HS4 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 HS4, the route from London to South Wales, and, in association with HS7, to Bristol and the West Country.

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.)

These considerations apply in extreme form when, as in the present case, the route starts from London. Here there are simply no free routes available. The design has to follow an existing route, widened where there is space for it, (this involves searching, via satellite maps at a high magnification, where there is space to fit extra tracks within the existing alignment or where there is adjoining space to widen the alignment,) with recourse to tunnelling where there isn't.

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 no gradients, as the new alignments – Maidenhead to Didcot and Bristol Parkway to Cardiff (Rhoose) Airport – are essentially level, or, for the approaches to the HS Severn Tunnel, whatever gradient we choose, affecting merely the length of the approach.

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 HS4, including sections of other routes over which HS4's services run. These overall maps come at the end of the 'Route' description, and also show HS4'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 HS4.

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 HS4 (and HS7) stations are served by all services, so don't need overtaking/avoiding lines (except Swindon, which is effectively on an avoiding line). 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 HS4 west of Cardiff (and HS7 south of Bristol) – but see Appendix G concerning Cardiff Airport.

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, the southern half of HS7, the NE-SW route, must also be considered, as HS4 and HS7 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 Cardiff and Bristol, 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 Cardiff and Bristol, and another 4tph with one cross-platform change, giving exactly the same journey time. (Indeed London has an extra 2tph to each, but these are classic-compatible services, intended primarily for the benefit of intermediate locations.)

Two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic compatible) which travel on HS4 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS3, to York and Preston. It's all rather arbitrary, at present. Provided that there are no difficult technical issues in running double deck trains at 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, and for several CC services also. The assumptions and approximations made are explained.

HS4 Route – Introduction and Assumptions

Except for those parts of the route between Maidenhead and Didcot, and between the HS Severn Tunnel eastern approach and Cardiff (Rhoose) Airport, HS4 closely follows existing alignments, railway and motorway.

HS4's long-term classic-compatible services begin at Paddington, and the GC-gauge services are all cross-London inter-regional, via Euston Cross. This is an underground station with 6 platforms, (with passive provision for 8,) located on a west-east axis between Euston and St. Pancras / King's Cross stations, the precise location, horizontal position and depth, to be determined by the configuration of all the other tunnels in that area. Euston Cross and its approaches are shared by HS4 and HS2, GC-gauge

services only. It is a through station; nothing starts or terminates there. HS4's services via Euston Cross continue into East Anglia and North Kent, as routes HS11 and HS12. Appendix A gives full details of Euston Cross and its approaches. Full details of the services on HS11/HS12 are contained in the article 'HS East Anglia and N. Kent Routes and Service Plans (HS11 and HS12)'. Summary details of the inter-regional services are in the service plans of the present article.

The maximum speed for HS4 is 360kph (225mph) between Maidenhead (or, possibly, LHR Interchange,) and Bristol Parkway. Elsewhere the non-stop runs are not long enough to take advantage of this speed, so a lower limit of 175mph applies there, with no detriment to the service provided, and with significant savings in construction costs. (The limit of 175mph applies throughout on HS7, except where it shares route with HS3, above Nuthall North Junction, Nottingham.)

HS4 will be based closely on the classic GW alignment, certainly in the section from Paddington to Langley. This really is a no-brainer; it's by far the best alignment available. The section from Langley to west of Maidenhead is problematic, giving the choice of either a long tunnel or extensive demolition. A less ideal alignment along the M4 is thus chosen, which does not have this disadvantage. The planning of the section from Maidenhead to Didcot is actually considerably more difficult, since it would be very awkward (and extremely unpopular) to widen the existing alignment, so, rather than putting most of it in tunnel, a completely new alignment is proposed for this section, to avoid these difficulties. The section from Didcot westwards, as far as Bristol Parkway, is again based closely on the classic alignment; this could hardly be improved on in any significant respect. (It is an open question whether this would better be achieved by a new build, or by expansion to GC-gauge of the existing alignment west of Wootton Bassett. See Appendix D for more details.) From Bristol Parkway to Cardiff (Rhoose) Airport is a largely new alignment; for the rest of the route to Swansea, existing alignments are followed.

HS4 will serve Heathrow Airport, but not directly. Heathrow will be served on the Paddington – Reading axis by an express shuttle service of at least 6tph, serving Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange (the former Langley, extensively redeveloped) – Slough. HS4 services will all stop at Old Oak Common and LHR Interchange. Beyond Slough the Heathrow Shuttle splits into three half-hourly services:

- Slough – Reading – Thatcham –Newbury – Kintbury – Hungerford – Bedwyn – Pewsey
- Slough – Maidenhead – Twyford – Reading – Tilehurst – Pangbourne – Goring & Streatley – Cholsey – Didcot – Oxford
- Slough – Reading – Didcot (for stations to Oxford) – Wantage Road – Swindon

I envisage that the existing Heathrow Express service would be subsumed within the Shuttle. This of course belongs (as does the railway itself between Airport Junction and Terminal 5) to the Airport holding company, so some advanced bargaining would doubtless be required.

The Airport Shuttle will incorporate all local services on the GW route, and of course connect with Crossrail (at Reading, Maidenhead, Slough, LHR Interchange, Old Oak Common and Paddington). At a later date, three further Shuttle routes will be added. Further details are in Appendix C. Full details of all classic services on the GWML and associated routes is contained in the article 'GWML Service Plans'; these are structured to correspond exactly with the service plans in the current article.

HS4 Route – Junctions

There are various junctions on the route of HS4, (though surprisingly few,) 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.

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

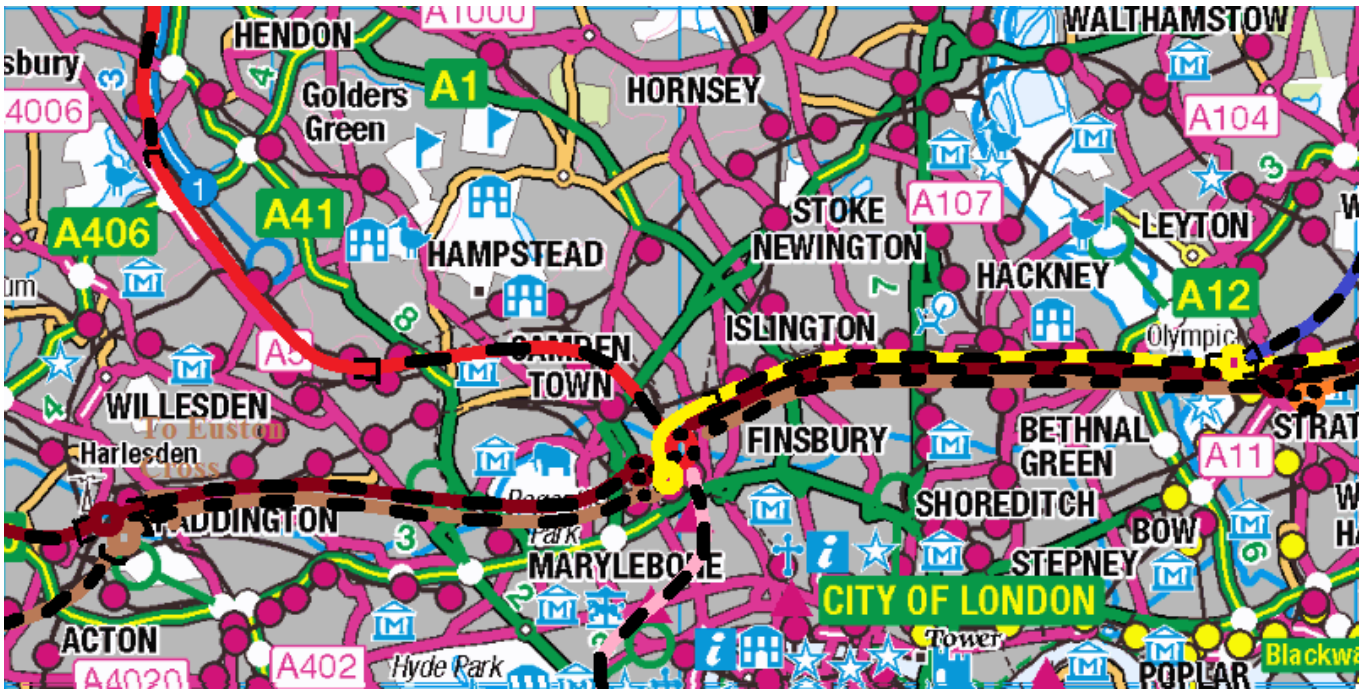
- Old Oak Common East — TQ220821 — HS4 diverges from HS2, with which it has shared tracks from Euston Cross, immediately east of Old Oak Common (Low Level). (The given location is **approximate** – it's underground!)
- Old Oak Common West — TQ213818 — Allows classic-compatible services from Paddington to join HS4, west of Old Oak Common station. (The given location is **approximate** – it's underground!)
- Magic Roundabout — SU218874 — (East) Eastbound services having stopped at Swindon re-join the main line.
  SU188867 — (West) Westbound services Stopping at Swindon diverge from the main line.
- Mannington — SU117828 — (East) Eastbound services stopping at Swindon diverge from the main line.
  SU088819 — (West) Westbound services having stopped at Swindon re-join the main line.
- Coalpit Heath — ST685803 — HS7 joins alignment of HS4. Note that this is a route junction, not a line junction. The line junctions are at:
- Pye Corner — ST635797 — Connects HS4 and HS7 with each other (with totally non-conflicting junctions), and with the classic route, just east of Bristol Parkway

There are various other links between HS4 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.

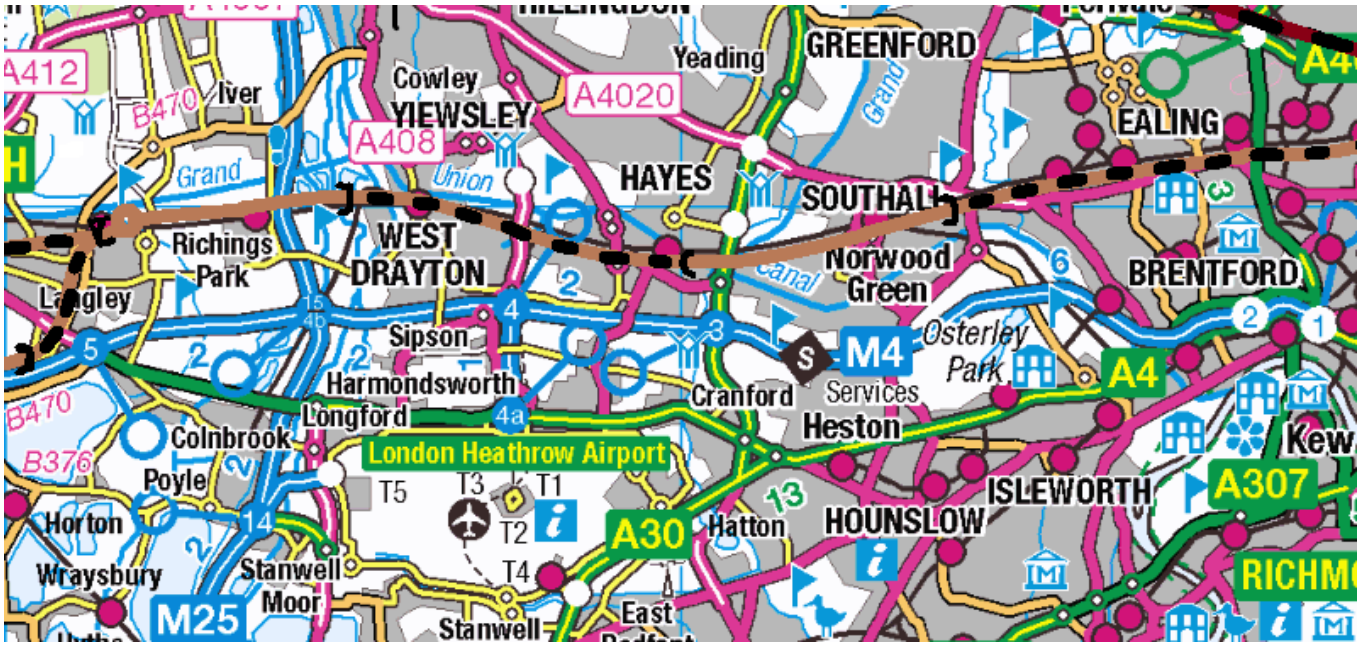
1. *Euston Cross - Maidenhead*

HS4 arrives at Old Oak Common East Junction (TQ220821) in tunnel from Euston Cross, which it shares with HS2; it diverges from HS2 and has its own platforms at Old Oak Common (Low Level). It is joined at Old Oak Common West Junction (TQ213818) by a connection from the classic route, from Paddington, used by the classic-compatible services, which serve platforms at Old Oak Common (Ground Level). Appendix A clarifies.



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

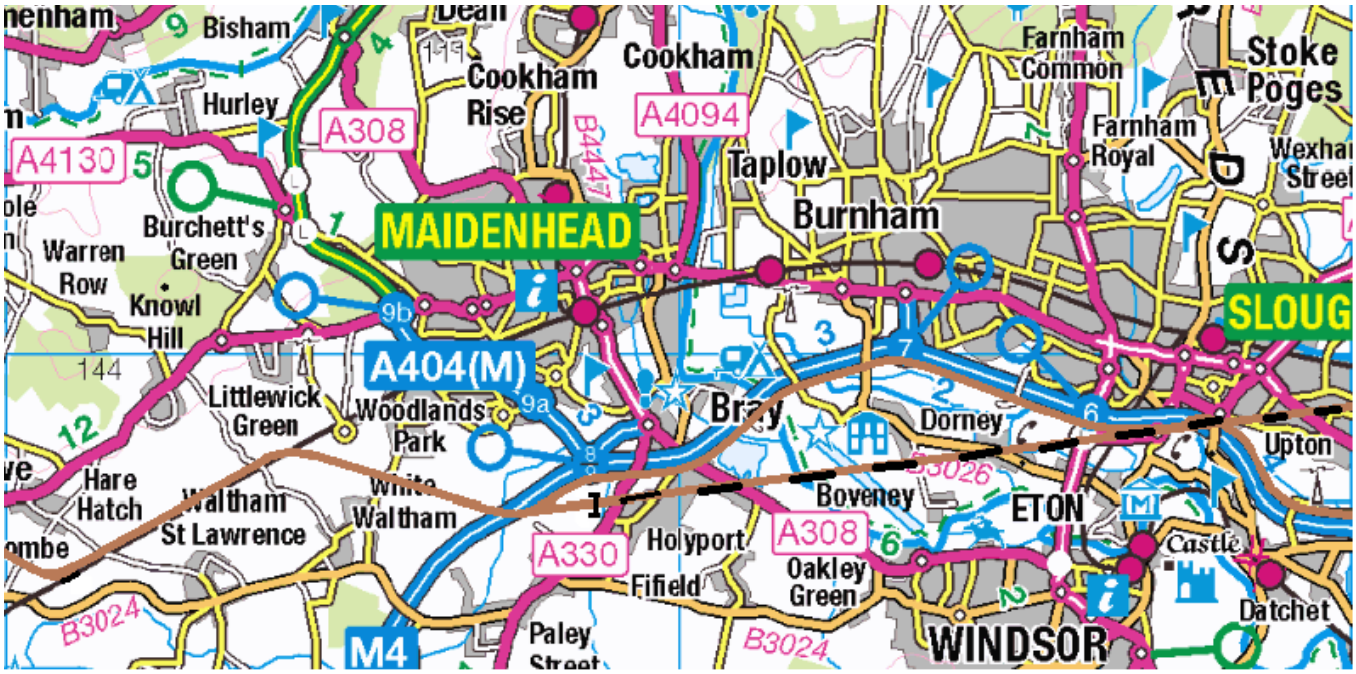
It follows the classic GW alignment, still in tunnel, for a further 5 miles to just after the bridge over the Uxbridge Road, at TQ140801. This section is fully built up on both sides of the alignment, with no practical scope for surface running. For nearly 3 miles from that point to just before Hayes and Harlington station (TQ100794), it follows the south side of the GW alignment. This area includes a lot of sidings, some warehousing, and actually some open land; it may be necessary to demolish the odd warehouse, but



1.2 Ealing – Langley Contains Ordnance Survey data © Crown copyright and database right 2013

no housing is threatened. It will be necessary to provide a flyover or diveunder at TQ129799 for the Brentford freight branch, if that is still in service.

HS4 enters a 2½ mile tunnel from Hayes and Harlington to just past West Drayton (TQ055801), emerging on the north side of the GW alignment and following that to LHR Interchange / Langley station. I imagine the new station will be slightly – 200 yds, say – to the east of the present one (TQ017798), as there's more room for expansion there. HS4 will have two island platforms, on the north side of the alignment; there will likewise be two island platforms for the classic fast lines, and thus the shuttle service, and a single island platform in the middle for Crossrail, with extensive lifts, escalators and perhaps even travelators to facilitate interchange).

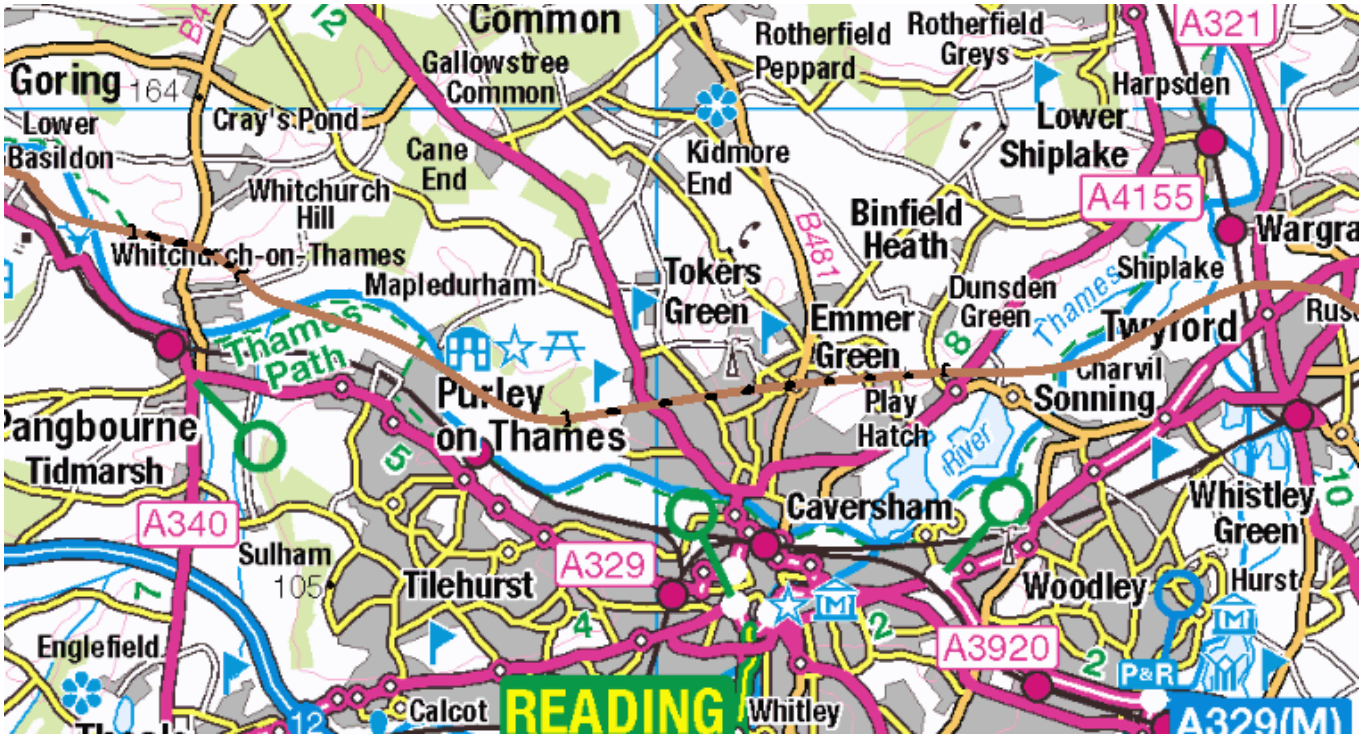


1.2 Slough – Ruscombe

From LHR Interchange, there is no room for expansion on either side of the GW alignment until west of Maidenhead without extensive demolition of housing. To avoid a 9 mile tunnel (on the best alignment), a slightly less than ideal alignment is chosen to the south of Slough, following the route of the M4. A 1.5 mile tunnel from LHR Interchange leads to the M4 near Ditton Farm (TQ007777). The route then follows the north side of the M4 to north east of Eton (SU977790), where it crosses over to the south side of the motorway. This it follows around the south of Maidenhead, past the junction with the A404(M), to SU873775, where it crosses over and leaves the M4, (and the maximum line speed is raised to 360kph, 250mph), passing around the southern edge of White Waltham Airfield, to rejoin the GW alignment near Shottesbrook Farm at SU842785, crossing to the north side of the alignment. (Of course, it may be decided to go for the 9 mile tunnel on the best alignment anyhow, between LHR Interchange and Shottesbrook Farm, so the maximum speed would increase to 360kph,250mph at LHR Interchange. This alternative is also shown on the above maps.)

2. *Maidenhead - Didcot*

HS4 continues along the north side towards Twyford, as far as SU810768, where the Reading bypass begins. The route passes to the north of Twyford, through the gravel pits area north of Sonning, bridging the Thames at SU760768, to Play Hatch (SU742762), where it enters a 3 mile tunnel under Caversham Park Village and Upper Caversham.



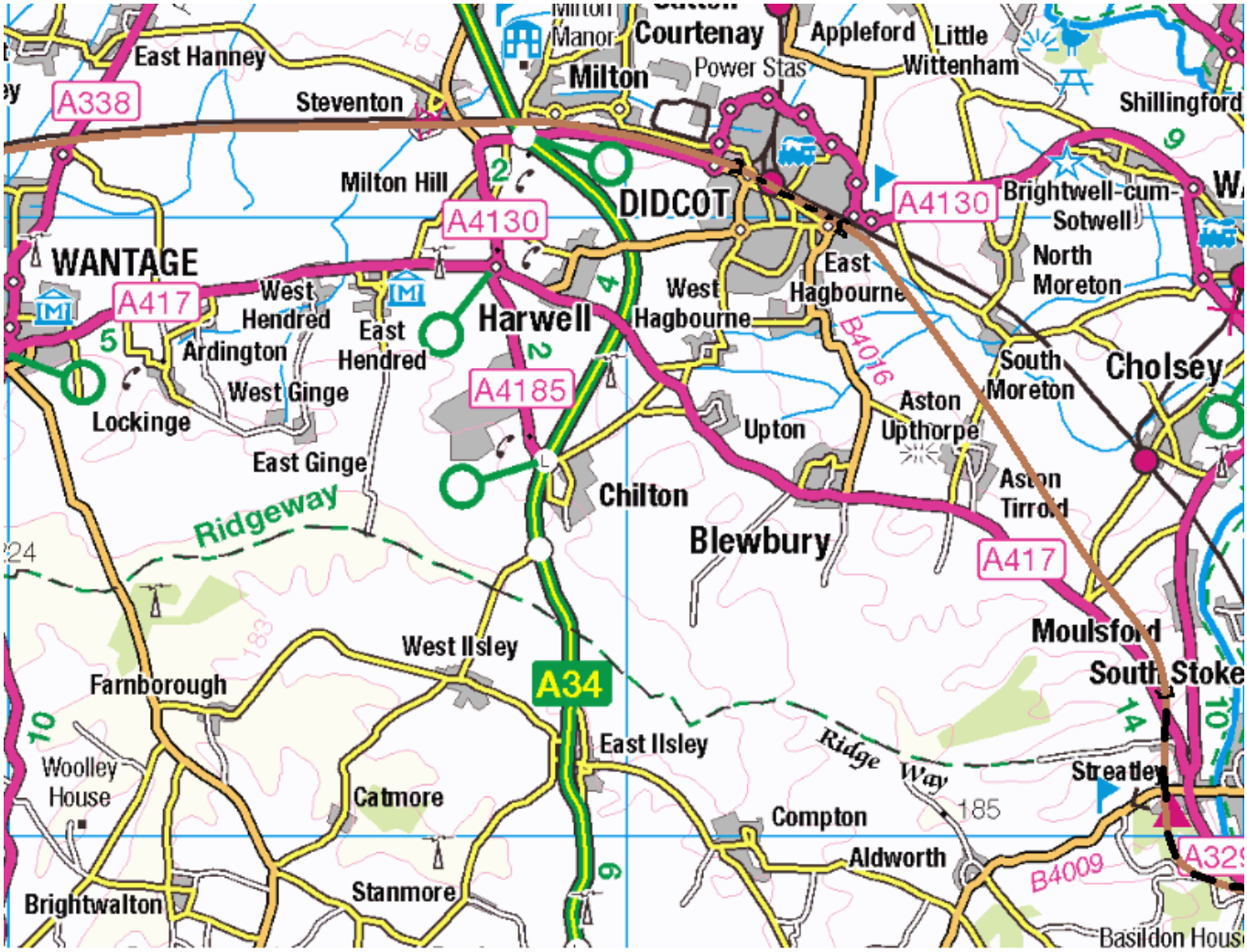
2.1 Twyford – Goring

Emerging from the tunnel at Chazey Wood (SU685757), it crosses the Thames at SU669764 before Mapledurham and passes to the north of Lower Purley, crossing the Thames again at SU650773 and enters a 1 mile tunnel under Whitchurch at SU647778. Emerging at SU627777, it crosses the Thames and runs alongside the GW alignment for 1 mile past Lower Basildon, then crossing over the classic line and entering a tunnel at SU602793, passing under Streatley for 2 miles to SU589820.

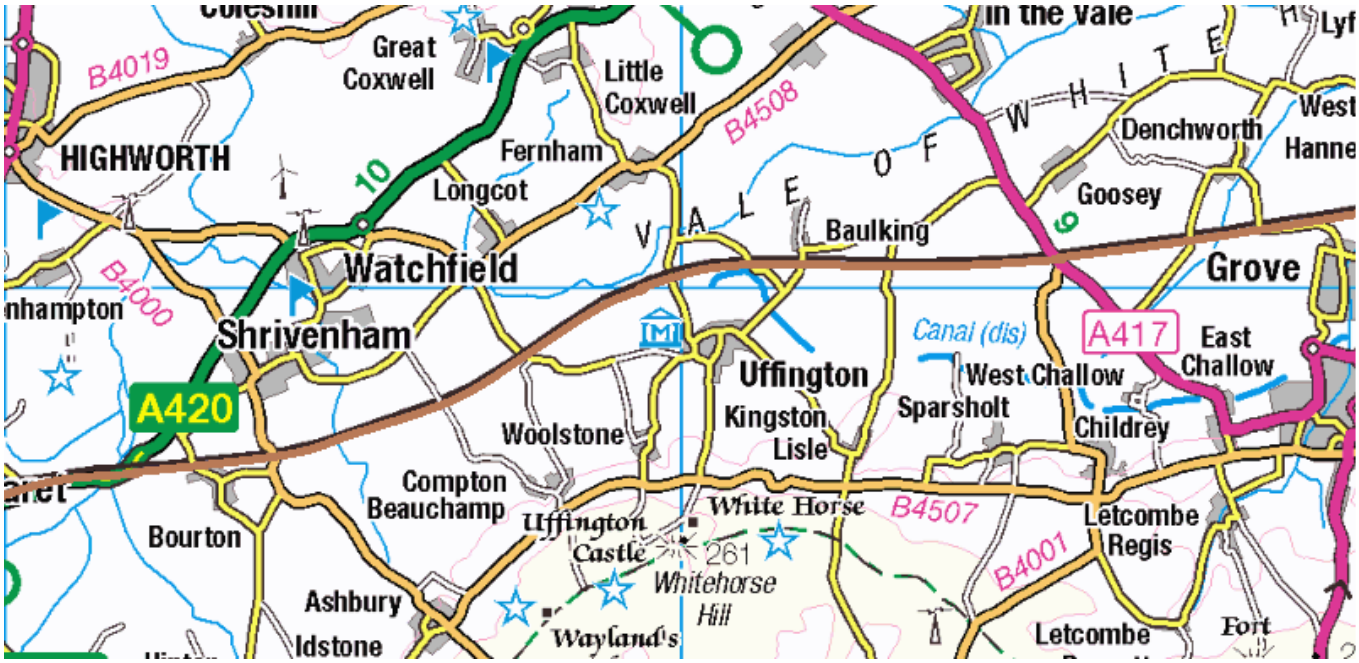
It runs along the slope of the Berkshire Downs, roughly following the A417 road, passing north of Astons Tirrold and Upthorpe, and approaching Didcot. This is a strongly undulating landscape in the southern part, likely to need heavy earthworks. It tunnels under Didcot station for 1 mile from SU532899 to SU522907, emerging on the south side of the GW alignment.

3. *Didcot - Swindon*

The route follows the south side of the GW alignment very closely, from Didcot to the approach to Swindon, at SU192869 (just before the famous Magic Roundabout, hence the name of the junction). There is a connection from HS to classic line at this point, to allow classic-compatible services to leave the HS line and enter Swindon station. The HS line enters a 4 mile tunnel under Swindon, emerging at SU132839, on the north side of the GW alignment. There is a connection from classic to HS line at this point, Mannington Junction. This allows the classic-compatible service to Swansea to regain the HS route after serving Swindon (and regain the classic route at Pye Corner Junction, just before Bristol Parkway).



2.2/3.1 Streatley – Wantage Contains Ordnance Survey data © Crown copyright and database right 2013



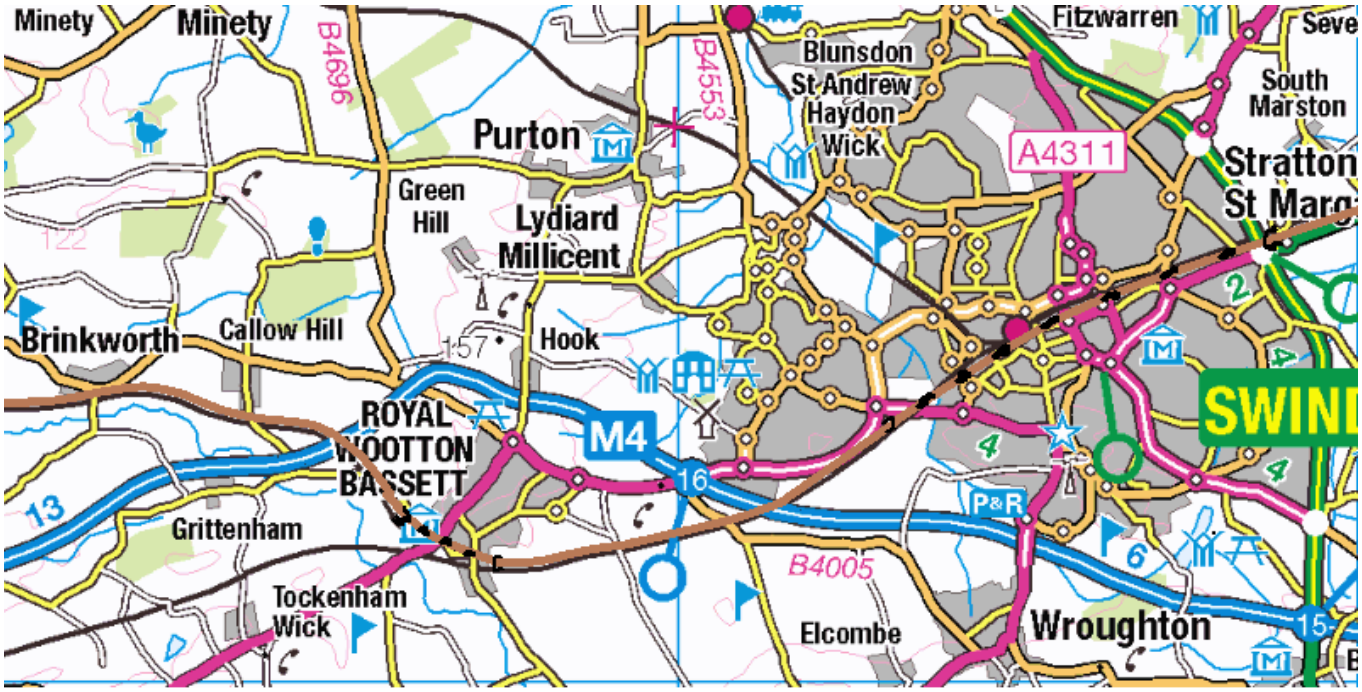
3.2 Grove – Shrivenham Contains Ordnance Survey data © Crown copyright and database right 2013

If Swindon station were rebuilt to GC-gauge, and provided with variable platforms, it could also be served by GC-gauge services, likewise rejoining the main line at Mannington Junction. The possibility is

noted; no specific requirement is currently foreseen for this, but there may well be, and it's obviously a lot easier to provide it in advance than to try and add it later.

4. *Swindon – Cardiff*

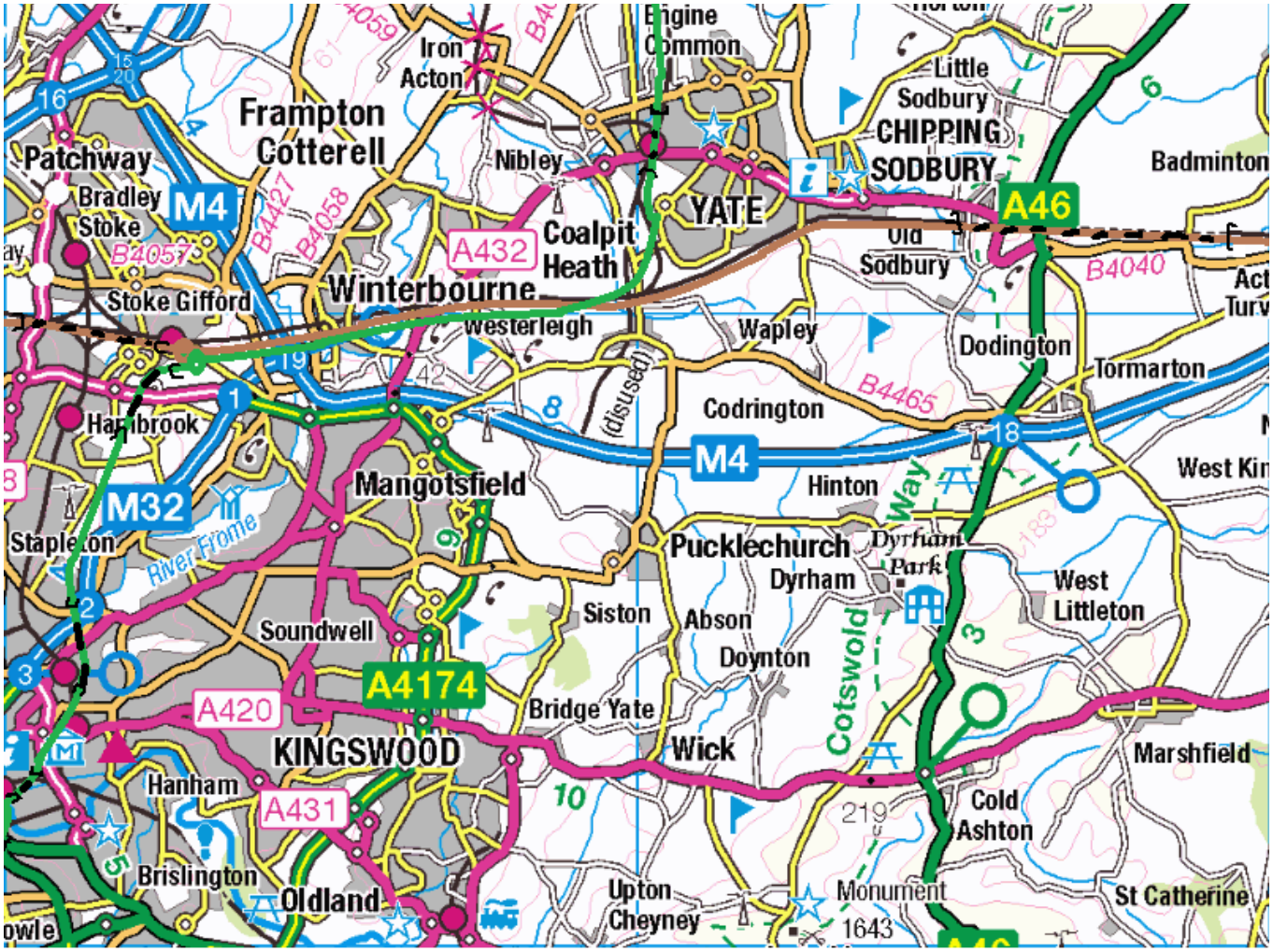
The route follows the GW alignment very closely from Swindon to Bristol Parkway, initially on the north side. It tunnels for 1 mile under Royal Wootton Bassett, from SU073817 to SU058824, also easing the curvature there.



4.1 Swindon – Brinkworth Contains Ordnance Survey data © Crown copyright and database right 2013

4.2 Little Somerford – Badminton Contains Ordnance Survey data © Crown copyright and database right 2013

Just before the site of Badminton station (ST810813) the HS route crosses over to the south side of the classic route, since the north side of the alignment is built-up in Chipping Sodbury, but unobstructed on the south side. (Indeed the south side of the GW alignment is clear all the way to Bristol Parkway station.) There is space at Bristol Parkway for two more island platforms on the south side; the odd warehouse may need to be demolished.



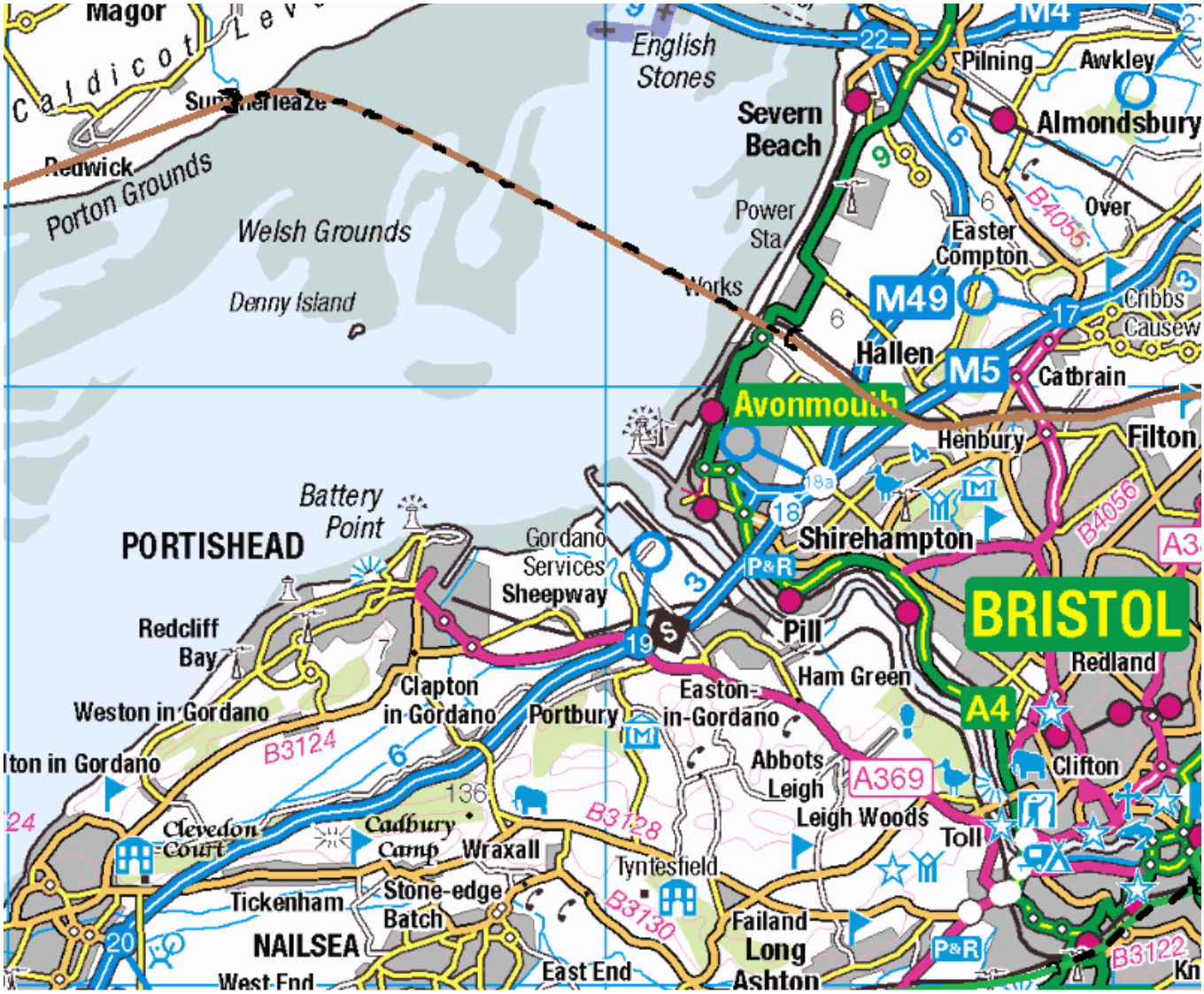
4.3 Chipping Sodbury – Bristol

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 H.

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 Plans) 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.



4.4 Bristol – Magor

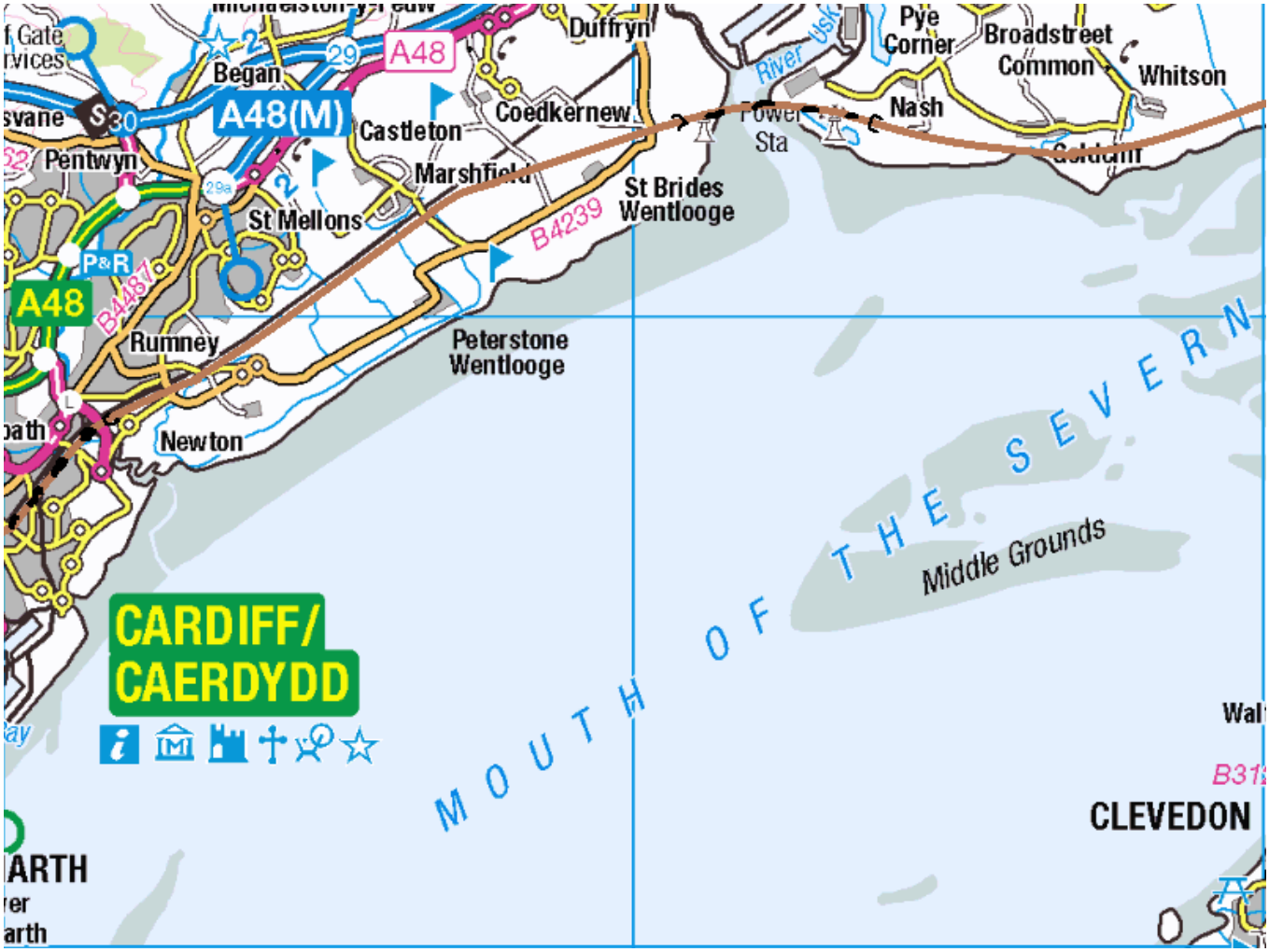
Likewise trains from S. Wales and Bristol/SW approach Bristol Parkway at full line speed, ideally arriving simultaneously, likewise departing simultaneously. But trains **from** S. Wales always arrive at platform HS-3 and those from Bristol/SW always arrive at platform HS-4. The sorting by destination 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.)

At Pye Corner Junction (ST635797) there is a connection from HS4 (and HS7) to the classic route. Initially, this is to enable the classic-compatible service to Swansea to regain the classic route, having benefited from high speed from Swindon. Other uses may well be found later. See Appendix F for the layout between Pye Corner Junction and Bristol Parkway.

Immediately west of Bristol Parkway, HS4 and HS7 diverge, and HS4 enters a tunnel to avoid the classic route junctions. It enters a 1.3 mile tunnel at ST622797 and emerges at ST602800. It follows the Hallen Marsh line and enters a 6 mile Severn Tunnel at ST530810, emerging at Magor Pill (ST440850). I'm

assuming a tunnel; if anything finally comes of the frequent proposals for a Severn Barrage, in the relevant time-frame, and it's in the right place, then that would clearly be preferable.

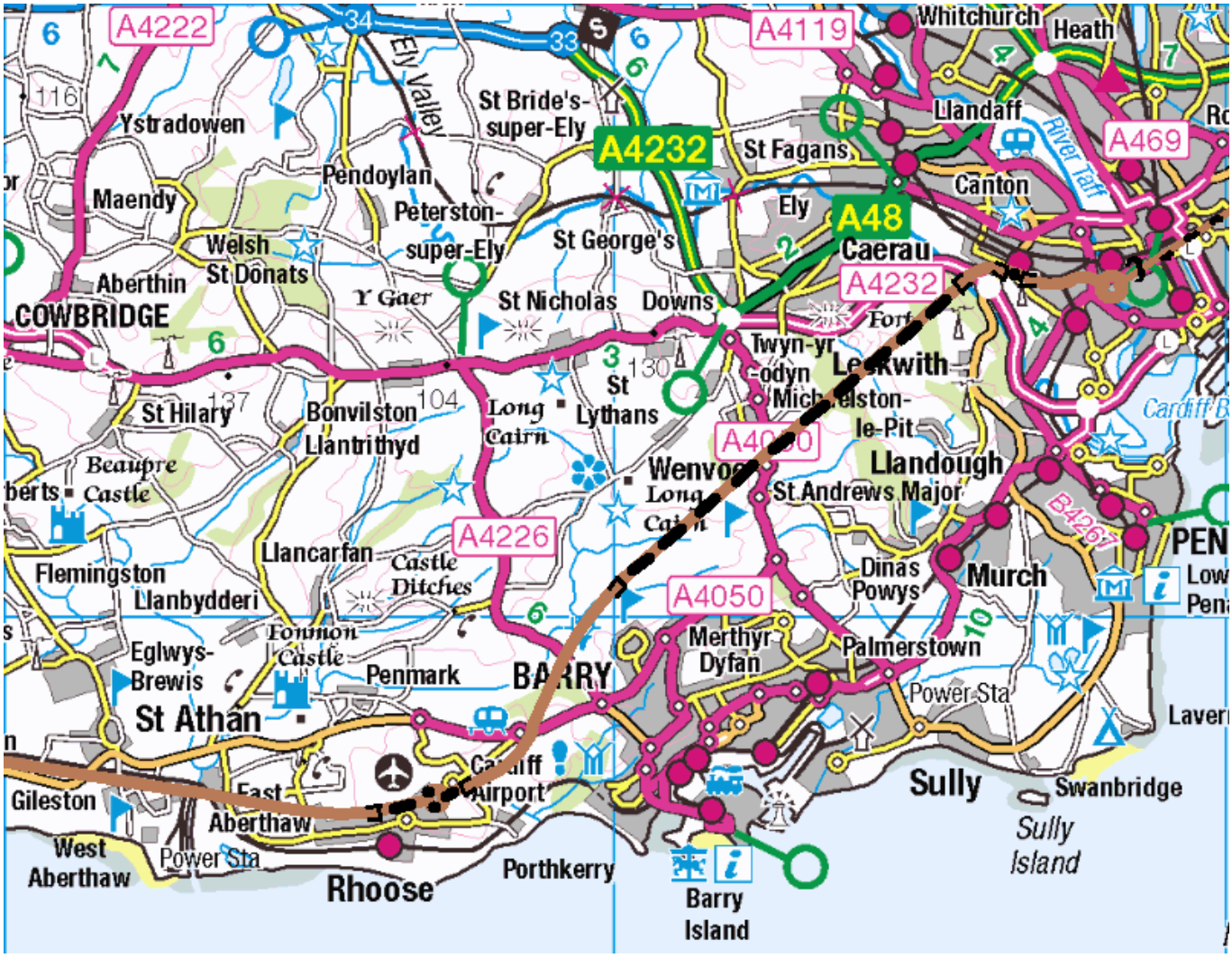
HS4 tunnels under the Usk estuary between ST335832 and ST305833, joining the alignment of the South Wales railway at Marshfield. It follows this alignment all the way to the Cardiff HS station, immediately to the south of Central station, in tunnel between ST215785 and the station itself.



4.5 Uskmouth – Cardiff

5. *Cardiff - Swansea*

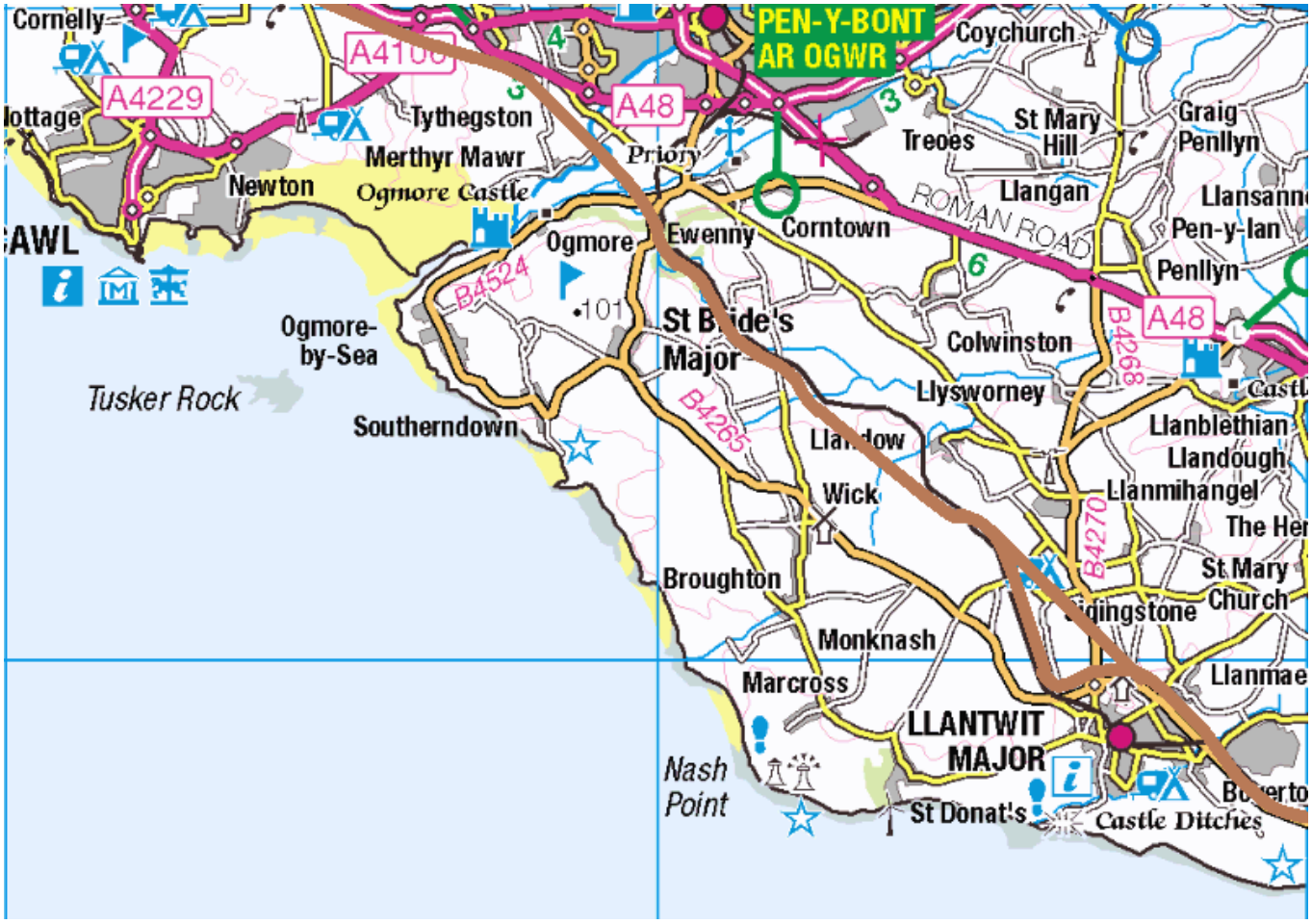
Cardiff HS is immediately to the south of Cardiff General, and is the standard HS two islands, mainly to give the facility of terminating and reversing some services at Cardiff.



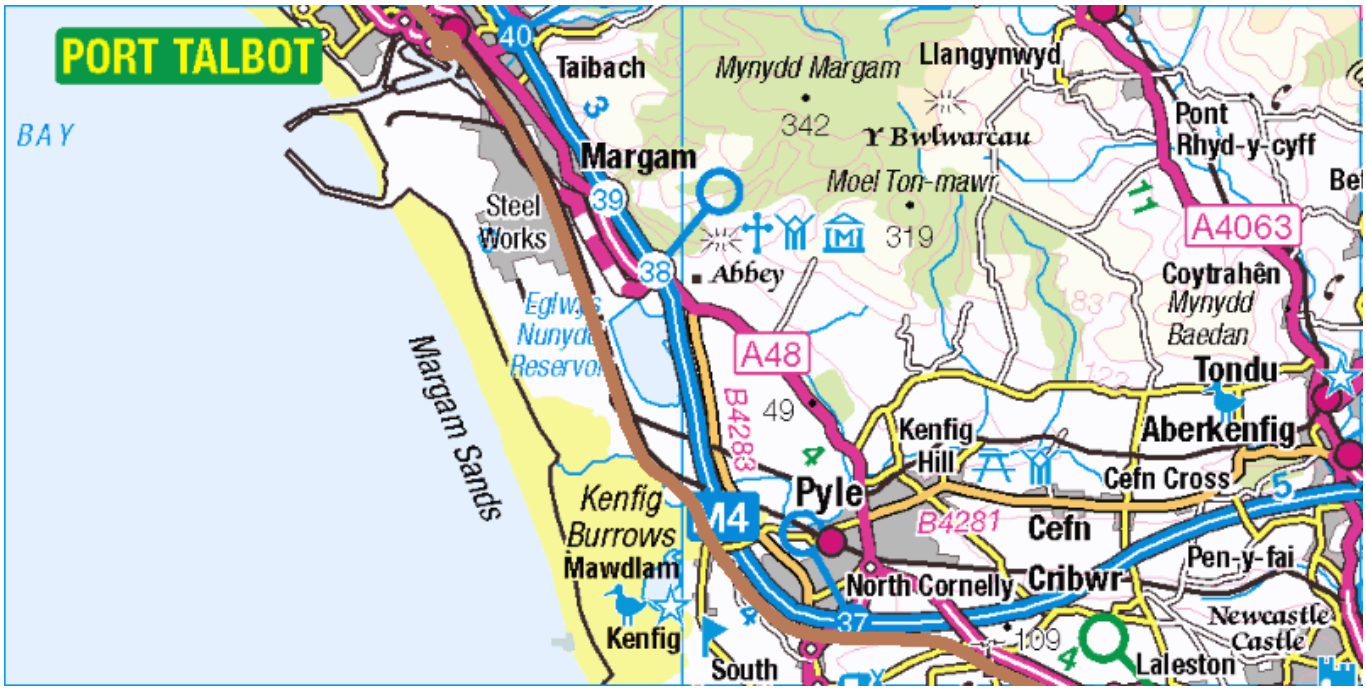
5.1 Cardiff – Gileston

HS4 crosses the Taff adjacent to the existing bridge. Pendyris St. has warehouses / industrial buildings (but also some student housing) on the north side leaving adequate space for the HS tracks – we don't have to worry about getting too close to a warehouse. It climbs to cross the Barry and Penarth line at ST175758, curves round the south side of Canton depot, (with an operational connection thereto, for services terminating at Cardiff), and follows the City Line to just short of Ninian Park, where it enters a short (¼ mile) tunnel at ST168758, curving to the south, and emerging at ST164757, curving round the north west side of the sports stadium, crossing the Ely River at ST156757, finally entering a 5 mile tunnel at ST155756, and emerging at ST105705, a little to the north of Barry. It crosses the A422 at ST090693 and again at ST081680, to arrive at Cardiff (Rhoose) Airport. It passes under the airport in a 1 mile tunnel, between ST075677 and ST059672, with the station under the terminal building, at ST069675.

HS4 joins the south side of the alignment of the Vale of Glamorgan line, at ST030673, and follows this to just before Llantwit Major, At SS988684 it joins the north side of the B4265, follows this round to the north of Llantwit Major, and rejoins the Vale of Glamorgan line (east side) at SS960696. Alternatively, it diverges from the B4265 at SS972696 and rejoins the Vale of Glamorgan line at SS950718, avoiding a sharp curve (this alternative is shown on the map). It crosses to the west side of the alignment at



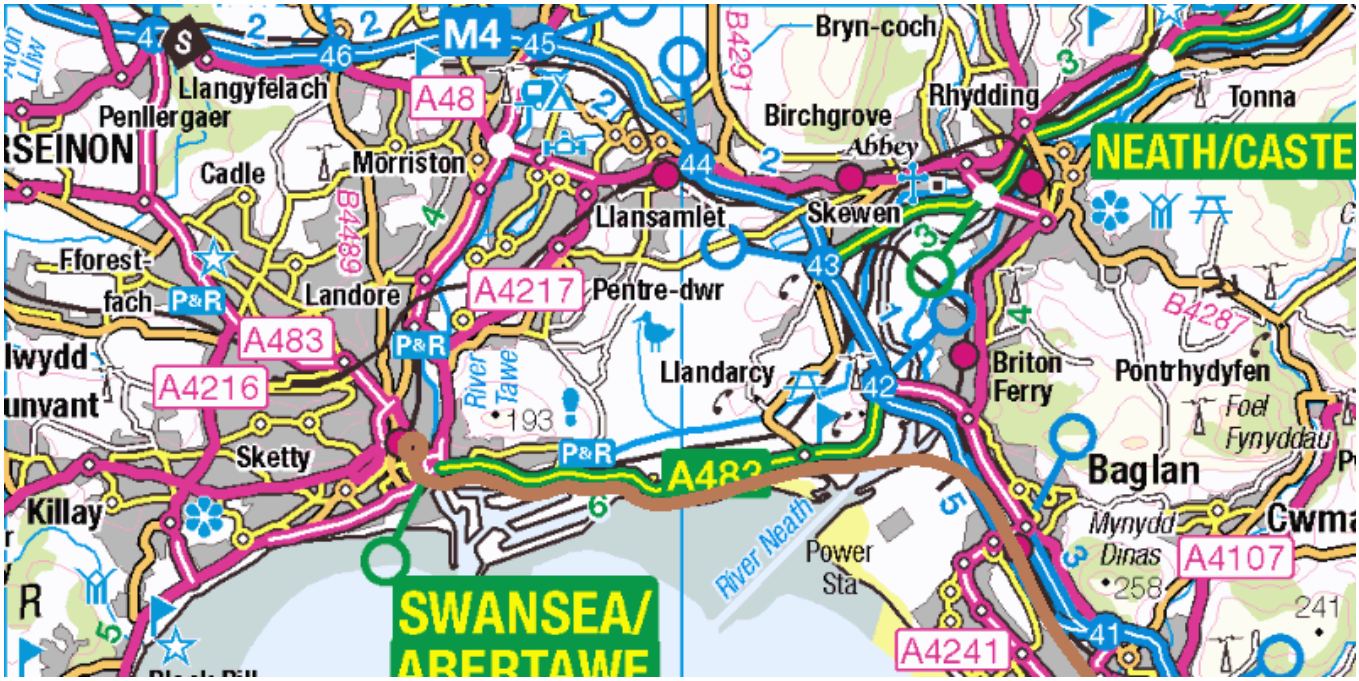
5.2 Llantwit Major – Bridgend



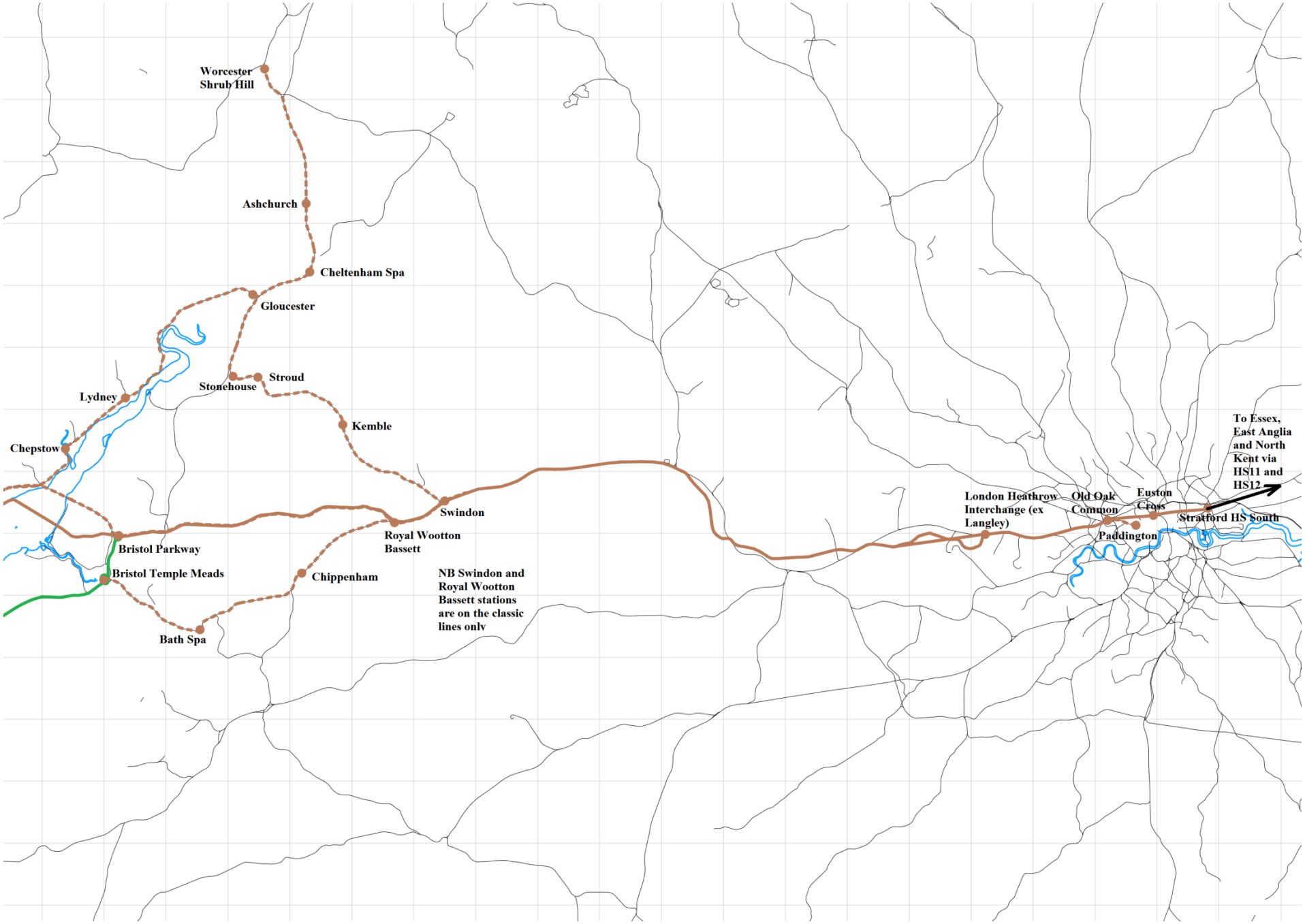
5.3 Laleston – Port Talbot

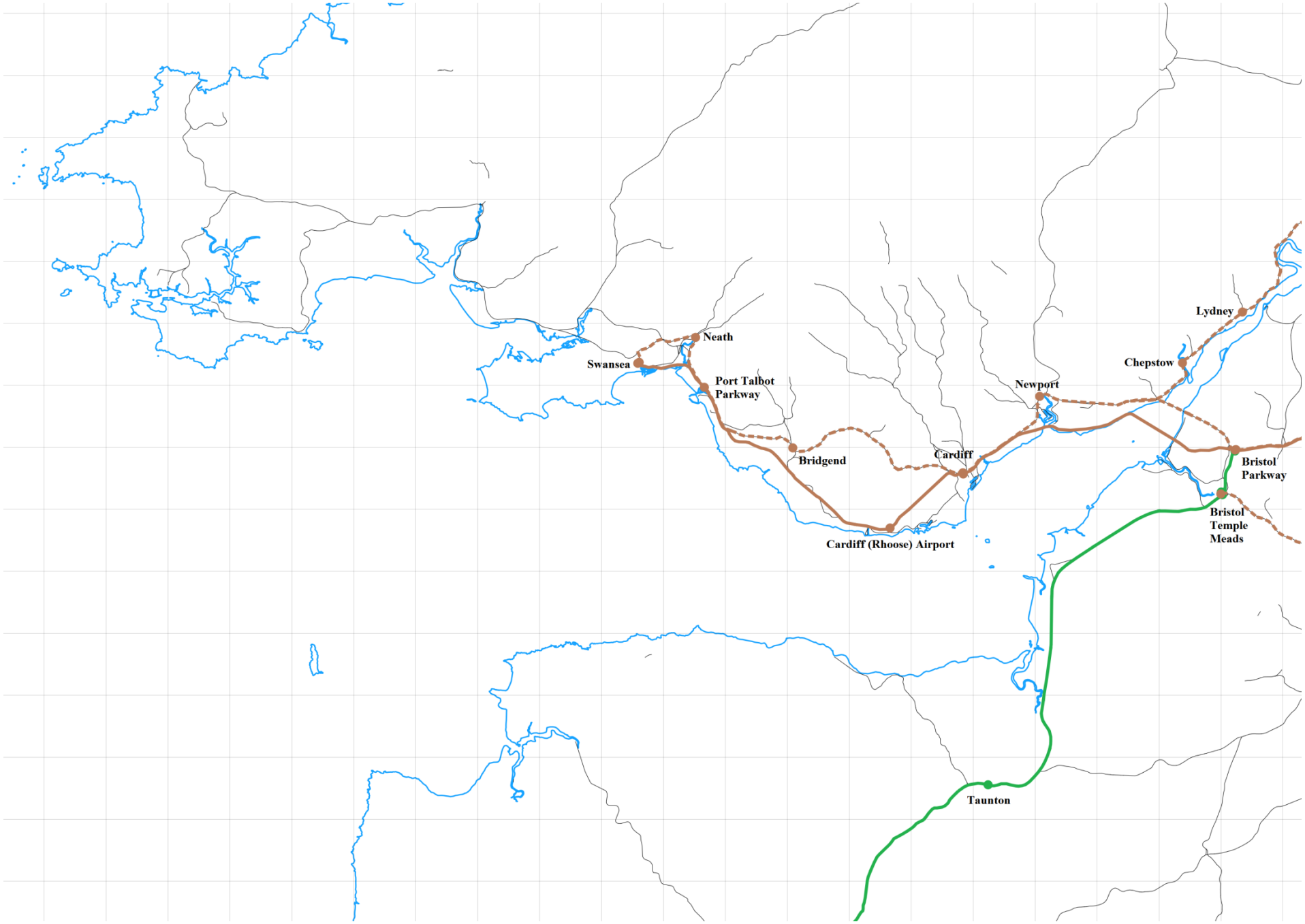
SS941926 then straightens out a major curve between there and SS926739, rejoining the Vale of Glamorgan at the latter point. It diverges after passing under the B5265 at SS900771, passing to the south of Bridgend and joining the south side of the A48 at SS878792, following this, and later the M4, until it joins the south west side of the South Wales railway at SS802829. This it follows to Port Talbot.

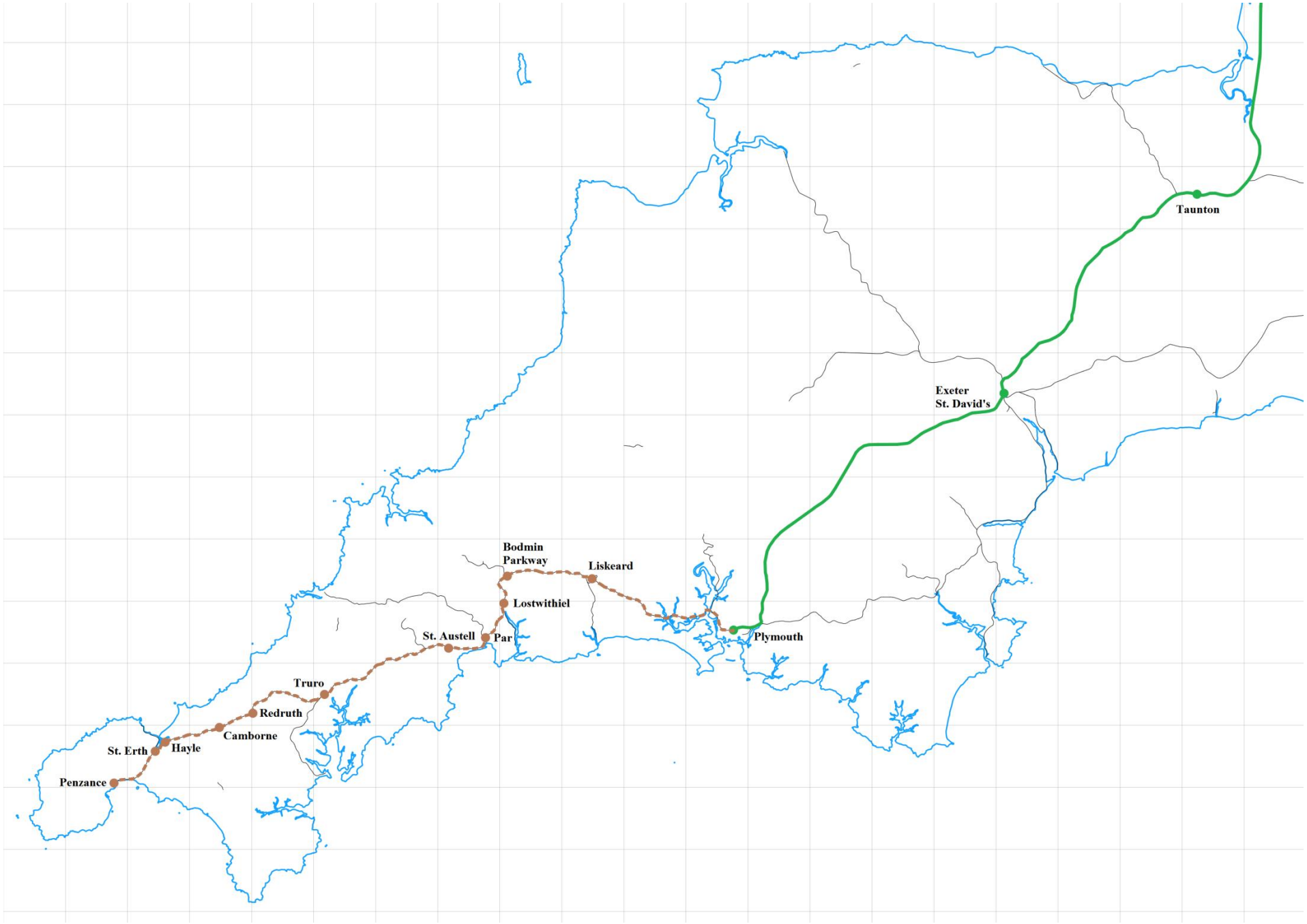
There's plenty of room on the west side of the station for a second island platform. Either HS4 or the classic route (whichever is the more convenient) has one line cross over the other route before the station, and back again afterwards, to enable cross-platform interchange between them. (Interchange will be between HS4 and a local service, providing connections to and from stations between Port Talbot and Swanea.) It continues along the west side of the alignment to SS745926, where it diverges, crossing the M4, then crossing the River Neath at SS730932 and joining the south side of the A483 at SS726934. This it follows to the River Tawe, crossing this at SS661931, possibly reusing the piers of the original railway bridge at this point. It crosses the A4067 then across an area of car parks, to Swansea High St. station. The HS island is parallel to the existing ststion, on the river side, and the tracks continue north to the servicing/stabling area.

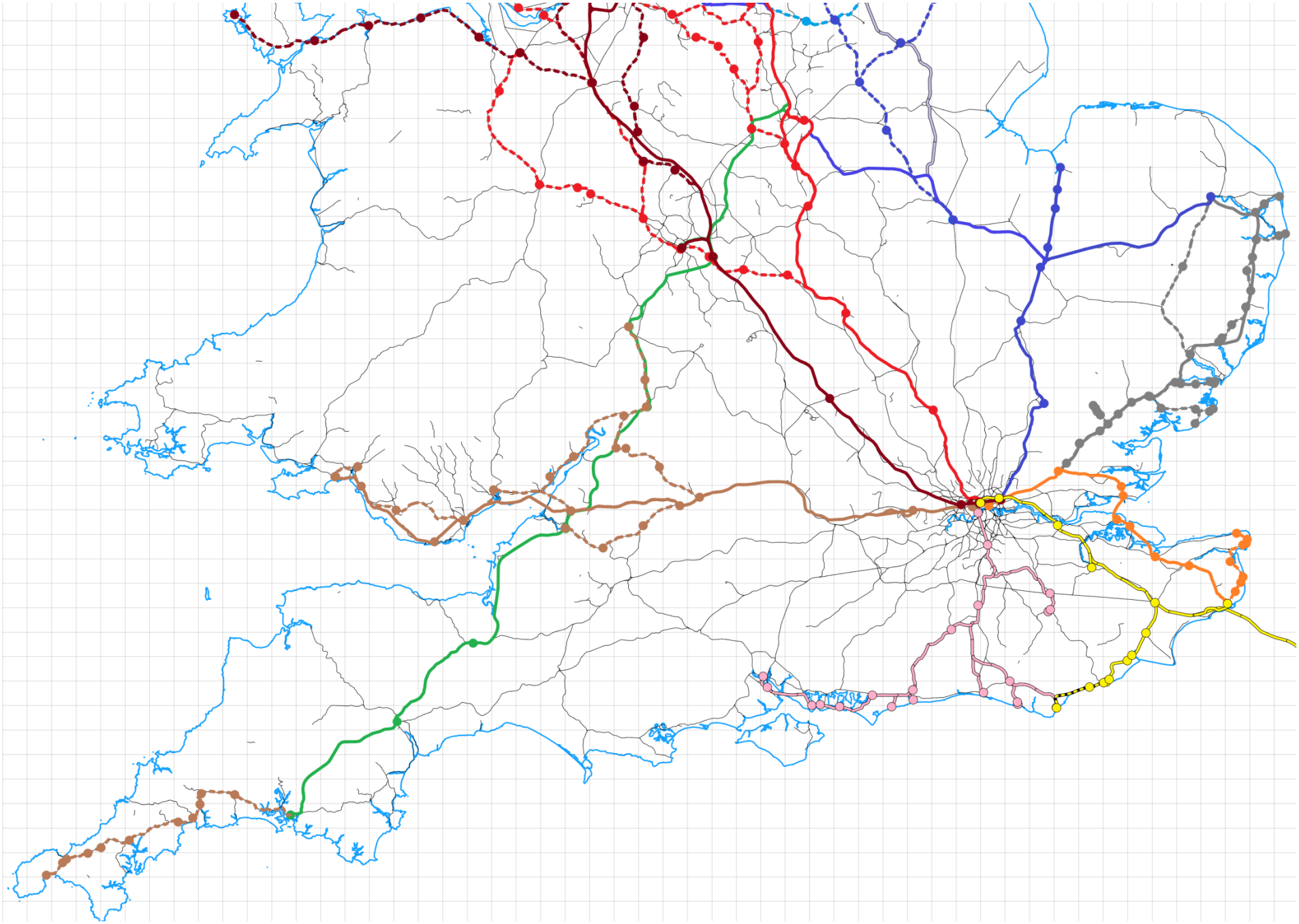


5.4 Baglan – Swansea

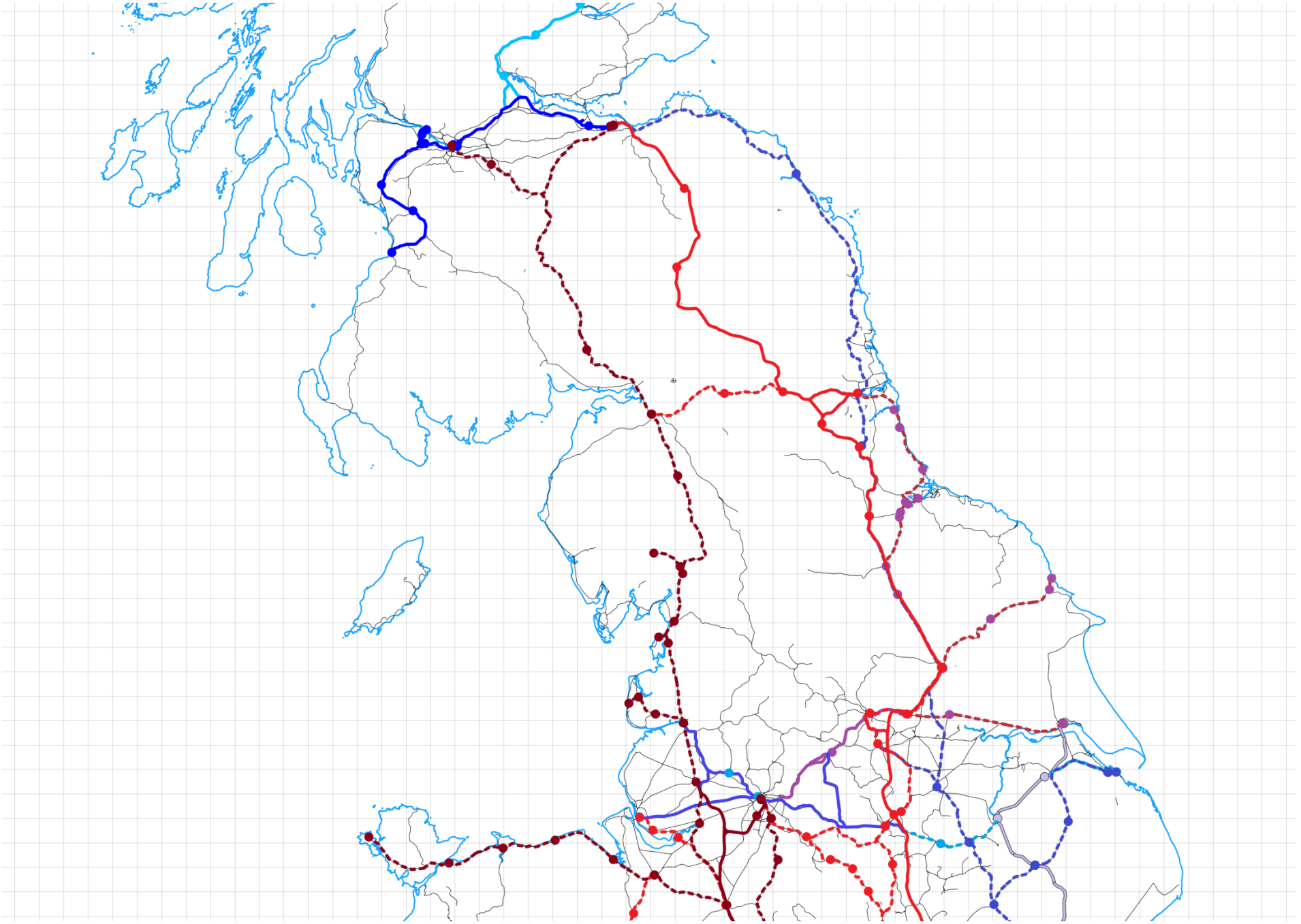


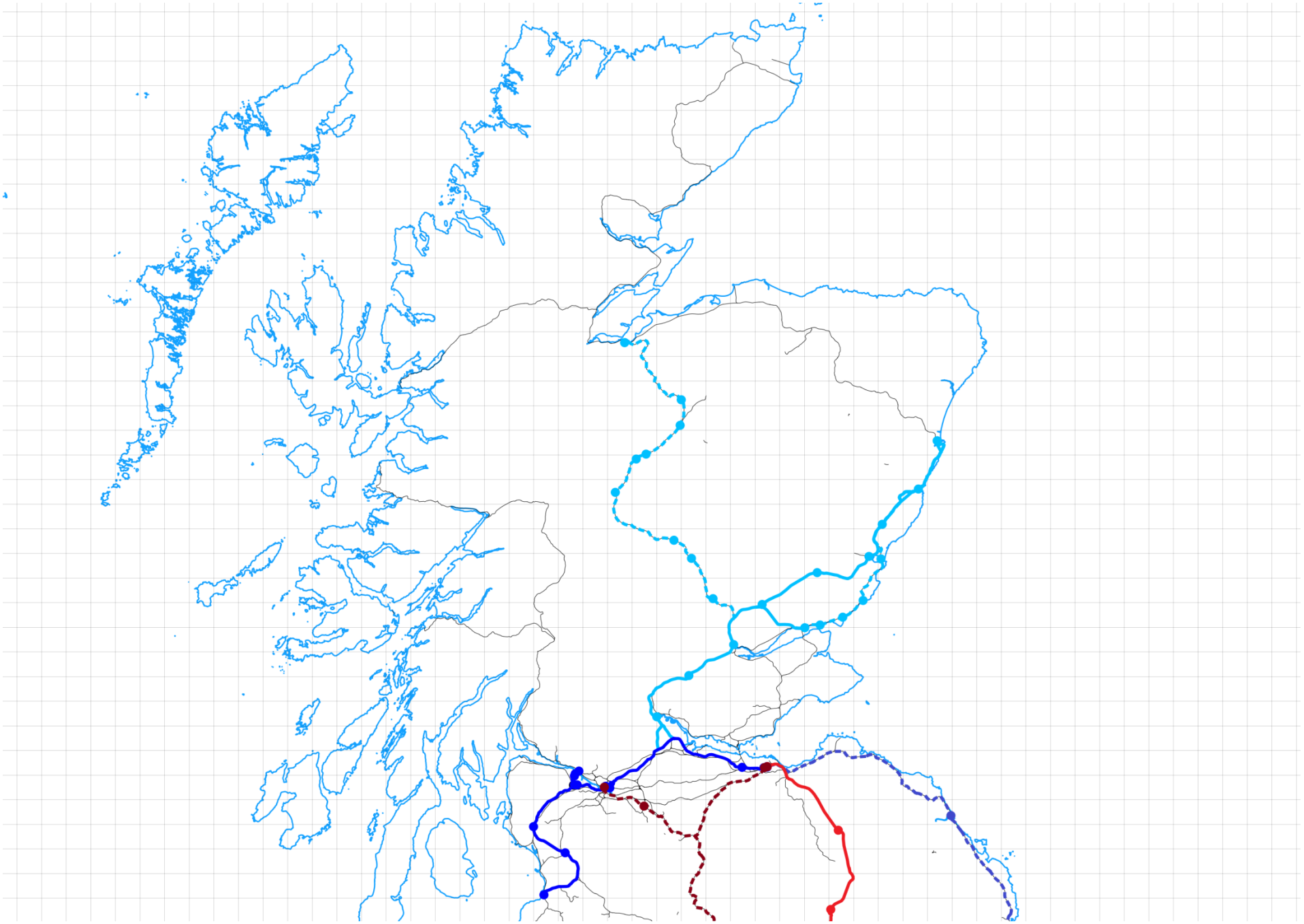






Complete HS Network, South Sheet





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 HS4 itself. This most commonly occurs when a new section of HS4 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. In the present article, X means classic express – which will eventually become regional metro when HS has taken over that route

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

Service Plan 1

The first service plan comes into effect as soon as the section from Old Oak Common West Junction to Magic Roundabout Junction opens (thus independent of Euston Cross). Only classic compatible services from Paddington are involved, and these replace the classic services to Bristol, South Wales and Gloucester/Cheltenham. There are no dependencies on any other HS route.

- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Bristol Parkway – Bristol Temple Meads (Brunel Trainshed)
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Royal Wootton Bassett – Chippenham – Bath Spa – Bristol Temple Meads
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Bristol Parkway – Newport – Cardiff – Bridgend – Port Talbot – Neath – Swansea
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Kemble – Stroud – Stonehouse – Gloucester (splits/joins) – :
  – Lydney – Chepstow – Newport – Cardiff
  – (reverse) Cheltenham – Ashchurch – Worcester Shrub Hill (NB via classic route)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Didcot – Wantage Road – Swindon (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Twyford – Reading – Tilehurst – Pangbourne – Goring and Streatley – Cholsey – Didcot – Oxford (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Kintbury – Hungerford – Bedwyn – Pewsey (LHR Shuttle)

- 2tphX Paddington – Old Oak Common – LHR Interchange – Reading – Taunton – Exeter St. David's – Plymouth – stations to Penzance
- 2tphR Paddington – Old Oak Common – LHR Interchange – Slough – Reading – Thatcham – Newbury – Pewsey – Westbury – Taunton – Tiverton Parkway – Cullompton – Exeter St. David's – Dawlish – Teignmouth – Newton Abbot – Totnes – Ivybridge – Plymouth
- 2tphR Paddington – Old Oak Common – LHR Interchange – Slough – Reading – Didcot – Wantage Road – Swindon – Royal Wootton Bassett – Chippenham – Melksham – Holt Junction – Trowbridge – Westbury – Frome – Castle Cary – Yeovil Pen Mill – Dorchester West – Weymouth
- 2tphR Paddington – Old Oak Common – LHR Interchange – Slough – Reading – Didcot – Oxford – Hanborough – Charlbury – Kingham – Moreton in March – Honeybourne – Evesham – Pershore – Worcester Shrub Hill – Worcester Foregate Street – Malvern Link – Great Malvern – Colwell – Ledbury – Hereford

With this service plan, Bristol, Bath, Chippenham, Swindon, Swansea, Neath, Port Talbot, Bridgend, Cardiff, Newport, Bristol Parkway, Cheltenham, Gloucester, Stonehouse, Stroud and Kemble all retain their existing services to Paddington (with the addition of a connection for Heathrow), at the same or better frequencies, but much faster. The route from Old Oak Common West Junction to Magic Roundabout Junction, and this service plan, could well and very advantageously be implemented at an early date, well before the rest, to give palpable, timely improvements to Bristol, South Wales and Gloucestershire.

Representative Hourly Cross-Platform Interchange Pattern at Swindon (refer to Appendix B for the revised layout at Swindon):

00C Paddington – Bristol Temple Meads (platform 1)
R Heathrow Shuttle (platform 2; reverse then return from platform 3)

15C Paddington – Swansea (platform 1)
R Paddington – Weymouth (platform 2)

23C Paddington – Gloucester – Cardiff / Worcester (platform 5; no interchange)

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

Representative Hourly Cross-Platform Interchange Pattern at Westbury:

00R Paddington – Plymouth
R Paddington – Weymouth

– repeating at 30 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Cardiff:

00C Paddington – Swansea
C Paddington – Cardiff via Gloucester

– repeating at 30 minutes past.

It imposes the following loadings on HS4:

- Euston Cross – Old Oak Common East Junction 10tph

- Old Oak Common East Jn. – Old Oak Common West Junction 0tph
- Paddington – Old Oak Common station (ground level) 26tph
- Old Oak Common station – Old Oak Common West Junction 8tph
- Old Oak Common West Jn. – Magic Roundabout Junction 8tph
- Magic Roundabout Junction – Mannington Junction (main line) 0tph
- Magic Roundabout Junction – Swindon station 12tph
- Swindon station – Mannington Junction 8tph
- Mannington Junction – Coalpit Heath Junction 0tph
- Coalpit Heath Junction – Pye Corner Junction 0 tph
- Pye Corner Junction – Bristol Parkway HS 0tph
- Bristol Parkway HS – Cardiff HS 0tph
- Cardiff HS – Swansea 0tph

(There are of course more than 2 tracks between Paddington and Old Oak Common, and the loading includes several services of no relevance whatever in the present context – see the article 'GWML Service Plans' for (exhaustively) full details. The loading between Euston Cross and Old Oak Common East Junction is all HS2, currently at service plan 3.)

Service Plan 2

This service plan comes into effect when:

- HS4 opens from Old Oak Common West to East Junction, and thus connects to the route to Euston Cross, which is already in service for HS2.
- HS11 opens from Southend Airport and Shenfield to Euston Cross. (Since Euston Cross is a through station only, when HS4 commences serving it, the balancing services on HS11 must commence simultaneously.)
- HS4 opens from Swindon (Magic Roundabout Junction) to Cardiff (see also appendix G).
- HS7 opens from Birmingham Curzon St. to Bristol Temple Meads.

The fast Paddington – Bristol classic compatible service is replaced by a GC-gauge service. (The Brunel Trainshed – designated by the BT suffix – at Bristol Temple Meads is enhanced as necessary to GC gauge. The HS suffix for a station is used if the HS station is physically distinct from the classic station, **or**, in the case of Bristol Temple Meads, to distinguish it from the Brunel Trainshed.) The classic compatible service to Swansea is rerouted along HS4 between Mannington and Pye Corner Junctions. Apart from stopping at Swindon and Newport, it is almost as fast to Cardiff as the new GC-gauge services, below.

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

- 2tphG [HS12 Shenfield –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads HS]

- 2tphG [HS11 Southend Airport –>] Euston Cross – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads BT. This replaces the classic-compatible extra-fast service to Bristol of service plan 1. [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS]
- 2tphG [HS11 Southend Airport –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads BT]
- [HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS (included for completeness; it doesn't make any connection with HS4 in this service plan).]

In addition, the NE-SW Regional Metro service is introduced:

- 2tphR York – Micklefield – Leeds City – Wakefield Westgate – Rotherham – 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 [Shenfield –] Euston Cross – Cardiff HS
G Birmingham HS – Bristol Temple Meads HS
C Paddington – Swansea
R York – Plymouth

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

15G Birmingham HS – Cardiff HS (no interchange)

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

– 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
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 HS4 (remembering that HS4 and HS7 each have their own tracks between Coalpit Heath Junction and Bristol Parkway) of 6tph Euston Cross – Bristol Parkway HS (strictly speaking 2tph of that between Coalpit Heath and Bristol Parkway HS are supplied by the Nottingham – Cardiff service, the corresponding 2tph Euston Cross – Bristol Temple Meads having switched to HS7 on that section), and 8tph Bristol Parkway HS – Cardiff HS. There is a reduction of 2tph Paddington – Mannington junction because the classic-compatible service to Bristol has been replaced by GC gauge, as noted above.

It imposes the following loadings on HS4:

- Euston Cross – Old Oak Common East Junction 16tph
- Old Oak Common East Jn. – Old Oak Common West Junction 6tph
- Paddington – Old Oak Common station (ground level) 24tph
- Old Oak Common station – Old Oak Common West Junction 6tph
- Old Oak Common West Jn. – Magic Roundabout Junction 12tph
- Magic Roundabout Junction – Mannington Junction (main line) 6tph
- Magic Roundabout Junction – Swindon station 10tph
- Swindon station – Mannington Junction 6tph
- Mannington Junction – Coalpit Heath Junction 8tph
- Coalpit Heath Junction – Pye Corner Junction 10tph
- Pye Corner Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – Cardiff HS 8tph
- Cardiff HS – Swansea 0tph

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

Service Plan 3

This service plan comes into effect when HS7 opens from Bristol Temple Meads to Plymouth, and HS11 opens from Southend Airport to Faversham. A new HS4 classic compatible service is introduced, 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 Launceston, Wadebridge and Padstow, assuming that route has by then been reopened. The HS7 service to Plymouth terminates there. The new classic-compatible service Paddington – Plymouth –> Penzance replaces the classic express of service plan 1, (thus there is no change in loading between Paddington and Old Oak Common, but an extra 2tph on HS4 thereafter). In addition, three new services are introduced for the LHR Shuttle and the existing service to Pewsey extended to Devizes and Bristol. These facts are noted here but with no further details; they have minimal impact on HS4 services, and none at all on HS4 loadings. Appendix C gives more details.

- 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 (see appendix E). [Interchange with HS7 2tphG Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS]

Representative Hourly Cross-Platform Interchange at Bristol Parkway:

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

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

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

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

– 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 HS4 of 2tph Paddington – Coalpit Heath Junction.

It imposes the following loadings on HS4:

• Euston Cross	– Old Oak Common East Junction	16tph
• Old Oak Common East Jn.	– Old Oak Common West Junction	6tph
• Paddington	– Old Oak Common station (ground level)	30tph
• Old Oak Common station	– Old Oak Common West Junction	8tph
• Old Oak Common West Jn.	– Magic Roundabout Junction	14tph
• Magic Roundabout Junction	– Mannington Junction (main line)	8tph
• Magic Roundabout Junction	– Swindon station	10tph
• Swindon station	– Mannington Junction	6tph
• Mannington Junction	– Coalpit Heath Junction	10tph
• Coalpit Heath Junction	– Pye Corner Junction	10tph
• Pye Corner Junction	– Bristol Parkway HS	8tph
• Bristol Parkway HS	– Cardiff HS	8tph
• Cardiff HS	– Swansea	0tph

The jump in loadings between Paddington and Old Oak Common reflects the addition of the extra LHR Shuttle services, mentioned in passing earlier.

Service Plan 4

This service plan comes into effect when:

- HS7 is opened north of Birmingham, to York and Leeds, also to Nottingham.
- HS9 opens its initial section between Leeds and Garforth.

As far as HS7's services south of Birmingham (and thus relevant to HS4) are concerned, the only changes are that the Plymouth service now starts from York, and one of the Cardiff services starts form Nottingham. These services now do not serve Birmingham HS, but travel directly from Water Orton North Junction to Birmingham Interchange.

Service Plan 4A

This service plan comes into effect when:

- HS7 is extended from York to Newcastle, via Durham (Relly Mill) and Consett.

The only change relevant here is that the Plymouth service now starts at Newcastle, and the NE/SW route is now complete.

Service Plan 4B

This service plan comes into effect when:

- HS8 opens between Huddersfield and Ladybower Junction.

The only significance of this, in the present context, is that NE-SW services now travel between York and Beighton Junction via Leeds, Huddersfield and Sheffield, rather than via South Yorkshire (Meadowhall).

Service Plan 4C

This service plan comes into effect when:

- HS8 opens between Nottingham and Ely, via Peterborough.

The only significance of this, in the present context, is that service fron Nottingham to Cardiff HS now starts from Norwich.

As a result of the changes in the various phases of service plan 4, the HS4/HS7 services are now:

- 2tphG [HS12/HS11 Shenfield –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS. [Interchange with HS7 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 [HS11 Faversham –>] Euston Cross – Old Oak Common – London Heathrow Interchange –Bristol Parkway HS – Bristol Temple Meads BT. [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS]
- 2tphG [HS11 Faversham –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – 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. [Interchange with HS7 2tphG Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS]

Representative Hourly Cross-Platform Interchange at Bristol Parkway:

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

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

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

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

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

– repeating at 30 and 45 minutes past.

It imposes the following loadings on HS4:

- Euston Cross – Old Oak Common East Junction 18tph
- Old Oak Common East Jn. – Old Oak Common West Junction 6tph
- Paddington – Old Oak Common station (ground level) 30tph
- Old Oak Common station – Old Oak Common West Junction 8tph
- Old Oak Common West Jn. – Magic Roundabout Junction 14tph
- Magic Roundabout Junction – Mannington Junction (main line) 8tph
- Magic Roundabout Junction – Swindon station 10tph
- Swindon station – Mannington Junction 6tph
- Mannington Junction – Coalpit Heath Junction 8tph
- Mannington Junction – Coalpit Heath Junction 10tph
- Coalpit Heath Junction – Pye Corner Junction 10tph
- Pye Corner Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – Cardiff HS 8tph
- Cardiff HS – Swansea 0tph

Note that the loading of Euston Cross – Old Oak Common East Junction has now exceeded my preferred maximum of 16tph, (but HS2 Ltd. are perfectly happy with 18tph).

Service Plan 5

This final service plan comes into effect much later, when:

- HS4 is extended from Cardiff to Swansea. I have assumed that this will serve Cardiff Rhoose Airport whether or not it becomes a Heathrow satellite, and will also serve Port Talbot, approaching Swansea from the east (as opposed to from the north, with the classic route). Half the services will continue to Swansea, and half terminate at Cardiff, as detailed below.
- HS11 is extended from Faversham to Dover.
- HS12 is extended from Shenfield North Junction to Norwich.

(These are among the remaining odds and sods sections, completing the entire HS network. The changes are worthwhile but minor; the services at service plan 4 are already almost as good as they finally get.)

The HS4/HS7 services are now:

- 2tphG [HS12/HS11 Norwich –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose) Airport – Port Talbot – Swansea. [Interchange with HS7 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 [HS11 Dover –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Bristol Temple Meads BT. [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS]

- 2tphG [HS11 Dover –>] Euston Cross – Old Oak Common – London Heathrow Interchange – Bristol Parkway HS – Cardiff HS [Interchange with HS7 2tphG Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – 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. [Interchange with HS7 2tphG Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose) Airport – Port Talbot – Swansea]

In other words, the Euston Cross – Cardiff service which connects with HS7 Newcastle – Plymouth, and the HS7 Norwich – Cardiff service (which connects with Paddington – Plymouth – stations in Cornwall) are extended to Swansea; the Euston Cross – Cardiff service which connects with HS7 Birmingham – Bristol Temple Meads BT and the HS7 Birmingham – Cardiff aren't.

Representative Hourly Cross-Platform Interchange at Bristol Parkway:

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

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

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

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

– 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.

It imposes the following loadings on HS4:

- Euston Cross – Old Oak Common East Junction 18tph
- Old Oak Common East Jn. – Old Oak Common West Junction 6tph
- Paddington – Old Oak Common station (ground level) 30tph
- Old Oak Common station – Old Oak Common West Junction 8tph
- Old Oak Common West Jn. – Magic Roundabout Junction 14tph

- Magic Roundabout Junction – Mannington Junction (main line) 8tph
- Magic Roundabout Junction – Swindon station 10tph
- Swindon station – Mannington Junction 6tph
- Mannington Junction – Coalpit Heath Junction 10tph
- Coalpit Heath Junction – Pye Corner Junction 10tph
- Pye Corner Junction – Bristol Parkway HS 8tph
- Bristol Parkway HS – Cardiff HS 8tph
- Cardiff HS – Swansea 4tph

Service Pattern at Reading

There are no HS4 interchange arrangements at Reading, necessarily so as Reading is bypassed by HS4. Reading's services are all Regional Metro, with the pattern

00 LHR Shuttle – Swindon
00 Gatwick Airport – Milton Keynes
10 Bournemouth – Manchester (rev)
10 LHR Shuttle – Devizes – Bristol
12 Manchester – Bournemouth (rev)
15 Paddington – Weymouth
15 LHR Shuttle – Oxford
24 Paddington – Hereford
25 Bournemouth – York (rev)
25 LHR Shuttle – Marlborough
27 York – Bournemouth (rev)
28 Paddington – Plymouth

– repeating at 30 minutes past. There are also stopping services to Newbury, Basingstoke and Henley, and Crossrail. See the 'GWML Service Plans' article for full details.

Service Plan 5 Summary

It's worth summarising the full set of services at service plan 5, as this represents the final, complete state of these plans, and the services have so far been introduced piecemeal, at the various stages.

HS4:

- 2tphG [HS12/HS11 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
- 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.
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Royal Wootton Bassett – Chippenham – Bath Spa – Bristol Temple Meads
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Royal Wootton Bassett – Bristol Parkway – Newport – Cardiff – Bridgend – Port Talbot – Neath – Swansea
- 2tphC Paddington – Old Oak Common – London Heathrow Interchange – Swindon – Kemble – Stroud – Stonehouse – Gloucester (splits) – :
  – Lydney – Chepstow – Newport – Cardiff
  – Cheltenham – Ashchurch – Worcester Shrub Hill (NB via classic route)

GWML Regional Metro:

- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough –Reading – Didcot – Wantage Road – Swindon (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Twyford – Reading – Tilehurst – Pangbourne – Goring and Streatley – Cholsey – Didcot – Oxford (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Hungerford – Bedwyn – Pewsey – Devizes – Holt Junction – Bradford on Avon – Bath – Bristol Temple Meads (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Kintbury – Hungerford – Bedwyn – Savernake – Marlborough (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Bourne End (connections to and from Marlow) High Wycombe – Princes Risborough – Little Kimble – Aylesbury – Aylesbury Vale Parkway – Calvert (for HS2) – Winslow – Bletchley – Milton Keynes (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Twyford – Wargrave – Shiplake – Henley (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – Slough – Reading – Thatcham – Newbury – Pewsey – Westbury – Taunton – Tiverton Parkway – Cullompton – Exeter St. David's – Dawlish – Teignmouth – Newton Abbot – Totnes – Ivybridge – Plymouth
- 2tphR Paddington – Old Oak Common – Slough – Reading – Didcot – Wantage Road – Swindon – Royal Wootton Bassett – Chippenham – Melksham – Holt Junction – Trowbridge – Westbury – Frome – Castle Cary – Yeovil Pen Mill – Dorchester West – Weymouth
- 2tphR Paddington – Old Oak Common – Slough – Reading – Didcot – Oxford – Hanborough – Charlbury – Kingham – Moreton in March – Honeybourne – Evesham – Pershore – Worcester Shrub Hill – Worcester Foregate Street – Malvern Link – Great Malvern – Colwell – Ledbury – Hereford

HS7 South of Birmingham:

- 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 Birmingham HS – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Bristol Temple Meads BT
- 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

NE-SW Regional Metro:

- 2tphR York – Micklefield – Leeds City – Wakefield Westgate – Rotherham – 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 Pattern at Swindon:

00C Paddington – Bristol Temple Meads
R Heathrow Shuttle

15C Paddington – Swansea
R Paddington – Weymouth

20C Paddington – Gloucester – Cardiff / Worcester (no interchange)

– repeating at 30, 45, and 50 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Bristol Parkway:

00G Euston Cross – Swansea
G Newcastle – Plymouth
C Paddington – Swansea
R York – Plymouth

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

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

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

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

Representative Hourly Cross-Platform Interchange Pattern at Westbury:

00R Paddington – Plymouth
R Paddington – Weymouth

– repeating at 30 minutes past.

Representative Hourly Cross-Platform Interchange Pattern at Cardiff:

00G Pancras Cross – Swansea (not cross-platform)
C Paddington – Swansea
C Paddington – Cardiff via Gloucester

– repeating at 30 minutes past.

Representative Hourly Cross-Platform Interchange at Worcester Shrub Hill:

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

15G Norwich – Swansea (not cross-platform)
R York – Plymouth

– repeating at 30 and 45 minutes past.

HS4 Final Loadings:

• Euston Cross	– Old Oak Common East Junction	18tph
• Old Oak Common East Jn.	– Old Oak Common West Junction	6tph
• Paddington	– Old Oak Common station (ground level)	30tph
• Old Oak Common station	– Old Oak Common West Junction	8tph
• Old Oak Common West Jn.	– Magic Roundabout Junction	14tph
• Magic Roundabout Junction	– Mannington Junction (main line)	8tph
• Magic Roundabout Junction	– Swindon station	10tph
• Swindon station	– Mannington Junction	6tph
• Mannington Junction	– Coalpit Heath Junction	10tph
• Coalpit Heath Junction	– Pye Corner Junction	10tph
• Pye Corner Junction	– Bristol Parkway HS	8tph
• Bristol Parkway HS	– Cardiff HS	8tph
• Cardiff HS	– Swansea	4tph

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 Paddington – Old Oak Common, my estimate 5km, actual 4.8km; Old Oak Common – LHR Interchange – replacing, slightly to the east of the present Langley – my estimate 20km, Old Oak Common – Langley actual 20.8km; Swindon – Bristol Parkway, my estimate 55km, actual 56km) leads me to believe they are accurate to within 4%.

The crudest approximation, usually, is the assumption that, once line speed has been reached, that speed (360kph between LHR Interchange and Cardiff, and 300kph elsewhere,) is maintained until it becomes necessary to decelerate for a junction or a station stop. In fact, given the notably excellent alignments of this particular route, and its peculiar suitability for really high speed, 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:

- Pancras Cross – Old Oak Common 8km
- Paddington – Old Oak Common 5km
- Old Oak Common – LHR Interchange 20km
- LHR Interchange – Swindon 97km
- Swindon – Bristol Parkway 55km
- LHR Interchange – Bristol Parkway (non-stop) 152km (*)
- 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

The above are all distances on HS4 itself or the associates HS7. In addition the following distances on the classic route are included in the tables (there's no uncertainty about these!)

- Bristol Parkway – Newport 34km
- Newport – Cardiff 35km
- Cardiff – Bridgend 32km
- Bridgend – Port Talbot 19km
- Port Talbot – Neath 9km
- Neath – Swansea 13km

- Swindon – Royal Wootton Bassett 10km
- Royal Wootton Bassett – Chippenham 18km
- Chippenham – Bath Spa 20km
- Bath Spa – Bristol Temple Meads 18km

(*) Travelling non-stop through Swindon avoids the station, by tunnelling under it, but involves exactly the same distance.

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 Euston Cross to Old Oak Common (start to stop) is 292 seconds
- Time to travel from Paddington to Old Oak Common (start to stop) is 231 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 five 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.

For those sections of classic route included in CC schedules, the section journey times are taken from current timetables. These are all arrival times, so the station wait time is already included. There is thus no need to add 3 minutes per station stop on these sections. With that summary, we now proceed to the results.

1. HS Euston Cross – Swansea / Bristol Temple Meads (6/3 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Euston Cross - Old Oak Common	8	8	4.9	4.9	4.9
Old Oak Common - LHR Interchange	20	28	7.7	12.6	15.6
LHR Interchange - Bristol Parkway	152	180	29.8	42.4	48.4
Bristol Parkway - Cardiff	48	228	12.4	54.8	63.8
Cardiff - Cardiff (Rhoose) Airport	15	243	6.7	61.5	73.5
Cardiff (Rhoose) Airport - Port Talbot	39	282	11.5	73.0	88.0
Port Talbot - Swansea	13	295	6.2	79.2	97.2
Bristol Parkway - Bristol Temple Meads	8	303	4.9	47.3	56.3

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

- Bristol Parkway 80 [49]
- Cardiff 121 [64]
- Port Talbot 157 [88]
- Swansea 178 [98]
- Bristol Temple Meads 99 [57]

2. HS Paddington – Plymouth (6 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Paddington - Old Oak Common	5	5	3.9	3.9	3.9
Old Oak Common - LHR Interchange	20	25	7.7	11.6	14.6
LHR Interchange - Bristol Parkway	152	177	29.8	41.4	47.4
Bristol Parkway - Bristol Temple Meads	8	185	4.9	46.3	55.3
Bristol Temple Meads - Taunton	71	256	17.9	64.2	76.2
Taunton - Exeter St. David's	48	304	13.3	77.5	92.5
Exeter St. David's - Plymouth	65	369	16.7	94.2	112.2

This is in fact a classic-compatible service, but high speed all the way to Plymouth, then on the classic route to Penzance and, perhaps, Padstow. Between Old Oak Common and Bristol Temple Meads, times are exactly as in the previous table (but 1 minute less from London, as it starts from Paddington).

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

- Bristol Parkway 80 [48]
- Bristol Temple Meads 99 [56]
- Taunton 102 [77]
- Exeter St. David’s 120 [93]
- Plymouth 179 [113]

3. CC Paddington – Swansea / Bristol Temple Meads (9/6 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Paddington - Old Oak Common	5	5	3.9	3.9	3.9
Old Oak Common - LHR Interchange	20	25	7.7	11.6	14.6
LHR Interchange - Swindon	97	102	20.6	32.2	38.2
Swindon - Bristol Parkway	55	80	13.6	45.8	54.8
Bristol Parkway - Newport	34	114	22.0	67.8	76.8
Newport - Cardiff	35	149	15.0	82.8	91.8
Cardiff - Bridgend	32	181	23.0	105.8	114.8
Bridgend - Port Talbot	19	200	13.0	118.8	127.8
Port Talbot - Neath	9	209	8.0	126.8	135.8
Neath - Swansea	13	222	13.0	139.8	148.8
Swindon - Royal Wootton Bassett	10	112	7	39.2	45.2
Royal Wootton Bassett - Chippenham	18	130	8	47.2	53.2
Chippenham - Bath Spa	20	150	15	62.2	68.2
Bath Spa - Bristol Temple Meads	18	168	15	77.2	83.2

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

- Swindon 53 [39]
- Bristol Parkway 80 [55]
- Newport 105 [77]
- Cardiff 121 [92]
- Bridgend 144 [115]
- Port Talbot 157 [128]
- Neath 165 [136]
- Swansea 178 [149]
- Chippenham 68 [54]
- Bath Spa 83 [69]
- Bristol Temple Meads 99 [84]

Note that the South Wales service, although it makes a station stop at Swindon, travels on HS4 all the way to Bristol Parkway. Note how all the South Wales destinations on the classic route enjoy a time benefit of nearly 30 minutes, by their CC service travelling on HS4 all the way to Bristol Parkway. Stations on the classic route between Swindon and Bristol likewise enjoy a time benefit of nearly 15 minutes, by their CC service travelling on HS4 as far as Swindon.

4. Summary Table:

Section	Euston Cross - Swansea HS	Euston Cross - Bristol Temple Meads HS	Paddington - Plymouth HS	Paddington - Swansea CC	Paddington - Bristol Temple Meads CC
Euston Cross OR Paddington - Old Oak Common	4.9	4.9	3.9	3.9	3.9
Old Oak Common - LHR Interchange	15.6	15.6	14.6	14.6	14.6
LHR Interchange - Bristol Parkway	48.4	48.4	47.4	|	|
Bristol Parkway - Cardiff	63.8	|	|	|	|
Cardiff - Cardiff (Rhoose) Airport	73.5	|	|	|	|
Cardiff (Rhoose) Airport - Port Talbot	88.0	|	|	|	|
Port Talbot - Swansea	97.2	|	|	|	|
Bristol Parkway - Bristol Temple Meads		56.3	55.3	|	|
LHR Interchange - Swindon			|	38.2	38.2
Swindon - Bristol Parkway			|	54.8	|
Bristol Parkway - Newport			|	76.8	|
Newport - Cardiff			|	91.8	|
Cardiff - Bridgend			|	114.8	|
Bridgend - Port Talbot			|	127.8	|
Port Talbot - Neath			|	135.8	|
Neath - Swansea			|	148.8	|
Swindon - Royal Wootton Bassett			|		45.2
Royal Wootton Bassett - Chippenham			|		53.2
Chippenham - Bath Spa			|		68.2
Bath Spa - Bristol Temple Meads			|		83.2

Bristol Temple Meads - Taunton			76.2		
Taunton - Exeter St. David's			92.5		
Exeter St. David's - Plymouth			112.2		

Appendix A – Euston Cross and the Inter-Regional Connections

General

By routing the classic-compatible services of HS2 and HS4 into Euston and Paddington, respectively, and all the GC-gauge services of both routes through Euston Cross, and on to HS1 and HS11/HS12, superlative cross-London inter-regional HS services are enabled, between the West Midlands / North West and Kent / East Sussex, and between South Wales / West Country and North Kent / East Anglia. The classic compatible services of HS1 (there's only one) and HS11/HS12 are likewise routed into St. Pancras East (the 'Javelin' platforms) and Liverpool Street respectively. The GC-gauge services of HS1 (not the international ones) and HS11/HS12 balance exactly those of HS2 and HS4. There is thus no need for any rebuilding work at the four terminal stations to accommodate GC-gauge trains. (Euston certainly needs rebuilding because it's such a disgusting mess, but it need not expand significantly beyond its current footprint, Paddington needs nothing more than a good clean and a fresh coat of paint, St. Pancras and Liverpool Street probably need nothing at all.) Given the GC-gauge loadings of the London end of HS2 and HS1 (12tph) and of HS4 and HS11/HS12 (6tph) – these are at the final service plans of each route – a single tunnel in each direction, with a minimum of 6 platforms, (passive provision for 8,) at Euston Cross, would suffice. That a single Euston Cross station, with a single pair of approach tunnels, would serve two HS inter-regional routes should seriously enhance its business case. I would like to see **passive** provision for 8 platforms, as is indicated in the diagrams.

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

Old Oak Common

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

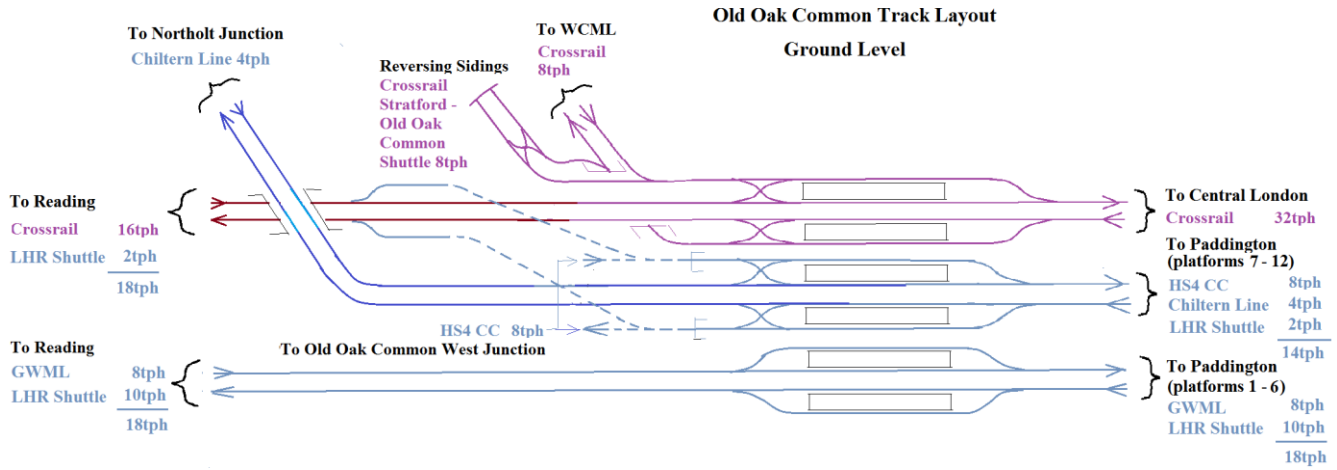
Ground Level, consisting of three sets of four platforms, serving the routes:

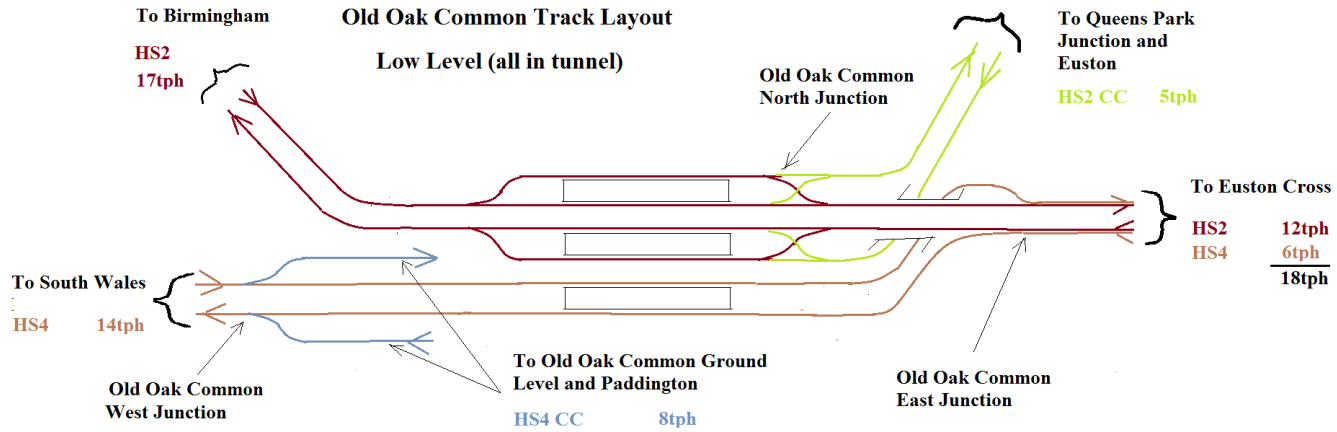
- GWML (Classic, long distance, and Heathrow Shuttle services,) on the fast lines
- HS4 Classic Compatibles and Chiltern Line services on the relief lines, both of which diverge immediately west of the platforms, the CCs to join HS4 at Old Oak Common West Junction, at the low level and the Chiltern Line services to Northolt Junction

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

Low Level, consisting of HS2 (all services, so variable platforms will be required) and HS4 (GC-gauge services).

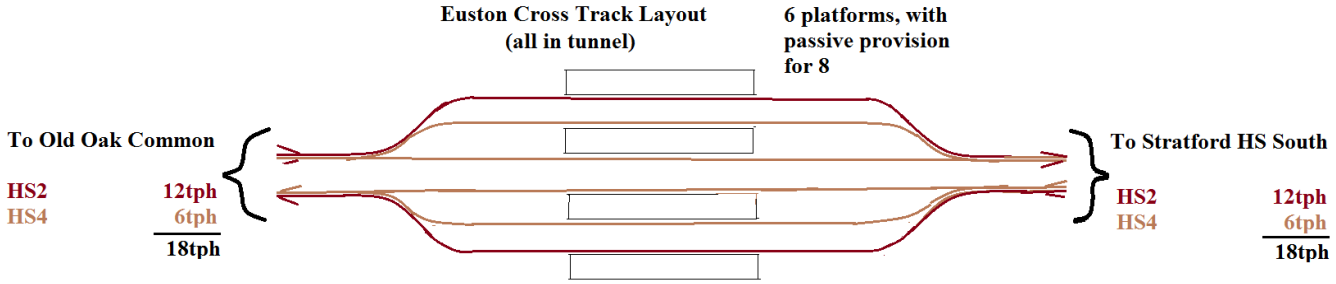
Ideally, these should be one above the other, with the passenger entrances and circulating area between them, with lifts, escalators and stairs directly to all platforms. In order for HS2 and HS4 GC-gauge services to share the same pair of tracks, the classic-compatible services must first diverge, those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





Euston Cross

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



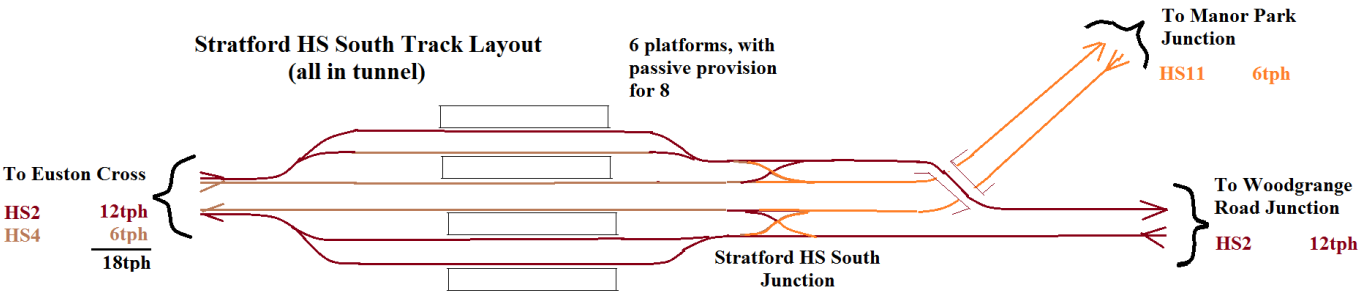
Stratford HS South

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

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

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

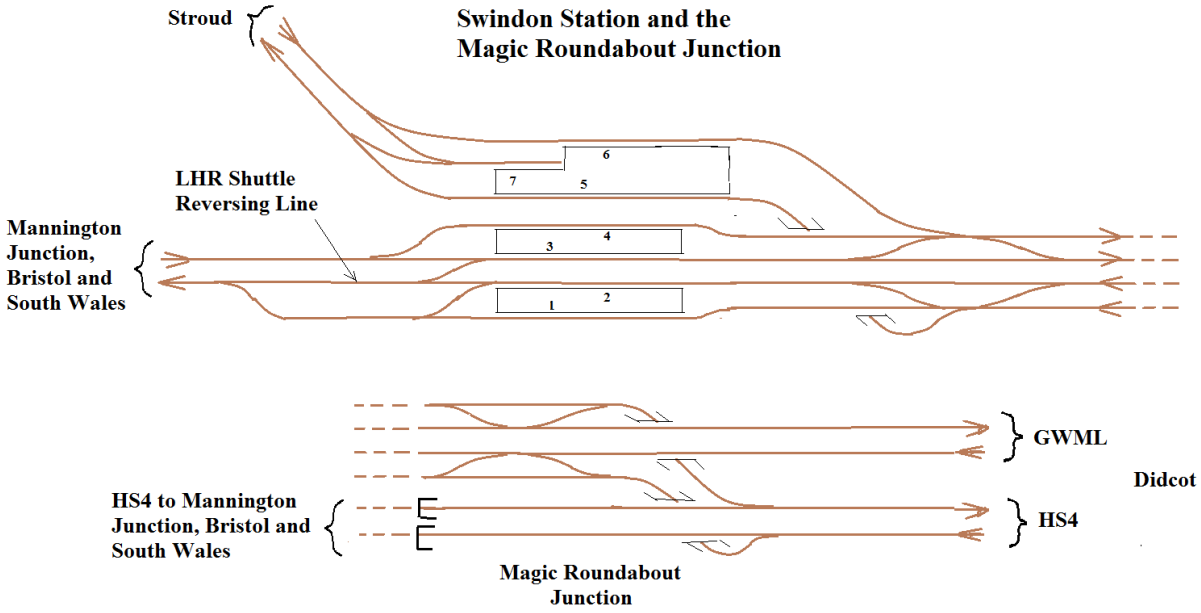
Stratford HS South corresponds in many respects to Old Oak Common. Both are served by all the GC-gauge inter-regional services, and afford convenient interchange with Crossrail. The Crossrail tracks are likewise in the high level station, having taken over the former slow lines, thus providing cross-platform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



Appendix B – Swindon Station Arrangements

Swindon needs a few more platforms.

3 & 4 are the existing island platform, unchanged. The westbound platform has been slewed one track's width north – through lines are not required – and another platform face opened on the other side (there should be room between the railway alignment and the adjacent office block. This is 1 & 2. Platforms 5 & 6 are an island on the north side, formerly sidings. 7 is a short bay.



1 & 2 deal with westbound services. 1 generally takes classic-compatibles to Bristol and South Wales, and 2 the Swindon arm of the LHR shuttle and the Paddington – Weymouth Regional Metro service.

3 & 4 deal with eastbound services. 4 generally takes classic-compatibles from Bristol and South Wales, and 3 the returning LHR shuttle and the Weymouth – Paddington Regional Metro service.

5 & 6 deal with classic-compatibles to and from Stroud, Gloucester (split / join) and Cardiff / Worcester. 7 deals with the Cirencester shuttle, via the restored line from Kemble, a service of 2tph timed to provide connections at Kemble for Cirencester – Gloucester and vice versa (there's plenty of stuff for it to connect into at Swindon).

Appendix C – The Heathrow Shuttle

The initial 3 Shuttle services:

- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Didcot – Wantage Road – Swindon (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Twyford – Reading – Tilehurst – Pangbourne – Goring and Streatley – Cholsey – Didcot – Oxford (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Kintbury – Hungerford – Bedwyn – Pewsey

actually predate service plan 1. They are part of the basic service plan 0 on the GWML (which assumes that various projects currently being implemented or imminent, in particular the GW electrification, Crossrail and the western approach to Heathrow, have been completed).

At service plan 3, the introduction of the classic-compatible service to Plymouth and stations in Cornwall, frees up 2 slots on the GWML, and advantage is taken of this to introduce 3 forther Shuttle services, and extend the existing Pewsey one:

- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Hungerford – Bedwyn – Pewsey – Devizes – Holt Junction – Bradford on Avon – Bath – Bristol Temple Meads (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Reading – Thatcham – Newbury – Kintbury – Hungerford – Bedwyn – Savernake – Marlborough (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Bourne End (connections to and from Marlow) High Wycombe – Princes Risborough – Little Kimble – Aylesbury – Aylesbury Vale Parkway – Calvert (for HS2) – Winslow – Bletchley – Milton Keynes (LHR Shuttle)
- 2tphR Paddington – Old Oak Common – LHR Terminals 1,2,3 – LHR Terminal 5 – LHR Interchange – Slough – Maidenhead – Twyford – Wargrave – Shiplake – Henley (LHR Shuttle)

The Swindon, Marlborough and Devizes / Bristol services travel west of Slough on the main lines, and the Oxford, Milton Keynes and Henley ones on the relief lines. This involves integrating them with Crossrail. ‘GWML Service Plans’ has all the information on this and everything else on the (London end of the) GWML, in extensive, comprehensive and thoroughly exhausting detail.

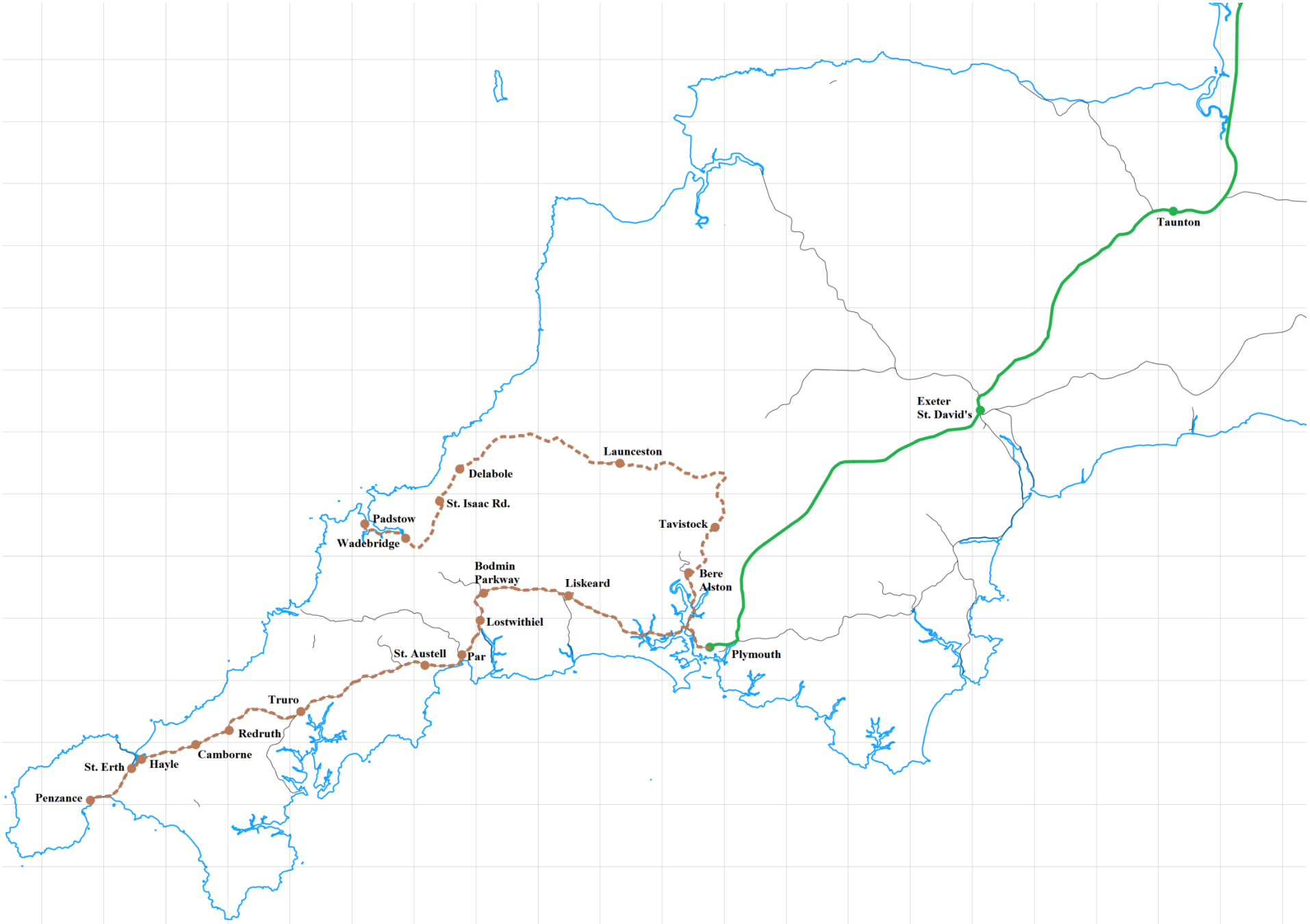
Appendix D – Royal Wootton Bassett to Yate – New Build or Conversion?

From SP2, the classic-compatible service from Paddington to Swansea rejoins HS4 at Mannington Junction and returns to the classic route at Pye Corner Junction, just before Bristol Parkway. There are thus no regular passenger services on the classic route via Badminton. The question therefore needs to be addressed, of whether it is sensible to build a new line alongside the existing alignment, or to rebuild the existing one to GC gauge. (The precise section in question is from just west of Wootton Bassett Junction, where HS4 emerges from its tunnel at SU058824, to ST703804, just before Westerleigh West Junction, near Yate, where the classic route from Birmingham joins – actually, of course, in the case of a rebuild, Westerleigh West Junction would no longer be a junction.)

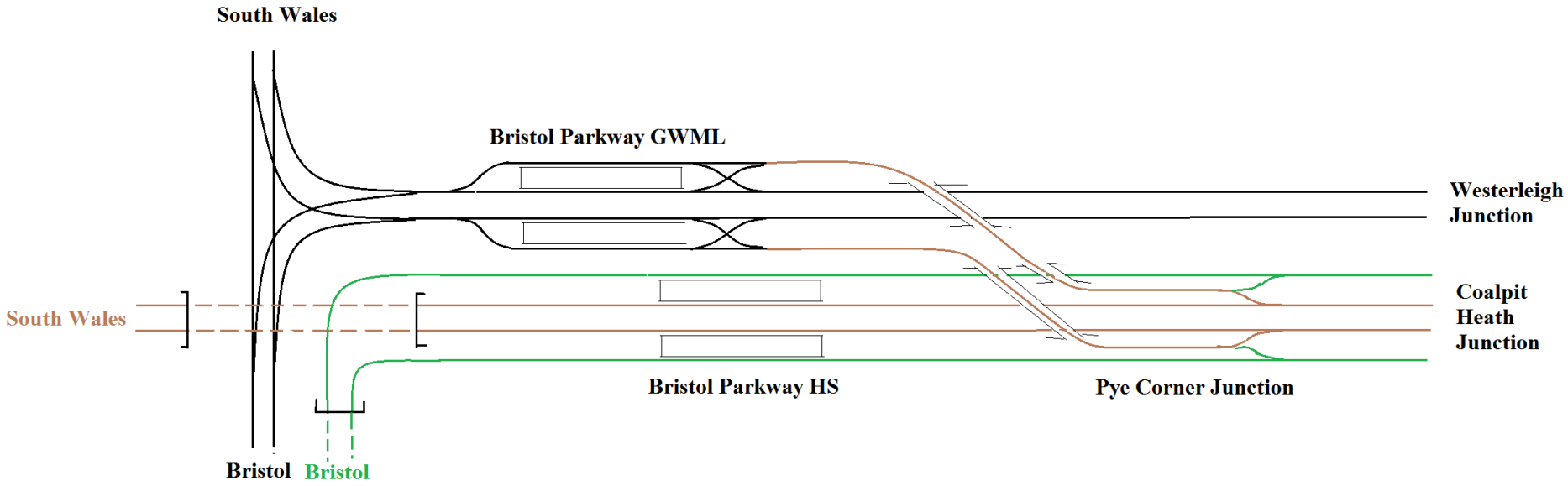
The main consideration is precisely what traffic, presumably just freight, would continue to use the existing line, in the case of a new build.

Enlarging the existing route to GC gauge would certainly be practicable; there are no remaining stations (nor, currently, any foreseen need for any,) and relatively few under- or over-bridges. However, new, single-bore tunnels would be needed at Chipping Sodbury and Alderton, the existing ones becoming single track in the other direction. So rebuilding would not provide a huge, decisive saving over new build. And, of course, new build does (more than) double the available capacity.

I raise this necessary question, but have no convincing answer to it (nor even a preference). Freight requirements may of course decide the answer.



Appendix F – Bristol Parkway Stations and Junctions



Pye Corner Junction allows the CC Paddington – Swansea service to use HS4 between Swindon (Mannington Junction) and Bristol Parkway GWML. Connection are provided with HS7 also, but purely for operational convenience; no regular usage is currently foreseen.

The Bristol Parkway HS platforms are somewhat to the east of the GWML ones, to give HS4 more room to descend to tunnel under the classic lines to Bristol.

The above diagram shows only HS and GWML lines. In particular, the line to Avonmouth via Henbury is omitted.

Appendix G – 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 HS4.

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) 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):

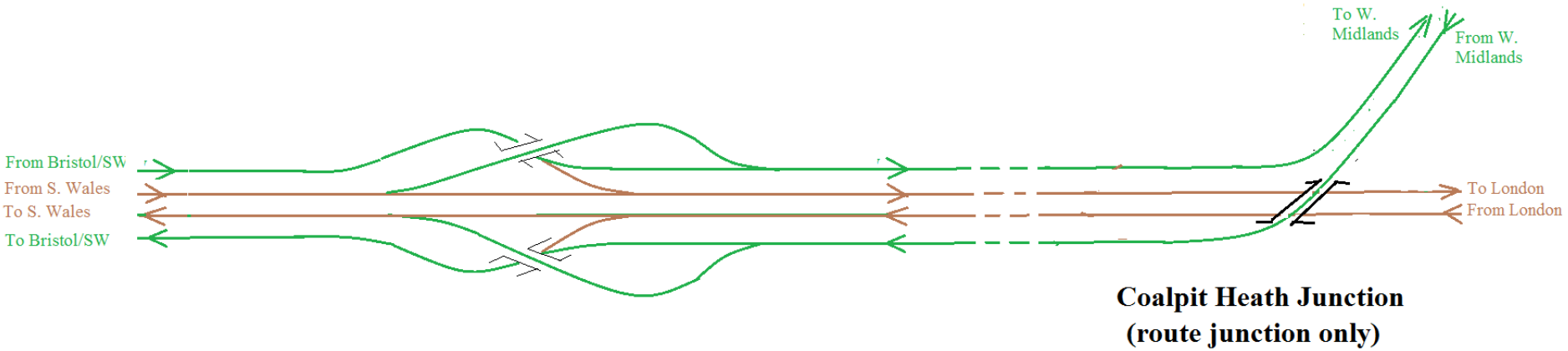
00 Norwich – Swansea via London
Birmingham HS – Rhoose (arrives c.5 minutes earlier)

07 Plymouth – Swansea

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

23 Bristol TM (HS) – Swansea ???

Appendix H – 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.