# HS7 Route and Service Plans

## *The Purpose, Background and Method*

This article refers to and should be read in conjunction with my article 'Towards a High Speed **Network**'. That article sought to make the case for developing a network plan for all the HS routes which will eventually be needed, and, as a contribution to getting the discussion started, gave my own thoughts of what such a network could look like. Naturally, this involved describing a number of routes, in varying but superficial detail. This lays me open to the charge, something on the lines of 'That's all very easy to say, but how would you actually go about doing it?' Accordingly, a decent respect to the opinions of the interested public requires that I should go into more detail on the individual routes. The present article deals with HS7, the NE/SW route from Newcastle to Bristol and the West Country, and, in association with HS4, to South Wales.

The general route is decided on strategic and business grounds, thus which locations are to be served. This gives the general alignment, at a very high, superficial level. I plan the detailed route using Ordnance Survey maps, taking careful account of the shape of the landscape, from the contours. I note the location of all significant infrastructure, thus tunnels (generally, over about a quarter mile in length), viaducts and major river crossings. I simultaneously make a virtual tour of the route from my computer, via satellite maps, to make sure, as far as possible, that there is actually room for my lines where I wish to put them, and that, for example, a housing estate has not materialised in an inconvenient location since the (paper) map was published. (I understand that the images used by satellite maps are up to a maximum of three years old, so not exactly real-time, but still pretty good.) I make a great effort to avoid any housing. I'm blasé about demolishing warehouses – after all, all that's required there is to build a (better) new one nearby, and the owners will be very happy. But I regard demolishing housing (or even getting very close to it) as a thoroughly bad idea; people just don't like it, and I understand their feelings. If ever I must (knowingly) propose to demolish housing, I will point out the fact. And I really ought to know, working with satellite maps to a magnification where, typically, individual cars are clearly visible, about 1mm in length, (the scales of these maps, as displayed, are distinctly odd – this particular one comes out as 1 in ~2778!) but it's not always possible to be certain, from above, of what an individual building actually is – I have, on one noted occasion, mistaken as warehouses what subsequently turned out to be purpose-built student accommodation; I refrain from further comment. (At the maximum magnification I have available, the cars are about 1" in length, probably good enough for someone familiar with the subject to identify make and model. But at these highest magnifications there is some loss of resolution – the edges of objects become increasingly fuzzy. As noted earlier, these scales are strange; this maximum is 1 in ~179.)

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

When I am following an existing alignment, (this obviously includes taking over the route and trackbed of a former railway, now closed,) I don't generally worry about gradients, confident that they will be well

within the capacity of HS trains. Very occasionally, when following a motorway or (more likely) non-motorway road, the contour pattern suggests that there might be a problem, and then I do check the gradients, (and state what these are, in the route plan). When I am obliged to design a completely new alignment, then the gradient profile forms part of the design, and will be stated, (unless, from the contours, it's obviously essentially level, or undulating but with no significant underlying change of level). The present article contains gradient profiles for the new alignments Birmingham Interchange to Barnt Green and Exeter to Plymouth, but not for Derby to Polesworth as this section, though undulating, is level overall.

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

## *The Maps*

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

The Strategi Dataset contains GIS (Geographical Information Systems) data, which has to be processed by special software; I have used the Open Source QGIS product. This has been used to produce an overall map of HS7, including sections of other routes over which HS7's services run. These overall maps come at the end of the 'Route' description, and also show HS7'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 HS7.

## *The Service Plans*

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

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

A standard HS station has two island platforms, thus two platformed tracks in each direction. If some of the services passing through the station are non-stop, then the main line must pass through the layout without adjacent platforms, either through the centre of the alignment, in tunnel below or on viaduct above, or the station must be on a branch loop off the main line, which thus bypasses it completely. In fact, all HS7 (and HS4) stations are served by all services, so don't need overtaking/avoiding lines. At the end(s) of a route, the traffic density may not be sufficient to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice; this is the case with HS7 south of Bristol (and HS4 west of Cardiff).

Several service plans are developed, reflecting the piecemeal development of the network. As new sections open, further services come into operation. In all cases, consideration is given to maximum loadings – which section(s) are fully loaded and thus determine the maximum service frequencies. In general I take 16tph as the maximum throughput; if this is ever exceeded, the fact will be highlighted.

In the present article, HS4, the route from London to South Wales, must also be considered, as HS7 and HS4 are intimately linked in providing the overall service pattern. The final result (as far ahead as these plans consider) is a combined service of 8tph to both Bristol and Cardiff, and 4tph beyond those, with cross-platform interchange at Bristol Parkway HS, so both London and Birmingham (strictly Birmingham **Interchange**) have 4tph direct to both Bristol and Cardiff, and another 4tph with one cross-platform change, giving exactly the same journey time.

Two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic compatible) which travel on HS7 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS7, to York and Preston. It's all rather arbitrary, at present. Provided that there are no difficult technical issues in running double deck trains at 360kph, 225mph, and that public reaction to them is favourable, I would like to see all GC gauge services run with double deck trains. (The Swiss like them.)

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

## *Estimated Journey Times*

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

## *HS7 Route – Introduction and Assumptions*

The route from Newcastle, via Leeds, to Nuthall North Junction, Nottingham, is shared with HS3. This is fully described in 'HS3 Route and Service Plans', and will not be repeated here (but this part will of course feature in the service plans). The route from Nuthall North Junction to just west of Polesworth is a new alignment, in part taking over the route of a closed line. From Polesworth into Birmingham Curzon Street, the route taken is that proposed by the HS2 Project Team for the eastern arm of the HS2 'Y' configuration. There is a new alignment from Birmingham to Barnt Green. Between Barnt Green and Exeter St. David's, HS7 closely follows existing alignments, railway and motorway (but with short sections of new alignment in the Droitwich, Cheltenham, Gloucester and Bristol areas). Between Exeter and Plymouth an entirely new alignment is chosen (avoiding Dawlish!).

The maximum speed for HS7 is 300kph, 187.5mph, except for the section shared with HS3 between Darlington and Nuthall North Junction, where it is 360kph, 225mph. (From Newcastle to Darlington, HS3 also has a maximum of 300kph, 187.5mph.) This is because the non-stop distances travelled on HS7 are not long enough to take advantage of the higher speed (likewise for HS4, west of Cardiff). HS7 in its entirety has the characteristics of a HS Metro.

## *HS7 Route – Junctions*

There are various junctions on the route of HS7, enabling connections with other HS and classic routes. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

| | | |
|---|---|---|
| • Paradise | NZ220634 | HS3 route from Newcastle to Hexham and Edinburgh diverges from HS7 |
| • Derwent Hill | NZ103537 | HS3 route from Edinburgh and Hexham joins HS7 |
| • Garforth East | SE395341 | HS9 route (to Leeds New Lane) diverges from HS3 |
| • Gelderd Road North | SE282232 | HS7 diverges from HS9 after New Lane station |
| • Gelderd Road South | SE279320 | HS7 joins classic route from Leeds City |
| • Ardsley | SE302265 | HS7 diverges from classic route from Leeds City |
| • Altofts | SE370243 | HS7 joins HS3 main line from York |
| • Beighton | SK447838 | Connection from Sheffield – Retford route |
| • Nuthall North | SK514469 | HS7 diverges from HS3 |
| • Awsworth | SK484444 | Spur from HS3 Nottingham branch (passing over HS3 main line) joins HS7 main line |
| • Strelley | SK512423 | Connects HS3 Nottingham branch to HS7 |
| • Marston | SP190943 | HS7 (north) joins HS2 |
| • Water Orton: | | |
| – North | SP190913 | HS7 Birmingham avoiding line diverges from route to Birmingham Curzon Street from the north |
| – West | SP172904 | HS7 Birmingham Curzon Street routes join |
| – South | SP192892 | HS7 Birmingham avoiding line joins route from Birmingham Curzon Street to the south |
| • Birmingham Interchange | SP203831 | HS7 (south) diverges from HS2 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.) |
| • Coalpit Heath | ST685803 | HS7 joins alignment of HS4. Non-conflicting junctions allow services from each origin to be routed to each destination. |

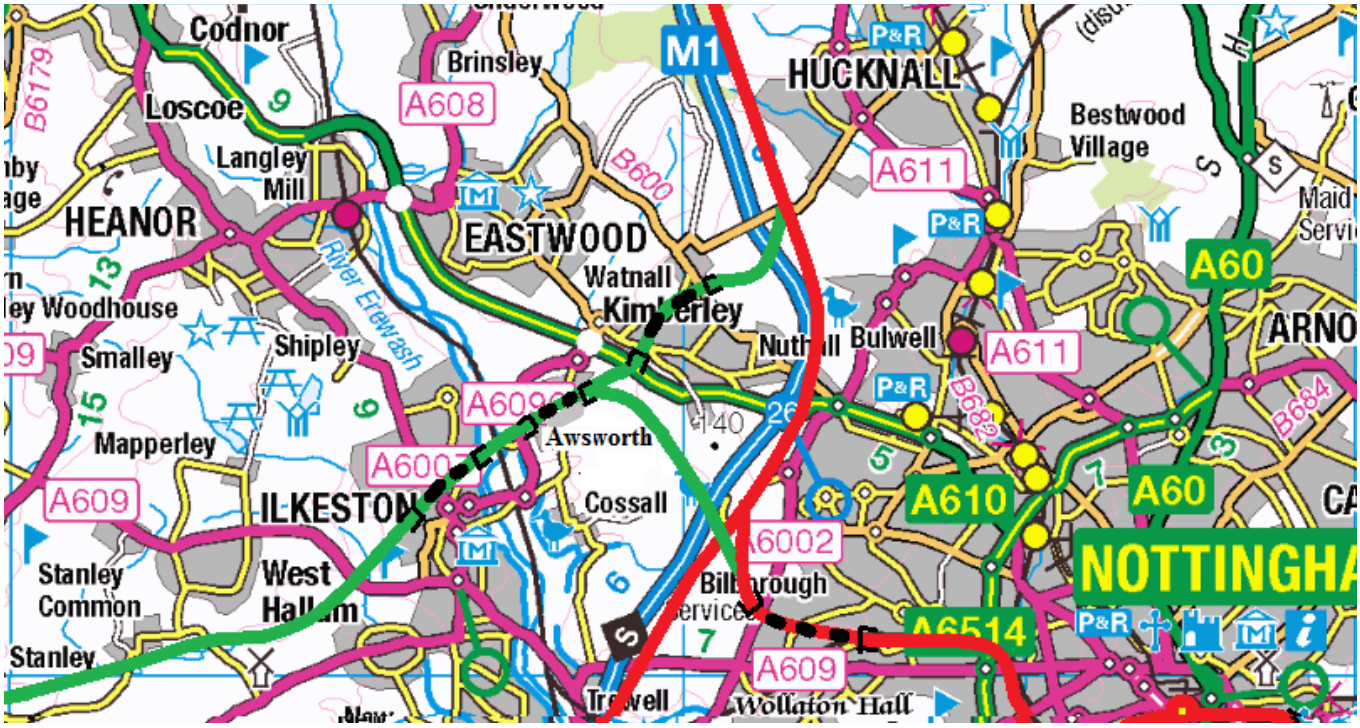
- St. Philip's ST604734 HS7 divides in tunnel; north branch goes to Bristol Temple Meads (Brunel Trainshed) and main line goes to the HS platforms on the east side of the station.

There are various other links between HS7 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context.

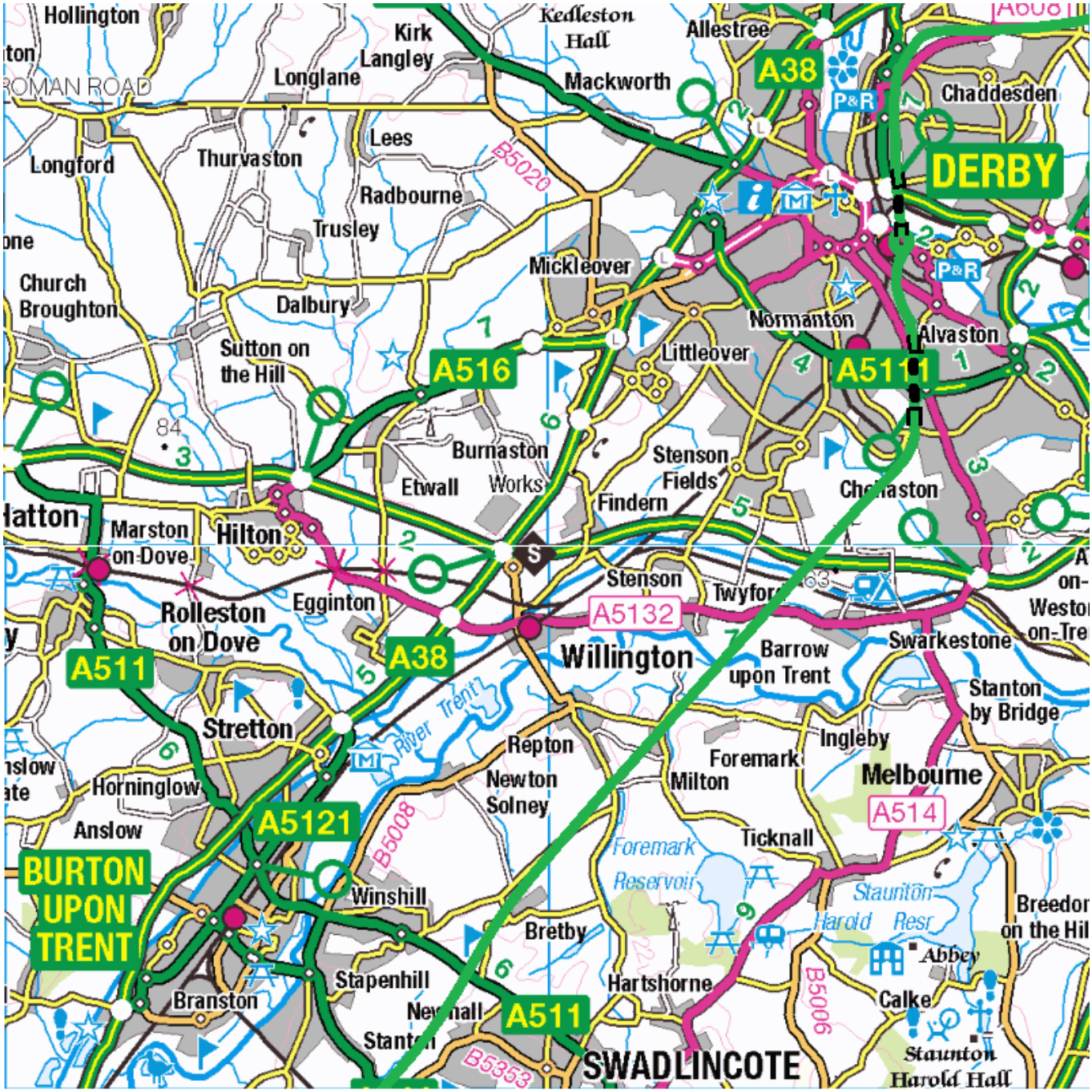
There now follows the definition of the actual route, in several logical sections.

## *1. Nuthall North Junction – Birmingham Curzon Street*

HS7 shares the route of HS3 from Newcastle to Nuthall North Junction (SK514469), where it diverges, and has its own route from there to Plymouth. It takes over the trackbed of the former Great Northern branch from Nottingham to Derby at SK508451, and follows that to near where it crosses the Midland line, north of Derby. A ¾ mile tunnel under Kimberley extends from SK507451 (Main Road) to SK496447 (Church Hill). At Awsworth Junction (SK484444) it is joined by the spur from Strelley Junction (SK512423) on the Nottingham branch of HS3, this passes over the HS3 main line, and completes a HS route between Nottingham and Derby. A ½ mile tunnel under Awsworth itself extends from SK483444 (Gin Close Way, immediately west of the junction,) to SK478442 (A6096). There immediately follows that noted survivor, the splendid Bennerley Viaduct, which, it is sincerely hoped, may be brought back into use (otherwise a short sideways diversion will be required). Just before the viaduct is the course of the currently derelict Nottingham canal; an adequate bridge should be provided, so as not to impede future restoration. Shortly after the viaduct there is a further ½ mile tunnel under Ilkeston, between SK469437 and SK463427. There is the choice of a very short tunnel under the A609, High Lane East, or demolishing perhaps 3 houses; I make no recommendation. These 3, perhaps 4 tunnels are all to avoid housing which has been built since the original line closed, 50 years ago; there are no further obstructions until immediately before Derby. For a route closed for 50 years, this is remarkably




1.1 Nuthall North Junction – Stanley Contains Ordnance Survey data © Crown copyright and database right 2013

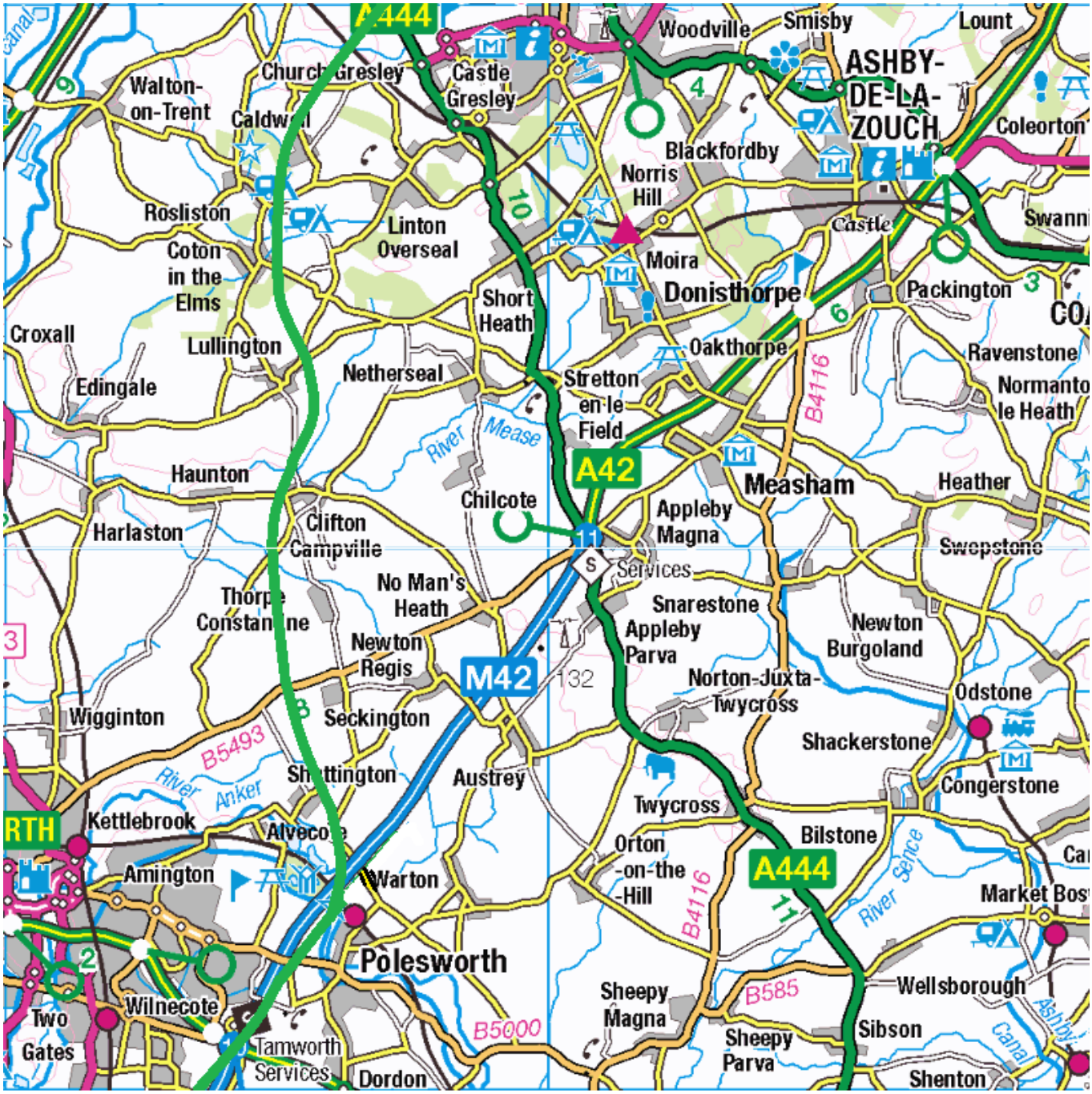



1.2 Derby – Stanton



little obstruction. HS7 thereafter follows the trackbed without further note until it reaches the A61, Sir Frank Whittle Road, at SK363383. Beyond this, the original route has disappeared beneath an industrial estate, however there is plenty of space on the east side of the A61 (and on a very good alignment) as far as SK362370, with a ¾ mile tunnel from there underneath the Derwent to SK362358, emerging (at the appropriate location amongst the tracks, i.e. between the classic routes to Birmingham and London) actually in Derby station. This is in fact a much better approach to Derby than using the original route to join the Midland alignment.

Leaving Derby, HS7 passes through the Litchurch Lane industrial estate on existing tracks and enters a ¾ mile tunnel at SK366338, passing under Osmaston and emerging at SK366323. It veers to the west, passing round the south side of Sinfin (Wilmore Road). It crosses Sinfin Moor and proceeds straight to SK308253, south east of Repton. Continuing in a straight course to Stanhope Bretby (SK285222), it takes over the trackbed of a former mineral branch to SK263193, shortly before that would have joined the

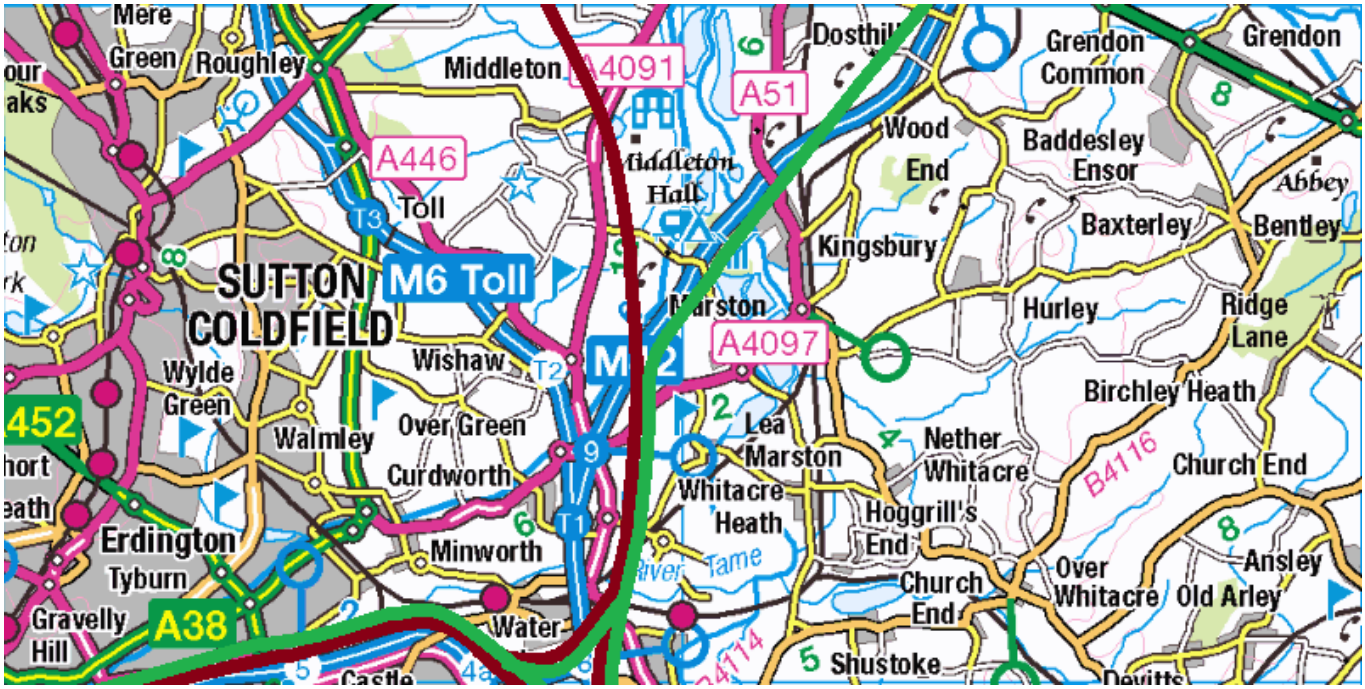



1.3 Church Gresley – Tamworth



Leicester – Burton line. It follows roughly the course of the 250ft contour, passing to the east of Rosliston, Coton in the Elms and Lullington, then to the west of Clifton Campville, Thorpe Constantine and Seckington, and finally to the east of Shuttington (a particularly nice selection of village names) it joins the route proposed in the HS2 plans for the eastern arm of the HS2 ‘Y’ at SK258036 and follows that all the way to Birmingham Curzon Street. See appendix F for the precise track layout in this area; it’s rather complicated!

See also appendix C on the impact on HS7 of the Coventry Variant of HS2. This affects the sections around Birmingham.



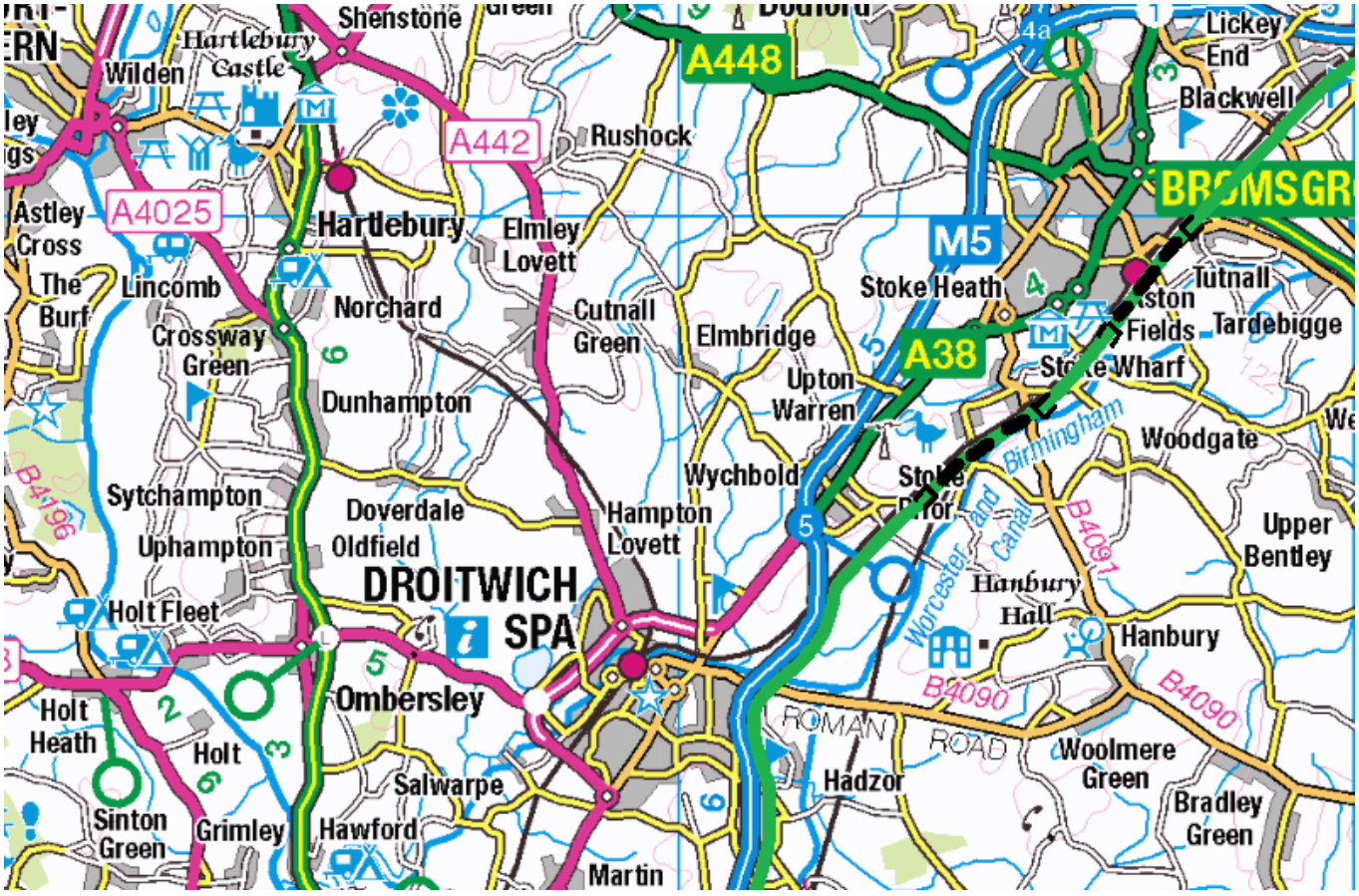

1.4 Dosthill – Gravelly Hill Contains Ordnance Survey data © Crown copyright and database right 2013


1.5 Water Orton – Birmingham Contains Ordnance Survey data © Crown copyright and database right 2013

## 2. *Birmingham – Worcester*

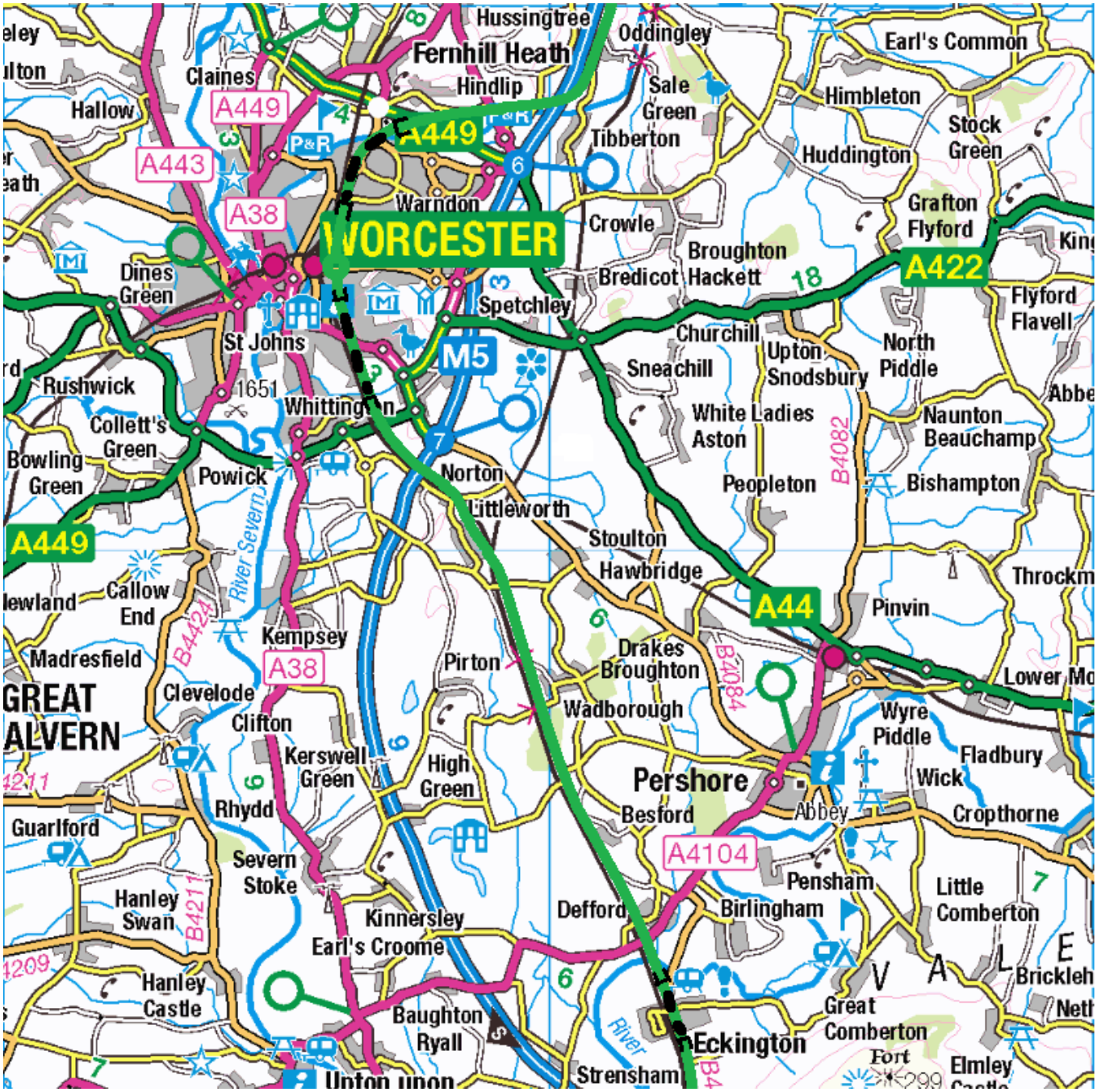
As noted above, HS7 has its own pair of tracks throughout the Birmingham region, duplicating those of HS2 on the common routes. HS7 and HS2 offer cross-platform interchange at Birmingham Interchange, with HS7 tracks on the outside, where, immediately on leaving the station, HS7 enters a 7 mile tunnel, initially curving sharply to the west, (which doesn't matter as all trains stop there,) passing beneath


2.1 Eastcote – Barnt Green Contains Ordnance Survey data © Crown copyright and database right 2013




2.2 Bromsgrove – Droitwich Spa Contains Ordnance Survey data © Crown copyright and database right 2013

Solihull and Shirley, and emerging at SP101782, just west of Shirley station. It continues in a more or less straight line, crossing the Alcester Road at SP081780 – the only bit not built-up – and skirting round the south of Hawkesley (passing through SP45768), on to SP027767, near High Hill. It then veers to the south west and joins the Midland route on the eastern side of the alignment at Cofton Hall, SP012750. Average gradients on this section are 1 in 370 through the tunnel, 1in 120 thence to High Hill, and 1 in 66 descending to Cofton Hall.

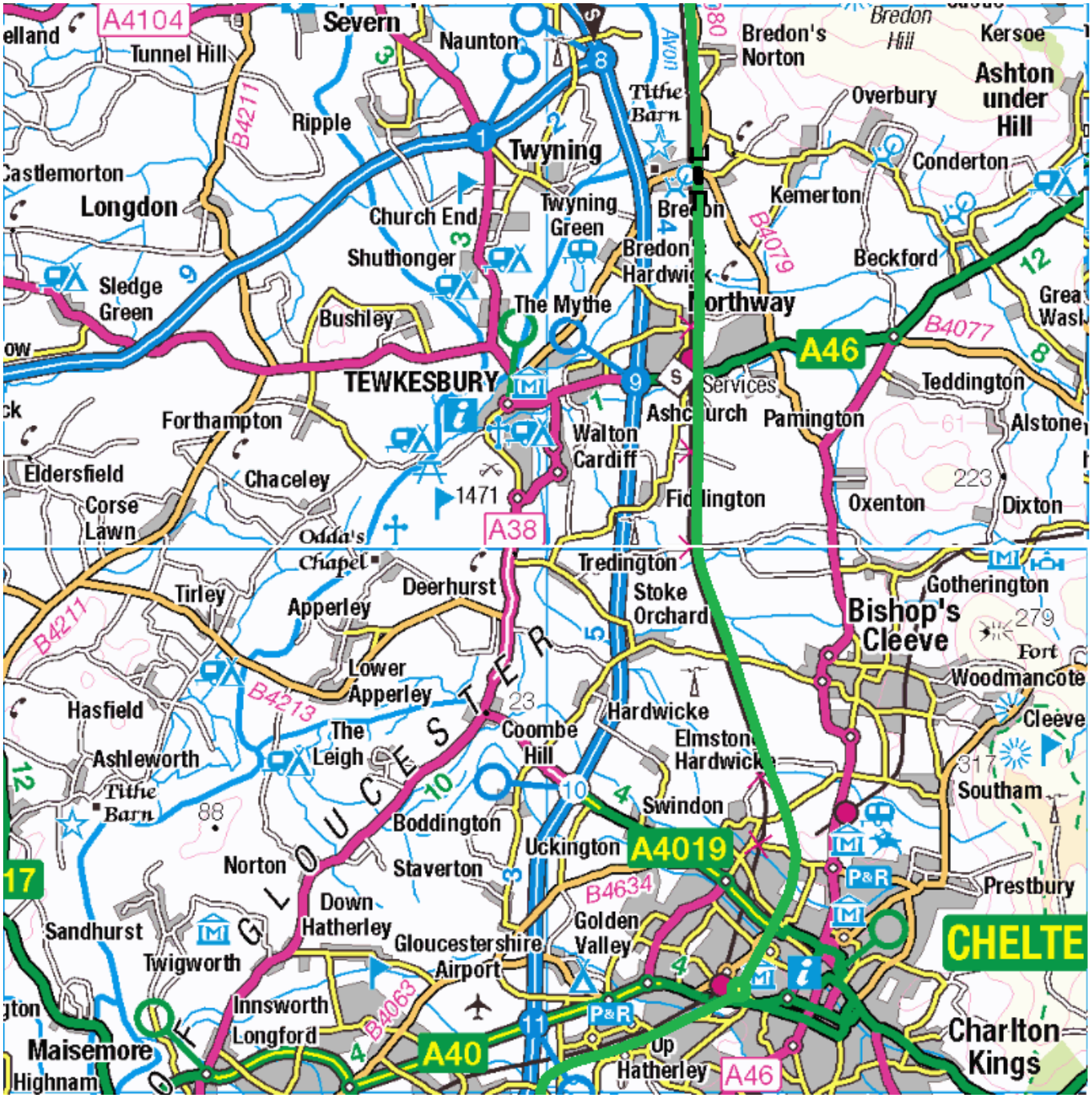



2.3/3.1 Worcester – Eckington Contains Ordnance Survey data © Crown copyright and database right 2013

HS7 follows the east side of the Midland alignment on to the Droitwich route, as far as the M5 crossing at SO920644. During this section it tunnels for ½ mile under Barnt Green, between SP009741 and SP045768, for 1 mile under Bromsgrove between SO976701 and SO966689, and for ½ mile under Stoke Works between SO951672 and SO940664. In all these cases, the tunnelling is to avoid housing, but in the first and third cases also advantageously passes beneath a junction. Some warehouses need relocation near Stoke Pond (SO961682). HS7 follows the east side of the Droitwich line until SO920644, as noted

above, where it diverges to follow the east side of the M5. It would be very difficult to take the route through Droitwich without extensive tunnelling or heavy demolition, hence the diversion. It follows the M5 until just before it crosses the Worcester and Birmingham canal. HS7 crosses over the M5 at SO903584 and follows a little to the north of the canal until SO870578, where it enters a 1 mile tunnel under the Blackpole industrial estate and a built-up area alongside the Worcester line, emerging at SO862564 (King George's Field) on the east side of the Worcester route. This it follows (with a tunnel at the same place under Rainbow Hill) all the way to Shrub Hill station, taking over a pair of goods lines approaching Shrub Hill, to avoid the junction from Foregate Street. There is plenty of railway land on the east side of Shrub Hill station, for a full HS station.

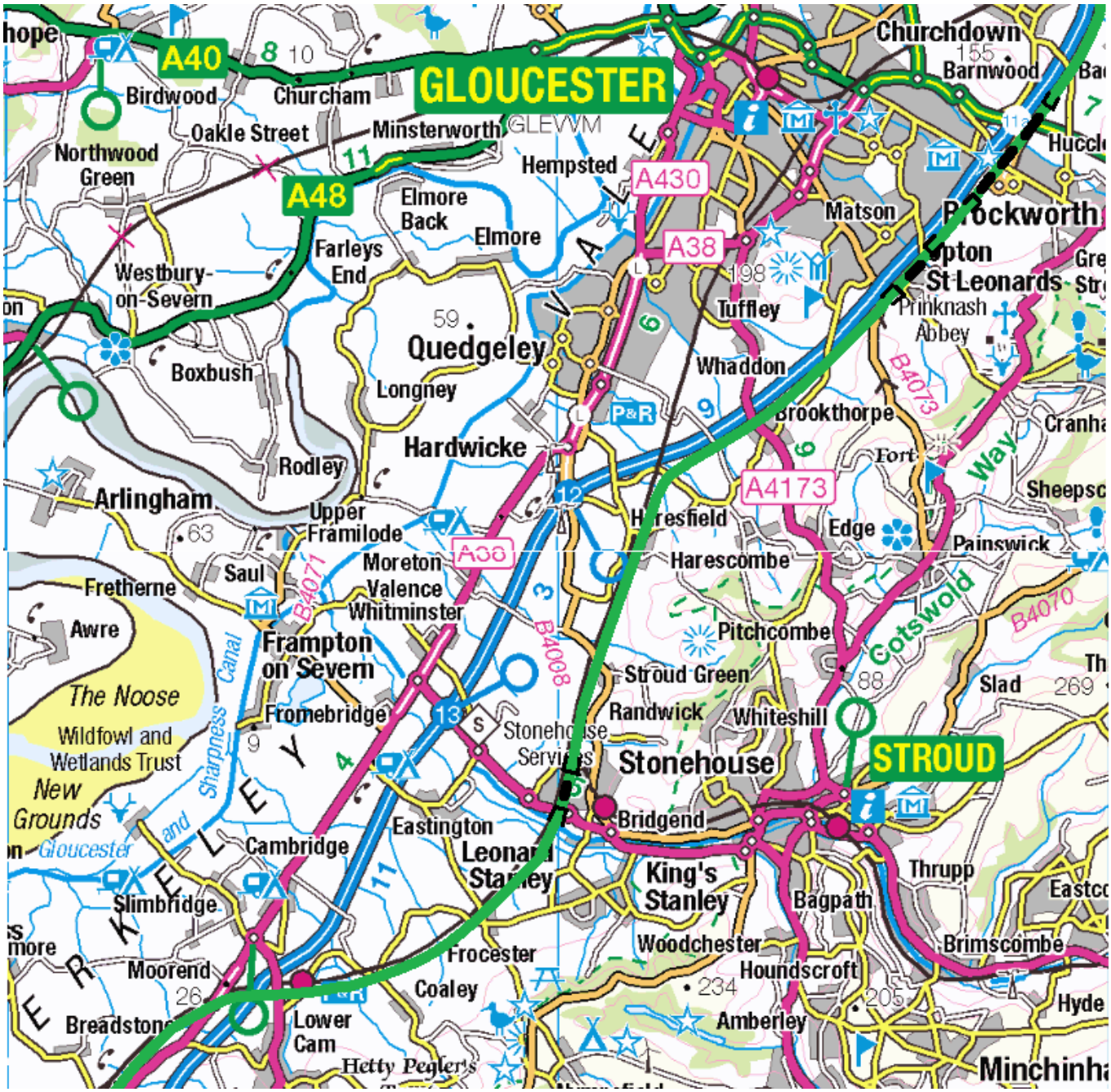
## *3. Worcester – Bristol Parkway*




3.2 Bredon – Cheltenham

The route south from Worcester follows the east/north side of the alignment all the way to Norton. It is in tunnel between SO860547 and SO864533, purely to avoid housing, but apart from this, that side of the alignment is completely unobstructed. At Norton (SO886509) it crosses on viaduct the Cotswold and Birmingham and Gloucester lines, joining the east side of the B&G at SO889499.

It follows the east side of the alignment all the way to Brockhampton (SO939259). In this distance there are only two obstructions, due to housing, and tunnelled under, each ¼ mile, at Eckington, between SO920417 and SO923411, and at Bredon, between SO926370 and SO926365. From Brockhampton, HS7 veers away from the Birmingham and Gloucester alignment to join the alignment (taking over the trackbed) of the GW route from Honeybourne, just south of Hunting Butts tunnel, at SO947244, and follows that through Cheltenham to its own station adjacent to Lansdowne (the alignment and all the bridges except one are still in place). I see merit in the idea of a racecourse station at Hunting Butts – just for special traffic associated with meetings.




3.3 Churchdown – Lower Cam

The line used to be 4 track between Cheltenham and Stonehouse Junction (the Midland and GW each having their own tracks. Two tracks were removed in the '60s (I presume) and in the intervening period, the spare alignment has been severely encroached on. In particular, the area surrounding the alignment through Gloucester is very congested. Accordingly the M5 alignment is followed to pass round the south of Gloucester. HS7 diverges from the Birmingham and Gloucester alignment at SO902205 and joins the east side of the M5 alignment at SO898201. It follows the M5 until it intersects with the Gloucester – Bristol line at SO819118. Two tunnels are nonetheless needed on this section, to avoid built-up areas which encroach surprisingly closely to the motorway – 1½ miles between SO888183 and SO873164 (this also passes under a motorway junction, which I don't normally consider), and ½ mile between SO866157 and SO861150.

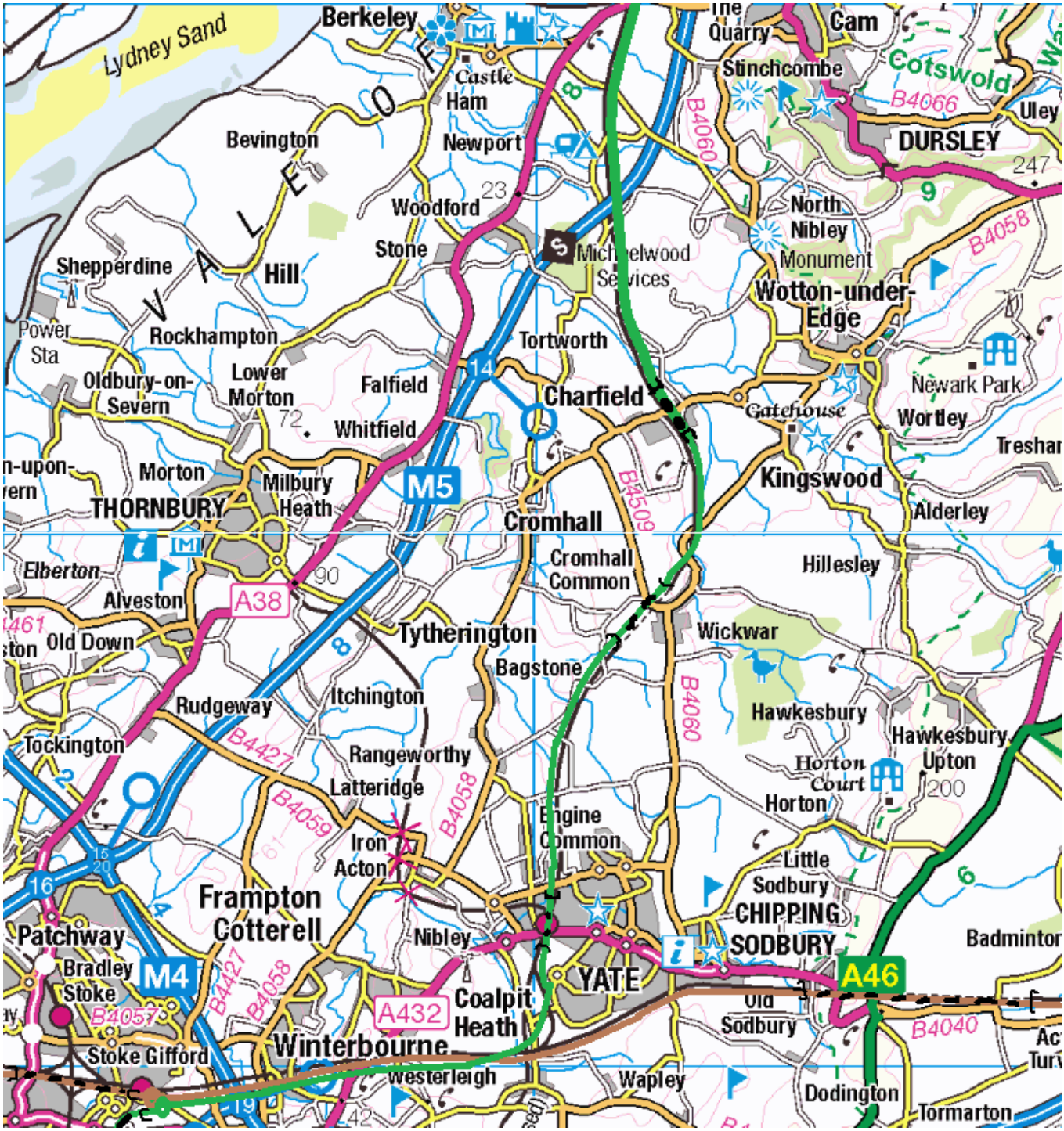
HS7 rejoins the Bristol – Gloucester route at SO818115, and follows the east side of the alignment until Wickwar. It tunnels for ½ m under Stonehouse, between SO801060 and SO798052 (not forgetting to provide an adequate bridge over the Stroudwater Navigation, currently under restoration). It tunnels for ½ mile under Charfield, between ST721928 and ST727919. It switches to the west side of the alignment approaching Wickwar, at ST728895, and stays on that side until Yate, where it tunnels for ½ m under the station, between ST703837 (west side) and ST701824 (east).

HS7 joins HS4 at ST685803, just before Coalpit Heath, the westbound line crossing over HS4 and running along the south side. HS4 and HS7 run together as a 4-track section, paired by direction, thence to Bristol Parkway. Note that this is a route junction, but not a track junction. Non-conflicting junctions between HS4 and HS7 tracks are provided at Pye Corner Junction, just east of Bristol Parkway (where there is also a connection from HS4 and HS7 to the classic tracks).These arrangements allow trains from either London or the W. Midlands to be routed on the appropriate line to Bristol Parkway for either South Wales or Bristol/SW and for trains from South Wales or Bristol/SW, on the appropriate line from Bristol Parkway to be routed to either London or the Midlands. A suitable layout is shown in appendix D.

The original idea was to have the track junctions at Coalpit Heath, but that would require the fastest junction trackwork available, and also impose time penalties on the services. By relocating the track junctions westwards, to where speed will already have been seriously reduced, in readiness for the Bristol Parkway stop, perfectly ordinary pointwork is suitable, and no time penalties are incurred..

The point of all this (anticipating the Service Plan) is that trains from London serve S. Wales and Bristol/SW alternately, and trains from the W. Midlands serve Bristol/SW and S. Wales alternately. These services make cross-platform connections at Bristol Parkway HS. There are no conflicting movements between the two groups. In the ideal situation, trains from London and the W. Midlands approach Bristol Parkway at full line speed, arriving simultaneously, and likewise departing simultaneously, whatever their destination. Trains to Bristol/SW always depart from platform HS-1 (the most southerly), and those to S. Wales always depart from platform HS-2.

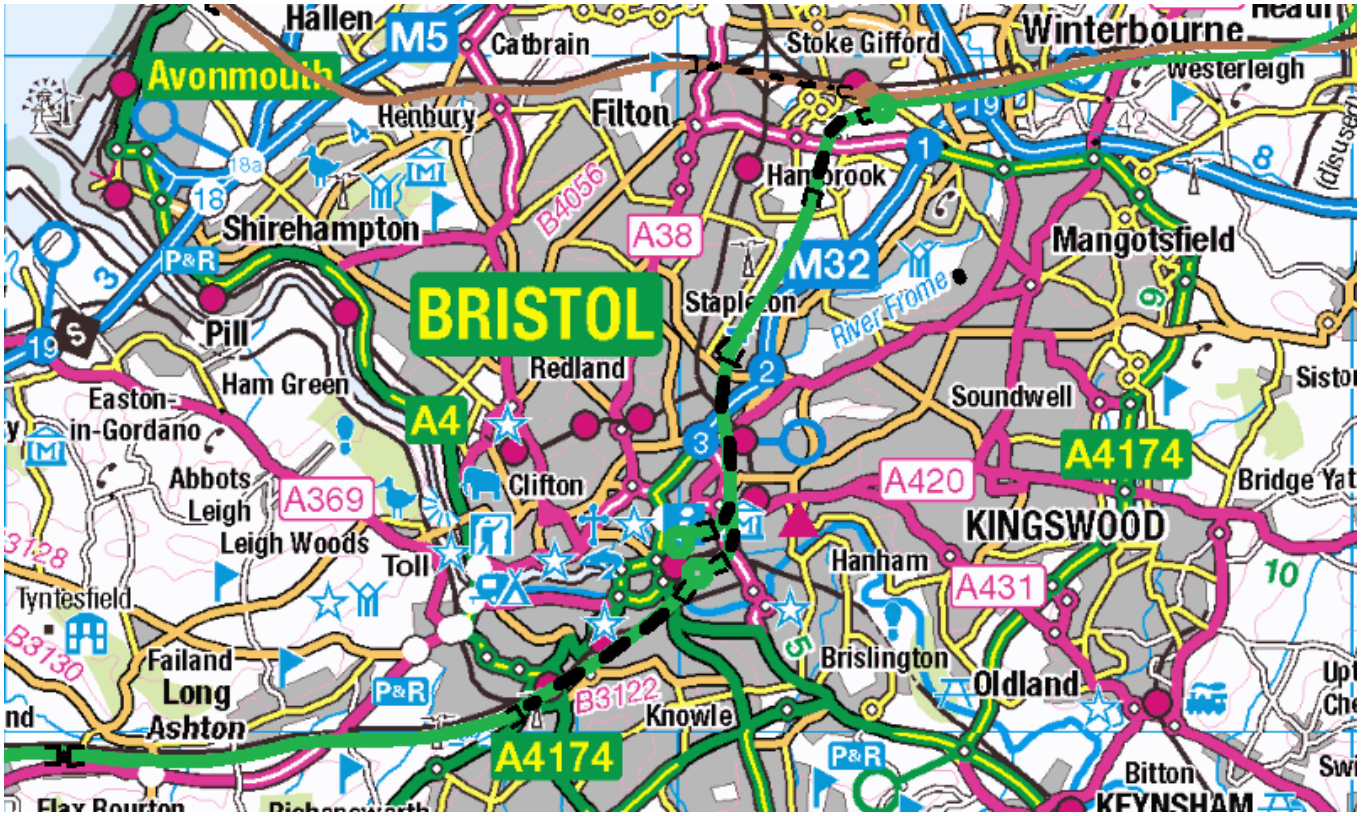
Likewise trains from S. Wales and Bristol/SW approach Bristol Parkway at full line speed, ideally arriving simultaneously, likewise departing simultaneously. But trains **from** S. Wales always arrive at platform HS-3 and those from Bristol/SW always arrive at platform HS-4. The sorting by destination is done post hoc, at Coalpit Heath. (I would have liked to have eastbound trains also sorted by destination, but there simply isn't room for (half of a) Coalpit Heath-type junction west of Bristol Parkway.)




3.4 Berkeley Road – Bristol Parkway 

## *4. Bristol Parkway – Bristol Temple Meads*

Immediately west of Bristol Parkway, HS4 and HS7 diverge. HS7 enters a 1 mile tunnel immediately, at ST621797, and emerges at ST616780. It skirts the eastern edge of Lockleaze, and enters a 2 mile tunnel at ST604756, all the way to Temple Meads station. At St. Philip's Junction, ST604734, the line divides (still in tunnel). The northern branch emerges from tunnel at ST600728, crosses the Avon at ST599726 and enters the Brunel Trainshed platforms at Bristol Temple Meads. These are enlarged to GC gauge, and become the exclusive province of HS7, used by the premier Bristol expresses from London and Birmingham, very deluxe. The southern branch (actually the main line) is quite different. The area




4.1 Bristol Parkway – Long Ashton 

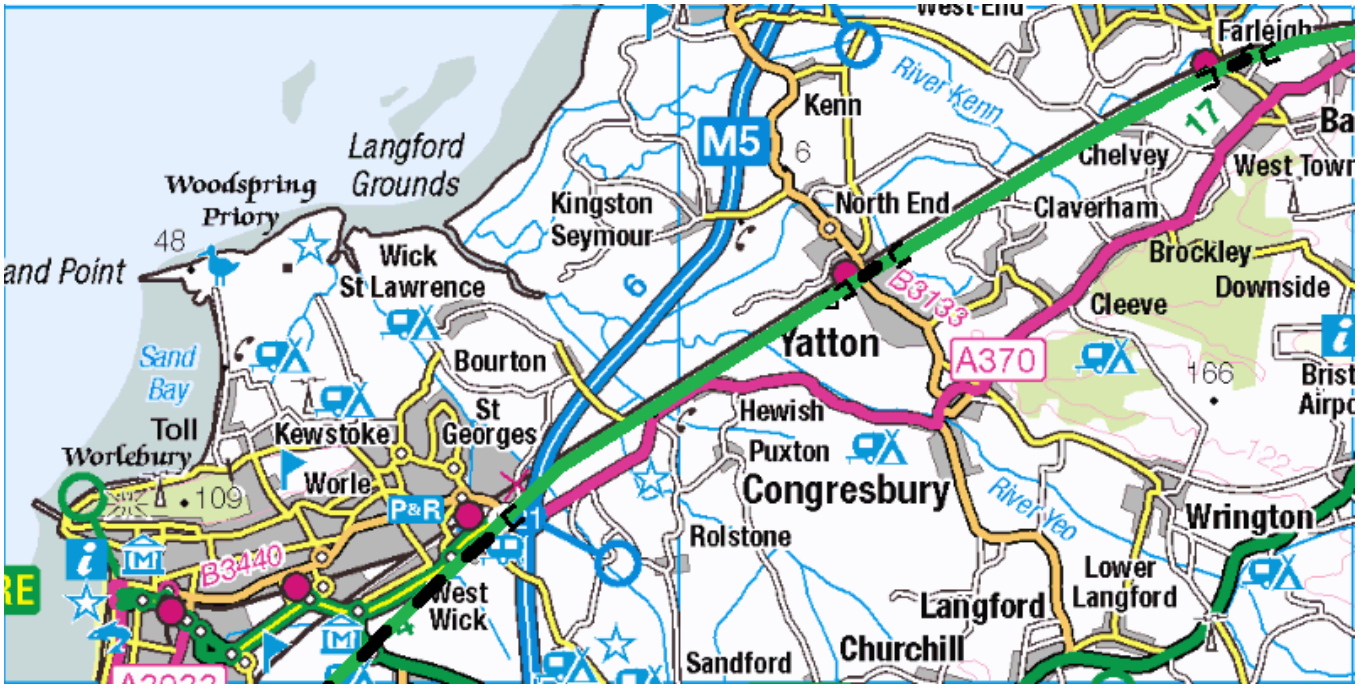
adjoining Bristol Temple Meads station to the east is currently one of appalling dereliction. The old cattle market and the Post Office building closed almost a decade ago, since when the area has simply festered, a public scandal and a disgrace to Bristol (I am by no means alone in this opinion!). What better location for a new HS station, promoting its regeneration, and making it the prime location in the city? Accordingly the HS7 main line emerges from tunnel at ST602726, between Kingsland Road and Gas Lane, crossing the Avon at ST599725 and entering the new Bristol HS station.

## *5. Bristol Temple Meads – Taunton*

Leaving Bristol HS, HS7 immediately enters a 2½ mile tunnel between ST597721 and ST515697, emerging at Bedminster Junction, on the south side of the alignment. A very short (¼ mile) tunnel under Cambridge Batch between ST522697 and ST515697, a ½ mile tunnel under Backwell between ST484694 and ST478692, and a further ½ mile tunnel under Yatton between ST428663 and ST423659 are all to avoid housing. In addition, a few farm buildings will need to be relocated at Claverham Court (ST445673).

There are so many separate obstructions on the section round the south east of Weston-Super-Mare that it simply isn't worth trying to avoid them individually. Accordingly a single tunnel of 4½ miles is proposed between ST378632 and ST325577.

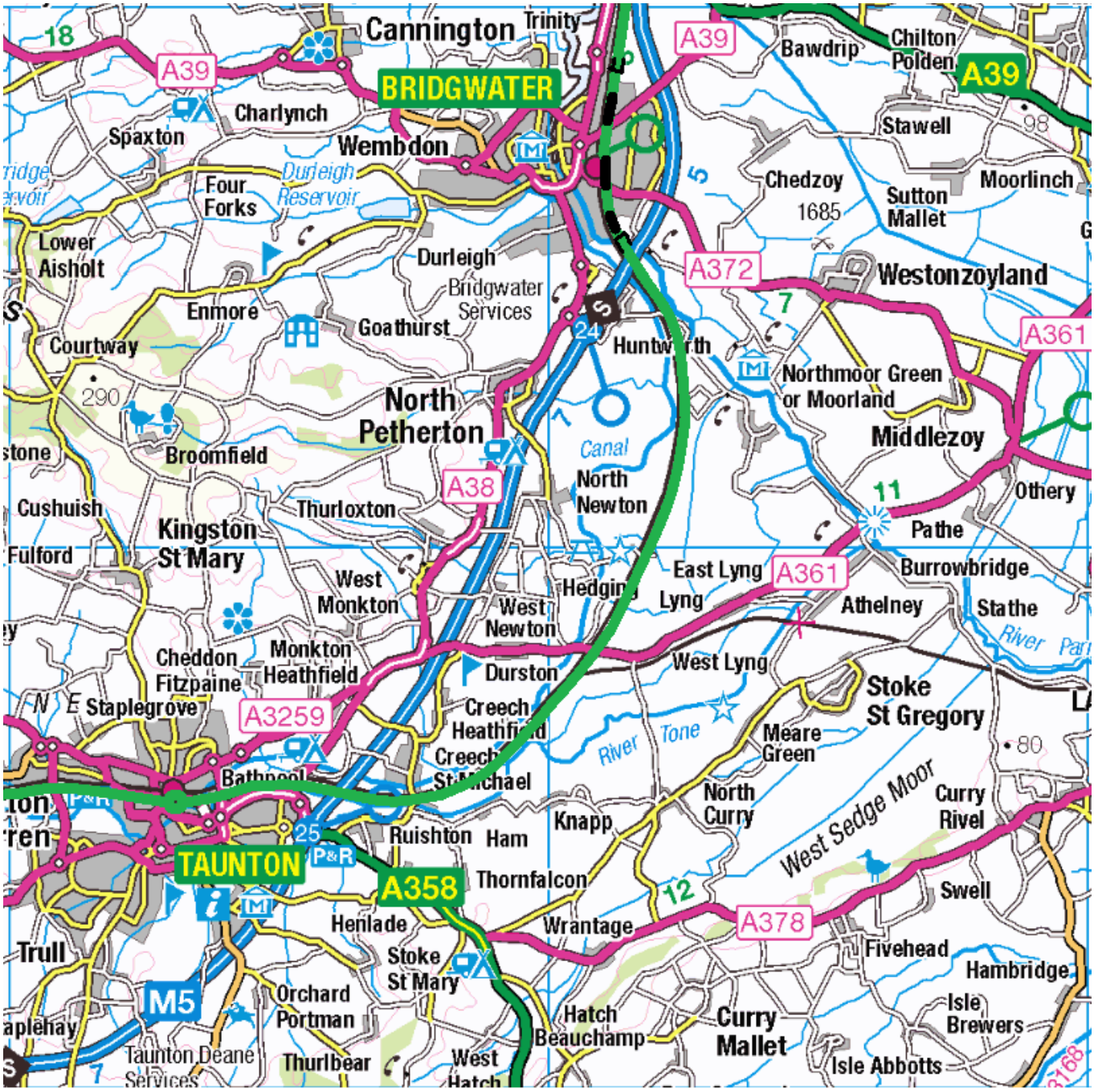
Thereafter there are no obstructions beyond the odd farm building at Batts Bow Bridge (ST321461) until Bridgwater, which has a 2 mile tunnel between ST310387 and ST310359. Then a bit more agricultural relocation at Bankland Farm (ST316299) and that's it all the way to Taunton. Just before Creech St. Michael (at, say, ST282257) the HS tracks cross to the middle of the alignment, (thus the classic tracks are on the outside of a 4-track railway). There is plenty of room for 4 tracks all the way to Taunton and




5.1 Bristol Parkway – Long Ashton 

beyond. HS7 takes over the island platform in the middle of the alignment at Taunton station, suitably modified to GC gauge. (Two platforms are certainly adequate here.)


5.2 Weston-Super-Mare – Puriton

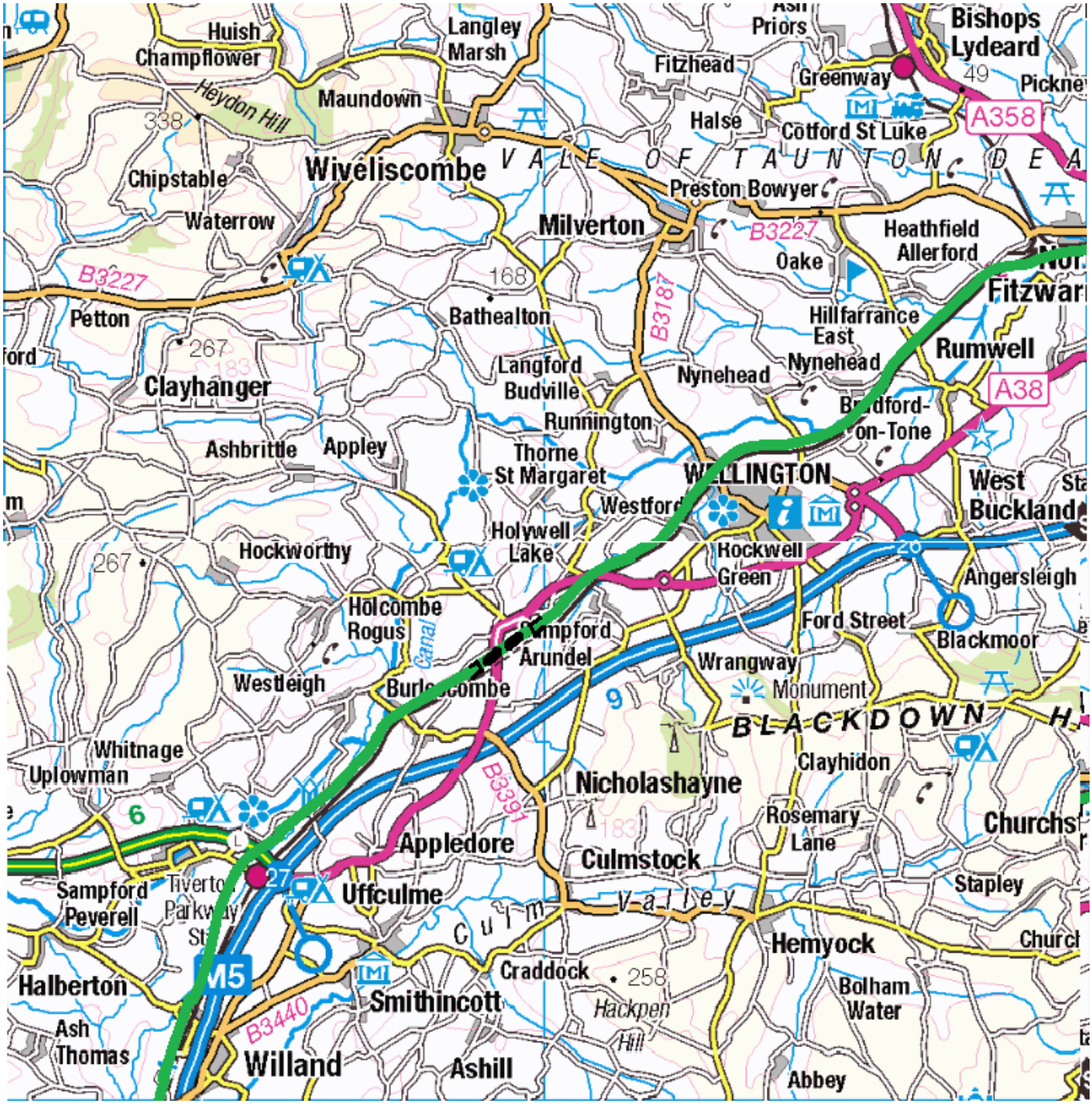



5.3 Bridgwater – Taunton



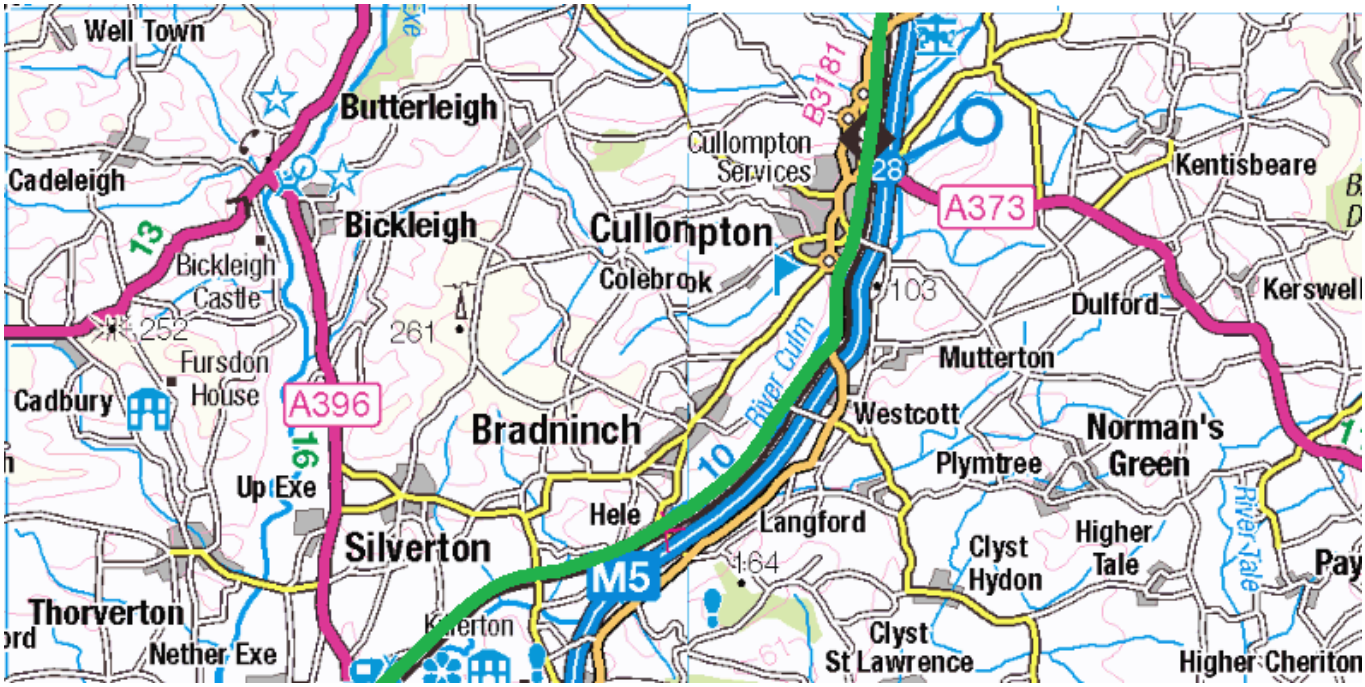
## *6. Taunton - Exeter*

HS7 continues in the centre of the 4-track alignment until Norton Fitzwarren (ST188254), where it switches to the west/north side. (The only reason not to continue in this fashion all the way to Exeter is the problems it would cause at Whiteball Tunnel – there's plenty of room for it.) A little agricultural relocation will be required at Ash Farm (ST155223). The alignment is almost completely free through Wellington; I think it may be necessary to demolish one house on Milverton Road (because HS7 gets uncomfortably close to it, rather than actually through it). It may also be necessary to demolish 2 or 3 houses in Westford (ST123203) and relocate a farm at Beam Bridge (ST108194). HS7 has its own Whiteball Tunnel adjacent to the classic one. A very short tunnel will be required at Great Fossend, or demolish a row of 4 houses and relocate a warehouse (ST072169). A slight diversion (of say 200 yards)

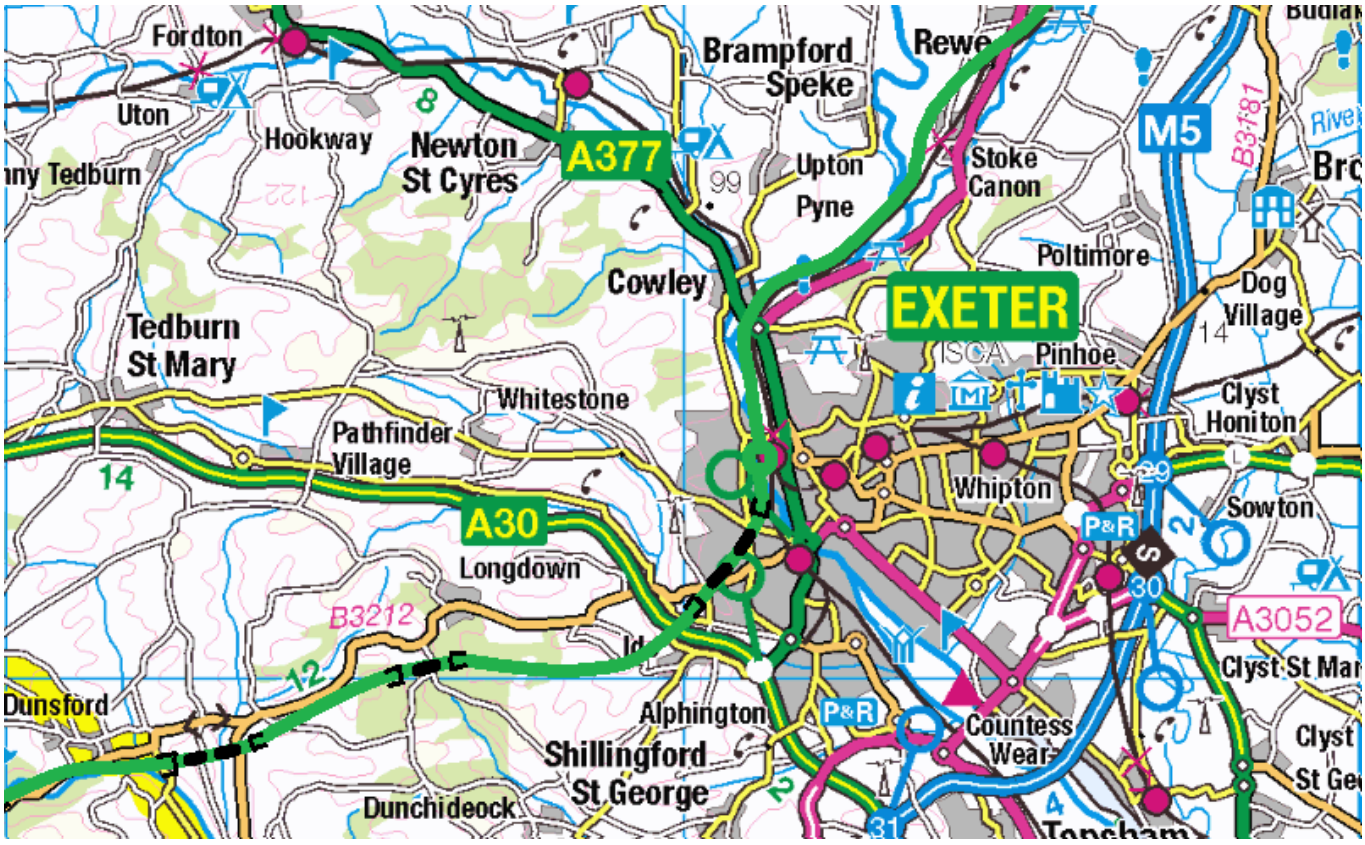



6.1 Norton Fitzwarren – Willand 

to the west is desirable at Tiverton Parkway, between ST055149 and ST042133, say, to avoid the station building and car park, which are on the west side of the alignment. There are already 4 tracks through the former Tiverton Junction station; the classic tracks will need to be slewed to the east to make room for the HS tracks, and the freight passing loops relocated a little to the south. A further slight diversion to the west is required, between SX943992 to SX934976, say, (which actually gives a mild improvement to the alignment,) to avoid buildings at Stoke Cannon. Thereafter there are no obstructions into Exeter. It would be desirable to carry the line on a low viaduct from just south of Stoke Cannon to a mile or so north of Exeter St. David's because of the tendency to flooding in this area.




6.2 Cullompton – Silverton Contains Ordnance Survey data © Crown copyright and database right 2013

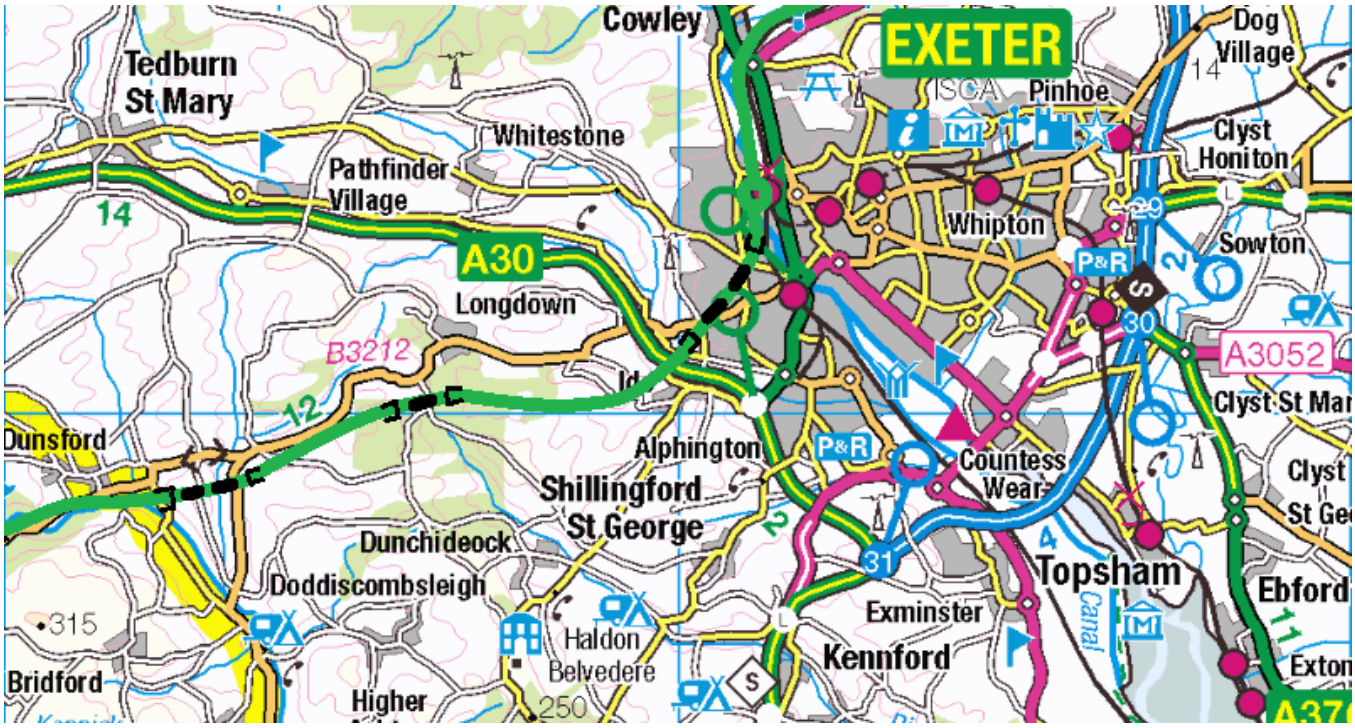



6.3 Rewe – Exeter Contains Ordnance Survey data © Crown copyright and database right 2013

# 7. *Exeter – Plymouth*

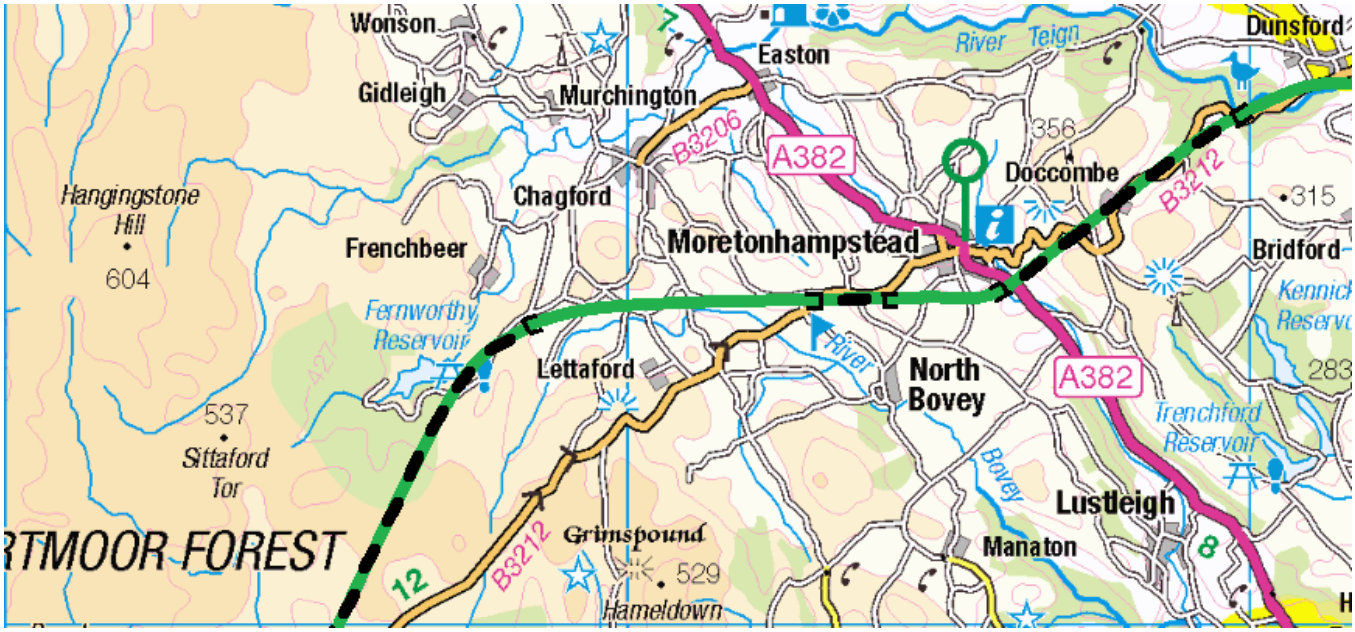
There is no easy solution between Exeter and Plymouth (or it would have been built already).

Given a sufficiently generous budget, my solution would be to take it in an essentially straight line, the shortest route possible, directly across (or under!) the middle of Dartmoor. Those who think this manifestly insane are referred to appendix A, which demonstrates its essential practicability in engineering terms. In fact, the real difficulty on this section is the extraordinarily complex landscape immediately west of Exeter; once you've fought your way through to Moretonhampstead, the way across Dartmoor is pretty obvious.




7.1 Exeter – Dunsford



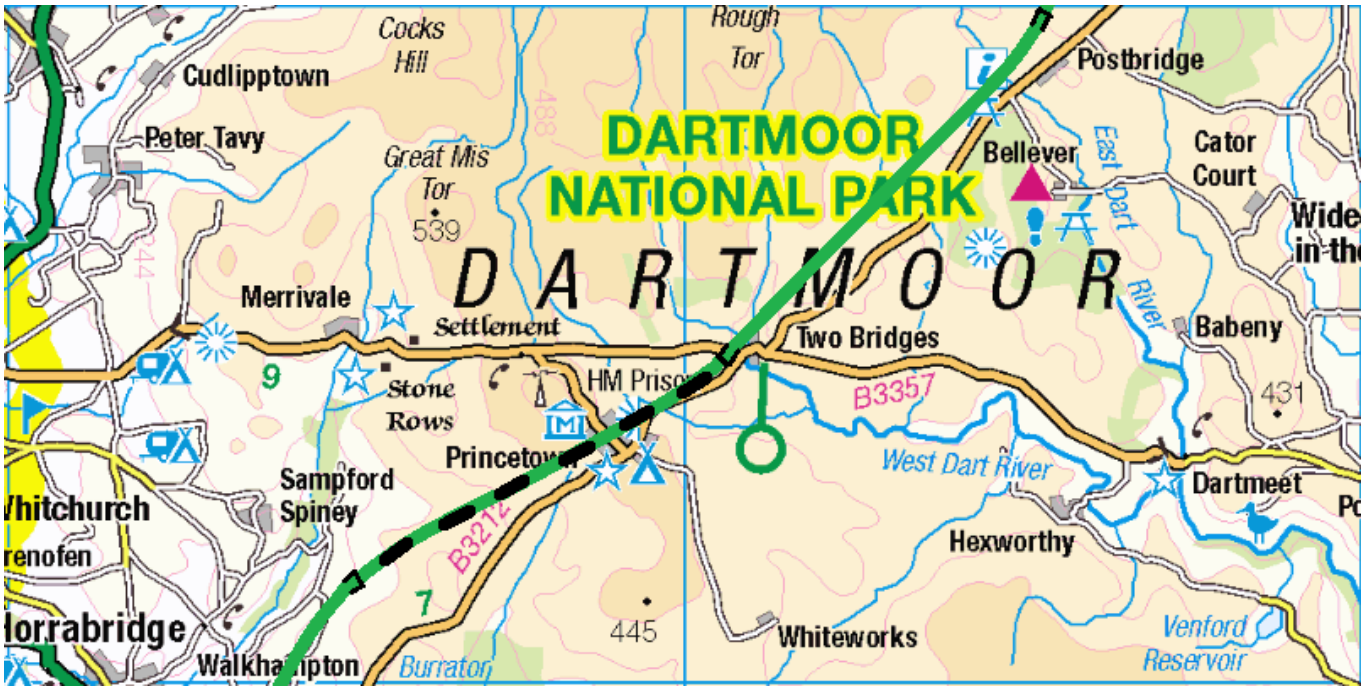



7.2 Dunsford – Moretonhampstead

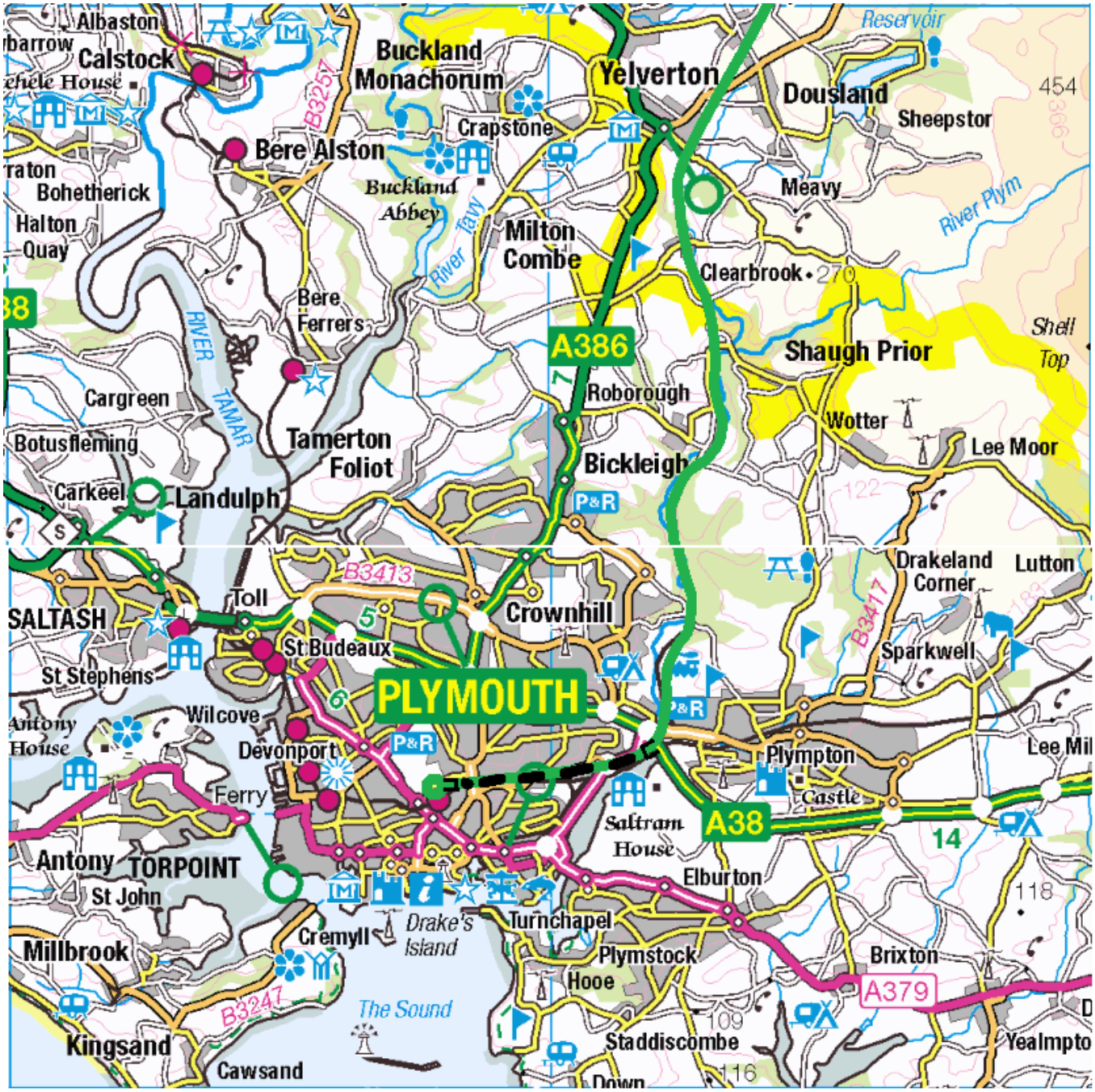
HS7 diverges from the GW alignment immediately on leaving Exeter St. David's. It crosses the Exe slightly upstream of the existing bridge, cuts across some allotments and enters a 1 mile tunnel at SX909924, emerging at SX900910. Continuing to SX888903, it joins the trackbed of the long-closed line between Exeter and Newton Abbot via Chudleigh, and follows that (with variations to improve the alignment) until Farrant's Bridge (SX836894). Gradients on the two sections between the allotments and the disused line are 1 in 66 and 1 in 80. On the re-used alignment, Perridge tunnel, ½ mile between SX865904 and SX857903, is enlarged to GC gauge and a second bore provided alongside. A 1 mile tunnel between Farrant's Bridge (SX834894) and Reedy (SX821892) leads to Dunsford. HS7 passes to the south of Dunsford, crossing the River Teign at SX816887 and following the south bank until the river turns sharply north, and HS7 enters a 3 mile tunnel to Moretonhampstead, between SX797883 and SX760855. Between Farrant's Bridge and the tunnel, the alignment is essentially level, at around 250ft altitude, while through the tunnel the gradient is 1 in 53. HS7 passes around the south of Moretonhampstead, following the course of Wadley Brook, to a further 1 mile tunnel between SX740856 and SX720850, and following the course of the (very young) River Bovey to Shapley (SX683848). The average gradient between Moretonhampstead and Shapley is 1 in 60.

HS7 now enters a 4 mile tunnel to Postbridge, between Shapley and SX652798, (gradient 1 in 141,) then following the 1150ft contour to Two Bridges, 4 miles essentially level. A 4 mile tunnel leads from Two Bridges, at SX606750, to a point on the 750ft contour, above Ward Bridge, at SX548715. It descends along the side of the hill, passing to the west of Walkhampton, and through the saddle between Lake and Yelverton, joining the trackbed of the former Launceston – Plymouth branch at SX521665, following that (with easing of curves) all the way to Marsh Mills, where it joins the classic route to Plymouth – amazingly, there are no obstructions. The average gradient from Two Bridges to the tunnel exit is 1 in 63, and from there to joining the trackbed south of Yelverton is 1 in 92.

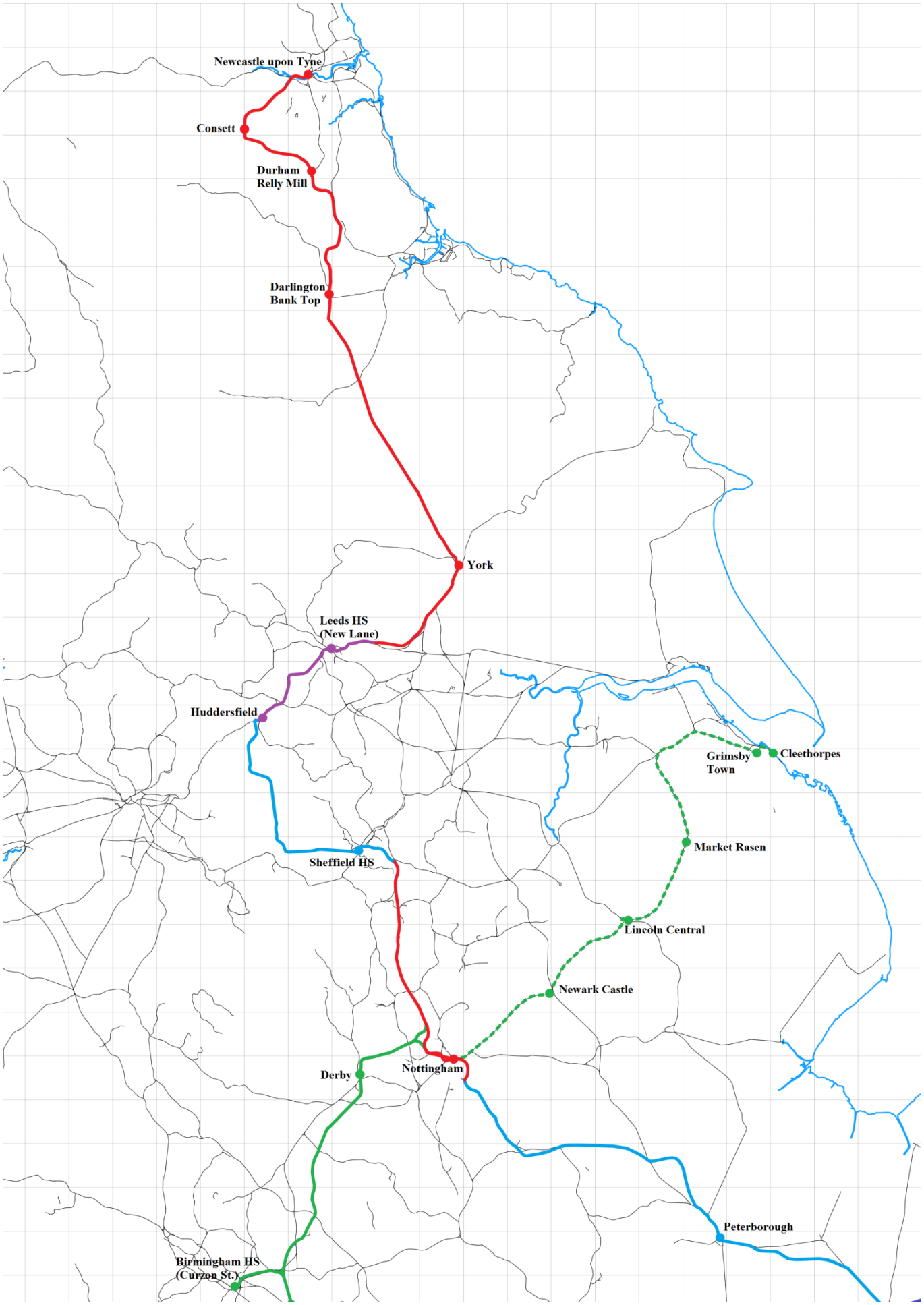
The final section into Plymouth station is far less accommodating – there's no room at all for extra tracks. So it will have to be a 2 mile tunnel from SX517563 to SX479555, with the HS platforms on the north side of the station.



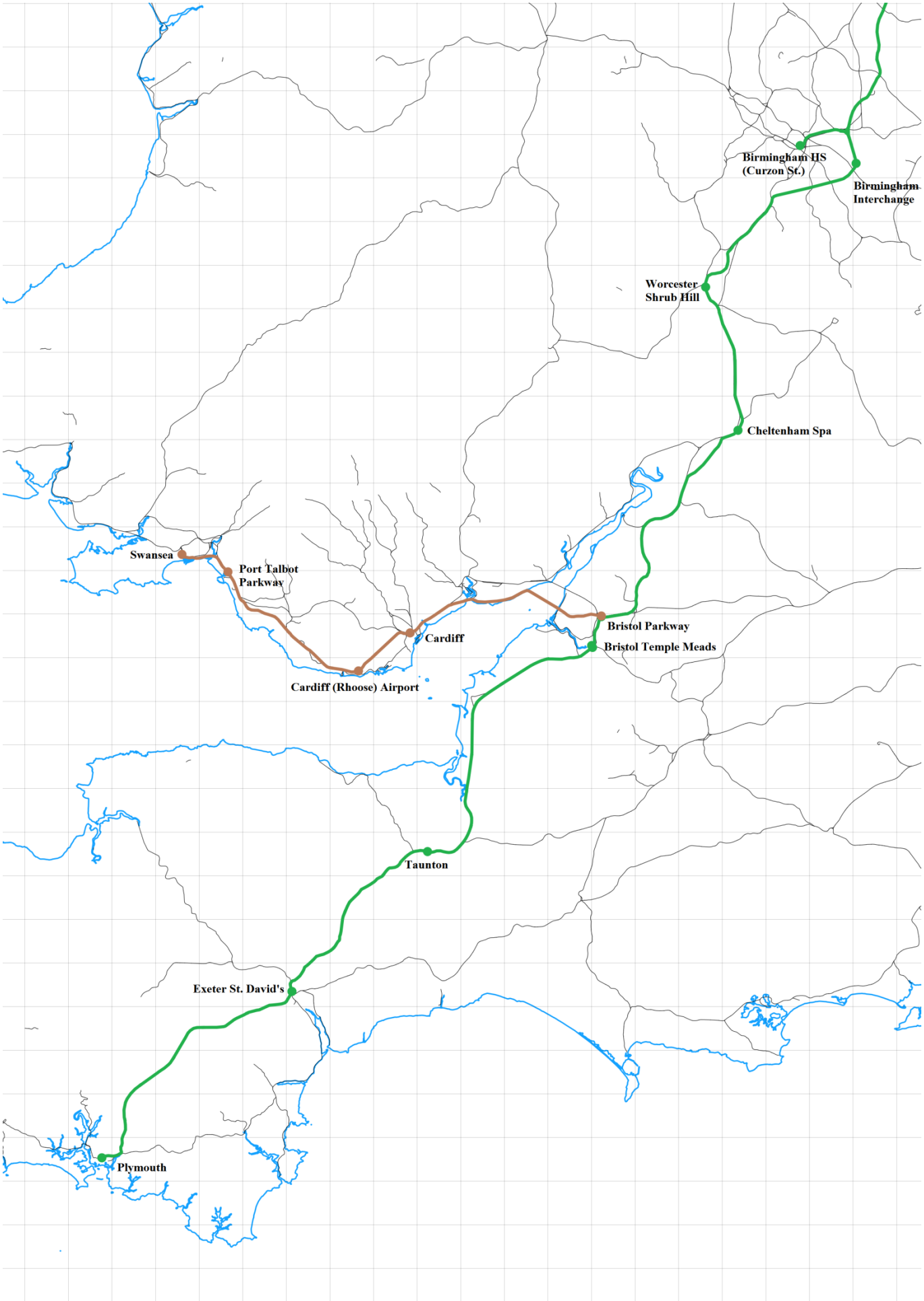

7.3 Postbridge – Walkhampton



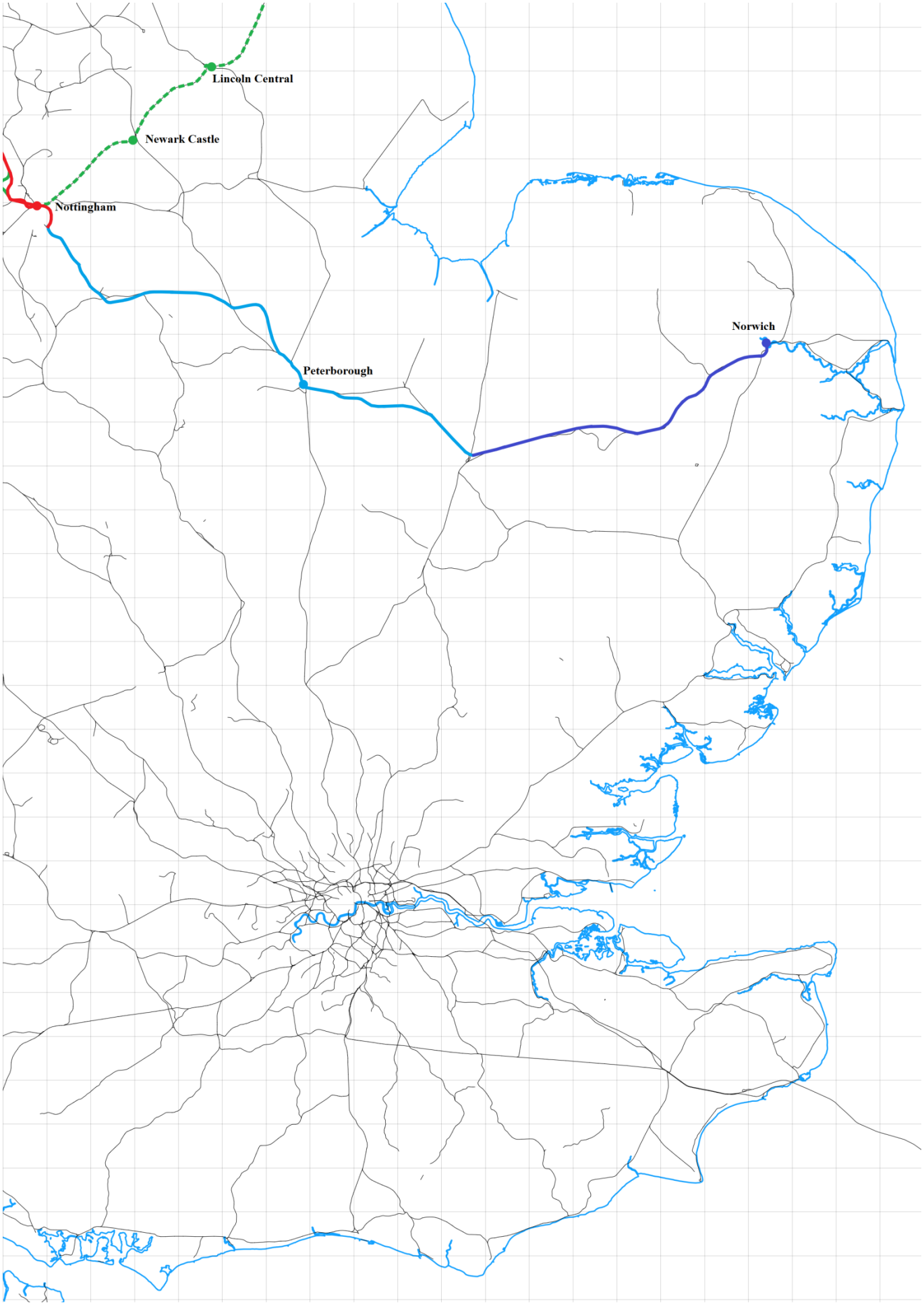

7.4 Yelverton – Plymouth



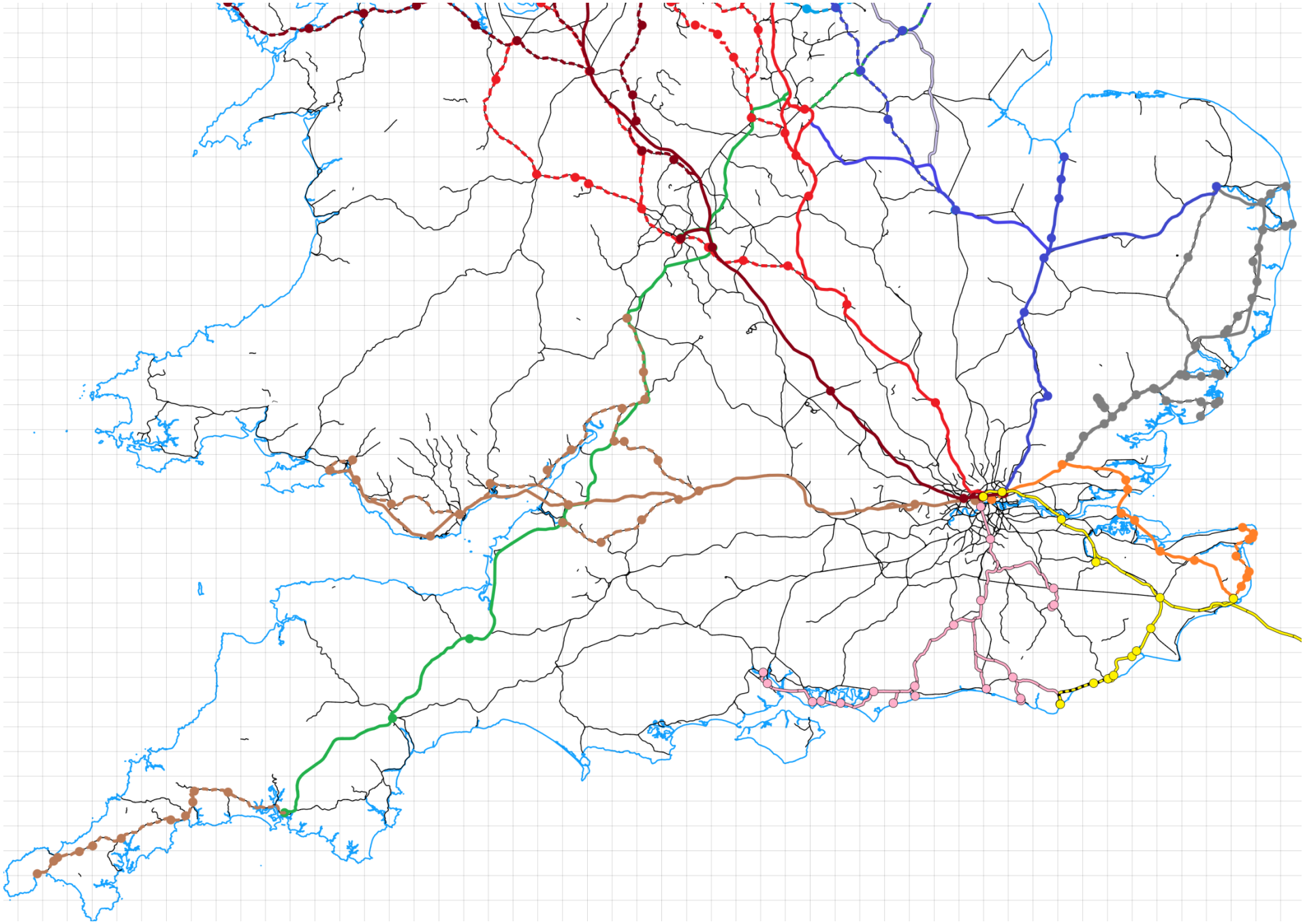

 



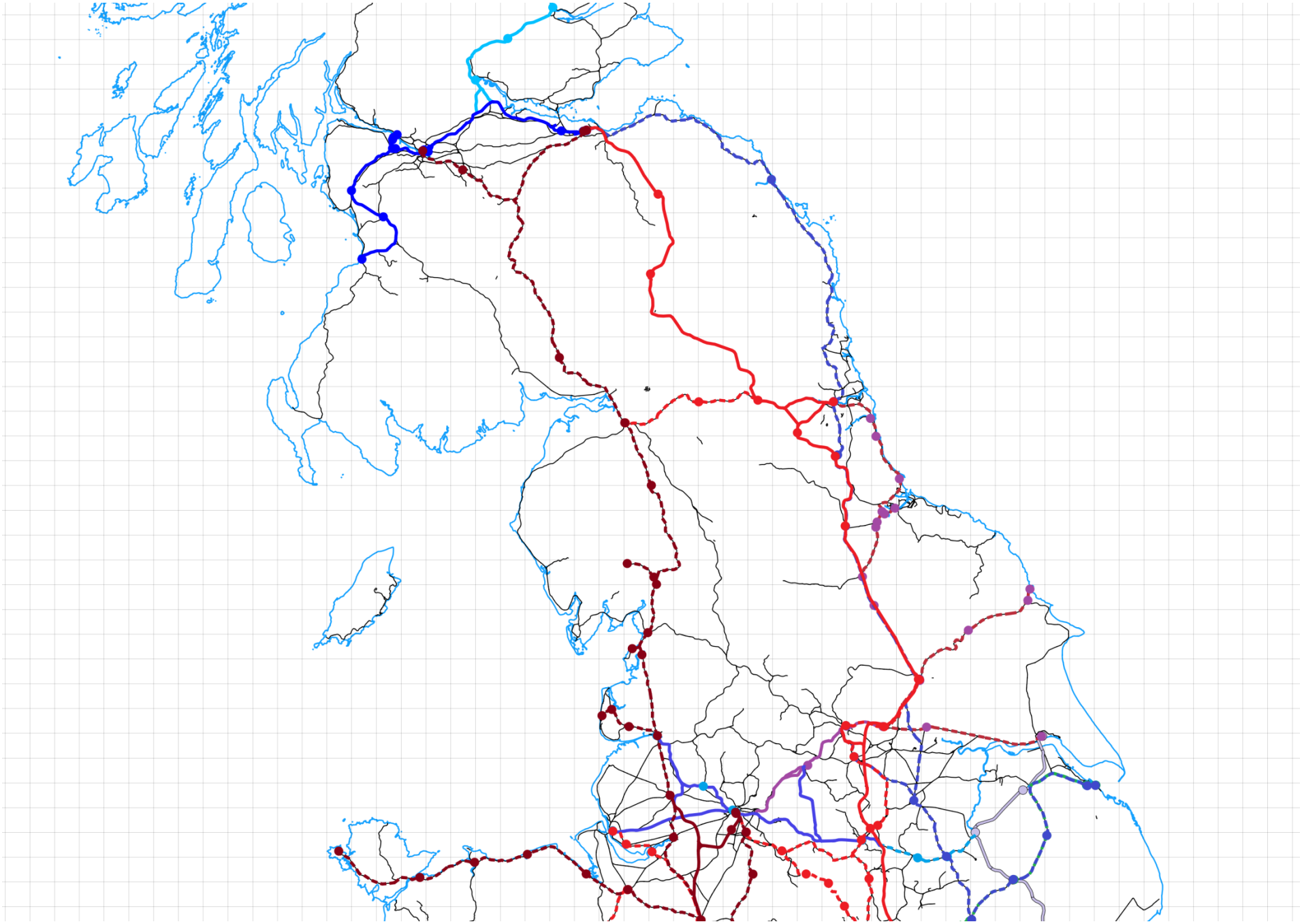

 



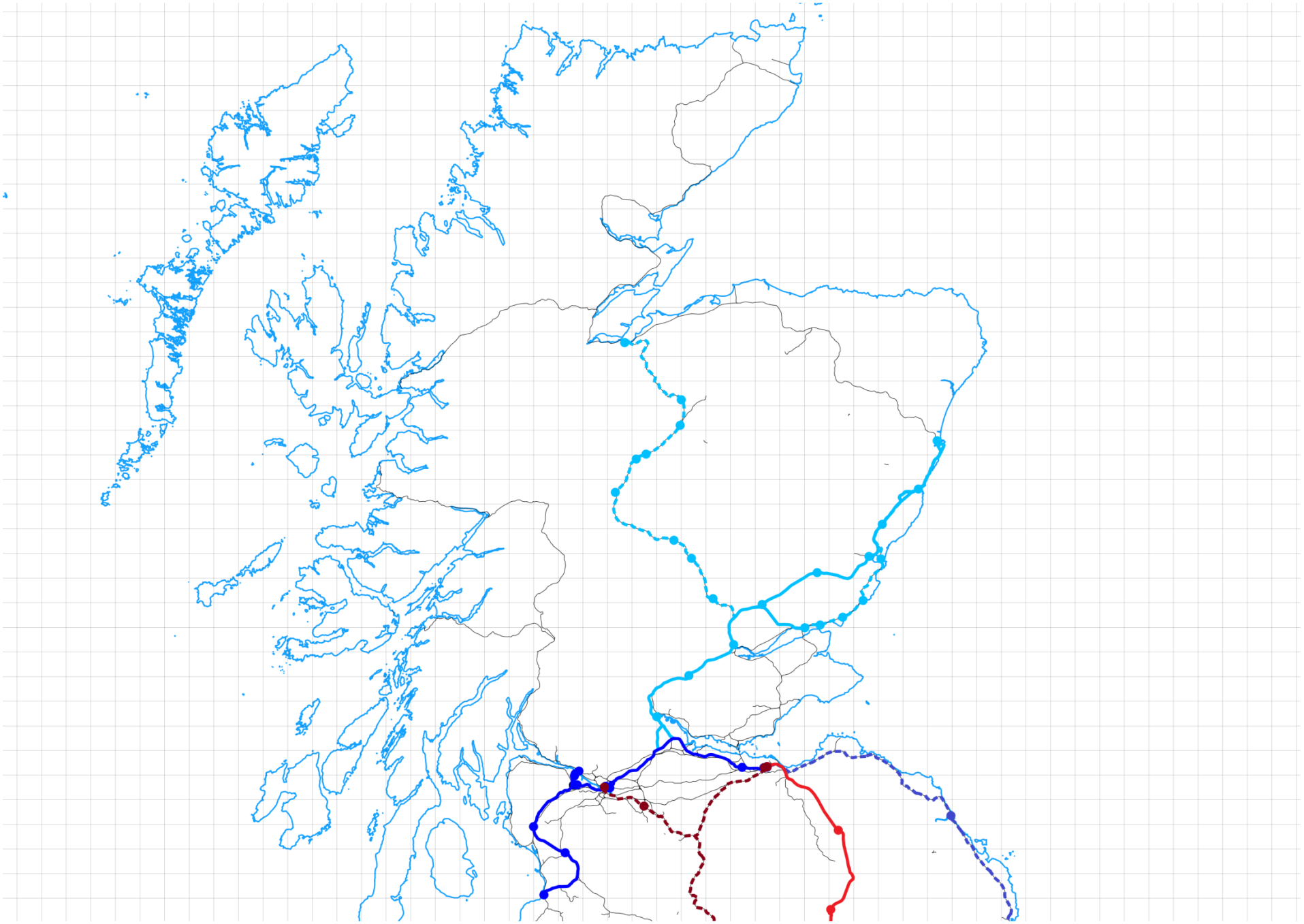

 



Complete HS Network, South Sheet



Complete HS Network, Central Sheet



Complete HS Network, North 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 HS7 itself. This most commonly occurs when a new section of HS7 opens, but it may also be a consequence of a change on some other HS route.

The service plans use the following notation:

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

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

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

## *Service Plan 1*

[The very first section of HS7, the approaches to Birmingham, comprising everything in the triangle Water Orton North Junction, Birmingham HS (Curzon St.) and Birmingham Interchange, exactly duplicates the equivalent provision for HS2, and is most sensibly built at the same time. This will not actually be used, initially.]

Service Plan 1 comes into effect when HS7 opens from Birmingham Interchange (and thus also from Curzon St., as noted above,) to Bristol, HS4 opens from Swindon to Cardiff, (having previously opened from Paddington to Swindon, but this had no effect on HS7,) and HS11 opens from Shenfield to Southend Airport. (Note also appendix B, on the possible significance of Cardiff Airport.)

The following GC gauge services are introduced. HS7 and HS4 services make cross-platform connections at Bristol Parkway HS, as noted.

- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS. [Interchange with HS4 2tphG {HS12 Shenfield –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS [Interchange with HS4 2tphG {HS11 Southend Airport –>} Euston Cross – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads BT]
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads BT [Interchange with HS4 2tphG {HS11 Southend Airport –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]

- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS (no interchange in this service plan).

The above impose a load on HS7 of 8tph between Birmingham HS and Coalpit Heath Junctions, 6tph between Coalpit Heath Junctions and St. Philip's Junction, 4tph between St. Philip's Junction and Bristol Temple Meads BT, and 2tph between St. Philip's Junction and Bristol Temple Meads HS. (Note that the actual trains between Coalpit Heath Junctions and Bristol are 4tph HS7 and 2tph HS4 – the other 4tph of each of HS7 and HS4 travelling between Coalpit Heath Junctions and Cardiff HS, on HS4's tracks.)

In addition to the HS services above, a new NE-SW Regional Metro service is introduced:

- 2tphR York – Micklefield – Leeds City – Wakefield Westgate – Rotherham – South Yorkshire (Meadowhall) – Sheffield Midland – Chesterfield – Derby – Burton on Trent – Tamworth – Birmingham New St. – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill – Ashchurch – Cheltenham Spa – Gloucester (reverse) – Bristol Parkway – Bristol Temple Meads – Weston Super Mare – Highbridge – Bridgwater – Taunton – Tiverton Junction – Cullompton – Exeter St. David's – Dawlish – Teignmouth – Newton Abbot – Totnes – Ivybridge – Plymouth

Representative Hourly Cross-Platform Interchange at Bristol Parkway HS / Classic (both HS, GC gauge, and Classic, compatible and RM, each have cross-platform interchange; but classic has longer stops to allow for change to/from HS platforms):

00G Birmingham HS – Bristol Temple Meads HS
G Shenfield – Euston Cross – Cardiff HS
R York – Plymouth
C Paddington – Swansea

07G Birmingham HS – Cardiff HS
G Southend Airport – Euston Cross – Bristol Temple Meads BT

15G Birmingham HS – Cardiff HS (no interchange)

23G Birmingham HS – Bristol Temple Meads BT
G Southend Airport – Euston Cross – Cardiff HS

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

Representative Hourly Cross-Platform Interchange at Worcester Shrub Hill (the HS services have cross-platform interchange and the RM services have longer stops to allow for platform change):

00G Birmingham HS – Bristol Temple Meads HS
C Worcester – Gloucester – Paddington
R Hereford – Paddington

15G Nottingham – Cardiff HS (no cross-platform interchange)
R York – Plymouth

– repeating at 30 and 45 minutes past.

Service Plan 2 imposes the following loadings on HS7:

- Newcastle – Paradise Junction 0tph
- Paradise Junction – Derwent Hill Junction 0tph
- Derwent Hill Junction – York 0tph
- York – Garforth East Junction 0tph
- Garforth East Junction – Garforth West Junction 0tph
- Garforth West Junction – Gelderd Road North Junction 0tph
- Gelderd Road North Junction – Gelderd Road South Junction 0tph
- Gelderd Road South Junction – Altofts Junction 0tph
- Garforth East Junction – Altofts Junction 0tph
- Altofts Junction – Beighton Junction 0tph
- Beighton Junction – Nuthall North Junction 0tph
- Nuthall North Junction – Awsworth Junction 0tph
- Strelley Junction – Awsworth Junction 0tph
- Awsworth Junction – Water Orton North Junction 0tph
- Water Orton North Junction – Water Orton West Junction 0tph
- Water Orton West Junction – Birmingham HS 8tph
- Water Orton North Junction – Water Orton South Junction 0tph
- Water Orton West Junction – Water Orton South Junction 8tph
- Water Orton South Junction – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Bristol Parkway HS 6tph
- Bristol Parkway HS – St. Philip's Junction 6tph
- St. Philip's Junction – Bristol Temple Meads BT 4tph
- St. Philip's Junction – Bristol Temple Meads HS 2tph
- Bristol Temple Meads HS – Plymouth 0tph

(The value for Coalpit Heath Junction – Bristol Parkway HS are for just the HS7 pair of tracks – HS4 has its own pair of tracks.)

## *Service Plan 2*

This service plan comes into effect when HS7 opens from Bristol Temple Meads to Plymouth. A new HS4 classic compatible service is introduced from Paddington, high speed all the way to Plymouth, then through to Penzance. Possibly this train splits at Plymouth, one half proceeding to Penzance and the other to Padstow, if that route has been reopened. The HS7 service to Plymouth terminates there. In addition, HS11 opens from Southend Airport to Faversham, but this makes no change to HS7's loadings.

- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth. [Interchange with HS4 2tphG {HS12 Shenfield –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS. [Interchange with HS4 2tphC Paddington – Old Oak Common

– London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth – stations to Penzance / Padstow.]

Representative Hourly Cross-Platform Interchange Pattern at Bristol Parkway:

00G Birmingham HS – Plymouth
G [Shenfield – ] Euston Cross – Cardiff HS
R York – Plymouth
C Paddington – Swansea

07G Birmingham HS – Cardiff HS
G [Faversham– ] Euston Cross – Bristol Temple Meads BT

15G Birmingham HS – Cardiff HS
C Paddington – Plymouth and stations to Penzance / Padstow

23G Birmingham HS – Bristol Temple Meads BT
G [Faversham– ] Euston Cross – Cardiff HS

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

Representative Hourly Cross-Platform Interchange at Worcester Shrub Hill:

00G Birmingham HS – Plymouth
C Worcester – Gloucester – Paddington
R Hereford – Paddington

15G Birmingham HS – Cardiff HS (no cross-platform interchange)
R York – Plymouth

– repeating at 30 and 45 minutes past.

This imposes the extra loadings on HS7 of 2tph Coalpit Heath Junction – Bristol HS and 4tph Bristol HS – Plymouth.

It imposes the following overall loadings on HS7:

- Newcastle – Paradise Junction 0tph
- Paradise Junction – Derwent Hill Junction 0tph
- Derwent Hill Junction – York 0tph
- York – Garforth East Junction 0tph
- Garforth East Junction – Garforth West Junction 0tph
- Garforth West Junction – Gelderd Road North Junction 0tph
- Gelderd Road North Junction – Gelderd Road South Junction 0tph
- Gelderd Road South Junction – Altofts Junction 0tph
- Altofts Junction – Beighton Junction 0tph
- Beighton Junction – Nuthall North Junction 0tph
- Nuthall North Junction – Awsworth Junction 0tph
- Strelley Junction – Awsworth Junction 0tph
- Awsworth Junction – Water Orton North Junction 0tph
- Water Orton North Junction – Water Orton West Junction 0tph

- Water Orton West Junction – Birmingham HS 8tph
- Water Orton North Junction – Water Orton South Junction 0tph
- Water Orton West Junction – Water Orton South Junction 8tph
- Water Orton South Junction – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – St. Philip's Junction 8tph
- St. Philip's Junction – Bristol Temple Meads BT 4tph
- St. Philip's Junction – Bristol Temple Meads HS 4tph
- Bristol Temple Meads HS – Plymouth 4tph

## *Service Plan 3*

This service plan comes into effect when HS7 opens north of Birmingham, i.e. between Nuthall North Junction and Water Orton North Junction, together with the spur from Strelley Junction to Awsworth Junction. Additionally, HS3 opens between York / Leeds HS and Nottingham Midland station (connection to HS7 at Nuthall North Junction and Strelley Junction), and HS9 opens between Garforth East Junction and Leeds HS. Initially, this section of HS3 is used only by HS7's services (HS3 otherwise being open only as far as Leicester). The previous service from Birmingham HS to Plymouth, and one of the services to Cardiff HS now start from York and Nottingham respectively, and now travel directly between Water Orton North and South Junctions, i.e. they no longer serve Birmingham HS (but do serve Birmingham Interchange). In addition, new services are introduces between York, Nottingham and Birmingham HS.

- 2tphG York – Leeds HS – South Yorkshire – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth. [Interchange with HS4 2tphG {HS12 Shenfield –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]
- 2tphG Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS. [Interchange with HS4 2tphC Paddington – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's - Plymouth – stations to Penzance / Padstow.]
- 2tphGG York – Leeds HS – South Yorkshire – Derby – Birmingham HS.
- 2tphC Cleethorpes – Grimsby Town – Market Rasen – Lincoln – Newark Castle – Nottingham – Derby – Birmingham HS.

This imposes a load of 8tph between Awsworth Junction and Birmingham Curzon Street, and 4tph elsewhere.

Representative Hourly Cross-Platform Interchange at Birmingham Interchange:

00G York – Plymouth
C HS2 Manchester Piccadilly – Euston (via Stoke)

15G Nottingham – Cardiff HS
C HS2 Blackpool / Windermere – Preston – Euston

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange at Birmingham HS (paired by HS7 and HS2):

00GG York – Birmingham HS
G Birmingham HS – Bristol Temple Meads BT
GG HS2 Manchester HS – Birmingham HS
GG HS2 Birmingham HS – Euston Cross [–> Maidstone HS1]

15C Cleethorpes – Birmingham HS
G Birmingham HS – Cardiff HS
C HS2 Glasgow / Edinburgh – Birmingham HS OR Holyhead – Birmingham HS (at 45 mins past)
GG HS2 Birmingham HS – Euston Cross [–> Maidstone HS1]

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange at Nottingham:

00GG HS8 Norwich – Preston (no connection)

07GG Pancras Cross – York (HS Metro)
C Cleethorpes – Birmingham HS
R St. Pancras – Melton Mowbray – York
R Norwich / Stansted Airport – Morecambe

23GG HS3/HS8 Pancras Cross – Preston (HS Metro)
G HS8/HS7 Norwich – Cardiff

– repeating at 30, 37 and 53 minutes past.

## *Service Plan 3A*

This service plan comes into effect when HS3/HS7 opens between Newcastle and York, and the core, transpennine sections of HS8/HS9 open between (Liverpool – ) Newton West Junction / Preston and Guide Bridge HS Junction and on to (HS8) Beighton Junction and (HS9) Gelderd Rd. North Junction. Thus:

- 2tphG Newcastle – Consett – Durham (Relly Mill) – Darlington – York – Leeds HS – South Yorkshire – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth. [Interchange with HS4 2tphG {HS12 Shenfield –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]
- 2tphGG HS8 Preston – Bolton – Manchester Victoria (LL) – Manchester HS – Sheffield HS – Nottingham
- 2tphGG HS9 Newcastle – Consett – Durham (Relly Mill) – Darlington – York – Leeds HS – Huddersfield – Manchester HS – Manchester Victoria (LL) – Liverpool Lime St.
- 2tphC HS9 Middlesborough – Thornaby – Eaglescliffe – Yarm – Northallerton – Thirsk – York – Micklefield – Leeds HS – Huddersfield – Manchester HS – Manchester Victoria (LL) – Liverpool Lime St.

- 2tphC HS9 Newcastle – Sunderland – Seaham –Hartlepool – Stockton – Eaglescliffe – Yarm – Northallerton – Thirsk – York – Micklefield – Leeds HS – Huddersfield – Manchester HS – Manchester Victoria (LL) – Liverpool Lime St.
- 2tphC HS9 Hull – Selby – Micklefield – Leeds HS – Huddersfield – Manchester HS – Manchester Victoria (LL) – Bolton – Preston
- 2tphC HS9 Scarborough – Seamer – Malton – York – Micklefield – Leeds HS – Huddersfield – Manchester HS – Manchester Victoria (LL) – Bolton – Preston

A new Regional Metro service is introduced on the ECML:

- 2tphR Edinburgh – Drem – Dunbar – Berwick-upon-Tweed – Alnmouth – Morpeth – Newcastle – Chester le Street – Durham – Darlington – Northallerton – Thirsk – York

The Tees Valley Metro may or may not have been in service previously:

- 8tphRS Bishop Auckland – Shildon – Newton Aycliffe – Heighington –North Road – Darlington – Dinsdale – Tees-Side Airport – Allen's West – Eaglescliffe – Thornaby – Middlesborough – British Steel (Redcar) – Redcar Central – Redcar East – Marske – Saltburn

Representative Hourly Cross-Platform Interchange Pattern at Newcastle:

00G Newcastle – Plymouth
C Newcastle – Liverpool (via Stockton)
R Edinburgh – York

15GG Newcastle – Liverpool
(no interchange)

– repeating at 30 and 45 minutes past

Representative Hourly Cross-Platform Interchange Pattern at Darlington:

00G Newcastle – Plymouth
RS Saltburn – Middlesborough – Bishop Auckland

15GG Newcastle – Liverpool
RS Saltburn – Middlesborough – Bishop Auckland

– repeating at 30 and 45 minutes past

The several phases of SP3 impose the following loadings on HS7:

| | | |
|---|---|---|
| • Newcastle | – Paradise Junction | 4tph |
| • Paradise Junction | – Derwent Hill Junction | 4tph |
| • Derwent Hill Junction | – York | 4tph |
| • York | – Garforth East Junction | 6tph |
| • Garforth East Junction | – Garforth West Junction | 6tph |
| • Garforth West Junction | – Gelderd Road North Junction | 14tph |
| • Gelderd Road North Junction | – Gelderd Road South Junction | 4tph |
| • Gelderd Road South Junction | – Altofts Junction | 4tph |
| • Garforth East Junction | – Altofts Junction | 0tph |

- Altofts Junction – Beighton Junction 4tph
- Beighton Junction – Nuthall North Junction 4tph
- Nuthall North Junction – Awsworth Junction 4tph
- Strelley Junction – Awsworth Junction 4tph
- Awsworth Junction – Water Orton North Junction 8tph
- Water Orton North Junction – Water Orton West Junction 4tph
- Water Orton West Junction – Birmingham HS 8tph
- Water Orton North Junction – Water Orton South Junction 4tph
- Water Orton West Junction – Water Orton South Junction 4tph
- Water Orton South Junction – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – St. Philip's Junction 8tph
- St. Philip's Junction – Bristol Temple Meads BT 4tph
- St. Philip's Junction – Bristol Temple Meads HS 4tph
- Bristol Temple Meads HS – Plymouth 4tph

Note that only HS7 services currently run north of Nuthall North Junction, and, since these travel via Leeds, no services run as yet between Garforth East Junction and Altofts Junction.

## *Service Plan 4*

HS7 Service Plan 4 is the consequence of changes elsewhere, causing changes in detail to the HS7 services; there are no changes to HS7 per se.

HS3 opens between Edinburgh and Derwent Hill Junction, between Nuthall South junction (where it is joined by the section opened between Leeds / York and Nottingham, noted above,) and Leicester, between Nottingham station and Stanford Junction (completing the Nottingham station loop), and between West Hampstead Junction and Pancras Cross. This is immensely important, and completes HS3, but has no effect on HS7. In addition, the section of HS8 between Paddock Junction and Ladybower Junction is opened, allowing HS7's services (similarly HS3's HS Metro service to York) to be routed between Leeds and Beighton Junction via Huddersfield and Sheffield, instead of via South Yorkshire. For HS7 this removes 4tph from the section between Gelderd Rd. North Junction and Beighton Junction via Altofts Junction, and adds them to the section via Huddersfield and Sheffield. Thus:

- 2tphG Newcastle – Consett – Durham (Relly Mill) – Darlington Bank Top – York – Leeds HS – Huddersfield – Sheffield HS – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth. [Interchange with HS4 2tphG {HS12 Shenfield –>} Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS]
- 2tphGG York – Leeds HS – Huddersfield – Sheffield HS – Derby – Birmingham HS.

## *Service Plan 4A*

HS7 Service Plan 4A is likewise the consequence of changes elsewhere, causing changes in detail to the HS7 services; there are no changes to HS7 per se.

HS8 opens between Nottingham and Ely, and HS6 opens between Ely and Norwich. HS7's service from Nottingham to Cardiff now starts from Norwich:

- 2tphG Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS. [Interchange with HS4 2tphC Paddington – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's - Plymouth – stations to Penzance / Padstow.]

(as does HS8's service from Nottingham to Preston).

## *Service Plan 4B*

The final service plan (much later, when the final sections of the HS network are being tidied up,) comes into effect when HS4 is extended from Cardiff to Swansea. Half the services to Cardiff now run through to Swansea. Likewise, HS11 is extended from Faversham to Dover, and HS12 from Shenfield to Norwich.

As a result of changes in the various stages of SP4, the HS7/HS4 services are now:

- 2tphG Newcastle – Consett – Durham (Relly Mill) – Darlington – York – Leeds HS – Huddersfield – Sheffield HS – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth. [Interchange with HS4 2tphG {HS12 Norwich – } Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose) Airport – Port Talbot – Swansea.]
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS. [Interchange with HS4 2tphG {HS11 Dover – } Euston Cross – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads BT.]
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads BT. [Interchange with HS4 2tphG {HS11 Dover – } Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS.]
- 2tphG Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose) Airport – Port Talbot – Swansea. [Interchange with HS4 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's –. Plymouth – stations to Penzance / Padstow.]

In other words, the HS4 [HS12 Norwich – ] Euston Cross – Cardiff service which connects with Newcastle – Plymouth, and HS7's Norwich – Cardiff service (which connects with HS4 Paddington – Plymouth – stations in Cornwall) are both extended to Swansea (thus there are two through services

between Norwich and Swansea, via London and via Birmingham), whereas the HS4 [HS11 Dover – ] Euston Cross – Cardiff service which connects with Birmingham – Bristol Temple Meads BT and the HS7 Birmingham – Cardiff services aren't so extended.

Representative Hourly Cross-Platform Interchange Pattern at Bristol Parkway:

00G Newcastle – Plymouth
G [HS12 Norwich – ] Euston Cross – Swansea
R York – Plymouth
C Paddington – Swansea

07G Birmingham HS – Cardiff HS
G [HS11 Dover – ] Euston Cross – Bristol Temple Meads BT

15G Norwich – Swansea
C Paddington – Plymouth and stations to Penzance / Padstow

23G Birmingham HS – Bristol Temple Meads BT
G [HS11 Dover – ] Euston Cross – Cardiff HS

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

Representative Hourly Cross-Platform Interchange at Worcester Shrub Hill:

00G Newcastle – Plymouth
C Worcester – Gloucester – Paddington
R Hereford – Paddington

15G Norwich – Swansea (no cross-platform interchange)
R York – Plymouth

– repeating at 30 and 45 minutes past.

Representative Hourly (non-cross-platform) Interchange Pattern at Derby:

00G Newcastle – Plymouth
C Manchester – St. Pancras

15G Norwich – Swansea
C York – St. Pancras

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange at Nottingham:

00GG HS8 Norwich – Preston (no connection)

07GG Pancras Cross – York (HS Metro)
C Cleethorpes – Birmingham HS
R St. Pancras – Melton Mowbray – York
R Norwich / Stansted Airport – Morecambe

23GG HS3/HS8 Pancras Cross – Preston (HS Metro)
G HS8/HS7 Norwich – Swansea

– repeating at 30, 37 and 53 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Darlington:

00G Newcastle – Plymouth
RS Saltburn – Middlesborough – Bishop Auckland

07G HS3 Newcastle – Pancras Cross [HS5 –> Newhaven]
RS Saltburn – Middlesborough – Bishop Auckland

15GG Newcastle – Liverpool
RS Saltburn – Middlesborough – Bishop Auckland

23C HS6 Edingburgh – St. Pancras (East)
RS Saltburn – Middlesborough – Bishop Auckland

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

Representative Hourly Cross-Platform Interchange Pattern at Newcastle:

00G Newcastle – Plymouth
C Newcastle – Liverpool (via Stockton)
R Edinburgh – York

07G HS3 Newcastle – Pancras Cross [HS5 –> Newhaven]
(no interchange)

15GG Newcastle – Liverpool
C HS6 Edinburgh – St. Pancras (East)

– repeating at 30, 37 and 45 minutes past

The final HS7 loadings are:

| | | |
|---|---|---|
| • Newcastle | – Paradise Junction | 10tph |
| • Paradise Junction | – Derwent Hill Junction | 6tph |
| • Derwent Hill Junction | – York | 8tph |
| • York | – Garforth East Junction | 14tph |
| • Garforth East Junction | – Garforth West Junction | 10tph |
| • Garforth West Junction | – Gelderd Road North Junction | 18tph |
| • Gelderd Road North Junction | – Gelderd Road South Junction | 2tph |
| • Gelderd Road South Junction | – Altofts Junction | 2tph |
| • Garforth East Junction | – Altofts Junction | 4tph |
| • Altofts Junction | – Beighton Junction | 6tph |
| • Beighton Junction | – Nuthall North Junction | 18tph |
| • Nuthall North Junction | – Awsworth Junction | 4tph |
| • Strelley Junction | – Awsworth Junction | 4tph |
| • Awsworth Junction | – Water Orton North Junction | 8tph |

- Water Orton North Junction – Water Orton West Junction 4tph
- Water Orton West Junction – Birmingham HS 8tph
- Water Orton North Junction – Water Orton South Junction 4tph
- Water Orton West Junction – Water Orton South Junction 4tph
- Water Orton South Junction – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – St. Philip's Junction 8tph
- St. Philip's Junction – Bristol Temple Meads BT 4tph
- St. Philip's Junction – Bristol Temple Meads HS 4tph
- Bristol Temple Meads HS – Plymouth 4tph

For the sections north of Nuthall North Junction, the above loadings contain contributions from HS3, HS8 and HS9 (see the relevant Route and Service Plans documents for full details of these).

## *Service Plan 4 Summary*

It's worth summarising the full set of services at service plan 4, as this represents the final, complete state of these plans, and the services have so far been introduced piecemeal, at the various stages.

HS7:

- 2tphGG York – Leeds HS – Huddersfield – Sheffield HS – Derby – Birmingham HS
- 2tphC Cleethorpes – Grimsby Town – Market Rasen – Lincoln – Newark Castle – Nottingham – Derby – Birmingham HS
- 2tphG Newcastle – Consett – Durham (Relly Mill) – Darlington – York – Leeds HS – Huddersfield – Sheffield HS – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth
- 2tphG Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose Airport) – Port Talbot – Swansea
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS
- 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads BT

Regional Metro:

- 2tphR York – Micklefield – Leeds City – Wakefield Westgate – Rotherham – South Yorkshire (Meadowhall) – Sheffield Midland – Chesterfield – Derby – Burton on Trent – Tamworth – Birmingham New St. – University – Bromsgrove – Droitwich Spa – Worcester Shrub Hill – Ashchurch – Cheltenham Spa – Gloucester (reverse) – Bristol Parkway – Bristol Temple Meads – Weston Super Mare – Highbridge – Bridgwater – Taunton – Tiverton Junction – Cullompton – Exeter St. David's – Dawlish – Teignmouth – Newton Abbot – Totnes – Ivybridge – Plymouth
- 2tphR Edinburgh – Drem – Dunbar – Berwick-upon-Tweed – Alnmouth – Morpeth – Newcastle – Chester le Street – Durham – Darlington – Northallerton – Thirsk – York

HS4:

- 2tphG [HS11 Dover – ] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Bristol Temple Meads BT.
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Bristol Temple Meads HS – Taunton – Exeter St. David's – Plymouth – stations to Penzance / Padstow.
- 2tphG [HS12 Norwich – ] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose Airport) – Port Talbot – Swansea
- 2tphG [HS11 Dover – ] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS

Representative Hourly Cross-Platform Interchange Pattern at Bristol Parkway:

00G Newcastle – Plymouth
G [HS12 Norwich – ] Euston Cross – Swansea
R York – Plymouth
C Paddington – Swansea

07G Birmingham HS – Cardiff HS
G [HS11 Dover – ] Euston Cross – Bristol Temple Meads BT

15G Norwich – Swansea
C Paddington – Plymouth and stations to Penzance / Padstow

23G Birmingham HS – Bristol Temple Meads BT
G [HS11 Dover – ] Euston Cross – Cardiff HS

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

Representative Hourly Cross-Platform Interchange at Worcester Shrub Hill:

00G Newcastle – Plymouth
C Worcester – Gloucester – Paddington
R Hereford – Paddington

15G Norwich – Swansea (no cross-platform interchange)
R York – Plymouth

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Birmingham Interchange:

00G Newcastle – Plymouth
C HS2 Manchester Piccadilly – Euston (via Stoke)

15G Norwich – Swansea
C HS2 Blackpool / Windermere – Preston – Euston

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange at Birmingham HS (paired by HS7 and HS2):

00GG York – Birmingham HS
G Birmingham HS – Bristol Temple Meads BT
GG HS2 Manchester HS – Birmingham HS
GG HS2 Birmingham HS – Euston Cross [–> Maidstone HS1]

15C Cleethorpes – Birmingham HS
G Birmingham HS – Cardiff HS
G HS13/HS3/HS2 Glasgow – Edinburgh– Birmingham HS
GG HS2 Birmingham HS – Euston Cross [–> Maidstone HS1]

– repeating at 30 and 45 minutes past.

Representative Hourly (non-cross-platform) Interchange Pattern at Derby:

00G Newcastle – Plymouth
C Manchester – St. Pancras

15G Norwich – Swansea
C York – St. Pancras

– repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Interchange at Nottingham:

00GG HS8 Norwich – Preston (no connection)

07GG Pancras Cross – York (HS Metro)
C Cleethorpes – Birmingham HS
R St. Pancras – Melton Mowbray – York
R Norwich / Stansted Airport – Morecambe

23GG HS3/HS8 Pancras Cross – Preston (HS Metro)
G HS8/HS7 Norwich – Swansea

– repeating at 30, 37 and 53 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Lincoln:

00G HS6/HS10 Norwich – Hull Paragon
C Birmingham HS – Cleethorpes

15G [HS5 Southampton –>] HS6/HS10 Pancras Cross – Hull Paragon
C HS6 St. Pancras (East) – Cleethorpes

– repeating at 30 and 45 minutes past.

See appendix E for the contraflow track layout at Lincoln, to make this interchange as convenient as possible.

Representative Hourly Cross-Platform Interchange Pattern at Darlington:

00G Newcastle – Plymouth
RS Saltburn – Middlesborough – Bishop Auckland

07G HS3 Newcastle – Pancras Cross [HS5 –> Newhaven]
RS Saltburn – Middlesborough – Bishop Auckland

15GG Newcastle – Liverpool
RS Saltburn – Middlesborough – Bishop Auckland

23C HS6 Edingburgh – St. Pancras (East)
RS Saltburn – Middlesborough – Bishop Auckland

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

Representative Hourly Cross-Platform Interchange Pattern at Newcastle:

00G Newcastle – Plymouth
C Newcastle – Liverpool (via Stockton)
R Edinburgh – York

07G HS3 Newcastle – Pancras Cross [HS5 –> Newhaven]
(no interchange)

15GG Newcastle – Liverpool
C HS6 Edinburgh – St. Pancras (East)

– repeating at 30, 37 and 45 minutes past

## *Estimated Journey Times*

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

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

The crudest approximation, usually, is the assumption that, once line speed has been reached, that speed (300kph) is maintained until it becomes necessary to decelerate for a junction or a station stop. In fact, given the generally good alignments of this particular route, I am considerably more confident of this assumption than on certain other routes (Trans-Pennine, in particular).

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

My estimated distances (between stations) are:

- Newcastle – Consett 22km
- Consett – Durham Relly Mill 20km
- Durham Relly Mill – Darlington 33km
- Darlington – York 70km
- York HS – Leeds New Lane 39km
- Leeds New Lane – Huddersfield 24km
- Huddersfield – Sheffield HS 53km
- Sheffield HS – Derby 70km
- Norwich – Peterborough 121km
- Peterborough – Nottingham 85km
- Nottingham – Derby 26km
- Derby – Birmingham Curzon St. 63km
- Derby – Birmingham Interchange 59km
- Birmingham Curzon St.– Birmingham Interchange 20km
- Birminham Interchange – Worcester Shrub Hill 49km
- Worcester Shrub Hill – Cheltenham Spa 35km
- Cheltenham Spa – Bristol Parkway 61km
- Bristol Parkway – Cardiff HS 48km
- Cardiff HS – Cardiff (Rhoose) Airport 15km
- Cardiff (Rhoose) Airport – Port Talbot 39km
- Port Talbot – Swansea 13km
- Bristol Parkway – Bristol Temple Meads 8km
- Bristol Temple Meads – Taunton 71km
- Taunton – Exeter St. David's 48km
- Exeter St. David's – Plymouth 65km

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

- Acceleration from stationary to 360kphtakes 16.67km and 333 seconds
- Acceleration from stationary to 300kphtakes 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 Cardiff to Rhoose Airport (start to stop) is 400 seconds
- Time to travel from Port Talbot to Swansea (start to stop) is 372 seconds
- Time to travel from Bristol Parkway to Bristol Temple Meads (start to stop) is 292 seconds

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

The procedure in calculating journey times between station stops is to take the two values of acceleration / deceleration distance, and the two times, as given in the first 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. The various section times are accumulated to obtain the overall journey times. One further refinement: a standard wait time of 3 minutes is assumed at stations, and this is added into the accumulated time at each stop.

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

- York – Leeds incurs a double junction penalty of 30 seconds at Garforth East and West Junctions, where it diverges from the main line of HS3, and joins the main line of HS9, Northern Transpennine. (NB 360kph line speed.)
- Sheffield – Derby incurs a double-junction penalty of 47 seconds at Nuthall North and Awsworth junctions, where HS7 diverges from the HS3 main line. (NB 360kph line speed.)
- Huddersfield – Sheffield incurs a time penalty of 52 seconds at Ladybower Junction, where it joins the main line of HS8, Southern Transpennine, from Manchester. NB 300kph line speed.)

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

## *1. Newcastle – Plymouth (15 stops):*

| Section | Distance (km) | Cumulative Distance (km) | Start - Stop Time (minutes) | Cumulative Journey Time (minutes) | Elapsed Time from Newcastle, inc. Station Wait Times |
|---|---|---|---|---|---|
| Newcastle - Consett | 22 | 22 | 8.1 | 8.1 | 8.1 |
| Consett - Durham Relly Mill | 20 | 42 | 7.7 | 15.8 | 18.8 |
| Durham Relly Mill - Darlington | 33 | 75 | 10.3 | 26.1 | 32.1 |
| Darlington - York | 70 | 145 | 16.1 | 42.2 | 51.2 |
| York - Leeds New Lane | 39 | 184 | 11.4 | 53.7 | 65.7 |
| Leeds New Lane - Huddersfield | 24 | 208 | 8.5 | 62.2 | 77.2 |
| Huddersfield - Sheffield | 53 | 261 | 15.2 | 77.4 | 95.4 |
| Sheffield - Derby | 70 | 331 | 16.9 | 94.3 | 115.3 |
| Derby - Birmingham Interchange | 59 | 390 | 15.5 | 109.8 | 133.8 |
| Birmingham Interchange - Worcester Shrub Hill | 49 | 439 | 13.5 | 123.3 | 150.3 |
| Worcester Shrub Hill - Cheltenham Spa | 35 | 474 | 10.7 | 134.0 | 164.0 |
| Cheltenham Spa - Bristol Parkway | 61 | 535 | 15.9 | 149.9 | 182.9 |
| Bristol Parkway - Bristol Temple Meads | 8 | 543 | 4.9 | 154.8 | 190.8 |
| Bristol Temple Meads - Taunton | 71 | 614 | 17.9 | 172.7 | 211.7 |
| Taunton - Exeter St. David's | 48 | 662 | 13.3 | 186.0 | 228.0 |
| Exeter St. David's - Plymouth | 65 | 727 | 16.7 | 202.8 | 247.8 |

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

- Durham 11 [19]
- Darlington 28 [37]
- York 56 [52]
- Leeds 85 [66]
- Huddersfield 111 [78]
- Sheffield 105 [96]
- Derby 136 [116]
- Birmingham 172 [134]
- Worcester 232 [151]
- Cheltenham Spa 229 [164]
- Bristol Parkway 259 [183]
- Bristol Temple Meads 271 [191]
- Taunton 308 [212]
- Exeter St. David's 334 [228]
- Plymouth 428 [248]

It is no surprise that the times from Newcastle to Durham and Darlington are not as fast as the current fastest times, straight down the ECML, given that Newcastle is served by a spur from Consett, the main line of HS3 proceeding to the Borders and Hawick. From York on, the situation is very different.

## *2. Norwich – Swansea (10 stops):*

| Section | Distance (km) | Cumulative Distance (km) | Start - Stop Time (minutes) | Cumulative Journey Time (minutes) | Elapsed Time from Norwich, inc. Station Wait Times |
|---|---|---|---|---|---|
| Norwich - Peterborough | 121 | 121 | 27.9 | 27.9 | 27.9 |
| Peterborough - Nottingham | 85 | 206 | 20.7 | 48.6 | 51.6 |
| Nottingham - Derby | 26 | 232 | 8.9 | 57.5 | 63.5 |
| Derby - Birmingham Interchange | 59 | 291 | 15.5 | 73.1 | 82.1 |
| Birmingham Interchange - Worcester Shrub Hill | 49 | 340 | 13.5 | 86.6 | 98.6 |
| Worcester Shrub Hill - Cheltenham Spa | 35 | 375 | 10.7 | 97.3 | 112.3 |
| Cheltenham Spa - Bristol Parkway | 61 | 436 | 15.9 | 113.2 | 131.2 |
| Bristol Parkway - Cardiff | 48 | 484 | 12.4 | 125.6 | 146.6 |
| Cardiff - Rhoose Airport | 15 | 499 | 6.7 | 132.3 | 156.3 |
| Rhoose Airport - Port Talbot# | 39 | 538 | 11.5 | 143.8 | 170.8 |
| Port Talbot - Swansea | 13 | 551 | 6.2 | 150.0 | 180.0 |

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

- Peterborough 86 [28]
- Nottingham 156 [52]
- Derby 206 (2 changes) [64]
- Birmingham 221 (1 change) [82]
- Worcester 284 (2 changes) [99]
- Cheltenham 293 (2 changes) [113]
- Bristol Parkway 248 (2 changes) [132]
- Cardiff 289 (2 changes) [147]
- Port Talbot 328 (2 changes) [171]
- Swansea 349 (2 changes) [180]

## *3. Birmingham – York / Cleethorpes (4/6 stops):*

| Section | Distance (km) | Cumulative Distance (km) | Start - Stop Time (minutes) | Cumulative Journey Time (minutes) | Elapsed Time from Birmingham, inc. Station Wait Times |
|---|---|---|---|---|---|
| Birmingham Curzon St. - Derby | 63 | 63 | 16.3 | 16.3 | 16.3 |
| Derby - Sheffield | 70 | 133 | 18.5 | 34.8 | 37.8 |
| Sheffield - Huddersfield | 53 | 186 | 15.2 | 50.0 | 56.0 |
| Huddersfield - Leeds New Lane | 24 | 210 | 8.5 | 58.5 | 67.5 |
| Leeds New Lane - York | 39 | 249 | 11.4 | 69.9 | 81.9 |
| Derby - Nottingham | 26 | 89 | 8.9 | 25.2 | 28.2 |
| Nottingham - Newark Castle | 27 | 116 | 22.0 | 47.2 | 50.2 |
| Newark Castle - Lincoln | 26 | 142 | 28.0 | 75.2 | 78.2 |
| Lincoln - Market Rasen | 25 | 167 | 16.0 | 91.2 | 94.2 |
| Lincoln - Grimsby Town | 47 | 214 | 37.0 | 128.2 | 131.2 |
| Grimsby Town - Cleethorpes | 5 | 219 | 10.0 | 138.2 | 141.2 |

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

- Derby 35 [17]
- Sheffield 74 [38]
- Huddersfield 134 (1 change) [56]
- Leeds 118 [68]
- York 129 [82]
- Nottingham 69 [29]
- Newark Castle 107 (1 change) [51]
- Lincoln 139 (2 changes) [79]
- Market Rasen 169 (2 changes0 [95]
- Grimsby Town 187 (1 change) [132]
- Cleethorpes 197 (1 change) [142]

## *4. Birmingham – Cardiff /Bristol Temple Meads (4 stops each):*

| Section | Distance (km) | Cumulative Distance (km) | Start - Stop Time (minutes) | Cumulative Journey Time (minutes) | Elapsed Time from Birmingham, inc. Station Wait Times |
|---|---|---|---|---|---|
| Birmingham Curzon St. - Birmingham Interchange | 20 | 20 | 8 | 7.7 | 7.7 |
| Birmingham Interchange - Worcester Shrub Hill | 49 | 69 | 14 | 21.2 | 24.2 |
| Worcester Shrub Hill - Cheltenham Spa | 35 | 104 | 11 | 31.9 | 37.9 |
| Cheltenham Spa - Bristol Parkway | 61 | 165 | 16 | 47.9 | 56.9 |
| Bristol Parkway - Cardiff | 48 | 213 | 13 | 61.2 | 73.2 |
| Bristol Parkway - Bristol Temple Meads | 8 | 173 | 5 | 52.8 | 64.8 |

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

- Worcester 38 [25]
- Cheltenham 40 [38]
- Bristol Parkway 72 [57]
- Cardiff 120 [74]
- Bristol Temple Meads 84 [65]

# Appendix A – Trans-Dartmoor Express

It may seem at first sight heroically imaginative (i.e. lunatic) to propose a railway straight across the middle of Dartmoor. The first thing, therefore, is to demonstrate that it is perfectly feasible, in engineering terms.

I've considered various routes, and selected the following one:

| Location | Grid Ref. (where needed) | Altitude (ft) | Altitude Difference (ft) | Crow Distance (miles) | Average Gradient 1 in : |
|---|---|---|---|---|---|
| Exeter St. David's | | 0 | - | - | - |
| Dunsford | | 250 | 250 | 7 | 148 |
| Moretonhampstead | | 600 | 350 | 4.5 | 68 |
| Shapley | SX683848 | 1000 | 400 | 4.5 | 59 |
| Postbridge | SX650803 | 1150 | 150 | 4 | 141 |
| Two Bridges | SX609750 | 1125 | 25 | 4 | 845 |
| (Above) Ward Bridge | SX548715 | 750 | 375 | 4.5 | 63 |
| Yelverton | | 632 | 128 | 3 | 124 |
| Laira | | 0 | 632 | 7 | 58 |

In HS terms, these are very reasonable gradients, not even steep. (Accepted maxima for HS lines are in the range 2.5% – 4%; the above come nowhere near these.) The sections between Shapley and Postbridge, and Two Bridges and the location above Ward Bridge are entirely in tunnel (ground level above being 3-400 ft higher).

Given that the loading between Exeter and Plymouth (between Bristol and Plymouth, actually) is only 4tph, I think it would be reasonable to run a local service (GC gauge, of course,) of 1 or 2tph between these, calling at Dunsford, Moretonhampstead, Postbridge, Two Bridges (with a bus connection to Princetown), and Yelverton Road. This would leave Exeter immediately after the Newcastle – Plymouth service, arriving in Plymouth just before the Paddington – Plymouth –> Cornwall service (if the timings are practicable, of course).

# Appendix B – Cardiff (Rhoose) Airport

There is, I understand, a proposal to develop Cardiff Airport as an extension/overflow to Heathrow. It's very difficult to find any details of this, let alone any formal plan. It may, indeed, be something of an urban legend. Certainly the Davies report on London's airports paid no attention to it.

But, assuming that there actually is such a proposal, then, given the intense opposition that any major extension to Heathrow (as Davies actually recommends) is bound to encounter, it's not beyond the bounds of possibility that a political compromise actually might go for the Cardiff solution. So, while not arguing for or against it, I merely consider what effect it would have on the current proposals for HS7.

The traffic through Rhoose would clearly be very greatly increased, and require a much enhanced service from HS4. Accordingly, The airport station would be the standard HS 2-island affair, with a turnback facility for services from the east. HS4 at service plan 2 would be extended to the airport, not just to Cardiff (indeed, it may be worthwhile to extend it immediately all the way to Swansea). Those services (from London and Birmingham – HS7 service plan 2) originally proposed to terminate at Cardiff would instead terminate at the airport. A HS7/HS4 south to west connection would be provided just north of Bristol, to enable an HS service from Plymouth to reach Swansea:

- 2tphG Plymouth – Exeter – Taunton – Bristol TM (HS) – Cardiff – Rhoose – Port Talbot – Swansea

Representative Hourly Interchange Pattern at Rhoose (all GC):

00 Norwich – Swansea via London
Birmingham HS – Rhoose (arrives c.5 minutes earlier)

07 Plymouth – Swansea

15 Norwich – Swansea via Birmingham
Dover – Rhoose (arrives c.5 minutes earlier)

23 Bristol TM (HS) – Swansea ???

# Appendix C – The Coventry Variant of HS2

The Coventry Variant of HS2 (HS2-CV) is described in appendix B of the HS2 Route and Service Plans article. Effectively it is an additional section of HS2 diverging from the existing route at Brackley and rejoining it at Berkswell, passing through Rugby and Coventry, allowing those cities also to be served.

As far as HS7 is concerned, this has no effect whatever on its services.

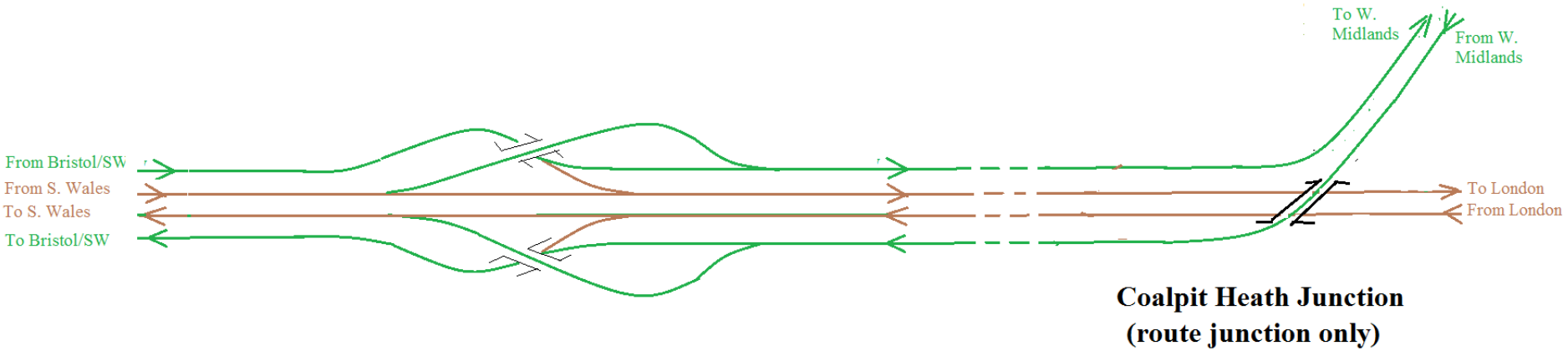
The section of HS2 between Berkswell and Streethay Junctions is quadruple track, (partly 6 track, indeed,) with the HS2-CV lines on the outside. It is recognised that, with service levels of 8tph on both HS7 and HS2-CV, they could very readily share tracks over this section, (specifically between Birmingham Interchange and Marston Junction, where HS7 shares a common alignment,) and also on the lines into Birmingham Curzon Street from Water Orton North and South, via West, junctions. This results in serious simplification in the track layouts; the HS2 Route and Service Plans article contains a track layout of the entire area.

The track loadings at SP4 over this section are now:

- Awsworth Junction – Marston Junction 8tph
- Marston Junction – Water Orton North Junction 16tph
- Water Orton North Junction – Water Orton West Junction 8tph
- Water Orton West Junction – Birmingham HS 16tph
- Water Orton North Junction – Water Orton South Junction 8tph
- Water Orton West Junction – Water Orton South Junction 8tph
- Water Orton South Junction – Birmingham Interchange station 16tph *
- Birmingham Interchange station – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Bristol Parkway HS 8tph

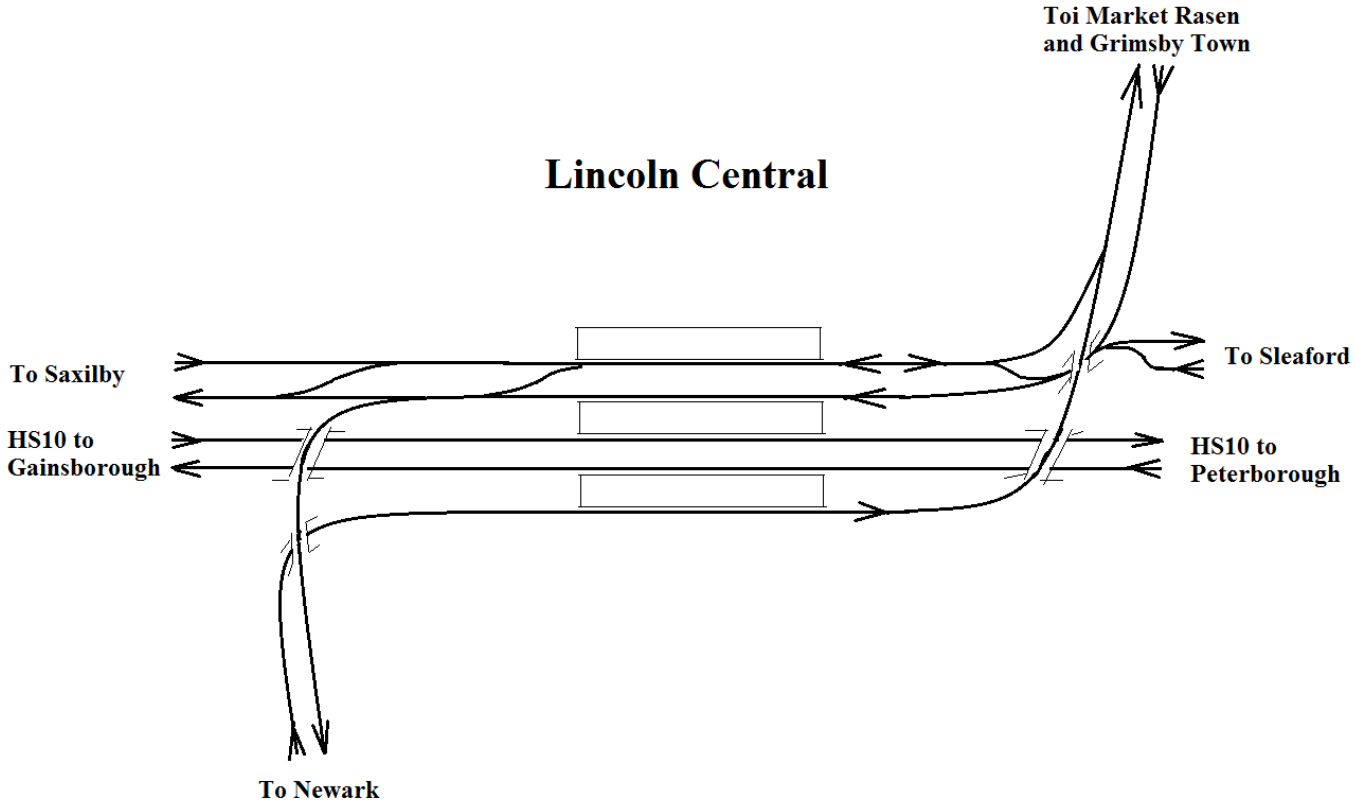
Note that these values are for both HS7 and HS2-CV loadings. Note also that they do not include the loadings of the UHS services of HS2, which occupy the inner pair of tracks. (*) There are actually 6 tracks over this section, so 8tph over each track of the two outer pairs.

# Appendix D – Coalpit Heath Junction



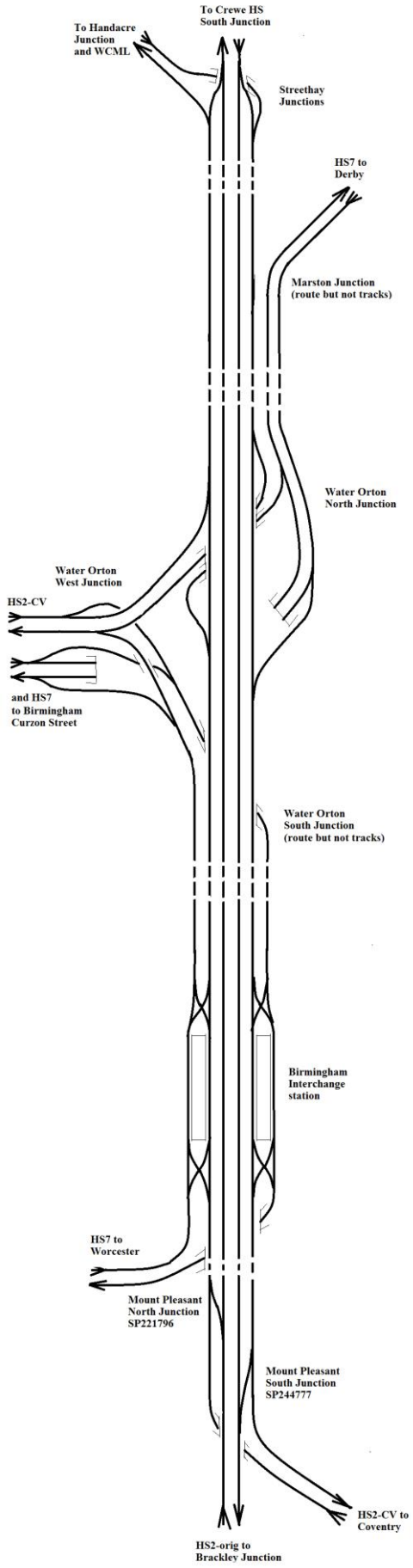

The junction at Coalpit Heath is now a route junction only – no connections between the tracks. The southbound line of HS7 crosses over HS4 then runs alongside it, the tracks arranged in parallel. Tbe non-conflicting track junstions are located shortly before Bristol Parkway, so the trains will have decelerated for the station stop, and be travelling quite slowly, so no special high-speed points are required for the junctions.

# Appendix E – Lincoln Central Track Layout




The key feature of this layout is, to enable cross-platform interchange between HS10 GC-gauge trains to Hull and CC trains to Cleethorpes, they must be travelling in opposite directions across the same island platform.

# Appendix F – Mount Pleasant to Streethay Junction




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.