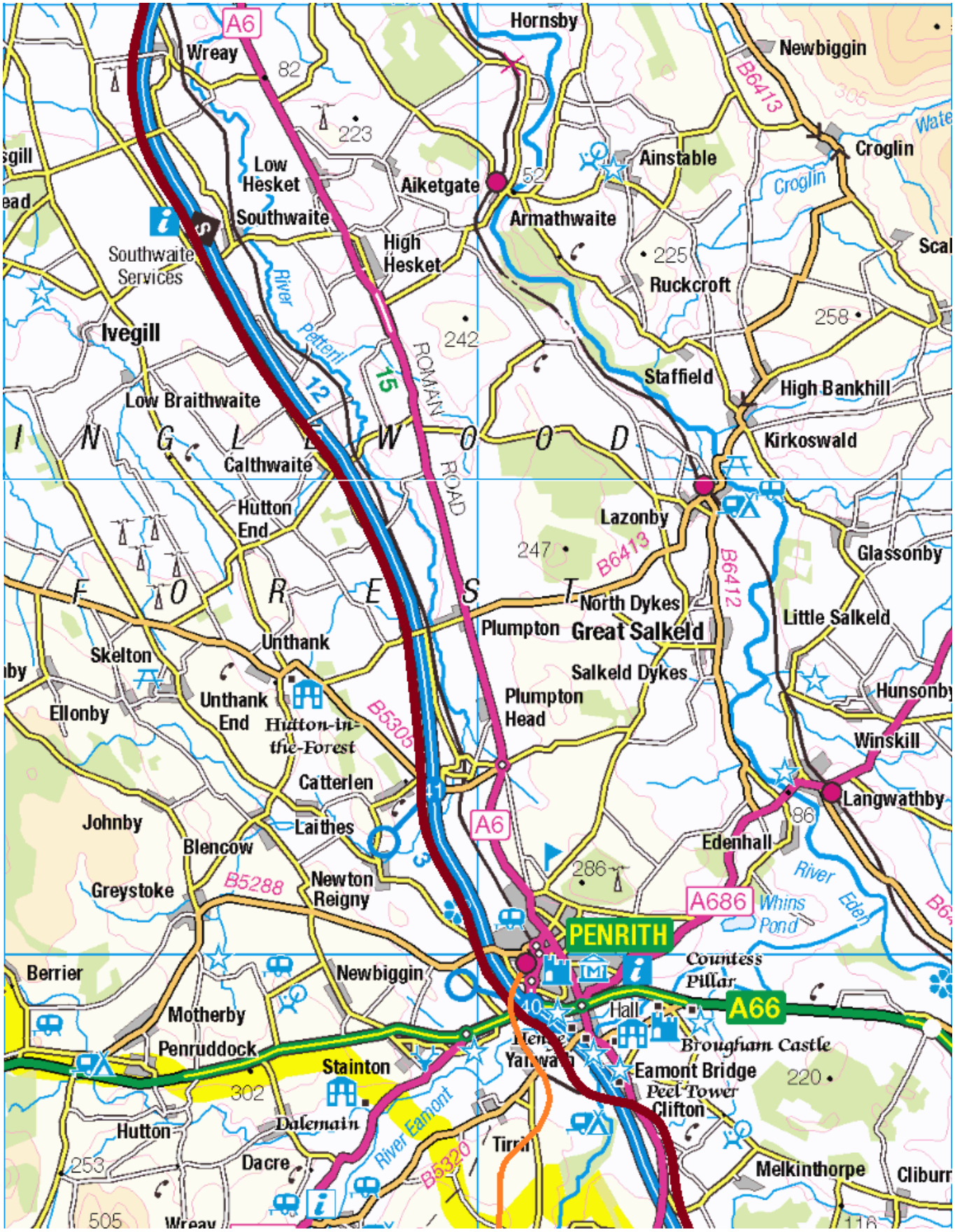
4.2 Forton – Warton



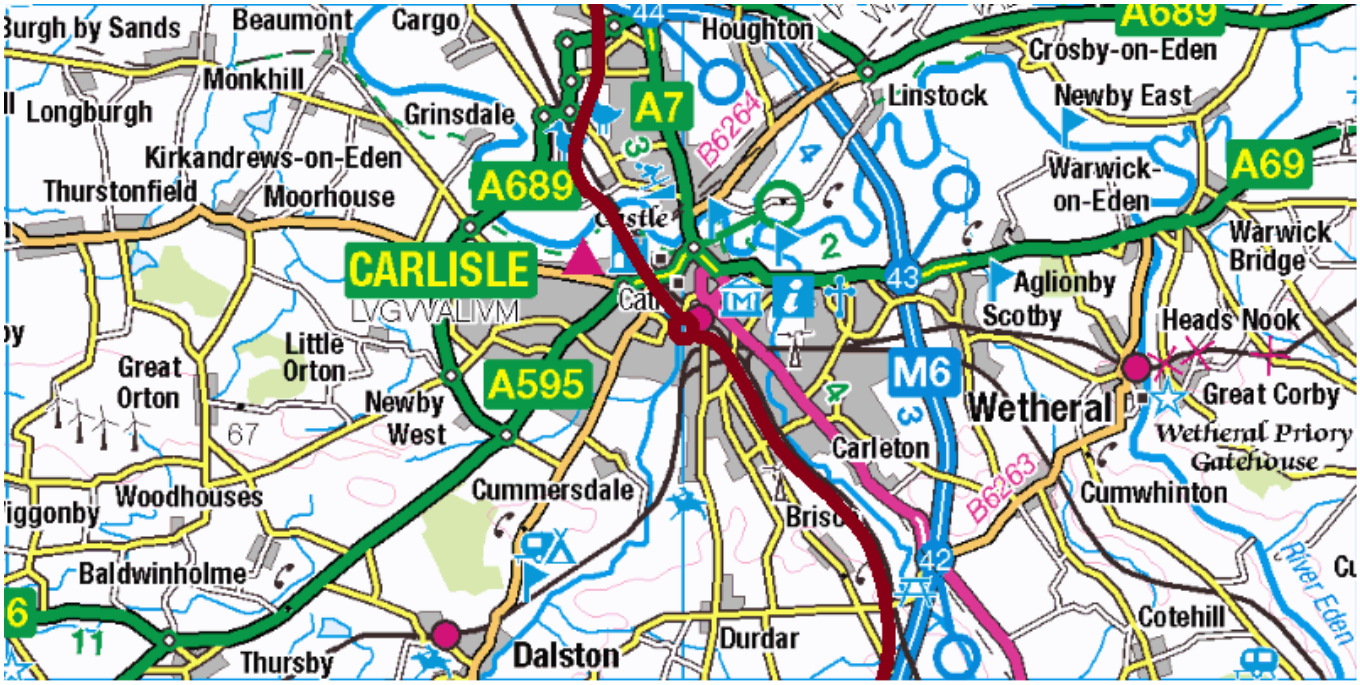
4.3 Yealand Conyers – Low Gill



4.4 Tebay – Great Strickland



4.5 Clifton – Wreay



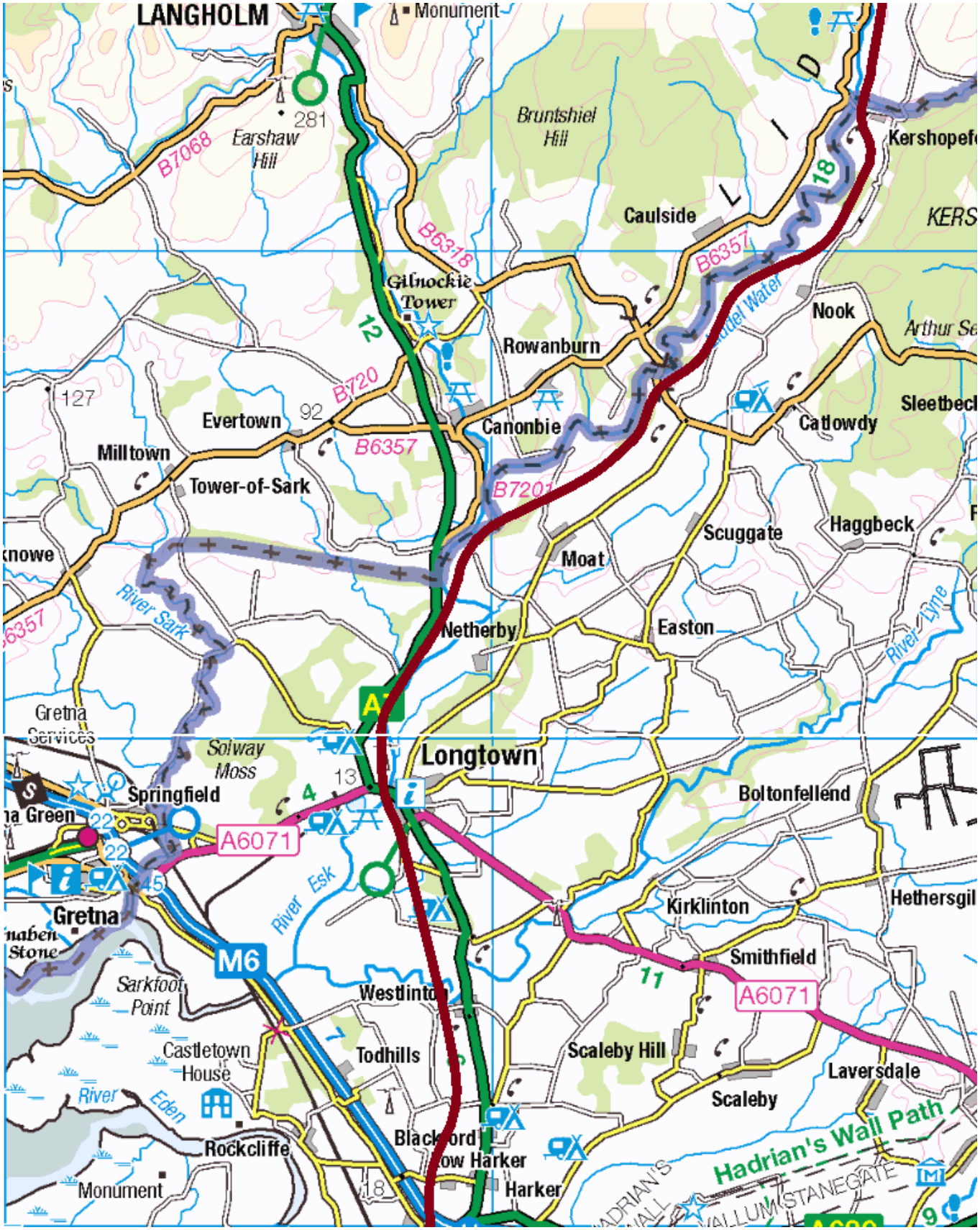
4.6 Brisco – Carlisle

4.2 Carlisle – Riccarton North Junction:

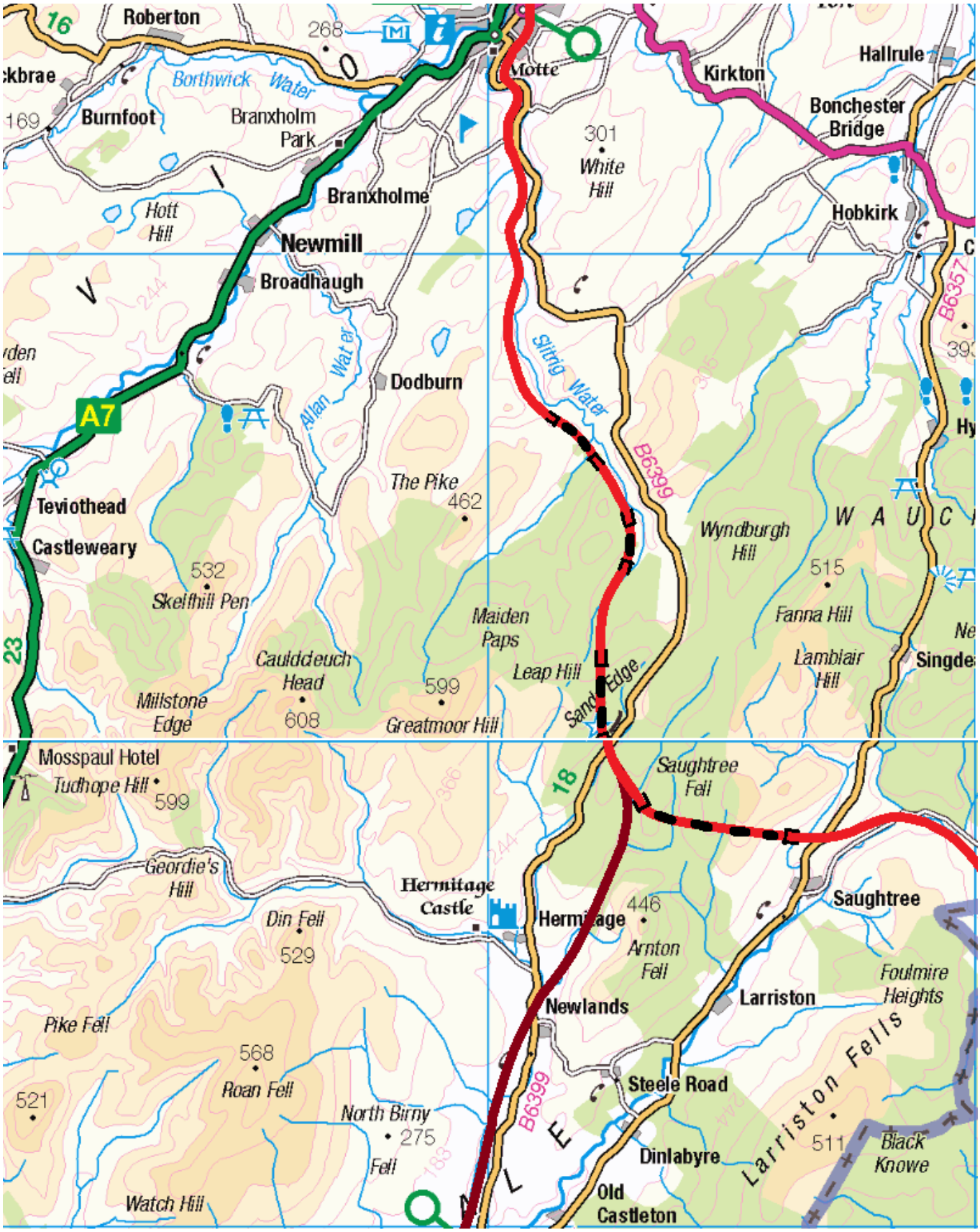
North from Carlisle, HS2 follows the west side of the WCML alignment for a short distance. It diverges at NY388572, just after crossing the Esk, passing to the west of Etterby Depot to join the Waverley route at NY383577. HS2 follows the alignment, and takes over the trackbed of the Waverley route, and follows this to NY490893, just north of Newcastleton. A few warehouses will need to be relocated in the Viaduct Estate in north Carlisle.

The section of the Waverley route at the Carlisle end already has excellent alignments and, with a bit of strategic straightening, could readily be brought up to HS standards. It's the bit in the middle, around the original Riccarton Junction, that's badly aligned. Accordingly, a 6 mile diversion is proposed, from NY490893, north of Newcastleton, straight up the valley of the Hermitage Water, then the Roughly Burn, to join HS3, which has already absorbed the northern part of the route, at NY531988, Riccarton North Junction, and then share the route to Edinburgh. This part is described in the HS3 Route and Service Plans article and will not be repeated here, though the maps will be, for completeness. This section does of course feature in the service plans.

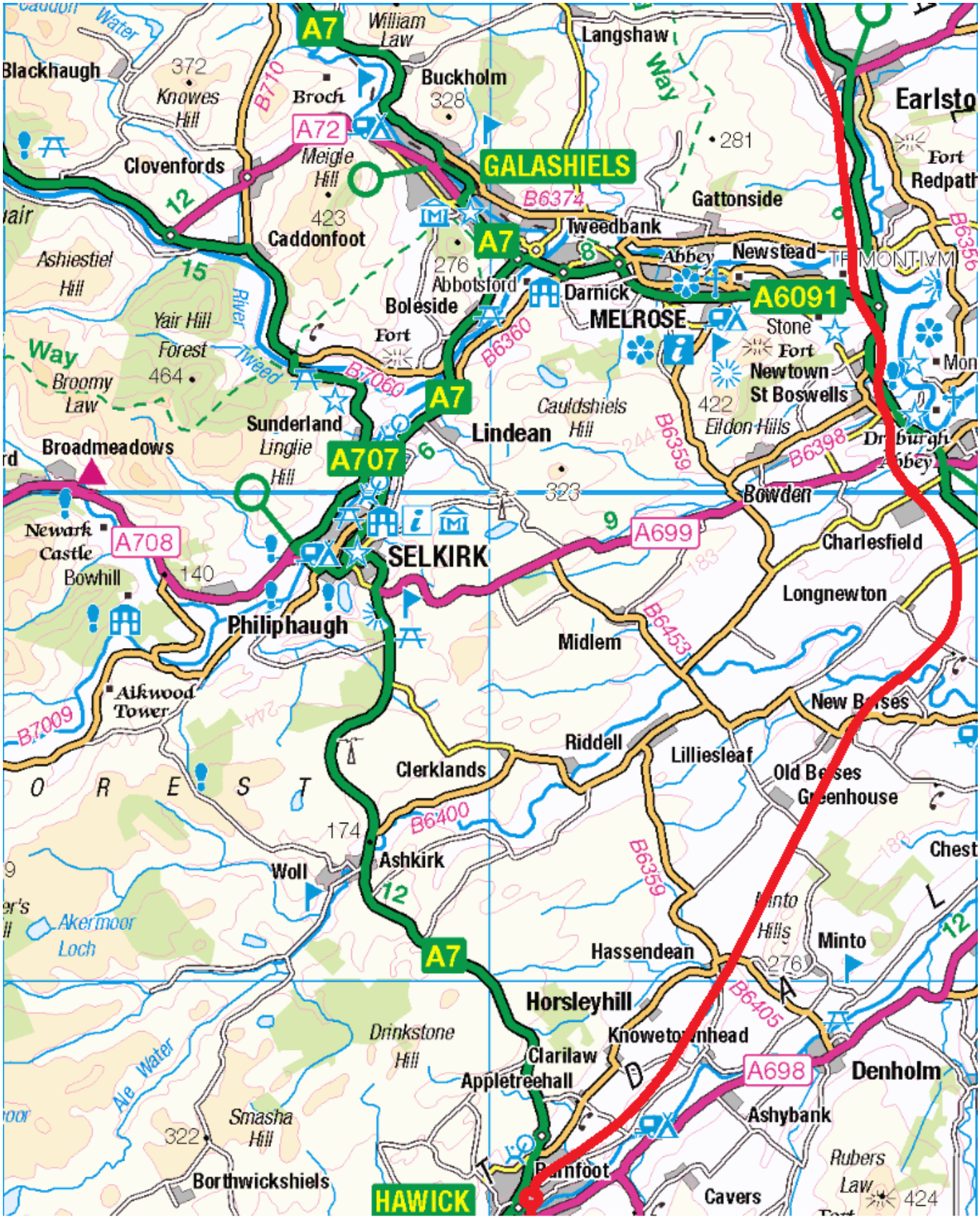
It is necessary to demonstrate the feasibility of the diversion between Newcastleton and Riccarton North Junction. The point of diversion is at an altitude of 400ft, and Riccarton North Junction is at 900ft, in a distance of 6 miles, so 500ft in 6 miles – 1 in 63. But things are rarely so convenient, and indeed here the altitude at NY514952 on the Roughly Burn, just 2 miles from Riccarton North Junction is only 500ft, leaving a climb of 400ft in 2 miles – 1 in 26. As I understand it, this is actually (just!) within the capacity of a HS train, but I don't like it; I try never to recommend a gradient in excess of 1 in 40. The valleys of the Hermitage Water and Roughly Burn are, however, cooperative – no side valleys making major viaducts unavoidable. So we can climb up the valley side to keep the gradients down. By passing through the following locations (with heights) the gradient is kept within 100ft/mile – 1 in 53:
NY508927 (500ft), NY514953 (600ft), NY519967 (700ft) and NY524975 (800ft).



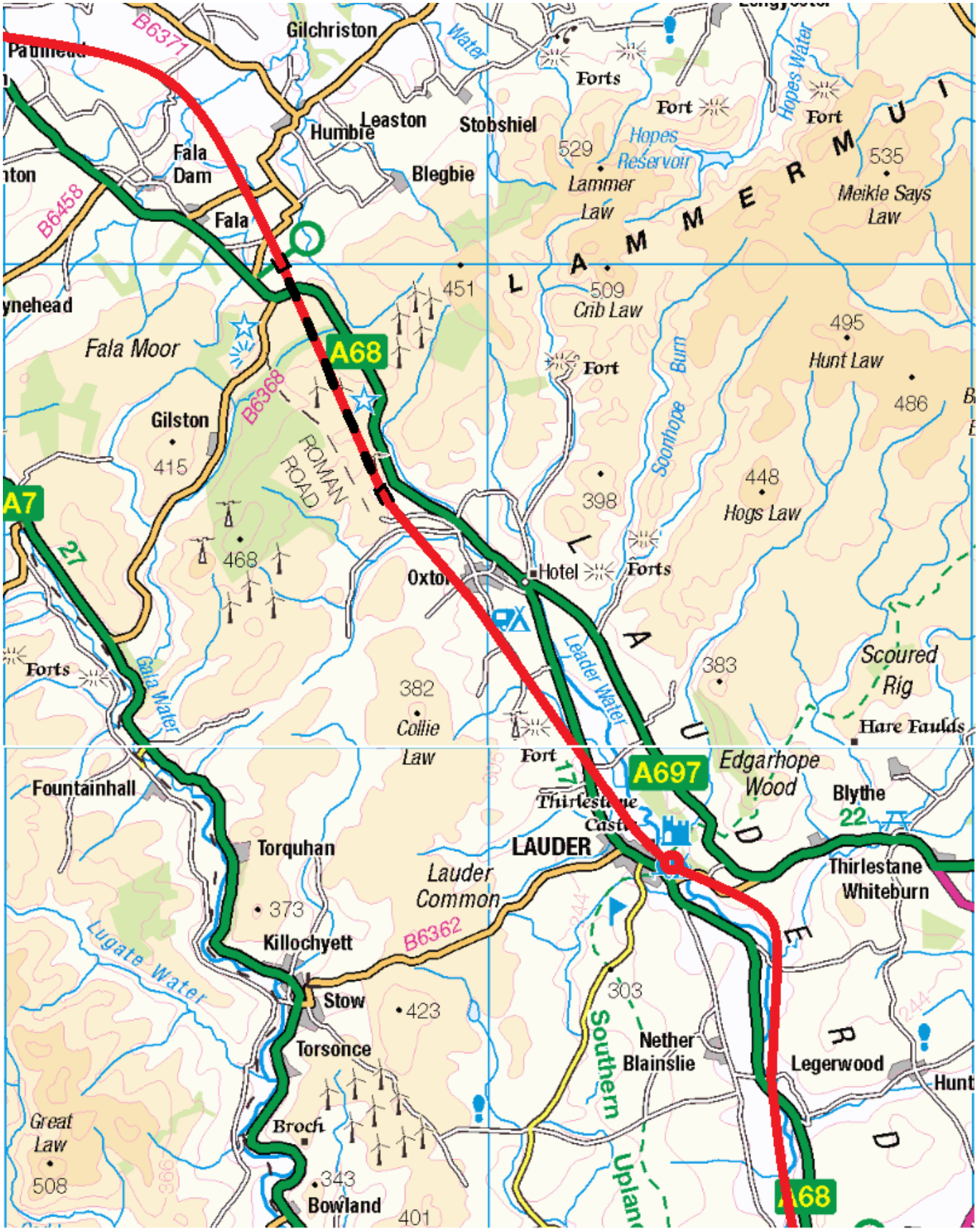
5.1 Harker – Kershopefoot



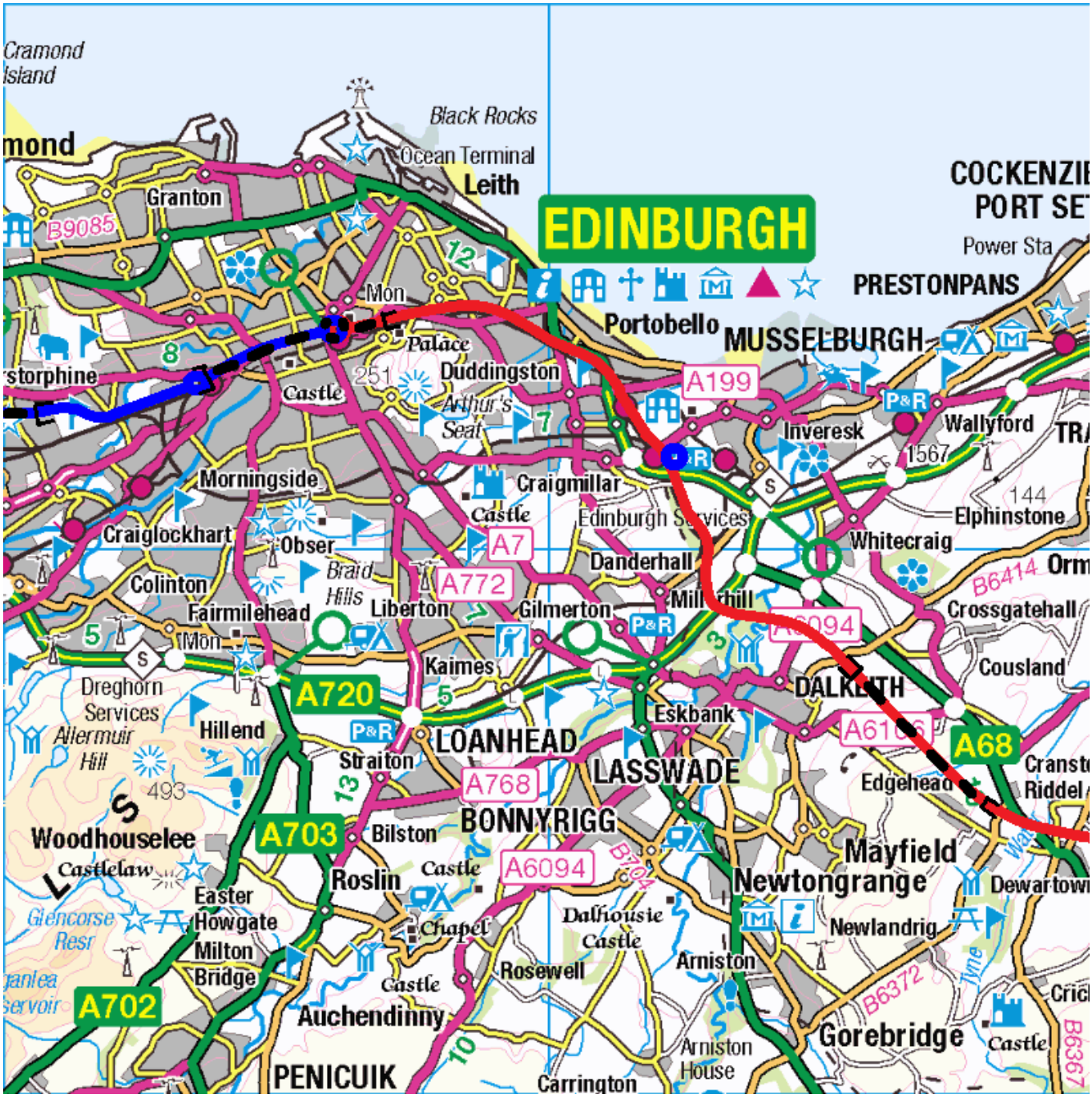
5.2 Old Castleton – Hawick



5.3 Hawick – Earlston



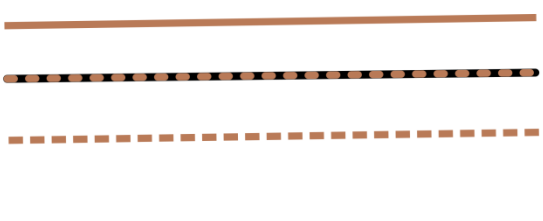
5.4 Legerwood – Pathhead



5.5 Dewar Town – Edinburgh

Overall Maps

There follow maps of the overall HS2 route (and portions of other associated HS routes used by HS2's services). At Mk1A, those portions of the main lines of HS2 which incorporate sections of classic route, and the sections of HS2's HS-Classic services extending over classic routes beyond the HS2 main lines, are shown as dotted lines, but differently. The following schematic should clarify:



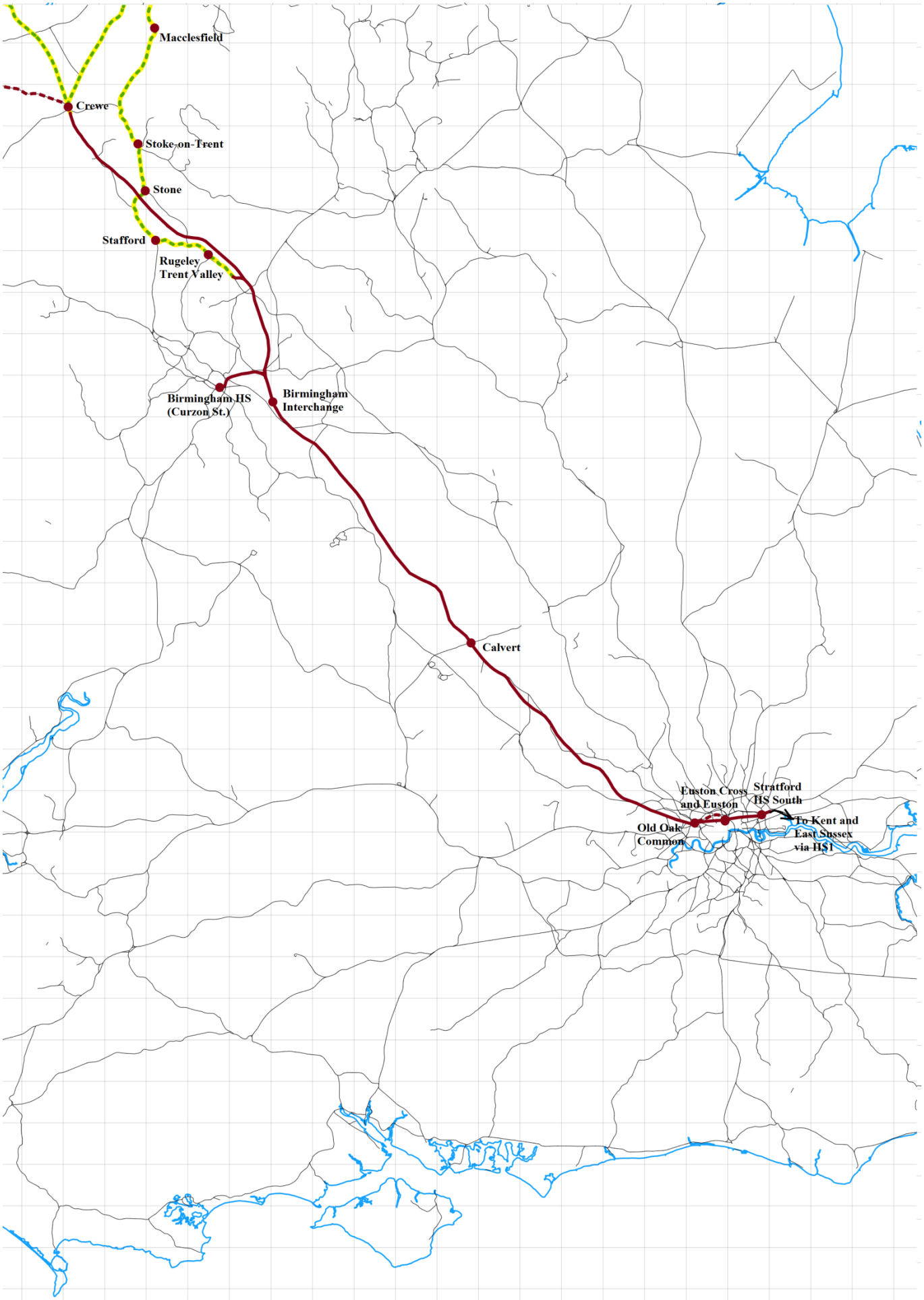
HS Line (main line - new infrastructure)

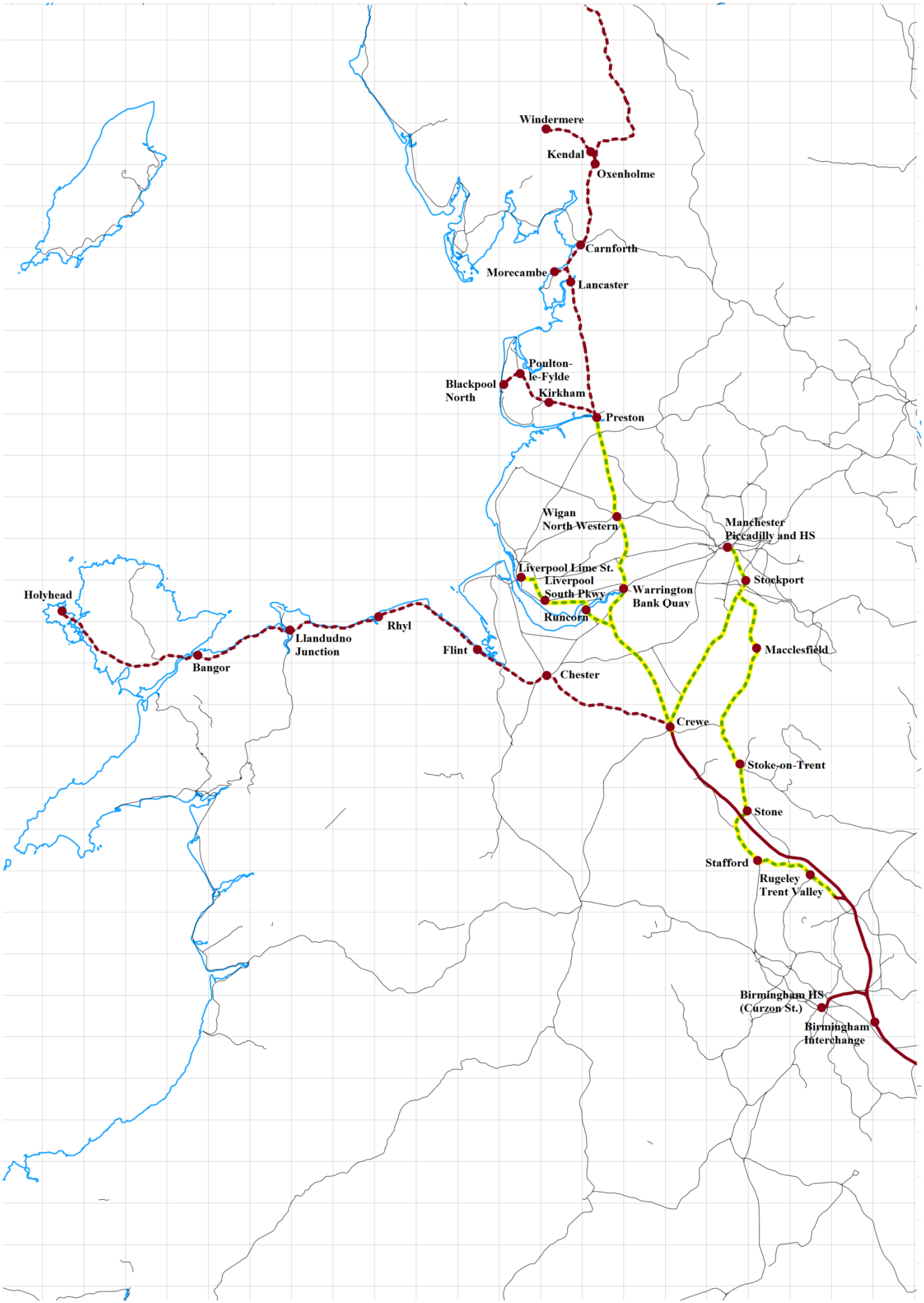
HS-Classic (classic section incorporated within HS main line)

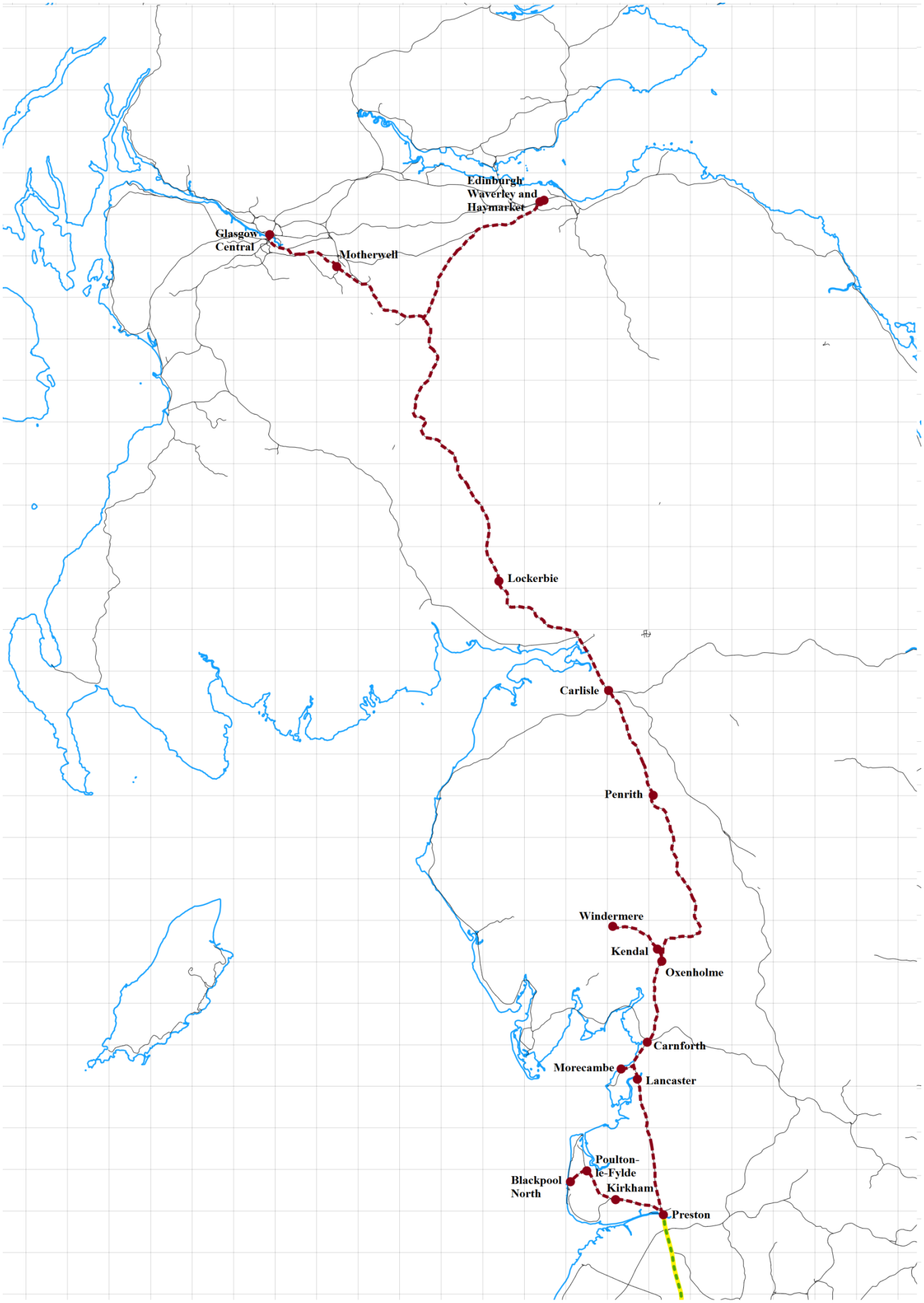
HS-Classic (HS services extending over classic lines beyond HS main line, in general as the final section of the journey, especially at the 'country end' - away from London).

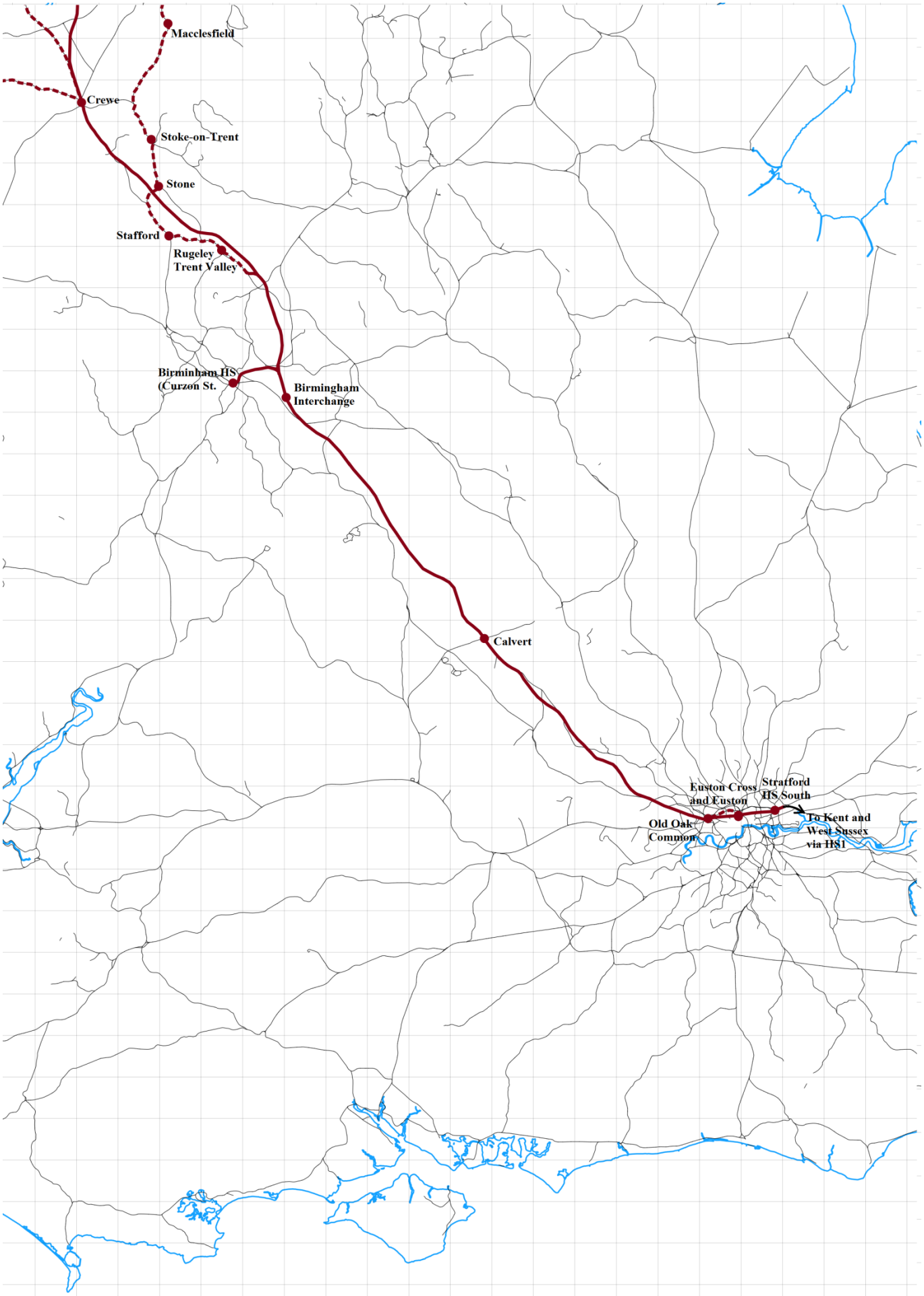
If Mk2 is implemented, there will no longer be any sections of classic route incorporated within the HS2 main line; it will all be new infrastructure. Accordingly, the middle of the above line symbols is no longer used. The connections between HS and classic routes will all remain, of course, no longer used by scheduled services, but immensely valuable for operational flexibility, in particular when engineering work is carried out on the main line.

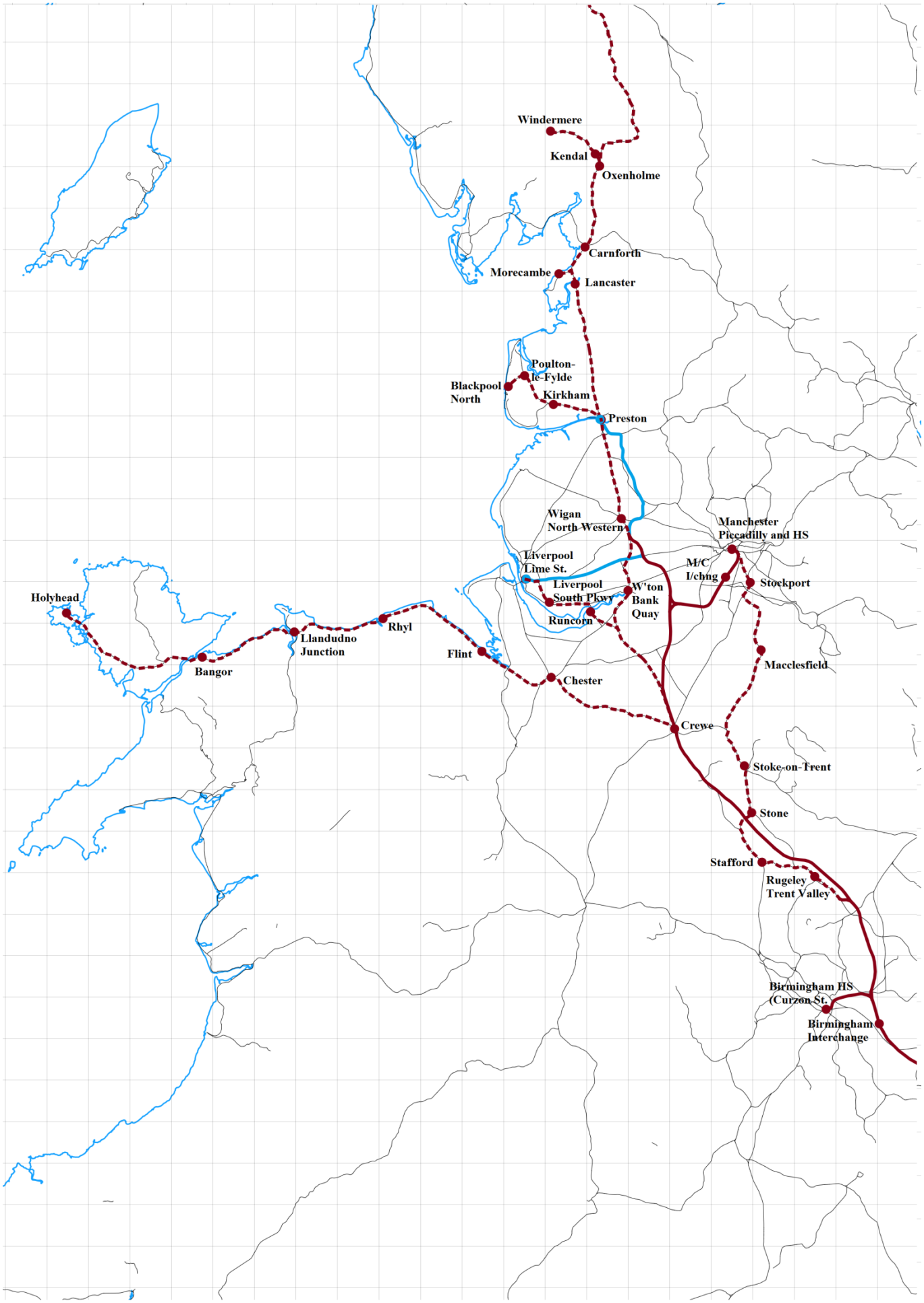
The first three maps show the HS2 routes (south, central and north sheets) at Mk1A. They show the alignments changed from Mk1, including sections of classic route incorporated into HS2. These are followed by the Mk2 versions of the same sheets. Unusually, HS2 also has a Mk3, so the next three sheets show that. Finally the maps of the overall network are presented, in Mk1A and extended (i.e. everything later) form. Note that these will be updated over the coming months as the various Route and Service Plans articles are reissued incorporating the Mk1A changes.

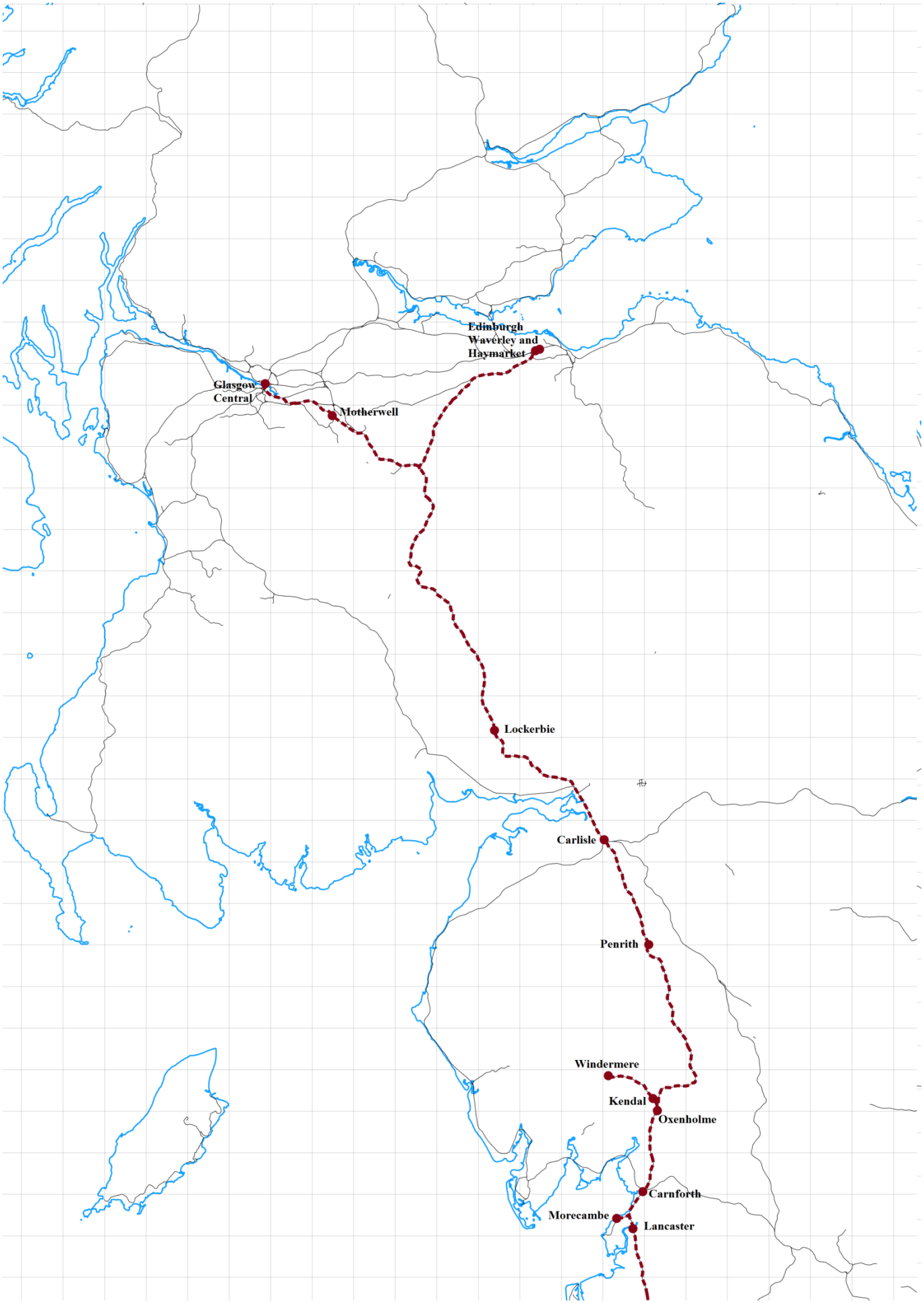


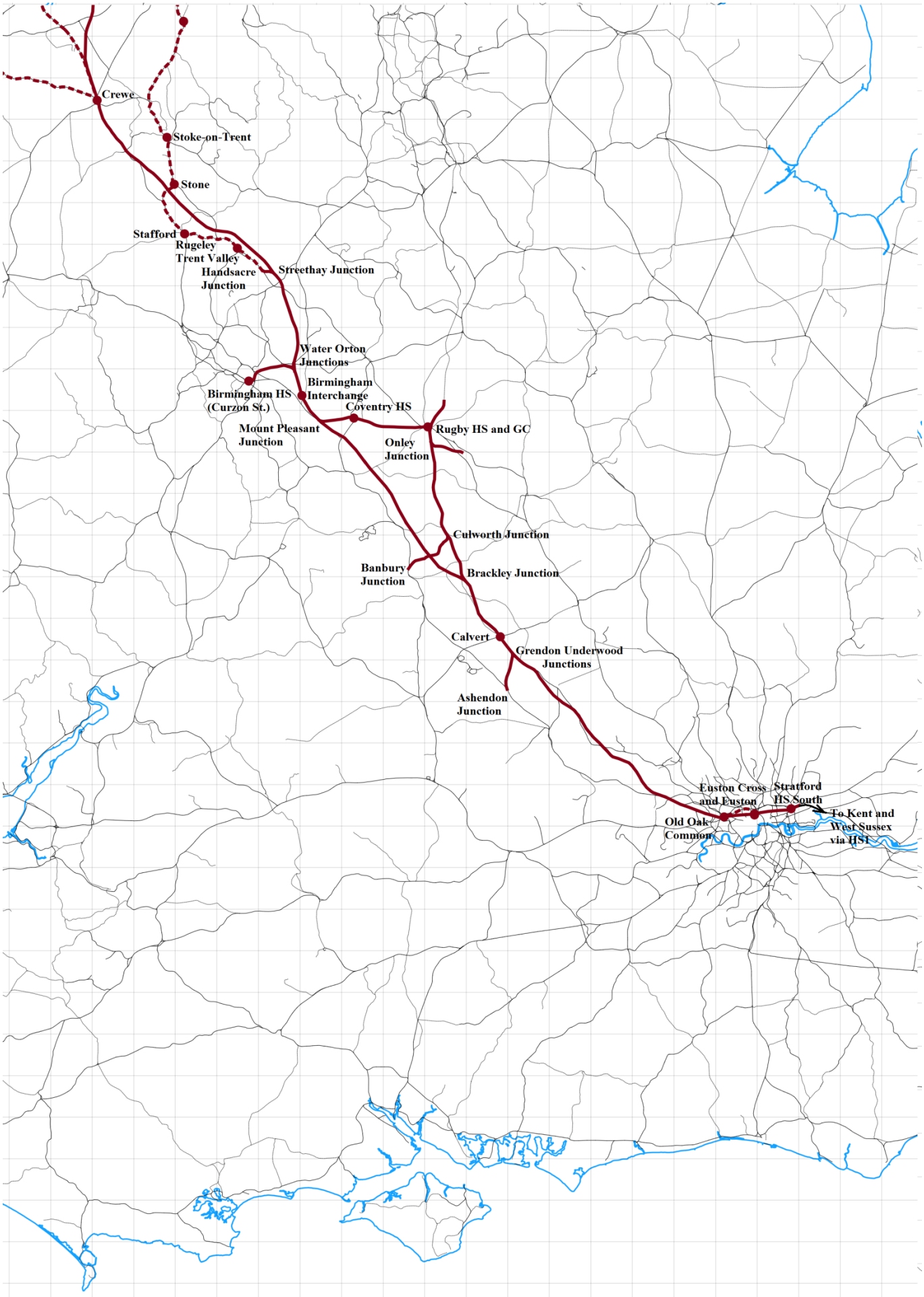


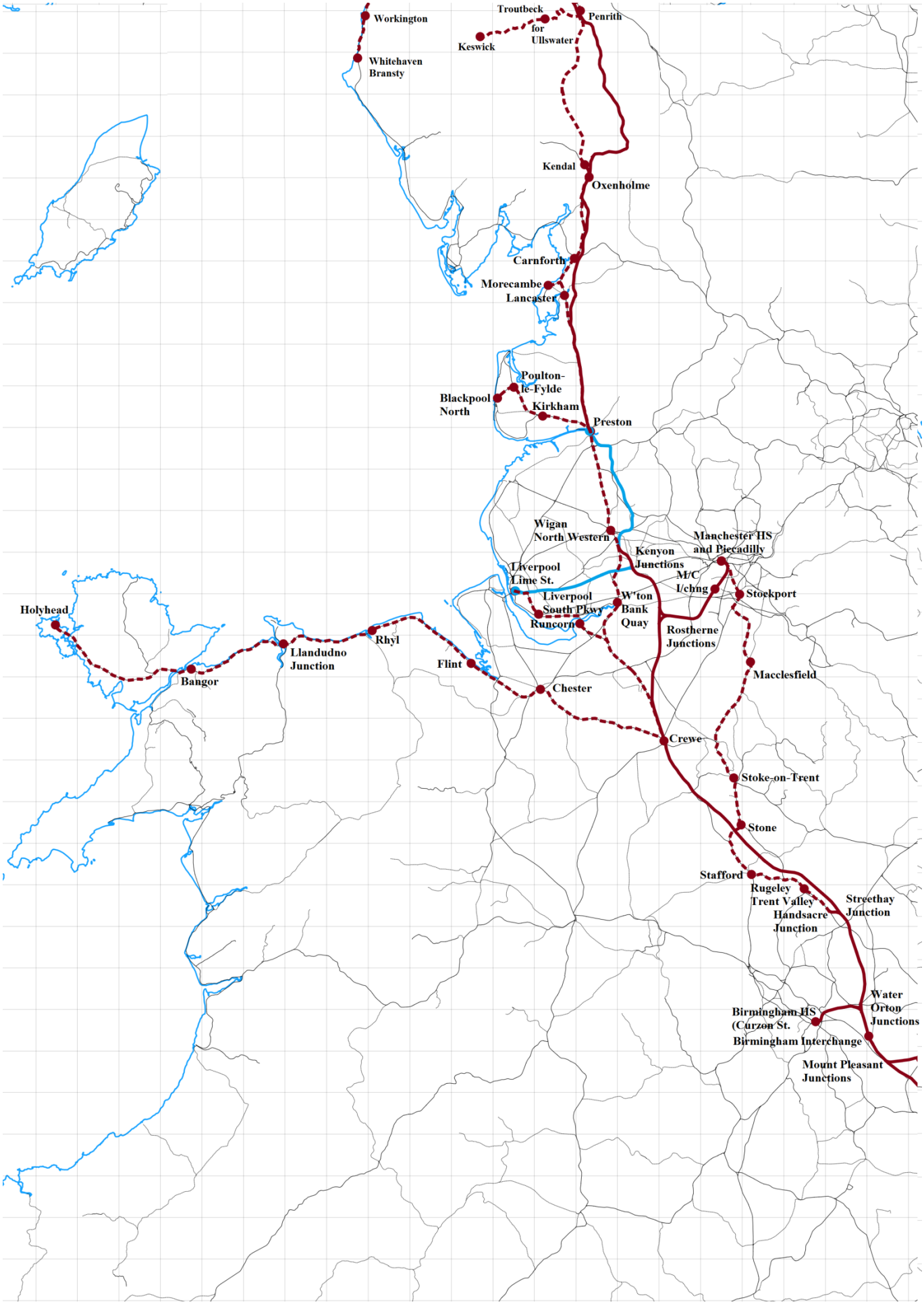


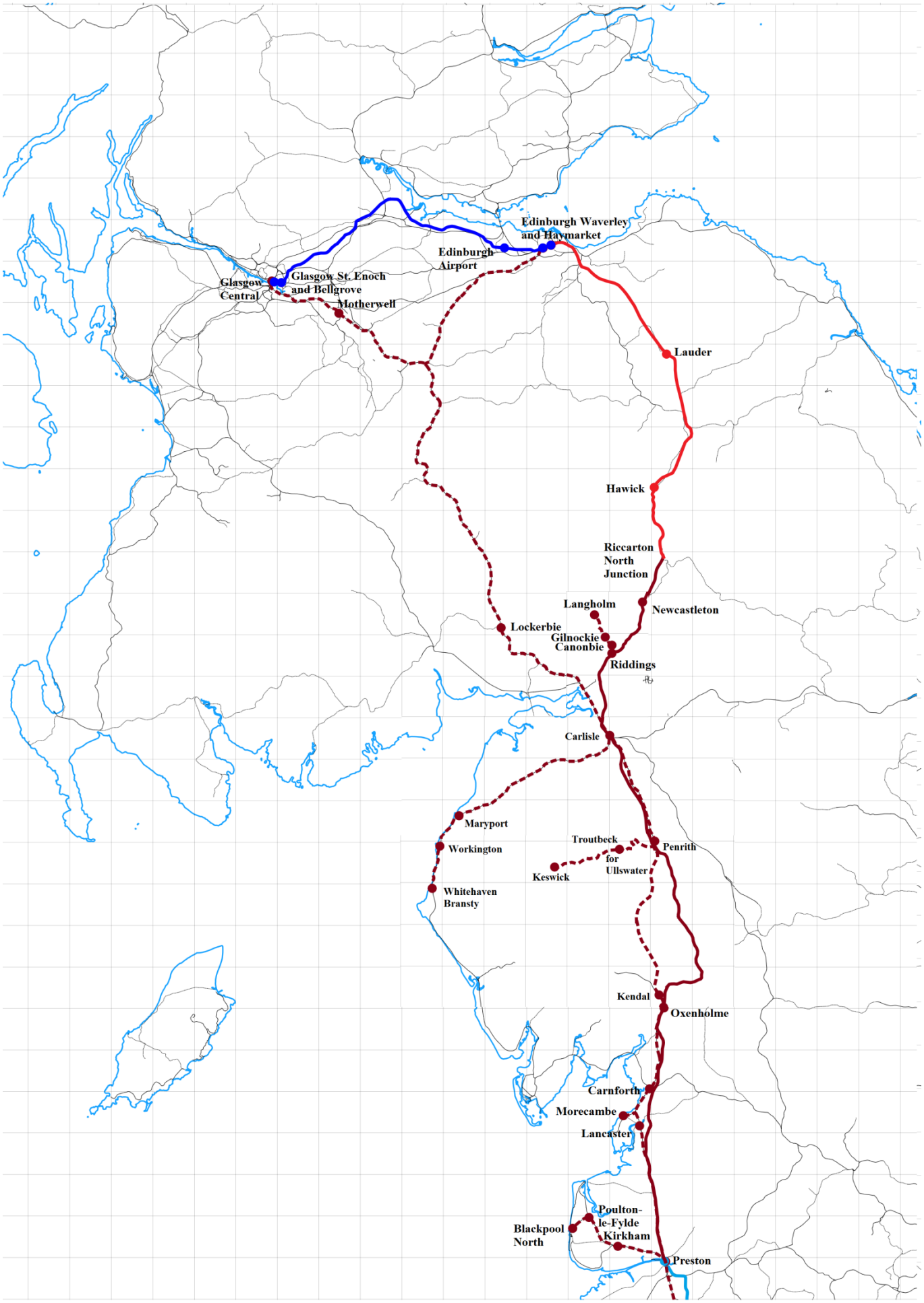


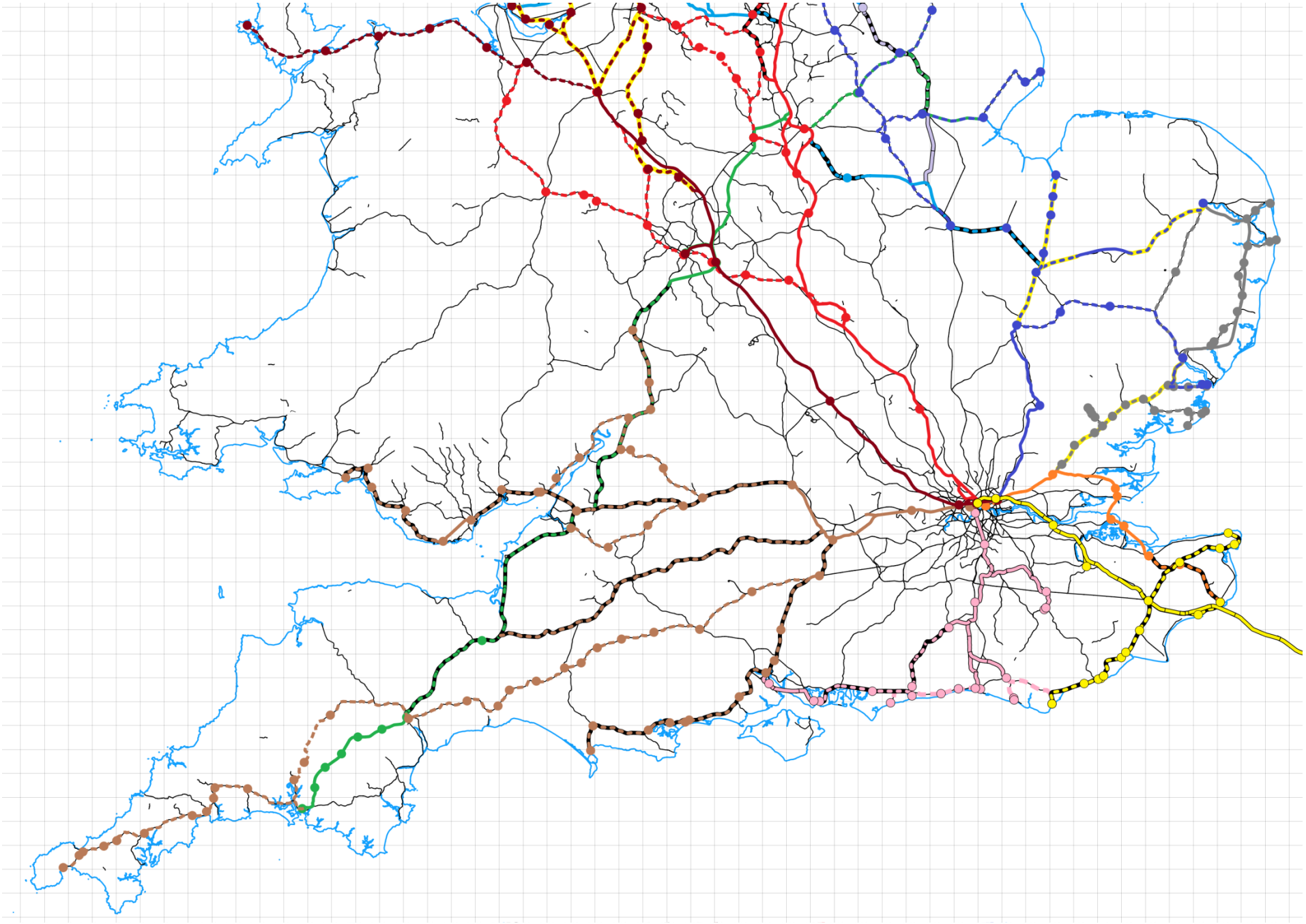




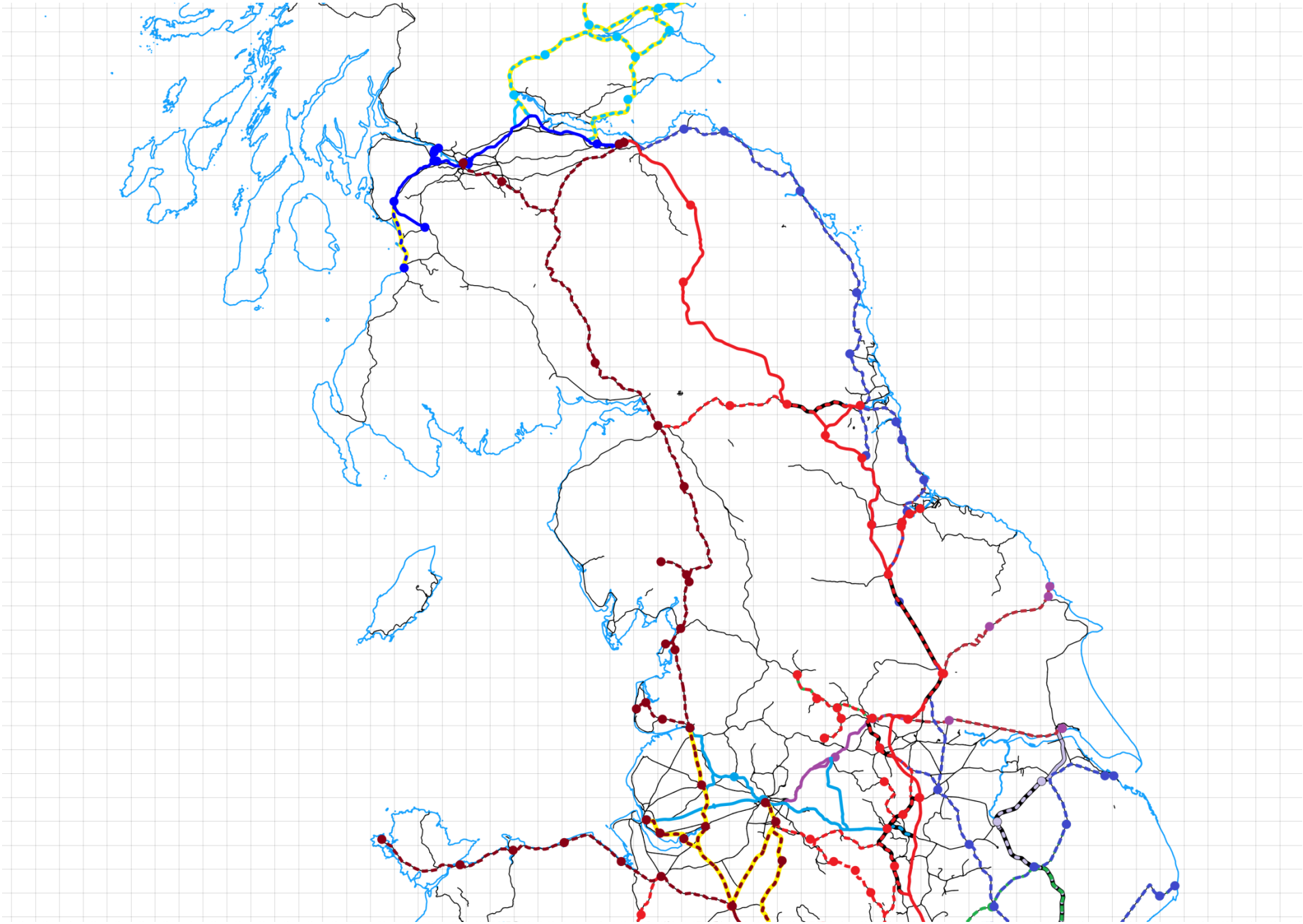


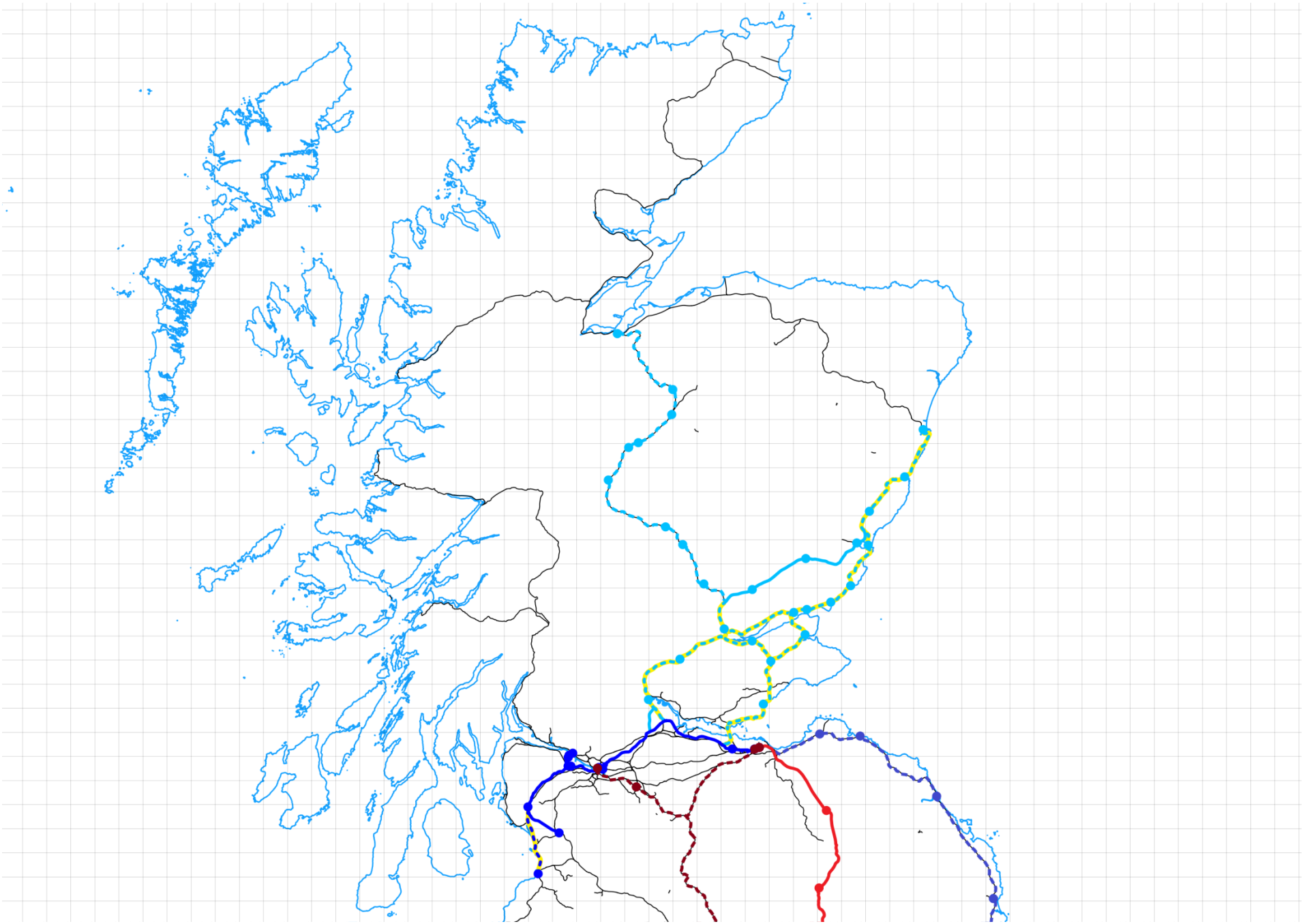


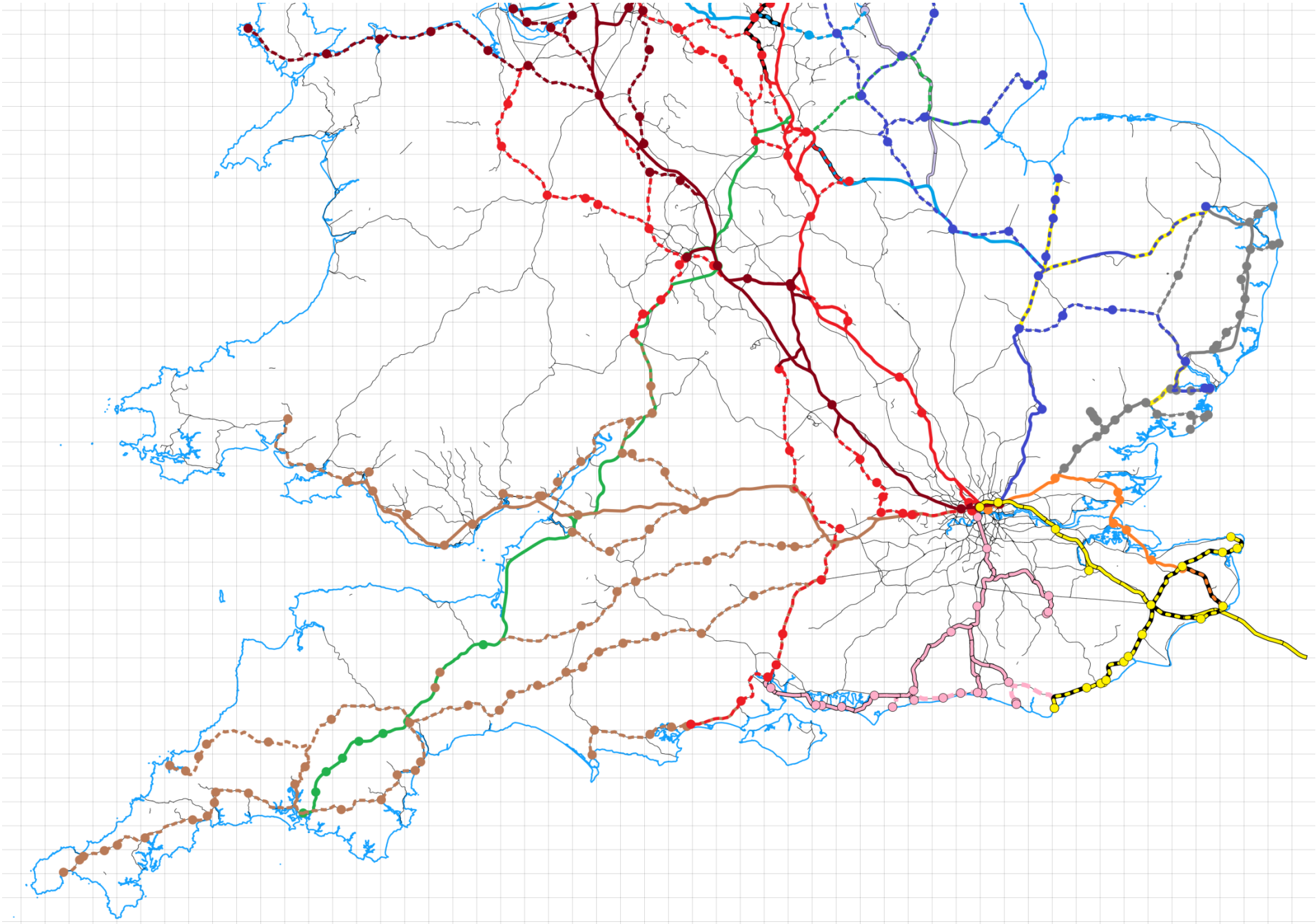




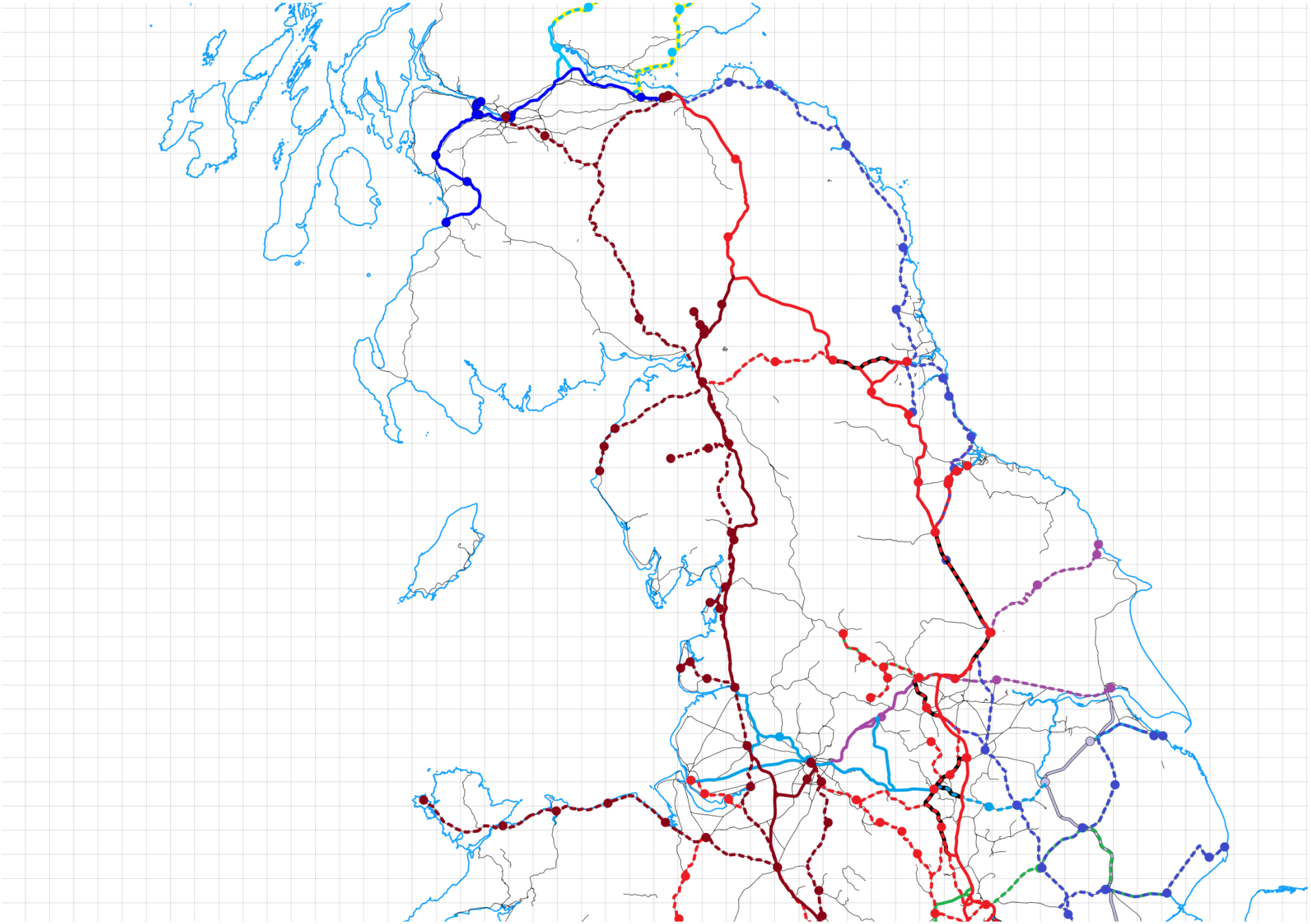
Complete HS Network, South Sheet



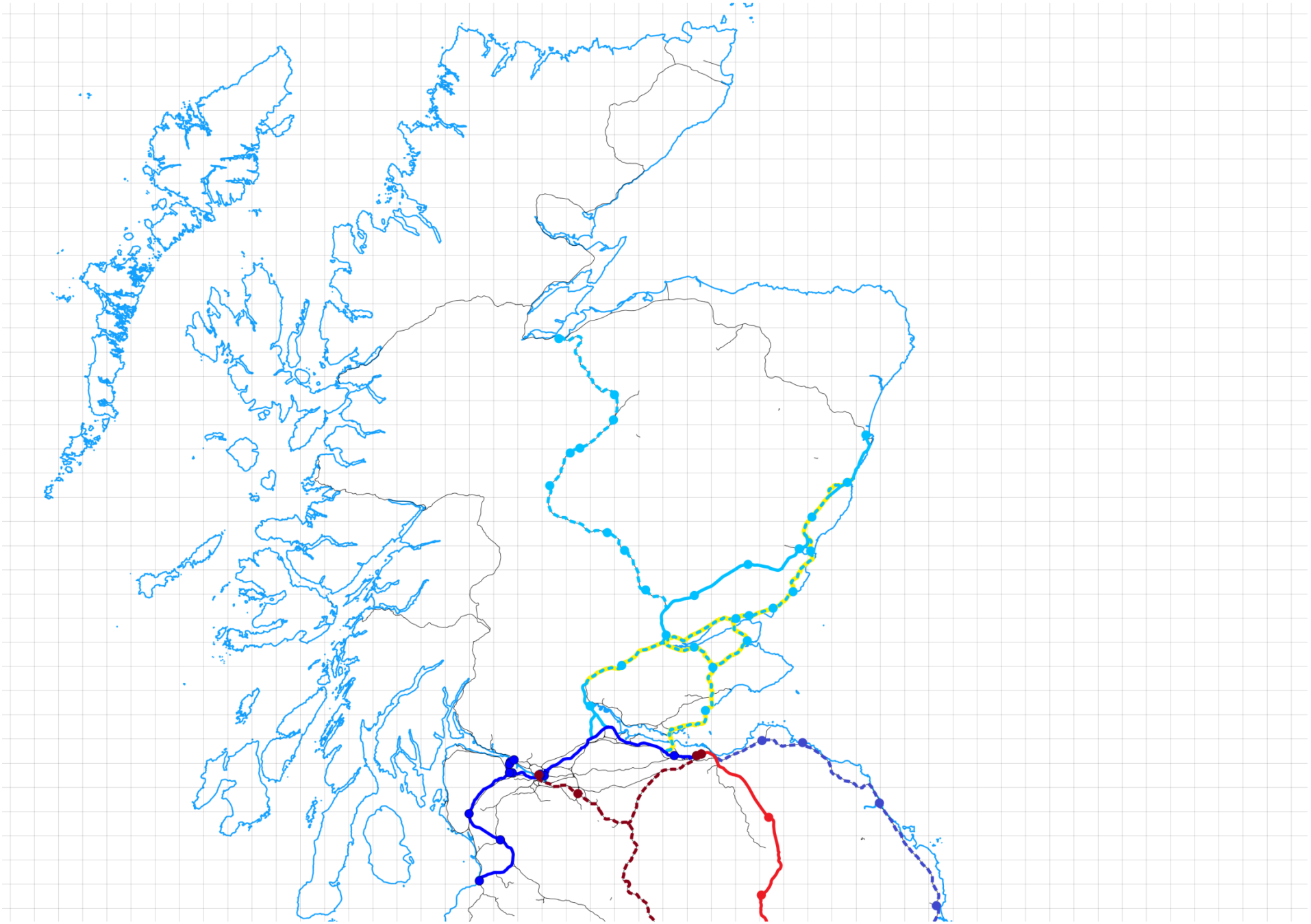




Extended HS Network, South Sheet



Extended HS Network, Central Sheet



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 HS2 itself. This most commonly occurs when a new section of HS2 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
- H High Speed train – at least part of the journey being on the HS main line
- R Regional Metro train, semi-fast service
- RS Regional Metro train, stopping service (all stations)

High Speed trains invariably travel over classic lines also (even if only those sections incorporated in the HS main line). Regional Metro services generally travel their entire journey over classic lines, though this is not an absolute requirement; but if they do travel over any HS section, they must be formed of HS stock – obviously!

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 1

The first service plan comes into effect as soon as HS2 Phase 1, the core route between Euston and Birmingham / Handsacre Junction, opens. The HS service to Birmingham starts, initially, from Old Oak Common. The other services all start from Euston.

- 3tphH Old Oak Common – Birmingham Interchange – Birmingham HS
- 2tphH Euston – Old Oak Common – Stockport – Manchester Piccadilly
- 1tphH Euston – Old Oak Common – Crewe – Wilmslow – Stockport – Manchester Piccadilly
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Euston – Old Oak Common – Crewe – Runcorn – Liverpool Lime Street
- 1tphH Euston – Old Oak Common – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Euston – Old Oak Common – Crewe – Preston – Lancaster – Oxenholme – Penrith – Carlisle – (splits / joins) – :
– Motherwell – Glasgow Central
– Haymarket – Edinburgh Waverley
- 2tphH Birmingham HS – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 1tphH Birmingham HS – Crewe –Warrington Bank Quay – Wigan North Western – Preston - Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
– Haymarket – Edinburgh Waverley
– Lockerbie – Motherwell – Glasgow Central

As compared with current services on the WCML, this frees up 6 slots/hour south of Handsacre Junction.

There are no interchanges at this service plan.

The following loadings are imposed on HS2:

- Euston Cross – Old Oak Common East Junction 0tph
- Old Oak Common East Junction – Old Oak Common station 0tph
- [Euston –] Queens Park Junction – Old Oak Common station 10tph
- Old Oak Common station – Water Orton South Junction 13tph
- Water Orton South Junction – Water Orton West Junction 3tph
- Water Orton West Junction – Birmingham HS 6tph
- Water Orton West Junction – Water Orton North Junction 3tph
- Water Orton South Junction – Water Orton North Junction 10tph
- Water Orton North Junction – Streethay Junction 13tph
- Streethay Junction – Handsacre Junction 13tph
- Handsacre Junction – Norton Bridge Junction 13tph
- Norton Bridge Junction – Cheadle Hulme 4tph
- Norton Bridge Junction – Crewe HS South Junction 9tph
- Crewe HS South Junction – Crewe station 9tph
- Crewe station – Cheadle Hulme 3tph
- Cheadle Hulme – Manchester Piccadilly 7tph
- Crewe station – Crewe Weaver Junction 5tph
- Weaver Junction – Liverpool Lime St. 2tph
- Weaver Junction – Preston 3tph

Note that the above list features only sections of HS2 route – including sections of classic route merged into HS2's main line. (Such sections of course include other traffic, not included here.)

Service Plan 1A

This service plan comes into effect as soon as HS2 Phase 2A, the extension from Streethay Junction to Crewe HS South Junction, opens. Those services **not** stopping at Stafford, thus everything except:

- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Birmingham HS – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly

now proceed directly from Streethay Junction to Crewe. The only changes in the route loadings are thus:

- [Water Orton North Junction – Streethay Junction 13tph]
- Streethay Junction – Crewe HS South Junction 9tph
- Streethay Junction – Handsacre Junction 4tph
- Handsacre Junction – Norton Bridge Junction 4tph
- Norton Bridge Junction – Cheadle Hulme 4tph

- Norton Bridge Junction – Crewe HS South Junction 0tph
- [Crewe HS South Junction – Crewe station 9tph]

Service Plan 2

This service plan comes into effect as soon as the first section of HS3, south of Northampton, opens. A service begins between St. Pancras and Wolverhampton, splitting/joining there, and proceeding on to Liverpool and Chester:

- 2tphH St. Pancras – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton – Rugby – Coventry – Birmingham New St. – Wolverhampton (splits/joins) – :
  - Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
  - Telford – Wellington – Shrewsbury – Wrexham – Chester

There are no changes in HS2's services, but only in the route loadings:

- [Streethay Junction – Crewe HS South Junction 9tph]
- [Streethay Junction – Handsacre Junction 4tph]
- Handsacre Junction – Stafford 4tph
- Stafford – Norton Bridge Junction 6tph
- Norton Bridge Junction – Cheadle Hulme 4tph
- Norton Bridge Junction – Crewe HS South Junction 2tph
- Crewe HS South Junction – Crewe station 11tph
- Crewe station – Crewe Weaver Junction 7tph
- Weaver Junction – Liverpool Lime St. 4tph
- [Weaver Junction – Preston 3tph]

The service to St. Pancras replaces the classic service from Birmingham to London, and thus frees up 3 further slots/hour on the WCML south of Rugby.

Service Plan 3

This service plan comes into effect when:

- HS2 opens from Euston Cross to Old Oak Common North Junction
- HS2 opens from Euston Cross to Woodgrange Road Junction, where it merges with HS1
- HS1's Maidstone, Dover, Margate and Eastbourne branches open
- Manchester HS station opens, reached from classic tracks approaching Piccadilly

– in other words, when the cross-Lindon inter-regional connection via Euston Cross opens, together with Manchester HS.

The 3tph Euston – Manchester via Crewe service adds a fourth tph, and switches to the new route, now originating from Dover Priory. The 3tph Euston – Birmingham service likewise adds a fourth tph, and switches to the new route, now originating from Maidstone HS. The 2tph Euston – Liverpool service switches to the new route, now originating from Eastbourne. The 2tph Euston – Manchester via Stoke

service switches to the new route, now originating from Margate. A new service from London to Blackpool North / Windermere, (see below,) splitting / joining at Preston, also uses the new route, likewise originating from Margate. The other changes do not involve the new route.

The full service on HS2 is thus (including the HS1 origins of the cross-London inter-regional services):

HS2 UHS:

- 4tphH Maidstone – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Birmingham Interchange – Birmingham HS
- 4tphH Dover – Folkestone Central – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Stockport – Manchester HS
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.

HS2 Metro:

- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Warrington Bank Quay – Wigan North Western – Preston (splits/joins) –:
  – Kirkham – Poulton le Fylde – Blackpool
  – Lancaster – Oxenholme – Kendal – Windermere
- 1tphH Euston – Old Oak Common – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Euston – Old Oak Common – Crewe – Preston – Lancaster – Oxenholme – Penrith – Carlisle – (splits / joins) – :
  – Motherwell – Glasgow Central
  – Haymarket – Edinburgh Waverley
- 2tphH Birmingham HS – Rugeley Trent Valley– Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 1tphH Birmingham HS – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 1tphH Birmingham HS – Crewe –Warrington Bank Quay – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Haymarket – Edinburgh Waverley
  – Lockerbie – Motherwell – Glasgow Central
- 1tphH Liverpool Lime St. – St. Helens – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Motherwell – Glasgow Central
  – Lockerbie – Haymarket – Edinburgh Waverley

Associated HS3 Metro service:

- 2tphH St. Pancras – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton – Rugby – Coventry – Birmingham New St. – Wolverhampton (splits/joins) – :
  - Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
  - Telford – Wellington – Shrewsbury – Wrexham – Chester

Representative Hourly Cross-Platform Interchange Pattern at Birmingham HS:

00H Maidstone – Birmingham HS
H Birmingham HS – Manchester Piccadilly

15H Maidstone – Birmingham HS
H Birmingham HS – Edinburgh / Glasgow

30H Maidstone – Birmingham HS
H Birmingham HS – Manchester Piccadilly

45H Maidstone – Birmingham HS
H Birmingham HS – Holyhead

Representative Hourly Cross-Platform Interchange Pattern at Crewe:

00H Euston – Holyhead (not cross-platform)
H Birmingham HS – Glasgow / Edinburgh
H HS3 St. Pancras – Liverpool

10H Dover – Manchester HS
R Euston – Crewe via Stafford

15H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere

20H Euston – Glasgow / Edinburgh
R Euston – Crewe via Stoke and Kidsgrove

25H Dover – Manchester HS
(no connection)

30H Birmingham HS – Holyhead
H HS3 St. Pancras – Liverpool

40H Dover – Manchester HS
R Euston – Crewe via Stafford

45H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere

50H Euston – Glasgow / Edinburgh
R Euston – Crewe via Stoke and Kidsgrove

55H Dover – Manchester HS
(no connection)

Representative Hourly Pattern at Wigan North Western:

00H Birmingham HS – Scotland

15H Margate – Preston – Blackpool / Windermere

30H Liverpool – Scotland

45H Margate – Preston – Blackpool / Windermere

Representative Hourly Cross-Platform Interchange Pattern at Preston:

00H Euston – Glasgow / Edinburgh
H Margate – Preston – Blackpool / Windermere

15H Birmingham HS – Glasgow / Edinburgh
R Manchester Airport – Preston – Blackpool / Windermere

30H Euston – Glasgow / Edinburgh
H Margate – Preston – Blackpool / Windermere

45H Liverpool – Glasgow / Edinburgh
R Manchester Airport – Preston – Blackpool / Windermere

The following loadings are imposed on HS2:

- Euston Cross – Old Oak Common East Junction 14tph
- Old Oak Common East Junction – Old Oak Common North Junction 14tph
- [Euston –] Queens Park Junction – Old Oak Common North Junction 3tph
- Old Oak Common North Junction – Water Orton South Junction 17tph
- Water Orton South Junction – Water Orton West Junction 4tph
- Water Orton West Junction – Birmingham HS 8tph
- Water Orton West Junction – Water Orton North Junction 4tph
- Water Orton South Junction – Water Orton North Junction 13tph
- Water Orton North Junction – Streethay Junction 17tph
- Streethay Junction – Handsacre Junction 4tph
- Handsacre Junction – Cheadle Hulme 4tph
- Streethay Junction – Crewe HS South Junction 13tph
- Crewe HS South Junction – Crewe station 15tph
- Crewe station – Cheadle Hulme 4tph
- Cheadle Hulme – Manchester HS 8tph
- Crewe station – Weaver Junction 9tph
- Weaver Junction – Liverpool Lime St. 4tph
- Weaver Junction – Springs Branch Junction 5tph
- Liverpool Lime St. – Springs Branch Junction 1tph
- Springs Branch Junstion – Preston 6tph

That is the complete set of services at Mk1A.

Estimated Journey Times for Mk1A

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'. Likewise the details of journey time calculations are dealt with in appendix C. 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. I have no official figures for distances in HS2 Ltd.'s plans, and have been obliged to derive them, to the nearest km, from my own maps.

The crudest approximation is the assumption that, once line speed has been reached, that speed (360kph on new infrastructure, between Old Oak Common and Crewe HS South Junction,) is maintained until it becomes necessary to decelerate for the next station stop.

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

Two versions are produced for each table, the summary version, containing results only for stations at which the service stops, and any locations, (invariably junctions,) where there is a change of line speed. The second version, suffixed P, contains the same results as previously, and, in addition, *passing times* (so indicated) for all other locations which are of interest for one reason or another.

My estimated distances are:

• Euston Cross – Old Oak Common	8km	(*)
• Euston – Old Oak Common	9km	(*)
• Old Oak Common – Calvert	73km	(360kph)
• Calvert – Birmingham Interchange	78km	(360kph)
• Old Oak Common – Birmingham Interchange	151km	(360kph)
• Birmingham Interchange – Birmingham Curzon St,	20km	(300kph)
• Birmingham Interchange – Handsacre Junction	33km	(360kph)
• Birmingham Curzon St. – Handsacre Junction	38km	(360kph)
• Handsacre Junction – Rugeley Trent Valley	8km	(200kph)
• Birmingham Interchange – Crewe	90km	(360kph)
• Birmingham Curzon St. – Crewe	95km	(360kph)
• Old Oak Common – Crewe	241km	(360kph)

The above are all distances on HS2's new infrastructure. In addition, they share the following sections of classic routes, whose lengths are known exactly!

• Rugeley Trent Valley – Stafford	14.90km	(200kph)
• Stafford – Stone	14.60km	(200kph)
• Stone – Stoke-on-Trent	11.31km	(200kph)
• Stoke-on-Trent – Macclesfield	31.63km	(200kph)
• Macclesfield – Stockport	19.29km	(200kph)
• Stockport – Manchester Piccadilly	9.44km	(200kph)
• Crewe – Chester	34.01km	(200kph)
• Chester – Flint	20.04km	(200kph)
• Flint – Rhyl	28.21km	(200kph)

- Rhyl – Llandudno Junction 23.11km (160kph)
- Llandudno Junction – Bangor 25.00km (160kph)
- Bangor – Holyhead 39.62km (160kph)
- Crewe – Stockport 40.25km (225kph)
- Crewe – Runcorn 36.21km (225kph)
- Runcorn – Liverpool South Parkway 12.00km (225kph)
- Liverpool South Parkway – Liverpool Lime St. 9.15km (160kph)
- Crewe – Warrington Bank Quay 38.84km (225kph)
- Warrington Bank Quay – Wigan North Western 9.23km (160kph)
- Liverpool Lime St. – St. Helens Central 17.96km (160kph)
- St. Helens Central – Wigan North Western 14.10km (160kph)
- Wigan North Western – Preston 33.99km (160kph)
- Warrington Bank Quay – Preston 43.22km (160kph)
- Crewe – Preston 82.06km (225/160kph)
- Preston – Kirkham 12.41km (160kph)
- Kirkham – Poulton-le-Fylde 10.74km (160kph)
- Poulton-le-Fylde – Blackpool North 4.99km (*)
- Preston – Lancaster 33.75km (225kph)
- Lancaster – Oxenholme 30.79km (200kph)
- Oxenholme – Kendal 3.34km (*)
- Kendal – Windermere 13.07km (160kph)
- Lancaster – Carnforth 9.80km (200kph)
- Carnforth – Oxenholme 20.99km (200kph)
- Oxenholme – Penrith 50.67km (200kph)
- Penrith – Carlisle 28.74km (200kph)
- Carlisle – Lockerbie 41.56km (200kph)
- Lockerbie – Motherwell 102.41km (200kph)
- Carlisle – Motherwell 143.97km (200kph)
- Motherwell – Glasgow Central 20.49km (160kph)
- Lockerbie – Edinburgh Haymarket 120.37km (200kph)
- Carlisle – Edinburgh Haymarket 161.93km (200kph)
- Edinburgh Haymarket – Edinburgh Waverley 1.99km (*)

The line speeds are chosen as follows:

- All new HS2 infrastructure has a line speed of 360kph.
- All sections of the WCML classic routes from Crewe to Stockport, Crewe to Liverpool South Parkway, Crewe to Warrington Bank Quay and Preston – Lancaster are upgraded to a line speed of 225kph.
- The WCML between Stockport and Manchester Piccadilly, between Rugeley and Cheadle Hulme via Stoke, between Crewe and Rhyl, between Lancaster and Motherwell and between Carstairs South Junction and Edinburgh Haymarket are upgraded to a line speed of 200kph.
- 160kph is taken as the line speed everywhere else, when nothing higher seems reasonable; no respectable railway should ever be slower than this.

- Those sections marked (*) are between Adjacent Stations, or between a station and a propinquant junction. For these sections, the elapsed time is derived from tables and stated explicitly. Refer to the article ‘Same Speed Railways (Appendices C and D) for the necessary explanations and values; only those values are stated here.

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

- Acceleration from stationary to 360kph takes 16.67km and 333 seconds
- Acceleration from stationary to 300kph takes 11.57km and 278 seconds
- Deceleration from 360kph to stationary takes 10.00km and 200 seconds
- Deceleration from 300kph to stationary takes 6.945km and 167 seconds
- Time to travel from Euston Cross to Old Oak Common (start to stop) is 292 seconds
- Time to travel from Euston to Old Oak Common (start to stop) is 310 seconds
- Time to travel from Poulton-le-Fylde to Blackpool North (start to stop) is 231 seconds
- Time to travel from Oxenholme to Kendal (start to stop) is 189 seconds
- Time to travel from Edinburgh Haymarket to Edinburgh Waverley (start to stop) is 146 seconds

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:

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 4 lines of the above list, and sum them, thus acceleration / deceleration takes 16.67 + 10.00 = 36.67km, and 333 + 200 = 533 seconds, at line speed 360kph, and 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. For any junction penalties, the explicit vale of the penalty is included in the formula, for that particular cell. 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.

1. UHS Services Euston Cross – Birmingham / Manchester / Liverpool / Preston (2/3/4/2 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Birmingham Interchange	151.0	159.0	29.6	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Old Oak Common - Crewe	241.0	249.0	44.6	49.5	52.5
Crewe - Stockport	40.3	289.3	13.5	63.0	69.0
Stockport - Manchester HS	9.4	298.7	5.3	68.3	77.3
Crewe - Runcorn	36.2	285.2	12.4	61.9	67.9
Runcorn - Liverpool South Parkway	12.0	297.2	6.0	67.9	76.9
Liverpool South Parkway - Liverpool Lime St.	9.2	306.4	5.4	73.3	85.3
Crewe -Warrington Bank Quay (pass)	38.8	287.8	12.2	61.7	
Warrington Bank Quay (pass) - Preston	43.2	331.1	16.9	78.6	84.6

Current fastest time (minutes) from London (with HS2 Ltd.'s estimates) [and the above values] to:

- London – Birmingham New Street (Curzon) 81 (49) [48]
- London – Crewe 90 [53]
- London – Stockport 115 (59) [69]
- London – Manchester 127 (68) [77]
- London – Runcorn 113 [68]
- London – Liverpool 128 (96) [85]
- London – Preston 128 [85].

I declare that the distances in the above spreadsheet are exactly as originally measured, and that no shading or refinement has been performed subsequently. The fact that I get very nearly exactly the same estimates as HS2 Ltd. for the Birmingham service, (the others are not directly comparable,) is either an extraordinary coincidence, or HS2 Ltd.'s estimating methods are as crude as mine!

1P. UHS Services Euston Cross – Birmingham / Manchester / Liverpool / Preston (2/3/4/2 stops with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	76.9	14.3	*19.1*	*22.1*
Grendon Underwood (S.) Jn. (pass) - Calvert (pass)	4.1	81.0	0.7	*19.8*	*22.8*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	87.8	1.1	*20.9*	*23.9*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	154.9	11.2	*32.1*	*35.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	159.0	2.3	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Mt. Pleasant (N.) Jn. (pass) - B'ham Intechange (pass)	4.1	159.0	0.7	*32.8*	*35.8*
B'ham Interchange (pass) - Streethay Junction (pass)	33.0	192.0	5.5	*38.3*	*41.3*
Streethay Junction (pass) - Crewe	57.0	249.0	11.2	49.5	52.5
Crewe - Stockport	40.3	289.2	13.5	63.0	69.0
Stockport - Manchester HS	9.4	298.7	5.3	68.3	77.3
Crewe - Runcorn	36.2	285.2	12.4	61.9	67.9
Runcorn - Liverpool South Parkway	12.0	297.2	6.0	67.9	76.9
Liverpool South Parkway - Liverpool Lime St.	9.2	306.3	5.4	73.3	85.3
Crewe - *Warrington Bank Quay (pass)*	38.8	287.8	12.2	*61.7*	*67.7*
Warrington Bank Quay (pass) - Preston	43.2	331.0	16.9	78.6	84.6

2. HS Metro Services Euston Cross / Birmingham – Manchester (9/6 stops) Euston Cross – Blackpool / Windermere (9/10 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Calvert	73.0	81.0	16.6	21.5	24.5
Calvert - Birmingham Interchange	78.0	159.0	17.4	38.9	44.9
Birmingham Interchange - Handsacre Junction	33.0	192.0	8.6	47.5	
Handsacre Juncton - Rugeley Trent Valley	8.0	200.0	3.3	50.9	59.9
Rugeley Trent Valley - Stafford	14.9	214.9	6.9	57.8	69.8
Stafford - Stone	14.6	229.5	6.8	64.6	79.6
Stone - Stoke-on-Trent	11.3	240.8	5.9	70.5	88.5
Stoke-on-Trent - Macclesfield	31.6	272.4	12.0	82.5	103.5
Macclesfield - Stockport	19.3	291.7	8.3	90.7	114.7
Stockport - Manchester Piccadilly	9.4	301.2	5.3	96.0	123.0
Birmingham Curzon St. - Handsacre Junction	38.0	38.0	9.4	9.4	
Handsacre Juncton - Rugeley Trent Valley	8.0	46.0	3.3	12.8	12.8
Rugeley Trent Valley - Stafford	14.9	60.9	6.9	19.7	22.7
Stafford - Stone	14.6	75.5	6.8	26.6	32.6
Stone - Stoke-on-Trent	11.3	86.8	5.9	32.4	41.4
Stoke-on-Trent - Macclesfield	31.6	118.4	12.0	44.4	56.4
Macclesfield - Stockport	19.3	137.7	8.3	52.6	67.6
Stockport - Manchester Piccadilly	9.4	147.2	5.3	57.9	75.9
Birmingham Interchange - Crewe	90.0	249.0	19.4	58.4	67.4
Crewe - Warrington Bank Quay	38.8	287.8	13.1	71.5	83.5
Warrington Bank Quay - Wigan North Western	9.2	297.1	5.4	76.9	91.9

Wigan North Western - Preston	34.0	331.1	14.7	91.7	109.7
Preston - Kirkham	12.4	343.5	6.6	98.3	119.3
Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	104.3	128.3
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	108.1	135.1
Preston - Lancaster	33.8	364.8	11.8	103.4	124.4
Lancaster - Oxenholme	30.8	395.6	11.7	115.1	139.1
Oxenholme - Kendal	3.3	398.9	3.2	118.3	145.3
Kendal - Windermere	13.1	412.0	6.9	125.2	155.2

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

- Rugeley TV 98 [60]
- Stafford 65 [70]
- Stone 103 (1 change) [80]
- Stoke-on-Trent 84 [89]
- Macclesfield 101 [103]
- Stockport 115 [115]
- Manchester 127 [123]
- Crewe 90 [67]
- Warrington BQ 104 [84]
- Wigan North Western 115 [92]
- Preston 128 [110]
- Kirkham 153 (1 change) [119]
- Poulton-le-Fylde 155 (1 change) [128]
- Blackpool North 165 (1 change) [135]
- Lancaster 144 [124]
- Oxenholme 154 [139]
- Kendal 176 (1 change) [145]
- Windermere 193 (1 change) [154]

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

- Rugeley TV 58 [13]
- Stafford 30 [23]
- Stone 49 (1 change) [33]
- Stoke-on-Trent 46 [41]
- Macclesfield 64 [56]
- Stockport 76 [68]
- Manchester 88 [76]

The times from London to Stoke-on-Trent and Macclesfield are slightly disappointing, being very similar to the present (albeit with 4 more stops). The fact of the extra stops will, doubtless, not impress the Potters, but they are essential to help fill the trains, as there's likely to be little if any traffic from London to Manchester (which is the bulk of the patronage of the current service). The above London – Manchester service is explicitly designed to ensure that Stoke-on-Trent and Macclesfield do not lose out when HS2 opens, as on HS2 Ltd.'s published plans they most disgracefully do, and it does achieve that aim. (There have been promises from HS2 Ltd. that Stoke will continue to enjoy services at least as good as at present, but, as yet, no delivery on that.) It also serves a very important interconnection role, making connections at Calvert with the East-West line and with Crossrail 4, and at Birmingham Interchange with the HS7 service from Plymouth to Newcastle.

The Birmingham – Manchester is deliberately routed via Stoke, since even a very fast service, with a single intermediate stop at Crewe, is, I feel, unlikely to attract a viable level of patronage. This service makes a favourable comparison with current times.

2P. HS Metro Services Euston Cross / Birmingham – Manchester (9/6 stops with passing times) Euston Cross – Blackpool / Windermere (9/10 stops with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	76.9	14.5	*19.3*	*22.3*
Grendon Underwood (S.) Jn. (pass) - Calvert	4.1	81.0	2.1	21.5	24.5
Calvert - *Chetwode (N.) Jn. (pass)*	6.8	87.8	3.5	*25.0*	*31.0*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	154.9	11.8	*36.8*	*42.8*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	159.0	2.1	38.9	44.9
Birmingham Interchange - *Handsacre Junction*	33.0	192.0	8.6	*47.5*	*56.5*
Handsacre Juncton - Rugeley Trent Valley	8.0	200.0	3.3	50.9	59.9
Rugeley Trent Valley - Stafford	14.9	214.9	6.9	57.8	69.8
Stafford - Stone	14.6	229.5	6.8	64.6	79.6

Stone - Stoke-on-Trent	11.3	240.8	5.9	70.5	88.5
Stoke-on-Trent - Macclesfield	31.6	272.4	12.0	82.5	103.5
Macclesfield - Stockport	19.3	291.7	8.3	90.7	114.7
Stockport - Manchester Piccadilly	9.4	301.2	5.3	96.0	123.0
Birmingham Curzon St. - *Handsacre Junction*	38.0	38.0	9.4	*105.5*	*135.5*
Handsacre Juncton - Rugeley Trent Valley	8.0	46.0	3.3	108.8	138.8
Rugeley Trent Valley - Stafford	14.9	60.9	6.9	115.7	148.7
Stafford - Stone	14.6	75.5	6.8	122.6	158.6
Stone - Stoke-on-Trent	11.3	86.8	5.9	128.4	167.4
Stoke-on-Trent - Macclesfield	31.6	118.4	12.0	140.4	182.4
Macclesfield - Stockport	19.3	137.7	8.3	148.7	193.7
Stockport - Manchester Piccadilly	9.4	147.2	5.3	154.0	202.0
Birmingham Interchange - Crewe	90.0	249.0	19.4	58.4	67.4
Crewe - Warrington Bank Quay	38.8	287.8	13.1	71.5	83.5
Warrington Bank Quay - Wigan North Western	9.2	297.1	5.4	76.9	91.9
Wigan North Western - Preston	34.0	331.0	14.7	91.7	109.7
Preston - Kirkham	12.4	343.5	6.6	98.3	119.3
Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	104.3	128.3
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	108.1	135.1
Preston - Lancaster	33.8	364.8	11.8	103.4	124.4
Lancaster - *Carnforth (pass)*	9.8	374.6	4.5	*107.9*	*131.9*
Carnforth (pass) - Oxenholme	21.0	395.6	7.2	115.1	139.1
Oxenholme - Kendal	3.3	398.9	3.2	118.3	145.3
Kendal - Windermere	13.1	412.0	6.9	125.2	155.2

3. HS Metro Services Euston / Birmingham – Holyhead (7/6 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Crewe	241.0	250.0	44.6	49.8	52.8
Crewe - Chester	34.0	284.0	12.7	62.4	68.4
Chester - Flint	20.0	304.1	8.5	70.9	79.9
Flint - Rhyl	28.2	332.3	10.9	81.9	93.9
Rhyl - Llandudno Junction	23.1	355.4	10.6	92.5	107.5
Llandudno Junction - Bangor	25.0	380.4	11.4	103.9	121.9
Bangor - Holyhead	39.6	420.0	16.8	120.7	141.7
Birmingham Curzon St. - Crewe	95.0	95.0	20.3	20.3	20.3
Crewe - Chester	34.0	129.0	12.7	32.9	35.9
Chester - Flint	20.0	149.1	8.5	41.4	47.4
Flint - Rhyl	28.2	177.3	10.9	52.4	61.4
Rhyl - Llandudno Junction	23.1	200.4	10.6	63.0	75.0
Llandudno Junction - Bangor	25.0	225.4	11.4	74.4	89.4
Bangor - Holyhead	39.6	265.0	16.8	91.2	109.2

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

- Crewe 90 [53]
- Chester 123 [68]
- Flint 146 [80]
- Rhyl 166 [94]
- Llandudno Junction 182 [108]
- Bangor 191 [122]
- Holyhead 229 [142]

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

- Crewe 52 [20]
- Chester 91 (1 change) [36]
- Flint 114 (2 changes) [47]

- Rhyl 134 (2 changes) [61]
- Llandudno Junction 155 (2 changes) [75]
- Bangor 174 (2 changes) [89]
- Holyhead 212 (2 changes) [109]

3P. HS Metro Services Euston / Birmingham – Holyhead (9/6 stops with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	77.9	14.3	*19.4*	*22.4*
Grendon Underwood (S.) Jn. (pass) - Calvert (pass)	4.1	82.0	0.7	*20.1*	*23.1*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	88.8	1.1	*21.2*	*24.2*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	155.9	11.2	*32.4*	*35.4*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange (pass)	4.1	160.0	0.7	*33.1*	*36.1*
B'ham Interchange (pass) - Streethay Junction (pass)	33.0	193.0	5.5	*38.6*	*41.6*
Streethay Junction (pass) - Crewe	57.0	250.0	11.2	49.8	52.8
Crewe - Chester	34.0	284.0	12.7	62.4	68.4
Chester - Flint	20.0	304.0	8.5	70.9	79.9
Flint - Rhyl	28.2	332.2	10.9	81.9	93.9
Rhyl - Llandudno Junction	23.1	355.3	10.6	92.5	107.5
Llandudno Junction - Bangor	25.0	380.3	11.4	103.8	121.8
Bangor - Holyhead	39.6	420.0	16.8	120.7	141.7
Birmingham Curzon St. - *Streethay Jn. (pass)*	38.0	38.0	9.1	*9.1*	*9.1*
Streethay Jn. (pass) - Crewe	57.0	95.0	11.2	20.3	20.3
Crewe - Chester	34.0	129.0	12.7	32.9	35.9
Chester - Flint	20.0	149.1	8.5	41.4	47.4
Flint - Rhyl	28.2	177.3	10.9	52.4	61.4

Rhyl - Llandudno Junction	23.1	200.4	10.6	63.0	75.0
Llandudno Junction - Bangor	25.0	225.4	11.4	74.4	89.4
Bangor - Holyhead	39.6	265.0	16.8	91.2	109.2

4. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (10/11/10 stops to each)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Calvert	73.0	82.0	16.6	21.8	24.8
Calvert - Birmingham Interchange	78.0	160.0	17.4	39.2	45.2
Birmingham Interchange - Crewe	90.0	250.0	19.4	58.7	67.7
Crewe - Warrington Bank Quay	38.8	288.8	12.2	70.8	
Warrington Bank Quay - Preston	43.2	332.1	16.9	87.8	99.8
Preston - Lancaster	33.8	365.8	11.8	99.6	114.6
Lancaster - Oxenholme	30.8	396.6	11.7	111.3	129.3
Oxenholme - Penrith	50.7	447.3	17.7	128.9	149.9
Penrith - Carlisle	28.7	476.0	11.1	140.0	164.0
Carlisle - Motherwell	144.0	620.0	45.7	185.7	212.7
Motherwell - Glasgow Central	20.5	640.5	9.7	195.4	225.4
Carlisle - Edinburgh Haymarket	161.9	637.9	51.0	191.1	218.1
Edinburgh Haymarket - Edinburgh Waverley	2.0	639.9	2.4	193.5	223.5
Birmingham Curzon St. - Crewe	95.0	95.0	20.3	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6

Preston - Lancaster	33.8	210.8	11.8	65.3	77.3
Lancaster - Oxenholme	30.8	241.6	11.7	77.1	92.1
Oxenholme - Penrith	50.7	292.3	17.7	94.7	112.7
Penrith - Carlisle	28.7	321.0	11.1	105.8	126.8
Carlisle - Lockerbie	41.6	362.6	14.9	120.8	144.8
Lockerbie - Motherwell	102.4	465.0	33.2	153.9	180.9
Motherwell - Glasgow Central	20.5	485.5	9.7	163.6	193.6
Carlisle - Edinburgh Haymarket	161.9	482.9	51.0	156.9	180.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	484.9	2.4	159.3	186.3
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - Lancaster	33.8	99.8	11.8	42.5	51.5
Lancaster - Oxenholme	30.8	130.6	11.7	54.2	66.2
Oxenholme - Penrith	50.7	181.3	17.7	71.8	86.8
Penrith - Carlisle	28.7	210.0	11.1	82.9	100.9
Carlisle - Motherwell	144.0	354.0	45.7	128.6	149.6
Motherwell - Glasgow Central	20.5	374.5	9.7	138.3	162.3
Carlisle - Lockerbie	41.6	251.6	14.9	97.9	118.9
Lockerbie - Edinburgh Haymarlet	120.4	371.9	38.6	136.5	160.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	373.9	2.4	138.9	165.9

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

- Preston 128 [92]
- Lancaster 144 [107]
- Oxenholme 154 [122]
- Penrith 151 [143]
- Carlisle 194 [157]
- Motherwell 253 [205]
- Glasgow Central 271 [218]
- Edinburgh Haymaket 271 (via ECML) [211]
- Edinburgh Waverlry 257 (via ECML) [216]

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

- Crewe 52 [20]
- Warrington BQ 71 [36]
- Wigan North Western 82 [45]
- Preston 96 [63]
- Lancaster 112 [77]
- Oxenholme 125 [92]
- Penrith 147 [113]
- Carlisle 164 [127]
- Edinburgh Haymarket 237 [181]
- Edinburgh Waverlry 247 [186]
- Lockerbie 192 (1 change) [145]
- Motherwell 268 (1 change) [181]
- Glasgow Central 242 [194]

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

- St. Helens Central 19 [9]
- Wigan North Western 33 [19]
- Preston 57 [37]
- Lancaster 84 (1 change) [52]
- Oxenholme 96 (1 change) [66]
- Penrith 119 (1 change) [87]
- Carlisle 136 (1 change) [101]
- Motherwell 195 (1 change) [150]
- Glasgow Central 211 (1 change) [162]
- Lockerbie 174 (1 change) [119]
- Edinburgh Haymarket 219 (1 change) [161]
- Edinburgh Waverlry 229 (1 change) [166]

4P. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (10/11/10 stops to each with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	77.9	14.5	*19.6*	*22.6*
Grendon Underwood (S.) Jn. (pass) - Calvert	4.1	82.0	2.1	21.8	24.8
Calvert - *Chetwode (N.) Jn. (pass)*	6.8	88.8	3.5	*25.3*	*31.3*
Chetwode (N.) Jn. (pass) - *Mt. Pleasant (N.) Jn. (pass)*	67.1	155.9	11.8	*37.1*	*43.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	160.0	2.1	39.2	45.2
B'ham Interchange - *Streethay Jn. (pass)*	33.0	193.0	8.3	*47.5*	*56.5*
Streethay Jn. (pass) - Crewe	57.0	250.0	11.2	58.7	67.7
Crewe - *Warrington Bank Quay (passing)*	38.8	288.8	12.2	*70.8*	*82.8*
Warrington Bank Quay (passing) - Preston	43.2	332.0	16.9	87.8	99.8
Preston - Lancaster	33.8	365.7	11.8	99.5	114.5
Lancaster - Oxenholme	30.8	396.5	11.7	111.3	129.3
Oxenholme - Penrith	50.7	447.2	17.7	128.9	149.9
Penrith - Carlisle	28.7	475.9	11.1	140.0	164.0
Carlisle - Motherwell	144.0	619.9	45.7	185.7	212.7
Motherwell - Glasgow Central	20.5	640.4	9.7	195.3	225.3
Carlisle - Edinburgh Haymarket	161.9	637.8	51.0	191.1	218.1
Edinburgh Haymarket - Edinburgh Waverley	2.0	639.8	2.4	193.5	223.5
Birmingham Curzon St. - *Streethay Jn. (pass)*	38.0	38.0	9.1	*9.1*	*9.1*
Streethay Jn. (pass) - Crewe	57.0	95.0	11.2	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4

Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6
Preston - Lancaster	33.8	210.8	11.8	65.3	77.3
Lancaster - Oxenholme	30.8	241.6	11.7	77.1	92.1
Oxenholme - Penrith	50.7	292.3	17.7	94.7	112.7
Penrith - Carlisle	28.7	321.0	11.1	105.8	126.8
Carlisle - Lockerbie	41.6	362.6	14.9	120.8	144.8
Lockerbie - Motherwell	102.4	465.0	33.2	153.9	180.9
Motherwell - Glasgow Central	20.5	485.5	9.7	163.6	193.6
Carlisle - Edinburgh Haymarket	161.9	482.9	51.0	156.9	180.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	484.9	2.4	159.3	186.3
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - Lancaster	33.8	99.8	11.8	42.5	51.5
Lancaster - Oxenholme	30.8	130.6	11.7	54.2	66.2
Oxenholme - Penrith	50.7	181.3	17.7	71.8	86.8
Penrith - Carlisle	28.7	210.0	11.1	82.9	100.9
Carlisle - Motherwell	144.0	354.0	45.7	128.6	149.6
Motherwell - Glasgow Central	20.5	374.5	9.7	138.3	162.3
Carlisle - Lockerbie	41.6	251.6	14.9	97.9	118.9
Lockerbie - Edinbugh Haymarket	120.4	371.9	38.6	136.5	160.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	373.9	2.4	138.9	165.9

Service Plan 4

This service plan comes into effect when the Mk2 sections open, specifically:

- HS2 phase 2B opens from Crewe HS South to North Junction, via the tunnel under Crewe station, from Crewe HS North Junction to Manchester HS via Rostherne South Junction, and from Rostherne South Junction to Bamfurlong Junction
- HS8 opens from Liverpool Lime St. to Kenyon South and North junctions. (This is HS8/9 SP0.) Note that the connection from Kenyon West to North Junction is not used in normal service until (very much) later, but provides a useful diversion for Liverpool – Scotland trains during engineering work, in the interim.

The HS2 service from Eastbourne to Liverpool now travels via Kenyon South and West junctions and HS8 (thus new, high speed infrastructure the whole way from Euston Cross). A new service is introduced between Euston and Liverpool, following the former route (with a few extra stops) so that Runcorn and Liverpool South Parkway supporters don't feel aggrieved. The service from Dover to Manchester travels via the tunnel under Crewe, Rostherne South and East junctions, and the new Manchester Interchange station (thus, likewise, new, high speed infrastructure the whole way from Euston Cross).

Service Plan 4A

This service plan comes into effect only when the Transpennine routes HS8 and HS9 open fully between Manchester HS and Liverpool / Bolton and Preston. (This is HS8/9 SP1.) The connections between HS2 and HS8 at Kenyon Junctions were made in service plan 4. Now a connection is likewise made between HS2 at Bamfurlong Junction and HS8 at Gibb Farm Junction making available new, high speed infrastructure throughout between Euston Cross and Preston. A new service is introduced between Eastbourne and Preston:

- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Preston

SP4A comes into effect possibly some time after SP4. Its effects on HS2 are minor but important: it completes the works for Mk2.

When HS7 opens, it has no effect on HS2's service plan, but does give rise to interchange arrangements at Birmingham Interchange; HS7 occupies the outer and HS2 the inner platform faces, giving cross-platform interchange. In addition to that, HS7's own services have cross-platform interchange at Birmingham HS, and also non-cross-platform interchange with those of HS2. Note that several service plans of HS7 come into effect during the currency of HS2 SP4 (which is HS2's final SP unless and until the Mk3 developments. Thus HS7 SP1 introduces services between Birmingham HS and Bristol Temple Meads (two services), Cardiff Airport and Swansea. SP2 extends one of the Bristol services to Plymouth. Sp3 introduces services north from Birmingham HS to York, Halifax / Skipton, Cleethorpes and Skegness. The service from Plymouth is extended from Birmingham Interchange (no longer calling at Birmingham HS) to Newcastle / Middlesborough, and likewise that from Swansea to Nottingham (and on to Norwich at SP4). HS7 SP5, which is HS7 Mk2, introduces new services between Plymouth and

Liverpool, and between Swansea and Holyhead. **All** of these services begin during the currency of HS2 SP4. The service plan below thus includes all the associated HS7 services, as do the interchange patterns.

In the original Mk1 plans, when HS3 opened to Scotland, HS2's service from Euston to Scotland was cancelled as redundant (but the Scottish services from Birmingham and Liverpool were maintained). After reconsideration (particularly given the relaxed capacity restrictions) HS2's London – Scotland service is retained; it now has important connections at Crewe from and to Staffordshire. Also, at Mk2, it switches to the new route between Crewe and Preston, and adds calls at Calvert and Birmingham Interchange.

The complete service for both parts of SP4, thus for HS2 Mk2, is:

HS2 UHS:

- 4tphH Maidstone – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Birmingham Interchange – Birmingham HS
- 4tphH Dover – Folkestone Central – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Stockport – Manchester HS
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Liverpool Lime St.
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Preston.

HS2 Metro:

- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Warrington Bank Quay – Wigan North Western – Preston (splits/joins) –:
  – Kirkham – Poulton le Fylde – Blackpool
  – Lancaster – Oxenholme – Kendal – Windermere
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
- 1tphH Euston – Old Oak Common – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Preston – Lancaster – Oxenholme – Penrith – Carlisle – (splits / joins) – :
  – Motherwell – Glasgow Central
  – Haymarket – Edinburgh Waverley
- 2tphH Birmingham HS – Rugeley Trent Valley– Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 1tphH Birmingham HS – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead

- 1tphH Birmingham HS – Crewe –Warrington Bank Quay – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Haymarket – Edinburgh Waverley
  – Lockerbie – Motherwell – Glasgow Central
- 1tphH Liverpool Lime St. – St. Helens – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Motherwell – Glasgow Central
  – Lockerbie – Haymarket – Edinburgh Waverley

Associated HS3 Metro service:

- 2tphH St. Pancras – Luton Airport Parkway – Milton Keynes Parkway - Northampton – Rugby – Coventry – Birmingham New St. – Wolverhampton (splits/joins) – :
  – Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
  – Telford – Wellington – Shrewsbury – Wrexham – Chester

Associated HS7 services (all HS-Metro):

- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Sheffield HS – Huddersfield – Leeds HS – York HS (splits / joins) – :
  – Darlington – Durham (Relly Mill) – Consett – Newcastle
  – Northallerton – Yarm – Eaglescliffe – thornaby – Middlesborough
- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Nottingham – Peterborough – Norwich
- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Bristol Temple Meads BT – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Cardiff Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Birmingham HS – Derby – Sheffield HS – Huddersfield – Leeds HS – York
- 2tphH Birmingham HS – Derby – Chesterfield – Sheffield Midland – South Yorkshire HL – Leeds City (splits / joins) – :
  – Shipley – Bradford City – Halifax
  – Shipley – Keighley – Skipton
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Market Rasen – Grimsby Town – Cleethorpes
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Sleaford – Boston – Wainfleet – Skegness

Representative Hourly Cross-Platform Interchange Pattern at Birmingham HS:

00H Maidstone – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

07H HS7 Birmingham HS – York HS
(no connection)

15H Maidstone – Birmingham HS
H Birmingham HS – Edinburgh / Glasgow
H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

23H HS7 Birmingham HS – Halifax / Skipton
(no connection)

30H Maidstone – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

37H HS7 Birmingham HS – York HS
(no connection)

45H Maidstone – Birmingham HS
H Birmingham HS – Holyhead
H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

53H HS7 Birmingham HS – Halifax / Skipton
(no connection)

Representative Hourly Cross-Platform Interchange Birmingham Interchange:

00H Margate – Manchester Piccadilly
H HS7 Swansea – Norwich
H HS7 Bristol Temple Meads (BT) – Birmingham HS

07H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool Lime St.

15H Margate – Blackpool / Windermere
H HS7 Plymouth – Newcastle / Middlesborough
H HS7 Cardiff Airport – Birmingham HS

23H Euston – Liverpool
H HS7 Swansea – Holyhead

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

Representative Hourly Cross-Platform Interchange Pattern at Crewe:

00H Euston – Holyhead (not cross-platform)
H HS3 St. Pancras – Liverpool
H Birmingham HS – Edinburgh / Glasgow

07H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

15H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

23H Eastbourne – Preston
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

30H Birmingham HS – Holyhead
H HS3 St. Pancras – Liverpool
[Slot reserved for Liverpool – Edinburgh / Glasgow]

37H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

45H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

53H Eastbourne – Preston
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

Representative Hourly Pattern at Warrington Bank Quay:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Windermere

30H [Slot reserved for Liverpool – Edinburgh / Glasgow]

45H Margate – Preston – Blackpool / Windermere

Representative Hourly Pattern at Wigan North Western:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Windermere

30H Liverpool – Edinburgh / Glasgow

45H Margate – Preston – Blackpool / Windermere

Representative Hourly Cross-Platform Interchange Pattern at Preston:

00H Birmingham HS – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

07H Euston – Glasgow / Edinburgh

15H Margate – Preston – Blackpool / Windermere

30H Liverpool – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

37H Euston – Glasgow / Edinburgh

45H Margate – Preston – Blackpool / Windermere

The following loadings are imposed on HS2:

- Euston Cross – Old Oak Common East Junction 16tph
- Old Oak Common East Junction – Old Oak Common North Junction 16tph
- [Euston –] Queens Park Junction – Old Oak Common North Junction 5tph
- Old Oak Common North Junction – Water Orton South Junction 21tph
- Water Orton South Junction – Water Orton West Junction 4tph
- Water Orton West Junction – Birmingham HS 8tph
- Water Orton West Junction – Water Orton North Junction 4tph
- Water Orton South Junction – Water Orton North Junction 17tph
- Water Orton North Junction – Streethay Junction 21tph
- Streethay Junction – Handsacre Junction 4tph
- Handsacre Junction – Manchester Piccadilly 4tph
- Streethay Junction – Crewe HS South Junction 17tph
- Crewe HS South Junction – Crewe HS North Junction 4tph
- Crewe HS South Junction – Crewe station 15tph
- Crewe station – Crewe HS North Junction 13tph
- Crewe HS North Junction – Rostherne South Junction 10tph
- Rostherne South Junction – Manchester HS 4tph
- Rostherne South Junction – Kenyon South Junction 6tph
- Kenyon South Junction – Liverpool Lime St. 2tph
- Kenyon South Junction – Preston 4tph
- Crewe HS North Junction – Weaver Junction 7tph
- Weaver Junction – Liverpool Lime St. 4tph
- Weaver Junction – Springs Branch Junction 3tph
- Liverpool Lime St. – Springs Branch Junction 1tph
- Springs Branch Junction – Preston 4tph

That is the complete set of services at Mk2.

Estimated Journey Times for Mk2

The new HS infrastructure added at Mk2 is:

- Crewe HS South Junction – HS North Junction (tunnel under station)
- Crewe HS North Junction – Manchester HS including new station at Manchester Interchange
- Rostherne South Junction – Bamfurlong, thence HS8 to Gibb Farm Junction and Preston
- Links from Kenyon South and North junctions to Kenyon West Junction, thence HS8 to Liverpool

Estimated distances on the new infrastructure:

• Old Oak Common – Crewe	241km	(360kph)
• Crewe station – Manchester Interchange	45km	(360kph)
• Crewe station – Rostherne South Junction	29km	(360kph)
• Rostherne S. Junction – Manchester Interchange	16km	(360kph)
• Manchester Interchange – Manchester HS	8km	(*)
• Crewe – Preston via Bamfurlong and HS8	83km	(360kph)
• Crewe – Bamfurlong Junction	50km	(360kph)
• Rostherne S. Junction – Kenyon South Junction	13.6km	(360kph)
• Kenyon South Junction – Bamfurlong Junction	7.1km	(360kph)
• Old Oak Common – Manchester Interchange	286km	(360kph)
• Bamfurlong Junction – Gibb Farm Junction	9km	(360kph)
• Gibb Farm Junction – Preston	24km	(360kph)
• Crewe – Liverpool Lime St. via Kenyon junctions	73km	(360kph)
• Crewe – Kenyon South Junction	43km	(360kph)
• Kenyon South Junction – Kenyon West Junction	1.40km	(230kph)
• Kenyon West Junction – Liverpool Lime Street	29km	(360kph)
• Kenyon West Junction – Kenyon North Junction	1.07km	(230kph)
• Kenyon South Junction – Kenyon North Junction	1.3km	(360kph)
• Kenyon North Junction. – Bamfurlong Junction	5.7km	(360kph)

Only one section time is specified explicitly:

- Manchester Interchange – Manchester HS (start to stop) is 292 seconds.

In addition, the two junctions Kenyon South and West are adjacent junctions, and they impose a time penalty of 58 seconds (refer to ‘Same Speed Railways, Appendix C, section ‘Adjacent Junctions’ for elucidation).

The main line of HS2 is from London to Preston (though the last section, north of Bamfurlong Junction, this is actually HS8’s tracks). The route to Manchester diverges at Rostherne South Junction, and this imposes the standard time penalty (37sec) on Manchester-bound trains. The route (via HS8) to Liverpool diverges at Kenyon South Junction and this, together with Kenyon West Junction, imposes the penalty noted above on the Liverpool-bound trains. Note that, rather amusingly, the HS8 line from Bamfurlong Junction is the main line at Gibb Farm Junction, where it joins the line from Manchester to Preston!

Note that only spreadsheets 1 and 4 are affected; the others are unchanged from Mk1A.

1. UHS Services Euston Cross – Birmingham / Manchester / Liverpool / Preston (2 stops in all cases)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Birmingham Interchange	151.0	159.0	29.6	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Old Oak Common - Manchester Interchange	286.0	294.0	52.7	57.6	60.6
Manchester Interchange - Manchester HS	8.0	302.0	4.9	62.5	68.5
Old Oak Common - Crewe	241.0	249.0	44.6	49.5	52.5
Crewe - Liverpool Lime Street	73.0	322.0	17.4	66.8	72.8
Crewe - Preston	83.0	332.0	18.3	67.8	73.8

Current fastest time (minutes) from London (with HS2 Ltd.'s estimates) [and the above values] to:

- London – Birmingham New Street [Curzon Street] 81 (49) [49]
- London – Crewe 90 [53]
- London – Manchester Interchange 115 (59) [61]
- London – Manchester HS 127 (68) [69]
- London – Liverpool 128 (96) [73]
- London – Preston 128 [74].

I declare that the distances in the above spreadsheet are exactly as originally measured, and that no shading or refinement has been performed subsequently. The fact that I get very nearly exactly the same estimates as HS2 Ltd. for the Birmingham and Manchester services, (the others are not directly comparable,) is either an extraordinary coincidence, or HS2 Ltd.'s estimating methods are as crude as mine!

Actually, the above claim is far too modest (though it has taken me literally years to recognise this). The Same Speed Railway (whatever the actual speed) is an ideal, and the journey times calculated for it are not estimates at all, but the exact values that that ideal would deliver. Any inaccuracy is therefore the expression of the extent to which the real world railway diverges from the same speed ideal.

1a. UHS Services Euston Cross – Birmingham / Manchester / Liverpool / Preston (2 stops in all cases) with Line Speed 400kph/250mph

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Birmingham Interchange	151.0	159.0	27.6	32.5	35.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	40.2	46.2
Old Oak Common - Manchester Interchange	286.0	294.0	48.8	53.6	56.6
Manchester Interchange - Manchester HS	8.0	302.0	4.9	58.5	64.5
Old Oak Common - Crewe	241.0	249.0	41.1	46.0	49.0
Crewe - Liverpool Lime Street	73.0	322.0	17.0	62.9	68.9
Crewe - Preston	83.0	332.0	17.4	63.3	69.3

Current fastest time (minutes) from London (with HS2 Ltd.'s estimates) [and the 360kph values of the previous table] {and the above 400kph values} to:

- London – Birmingham New Street [Curzon Street] 81 (49) [49] {46}
- London – Manchester Interchange 115 (59) [61] {57}
- London – Manchester HS 127 (68) [69] {65}
- London – Crewe 90 [53] {49}
- London – Liverpool 128 (96) [73] {69}
- London – Preston 128 [74]. {69}

Since HS2 Ltd.'s declared ambition is eventually to move to a line speed of 400kph, it is instructive to see what difference to the estimated times this would make.

Not a lot, evidently.

1P. UHS Services Euston Cross – Birmingham / Manchester / Liverpool / Preston (2 stops in all cases, with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	76.9	14.3	*19.1*	*22.1*
Grendon Underwood (S.) Jn. (pass) - Calvert (pass)	4.1	81.0	0.7	*19.8*	*22.8*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	87.8	1.1	*20.9*	*23.9*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	154.9	11.2	*32.1*	*35.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	159.0	2.3	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Mt. Pleasant (N.) Jn. (pass) - B'ham Intechange (pass)	4.1	159.0	0.7	*32.8*	*35.8*
B'ham Interchange (pass) - Streethay Junction (pass)	33.0	192.0	5.5	*38.3*	*41.3*
Streethay Junction (pass) - Crewe (pass - in tunnel)	57.0	249.0	9.5	*47.8*	*50.8*
Crewe (pass - in tunnel) - Rostherne (S.) Jn. (pass)	29.0	278.0	5.1	*52.9*	*55.9*
Rostherne (S.) Jn. (pass) - Manchester Interchange	16.0	294.0	4.7	57.6	60.6
Manchester Interchange - Manchester HS	8.0	302.0	4.9	62.5	68.5
Old Oak Common - Crewe	241.0	249.0	44.6	49.5	52.5
Crewe - *Rostherne (S.) Jn. (pass)*	29.0	278.0	7.6	*57.1*	*63.1*
Rostherne (S.) Jn. (pass) - Kenyou (S.) Junction (pass)	13.6	291.6	2.5	*59.6*	*65.6*
Kenyou (S.) Junction (pass) - Kenyou (W.) Junction (pass)	1.4	293.0	0.4	*59.9*	*65.9*
Kenyou (W.) Junction (pass) - Liverpool Lime Street	29.0	322.0	6.9	66.8	72.8
Rostherne (S.) Jn. (pass) - Kenyou (S.) Junction (pass)	13.6	291.6	2.3	*59.4*	*65.4*

Kenyou (S.) Junction (pass) - Kenyou (N.) Junction (pass)	1.3	292.9	0.2	*59.6*	*65.6*
Kenyou (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	299.0	1.0	*60.6*	*66.6*
Bamfurlong Jn. (pass) - Gibb Farm Junction (pass)	9.0	308.0	1.5	*62.1*	*68.1*
Gibb Farm Junction (pass) - Preston	24.0	332.0	5.7	67.8	73.8

4. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (10/11/10 stops to each)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Calvert	73.0	82.0	16.6	21.8	24.8
Calvert - Birmingham Interchange	78.0	160.0	17.4	39.2	45.2
Birmingham Interchange - Crewe	90.0	250.0	19.4	58.7	67.7
Crewe - Runcorn	36.2	286.2	12.4	71.1	83.1
Runcorn - Liverpool S. Parkway	12.0	298.2	6.0	77.1	92.1
Liverpool S. Parkway - Liverpool Lime St.	9.2	307.4	5.4	82.5	100.5
Crewe - Preston	83.0	333.0	18.3	76.9	88.9
Preston - Lancaster	33.8	366.8	11.8	88.7	103.7
Lancaster - Oxenholme	30.8	397.5	11.7	100.4	118.4
Oxenholme - Penrith	50.7	448.2	17.7	118.1	139.1
Penrith - Carlisle	28.7	477.0	11.1	129.2	153.2
Carlisle - Motherwell	144.0	620.9	45.7	174.8	201.8
Motherwell - Glasgow Central	20.5	641.4	9.7	184.5	214.5
Carlisle - Edinburgh Haymarket	161.9	638.9	51.0	180.2	207.2
Edinburgh Haymarket - Edinburgh Waverley	2.0	640.9	2.4	182.7	212.7

Birmingham Curzon St. - Crewe	95.0	95.0	20.3	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6
Preston - Lancaster	33.8	210.8	11.8	65.3	77.3
Lancaster - Oxenholme	30.8	241.6	11.7	77.1	92.1
Oxenholme - Penrith	50.7	292.3	17.7	94.7	112.7
Penrith - Carlisle	28.7	321.0	11.1	105.8	126.8
Carlisle - Lockerbie	41.6	362.6	14.9	120.8	144.8
Lockerbie - Motherwell	102.4	465.0	33.2	153.9	180.9
Motherwell - Glasgow Central	20.5	485.5	9.7	163.6	193.6
Carlisle - Edinburgh Haymarket	161.9	482.9	51.0	156.9	180.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	484.9	2.4	159.3	186.3
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - Lancaster	33.8	99.8	11.8	42.5	51.5
Lancaster - Oxenholme	30.8	130.6	11.7	54.2	66.2
Oxenholme - Penrith	50.7	181.3	17.7	71.8	86.8
Penrith - Carlisle	28.7	210.0	11.1	82.9	100.9
Carlisle - Motherwell	144.0	354.0	45.7	128.6	149.6
Motherwell - Glasgow Central	20.5	374.5	9.7	138.3	162.3
Carlisle - Lockerbie	41.6	251.6	14.9	97.9	118.9
Lockerbie - Edinbugh Haymarket	120.4	371.9	38.6	136.5	160.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	373.9	2.4	138.9	165.9

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

- Crewe 90 [68]
- Runcorn 113 [83]
- Liverpool South Parkway 140 [92]
- Liverpool Lime St. 128 [101]
- Preston 128 [89]
- Lancaster 144 [104]
- Oxenholme 154 [118]
- Penrith 151 [139]
- Carlisle 194 [153]
- Motherwell 253 [202]
- Glasgow Central 271 [215]
- Edinburgh Haymaket 271 (via ECML) [207]
- Edinburgh Waverlry 257 (via ECML) [213]

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

- Crewe 52 [20]
- Warrington Bank Quay 71 [36]
- Wigan North Western 82 [45]
- Preston 96 [63]
- Lancaster 112 [77]
- Oxenholme 125 [92]
- Penrith 147 [113]
- Carlisle 164 [127]
- Edinburgh Haymarket 237 [181]
- Edinburgh Waverley 244 [186]
- Lockerbie 195 (1 change) [145]
- Motherwell 223 [181]
- Glasgow Central 240 [194]

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

- St. Helens 17 [9]
- Wigan North Western 30 [19]
- Preston 49 [37]
- Lancaster 77 (1 change) [52]
- Oxenholme 87 (1 change) [66]
- Penrith 111 (1 change) [87]
- Carlisle 128 (1 change) [101]
- Motherwell 193 (1 change) [149]
- Glasgow Central 202 (1 change) [162]
- Lockerbie 165 (2 changes) [119]
- Edinburgh Haymarket 207 (1 change) [161]
- Edinburgh Waverley 214 (1 change) [166]

The main interest is in the times from London to Scotland. The times quoted between Preston and Edinburgh/Glasgow are the fastest in the current timetable, but include 3 stops – Lancaster, Oxenholme or Penrith, and Carlisle. (The Edinburgh service also assumes a stop at Haymarket, but **every** service approaching Waverley from the west assumes a stop at Haymarket.) HS2 Ltd. has promised a headline time to Edinburgh and Glasgow of within 3 hours. Referring back to spreadsheets 1/1a, the fastest time London – Preston on my calculations, high speed all the way with just 2 stops, is 74 minutes for a line speed of 225mph, or 69 minutes for the (surely phantastical?) 250mph. This leaves c.110 minutes to get from Preston to Edinburgh or Glasgow (124/126km respectively, so an average speed of 68kph or 42.4mph – non-stop). The fastest timings currently take c.140 minutes. So HS2 Ltd. must therefore find time savings of c.30 minutes on the current schedule to make good that promise. Two of the present stops could be dropped, saving perhaps 10 minutes. There must still be a stop at Carlisle or, alternatively, Carstairs, to split / join the Glasgow and Edinburgh portions. HS2's published service plans allow for two London – Scotland services per hour, so if both Edinburgh and Glasgow are to get two London trains per hour, there must be separate portions. So there needs to be an actual acceleration of the order of 30 minutes north of Preston. I don't say that this **can't** be done, (at least, without some serious infrastructure investment,) but I should certainly be very interested to see **how** it were proposed to be done.

4P. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (10/11/10 stops to each with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	77.9	14.5	*19.6*	*22.6*
Grendon Underwood (S.) Jn. (pass) - Calvert	4.1	82.0	2.1	21.8	24.8
Calvert - *Chetwode (N.) Jn. (pass)*	6.8	88.8	3.5	*25.3*	*31.3*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	155.9	11.8	*37.1*	*43.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	160.0	2.1	39.2	45.2
B'ham Interchange - *Streethay Jn. (pass)*	33.0	193.0	8.3	*47.5*	*56.5*
Streethay Jn. (pass) - Crewe	57.0	250.0	11.2	58.7	67.7
Crewe - *Rostherne (S.) Jn. (pass)*	29.0	279.0	7.6	*66.3*	*78.3*
Rostherne (S.) Jn. (pass) - Kenyon (S.) Junction (pass)	13.6	292.6	2.3	*68.5*	*80.5*
Kenyon (S.) Junction (pass) - Kenyon (N.) Junction (pass)	1.3	293.9	0.2	*68.8*	*80.8*

Kenyon (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	300.0	1.0	*69.8*	*81.8*
Bamfurlong Junction (pass) - Gibb Farm Junction (pass)	9.0	309.0	1.5	*71.3*	*83.3*
Gibb Farm Junction (pass) - Preston	24.0	333.0	5.7	76.9	88.9
Preston - Lancaster	33.8	366.7	11.8	88.7	103.7
Lancaster - Oxenholme	30.8	397.5	11.7	100.4	118.4
Oxenholme - Penrith	50.7	448.2	17.7	118.1	139.1
Penrith - Carlisle	28.7	476.9	11.1	129.2	153.2
Carlisle - Motherwell	144.0	620.9	45.7	174.8	201.8
Motherwell - Glasgow Central	20.5	641.4	9.7	184.5	214.5
Carlisle - Edinburgh Haymarket	161.9	638.8	51.0	180.2	207.2
Edinburgh Haymarket - Edinburgh Waverley	2.0	640.8	2.4	182.7	212.7
Birmingham Curzon St. - *Streethay Jn. (pass)*	38.0	38.0	9.1	*9.1*	*9.1*
Streethay Jn. (pass) - Crewe	57.0	95.0	11.2	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6
Preston - Lancaster	33.8	210.8	11.8	65.3	77.3
Lancaster - Oxenholme	30.8	241.6	11.7	77.1	92.1
Oxenholme - Penrith	50.7	292.3	17.7	94.7	112.7
Penrith - Carlisle	28.7	321.0	11.1	105.8	126.8
Carlisle - Lockerbie	41.6	362.6	14.9	120.8	144.8
Lockerbie - Motherwell	102.4	465.0	33.2	153.9	180.9
Motherwell - Glasgow Central	20.5	485.5	9.7	163.6	193.6
Carlisle - Edinburgh Haymarket	161.9	482.9	51.0	156.9	180.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	484.9	2.4	159.3	186.3
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7

Preston - Lancaster	33.8	99.8	11.8	42.5	51.5
Lancaster - Oxenholme	30.8	130.6	11.7	54.2	66.2
Oxenholme - Penrith	50.7	181.3	17.7	71.8	86.8
Penrith - Carlisle	28.7	210.0	11.1	82.9	100.9
Carlisle - Motherwell	144.0	354.0	45.7	128.6	149.6
Motherwell - Glasgow Central	20.5	374.5	9.7	138.3	162.3
Carlisle - Lockerbie	41.6	251.6	14.9	97.9	118.9
Lockerbie - Edinbugh Haymarket	120.4	371.9	38.6	136.5	160.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	373.9	2.4	138.9	165.9

Service Plan 5

This service plan comes into effect probably quite a long time after service plan 4, when HS2-CV opens. There are very few changes from service plan 4, and these are now listed and explained: This is Mk3.1. It corresponds to SP6 of HS3, which introduces several new services which assume the availability of HS2-CV, and will be implemented at the same time. Note also new services on HS7, Plymouth – Liverpool and Swansea – Holyhead (this is HS7 SP5).

A new service of 4tph Rainham (*) – Gillingham –> Birmingham HS is introduced, travelling via Coventry. (* There is provision for reversal at Rainham.) The existing Maidstone – Birmingham, Dover – Manchester and Eastbourne – Liverpool / Preston services are unaffected. The full service at SP5 is thus:

HS2 UHS:

- 4tphH Maidstone – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Birmingham Interchange – Birmingham HS
- 4tphH Rainham – Gillingham – Chatham – Rochester – Strood – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Rugby HS – Coventry HS – Birmingham Interchange –Birmingham HS
- 4tphH Dover – Folkestone Central – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Stockport – Manchester HS
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Liverpool Lime St.
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Preston.

HS2 Metro:

- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Warrington Bank Quay – Wigan North Western – Preston (splits/joins) –:
  – Kirkham – Poulton le Fylde – Blackpool
  – Lancaster – Oxenholme – Kendal – Windermere
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
- 1tphH Euston – Old Oak Common – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Preston – Lancaster – Oxenholme – Penrith – Carlisle – (splits / joins) – :
  – Motherwell – Glasgow Central
  – Haymarket – Edinburgh Waverley
- 2tphH Birmingham HS – Rugeley Trent Valley– Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly

- 1tphH Birmingham HS – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 1tphH Birmingham HS – Crewe –Warrington Bank Quay – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Haymarket – Edinburgh Waverley
  – Lockerbie – Motherwell – Glasgow Central
- 1tphH Liverpool Lime St. – St. Helens – Wigan North Western – Preston – Lancaster – Oxenholme – Penrith – Carlisle (splits / joins) – :
  – Motherwell – Glasgow Central
  – Lockerbie – Haymarket – Edinburgh Waverley

Associated HS3 Metro services:

- 2tphH St. Pancras West – West Hampstead – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton Castle – Rugby HS – Coventry HS – Birmingham International – Birmingham New St. – Wolverhampton (splits/joins) – :
  – Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
  – Telford – Wellington – Shrewsbury – Wrexham – Chester
- 2tphH St. Pancras West – West Hampstead – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton Castle – Rugby HS – Coventry HS – Birmingham International – Birmingham New St. – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill
  (NB this was formerly a RM service)
- 2tphH Bournemouth West – Bournemouth Central – Brockenhurst – Southampton – Southampton Airport Parkway – Winchester – Basingstoke – Reading (reverse) – Oxford – Banbury – Rugby (GC) – Leicester – Nottingham –South Yorkshire HS –
  York HS (splits / joins) – :
  – Darlington – Durham Relly Mill – Consett – Newcastle
  – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
  (NB this is in addition to the RM Bournemouth West – York service)
- 2tphH Paddington – Old Oak Common – LHR Interchange – Slough – Maidenhead – Bourne End (to/from Marlow) – High Wycombe – Princes Risborough – Calvert – Rugby (GC) – Leicester – Melton Mowbray (reverse) – Nottingham – Derby

Associated HS7 services (all HS-Metro):

- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Sheffield HS – Huddersfield – Leeds HS – York HS (splits / joins) – :
  – Darlington – Durham (Relly Mill) – Consett – Newcastle
  – Northallerton – Yarm – Eaglescliffe – thornaby – Middlesborough
- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Nottingham – Peterborough – Norwich
- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.

- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Bristol Temple Meads BT – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Cardiff Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Birmingham HS – Derby – Sheffield HS – Huddersfield – Leeds HS – York
- 2tphH Birmingham HS – Derby – Chesterfield – Sheffield Midland – South Yorkshire HL – Leeds City (splits / joins) – :
  – Shipley – Bradford City – Halifax
  – Shipley – Keighley – Skipton
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Market Rasen – Grimsby Town – Cleethorpes
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Sleaford – Boston – Wainfleet – Skegness

Representative Hourly Cross-Platform Interchange Pattern at Birmingham HS:

00H Rainham – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

07H Maidstone – Birmingham HS
HS7 Birmingham HS – York HS
(not cross-platform)

15H Rainham – Birmingham HS
H Birmingham HS – Edinburgh / Glasgow
H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

23H Maidstone – Birmingham HS
HS7 Birmingham HS – Halifax / Skipton
(not cross-platform)

30H Rainham – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

37H Rainham – Birmingham HS
HS7 Birmingham HS – York HS
(not cross-platform)

45H Maidstone – Birmingham HS
H Birmingham HS – Holyhead

H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

23H Rainham – Birmingham HS
HS7 Birmingham HS – Halifax / Skipton1
(not cross-platform)

Representative Hourly Cross-Platform Interchange Birmingham Interchange:

00H Margate – Manchester Piccadilly
H HS7 Swansea – Norwich

05H Rainham – Birmingham HS
H HS7 Bristol Temple Meads (BT) – Birmingham HS

10H Euston – Liverpool Lime St.
H HS7 Swansea – Holyhead

13H Maidstone – Birmingham HS
(no connection)

15H Margate – Blackpool / Windermere
H HS7 Plymouth – Newcastle / Middlesborough

20H Rainham – Birmingham HS
H HS7 Cardiff Airport – Birmingham HS

25H Euston – Edinburgh / Glasgow
H Plymouth – Liverpool Lime St.

28H Maidstone – Birmingham HS
(no connection)

– repeating at 30, 35, 40, 43, 45, 50, 55 and 58 minutes past. Note that the HS7 services are in exactly the same sequence as their northbound departures from Bristol Parkway HS; naturally, since they all take exactly the same time to Birmingham. Note also that the Plymouth – Liverpool service departs from Birmingham Interchange precisely 107 seconds after the Euston – Edinburgh / Glasgow service, likewise the Swansea – Holyhead 107 secs after the Euston – Liverpool. This ensures that, once they have reached full line speed they are exactly the Extended Train Separation Distance apart. They travel with this separation until the approach to Crewe, where the HS7 service arrives precisely 107 seconds behind the HS2 service. (See Same Speed Railways, Appendix C, the Capacity-Slot Model section, for the full explanation of this stuff.) Note finally that interchange between the services is intended to be at Birmingham Interchange rather than at Crewe, since arrival (northbound) and departure (southbound) of the two service is scheduled to be simultaneous there – they have separate tracks south of the station.

Representative Hourly Cross-Platform Interchange Pattern at Crewe:

00H Euston – Holyhead (not cross-platform)
H HS3 St. Pancras – Liverpool
H Birmingham HS – Edinburgh / Glasgow

10H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

15H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

25H Eastbourne – Preston
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

30H Birmingham HS – Holyhead
H HS3 St. Pancras – Liverpool
[Slot reserved for Liverpool – Edinburgh / Glasgow]

40H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

45H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

55H Eastbourne – Preston
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

Note that the slightly irregular departures from Crewe (every 5 minutes except for 05 and 35) are determined by the departure times of the relevant services from Bitmingham Interchange

Representative Hourly Pattern at Warrington Bank Quay:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Windermere

30H [Slot reserved for Liverpool – Edinburgh / Glasgow]

45H Margate – Preston – Blackpool / Windermere

(Note that the Euston – Edinburgh / Glasgow service travels non-stop via HS2/HS8 between Crewe and Preston.)

Representative Hourly Pattern at Wigan North Western:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Windermere

30H Liverpool – Edinburgh / Glasgow

45H Margate – Preston – Blackpool / Windermere

Representative Hourly Cross-Platform Interchange Pattern at Preston:

00H Birmingham HS – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

07H Euston – Glasgow / Edinburgh

15H Margate – Preston – Blackpool / Windermere

30H Liverpool – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

37H Euston – Glasgow / Edinburgh

45H Margate – Preston – Blackpool / Windermere

(The Euston – Edinburgh / Glasgow service travels non-stop via HS2/HS8 between Crewe and Preston, as already noted; their times are therefore different.)

Route loadings are given separately for the main lines (Euston Cross / Euston to Ashenden Junction, and above Streethay Junction, and the HS2-orig tracks between those locations) and for the relief lines (HS2-CV between Ashenden Junction and Streethay / Handsacre Junctions via Rugby, also for the HS7 tracks, where separate, around Birmingham). Understanding these loadings will certainly require reference to the track diagrams for the sections between Grandon Underwood and Brackley junctions and between Mount Pleasant and Streethay junctions, and around Coventry station; these are contained in appendix A.

The following loadings are imposed on the main lines of HS2:

- Euston Cross – Old Oak Common East Junction 20tph
- Old Oak Common East Junction – Old Oak Common North Junction 20tph
- [Euston –] Queens Park Junction – Old Oak Common North Junction 5tph
- Old Oak Common North Junction – Grendon Underwood Junctions 25tph
- Grendon Underwood Junctions – Chetwode Junctions 13tph
- Chetwode Junctions – Mount Pleasant Junctions 21tph
- Mount Pleasant Junctions – Streethay Junction 9tph
- Streethay Junction – Crewe HS South Junction 21tph
- Crewe HS South Junction – Crewe HS North Junction 4tph
- Crewe HS South Junction – Crewe station 19tph
- Crewe station – Crewe HS North Junction 15tph
- Crewe HS North Junction – Rostherne South Junction 12tph
- Rostherne South Junction – Manchester HS 4tph
- Rostherne South Junction – Kenyon South Junction 8tph
- Kenyon South Junction – Liverpool Lime St. 4tph
- Kenyon South Junction – Preston 4tph
- Crewe HS North Junction – Weaver Junction 7tph
- Weaver Junction – Liverpool Lime St. 4tph
- Weaver Junction – Springs Branch Junction 3tph
- Liverpool Lime St. – Springs Branch Junction 1tph
- Springs Branch Junction – Preston 4tph

- Preston – Blackpool North 2tph
- Preston – Oxenholme 6tph
- Oxenholme – Windermere 2tph
- Oxenholme – Carlisle 4tph
- Carlisle – Carstairs South Junction 8tph
- Carstairs South Junction – Glasgow Central 4tph
- Carstairs South Junction – Edinburgh Waverley 4tph

The following loadings are imposed on the relief lines of HS2, and the distinct tracks of HS7:

- Ashendon Junction – Grendon Underwood Junctions 2tph
- Grendon Underwood Junctions – Chetwode Junctions direct 6tph
- Grendon Underwood Junctions – Chetwode Junctions via Calvert 8tph
- Chetwode Junctions – Culworth Junction 6tph
- Banbury Junction – Culworth Junction 2tph
- Culworth Junction – Onley Junction 8tph
- Watford Gap Junction (HS3) – Onley Junction 4tph
- Onley Junction – Rugby HS Junction 12tph
- Rugby HS Junction – Cotesbach Junction (HS3) 4tph
- Rugby HS Junction – Warwick Road Junction 8tph
- Warwick Road Junction – Mount Pleasant Junctions 4tph
- Mount Pleasant Junctions – Birmingham Interchange station 16tph
- Birmingham Interchange station – Water Orton South Junction (inner) 16tph
- Birmingham Interchange station – Water Orton South Junction (outer) 12tph
- Water Orton South Junction (outer) – Water Orton West Junction (HS2) 8tph
- Water Orton South Junction (outer) – Water Orton West Junction (HS7) 4tph
- Birmingham HS – Water Orton West Junction (HS2) 12tph
- Birmingham HS – Water Orton West Junction (HS7) 12tph
- Water Orton West Junction (HS7) – Marston Junction (HS7) 8tph
- Water Orton South Junction (inner) – Marston Junction (HS7) 4tph
- Marston Junction (HS7) – Derby 12tph
- Water Orton South Junction (relief) – Water Orton North Junction 12tph
- Water Orton West Junction (HS2) – Water Orton North Junction 4tph
- Water Orton North Junction – Streethay Junction (relief lines) 16tph
- Streethay Junction (relief lines) – Handsacre Junction 4tph
- Streethay Junction (relief lines) – Streethay Junction (main lines) 12tph

Note that the ‘inner’ lines between Birmingham Interchange station and Water Orton South Junction, so called to distinguish them from the ‘outer’ lines between those points, (which diverge at the latter point and proceed to Water Orton West Junction,) revert to their proper name, the relief lines, north of Water Orton (distinguishing them from the main lines, which pass between Mount Pleasant and Streethay junctions entirely independently of everyone else).

That is the complete set of services at Mk3.1.

Estimated Journey Times for Mk3.1

The new HS infrastructure added at Mk3.1 (HS2-CV) is:

- Ashendon Junction – Grendon Underwood North Junctions
- Chetwode Junctions – Brackley Junction.
- Brackley Junction – Culworth Junction
- Banbury Junction – Culworth Junction
- Culworth Junction – Onley Junction
- Watford Gap Junction – Onley Junction
- Onley Junction – Rugby HS Junction
- Rugby HS Junction – Cotesbach Junction
- Rugby HS Junction – Warwick Rd. Junction
- Warwick Rd. Junction – Mount Pleasant Junction

Refer to the track diagrams in Appendix B for elucidation of the layout between Grendon Underwood and Brackley Junctions, between Mount Pleasant and Streethay Junctions, and around Coventry. Refer to HS2 Mk3 South Sheet of the Overall Maps for the location of (most of) the other junctions.

Grendon Underwood and Chetwode Junctions are the ends of the Calvert station loops, and are present from the beginning, from Mk1A. Unusually, the station loops at Calvert include an extra passing track in each direction (in addition to the main lines through the centre of the alignment) as forward provision for HS2-CV. The branch from Ashendon Junction joins the Calvert station loops (not the main line) immediately north of Grendon Underwood North Junction. The new infrastructure of HS2-CV actually begins at Chetwode Junctions, where the station loops lines are extended to Brackley Junction, where they diverge from the HS2 main line without further connection.

Mount Pleasant Junctions (on the HS2 main line) are the south ends of the station loops for Birmingham Interchange and thus, like Grendon Underwood and Chetwode Junctions, present from the beginning, from Mk1A. At Mk3.1. HS2-CV joins the station loop tracks there. HS7 likewise joins the station loops at Birmingham Interchange Junction, immediately before the station. There are (at least) 4 tracks between Mount Pleasant and Streethay Junctions, but the only connections with the main line tracks are at those endpoints.

Estimated distances on the new infrastructure:

• Old Oak Common – Rugby HS	130km	(360/300kph)
• Old Oak Common – Grendon Underwood N. Jn.	68.9km	(360kph)
• Grendon Underwood North Junction – Rugby HS	61.1km	(300kph)
• Chetwode Junction – Brackley Junction	11.2km	(300kph)
• Brackley Junction – Culworth Junction	10km	(300kph)
• Culworth Junction – Onley Junction	23km	(300kph)
• Onley Junction – Rugby HS	6km	(300kph)
• Rugby HS – Coventry HS	18km	(*)
• Coventry HS – Birmingham Interchange	17km	(*)

The section between Old Oak Common and Rugby HS station has line speed 360kph as far as Grendon Underwood Junctions and 300kph thereafter (after the deceleration to 230kph to diverge from / converge:

with the main line at the junctions. The sections Rugby HS – Coventry HS and Coventry HS – Birmingham Interchange have a notional line speed of 300kph, but are (just) too short to allow that quite to be reached. Their inter-station times are thus specified explicitly:

- Rugby HS – Coventry HS (start to stop) is 438 seconds.
- Coventry HS – Birmingham Interchange (start to stop) is 426 seconds.

1. UHS Services Euston Cross – Birmingham, direct and via Coventry (2/4 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Birmingham Interchange	151.0	159.0	29.6	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Old Oak Common - Grendon Underwood North Junction	68.9	76.9	14.5	19.3	
Grendon Underwood North Junction - Rugby HS	61.1	138.0	13.7	33.1	36.1
Rugby HS - Coventry HS	18.0	156.0	7.3	40.4	46.4
Coventry HS - Birmingham Interchange	17.0	173.0	7.1	47.5	56.5
Birmingham Interchange - Birmingham Curzon St.	20.0	193.0	7.7	55.2	67.2

Comparative timings (minutes) London to	Current Fastest	Via HS2-CV	Via HS2-orig
• Rugby HS	48	36	-
• Coventry HS	59	46	-
• Birmingham Intn'l / Interchange	70	57	38
• Birmingham New St. / Curzon St.	81	67	48

These are very respectable times for HS2-CV, though obviously overshadowed by HS2-orig's Birmingham times.

1P. UHS Services Euston Cross – Birmingham, direct and via Coventry (2/4 stops, with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - *Grendon Underwood N.) Jn. (pass)*	68.9	76.9	14.3	*19.1*	*22.1*
Grendon Underwood (N.) Jn. (pass) - Calvert (pass)	4.1	81.0	0.7	*19.8*	*22.8*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	87.8	1.1	*20.9*	*23.9*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	154.9	11.2	*32.1*	*35.1*
***Mt. Pleasant (N.) Jn. (pass) -* B'ham Interchange**	4.1	159.0	2.3	34.5	37.5
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	7.7	42.2	48.2
Old Oak Common - *Grendon Underwood N.) Jn. (pass)*	68.9	76.9	14.5	*19.3*	*22.3*
Grendon Underwood (N.) Jn. (pass) - Calvert (pass)	4.1	81.0	0.9	*20.3*	*23.3*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	87.8	1.4	*21.7*	*24.7*
Chetwode (N.) Jn. (pass) - Brackley Junction (pass)	11.2	99.0	2.2	*23.9*	*26.9*
Brackley Junction (pass) - Culworth Junction (pass)	10.0	109.0	2.0	*25.9*	*28.9*
Culworth Junction (pass) - Onley Junction (pass)	23.0	132.0	5.4	*31.3*	*34.3*
***Onley Junction (pass) -* Rugby HS**	6.0	138.0	1.8	33.1	36.1
Rugby HS - Coventry HS	18.0	156.0	7.3	40.4	46.4
Coventry HS - Birmingham Interchange	17.0	173.0	7.1	47.5	56.5
Birmingham Interchange - Birmingham Curzon St.	20.0	193.0	7.7	55.2	67.2

All other times are unchanged from Mk2.

Service Plan 6

This service plan comes into effect probably a long time after service plan 5, and **certainly** a long time after service plan 4, when HS2 to Scotland opens. The section between Carlisle and Edinburgh opened much earlier – the section from Riccarton North Junction to Ravenswood Junction opened as part of HS3, and the connections from Tweedbank to Ravenwood Junction, and from Riccarton North Junction to Carlisle opened shortly after, as completion of the restored Waverley route. From Carlisle to Ravenswood Junction, (and on to Edinburgh via Lauder,) it is built as a HS line, but is not restricted to HS2 traffic. The new HS2 services from Whitehaven and Keswick to Glasgow, idescribed below, were actually introduced as soon as the Waverley route re-opened.

The connection from Kenyon West Junction on HS8 to Kenyon North Junction (SJ634968) on HS2 allows a UHS service from Liverpool to Scotland. (This junction was built at the same time as the rest of the initial section of HS8, between Kenyon West Junction and Liverpool, but had not seen regular service use previously.) No similar service is provided from Manchester as it already has 8tph to Scotland, via a cross-platform interchange at Preston.

Birmingham also gains a new UHS service to Scotland.

The Euston Cross – Preston service omits the Crewe stop, and is extended to Scotland.

The Euston – Blackpool / Windermere service is switched to Blackpool / Morecambe, since Kendal is now on the (new) classic WCML between Oxenholme and Penrith. The Scottish services on the WCML from Euston, Birmingham and Liverpool all omit the Oxenholme stop, and add new stops at Carnforth and Kendal. In addition, they now serve the HS platforms at Preston, which were previously served only by HS2, HS3, HS8 and HS9 services terminating there. (The Euston – Edinburgh / Glasgow service previously regained the classic tracks immediately before Preston, having travelled directly between Crewe and Preston via HS8.) Above Preston, they, and the Morecambe portion of the Euston – Blackpool / Morecambe service, travel on the new HS2 tracks as far as Galgate Junction, south of Lancaster, where they rejoin the WCML (and the HS2 tracks diverge and follow the M6).

The following services are introduced / amended (note the Regional Metro services):

- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledare – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Preston – Carlisle – Hawick – Edinburgh Waverley – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Warrington Bank Quay – Wigan North Western – Preston (splits/joins) –:
  – Kirkham – Poulton le Fylde – Blackpool
  – Lancaster – Morecambe
- 2tphH Birmingham HS – Crewe – Preston – Carlisle – Hawick – Edinburgh Waverley – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Liverpool Lime St. – Preston – Carlisle – Hawick – Edinburgh Waverley –Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle (splits / Joins) – :

– Motherwell – Glasgow Central
– Edinburgh Haymarket – Edinburgh Waverley

- 1tphH Birmingham HS – Crewe – Warrington Bank Quay – Wigan North Western – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle (splits/joins) – :
  – Edinburgh Haymarket – Edinburgh Waverley
  – Lockerbie – Motherwell – Glasgow Central
- 1tphH Liverpool Lime St. – St. Helens Central – Wigan North Western – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle (splits/joins) – :
  – Lockerbie – Edinburgh Haymarket – Edinburgh Waverley
  – Motherwell – Glasgow Central
- 2tphH Whitehaven – Workington – Maryport – Carlisle – Riddings – Newcastleton – Hawick – Lauder – Edinburgh Waverley – Edinburgh Haymarket – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Keswick – Troutbeck for Ullswater – Penrith – Carlisle – Longtown – Riddings – Canonbie – Gilnockie - Langholm
- 2tphR Euston – Watford Junction – Bletchley – Milton Keynes Central – Wolverton – Northampton –Long Buckby – Rugby – Nuneaton – Atherstone – Polesworth – Tamworth – Lichfield Trent Valley – Rugeley Trent Valley – Stafford – Crewe
- 2tphR Euston – Watford Junction – Milton Keynes Central – Northampton – Rugby – Nuneaton – Atherstone – Polesworth – Tamworth – Lichfield TV – Rugeley TV – Stone – Stoke-on-Trent – Longport – Kidsgrove – Alsager – Crewe
- 2tphR Manchester Airport – Manchester Piccadilly – Manchester Oxford Rd. – Bolton – Horwich Parkway – Chorley – Preston – Lancaster – Carnforth – Silverdale – Arnside – Grange-over-Sands – Cark and Cartmel – Ulverston – Dalton – Roose – Barrow in Furness
- 2tphR Leeds City – Bradford Central – Shipley – Keighley – Skipton – Gargrave – Hellifield – Long Preston – Giggleswick – Clapham – Bentham – Wennington – Carnforth (reverse) – Silverdale – Arnside – Grange-over-Sands – Cark and Cartmel – Ulverston – Dalton – Roose – Barrow in Furness

The complete service plan is thus:

HS2 UHS:

- 4tphH Maidstone – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Birmingham Interchange – Birmingham HS
- 4tphH Rainham – Gillingham – Chatham – Rochester – Strood – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Rugby HS – Coventry HS – Birmingham Interchange –Birmingham HS
- 4tphH Dover – Folkestone Central – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Stockport – Manchester HS
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Crewe – Liverpool Lime St.
- 2tphH Eastbourne – Bexhill – St. Leonards Warrior Square – Hastings – Ore – Winchelsea – Rye – Appledore – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Preston – Carlisle – Hawick – Edinburgh Waverley – Edinburgh Haymarket – Edinburgh Airport – Glasgow Birchgrove – Glasgow St. Enoch

HS2 Metro:

- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Rugeley Trent Valley – Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 2tphH Margate – Ramsgate – Minster – Ashford – Ebbsfleet – Stratford HS South – Euston Cross – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Warrington Bank Quay – Wigan North Western – Preston (splits/joins) –:
  – Kirkham – Poulton le Fylde – Blackpool
  – Lancaster – Morecambe
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
- 1tphH Euston – Old Oak Common – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Euston – Old Oak Common – Calvert – Birmingham Interchange – Crewe – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle – (splits / joins) – :
  – Motherwell – Glasgow Central
  – Haymarket – Edinburgh Waverley
- 2tphH Birmingham HS – Crewe – Preston – Carlisle – Hawick – Edinburgh Waverley – Edinburgh Haymarket –Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Birmingham HS – Rugeley Trent Valley– Stafford – Stone – Stoke on Trent – Macclesfield – Stockport – Manchester Piccadilly
- 1tphH Birmingham HS – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 1tphH Birmingham HS – Crewe –Warrington Bank Quay – Wigan North Western – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle (splits / joins) – :
  – Haymarket – Edinburgh Waverley
  – Lockerbie – Motherwell – Glasgow Central
- 2tphH Liverpool Lime St. – Preston – Carlisle – Hawick – Edinburgh Waverley – Edinburgh Haymarket –Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 1tphH Liverpool Lime St. – St. Helens – Wigan North Western – Preston – Lancaster – Carnforth – Kendal – Penrith – Carlisle (splits / joins) – :
  – Motherwell – Glasgow Central
  – Lockerbie – Haymarket – Edinburgh Waverley
- 2tphH Whitehaven – Workington – Maryport – Carlisle – Riddings – Newcastleton – Hawick – Lauder – Edinburgh Waverley – Edinburgh Haymarket – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphH Keswick – Troutbridge for Ullswater – Penrith – Carlisle – Longtown – Riddings – Canonbie – Gilnockie - Langholme

Associated HS3 Metro services:

- 2tphH St. Pancras West – West Hampstead – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton Castle – Rugby HS – Coventry HS – Birmingham International – Birmingham New St. – Wolverhampton (splits/joins) – :
  – Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
  – Telford – Wellington – Shrewsbury – Wrexham – Chester

- 2tphH St. Pancras West – West Hampstead – Luton & Dunstable Parkway – Milton Keynes Parkway – Northampton Castle – Rugby HS – Coventry HS – Birmingham International – Birmingham New St. – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill (NB this was formerly a RM service)
- 2tphH Bournemouth West – Bournemouth Central – Brockenhurst – Southampton – Southampton Airport Parkway – Winchester – Basingstoke – Reading (reverse) – Oxford – Banbury – Rugby (GC) – Leicester – Nottingham –South Yorkshire HS – York HS (splits / joins) – :
  – Darlington – Durham Relly Mill – Consett – Newcastle
  – Northallerton – Yarm – Eaglescliffe – Thornaby – Middlesborough
  (NB this is in addition to the RM Bournemouth West – York service)
- 2tphH Paddington – Old Oak Common – LHR Interchange – Slough – Maidenhead – Bourne End (to/from Marlow) – High Wycombe – Princes Risborough – Calvert – Rugby (GC) – Leicester – Melton Mowbray (reverse) – Nottingham – Derby

Associated HS7 services (all HS-Metro):

- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Sheffield HS – Huddersfield – Leeds HS – York HS (splits / joins) – :
  – Darlington – Durham (Relly Mill) – Consett – Newcastle
  – Northallerton – Yarm – Eaglescliffe – thornaby – Middlesborough
- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Derby – Nottingham – Peterborough – Norwich
- 2tphH Plymouth – Exeter St. David's – Taunton – Bristol Temple Meads HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime St.
- 2tphH Swansea – Port Talbot – Cardiff (Rhoose) Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Crewe – Chester – Flint – Rhyl – Llandudno Junction – Bangor – Holyhead
- 2tphH Bristol Temple Meads BT – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Cardiff Airport – Cardiff HS – Bristol Parkway HS – Cheltenham Spa – Worcester Shrub Hill – Birmingham Interchange – Birmingham HS
- 2tphH Birmingham HS – Derby – Sheffield HS – Huddersfield – Leeds HS – York
- 2tphH Birmingham HS – Derby – Chesterfield – Sheffield Midland – South Yorkshire HL – Leeds City (splits / joins) – :
  – Shipley – Bradford City – Halifax
  – Shipley – Keighley – Skipton
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Market Rasen – Grimsby Town – Cleethorpes
- 2tphH Birmingham HS – Derby – Nottingham – Newark Castle – Lincoln Central – Sleaford – Boston – Wainfleet – Skegness
- 2tphH HS3 Pancras Cross – Luton Airport Parkway – Northampton – Rugby HS – Coventry HS – Birmingham International – Birmingham New St.– Wolverhampton (splits/joins) – :

– Stafford – Crewe – Runcorn – Liverpool South Parkway – Liverpool Lime Street
– Telford – Wellington – Shrewsbury – Wrexham – Chester

Associated Regional Metro Services:

- 2tphR (XC) Bournemouth West – Bournemouth Central – Brockenhurst – Southampton Cantral – Southampton Aitport Parkway - Winchester – Basingstoke – Reading (reverse) – Oxford – Banbury – Leamington Spa – Coventry – Birmingham International – Birmingham New St. (reverse) – Tamworth – Burton-on-Trent – Derby – Chesterfield – Sheffield Midland – Rotherham – South Yorkshire HL – Wakefield Westgate – Leeds City – Micklefield – York
- 2tphR (XC) Bournemouth West – Bournemouth Central – Brockenhurst – Southampton Cantral – Southampton Aitport Parkway - Winchester – Basingstoke – Reading (reverse) – Oxford – Banbury – Leamington Spa – Coventry – Birmingham International – Birmingham New St. – Wolverhampton – Stafford – Crewe – Stockport – Manchester Piccadilly
- 2tphR Euston – Watford Junction – Bletchley – Milton Keynes – Wolverton –Northampton – Long Buckby – Rugby – Nuneaton – Atherstone – Polesworth– Tamworth (LL) – Lichfield Trent Valley (LL) – Rugeley Trent Valley –Stafford – Crewe
- 2tphR Euston – Watford Junction – Milton Keynes Central – Northampton – Rugby – Nuneaton – Atherstone – Polesworth – Tamworth – Lichfield TV – Rugeley TV – Stone – Stoke-on-Trent – Longport – Kidsgrove – Alsager – Crewe
- 2tphR Manchester Airport – Manchester Piccadilly – Manchester Oxford Rd. –Bolton – Horwich Parkway – Chorley – Preston (splits / joins) – :
  – Kirkham – Poulton-le-Fylde – Blackpool North
  – Lancaster – Carnforth – Oxenholme – Kendal – Burnside – Staveley – Windermere
- 2tphR Manchester Airport – Manchester Piccadilly – Manchester Oxford Rd. –Bolton – Horwich Parkway – Chorley – Preston – Lancaster – Carnforth –Silverdale – Arnside – Grange-over-Sands – Cark and Cartmel – Ulverston –Dalton – Roose – Barrow in Furness
- 2tphR Leeds City – Bradford City – Shipley – Keighley – Skipton – Gargrave –Hellifield – Long Preston – Giggleswick – Clapham – Bentham – Wennington– Carnforth (reverse) – Silverdale – Arnside – Grange-over-Sands – Cark and Cartmel – Ulverston – Dalton – Roose – Barrow in Furness

Representative Hourly Cross-Platform Interchange Pattern at Birmingham HS:

00H Rainham – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

07H Maidstone – Birmingham HS
HS7 Birmingham HS – York HS
(not cross-platform)

15H Rainham – Birmingham HS
H Birmingham HS – Edinburgh / Glasgow
H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

23H Maidstone – Birmingham HS
HS7 Birmingham HS – Halifax / Skipton
(not cross-platform)

30H Rainham – Birmingham HS
H Birmingham HS – Manchester Piccadilly
H HS7 Bristol Temple Meads (BT) – Birmingham HS
H HS7 Birmingham HS – Cleethorpes

37H Rainham – Birmingham HS
HS7 Birmingham HS – York HS
(not cross-platform)

45H Maidstone – Birmingham HS
H Birmingham HS – Holyhead
H HS7 Cardiff Airport – Birmingham HS
H HS7 Birmingham HS – Skegness

23H Rainham – Birmingham HS
HS7 Birmingham HS – Halifax / Skipton1
(not cross-platform)

Representative Hourly Cross-Platform Interchange Birmingham Interchange:

00H Margate – Manchester Piccadilly
H HS7 Swansea – Norwich

05H Rainham – Birmingham HS
H HS7 Bristol Temple Meads (BT) – Birmingham HS

10H Euston – Liverpool Lime St.
H HS7 Swansea – Holyhead

13H Maidstone – Birmingham HS
(no connection)

15H Margate – Blackpool / Morecambe
H HS7 Plymouth – Newcastle / Middlesborough

20H Rainham – Birmingham HS
H HS7 Cardiff Airport – Birmingham HS

25H Euston – Edinburgh / Glasgow
H Plymouth – Liverpool Lime St.

28H Maidstone – Birmingham HS
(no connection)

– repeating at 30, 35, 40, 43, 45, 50, 55 and 58 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Crewe:

00H Euston – Holyhead (not cross-platform)
H HS3 St. Pancras – Liverpool
H Birmingham HS – Edinburgh / Glasgow

10H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

15H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

25H Birmingham HS – Glasgow
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

30H Birmingham HS – Holyhead
H HS3 St. Pancras – Liverpool
[Slot reserved for Liverpool – Edinburgh / Glasgow]

40H Euston – Edinburgh / Glasgow
H HS7 Plymouth – Liverpool

45H Eastbourne – Liverpool
H Margate – Preston – Blackpool / Windermere
R Euston – Crewe via Stafford (not cross-platform)

55H Birmingham HS – Glasgow
H HS7 Swansea – Holyhead
H Euston – Liverpool (not cross-platform)
R Euston – Crewe via Stoke and Kidsgrove (not cross-platform)

Note that the slightly irregular departures from Crewe (every 5 minutes except for 05 and 35) are determined by the departure times of the relevant services from Bitmingham Interchange

Representative Hourly Pattern at Warrington Bank Quay:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Morecambe

30H [Slot reserved for Liverpool – Edinburgh / Glasgow]

45H Margate – Preston – Blackpool / Morecambe

(Note that the Euston – Edinburgh / Glasgow service travels non-stop via HS2/HS8 between Crewe and Preston.)

Representative Hourly Pattern at Wigan North Western:

00H Birmingham HS – Edinburgh / Glasgow

15H Margate – Preston – Blackpool / Morecambe

30H Liverpool – Edinburgh / Glasgow

45H Margate – Preston – Blackpool / Morecambe

Representative Hourly Cross-Platform Interchange Pattern at Preston Classic:

00H Birmingham HS – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

07H Euston – Glasgow / Edinburgh

15H Margate – Preston – Blackpool / Morecambe

30H Liverpool – Edinburgh / Glasgow
R Manchester Airport – Preston – Blackpool / Windermere

37H Euston – Glasgow / Edinburgh

45H Margate – Preston – Blackpool / Morecambe

(The Euston – Edinburgh / Glasgow service travels non-stop via HS2/HS8 between Crewe and Preston, as already noted; their times are therefore different.)

Representative Hourly Same-Platform Interchange Pattern at Preston HS:

00H Eastbourne – Glasgow

05H HS8 Norwich – Preston
H HS9 Hull – Preston

10H Birmingham HS – Glasgow

15H HS8 Cleethorpes – Preston
H HS9 Scarborough – Preston

20H Liverpool Lime St. – Glasgow

25H HS3 UHS Tunbridge Wells West – Preston
H HS3 Metro Brighton - Preston

Until this service plan, all the services using the HS platforms at Preston terminated there. Those services are unchanged in themselves, but they now **feed into** (and accept traffic from) HS2's Scottish services. (Note that these trains will all be sharing the same track between Gibb Farm Junction and Preston, so the earlier-arriving trans-pennine train of the pair needs to get out of the way pretty sharpish to make way for the Scottish service, 5 minutes later.)

Representative Hourly Non-Cross-Platform Interchange Pattern at Carnforth:

00H Euston – Carlisle – Glasgow / Edinburgh
R Manchester Airport – Barrow in Furness

15H Birmingham HS – Carlisle – Edinburgh / Glasgow
R Leeds City – Barrow in Furness

30H Euston – Carlisle – Glasgow / Edinburgh
R Manchester Airport – Barrow in Furness

45H Liverpool Lime St. – Carlisle – Edinburgh / Glasgow
R Leeds City – Barrow in Furness

Representative Hourly Cross-Platform Interchange Pattern at Carlisle:

00H Eastbourne – Glasgow
H Euston – Carlisle – Edinburgh / Glasgow

10H Birmingham – Glasgow
H Keswick – Langholm

15H Birmingham – Carlisle – Edinburgh / Glasgow
H HS3 Newcastle – Carlisle

20H Liverpool – Glasgow
H Whitehaven – Glasgow

30H Eastbourne – Glasgow
H Euston – Carlisle – Edinburgh / Glasgow

40H Birmingham – Glasgow
H Keswick – Langholm

45H Liverpool Lime St. – Carlisle – Edinburgh / Glasgow
H HS3 Newcastle – Carlisle

50H Liverpool – Glasgow
H Whitehaven – Glasgow

Representative Hourly Cross-Platform Interchange Pattern at Hawick:

00H [HS3] Eastbourne – Glasgow

05H [HS2] Birmingham – Glasgow

10H Hawick – Inverness (departs first)
H [HS3] Newcastle – Glasgow (calls Lauder)
R Hawick – Dundee via Ladybank

15H [HS2] Eastbourne – Glasgow

20H [HS2] Liverpool – Glasgow

25H [HS2] Whitehaven – Carlisle – Glasgow (calls Lauder)
R Hawick – Perth via Ladybank

– repeating at 30, 35, 40, 45, 50 and 55 minutes past.

A little elucidation is worthwhile describing the connections between Carlisle and Edinburgh.

Note first of all that the departure times from Hawick quoted above **are to the same (relative) time base as those from Carlisle** (this is certainly not usually the case!). A non-stop Scottish service reaches Hawick in c.15 minutes from Carlisle whereas the 2-stop Whitehaven – Glasgow service takes c.30 minutes. So the Whitehaven – Glasgow service departing Carlisle at 00:20 arrives Hawick at 00:50 whereas the Eastbourne – Glasgow service departing Carlisle at 00:30 arrives Hawich 00:45. Thus the Whitehaven – Glasgow service departing Carlisle 10 minutes before an Eastbourne – Glasgow service arrives in Hawick 5 minutes after it.

The Keswich – Langholm service departing Carlisle at 00:10 calls at Longtown, and then Riddings, where it has cross-platform interchange with the Whitehaven – Glasgow service, departing Carlisle at 00:20 but not stopping at Longtown. This latter service rejoins the main line for a short distance (c.4km) before diverging again for its Newcastleton stop, where it is overtaken by the Eastbourne – Glasgow service, departing Carlisle at 00:30. (It may well be considered preferable to keep the line quadruple throughout the entire distance between Westlinton North Junction, before Longtown, and Leahaugh North Junction, after Newcastleton, saving two sets of high speed points in each direction at the cost of an extra 4km of track. It would also of course improve operational flexibility.) Finally, the Whitehaven – Glasgow service serves Lauder, and is overtaken on that station loop by the Birmingham – Glasgow service, departing Carlisle at 00:40.

The loadings imposed on the relief lines below Birmingham (specifically below Water Orton West Junction (HS2 lines), likewise on the specifically HS7 lines, are unchanged from SP5, so are not repeated here. The section Between Birmingham HS (HS2 lines) and Streethay (main lines) Junction does have new services, so this section is included in the (otherwise main line) table below.

The loadings imposed on the relief lines below Birmingham (specifically below Water Orton West Junction (HS2 lines), likewise on the specifically HS7 lines, are unchanged from SP5, so are not repeated here. The section Between Birmingham HS (HS2 lines) and Streethay (main lines) Junction does have new services, so this section is included in the (otherwise main line) table below.

The following loadings are imposed on HS2:

- Euston Cross – Old Oak Common North Junction 20tph
- [Euston –] Queens Park Junction – Old Oak Common North Junction 5ph
- Old Oak Common North Junction – Grendon Underwood Junction 25tph
- Grendon Underwood Junction – Chetwode Junction 13tph
- Chetwode Junction – Mount Pleasant South Junction 21tph
- Mount Pleasant Junction – Streethay (main lines) Junction 9tph
- Birmingham HS – Water Orton West Junction (HS2) 14tph
- Water Orton West Junction (HS2) – Water Orton North Junction 6tph
- Water Orton North Junction – Streethay (relief lines) Junction 19tph
- Streethay (relief lines) Junction – Handsacre Junction 4tph
- Streethay (relief lines) Junction – Streethay (main lines) Junction 16tph

- Streethay (main lines) Junction – Crewe HS South Junction 23tph
- Crewe HS South Junction – Crewe HS North Junction 6tph
- Crewe HS South Junction – Crewe station 19tph (*)
- Crewe station – Crewe HS North Junction 15tph (*)
- Crewe HS North Junction – Rostherne South Junction 14tph
- Rostherne South Junction – Manchester HS 4tph
- Rostherne South Junction – Kenyon South Junction 10tph
- Kenyon South Junction – Kenyon West Junction (– Livpl) 4tph
- (Livpl –) Kenyon West Junction – Kenyon North Junction 2tph
- Kenyon South Junction – Kenyon North Junction 6tph
- Kenyon North Junction – Gibb Farm Junction 8tph
- Gibb Farm Junction – Preston station 8tph (*)
- Crewe HS North Junction – Weaver Junction 7tph (*)
- Weaver Junction – Liverpool Lime St. 4tph (*)
- Weaver Junction – Springs Branch Junction 3tph (*)
- Liverpool Lime St. – Springs Branch Junction 1tph (*)
- Springs Branch Junction – Preston station 4tph (*)
- Preston station – Blackpool North 4tph (*)
- Preston station – Galgate Junction (HS2) 12tph
- Preston station – Galgate Junction (WCML) 4tph (*)
- Galgate Junction – Oxenholms (HS2) 6tph
- Oxenholme - Penrith (HS2) 6tph
- Penrith – Carlisle (HS2) 6tph
- Galgate Junction – Morcambe S. Junction (WCML) 10tph (*)
- Morecambe South Junction - Morecambe 2tph (*)
- Morecambe South Junction - Carnforth 8tph (*)
- Carnforth – Kendal 6tph (*)
- Kendal – Penrith (WCML new section) 4tph (*)
- Penrith – Carlisle (WCML) 6tph (*)
- Carlisle – Riddings 10tph
- Riddings – Riccarton North Junction 8tph
- Riccarton North Junction – Hawick 12tph (**)
- Hawick – Edinburgh Waverley 14tph (**)
- Carlisle – Carstairs South Junction 8tph (*)
- Carstairs South Junction – Glasgow Central 4tph (*)
- Carstairs South Junction – Edinburgh Waverley 4tph (*)

(*) HS2 loadings only; these sections are all used by classic services also or, in the case of Gibb Farm Junction – Preston, by other HS routes (HS3, HS8, HS9).
(**) Includes the services of other HS routes (HS3 and HS14

Estimated Journey Times for Mk3.2

The new HS infrastructure added at Mk3.2 (HS2 Scottish Extension) is:

- Preston – Galgate Junction
- Galgate Junction – Oxenholme
- Oxenholme – (just short of) Penrith (upgrading of existing WCML)
- Kendal – Penrith (new route of WCML)
- (just short of) Penrith – Carlisle
- Carlisle – Riccarton North Juntion

Estimated (to the nearest km) distances on the new infrastructure (those stated to 2 decimal places are on classic infrastructure – from the track mileposts; see appendix C):

• Old Oak Common – Preston (non-stop)	324km	(360kph)
• Preston – Galgate Junction	24km	(360kph)
• Galgate Junction – Lancaster	10km	(225kph)
• Lancaster – Morecambe	6.48km	(160kph)
• Lancaster – Carnforth	9.80km	(200kph)
• Carnforth – Kendal	24.33km	(200kph)
• Kendal – Penrith (new WCML)	38km	(225kph)
• Preston – Oxenholme	60km	(360kph)
• Oxenholme – Carlisle	78km	(360kph)
• Preston – Carlisle (non-stop)	138km	(360kph)
• Carlisle – Westlinton (North) Jn.	11.83km	(360kph)
• Westlinton (North) Jn. – Longtown	4.1km	(360kph)
• Longtown – Riddings	7.6km	(360kph)
• Riddings – Watleyhirst (North) Jn.	6.8km	(360kph)
• Watleyhirst (North) Jn. – Kershopefoot (North) Jn.	5.99km	(360kph)
• Kershopefoot (North) Jn. – Newcastleton	4.1km	(360kph)
• Newcastleton – Leahaugh (North) Jn. Junction	6.8km	(360kph)
• Leahaugh (North) Jn. – Riccarton North Junction0	0.78km	(360kph)
• Carlisle – Riccarton North Junction	47km	(360kph)
• Riccarton North Junction – Hawick	20km	(360kph)
• Carlisle – Hawick	67km	(360kph)
• Hawick – Ravenswood Junction	21km	(360kph)
• Ravenswood Junction – Birkenside (North) Jn.	11.9km	(360kph)
• Birkenside (North) Junction – Lauder	4.1km	(360kph)
• Hawick – Lauder	37km	(360kph)
• Lauder – Wiselawmill (North) Junction	6.8km	(360kph)
• Wiselawmill (North) Junction – Newcraighall HS	31km	(360kph)
• Lauder – Newcraighall HS	37.8km	(360kph)
• Newcraighall HS – Edinburgh	7.2km	(360kph)
• Lauder – Edinburgh	45km	(360kph)
• Hawick – Edinburgh (non-stop)	82km	(360kph)
• Liverpool Lime St. – Preston via Kenyon N. Jn.	69km	(360kph)

1. UHS Services Euston Cross / Birmingham / Liverpool / Carlisle – Edinburgh (4/4/3/4 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times (minutes)
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Preston	324.0	332.0	58.4	63.3	66.3
Preston - Carlisle	138.0	470.0	27.4	90.8	96.8
Carlisle - Hawick	67.0	537.0	15.6	106.4	115.4
Hawick - Edinburgh	82.0	619.0	18.1	124.5	136.5
Birmingham Curzon St. - Crewe	95.0	95.0	20.3	20.3	20.3
Crewe - Preston	83.0	178.0	18.3	38.6	41.6
Preston - Carlisle	138.0	316.0	27.4	66.0	72.0
Carlisle - Hawick	67.0	383.0	15.6	81.6	90.6
Hawick - Edinburgh	82.0	465.0	18.1	99.7	111.7
Liverpool - Preston	69.0	69.0	16.7	16.7	16.7
Preston - Carlisle	138.0	207.0	27.4	44.1	47.1
Carlisle - Hawick	67.0	274.0	15.6	59.7	65.7
Hawick - Edinburgh	82.0	356.0	18.1	77.8	86.8
Carlisle - Westlinton (N.) Jn. (pass)	11.8	11.8	4.7	4.7	
Westlinton (N.) Jn. (pass) - Riddings	10.7	22.5	3.8	8.6	8.6
Riddings - Newcastleton	16.9	39.4	7.1	15.7	18.7
Newcastleton - Hawick	27.6	67.0	9.0	24.7	30.7
Hawick - Lauder	37.0	104.0	10.6	35.3	44.3
Lauder - Edinburgh	45.0	149.0	11.9	47.3	59.3
Carlisle - Longtown	15.9	15.9	6.9	6.9	6.9
Longtown - Riddings	7.6	23.5	4.8	11.6	14.6

[Note that Westlinton North Junction is where the Keswick – Langholm service needs to diverge from the main line to stop at Longtown. This is c.4km before the Whitehaven – Glasgow service would need to diverge from the main line to serve Riddings (not having served Longtown). There is no point having two high speed junctions within a short distance of each other (they are expensive!). Instead, there are four tracks between Westlinton and Watleyhirst North junctions, and the Whitehaven – Glasgow service continues at 230kph beyond Westlinton North Junction until shortly after Longtown station, when it too needs to decelerate to stop at Ridding. It arrives there shortly after the arrival of the Keswick – Langholm service, and they make cross- platform interchange there. This is a distinctly non-standard calculation, hence the need to explain it.]

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

- Preston 128 [66]
- Carlisle 194 [97]
- Edinburgh 257 [137]

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

- Preston 96 [42]
- Carlisle 164 [72]
- Edinburgh 247 [112]

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

- Preston 57 [17]
- Carlisle 136 (1 change) [47]
- Edinburgh 229 (1 change) [87]

1a. UHS Services Euston Cross / Birmingham / Liverpool – Edinburgh (4/4/3 stops) with Line Speed 400kph/250mph

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times (minutes)
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Preston	324.0	332.0	53.5	58.4	61.4
Preston - Carlisle	138.0	470.0	25.6	84.0	90.0
Carlisle - Hawick	67.0	537.0	15.0	99.0	108.0
Hawick - Edinburgh	82.0	619.0	17.2	116.3	128.3
Birmingham Curzon St. - Crewe	95.0	95.0	19.2	19.2	19.2
Crewe - Preston	83.0	178.0	17.4	36.6	39.6
Preston - Carlisle	138.0	316.0	25.6	62.2	68.2
Carlisle - Hawick	67.0	383.0	15.0	77.2	86.2
Hawick - Edinburgh	82.0	465.0	17.2	94.4	106.4
Liverpool - Preston	69.0	69.0	16.3	16.3	16.3
Preston - Carlisle	138.0	207.0	25.6	42.0	45.0
Carlisle - Hawick	67.0	274.0	15.0	57.0	63.0
Hawick - Edinburgh	82.0	356.0	17.2	74.2	83.2

Current fastest time (minutes) from London [and the 360kph values] {and the above 400kph values} to:

- Preston 128 [66] {61}
- Carlisle 194 [97] {90}
- Edinburgh 257 [137] {128}

Current fastest time (minutes) from Birmingham [and the 360kph values] {and the 400kph values} to:

- Preston 96 [42] {40}
- Carlisle 164 [72] {68}
- Edinburgh 247 [112] {106}

Current fastest time (minutes) from Liverpool [and the 360kph values] {and the 400kph values} to:

- Preston 57 [17] {16}
- Carlisle 136 (1 change) [47] {45}
- Edinburgh 229 (1 change) [87] {83}

It really doesn't seem worth the effort.

1P. UHS Services Euston Cross / Birmingham / Liverpool / Carlisle – Edinburgh (4/4/3/4 stops, with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - *Grendon Underwood (N.) Jn. (pass)*	68.9	76.9	14.3	*19.1*	*22.1*
Grendon Underwood (N.) Jn. (pass) - Calvert (pass)	4.1	81.0	0.7	*19.8*	*22.8*
Calvert (pass) - Chetwode (N.) Jn. (pass)	6.8	87.8	1.1	*20.9*	*23.9*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	154.9	11.2	*32.1*	*35.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Intechange (pass)	4.1	159.0	0.7	*32.8*	*35.8*
B'ham Interchange (pass) - Streethay Junction (pass)	33.0	192.0	5.5	*38.3*	*41.3*
Streethay Junction (pass) - Crewe (pass - in tunnel)	57.0	249.0	9.5	*47.8*	*50.8*
Crewe (pass - in tunnel) - Rostherne (S.) Jn. (pass)	29.0	278.0	4.8	*52.6*	*55.6*
Rostherne (S.) Jn. (pass) - Kenyou (S.) Junction (pass)	13.6	291.6	2.3	*54.9*	*57.9*

Kenyou (S.) Junction (pass) - Kenyou (N.) Junction (pass)	1.3	292.9	0.2	*55.1*	*58.1*
Kenyou (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	299.0	1.0	*56.1*	*59.1*
Bamfurlong Jn. (pass) - Gibb Farm Junction (pass)	9.0	308.0	1.5	*57.6*	*60.6*
Gibb Farm Junction (pass) - Preston	24.0	332.0	5.7	63.3	66.3
Preston - *Galgate Junction (pass)*	24.0	356.0	6.8	*70.1*	*76.1*
Galgate Junction (pass) - Oxenholme WCML Jn. (pass)	36.3	392.3	6.1	*76.1*	*82.1*
Oxenholme WCML Jn. (pass) - Penrith WCML Junction (pass)	47.6	439.8	7.9	*84.1*	*90.1*
Penrith WCML Junction (pass) - Carlisle	30.1	470.0	6.7	90.7	96.7
Carlisle - *Longtown (North) Jn. (pass)*	18.4	488.4	5.8	*96.6*	*105.6*
Longtown (North) Jn. (pass) - Riddings (pass)	4.1	492.4	0.7	*97.3*	106.3
Riddings (pass) - Watleyhirst (N.) Jn. (pass)	6.8	499.3	1.1	*98.4*	107.4
Watleyhirst (N.) Jn. (pass) - Kershopefott (N.) Jn. (pass)	6.0	505.2	1.0	*99.4*	108.4
Kershopefott (N.) Jn. (pass) - Newcastleton (pass)	4.1	509.3	0.7	*100.1*	109.1
Newcastleton (pass) - Leahaugh (North) Jn. (pass)	6.8	516.1	1.1	*101.2*	110.2
Leahaugh (North) Jn. (pass) - Riccarton North Jn. (pass)	0.8	516.9	0.1	*101.4*	110.4
Riccarton North Jn. (pass) - Hawick	20.0	536.9	5.0	*106.4*	115.4
Hawick - *Ravenswood Junction (pass)*	21.0	557.9	6.3	*112.6*	*124.6*
Ravenswood Junction (pass) - Birkenside (North) Jn. (pass)	11.9	569.8	2.0	*114.6*	*126.6*
Birkenside (North) Jn. (pass) - Lauder (pass)	4.1	573.9	0.7	*115.3*	*127.3*
Lauder (pass) - Wiselawmill (North) Jn. (pass)	6.8	580.7	1.1	*116.4*	*128.4*
Wiselawmill (North) Jn. (pass) - Newcraighall HS (pass)	31.0	611.7	5.2	*121.6*	*133.6*
Newcraighall HS (pass) - Edinburgh	7.2	618.9	2.9	124.5	136.5

Birmingham Curzon St. - *Streethay Jn. (pass)*	38.0	38.0	9.1	*9.1*	*9.1*
Streethay Jn. (pass) - Crewe	57.0	95.0	11.2	20.3	20.3
Crewe - *Rostherne (S.) Jn. (pass)*	29.0	124.0	7.6	*27.9*	*30.9*
Rostherne (S.) Jn. (pass) - Kenyou (S.) Junction (pass)	13.6	137.6	2.3	*30.2*	*33.2*
Kenyou (S.) Junction (pass) - Kenyou (N.) Junction (pass)	1.3	138.9	0.2	*30.4*	*33.4*
Kenyou (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	145.0	1.0	*31.4*	*34.4*
Bamfurlong Jn. (pass) - Gibb Farm Junction (pass)	9.0	154.0	1.5	*32.9*	*35.9*
Gibb Farm Junction (pass) - Preston	24.0	178.0	5.7	38.6	41.6
Preston - *Galgate Junction (pass)*	24.0	202.0	6.8	*45.3*	*51.3*
Galgate Junction (pass) - Oxenholme WCML Jn. (pass)	36.3	238.3	6.1	*51.4*	*57.4*
Oxenholme WCML Jn. (pass) - Penrith WCML Junction (pass)	47.6	285.9	7.9	*59.3*	*65.3*
Penrith WCML Junction (pass) - Carlisle	30.1	316.0	6.7	66.0	72.0
Carlisle - *Longtown (North) Jn. (pass)*	18.4	334.4	5.8	*71.8*	*80.8*
Longtown (North) Jn. (pass) - Riddings (pass)	4.1	338.5	0.7	*72.5*	81.5
Riddings (pass) - Watleyhirst (N.) Jn. (pass)	6.8	345.3	1.1	*73.7*	82.7
Watleyhirst (N.) Jn. (pass) - Kershopefott (N.) Jn. (pass)	6.0	351.3	1.0	*74.7*	83.7
Kershopefott (N.) Jn. (pass) - Newcastleton (pass)	4.1	355.4	0.7	*75.3*	84.3
Newcastleton (pass) - Leahaugh (North) Jn. (pass)	6.8	362.2	1.1	*76.5*	85.5
Leahaugh (North) Jn. (pass) - Riccarton North Jn. (pass)	0.8	362.9	0.1	*76.6*	85.6
Riccarton North Jn. (pass) - Hawick	20.0	382.9	5.0	81.6	90.6
Hawick - *Ravenswood Junction (pass)*	21.0	403.9	6.3	*87.9*	*99.9*
Ravenswood Junction (pass) - Birkenside (North) Jn. (pass)	11.9	415.8	2.0	*89.9*	*101.9*
Birkenside (North) Jn. (pass) - Lauder (pass)	4.1	419.9	0.7	*90.5*	*102.5*

Lauder (pass) - Wiselawmill (North) Jn. (pass)	6.8	426.7	1.1	*91.7*	*103.7*
Wiselawmill (North) Jn. (pass) - Newcraighall HS (pass)	31.0	457.7	5.2	*96.8*	*108.8*
Newcraighall HS (pass) - Edinburgh	7.2	464.9	2.9	99.7	111.7
Liverpool Lime St. - *Kenyon (W.) Junction (pass)*	29.0	29.0	7.8	*7.8*	*7.8*
Kenyou (W.) Junction (pass) - Kenyou (N.) Junction (pass)	1.1	30.1	0.3	*8.1*	*8.1*
Kenyou (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	36.2	1.4	*9.5*	*9.5*
Bamfurlong Jn. (pass) - Gibb Farm Junction (pass)	9.0	45.2	1.5	*11.0*	*11.0*
Gibb Farm Junction (pass) - Preston	24.0	69.2	5.7	16.7	16.7
Preston - *Galgate Junction (pass)*	24.0	93.2	6.8	*23.5*	*26.5*
Galgate Junction (pass) - Oxenholme WCML Jn. (pass)	36.3	129.5	6.1	*29.5*	*32.5*
Oxenholme WCML Jn. (pass) - Penrith WCML Junction (pass)	47.6	177.0	7.9	*37.4*	*40.4*
Penrith WCML Junction (pass) - Carlisle	30.1	207.2	6.7	44.1	47.1
Carlisle - *Longtown (North) Jn. (pass)*	18.4	225.6	5.8	*50.0*	*56.0*
Longtown (North) Jn. (pass) - Riddings (pass)	4.1	229.7	0.7	*50.7*	56.7
Riddings (pass) - Watleyhirst (North) Jn. (pass)	6.8	236.5	1.1	*51.8*	57.8
Watleyhirst (North) Jn. (pass) - Kershopefoot (North) Jn. (pass)	6.0	242.4	1.0	*52.8*	58.8
Kershopefoot (North) Jn. (pass) - Newcastleton (pass)	4.1	246.5	0.7	*53.5*	59.5
Newcastleton (pass) - Leahaugh (North) Jn. (pass)	6.8	253.3	1.1	*54.6*	60.6
Leahaugh (North) Jn. (pass) - Riccarton North Jn. (pass)	0.8	254.1	0.1	*54.7*	60.7
Riccarton North Jn. (pass) - Hawick	20.0	274.1	5.0	59.7	65.7
Hawick - *Ravenswood Junction (pass)*	21.0	295.1	6.3	*66.0*	*75.0*
Ravenswood Junction (pass) - Birkenside (North) Jn. (pass)	11.9	307.0	2.0	*68.0*	*77.0*

Birkenside (North) Jn. (pass) - Lauder (pass)	4.1	311.1	0.7	*68.7*	*77.7*
Lauder (pass) - Wiselawmill (North) Jn. (pass)	6.8	317.9	1.1	*69.8*	*78.8*
Wiselawmill (North) Jn. (pass) - Newcraighall HS (pass)	31.0	348.9	5.2	*75.0*	*84.0*
Newcraighall HS (pass) - Edinburgh	7.2	356.1	2.9	77.8	86.8
Carlisle - *Westlinton (North) Jn. (pass)*	11.8	11.8	4.7	*4.7*	*4.7*
Westlinton (North) Jn. (pass) - Longtown (pass)	4.1	15.9	1.1	*5.8*	*5.8*
Longtown (pass) - Riddings	6.6	22.5	2.8	8.6	8.6
Riddings - *Watleyhirst (N.) Jn. (pass)*	6.8	29.3	3.5	*12.1*	*15.1*
Watleyhirst (N.) Jn. (pass) - Kershopefoot (N.) Jn. (pass)	6.0	35.3	1.4	*13.5*	*16.5*
Kershopefoot (N.) Jn. (pass) - Newcastleton	4.1	39.4	2.1	15.7	18.7
Newcastleton - *Leahaugh (North) Jn. (pass)*	6.8	46.2	3.5	*19.2*	*25.2*
Leahaugh (North) Jn. (pass) - Riccarton North Jn. (pass)	0.8	47.0	0.2	*19.4*	*25.4*
Riccarton North Jn. (pass) - Hawick	20.0	67.0	5.3	24.7	30.7
Hawick - *Ravenswood Junction (pass)*	21.0	88.0	6.3	*31.0*	*40.0*
Ravenswood Junction (pass) - Birkenside (North) Jn. (pass)	11.9	99.9	2.2	*33.2*	*42.2*
Birkenside (North) Jn. (pass) - Lauder	4.1	104.0	2.1	35.3	44.3
Lauder - *Wiselawmill (North) Jn. (pass)*	6.8	110.8	3.5	*38.9*	*50.9*
Wiselawmill (North) Jn. (pass) - Newcraighall HS (pass)	31.0	141.8	5.6	*44.4*	*56.4*
Newcraighall HS (pass) - Edinburgh	7.2	149.0	2.8	47.3	59.3
Carlisle - *Westlinton (North) Jn. (pass)*	11.8	11.8	4.7	*4.7*	*4.7*
Westlinton (North) Jn. (pass) - Longtown	4.1	15.9	2.1	6.9	6.9
Longtown - Riddings	7.6	23.5	4.8	11.6	14.6

4. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (11/11 / 10/11 / 9/10 stops in either case)

These timings have all changed because of the new section of HS route between Preston and Galgate Junction, and the new section of WCML between Kendal and Penrith. The service Euston – Liverpool via Runcorn is omitted (unchanged from Mk2) and the Euston **Cross** – Blackpool / Morecambe (formerly Windermere) is added from spreadsheet 2 (the rest of which – the Manchester services – is unchanged from Mk2). Strictly speaking, this saves 1km as against Euston; a time saving of 18sec is incorporated in the arrival times on the Blackpool and Morecambe branches, and a (cumulated) distance saving of 1km.

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Calvert	73.0	82.0	16.6	21.8	24.8
Calvert - Birmingham Interchange	78.0	160.0	17.4	39.2	45.2
Birmingham Interchange - Crewe	90.0	250.0	19.4	58.7	67.7
Crewe - Preston	83.0	333.0	18.3	76.9	88.9
Preston - Galgate Junction (pass)	24.0	357.0	7.0	84.0	
Galgate Junction (pass) - Lancaster	10.0	367.0	3.7	87.7	102.7
Lancaster - Carnforth	9.8	376.8	5.4	93.1	111.1
Carnforth - Kendal	24.3	401.1	9.8	102.8	123.8
Kendal - Penrith	38.0	439.1	12.9	115.8	139.8
Penrith - Carlisle	28.7	467.9	11.1	126.8	153.8
Carlisle - Motherwell	144.0	611.8	45.7	172.5	202.5
Motherwell - Glasgow Central	20.5	632.3	9.7	182.2	215.2
Carlisle - Edinburgh Haymarket	161.9	629.8	51.0	177.9	207.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	631.8	2.4	180.3	213.3
Crewe - Warrington Bank Quay	38.8	288.8	13.1	71.8	83.8
Warrington Bank Quay - Wigan North Western	9.2	298.1	5.4	77.2	92.2
Wigan North Western - Preston	34.0	332.1	14.7	92.0	110.0
Preston - Kirkham	12.4	343.5	6.6	98.3	119.3

Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	104.3	128.3
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	108.1	236.4
Preston - Galgate Junction (pass)	24.0	356.1	7.0	99.0	
Galgate Junction (pass) - Lancaster	10.0	366.1	3.7	102.7	123.7
Lancaster - Morecambe	6.5	372.5	4.4	107.1	131.1
Birmingham Curzon St. - Crewe	95.0	95.0	20.3	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6
Preston - Galgate Junction (pass)	24.0	201.1	7.0	60.6	
Galgate Junction (pass) - Lancaster	10.0	211.1	3.7	64.3	76.3
Lancaster - Carnforth	9.8	220.9	5.4	69.7	84.7
Carnforth - Kendal	24.3	245.2	9.8	79.5	97.5
Kendal - Penrith	38.0	283.2	12.9	92.4	113.4
Penrith - Carlisle	28.7	311.9	11.1	103.5	127.5
Carlisle - Lockerbie	41.6	353.5	14.9	118.4	145.4
Lockerbie - Motherwell	102.4	455.9	33.2	151.6	181.6
Motherwell - Glasgow Central	20.5	476.4	9.7	161.3	194.3
Carlisle - Edinburgh Haymarket	161.9	473.9	51.0	154.5	181.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	475.9	2.4	157.0	187.0
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - Galgate Junction (pass)	24.0	90.1	7.0	37.7	
Galgate Junction (pass) - Lancaster	10.0	100.1	3.7	41.4	50.4
Lancaster - Carnforth	9.8	109.9	5.4	46.8	58.8

Carnforth - Kendal	24.3	134.2	9.8	56.6	71.6
Kendal - Penrith	38.0	172.2	12.9	69.5	87.5
Penrith - Carlisle	28.7	201.0	11.1	80.6	101.6
Carlisle - Motherwell	144.0	344.9	45.7	126.3	150.3
Motherwell - Glasgow Central	20.5	365.4	9.7	135.9	162.9
Carlisle - Lockerbie	41.6	242.5	14.9	95.6	119.6
Lockerbie - Edinburgh Haymarlet	120.4	362.9	38.6	134.1	161.1
Edinburgh Haymarket - Edinburgh Waverley	2.0	364.9	2.4	136.6	166.6

Current fastest time (minutes) from London [with the values at Mk2] {and the above values at Mk3} to:

- Preston 128 [89] {89}
- Lancaster 144 [104] {102}
- Carnforth 160 (1 change) {111}
- Oxenholme 154 [118]
- Kendal 176 (1 change) {124}
- Penrith 151 [139] {140}
- Carlisle 194 [153] {154}
- Motherwell 253 [202] {203}
- Glasgow Central 271 [215] {215}
- Edinburgh Haymaket 271 (via ECML) [207] {208}
- Edinburgh Waverlry 257 (via ECML) [213] {213}

Current fastest time (minutes) from Birmingham [with the values at Mk1A] {and as above at Mk3} to:

- Crewe 52 [20] {20}
- Warrington BQ 71 [36] {36}
- Wigan North Western 82 [45] {45}
- Preston 96 [63] {63}
- Lancaster 112 [77] {76}
- Carnforth 135 (1 change) {85}
- Kendal 135 (1 change) {98}
- Penrith 147 [113] {113}
- Carlisle 164 [127] {128}
- Edinburgh Haymarket 237 [181] {182}
- Edinburgh Waverley 247 [186] {187}
- Lockerbie 192 (1 change) [145] {145}
- Motherwell 268 (1 change) [181] {182}
- Glasgow Central 242 [194] {194}

Current fastest time (minutes) from Liverpool [with the values at Mk1A] {and as above at Mk3} to:

- St. Helens Central 19 [9] {9}
- Wigan North Western 33 [19] {19}
- Preston 57 [37] {37}
- Lancaster 84 (1 change) [52] {50}
- Carnforth 93 (2 changes) {59}
- Kendal 117 (2 changes) {72}
- Penrith 119 (1 change) [87] {88}
- Carlisle 136 (1 change) [101] {102}
- Motherwell 195 (1 change) [149] {150}
- Glasgow Central 211 (1 change) [162] {163}
- Lockerbie 174 (1 change) [119] {120}
- Edinburgh Haymarket 219 (1 change) [161] {161}
- Edinburgh Waverlry 229 (1 change) [166] {167}

Note that the Mk3 times above Lancaster include a new stop at Carnforth, as compared with those at Mk1A and Mk2 (which both contained the no-longer-relevant stop at Oxenholme instead)..

Note also that the above table includes the service Euston – Morecambe, which replaces the Euston – Windermere service, splitting / joining the Euston – Blackpool service at Preston. This is considered a more equitable arrangement now that Kendal has become, finally, a full WCML station, with 6tph linking London, Birmingham and Liverpool with both Edinburgh and Glasgow.

4P. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (11/11 / 10/11 / 9/10 stops in either case; with passing times)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - *Grendon Underwood (S.) Jn. (pass)*	68.9	77.9	14.5	*19.6*	*22.6*
Grendon Underwood (S.) Jn. (pass) - Calvert	4.1	82.0	2.1	21.8	24.8
Calvert - *Chetwode (N.) Jn. (pass)*	6.8	88.8	3.5	*25.3*	*31.3*
Chetwode (N.) Jn. (pass) - Mt. Pleasant (N.) Jn. (pass)	67.1	155.9	11.8	*37.1*	*43.1*
Mt. Pleasant (N.) Jn. (pass) - B'ham Interchange	4.1	160.0	2.1	39.2	45.2
B'ham Interchange - *Streethay Jn. (pass)*	33.0	193.0	8.3	*47.5*	*56.5*
Streethay Jn. (pass) - Crewe	57.0	250.0	11.2	58.7	67.7
Crewe - *Rostherne (S.) Jn. (pass)*	29.0	279.0	7.6	*66.3*	*78.3*
Rostherne (S.) Jn. (pass) - Kenyon (S.) Junction (pass)	13.6	292.6	2.3	*68.5*	*80.5*
Kenyon (S.) Junction (pass) - Kenyon (N.) Junction (pass)	1.3	293.9	0.2	*68.8*	*80.8*
Kenyon (N.) Junction (pass) - Bamfurlong Junction (pass)	6.1	300.0	1.0	*69.8*	*81.8*
Bamfurlong Junction (pass) - Gibb Farm Junction (pass)	9.0	309.0	1.5	*71.3*	*83.3*
Gibb Farm Junction (pass) - Preston	24.0	333.0	5.7	76.9	88.9
Preston - *Galgate Junction (pass)*	24.0	357.0	7.0	*84.0*	*99.0*
Galgate Junction (pass) - Lancaster	10.0	367.0	3.7	87.7	102.7
Lancaster - Carnforth	9.8	376.8	5.4	93.1	111.1
Carnforth - Kendal	24.3	401.1	9.8	102.8	123.8
Kendal - Penrith	38.0	439.1	12.9	115.7	139.7
Penrith - Carlisle	28.7	467.8	11.1	126.8	153.8
Carlisle - Motherwell	144.0	545.1	45.7	172.5	202.5

Motherwell - Glasgow Central	20.5	565.6	9.7	182.2	215.2
Carlisle - Edinburgh Haymarket	161.9	629.8	51.0	177.9	207.9
Edinburgh Haymarket - Edinburgh Waverley	2.0	631.8	2.4	180.3	213.3
Crewe - Warrington Bank Quay	38.8	288.8	13.1	71.8	83.8
Warrington Bank Quay - Wigan North Western	9.2	298.0	5.4	77.2	92.2
Wigan North Western - Preston	34.0	332.0	14.7	92.0	110.0
Preston - Kirkham	12.4	343.4	6.6	98.3	119.3
Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	104.3	128.3
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	108.1	236.4
Preston - *Galgate Junction (pass)*	24.0	356.0	7.0	*99.0*	*120.0*
Galgate Junction (pass) - Lancaster	10.0	366.0	3.7	102.7	123.7
Lancaster - Morecambe	6.5	372.5	4.4	107.1	131.1
Birmingham Curzon St. - *Streethay Jn. (pass)*	38.0	38.0	9.1	*9.1*	*9.1*
Streethay Jn. (pass) - Crewe	57.0	95.0	11.2	20.3	20.3
Crewe - Warrington Bank Quay	38.8	133.8	13.1	33.4	36.4
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	38.8	44.8
Wigan North Western - Preston	34.0	177.1	14.7	53.6	62.6
Preston - *Galgate Junction (pass)*	24.0	201.1	7.0	*60.6*	*72.6*
Galgate Junction (pass) - Lancaster	10.0	211.1	3.7	64.3	76.3
Lancaster - Carnforth	9.8	220.9	5.4	69.7	84.7
Carnforth - Kendal	24.3	245.2	9.8	79.5	97.5
Kendal - Penrith	38.0	283.2	12.9	92.4	113.4
Penrith - Carlisle	28.7	311.9	11.1	103.5	127.5
Carlisle - Lockerbie	41.6	353.5	14.9	118.4	145.4
Lockerbie - Motherwell	102.4	455.9	33.2	151.6	181.6
Motherwell - Glasgow Central	20.5	476.4	9.7	161.3	194.3

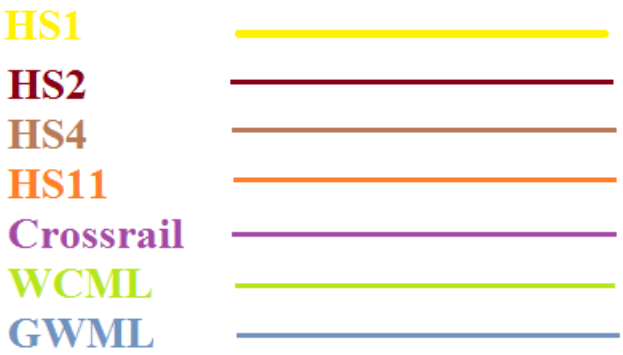
Carlisle - Edinburgh Haymarket	161.9	473.9	51.0	154.5	181.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	475.9	2.4	157.0	187.0
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - *Galgate Junction (pass)*	24.0	90.1	7.0	*37.7*	*46.7*
Galgate Junction (pass) - Lancaster	10.0	100.1	3.7	41.4	50.4
Lancaster - Carnforth	9.8	109.9	5.4	46.8	58.8
Carnforth - Kendal	24.3	134.2	9.8	56.6	71.6
Kendal - Penrith	38.0	172.2	12.9	69.5	87.5
Penrith - Carlisle	28.7	200.9	11.1	80.6	101.6
Carlisle - Motherwell	144.0	344.9	45.7	126.3	150.3
Motherwell - Glasgow Central	20.5	365.4	9.7	135.9	162.9
Carlisle - Lockerbie	41.6	242.5	14.9	95.5	119.5
Lockerbie - Edinbugh Haymarket	120.4	362.9	38.6	134.1	161.1
Edinburgh Haymarket - Edinburgh Waverley	2.0	364.8	2.4	136.5	166.5

Appendix A – Euston Cross and the Inter-Regional Connections

General

By routing the HS-C services of HS2 and HS4 into Euston and Paddington, respectively, and all the UHS and HS Metro services of both routes through Euston Cross, and on to HS1 and HS11/HS12, superlative cross-London inter-regional HS services are enabled, between the West Midlands / North West and Kent / East Sussex, and between South Wales / West Country and North Kent / East Anglia. The HS-C services HS11/HS12 are routed into Liverpool Street. The UHS and HS Metro services of HS1 (not the international ones) and HS11/HS12 balance exactly those of HS2 and HS4. There is thus no need for any rebuilding work at the four terminal stations to accommodate these trains. (Euston certainly needs rebuilding because it's such a disgusting mess, but it need not expand significantly beyond its current footprint, Paddington needs nothing more than a good clean and a fresh coat of paint, St. Pancras and Liverpool Street probably need nothing at all.) Given the service loadings of the London end of HS2 and HS1, and of HS4 and HS11/HS12, a single tunnel in each direction, with a minimum of 6 platforms, (passive provision for 8,) at Euston Cross, should suffice. That a single Euston Cross station, with a single pair of approach tunnels, would serve two HS inter-regional routes should seriously enhance its business case. I would like to see **passive** provision for 8 platforms, as is indicated in the diagrams.

The following sections illustrate the significant locations on the Euston Cross cross-London, inter-regional route. The track diagrams all use the colour scheme:



Old Oak Common

Old Oak Common station is on two levels, (3 actually, including London Overground, but that, although important, is not relevant in the current context):

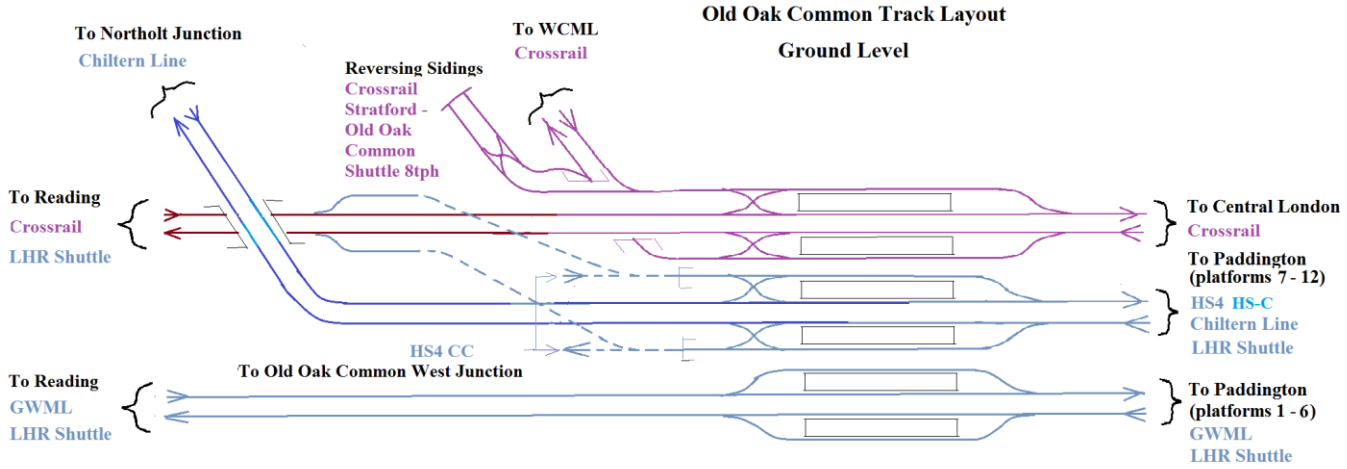
Ground Level, consisting of three sets of four platforms, serving the routes:

- GWML (Classic, long distance, and Heathrow Shuttle services,) on the fast lines.
- HS4 HS-C and Chiltern Line services, also some Shuttle services, on the relief lines, all of which diverge immediately west of the platforms, the HS-Cs to join HS4 at Old Oak Common West Junction, at the low level, the Chiltern Line services to Northolt Junction and the Shuttle services to join Crossrail on the relief lines west of Old Oak Common.

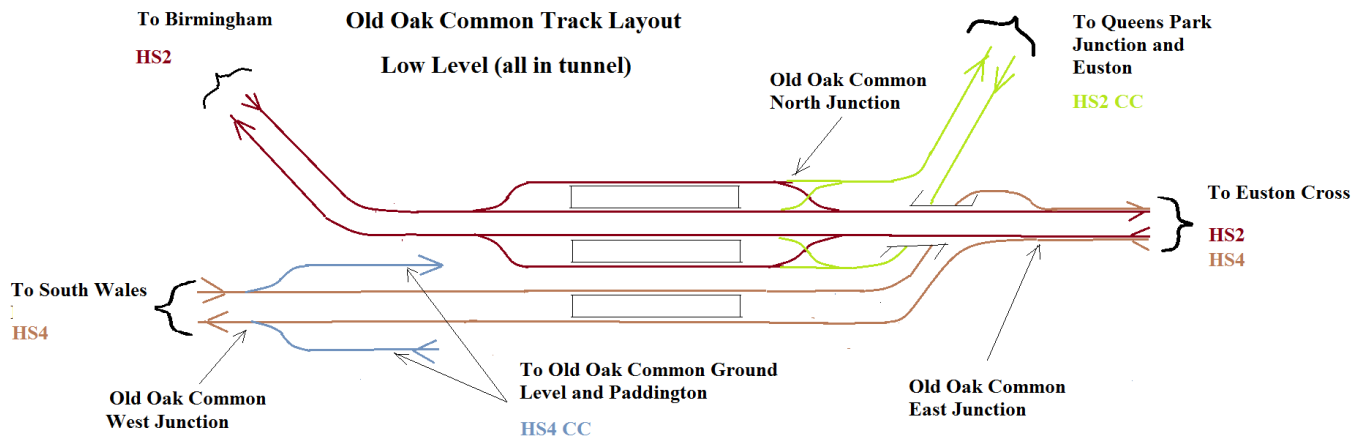
- Crossrail, of which the arm to the WCML and the Stratford Shuttle reversing sidings diverges immediately west of the platforms, and the GWML arm takes over the relief lines.

Low Level, consisting of HS2 (all services), and HS4 (UHS services).

Ideally, these should be one above the other, with the passenger entrances and circulating area between them, with lifts, escalators and stairs directly to all platforms. In order for HS2 and HS4 services to share the same pair of tracks, the HS-C services must first diverge, those of HS4 **before** the LL station (heading east), at Old Oak Common West Junction (then using the GWML platforms at ground level), and those of HS2 immediately after the LL station, at Old Oak Common North Junction. HS2 and HS4 merge shortly after that, at Old Oak Common East Junction. HS2's London-bound HS-C trains join the WCML at Queens Park Junction. In the original Euston Cross plans, this was seen as actually at Queens Park (since there was then no need to get them off HS2 as soon as possible after Old Oak Common). In fact Queens Park Junction (I'll keep the name as it's already in the literature) would best be located immediately west of the Kensal Green tunnels – there's plenty of room for it there, and it's only about ½ mile from Old Oak Common North Junction.

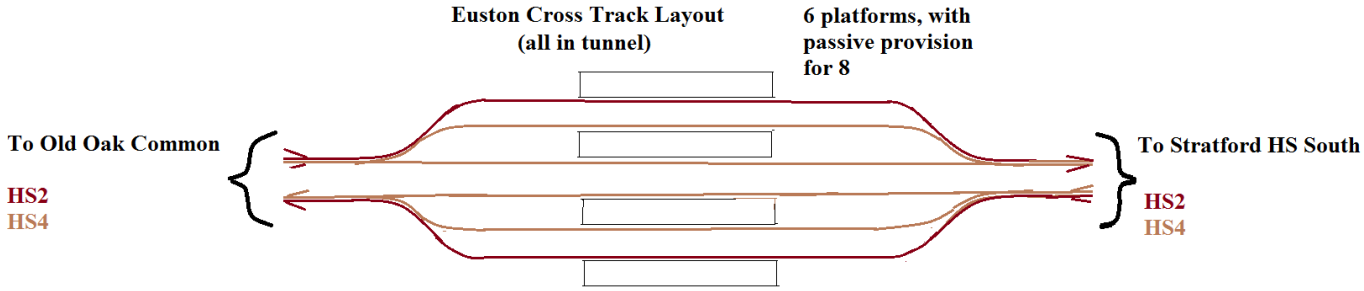


See the article 'GWML Service Plans' for a full explanation of the services between Paddington and Old Oak Common; as is clear from the diagram, the arrangement is rather complex.



Euston Cross

This is trivial, a two track route widening to serve 6 platforms. The middle two platform faces would ordinarily be served by HS4 trains, and the two outer pairs by HS2.



Stratford HS South

HS2/HS4 follow, in tunnel, the alignment of HS1, but a little to the south of it, from north of St. Pancras to Stratford. Thus whereas HS1/HS6 arrive at Stratford HS North station (the former Stratford International, which it never was,) HS2/HS4 arrive at Stratford HS South station, underneath Stratford (Regional) station. This is similar to Euston Cross – the route widens to serve 6 platforms, with HS4 occupying the middle two – but afterwards the HS4 tracks diverge from the HS2 tracks at Stratford HS South Junction, and HS4 metamorphoses into route HS11. The scissors crossovers are provided for operational flexibility but should not normally be used.

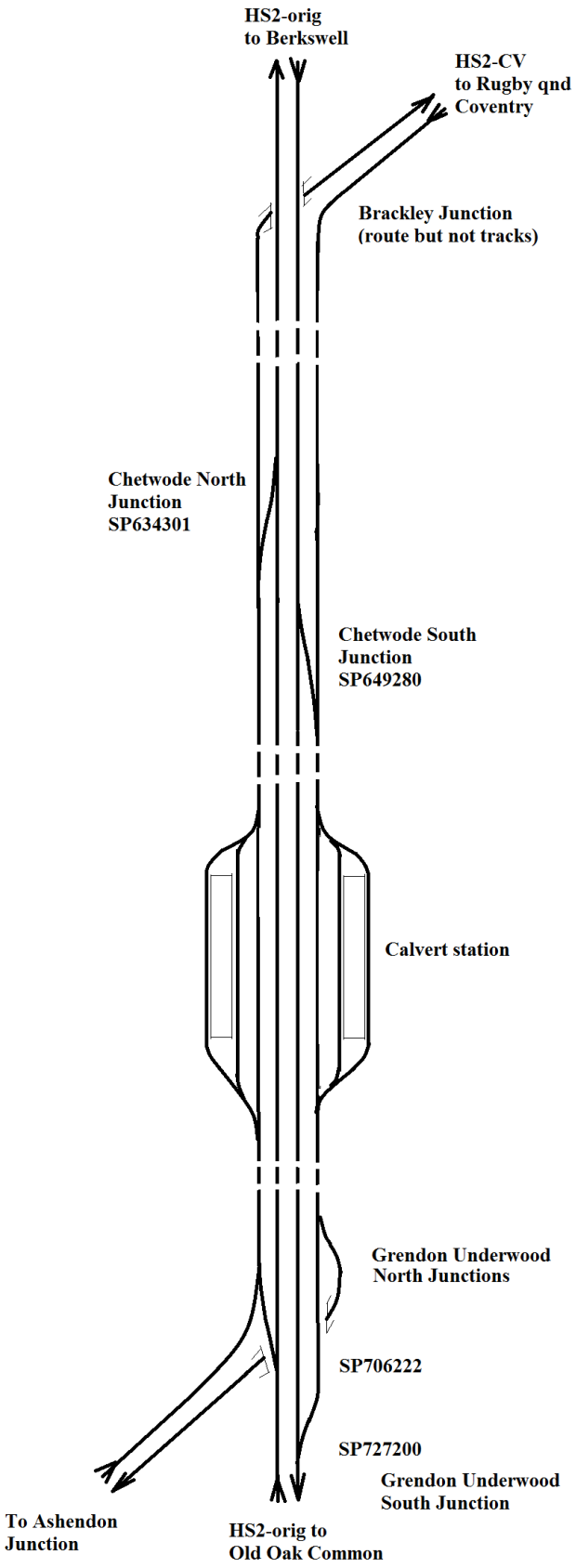
HS11 emerges from tunnel on the north side of the GEML and is joined by a connection from the classic route, at Manor Park Junction.

HS2 continues to Woodgrange Road Junction in Forest Gate, where it merges with HS1.

Stratford HS South corresponds in many respects to Old Oak Common. Both are served by all the cross-London inter-regional services, and afford convenient interchange with Crossrail. The Crossrail tracks are likewise in the high level station, having taken over the former slow lines, thus providing cross-platform interchange with the LT Central Line. Stratford HS South is on the Shenfield branch of Crossrail, and thus has a 12tph service, but additionally is served by the 8tph shuttle between Stratford and Old Oak Common.

Appendix B – Track Diagrams

Track Diagrams 1: Grendon Underwood Junction – Brackley Junction



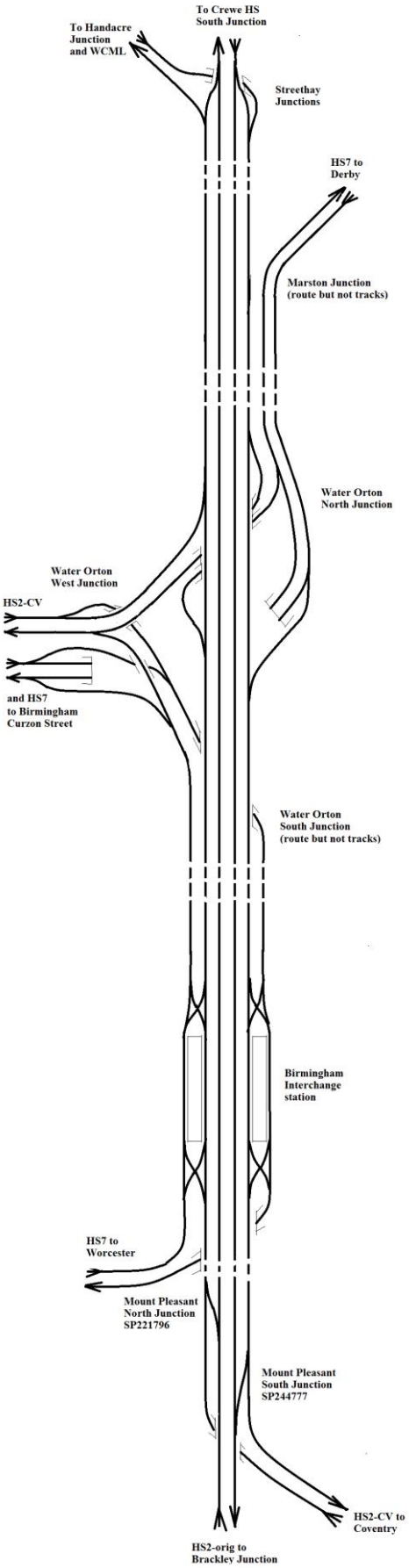
The article Same Speed Railways, Appendix B, gives extensive information on HS Junctions, layout of stations, acceleration and deceleration distances and times. The following track diagrams, whilc purely topological, follow the above conventions exactly.

HS2-CV begins at Grendon Underwood, where there are several track junctions. The northbound track of HS2-CV diverges from HS2-orig at map reference SP706222, and the southbound track joins HS2-orig further south at SP727200. These locations are prescribed by the requirement to come to a standstill in Calvert station, northbound, and to accelerate from standstill at Calvert station, southbound, diverging from / joining the main line at the turnoff limit speed of 230kph. (Deceleration actually begins / line speed is reached, some way further south, yet. These details are all in the above reference.) Chetwode junctions, north of Calvert, allow stopping services to regain / diverge from HS2-orig.

Calvert station and Brackley Junction are less than 18.5km, 11.6miles, apart (c.10miles, actually) so the station loops are continued between them, as recommended in the above reference; after Brackley Junction they become the lines of HS2-CV. There are 4 tracks through the middle of Calvert station, avoiding the platforms, since the HS2-CV services, while also using Grendon Underwood Junction, do not stop at Calvert, but pass through at high speed. I consider it very bad practice to allow a non-stop HS train to pass through a platform line.

Directly after Brackley station, the HS2-CV and HS2-orig routes diverge. Brackley Junction is a route junction but not a track junction, since there are no connections between the tracks. Indeed, after the connections at Grendon Underwood and Chetwode, the tracks do not have a further connection until Birmingham Interchange, for HS2-orig to HS2-CV, or, finally, Streethay Junction, for HS2-CV to HS2-orig.

Track Diagrams 2: Mount Pleasant – Streethay Junctions



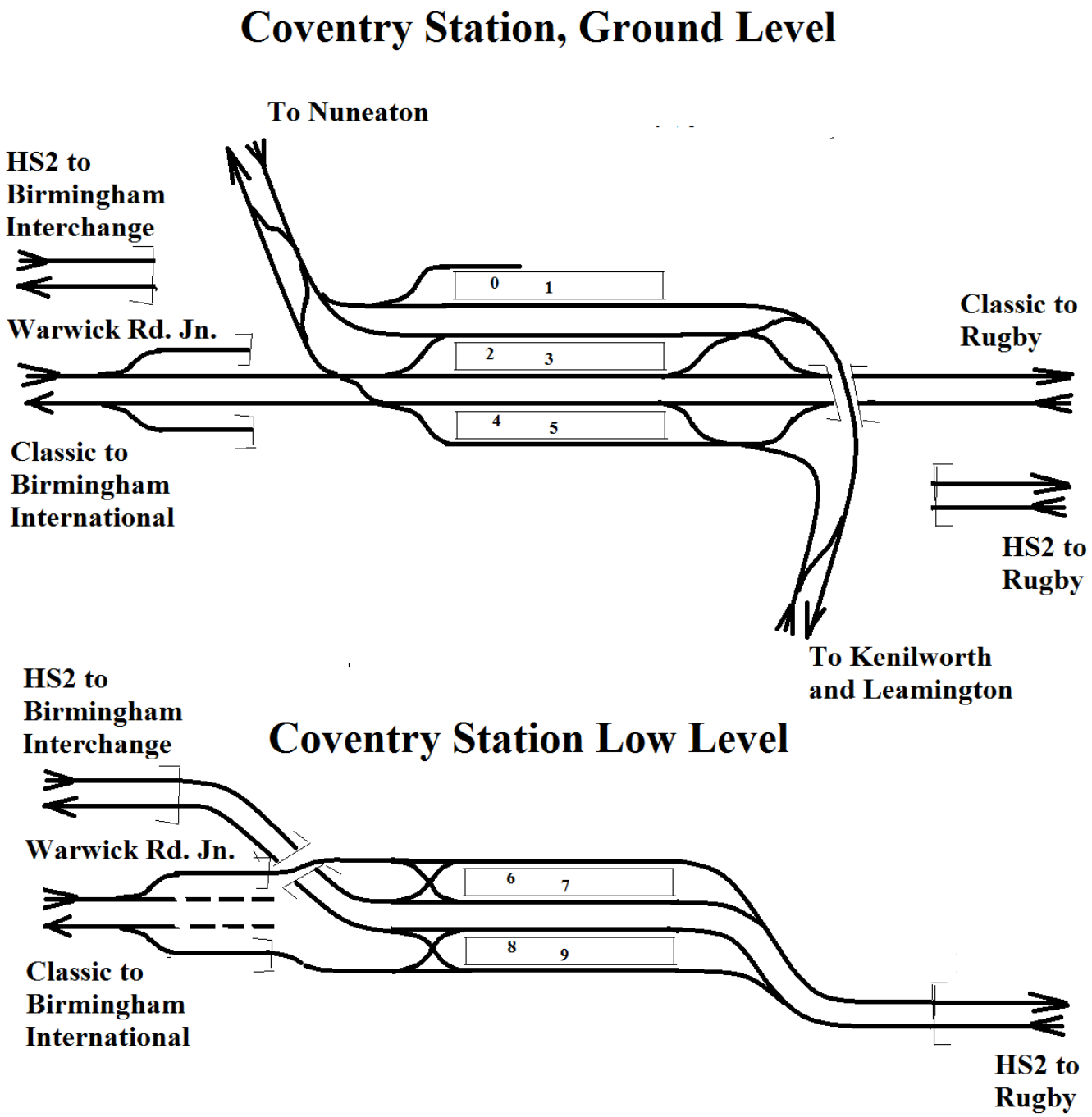
HS2-CV rejoins the route, but not the tracks, of HS2-orig at Mount Pleasant Junction, near Berkswell. Services on HS2-orig which stop at Birmingham Interchange, are, however able to switch to HS2-CV at Mount Pleasant North Junction, or join HS2-orig from HS2-CV at Mount Pleasant South Junction. By great good fortune, Mount Pleasant South Junction is just before the routes diverge (going south). HS2-CV occupies the outer two tracks of a 4-track, parallel arrangement. The 4-track section continues all the way to Streethay Junction, but over much of this section, where HS7 is also involved, there are effectively six tracks.

HS7 and HS2-CV have separate tracks, but with several connections between them. HS7 joins the route immediately south of Birmingham Interchange station. There are six tracks thence to Water Orton South Junction. There are scissors crossovers immediately south and north of Birmingham Interchange. Those to the south are for operational convenience, and not used in normal service, services switching between the outer pairs of tracks north of the station. The convention is that HS7 services use the two outermost platform faces, and HS2-CV the inner two. Services switch between tracks immediately north of the station, the arrangement being that services to and from Birmingham Curzon Street use the outermost of the six tracks, and those to and from Water Orton North Junction the inner tracks of the outer pairs.

There are four tracks between Water Orton West Junction and Curzon Street, arranged as alternating pairs, the north pair for HS2 services and the south pair for HS7. Northbound HS7 services from Curzon Street do not make connection with HS2, but pass beneath the HS2 tracks and diverge from the alignment at Marston Junction (a route but not a track junction). There are connections at Water Orton North Junction from the HS2 to the HS7 tracks, to enable the HS7 services not calling at Curzon Street to regain the HS7 route.

There are several track junctions at Streethay. The HS2-CV tracks finally merge with those of HS2-orig, for services to the North West via Crewe. But, immediately before that, there is a connection between the HS2-CV tracks and the WCML at Handsacre Junction. This is used only by the CC service from Euston to Manchester via Stoke. Note that there is no connection from the HS-orig tracks to Handsacre Junction.

Track Diagrams 3: Coventry Station



The above diagrams are intended to be largely self-explanatory.

The HS station is directly below the classic station, platforms 6,7 directly below 2,3 and 8,9 below 4.5, allowing stair, lift and escalator connections between them.

Platform 0 is for local services to Numeaton. Platform 1 is reversible, and intended for services, in both directions, between Nuneaton and Leamington, perhaps to more distant destinations. It is possible for Nuneaton services to access the main lines, but this is not foreseen as normal.

It is expected that CC services will use platforms 6,9 to ensure no conflict with GC-gauge services using 7,8. The scissors crossovers at the west ends of these platforms are for operational convenience, but not used in normal service.

Appendix C – Distance Table for WCML

Distance Table for WCML (extra 2m26ch for via N'ton)		
Euston to:	miles:chains	km
Watford Junction	17:34	1.37
Milton Keynes	49:65	80.15
Northampton Castle	65:68	105.95
Rugby	84:66	136.48
Nuneaton	99:36	160.02
Tamworth	112:27	180.75
Lichfield	118:45	190.77
Rugeley TV	126:48	203.70
Stafford	135:69	218.60
Stone	144:75	233.20
Stoke-on-Trent (via Stafford)	151:77	244.51
Macclesfield (via Stafford)	171:50	276.14
Stockport (via Stafford and Stoke)	183:49	295.43
Manchester Piccadilly (via Stafford and Stoke)	189:38	304.87
Crewe	160:26	257.96
Stockport (via Crewe)	185:27	298.21
Manchester Piccadilly (via Crewe)	191:16	307.64
Runcorn	182:66	294.17
Liverpool South Parkway	190:23	306.17
Liverpool Lime St.	195:78	315.32
Warrington Bank Quay	184:37	296.80
Wigan North Western	190:16	306.03
Preston	211:26	340.02
Kirkham	219:03	352.43
Poulton-le-Fylde	225:57	363.17
Blackpool North	228:65	368.16
Lancaster	232:24	373.77
Morecambe	236:26	380.25
Carnforth	238:31	383.57
Oxenholme	251;35	404.56
Kendal	253:41	407.90
Windermere	261:51	420.97
Penrith	283:44	456.23
Carlisle	301:33	484.97
Lockerbie	327:19	526.53
Motherwell	390:71	628.94
Glasgow Central	403:50	649.43
Edinburgh Haymarket	402:04	646.90
Edinburgh Waverley	403:23	648.89
Chester	181:37	291.97

Flint	193:73	312.01
Rhyl	211:36	340.22
Llandudno Junction	225:65	363.33
Bangor	241:28	388.33
Holyhead	265:78	427.95
Liverpool Lime St.	0:00	0.00
St. Helens Central	11:13	17.96
Wigan Noirth Western	19:74	32.06

Distance Table for Waverley Route (Carlisle end)		
Carlisle to:	miles (NB)	km
Longtown	9.9	15.93
Riddings	14.0	22.53
Newcastleton	24.5	39.42

The source of the first of the above sets of data is 'Track Atlas of Mainland Britain' (TRACKmaps 2009). The values are given in miles and chains (80 chains = 1 mile). The situation is straightforward along the main line to Crewe, thence to Manchester, Liverpool and Holyhead – everything is measured from Euston. (For my own purposes, I measure everything via Northampton; this adds an extra 2m26ch as compared with the normal route via Weedon.)

The complicating factors are in Staffordshire and above Newton-le-Willows. In Staffordshire, the mileages are from the North Stafforshire Railway, whose datum is 25ch north of Macclesfirld station (where the NS made an end-on junction with the LNW) and measuring southwards, just for a change. The section above Macclesfield is measured from a datum at Cheadle Heath North Junction. The connection from Stone to Norton Bridge is measured from a datum at Stone Junction.

Above Newton-le-Willows the situation is pathological. North of Carlisle, the distances are those of the Caledonian Railway, reasonably enough, measured from Carlisle. Between Lancaster and Carlisle, the distances are, unsurprisingly, those of the Lancaster and Carlisle Railway, whose independent existence ended in 1859, measured from Lancaster. Between Preston and Lancaster the distances are those of the amazingly obscure and ramshackle Lancaster and Preston Junction Railway – surprising it could do anything as organised as establish mileage posts – whose independent existence seems to have ended in 1842, though it's hard to say as it went through several changes of ownership, apparently. Finally, between Newton-le-Willows and Preston the distances are those of the North Union Railway, whose independent existence ended in 1846, measured from Newton-le-Willows Junction; the direct line (and thus mileages) from Euston joins this at Golborne Junction, 53ch from Newton-le-Willows Junction.

It really is astonishing that all this historical detritus has survived for so long, nobody ever having bothered to rationalise and unify it, but, as I perform these distance determinations, I am finding that this seems to be the case everywhere. Accordingly I am preserving the results, derived so tediously, so that I don't ever have to do it again.

The distances from Carlisle along the Waverley route are taken from 'Main Line Gradient Profiles' (Ian Allan, no date). This gives profiles for many historical routes also. This is in fact surprisingly accurate: thje profiles are given as a straight line, and I measure the relavant sections with dividers, comparing the reault against the mileage axis – the values (in miles) are certainly accurate to one decimal place.

Appendix D – Changes at Mk1A, Mk2 and Mk3

The changes of route at Mk1A, from Mk1, are as follows:

- The tunnel under Crewe, between Crewe HS South Junction and Crew HS North Junction is postponed.
- The section from Crewe HS North Junction to Manchester HS, including Manchester Interchange station is postponed, (but **not** Manchester HS station, which **is** implemented at Mk1A). The classic line from Crewe to Manchester is incorporated into HS2, with upgrading of line speed to 140mph (to Stockport).
- The section from Rostherne South Junction to Bamfurlong Junction (with the WCML), and also the early section of HS8 from Kenyon West Junction to Liverpool and the connections thereto from HS2 at Kenyon South and North junctions, are likewise postponed. The classic line from Crewe to Liverpool is incorporated into HS2, with upgrading of line speed to 140mph (to Liverpool South Parkway. The classic line from Weaver Junction to Preston is likewise merged into HS2, with upgrading of line speed to 125mph.

The changes of route at Mk2 are simply the implementation of the various postponed sections, above.

Mk3.1 adds the Coventry Variant, from Grendon Underwood Junction to Mount Pleasant Junction, via Rugby and Coventry, with connections from Ashendenand Banbury junctions and to HS3 at Watford Gap and Cotesbach junctions.

Mk3.2 is the Scottish Extension, from Preston to Carlisle and joining HS3 via the restored (as HS) Waverley route at Riccarton North Junction. The WCML is rerouted from Oxenholme through Kendal then via a completely new route to Penrith. HS2 takes over the original WCML between Oxenholme WCML Junction and Penrtih WCML Junction, with necessary upgrading and alignment easing.

Appendix Q – Journey Times for Line Speed 225kph, 140mph

The article ‘Line Capacity vs. Speed for High Speed Railways’ points out (in the section ‘Consequences of the Results’) that a good case can be made for a line speed of 225kph, 140mph, because this offers a good compromise between speed and line capacity (theoretical capacity 49tph at 225kph with basic Train Separation Distance as compared with 29tph at 360kph with extended TSD). Even more important is the fact that this is just within the current (as at 2014) Turnout Limit Speed of 230kph, 144mph. This is the maximum speed at which trains can diverge from the main line of a HS railway, using the fastest available pointwork. What this means is that diverging trains can leave the main line at full line speed; there is no need to decelerate on the main line before diverging. This means that the Extended Train Separation Distance standard, which allows diverging trains to decelerate on the main line, without affecting a following straight-ahead train, which continues at full line speed, is no longer necessary, which allows major simplification in the operation of HS railways.

This new appendix Q is being added to every Route and Service Plans article, to show what the effect would be for the journey times of the various services. No recommendation is actually being made for this change, but it is important that the supporting information be available to allow a reasoned decision to be made.

1. UHS Services:

Euston Cross – Birmingham (direct / via Coventry: 2/4 stops)

Euston Cross – Manchester / Liverpool (2 stops each)

Euston Cross / Birmingham / Liverpool – Edinburgh (4/4/3 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times (minutes)
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Birmingham Interchange	151.0	159.0	43.0	47.9	50.9
Birmingham Interchange - Birmingham Curzon St.	20.0	179.0	8.1	56.0	62.0
Old Oak Common - Rugby HS	130.0	138.0	37.4	42.3	45.3
Rugby HS - Coventry HS	18.0	156.0	7.6	49.9	55.9
Coventry HS - Birmingham Interchange	17.0	173.0	7.3	57.2	66.2
Birmingham Interchange - Birmingham Curzon St.	20.0	193.0	8.1	65.3	77.3
Old Oak Common - Manchester Interchange	286.0	294.0	79.0	83.9	86.9
Manchester Interchange - Manchester HS	8.0	302.0	4.9	88.8	94.8
Old Oak Common - Crewe	241.0	249.0	67.0	71.9	74.9
Crewe - Liverpool Lime Street	73.0	322.0	22.2	94.2	100.2
Old Oak Common - Preston	324.0	332.0	89.2	94.0	97.0
Preston - Carlisle	138.0	470.0	39.6	133.6	139.6
Carlisle - Hawick	67.0	537.0	20.6	154.3	163.3
Hawick - Edinburgh	82.0	619.0	24.6	178.9	190.9
Birmingham Curzon St. - Crewe	95.0	95.0	28.1	28.1	28.1
Crewe - Preston	83.0	178.0	24.9	53.0	56.0
Preston - Carlisle	138.0	316.0	39.6	92.6	98.6
Carlisle - Hawick	67.0	383.0	20.6	113.2	122.2
Hawick - Edinburgh	82.0	465.0	24.6	137.9	149.9
Liverpool - Preston	69.0	69.0	21.2	21.2	21.2
Preston - Carlisle	138.0	207.0	39.6	60.8	63.8
Carlisle - Hawick	67.0	274.0	20.6	81.4	87.4

Hawick - Edinburgh	82.0	356.0	24.6	106.0	115.0

Current fastest time (minutes) from London [and the 360kph values (300kph for Rugby and Coventry, via the Coventry Variant)] {and the above 225kph values} to:

- Birmingham Interchange 70 [38] {51}
- Birmingham Curzon Street 81 [48] {62}
- Rugby HS 48 [36] {45}
- Coventry HS 59 [46] {56}
- Manchester Interchange 115 [61] {87}
- Manchester HS 127 [69] {95}
- Crewe 90 [53] {75}
- Liverpool Lime Street 128 [73] {100}
- Preston 128 [66] {97}
- Carlisle 194 [97] {140}
- Edinburgh 257 [137] {191}

Current fastest time (minutes) from Birmingham [and the 360kph values] {and the 225kph values} to:

- Preston 96 [42] {56}
- Carlisle 164 [72] {99}
- Edinburgh 247 [112] {150}

Current fastest time (minutes) from Liverpool [and the 360kph values] {and the 225kph values} to:

- Preston 57 [17] {21}
- Carlisle 136 (1 change) [47] {64}
- Edinburgh 229 (1 change) [87] {115}

2. HS Metro Services Euston Cross / Birmingham – Manchester (9/6 stops) Euston Cross – Blackpool / Windermere (9/10 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8.0	8.0	4.9	4.9	4.9
Old Oak Common - Calvert	73.0	81.0	24.3	29.2	32.2
Calvert - Birmingham Interchange	78.0	159.0	25.7	54.9	60.9
Birmingham Interchange - Handsacre Junction	33.0	192.0	10.5	65.4	

Handsacre Juncton - Rugeley Trent Valley	8.0	200.0	3.3	68.7	77.7
Rugeley Trent Valley - Stafford	14.9	214.9	6.9	75.7	87.7
Stafford - Stone	14.6	229.5	6.8	82.5	97.5
Stone - Stoke-on-Trent	11.3	240.8	5.9	88.4	106.4
Stoke-on-Trent - Macclesfield	31.6	272.4	12.0	100.3	121.3
Macclesfield - Stockport	19.3	291.7	8.3	108.6	132.6
Stockport - Manchester Piccadilly	9.4	301.2	5.3	113.9	140.9
Birmingham Curzon St. - Handsacre Junction	38.0	38.0	11.9	11.9	
Handsacre Juncton - Rugeley Trent Valley	8.0	46.0	3.3	15.2	15.2
Rugeley Trent Valley - Stafford	14.9	60.9	6.9	22.1	25.1
Stafford - Stone	14.6	75.5	6.8	29.0	35.0
Stone - Stoke-on-Trent	11.3	86.8	5.9	34.9	43.9
Stoke-on-Trent - Macclesfield	31.6	118.4	12.0	46.8	58.8
Macclesfield - Stockport	19.3	137.7	8.3	55.1	70.1
Stockport - Manchester Piccadilly	9.4	147.2	5.3	60.4	78.4
Birmingham Interchange - Crewe	90.0	249.0	28.9	83.7	92.7
Crewe - Warrington Bank Quay	38.8	287.8	13.1	96.9	108.9
Warrington Bank Quay - Wigan North Western	9.2	297.1	5.4	102.3	117.3
Wigan North Western - Preston	34.0	331.1	14.7	117.0	135.0
Preston - Kirkham	12.4	343.5	6.6	123.6	144.6
Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	129.6	153.6
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	133.5	160.5
Preston - Lancaster	33.8	364.8	11.8	128.8	149.8
Lancaster - Oxenholme	30.8	395.6	11.7	140.5	164.5
Oxenholme - Kendal	3.3	398.9	3.2	143.6	170.6
Kendal - Windermere	13.1	412.0	6.9	150.5	180.5

Current fastest time (minutes) from London [and the 360kph values] {and the above 225kph values} to:

- Rugeley TV 98 [60] {78}
- Stafford 65 [70] {88}
- Stone 103 (1 change) [80] {98}
- Stoke-on-Trent 84 [89] {106}
- Macclesfield 101 [103] {121}
- Stockport 115 [115] {133}
- Manchester 127 [123] {141}
- Crewe 90 [67] {93}
- Warrington BQ 104 [84] {109}
- Wigan North Western 115 [92] {117}
- Preston 128 [110] {135}
- Kirkham 153 (1 change) [119] {145}
- Poulton-le-Fylde 155 (1 change) [128] {154}
- Blackpool North 165 (1 change) [135] {161}
- Lancaster 144 [124] {150}
- Oxenholme 154 [139] {165}
- Kendal 176 (1 change) [145] {171}
- Windermere 193 (1 change) [154] {181}

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

- Rugeley TV 58 [13] {15}
- Stafford 30 [23] {25}
- Stone 49 (1 change) [33] {35}
- Stoke-on-Trent 46 [41] {44}
- Macclesfield 64 [56] {59}
- Stockport 76 [68] {70}
- Manchester 88 [76] {78}

3. HS Metro Services Euston / Birmingham – Holyhead (7/6 stops)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Crewe	241.0	250.0	67.0	72.2	75.2
Crewe - Chester	34.0	284.0	12.7	84.9	90.9
Chester - Flint	20.0	304.1	8.5	93.4	102.4
Flint - Rhyl	28.2	332.3	10.9	104.3	116.3

Rhyl - Llandudno Junction	23.1	355.4	10.6	114.9	129.9
Llandudno Junction - Bangor	25.0	380.4	11.4	126.3	144.3
Bangor - Holyhead	39.6	420.0	16.8	143.1	164.1
Birmingham Curzon St. - Crewe	95.0	95.0	28.1	28.1	28.1
Crewe - Chester	34.0	129.0	12.7	40.8	43.8
Chester - Flint	20.0	149.1	8.5	49.3	55.3
Flint - Rhyl	28.2	177.3	10.9	60.2	69.2
Rhyl - Llandudno Junction	23.1	200.4	10.6	70.8	82.8
Llandudno Junction - Bangor	25.0	225.4	11.4	82.2	97.2
Bangor - Holyhead	39.6	265.0	16.8	99.0	117.0

Current fastest time (minutes) from London [and the 360kph values] {and the above 225kph values} to:

- Crewe 90 [53] {75{
- Chester 123 [68] {91}
- Flint 146 [80] {102}
- Rhyl 166 [94] {116}
- Llandudno Junction 182 [108] {130}
- Bangor 191 [122] {144}
- Holyhead 229 [142] {164}

Current fastest time (minutes) from B'ham [and the 360kph values] {and the above 225kph values} to:

- Crewe 52 [20] {28}
- Chester 91 (1 change) [36] {44}
- Flint 114 (2 changes) [47] {55}
- Rhyl 134 (2 changes) [61] {69}
- Llandudno Junction 155 (2 changes) [75] {83}
- Bangor 174 (2 changes) [89] {97}
- Holyhead 212 (2 changes) [109] {117}

4. HS Metro Services Euston / Birmingham / Liverpool – Glasgow / Edinburgh (10/11/10 stops to each)

Section	Distance (km)	Cumulative Distance (km)	Section Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston - Old Oak Common	9.0	9.0	5.2	5.2	5.2
Old Oak Common - Calvert	73.0	82.0	22.2	27.4	30.4
Calvert - Birmingham Interchange	78.0	160.0	23.6	51.0	57.0
Birmingham Interchange - Crewe	90.0	250.0	26.8	77.8	86.8
Crewe - Runcorn	36.2	286.2	12.4	90.2	102.2
Runcorn - Liverpool S. Parkway	12.0	298.2	6.0	96.2	111.2
Liverpool S. Parkway - Liverpool Lime St.	9.2	307.4	5.4	101.6	119.6
Crewe - Preston	83.0	333.0	24.9	102.7	114.7
Preston - Lancaster	34.0	367.0	11.8	114.5	129.5
Lancaster - Carnforth	9.8	376.8	5.4	119.9	137.9
Carnforth - Kendal	24.3	401.1	9.8	129.7	150.7
Kendal - Penrith	38.0	439.1	12.9	142.6	166.6
Penrith - Carlisle	28.7	467.9	11.1	153.7	180.7
Carlisle - Motherwell	144.0	611.8	45.7	199.4	229.4
Motherwell - Glasgow Central	20.5	632.3	9.7	209.0	242.0
Carlisle - Edinburgh Haymarket	161.9	629.8	51.0	204.7	234.7
Edinburgh Haymarket - Edinburgh Waverley	2.0	631.8	2.4	207.2	240.2
Crewe - Warrington Bank Quay	38.8	288.8	13.1	90.9	102.9
Warrington Bank Quay - Wigan North Western	9.2	298.1	5.4	96.3	111.3
Wigan North Western - Preston	34.0	332.1	14.7	111.1	129.1
Preston - Kirkham	12.4	343.5	6.6	117.4	138.4
Kirkham - Poulton-le-Fylde	10.7	354.2	6.0	123.4	147.4
Poulton-le-Fylde - Blackpool North	5.0	359.2	3.9	127.2	274.6

Preston - Lancaster	34.0	366.1	8.7	119.7	286.3
Lancaster - Morecambe	6.5	372.5	4.4	124.1	293.7
Birmingham Curzon St. - Crewe	95.0	95.0	28.1	28.1	28.1
Crewe - Warrington Bank Quay	38.8	133.8	13.1	41.2	44.2
Warrington Bank Quay - Wigan North Western	9.2	143.1	5.4	46.7	52.7
Wigan North Western - Preston	34.0	177.1	14.7	61.4	70.4
Preston - Lancaster	34.0	211.1	11.8	73.2	85.2
Lancaster - Carnforth	9.8	220.9	5.4	78.7	93.7
Carnforth - Kendal	24.3	245.2	9.8	88.4	106.4
Kendal - Penrith	38.0	283.2	12.9	101.3	122.3
Penrith - Carlisle	28.7	311.9	11.1	112.4	136.4
Carlisle - Lockerbie	41.6	353.5	14.9	127.4	154.4
Lockerbie - Motherwell	102.4	455.9	33.2	160.6	190.6
Motherwell - Glasgow Central	20.5	476.4	9.7	170.2	203.2
Carlisle - Edinburgh Haymarket	161.9	473.9	51.0	163.5	190.5
Edinburgh Haymarket - Edinburgh Waverley	2.0	475.9	2.4	165.9	195.9
Liverpool Lime St. - St. Helens Central	18.0	18.0	8.7	8.7	8.7
St. Helens Central - Wigan North Western	14.1	32.1	7.3	16.0	19.0
Wigan North Western - Preston	34.0	66.1	14.7	30.7	36.7
Preston - Lancaster	34.0	100.1	11.8	42.6	51.6
Lancaster - Carnforth	9.8	109.9	5.4	48.0	60.0
Carnforth - Kendal	24.3	134.2	9.8	57.7	72.7
Kendal - Penrith	38.0	172.2	12.9	70.6	88.6
Penrith - Carlisle	28.7	201.0	11.1	81.7	102.7
Carlisle - Motherwell	144.0	344.9	45.7	127.4	151.4
Motherwell - Glasgow Central	20.5	365.4	9.7	137.1	164.1
Carlisle - Lockerbie	41.6	242.5	14.9	96.7	120.7
Lockerbie - Edinburgh Haymarlet	120.4	362.9	38.6	135.3	162.3
Edinburgh Haymarket - Edinburgh Waverley	2.0	364.9	2.4	137.7	167.7

Current fastest time (minutes) from London [and the 360kph values] {and the above 225kph values} to:

- Crewe 90 [68] {87}
- Runcorn 113 [83] {102}
- Liverpool South Parkway 140 [92] {111}
- Liverpool Lime St. 128 [101] {120}
- Preston 128 [89] {115}
- Lancaster 144 [102] {130}
- Carnforth 160 (1 change) [111] {138}
- Kendal 176 (1 change) [124] {151}
- Penrith 151 [140] {167}
- Carlisle 194 [154] {181}
- Motherwell 253 [203] {229}
- Glasgow Central 271 [215] {242}
- Edinburgh Haymaket 271 (via ECML) [208] {235}
- Edinburgh Waverlry 257 (via ECML) [213] {240}

Current fastest time (minutes) from B'ham [and the 360kph values] {and the above 225kph values} to:

- Crewe 52 [20] {28}
- Warrington Bank Quay 71 [36] {44}
- Wigan North Western 82 [45] {53}
- Preston 96 [63] {70}
- Lancaster 112 [76] {85}
- Carnforth 135 (1 change) [85] {94}
- Kendal 135 (1 change) [98] {106}
- Penrith 147 [113] {122}
- Carlisle 164 [128] {136}
- Edinburgh Haymarket 237 [182] {191}
- Edinburgh Waverley 247 [187] {196}
- Lockerbie 192 (1 change) [145] {154}
- Motherwell 268 (1 change) [182] {191}
- Glasgow Central 242 [194] {203}

There are in fact no sections of track on the route from Liverpool with speeds in excess of 225kph, 140mph, so the timings are identical to the Mk3.2 values, listed on p127.