HS5 Route and Service Plans

HS5 Route Mk1A

Following the referendum on EU membership and the decision to disengage from the EU, several changes have been made to the plans for HS rail, most importantly, abandoning GC-gauge, and building all new infrastructure to standard UK loading gauge. This has, in most cases, very little impact on the routes proposed, but significant impact on the service plans. In certain cases it is now proposed to include sections of classic route in the HS route, rather than building exclusively new throughout. (Note that this is different from the previous proposals to run classic compatible services on classic lines, **beyond** the HS route; this actually incorporates classic sections, upgraded as appropriate, in the HS route itself.) Appendix C lists all specific changes of route, for HS5 and associated routes, which are also, of course, incorporated in the various route sections, following.

Because of the significant changes introduced at Mk1A, the latest versions of all the Mk1 plans (v5.2 in the case of HS5) have been preserved, available in an archive section on the website.

HS5 Route Mk2

As noted above, the Mk1A changes have, in general, little impact on the routes proposed (but great impact on the service plans). The changes proposed for HS5 at Mk1A, are indeed few, probably the least of all the various HS routes. This is because of the area served by HS5, where the existing infrastructure is already very seriously overloaded, essentially throughout. There is almost no scope for incorporating existing sections of classic route, because it has no available excess capacity. The entire Brighton section needs new infrastructure, as does that to Tunbridge Wells. The only scope for incorporating sections of classic route is at the extremities. Accordingly the Bognor, Littlehampton and Newhaven branches are merged into HS5, along with the coastal line between Lewes and Eastbourne, and the section of the 'Brighton' route to Portsmouth between Horsham and Portsmouth and Southsea. All new infrastructure proposed elsewhere in the Mk1 design remains.

It is expected that Mk1A will, in the present case, deliver so many of the benefits of the original proposals, for (not all that much) less expense, that this will form a satisfactory long-term solution. However, if further capacity is needed, (on the incorporated classic sections,) then HS5 Mk2 is proposed, which is effectively the reinstatement of those parts of the original plans removed for Mk1A, on a piecemeal basis, as and when the build-up of traffic on Mk1A makes extra capacity desirable. If this were implemented in full, we would end up with the original design, but having enjoyed years of service from the MK1A version in the interim. This all comes about from abandoning GC-gauge. The original plans required so much new infrastructure, because it all had to be to GC-gauge. Building to UK loading gauge instead allows some (but, in this case, not much) existing infrastructure to be incorporated.

The current document thus retains all the original content, but rearranged to emphasise what is Mk1A and what is now Mk2

I think it likely that the sections from Lewes to Eastbourne and Newhaven, and the Bognor and Littlehampton branches, will be well served long-term by the classic lines, but that the section between Horsham and Chichester will need new infrastructure in the medium term, and certainly at Mk3.

HS5 Route Mk3

HS5 is closely linked with HS3, and also HS6. Mk2 of HS3, a very futuristic proposal, is designed to give a very serious capacity upgrade, by installing 4 tracks between London and West Yorkshire, almost as far as York. This has serious implications for HS5, which must accommodate all HS3's extra services. Accordingly HS5 Mk3 is proposed, to be implemented simultaneously with HS3 Mk2. This involves little new in the way of routes, but extensive 4-tracking, unsurprisingly, of the tunnel section between Pancras Cross and East Croydon, via Victoria LL, continuing as far as Winders Hill Junction, where the Tunbridge Wells arm diverges, and possibly as far as Finches Shaw Junction, where the Southampton arm diverges.

The Purpose, Background and Method

This article refers to and should be read in conjunction with my article 'Towards a High Speed **Network**'. That article makes the case for developing a network plan for all the HS routes which will eventually be needed, and, as a contribution to getting the discussion started, gives my own thoughts of what such a network should look like. Naturally, this involves describing a number of routes, in varying but superficial detail. This lays me open to the charge, something on the lines of 'That's all very easy to say, but how would you actually go about doing it?' Accordingly, a decent respect to the opinions of the interested public requires that I should go into more detail on the individual routes. The present article deals with HS5, the route to various destinations south of London, but, popularly, 'The Brighton High Speed Line'.

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.

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 the present case, even this is insufficient, and the entire route out of London has to be in tunnel as far as East Croydon!

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 only one significant gradient – the approach to Brighton following the alignment of the A23 over the South Downs.

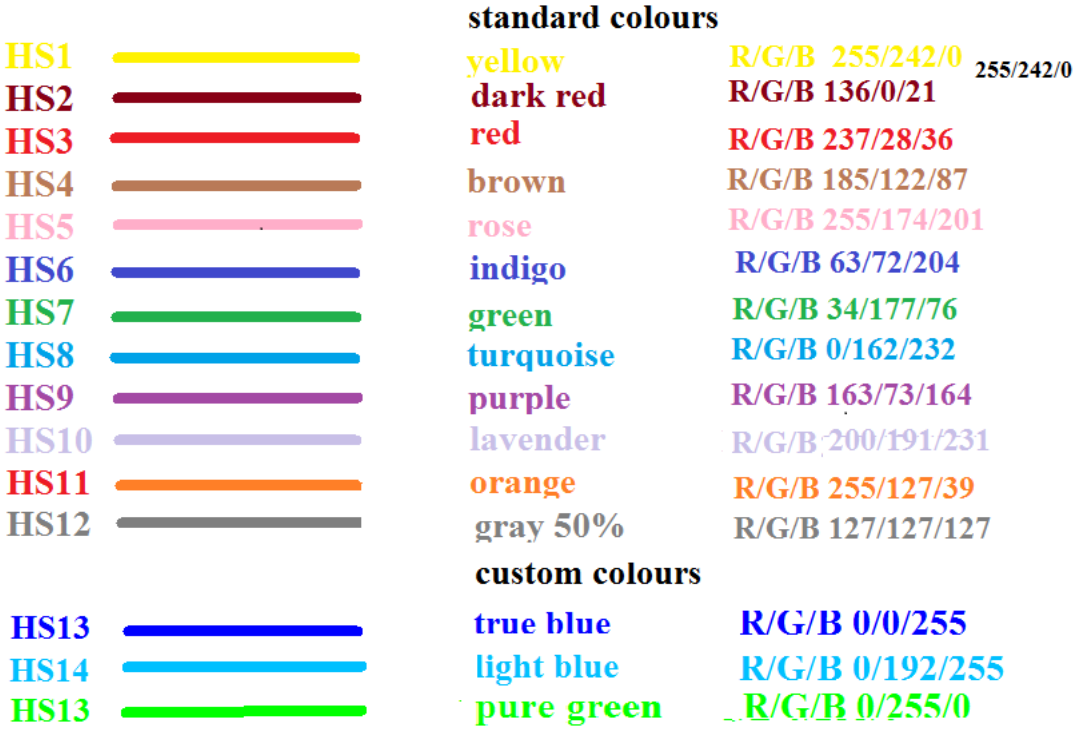
I believe that this approach gives a route which in general terms is practicable and satisfies the requirements, though obviously a lot of work, especially detailed surveying on the ground, would be needed to turn it into an implementable design. Specifically, I can say nothing about cuttings and embankments, 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 HS5. 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 HS5.

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 HS5 stations are served by all services, so don't need overtaking/avoiding lines. At the ends of a multi-destination route, the traffic density on the branches may not be sufficiently high to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice.

The point of insisting on two platforms in each direction is **either** to enable cross-platform interchange between different services, (both HS or HS and RM,) **or** to maximise capacity, (especially when all services stop at the station, as is the cases for HS5,) by allowing a second train to arrive at the station

before the preceding train has departed. (It also promotes resilience, if a failing train can make it at least as far as the next station, to be taken out of service.)

Several service plans are developed, reflecting the piecemeal development of the network. As new sections open, further services come into operation. In all cases, consideration is given to maximum loadings – which section(s) are fully loaded and thus determine the maximum service frequencies. I used to take 16tph as the maximum throughput, but, following new capacity calculations (expounded in appendix B of the article 'Same Speed Railways', which do include the effect of junctions,) I am now considerably more relaxed on this, and will countenance loadings of up to 24tph. (The quoted appendix contains my justification for this choice.) As stated above, the service plans deliberately quote maximum frequencies; initial services will almost certainly be to lower frequencies.

Normally, two types of services are contained in the plans, those featuring High Speed trains which travel on HS5 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). HS5 is, however, unusual in that there are no formal cross-platform connections planned between HS and RM services, but given the frequency of services in the entire area served by HS5, this is scarcely a deficiency; good, **informal** connections between HS and RM are available at Southampton, Portsmouth and Southsea, Chichester, Horsham (connections with Thameslink, in particular), Brighton, Lewes, Tunbridge Wells, Tonbridge, Gatwick Airport and East Croydon.

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

Estimated Journey Times

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

HS5 Route – Introduction and Assumptions

HS5 closely follows existing alignments, railway and motorway, for most of the way.

HS5 begins at Pancras Cross, which it shares with HS3 and HS6, and HS5 services all continue as HS3 or HS6 services, and vice versa; once Pancras Cross has become a through station, nothing terminates there. Appendix A gives full details of Pancras Cross and its surroundings. HS5, unusually, has no classic-compatible services.

The maximum speed for HS5 is 300kph, 187.5mph, throughout; the non-stop runs are not long enough to take advantage of a higher speed, and 300kph is adequate, with no detriment to the service provided, and with significant savings in construction costs.

West of Chichester, the Southampton branch of HS5, on an almost entirely new alignment, doesn't even pretend to be a HS line – there are several stations serving locations at present very poorly served or not at all, which will see a major enhancement in accessibility. A maximum speed of 125 or even 100mph would be adequate. A section near the end (not a new alignment) even has a freight service!

HS5 Route – Junctions

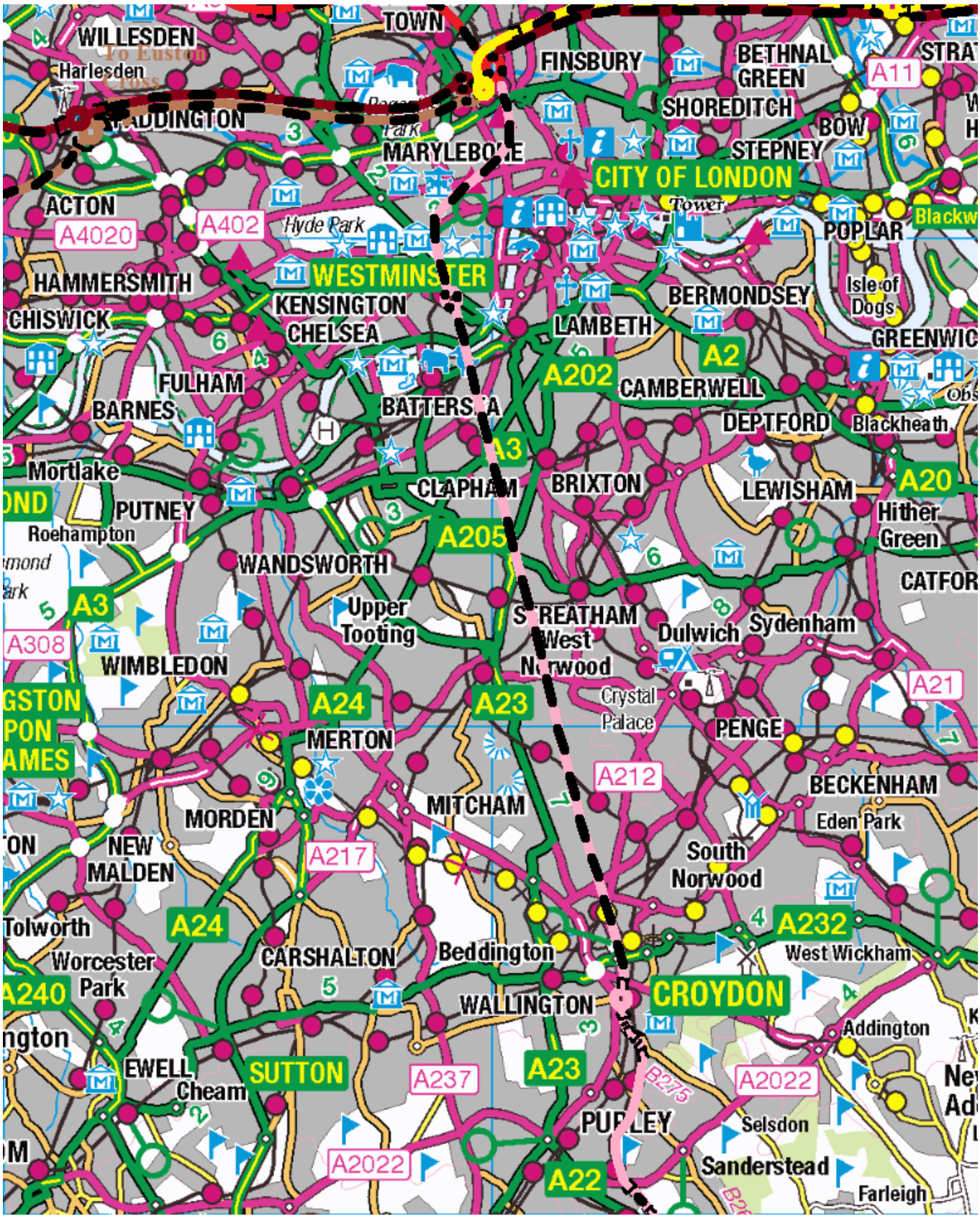
There are various junctions on the route of HS5, enabling it to divide for its several destinations. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

- Winders Hill TQ352535 HS5 Tunbridge Wells branch diverges from the main line.
- Finches Shaw TQ259327 HS5 Southampton branch diverges from the main line.
- Withdean TQ298075 Connection from HS5 to Brighton line (for Hove and Worthing)
- Tortington (Mk2 only) TQ005050 HS5 Littlehampton branch diverges from the Southampton branch.
- Ford East (Mk2 only) TQ012035 HS5 joins the classic Littlehampton branch.
- Barnham HS SU962043 HS5 Bognor branch diverges from the Southampton branch.
- Barnham South (Mk2 only) SU955043 HS5 joins the classic Bognor branch.
- Hickstead TQ269197 HS5 Eastbourne / Newhaven branch diverges from the main line.

There are various other links between HS5 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. *Pancras Cross – East Croydon*



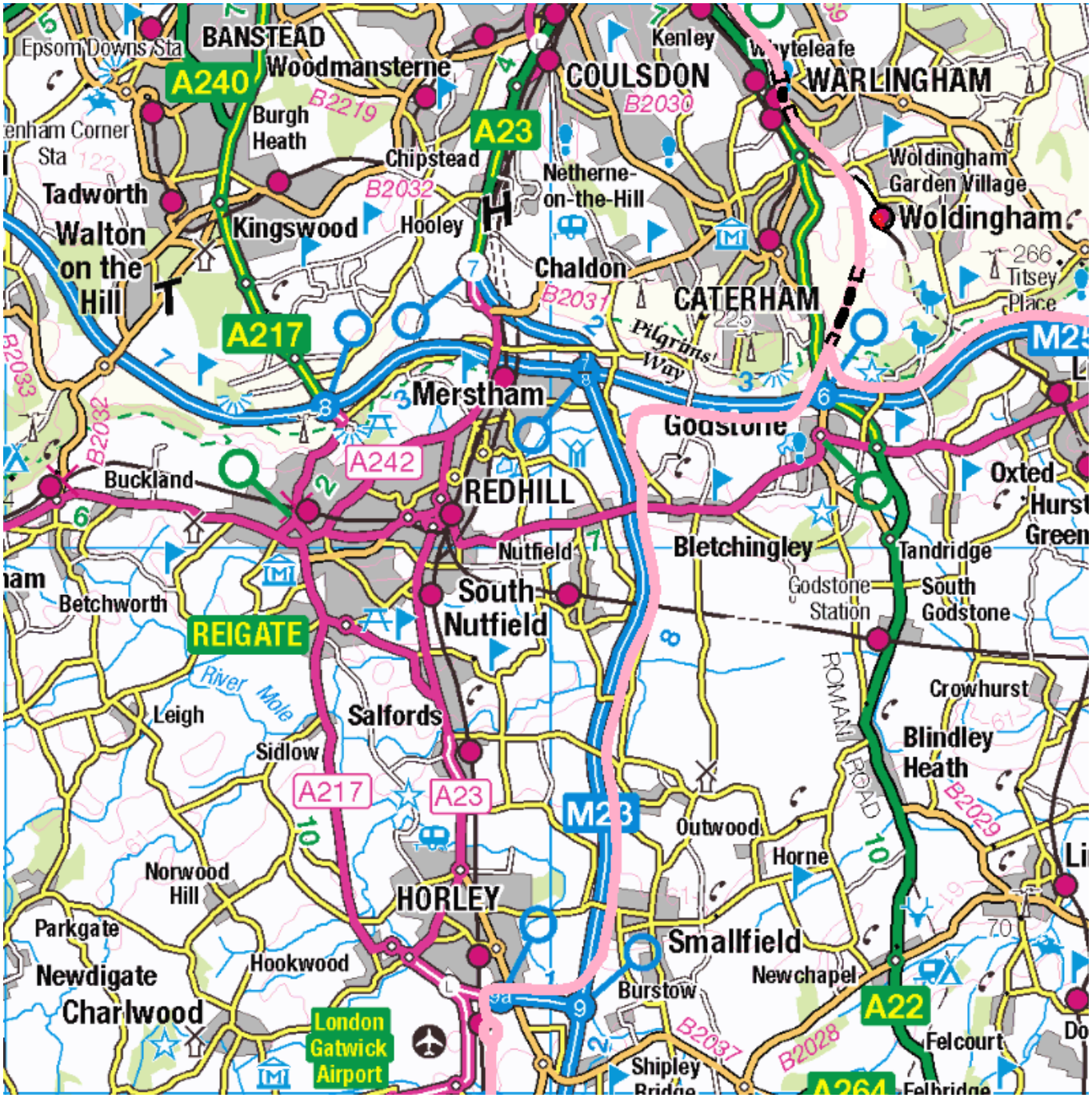
1.1 Pancras Cross – East Croydon

HS5 begins at Pancras Cross station. It passes beneath London to a low level station under Victoria. There are 3 HS platform faces in each direction, (with passive provision for a fourth,) as usual on the cross-London inter-regional connections. Interchange is provided with Crossrail 4, which is dealt with in a

separate article. From Victoria (LL) to East Croydon, the simplest solution is an 8 mile tunnel directly there, emerging at TQ328662, on the west side of the Brighton line alignment, immediately north of the station. There is plenty of room on the west side of the station for the usual two HS island platforms.

I've tried various alternatives, bringing it to the surface at Wandsworth Common, Tooting Bec Common and in Streatham, but all that effort saves just 2 miles of tunnel (and would doubtless attract widespread outrage and opposition). I've successfully devised plans for routes out of London to the north and west, but South London is intractable. (You could of course simply bulldoze your way through it, but that's an option I would never consider.)

2. East Croydon – Gatwick Airport



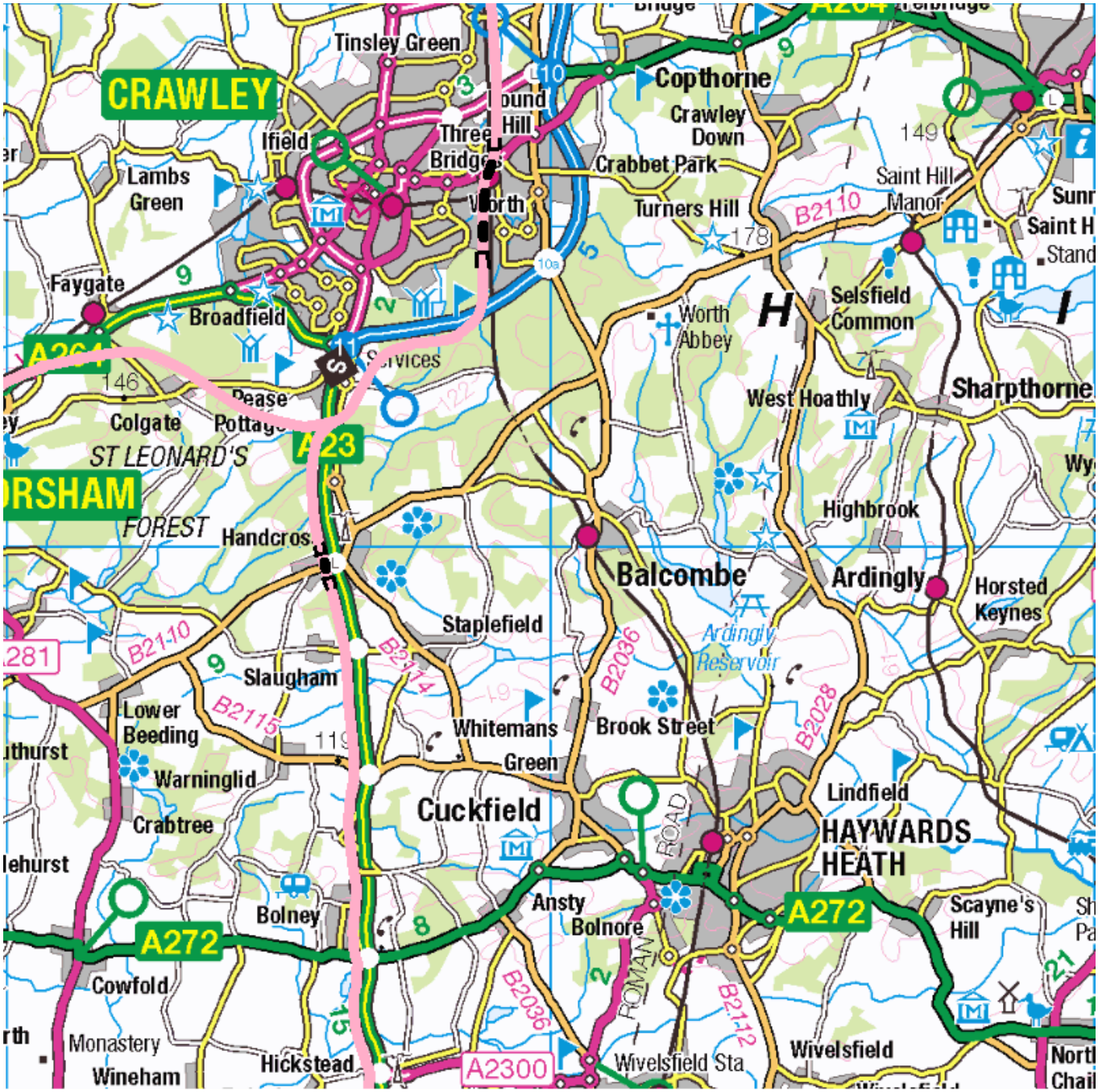
2.1 Kenley – Gatwick Airport

On leaving East Croydon, HS5 immediately enters a ¼ mile tunnel between TQ328657 and TQ329654 (Barclay Road), passing under the Brighton line to the east side of the alignment, then a ½ mile tunnel between TQ329648 (Coombe Road) and TQ328643, leaving it on the east side of the line to Oxted. A single property (flats?) will have to be demolished at TQ329638, at the end of Birchend Close, just before the line from Addiscombe joins.

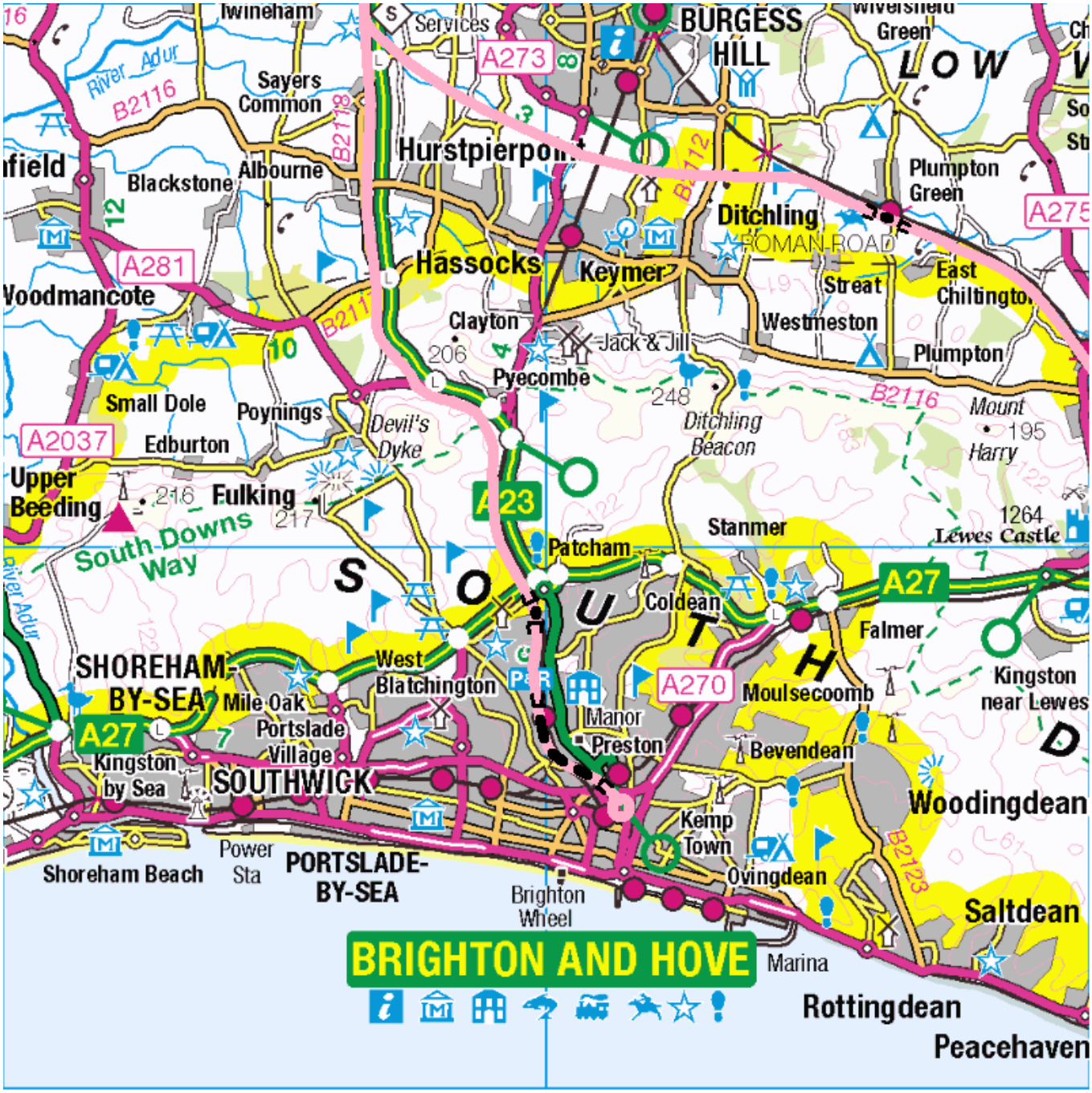
HS5 follows the east side of the Oxted line past Sanderstead (we're clipping the ends of substantial gardens on this stretch, but not threatening the houses; noise fences will be required) and Riddlesdown. A very short tunnel will be required under Upper Warlingham station, to avoid the station buildings and car park. At TQ353569 HS5 crosses to the west side of the classic alignment and diverges, following a new alignment, along the 500ft contour to TQ359549 then through a ¾ mile tunnel, emerging at TQ352535. Here, at Winders Hill Junction, it divides, the main line crossing the M25 and joining the south side of the motorway alignment at TQ344527, while the Tunbridge Wells branch turns east and joins the north side of the M25 alignment at TQ360528 (see later section). The main line follows the south side of the M25 until TQ325528, then takes a gentle curve to the south to join the east side of the M23 at TQ313518. It follows the east side of the M23 alignment until TQ307427, just before junction 9 for Gatwick Airport, where it crosses the main motorway and joins the north side of the Gatwick Airport motorway spur at TQ300418, following this to TQ289417 and then curving south to the HS platforms on the east side of Gatwick Airport station.

3. Gatwick Airport – Brighton

HS5 continues along the east side of the Brighton line to Three Bridges. A 1¼ mile tunnel under Three Bridges station between TQ288372 and TQ288353 brings it out on the west side of the alignment, which it follows for about 1 mile, diverging at TQ288348 and curving west and passing underneath the M23 to join the south side of the motorway alignment at TQ285340. This it follows for 1½ miles to junction 11, where the motorway merges into the A23. HS5 passes under the A23 between TQ263328 and TQ259327, Finches Shaw Junction, where the branch to Horsham and on to Southampton diverges. The main line to Brighton follows the west side of the A23. A short, ¼ mile tunnel is needed under Handcross, between TQ260300 and TQ261295, but otherwise the alignment is free of obstructions. At Hickstead Junction, TQ269197, the branch to Lewes, Eastbourne and Newhaven diverges. The main line follows the A23 until it crosses the classic Brighton line just above the southern exit from Clayton Tunnel; it diverges from the A23 at TQ292123, and joins the west side of the Brighton line at TQ292119. (The section of A23 just before this climbs from 200ft to 330ft at Pyecombe, 130ft in 1 mile – 1 in 40, steep but perfectly reasonable.) HS5 follows the west side of the alignment as far as Preston Park station. At Withdean Junction (TQ298075) a connection is made with the classic route, enabling HS services to diverge for Hove and Worthing, and on to Chichester. Beyond this, HS5 continues through a 1 mile tunnel, between TQ299069 and TQ308055, to Brighton station, emerging just after the coast line from Lewes has joined, and entering the HS platforms on the east side of the station, extended slightly further to the north than the classic platforms, as dictated by the availability of space for them.



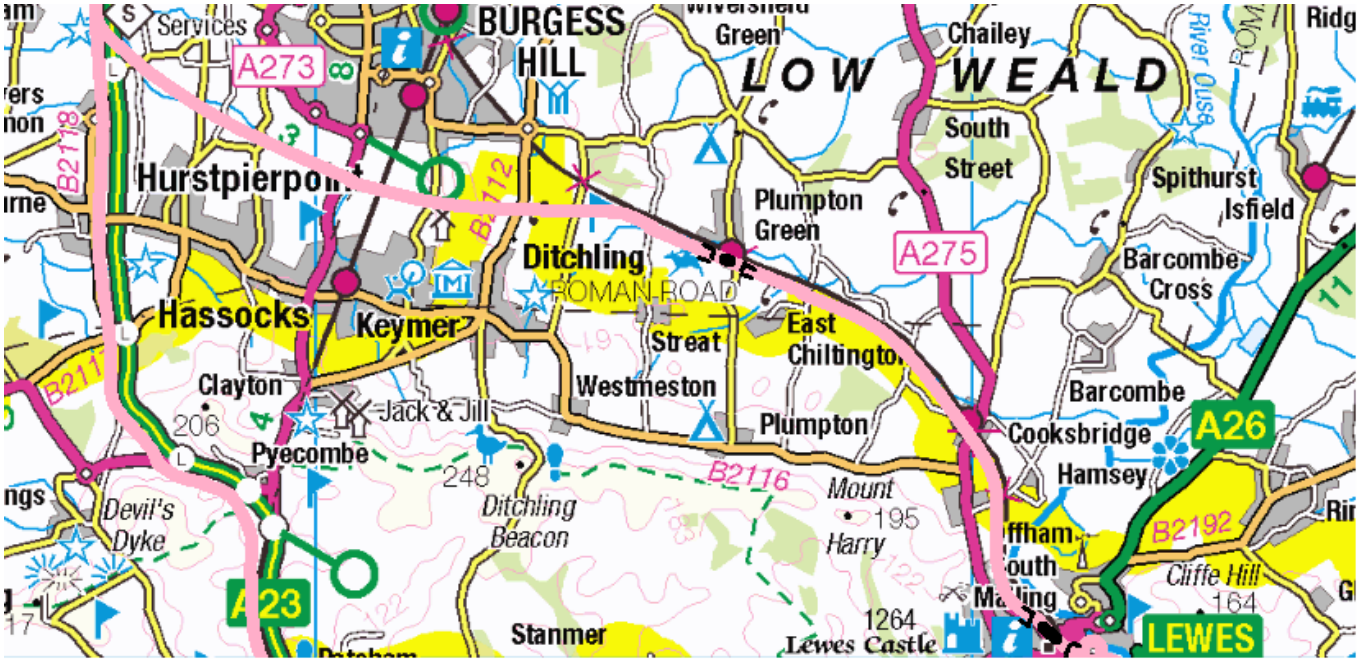
3.1 Tinsley Green – Hickstead



3.2 Twineham – Brighton

4. *Hickstead Junction – Eastbourne and Newhaven*

On leaving Hickstead Junction, the Eastbourne branch of HS5 crosses the A23 at TQ269200 and follows a stream (the young River Adur?) for 3 miles, almost to its source. It crosses Cuckfield Road at TQ283185, the A273 at TQ305174 and passes under the Brighton line at TQ310172. Between here and its crossing of Spatham Lane (TQ340168) a short tunnel may be required, rather than a deep cutting. It joins the southern side of the alignment of the Burgess Hill – Eastbourne line at TQ350167. A short (½ mile) tunnel between TQ363162 and TQ367160 at Plumpton station avoids the end of the racecourse, and a few houses. The HS tunnel at Lewes begins at TQ412107, a little to the north of that on the classic line, and crosses under it, to emerge on the north side at Lewes station, where there is plenty of room for the



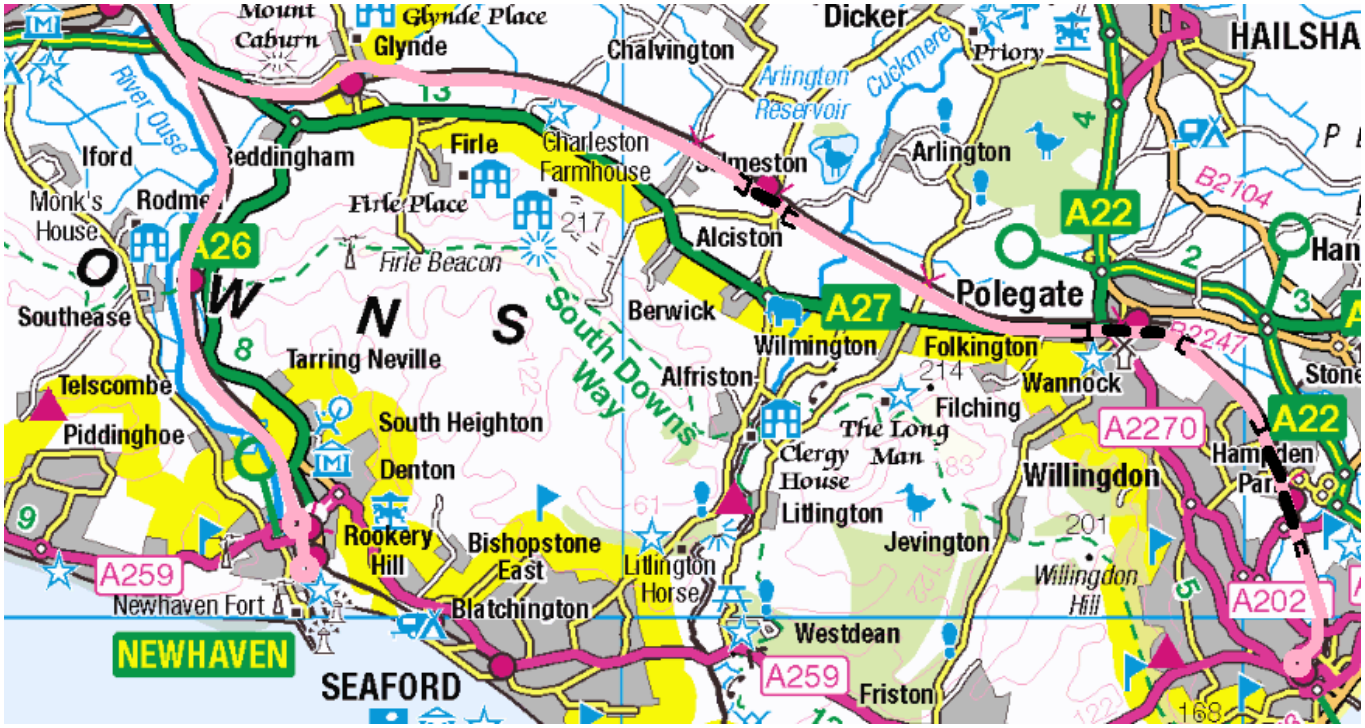
4.1 Hickstead Junction – Lewes Contains Ordnance Survey data © Crown copyright and database right 2013

HS platforms (car parks, again). It follows the north side of the alignment to Southerham HS Junction (TQ426091), a little before the classic one as the HS line to Newhaven has to cross the classic tracks, following the east side of the Newhaven branch's alignment. There is little further to remark on this, there is plenty of room at Newhaven Town station (but the station buildings will have to be relocated east of the HS platforms. The HS branch actually terminates at Newhaven Marine station. This is not used by the Seaford branch service (which serves Harbour station, pretty much contiguous with it). There is one long platform, and a bay, currently disused, on the east side of it. This is brought back into use to give HS5 a two platform terminating island.

I leave it as an open question whether it would be preferable / worthwhile to take over the Newhaven branch from Southerham HS Junction, and enlarge it to GC gauge (at Mk1A no longer relevant), rather than adding HS tracks to the alignment. It is proposed so to incorporate the Bognor and Littlehampton branches, but they are a good deal shorter and simpler.

The Eastbourne branch continues beyond Southerham HS Junction, initially on the north side. It veers slightly to the north at Glynde station, crossing Lacy's Hill at TQ458088. It crosses to the south side of the alignment at TQ470088, to avoid several properties on the north side, and remains on the south side all the way to Eastbourne. It tunnels under Berwick station for ½ mile between TQ524069 and TQ528066. It veers slightly south at Thornwell Road (TQ549055) and tunnels for 1 mile under Polegate station, between TQ577048 and TQ591046. A further 1 mile tunnel is required under Hampden Park

station, between TQ604029 and TQ609015. There are no further obstructions, and plenty of room at Eastbourne on the west side of the station for the HS platforms.



4.2 Lewes – Eastbourne Contains Ordnance Survey data © Crown copyright and database right 2013

The above describes the Mk2 configuration, all new infrastructure except, possibly, for the Newhaven branch, and corresponds to the original Mk1 design. At Mk1A, HS5 merges with the classic route immediately after Lewes station, and shares classic tracks all the way to Newhaven and Eastbourne.

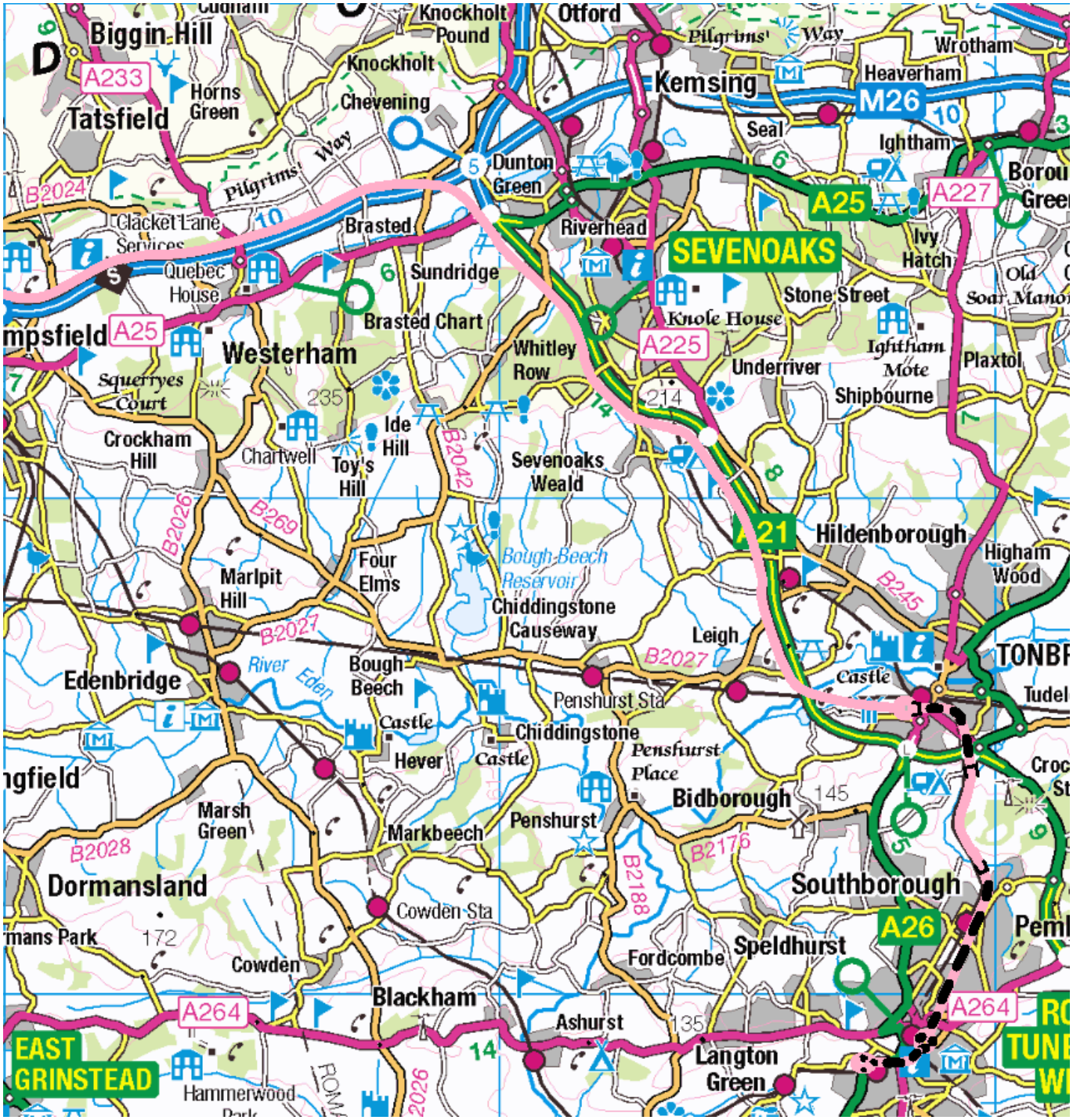
5. *Winders Hill Junction – Tunbridge Wells*

As noted, HS5 Tunbridge Wells branch diverges from the main line at Winders Hill Junction, and joins the north side of the M25 alignment, eastbound, at TQ360528. It follows this as far as TQ485564, shortly before junction 5, where it curves in a gentle arc to the south east, crossing the motorway and joining the west side of the A21 at TQ500556. This it follows until TQ560467, just before it crosses the Redhill – Tonbridge line, where HS5 crosses the A21 and the railway, and joins the south side of the classic alignment at TQ570460.

It is worth noting that in the entire section since Winders Hill Junction, HS5 has not encountered a single obstruction. One of the advantages of using motorway alignments is that nobody wants to be near a motorway, so new houses don't get built near them, leaving plenty of room for HS railways. The contrast with trying to get the line through Tonbridge is very stark. Here houses crowd the sides of the railway, and there is no free space at all.

Just before the junction with the line from Sevenoaks, starting at TQ578460, is an extensive area of sidings, on the north side of the alignment. The classic lines are slewed two track-widths to the north, and HS5 takes over the classic tracks. This allows it to get close enough to Tonbridge station. The HS platforms (just one island) are slightly to the west of the classic platforms, using the only bit of free space that there is on the south side of the alignment. HS5 enters a 1 mile tunnel under Tonbridge station, between TQ584460 and TQ594447. It then follows the east side of the alignment as far as TQ598422, just

before High Brooms, where is enters a 2 mile tunnel all the way to Tunbridge Wells station. This station is in a cutting (or, at least, the southbound track is, the road immediately behind the station being at a considerably higher level. The HS platforms are located underground, actually beneath Mount Pleasant Road. It would require very little further tunnelling, passing underneath the classic route, to bring HS5 out to Tunbridge Wells West, and the Spa Valley Railway, who would, I imagine, be very happy to provide servicing facilities, and a joint station. (The map illustrates this idea.)

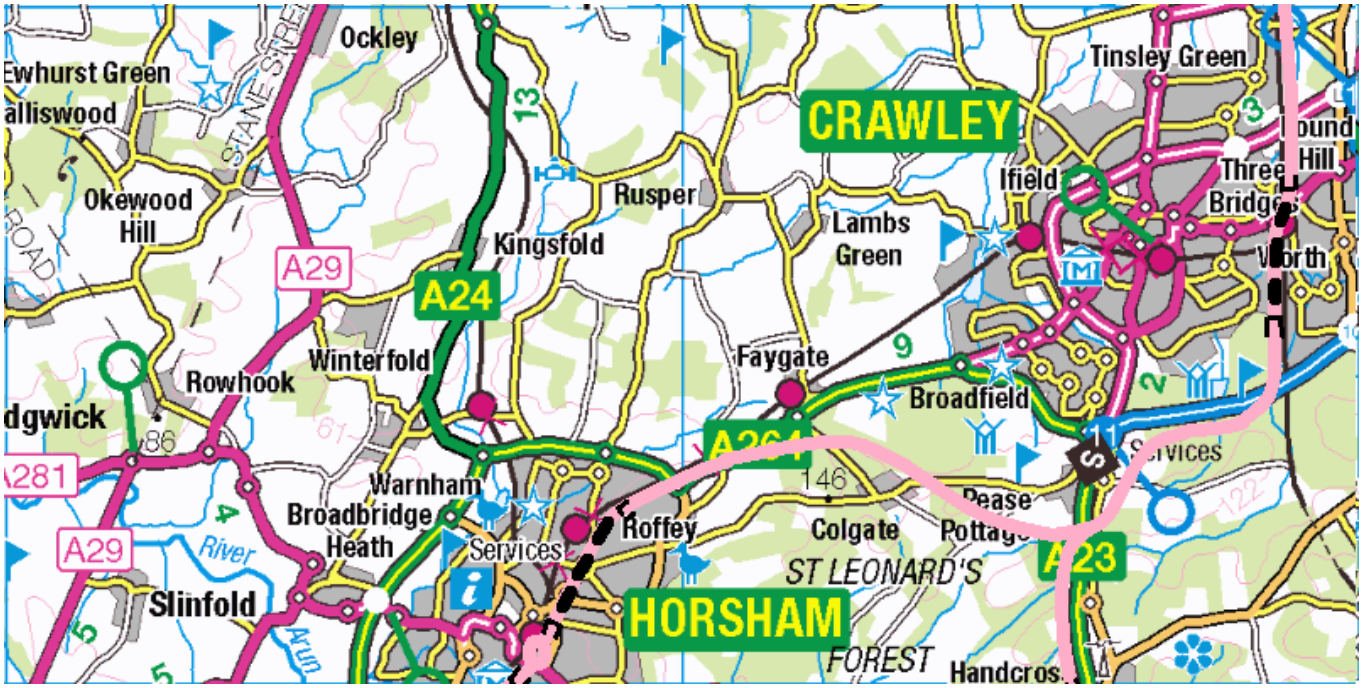


5.1 Limpsfield – Tunbridge Wells Contains Ordnance Survey data © Crown copyright and database right 2013

Note that this map is slightly wider than 20km (c21.4km)

6. *Finches Shaw Junction – Littlehampton, Bognor and Southampton*

After leaving Finches Shaw Junction, HS5 crosses the minor road at TQ240330, the A264 at TQ210336 and joins the south side of the classic line at TQ204334. It enters a 1 mile tunnel at TQ191327 to Horsham station, emerging at TQ179311, taking over the three terminating sidings on the east side of the station and crossing Station Road; the HS platforms starting south of Station Road – lots of car parks there. Beyond the station is a ¾ mile tunnel between TQ177307 and TQ169299.

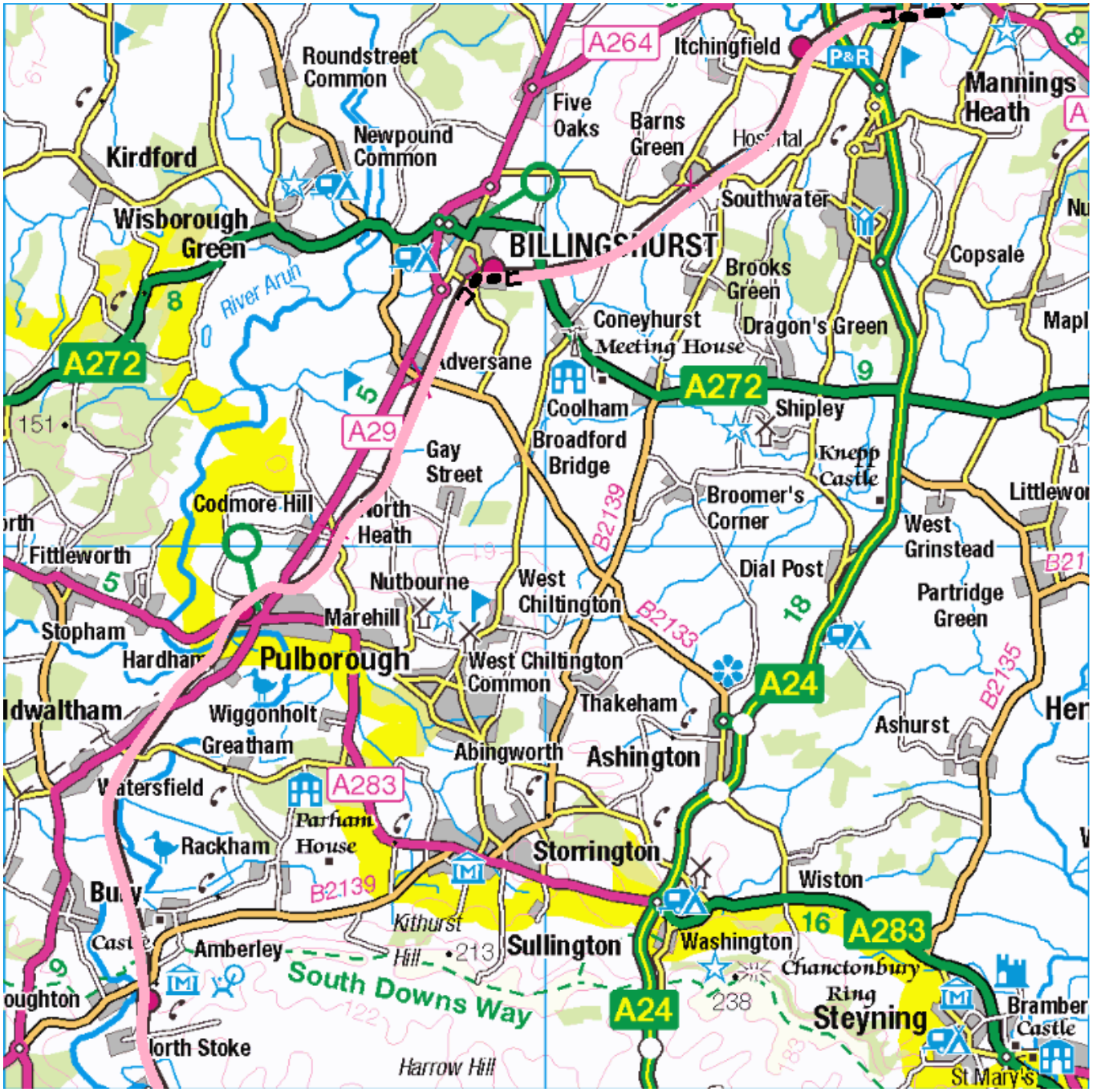


6.1 Tinsley Green – Horsham

HS5 continues along the south / east side of the alignment until Pulborough. There are very few obstructions: either veer a short way south or demolish one house at TQ126267, a ½ mile tunnel required under Billingshurst station between TQ090251 and TQ083247, either veer a short way south or demolish 2 houses at TQ060204. HS5 switches to the north side of the alignment at TQ051194 – to avoid Pulborough. Likewise at TQ035176, either veer a short way west or demolish 3 houses.

HS5 diverges from the alignment at TQ025065 and passes slightly to the north of the classic Arundel station, with the new HS station at TQ023063, avoiding the station buildings. It crosses the Arun at TQ011058. At Tortington Junction, TQ005050, the Littlehampton branch diverges, crossing over the classic lines just west of Ford, joining the Littlehampton branch at Ford East Junction, TQ012035, taking over the Littlehampton branch.

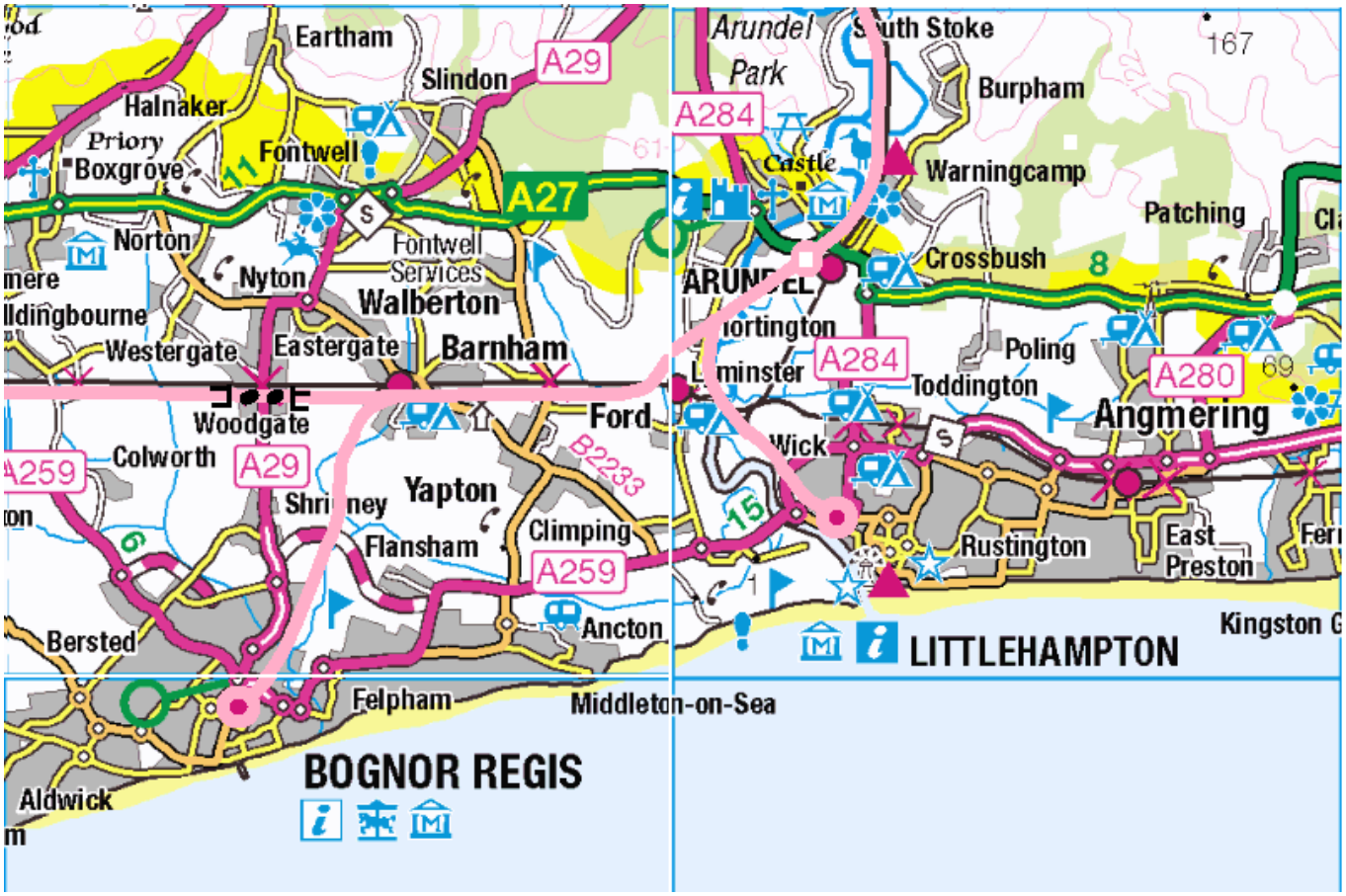
HS5 crosses the coast line at SU994044, just west of Ford, and joins the south side of the alignment. It passes to the south side of Barnham station, crossing over the Bognor branch. The HS connection to the Bognor branch diverges at SU962043, Barnham HS Junction. It joins the Bognor branch at SU955043, taking it over.



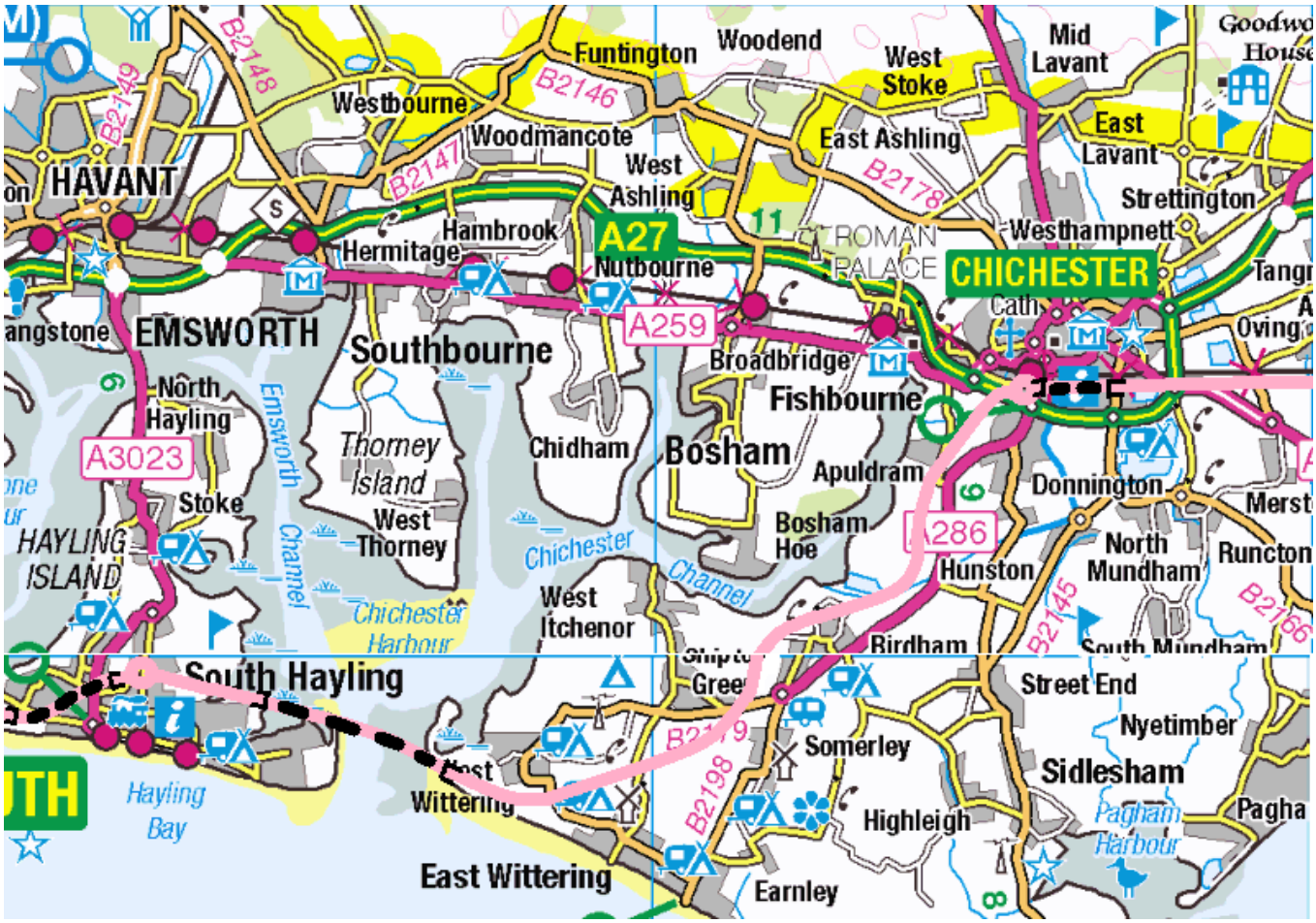
6.2 Itchingfield – North Stoke

The Southampton branch follows the south side of the coast line alignment. A ¼ mile tunnel is required at Woodgate, between SU940043 and SU937043, and a ¾ mile tunnel under Chichester, between SU8700430and SU860043, to the HS platforms on the south side of Chichester station – plenty of room (car parks).

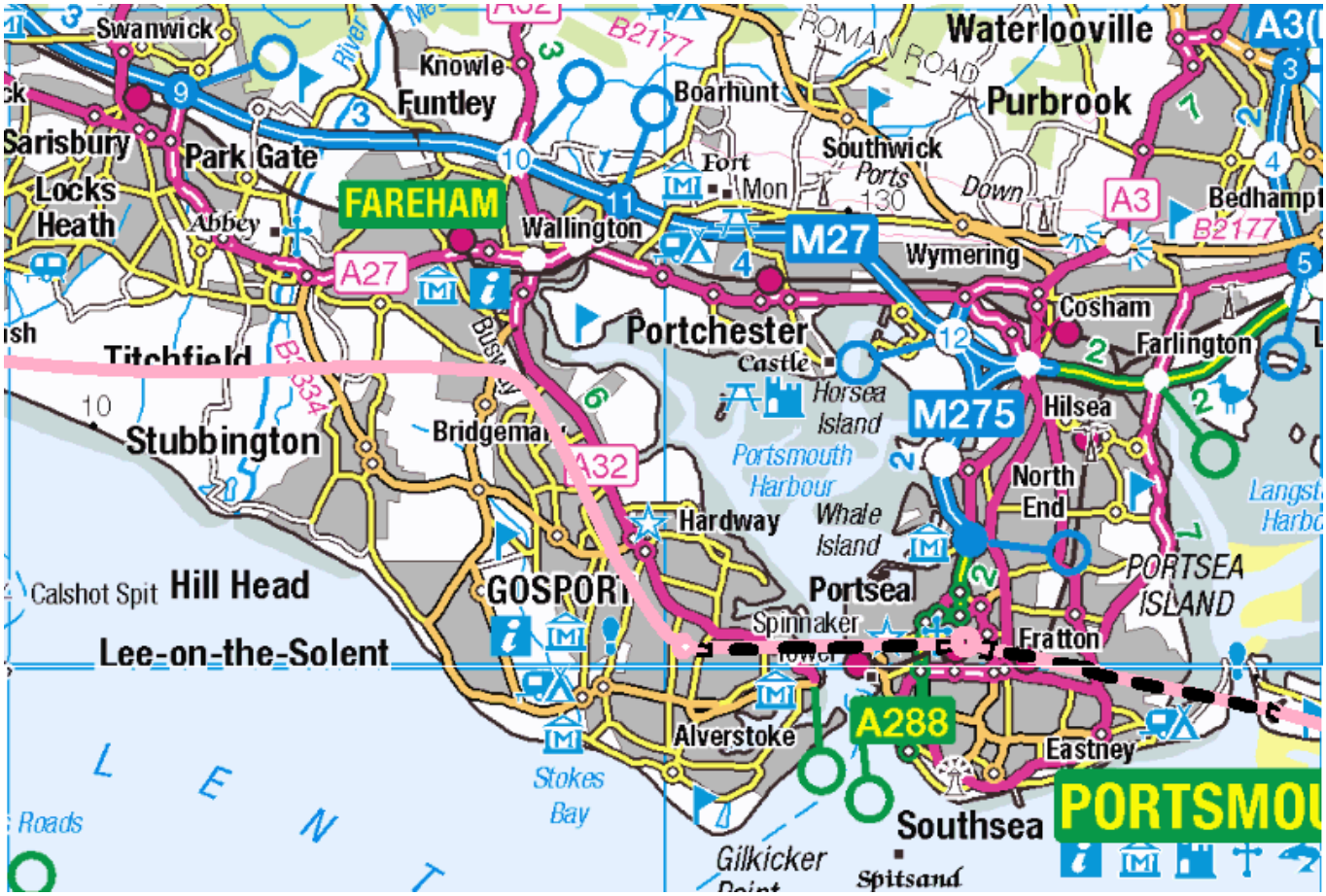
The above describes the Mk2 configuration, all new infrastructure, and corresponds to the original Mk1 design. At Mk1A, HS5 merges with the classic route immediately after Horsham station, and shares classic tracks all the way to Portsmouth and Southsea, after which the new infrastructure is resumed. There is thus no station for Hayling Island at Mk1A.



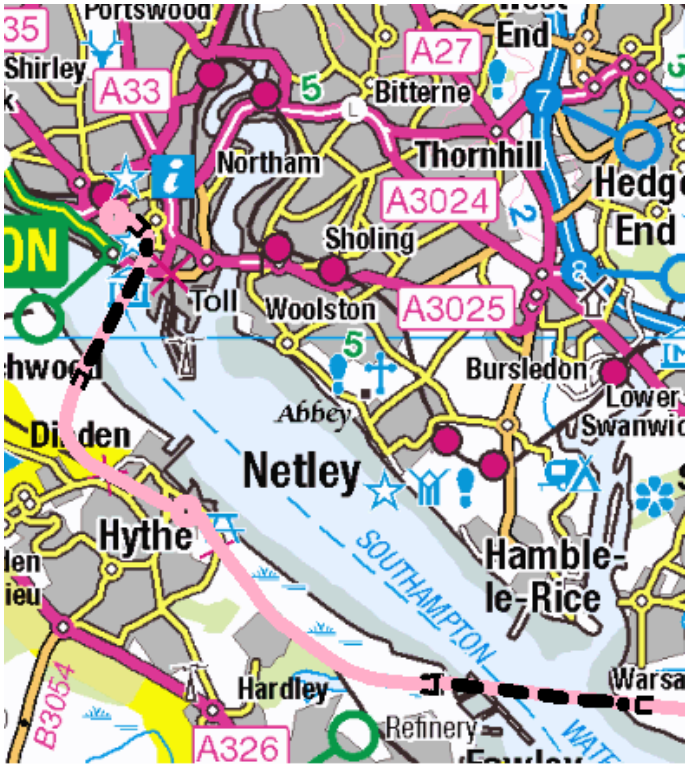
6.3 South Stoke – Alldingbourne



6.4 Chichester – South Hayling



6.5 Portsmouth – Titchfield



6.6 Portsmouth – Titchfield

To the south west of Chichester station is an area of warehouses, which HS5 can either tunnel under or negotiate its way through. It crosses the A27 at SU851042, and heads south west, crossing Dell Quay Road at SU841027. It passes east of the marina at SU836010, (not forgetting to provide an adequate

bridge over the Chichester Canal,) and, veering west, crosses two minor roads at SU824004 a SU820004. It crosses the B2179 at SZ811993, and Piggery Hall Lane at SZ798986, and passes to the south of West Wittering, entering a 2 mile tunnel under the entrance to Chichester Harbour at SZ767983. It emerges at SZ721997, on Hayling Island, providing a station at SZ721997 and redeveloping the area around it. It tunnels for ¾ mile beneath West Town, between SZ716997 and SZ706991, and enters a 3 mile tunnel under the entrance to Langstone Harbour at SZ690995, emerging at SU645002, immediately before Portsmouth and Southsea station, on the north side of the alignment. It needs a new island platform on the north side of the station; currently a multi-storey car park is in the way. There is a problem here; perhaps the platforms could be at a low level, in a cutting, particularly as a 2 mile tunnel begins immediately, at SU642043, under the entrance to Portsmouth Harbour. It emerges in Gosport, at SU607002, where the new Gosport station is located, and takes over the alignment of the former Gosport branch, which, from this point, as Henry Court Way, is completely unobstructed. It follows this alignment until SU578045, where it diverges and heads west. Several warehouses will need to be relocated. It crosses the B3385 at SU574046, Peak Lane at SU556046, the B3334 at SU547045 and Posbrook Lane at SU533044. It enters a 2 mile tunnel under Southampton Water at SU493047, emerging at SU460048, and joins the Fawley branch at SU451050. This is doubled, and a new station provided at Hythe, in the original location at SU427077. It follows this alignment to SU414083, diverging to the north and entering a 1½ mile tunnel under the Test at SU408103, emerging at SU415121, just to the east of Southampton station. The HS platforms are on the south side of the station.

Overall Maps

There follow maps of the overall HS5 routes. At Mk1A, those portions of the main lines of HS5which incorporate sections of classic route, and the sections of HS5's HS-Classic services extending over classic routes beyond the HS5 main lines, are shown as dotted lines, but differently. The following schematic should clarify:

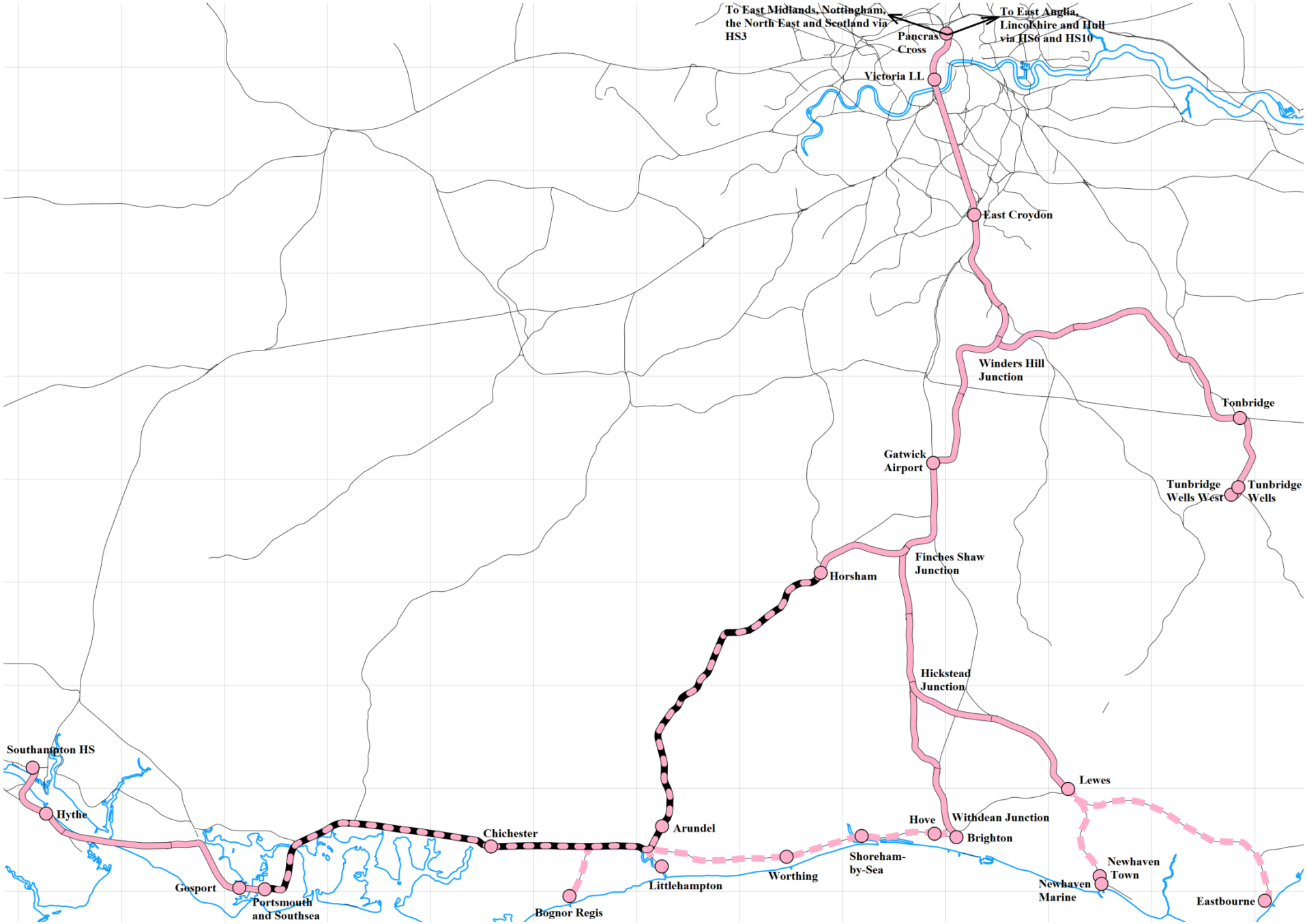
HS Line (main line - new infrastructure)

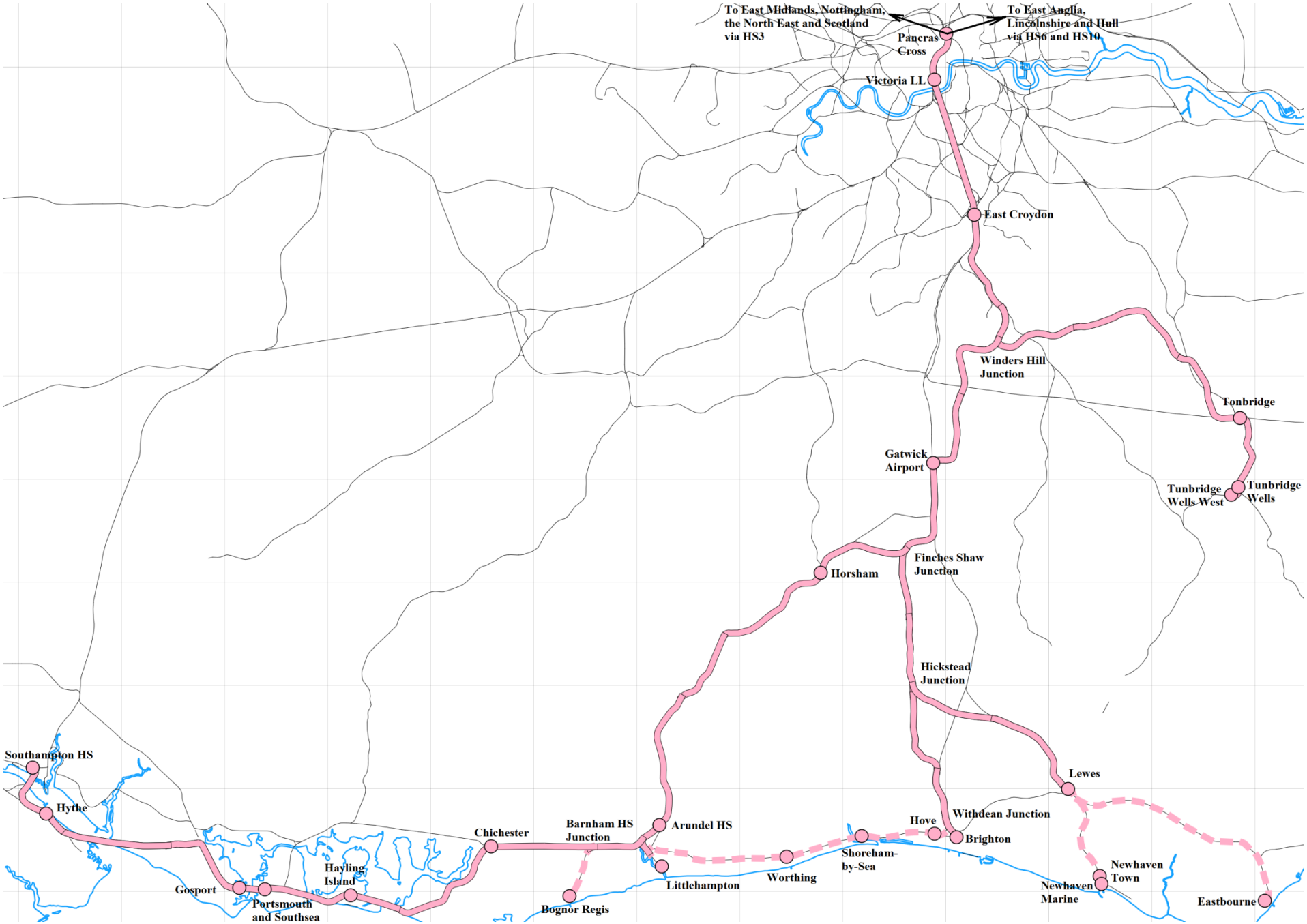
HS-Classic (classic section incorporated within HS main line)

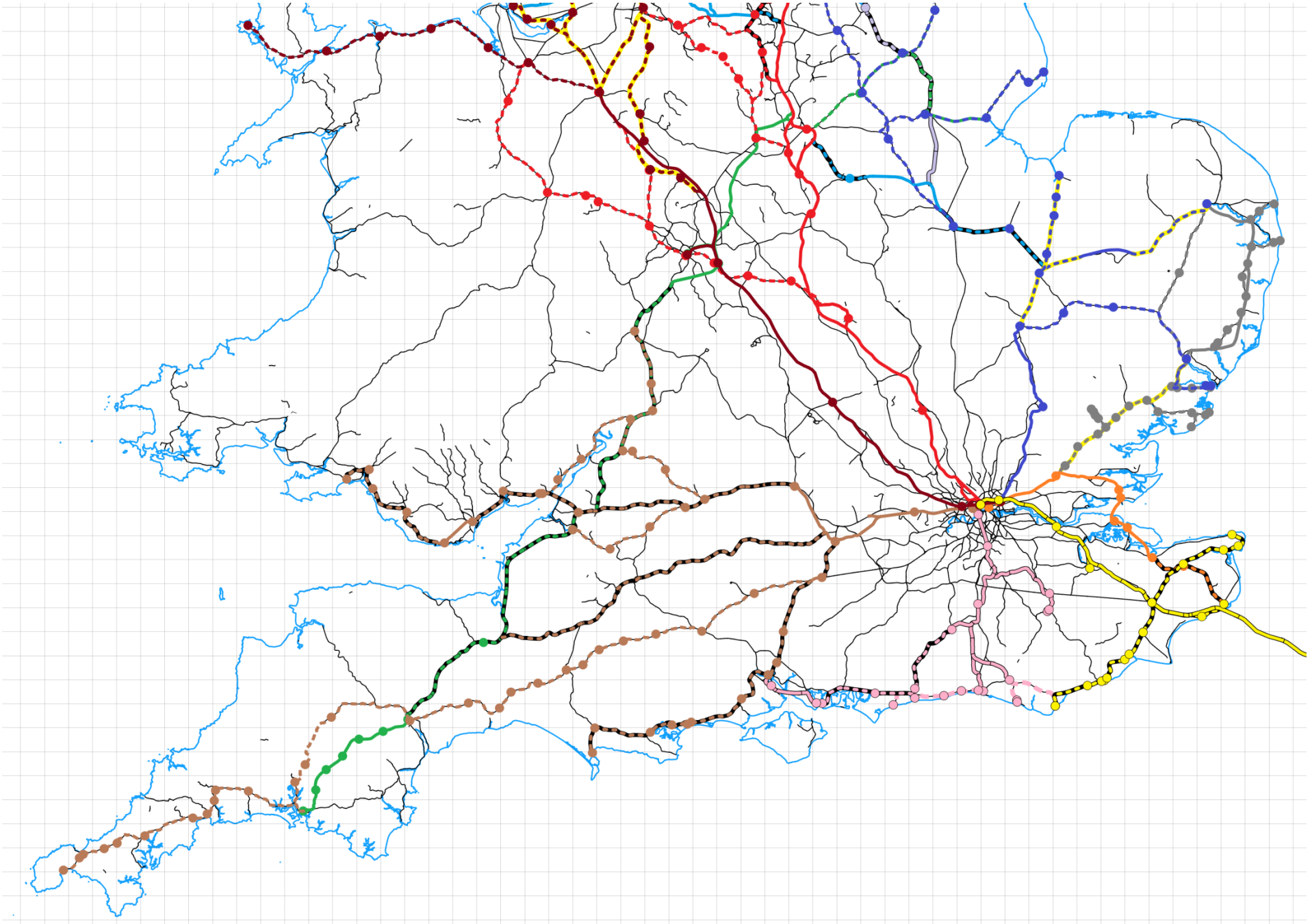
HS-Classic (HS services extending over classic lines beyond HS main line, in general as the final section of the journey, especially at the 'country end' - away from London).

If the full Mk2 is implemented, there will no longer be any sections of classic route incorporated within the HS5 main lines; it will all be new infrastructure. Accordingly, the middle of the above line symbols is no longer used. The connections between HS and classic routes will all remain, of course, no longer used by scheduled services, but immensely valuable for operational flexibility, in particular when engineering work is carried out on the main line.

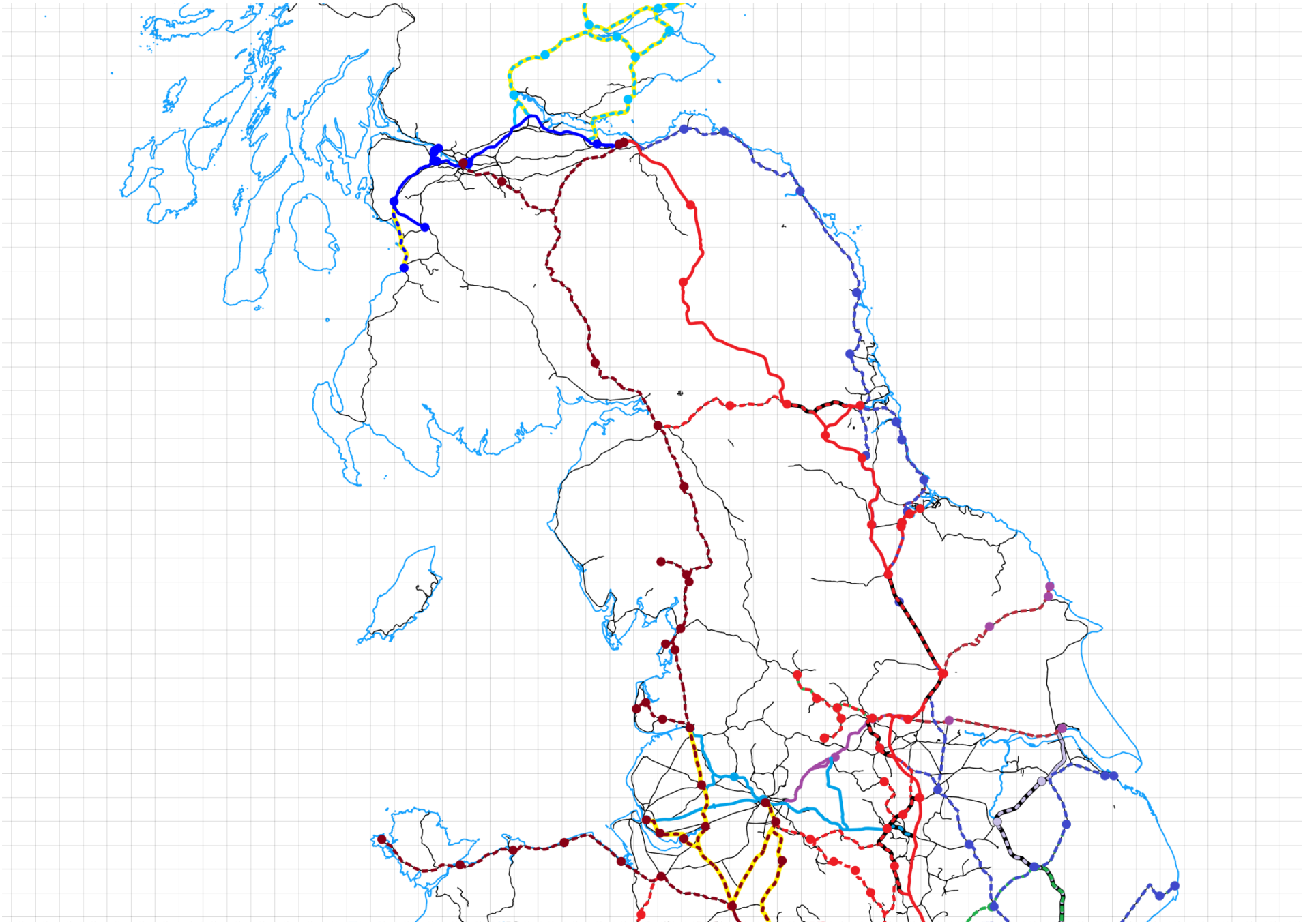
The first two maps show the HS5 route at Mk1A. They show the alignments changed from Mk1, including sections of classic route incorporated into HS5. These are followed by the full Mk2 (and Mk3, whose only infrastructure difference from Mk2 is 4-tracking to Winders Hill Junction,) versions of the same sheets. Finally the maps of the overall network are presented, in Mk1A and extended form. Note that these will be updated over the coming months as the various Route and Service Plans articles are reissued incorporating the Mk1A changes.

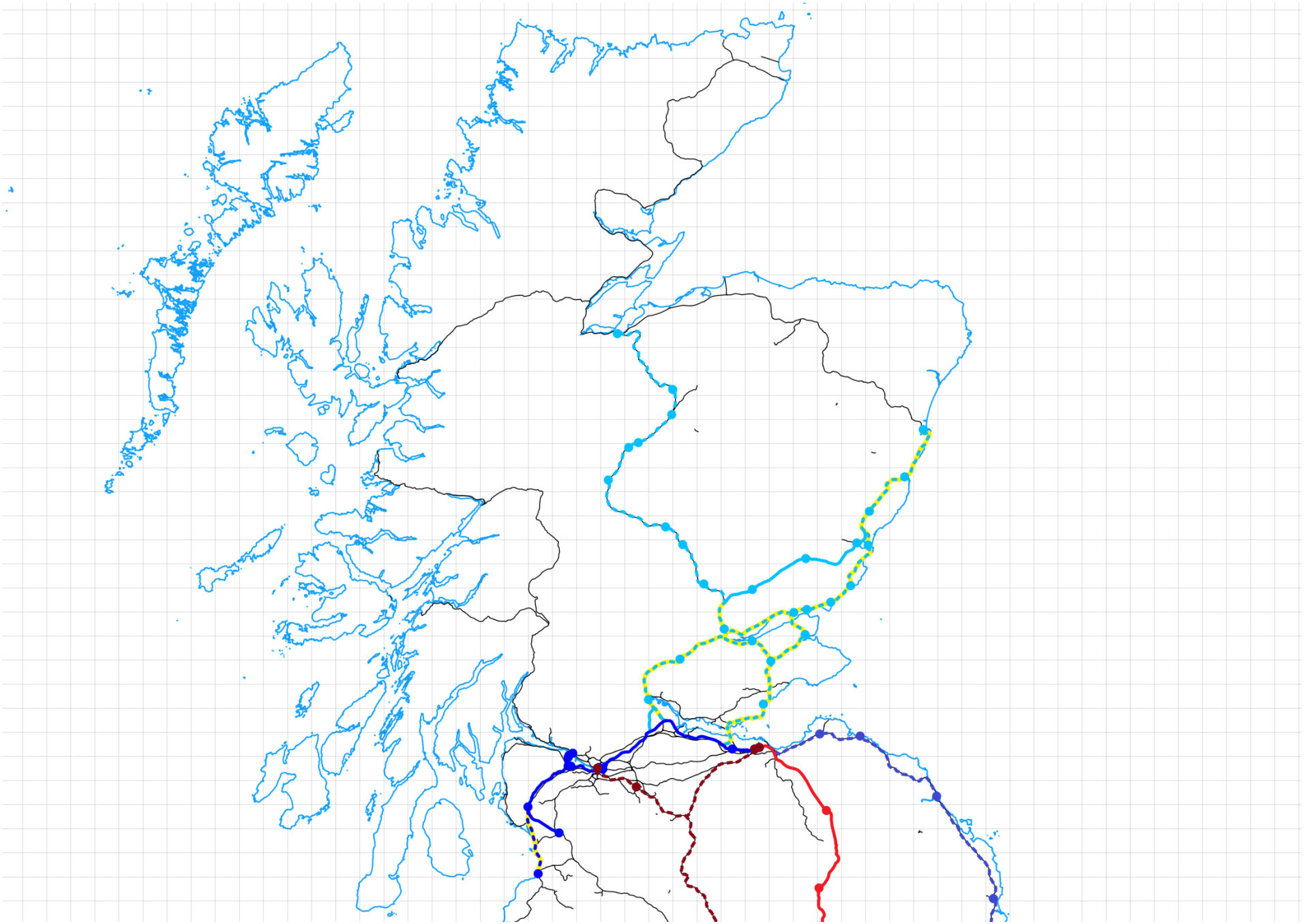




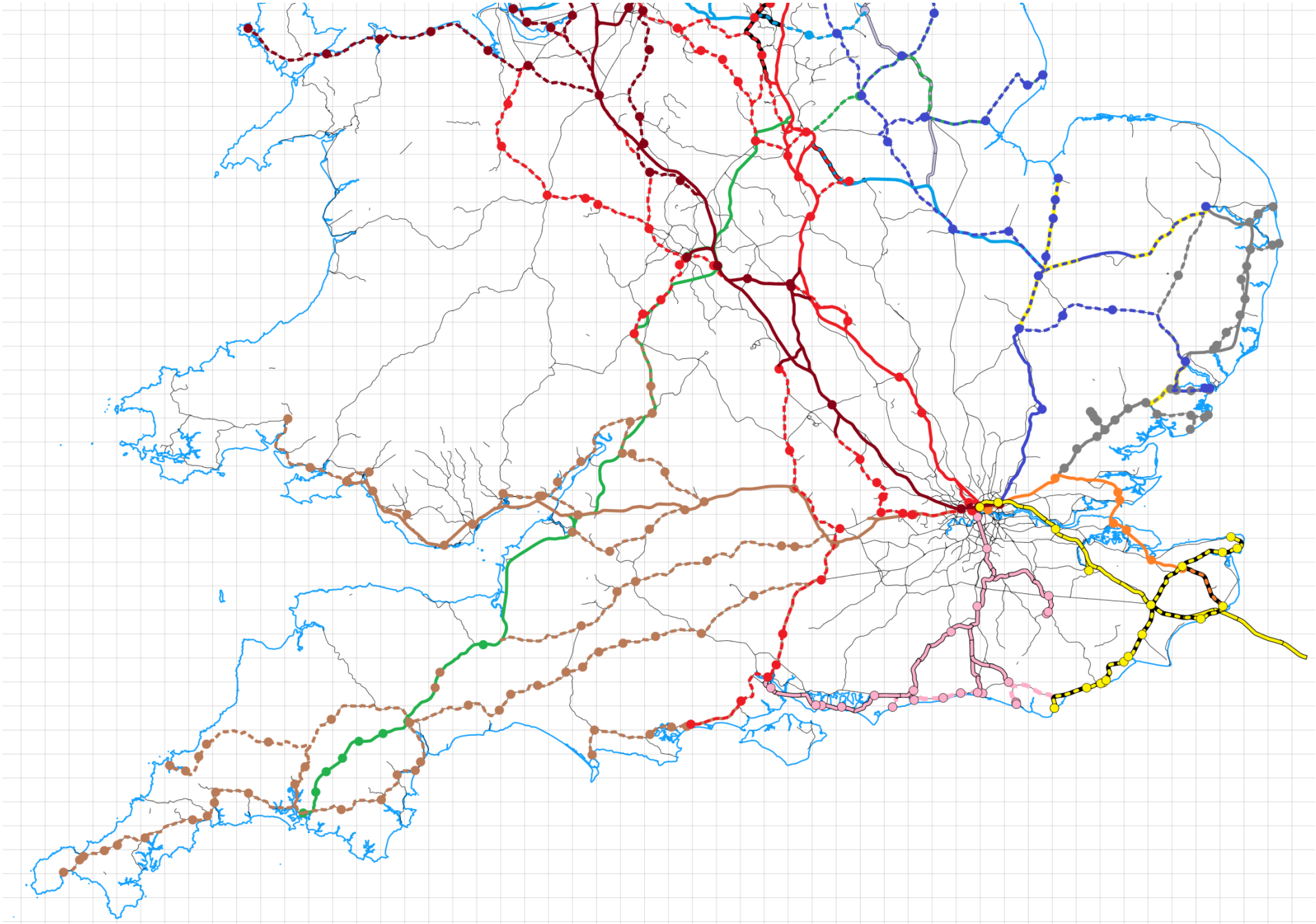


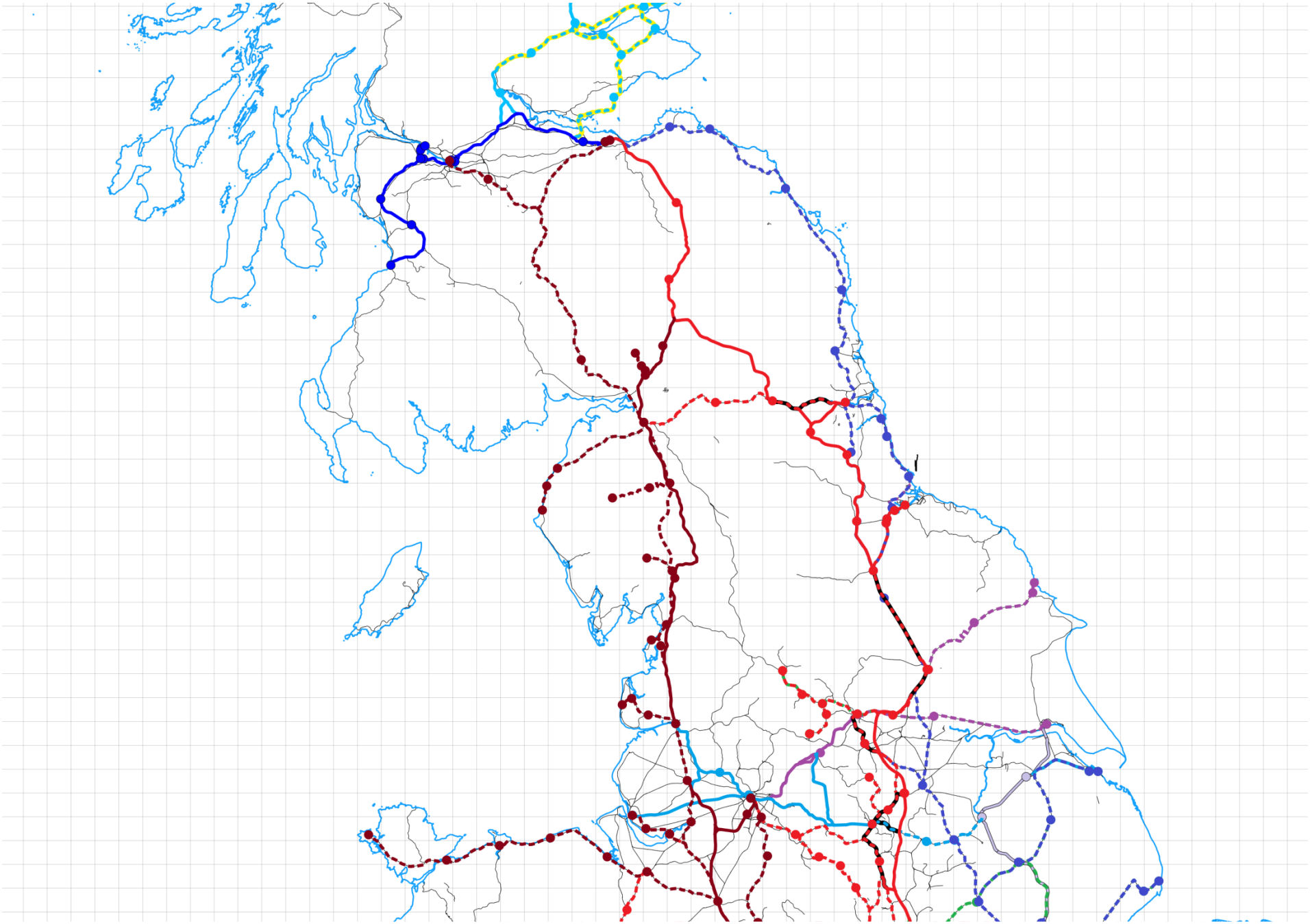
Complete HS Network, South Sheet

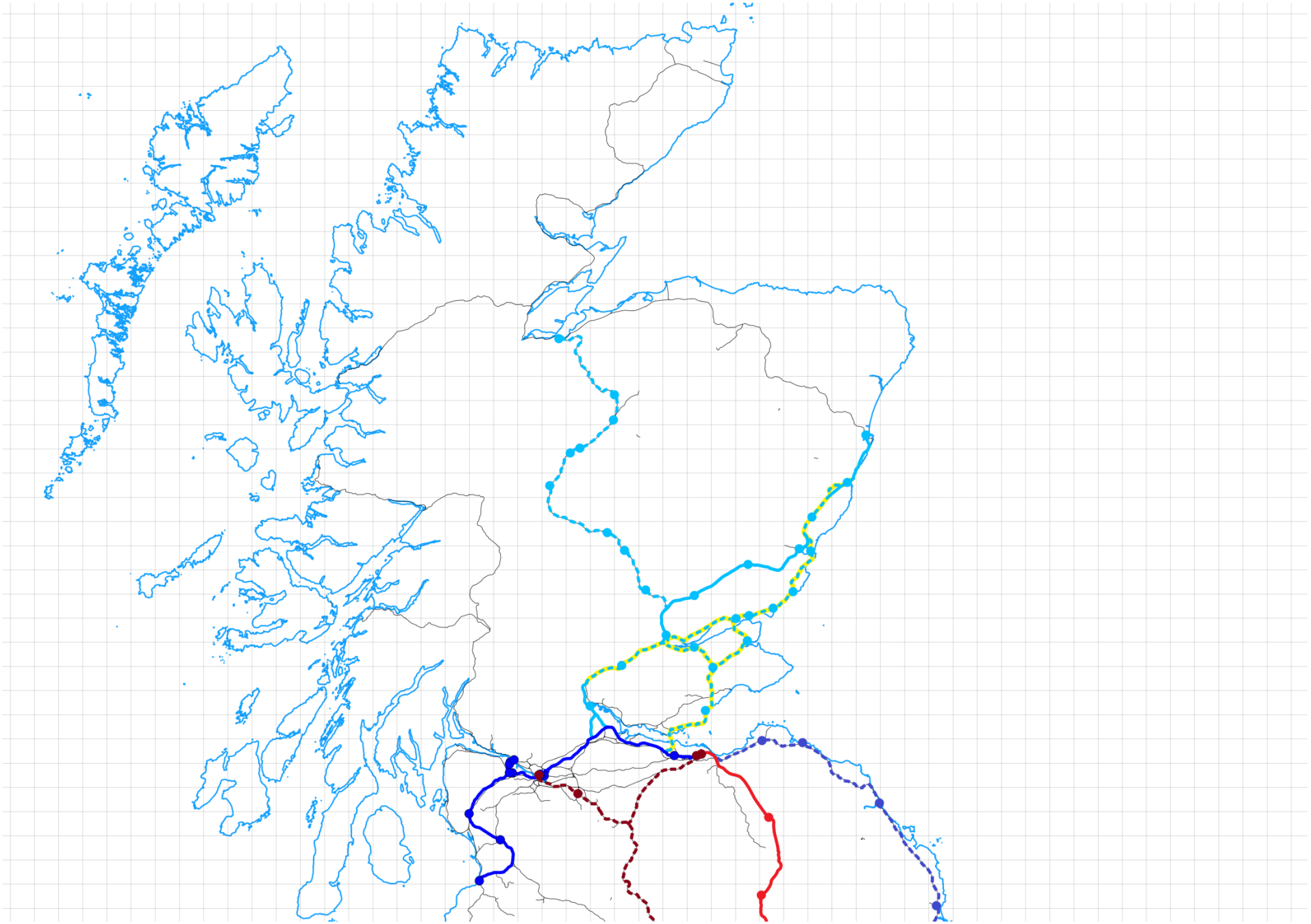




Complete HS Network, North Sheet







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 HS5 itself. This most commonly occurs when a new section of HS5 opens, but it may also be a consequence of a change on some other HS route.

The service plans use the following notation:

- tph trains per hour
- H High Speed train – at least part of the journey being on the HS main line.
- R Regional Metro train, semi-fast service
- RS Regional Metro train, stopping service (all stations)

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

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

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

Service Plan 1

As has been explained, once Pancras Cross becomes a through station, **all** services are through services. There are 8 services north from Pancras Cross when HS5 opens, (this is HS3 SP4,) thus there must be 8 balancing services on HS5.

Service Plan 1 comes into effect when HS5 opens to Brighton, (including the connection to the classic route to Chichester via Hove, although that is not used at this SP,) Eastbourne and Newhaven. The following services are introduced:

- 4tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Brighton
- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Lewes – Eastbourne
- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Lewes – Newhaven Town – Newhaven Marine.
- 8tphH Pancras Cross – Victoria (LL) – East Croydon.

The full, inter-regional HS services are:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston (HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow (UHS)]
- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]
- 2tphH East Croydon – Pancras Cross [–> York (UHS)]
- 2tphH East Croydon – Pancras Cross [–> Halifax / Skipton (UHS)]
- 2tphH East Croydon – Pancras Cross [–. Liverpool (UHS)]

- 2tphH East Croydon – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]

Service Plan 1A

This service plan comes into effect when HS5 opens to Tunbridge Wells (this is HS3 SP4A). The service terminating at East Croydon is extended to Tunbridge Wells:

- 8tphH Pancras Cross – Victoria (LL) – East Croydon – Tonbridge – Tunbridge Wells – Tunbridge Wells West

The full, inter-regional HS services are now:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston(HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow(UHS)]
- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> York (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Halifax / Skipton(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–. Liverpool (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]

Service Plan 1 overall imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	16tph
• Winders Hill Junction	– Tunbridge Wells	8tph
• Winders Hill Junction	– Finches Shaw Junction	8tph
• Finches Shaw Junction	– Hickstead Junction	8tph
• Hickstead Junction	– Brighton	4tph
• Hickstead Junction	– Lewes	4tph

Service Plan 2

Service Plan 2 comes into effect when the Southampton branch of HS5 opens as far as Horsham (and thus on to Portsmouth and Southsea, by classic tracks,) and, simultaneously, HS6 opens from Pancras Cross to King's Lynn (this is HS6/10 SP1, and also HS3 SP5 though that involves no change to HS3 itself).

The additional services are introduced:

- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel – Chichester – Portsmouth and Southsea
- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Hove – Shoreham-by-Sea – Worthing – Chichester

The full, inter-regional HS services are now:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston(HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow(UHS)]

- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> York (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Halifax / Skipton(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–. Liverpool (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> King's Lynn]
- 2tphH Chichester – (via Hove) – Pancras Cross [–> Harwich]

It imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	20tph
• Winders Hill Junction	– Tunbridge Wells	8tph
• Winders Hill Junction	– Finches Shaw Junction	12tph
• Finches Shaw Junction	– Hickstead Junction	10tph
• Hickstead Junction	– Withdean Junction	6tph
• Withdean Junction	– Brighton	4tph
• Hickstead Junction	– Lewes	4tph
• Finches Shaw Junction	– Arundel Junction	2tph
• Arundel Junction	– Chichester	4tph
• Chichester	– Portsmouth and Southsea	2tph

Service Plan 3

Service Plan 3 comes into effect when:

- HS5's Southampton branch opens between Portsmouth and Southsea and Southampton.
- HS6 opens from Ely to Norwich.
- HS8 opens from Ely to Peterborough and Nottingham (over classic tracks between Ely and Peterborough).

(This is HS6/10 SP2, also HS3 SP5A although it involves no **direct** changes to HS3 itself.)

The additional services are introduced:

- 4tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel (classic) – Chichester – Portsmouth and Southsea – Gosport – Hythe – Southampton
- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel (classic; splits / joins) –:
  – Bognor
  – Littlehampton

The full, inter-regional HS services are now:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston(HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow(UHS)]
- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]

- 2tphH Tunbridge Wells – Pancras Cross [–> York (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Halifax / Skipton(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–. Liverpool (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]
- 2tphH Southampton – Pancras Cross [–> Norwich]
- 2tphH Southampton – Pancras Cross [–> Peterborough (temporary, until HS10 opens)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> King's Lynn]
- 2tphH Chichester – (via Hove) – Pancras Cross [–> Harwich]
- 2tphH Bognor / Littlehampton – Pancras Cross [–> Cleethorpes / Skegness]

Service Plan 3A

This service plan comes into effect when HS10 opens to Hull and the service terminating at Peterborough in plan 3 is extended to Hull (this is HS6/10 SP2A).

There are no further services on HS5, but the full, inter-regional HS services are now:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston(HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow(UHS)]
- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> York (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Halifax / Skipton(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–. Liverpool (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]
- 2tphH Southampton – Pancras Cross [–> Norwich]
- 2tphH Southampton – Pancras Cross [–> Hull]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> King's Lynn]
- 2tphH Chichester – (via Hove) – Pancras Cross [–> Harwich]
- 2tphH Bognor / Littlehampton – Pancras Cross [–> Cleethorpes / Skegness]

Representative Hourly Cross-Platform Interchange Pattern at Pancras Cross:

00H Brighton – York (HS Metro)
H Southampton – Hull
04H Tunbridge Wells – Halifax / Skipton
(no connection)
07H Newhaven – Newcastle / Middlesborough (UHS)
H Chichester – Harwich
11H Tunbridge Wells – Barnsley / South Yorkshire LL
H Portsmouth – King's Lynn
15H Brighton – Preston (HS Metro)
H Southampton – Norwich
19H Tunbridge Wells – York (UHS)
H Bognor /Littlehampton – Cleethorpes / Skegness
23H Eastbourne – Glasgow (UHS)

(no connection)
26H Tunbridge Wells – Liverpool (UHS)
(no connection)

– repeating at 30, 34, 37, 41, 45, 49, 53 and 56 minutes past. Note that all connecting pairs have diverging routes from Pancras Cross (being HS3 and HS6/10 respectively).

Service Plan 3 overall imposes the following loadings on HS5:

- Pancras Cross – Winders Hill Junction 26tph
- Winders Hill Junction – Tunbridge Wells 8tph
- Winders Hill Junction – Finches Shaw Junction 18tph
- Finches Shaw Junction – Hickstead Junction 10tph
- Hickstead Junction – Withdean Junction 6tph
- Withdean Junction – Brighton 4tph
- Hickstead Junction – Lewes 4tph
- Finches Shaw Junction – Arundel Junction 8tph
- Arundel Junction – Barnham Junction 10tph
- Barnham Junction – Chichester 8tph
- Chichester – Portsmouth and Southsea 6tph
- Portsmouth and Southsea – Southampton HS 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 Tonbridge – Tunbridge Wells, my estimate 8km, actual 8km; Horsham – Arundel my estimate 33km, actual 32.8km; Arundel - Chichester, my estimate 18km, actual 18.4km) leads me to believe they are accurate to within 3%.

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

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

My estimated distances (between stations) are:

• Pancras Cross – Victoria Low Level	5km	(*)
• Victoria Low Level – East Croydon	13km	(*)
• East Croydon – Gatwick Airport	30km	(300kph)
• Gatwick Airport – Brighton	39km	(300kph)
• Gatwick Airport – Lewes	42km	(300kph)
• East Croydon – Tonbridge	42km	(300kph)
• Tonbridge – Tunbridge Wells	8km	(*)
• Tunbridge Wells - Tunbridge Wells West	1km	(*)
• Gatwick Airport – Horsham	18km	(*)
• Portsmouth & Sothsea – Gosport	3km	(*)
• Gosport – Hythe	21km	(300kph)
• Hythe – Southampton	6km	(*)
• Gatwick Airport – Hove	40km	(300kph)

The above are all distances on HS5 new infrastructure. In addition, they share the following sections of classic routes, whose lengths are known exactly!

• Horsham – Arundel	34.9km	(160kph)
• Arundel – Littlehampton	8.9km	(160kph)
• Arundel – Bognor	16.9km	(160kph)
• Arundel – Chichester	21.3km	(160kph)
• Chichester – Portsmouth and Southsea	25.7km	(160kph)
• Lewes – Newhaven Town	10.2km	(160kph)
• Newhaven Town – Newhaven Marine	0.95km	(*)
• Lewes – Eastbourne	25.3km	(160kph)
• Hove – Shoreham-by-Sea	7.1km	(160kph)

- Shoreham-by-Sea – Worthing 7.6km (160kph)
- Worthing – Chichester 29.0km (160kph)

A line speed of 160kph, 100mph, is chosen for all classic sections – I don't think more can be assumed, given the other traffic they share line with. The HS sections have a line speed of 300kph, except as follows. Those sections marked (*) are between Adjacent Stations, where the distance is insufficient for the line speed to be reached. The times between stations are given below, for a regime of acceleration switching to deceleration without any intervening steady speed. 'Same Speed Railways' contains a table of times taken to travel between adjacent stations, and the above times are taken from this.

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

- Acceleration from stationary to 300kphtakes 11.57km and 278 seconds
- Deceleration from 300kph to stationary takes 6.945km and 167 seconds
- Time to travel from Pancras Cross to Victoria Low Level (start to stop) is 231 seconds
- Time to travel from Victoria Low Level to East Croydon (start to stop) is 372 seconds
- Time to travel from Newhaven Town to Newhaven Marine (start to stop) is 90 seconds
- Time to travel from Tonbridge to Tunbridge Wells (start to stop) is 292 seconds
- Time to travel from Tunbridge Wells to Tunbridge Wells West (start to stop) is 103 seconds
- Time to travel from Gatwick Airport to Horsham (start to stop) is 438 seconds
- Time to travel from Portsmouth & Southsea to Gosport (start to stop) is 179 seconds
- Time to travel from Hythe to Southampton (start to stop) is 253 seconds

Same Speed Railways' contains a table of times taken to travel between adjacent stations, for inter-station distances of up to 18.5km, and the above times are taken from this.

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

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

- East Croydon – Tonbridge incurs a time penalty of 26 seconds at Winders Hill Junction, where the Tunbridge Wells branch diverges from the main line to Brighton.
- Gatwick Airport – Horsham incurs a time penalty of 26 seconds at Finches Shaw Junction, where the Southampton branch diverges from the main line.
- Gatwick Airport – Lewes incurs a double-junction penalty of 26 seconds at Hickstead Junction, where the branch to Newhaven and Eastbourne diverges from the main line.

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

Pancras Cross – Brighton / Newhaven / Eastbourne / Tunbridge Wells / Littlehampton / Bognor / Southampton (3/5/4/4/5/5/10 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Pancras Cross - Victoria Low Level	5	5	3.9	3.9	3.9
Victoria Low Level - East Croydon	13	18	6.2	10.1	13.1
East Croydon - Gatwick Airport	30	48	9.7	19.8	25.8
Gatwick Airport - Brighton	39	87	11.5	31.3	40.3
Gatwick Airport - Lewes	42	90	12.1	31.9	40.9
Lewes - Newhaven Town	10	100	5.8	37.7	49.7
Newhaven Town - Newhaven Marine	1	101	1.5	39.2	54.2
Lewes - Eastbourne	25	115	11.5	43.3	55.3
East Croydon - Tonbridge	42	60	12.1	22.2	28.2
Tonbridge - Tunbridge Wells	8	68	4.9	27.0	36.0
Tunbridge Wells - Tunbridge Wells West	1	69	1.7	28.7	40.7
Gatwick Airport - Horsham	18	66	7.3	27.1	36.1
Horsham - Arundel	33	99	14.4	41.4	53.4
Arundel - Littlehampton	6	105	4.2	45.6	60.6
Arundel - Bognor Regis	12	111	6.5	47.9	62.9
Arundel - Chichester	18	117	8.7	50.2	65.2
Chichester - Portsmouth and Southsea	25.7	143	11.6	61.8	79.8
Portsmouth and Southsea - Gosport	3	146	3.0	64.8	85.8
Gosport - Hythe	21	167	7.9	72.7	96.7

Hythe - Southampton	6	173	4.2	76.9	103.9
Gatwick Airport - Hove	40	88	11.7	31.5	40.5
Hove - Shoreham-by-Sea	7.1	95	4.6	36.1	48.1
Shoreham-by-Sea - Worthing	7.6	103	4.8	40.9	55.9
Worthing - Chichester	29	132	12.9	53.8	71.8

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

- Gatwick Airport 29 [26]
- Brighton 54 [40]
- Lewes 60 [41]
- Newhaven Town 81 (1 change) [50]
- Eastbourne 61 [55]
- Tonbridge 40 [28]
- Tunbridge Wells 54 [36]
- Horsham 49 [36]
- Littlehampton 99 [61]
- Bognor Regis 98 [63]
- Chichester 88 [65]
- Portsmouth & Southsea 88 [80]
- Southampton 74 [104]
- Hove 63 [41]
- Shoreham-by-Sea 70 [48]
- Worthing 78 [56]

HS5 Mk2 Enhancements

It is definitely envisaged that the HS route between Horsham and Chichester will be reinstated at Mk2, so HS services on the Southampton arm now call at the new Arundel HS station, and gain access to the Littlehampton and Bognor branches at Ford East and Barnham South junctions respectively.

It may be worthwhile to reinstate the route between Chichester and Portsmouth via Hayling Island also, depending on how overloaded the classic section between Chichester and Portsmouth has become. This is a major investment, however, with extensive under-water tunnelling, so I am assuming that this is not implemented at this time (but see below).

I think it doubtful that the section east of Lewes is worth reinstating, since (I believe that) loadings on this section will not justify it, certainly not on the Newhaven branch.

Thus, with the exception of the new Arundel HS station, the services are unchanged from Mk1A, merely accelerated between Horsham and Chichester. I therefore give no results specifically for Mk2, but pass straight on to:

HS5 Mk3 Enhancements

This is tied in with the enhancements in HS3 Mk2 and, as there, involve 4-tracking between Pancras Cross and at least Winders Hill Junction, possibly as far as Finches Shaw Junction.

Given the extra services introduced at Mk3, reinstatement of the HS infrastructure between Chichester and Portsmouth via Hayling Island is now, I believe, definitely justified (but that east of Lewes still not).

Service Plan 4

Service Plan 4 comes into effect when the section of the Southampton arm between Chichester and Portsmouth via Hayling Island is implemented.

The following additional services are introduced on HS5:

- 6tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel – Chichester – Portsmouth and Southsea (so now 8tph in total)
- 2tphH Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Hove – Shoreham-by-Sea – Worthing – Chichester (so now 4tph in total)

The following additional services are introduced on HS3 (this is HS3 SP6):

- 2tphH Tunbridge Wells – Pancras Cross [–> Preston (UHS)] (NB this replaces the existing service from Tunbridge Wells to Barnsley / South Yorkshire LL, which now starts from Portsmouth and Southsea.)
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Derby (UHS)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Barnsley / South Yorkshire LL] (As noted above, this service used to start at Tunbridge Wells.)
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Hull, via Sheffield Midland (UHS)]

- 2tphH Chichester – (via Hove) – Pancras Cross [–> Derby via Melton Mowbray (HS Metro)]

There are no further services on HS6/10, which thus remains at SP3.

The full, inter-regional HS services are now:

- 2tphH Brighton – Pancras Cross [–> York (HS Metro)]
- 2tphH Brighton – Pancras Cross [–> Preston(HS Metro)]
- 2tphH Eastbourne – Pancras Cross [–> Glasgow(UHS)]
- 2tphH Newhaven – Pancras Cross [–> Newcastle / Middlesborough(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> York (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Halifax / Skipton(UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Liverpool (UHS)]
- 2tphH Tunbridge Wells – Pancras Cross [–> Preston (UHS)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Barnsley / South Yorkshire LL (UHS)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Hull, via Sheffield Midland (UHS)]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> Derby (UHS)]
- 2tphH Chichester – (via Hove) – Pancras Cross [–> Derby (HS Metro)]
- 2tphH Southampton – Pancras Cross [–> Norwich]
- 2tphH Southampton – Pancras Cross [–> Hull]
- 2tphH Portsmouth and Southsea – Pancras Cross [–> King's Lynn]
- 2tphH Chichester – (via Hove) – Pancras Cross [–> Harwich]
- 2tphH Bognor / Littlehampton – Pancras Cross [–> Cleethorpes / Skegness]

Service Plan 4 imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	34tph
• Winders Hill Junction	– Tunbridge Wells	8tph
• Winders Hill Junction	– Finches Shaw Junction	26tph
• Finches Shaw Junction	– Hickstead Junction	12tph
• Hickstead Junction	– Withdean Junction	8tph
• Withdean Junction	– Brighton	4tph
• Hickstead Junction	– Lewes	4tph
• Finches Shaw Junction	– Arundel HS	14tph
• Arundel HS	– Tortington Junction	16tph
• Tortington Junction	– Barnham HS Junction	14tph
• Barnham HS Junction	– Chichester	12tph
• Chichester	– Portsmouth and Southsea (via Hayling Is.)	12tph
• Portsmouth and Southsea	– Southampton HS	4tph

Note that the 4tp Withdean Junction – Chichester service does not appear in the count because it used classic tracks throughout that section. The extra 2tph between Arundel HS and Tortington Junction is of course the Littlehampton portion of the Bognor service.

Estimated Journey Times

As compared with Mk1A, The following distances need to be taken into account, reflecting new infrastructure:

- Horsham – Arundel HS 33km (300kph)
- Arundel HS – Littlehampton 6km (*)
- Arundel HS – Bognor Regis 12km (*)
- Arundel HS – Chichester 18km (*)
- Chichester – Hayling Island 15km (*)
- Hayling Island – Portsmouth & Sothsea 8km (*)

With the exception of Horsham – Arundel HS, these are all (for a line speed of 300kph) between adjacent stations, so the times are:

- Time to travel from Arundel HS to Littlehampton (start to stop) is 253 seconds
- Time to travel from Arundel HS to Bognor (start to stop) is 358 seconds
- Time to travel from Arundel HS to Chichester (start to stop) is 438 seconds
- Time to travel from Chichester to Hayling Island (start to stop) is 400 seconds
- Time to travel from Hayling Island to Portsmouth & Southsea (start to stop) is 292 seconds

The services to Brighton, Newhaven, Eastbourne, Tunbridge Wells and Chichester via Hove are all unchanged from Mk1A, and so are omitted.

Pancras Cross – Southampton (10 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Pancras Cross - Victoria Low Level	5	5	3.9	3.9	3.9
Victoria Low Level - East Croydon	13	18	6.2	10.1	13.1
East Croydon - Gatwick Airport	30	48	9.7	19.8	25.8
Gatwick Airport - Horsham	18	66	7.3	27.1	36.1
Horsham - Arundel HS	33	99	10.3	37.4	49.4
Arundel HS - Littlehampton	6	105	4.2	41.6	56.6
Arundel HS - Bognor Regis	12	111	6.0	43.3	58.3
Arundel HS - Chichester	18	117	7.3	44.7	59.7
Chichester - Hayling Island	15	114	6.7	51.3	69.3
Hayling Island - Portsmouth and Southsea	8	122	4.9	56.2	77.2
Portsmouth and Southsea - Gosport	3	125	3.0	59.2	83.2
Gosport - Hythe	21	146	7.9	67.1	94.1
Hythe - Southampton	6	152	4.2	71.3	101.3

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

- Gatwick Airport 29 [26]
- Horsham 49 [36]
- Littlehampton 99 [57]
- Bognor Regis 98 [58]
- Chichester 88 [60]
- Portsmouth & Southsea 88 [77]
- Southampton 74 [101]

Appendix A – Pancras Cross and the Inter-Regional Connections

General

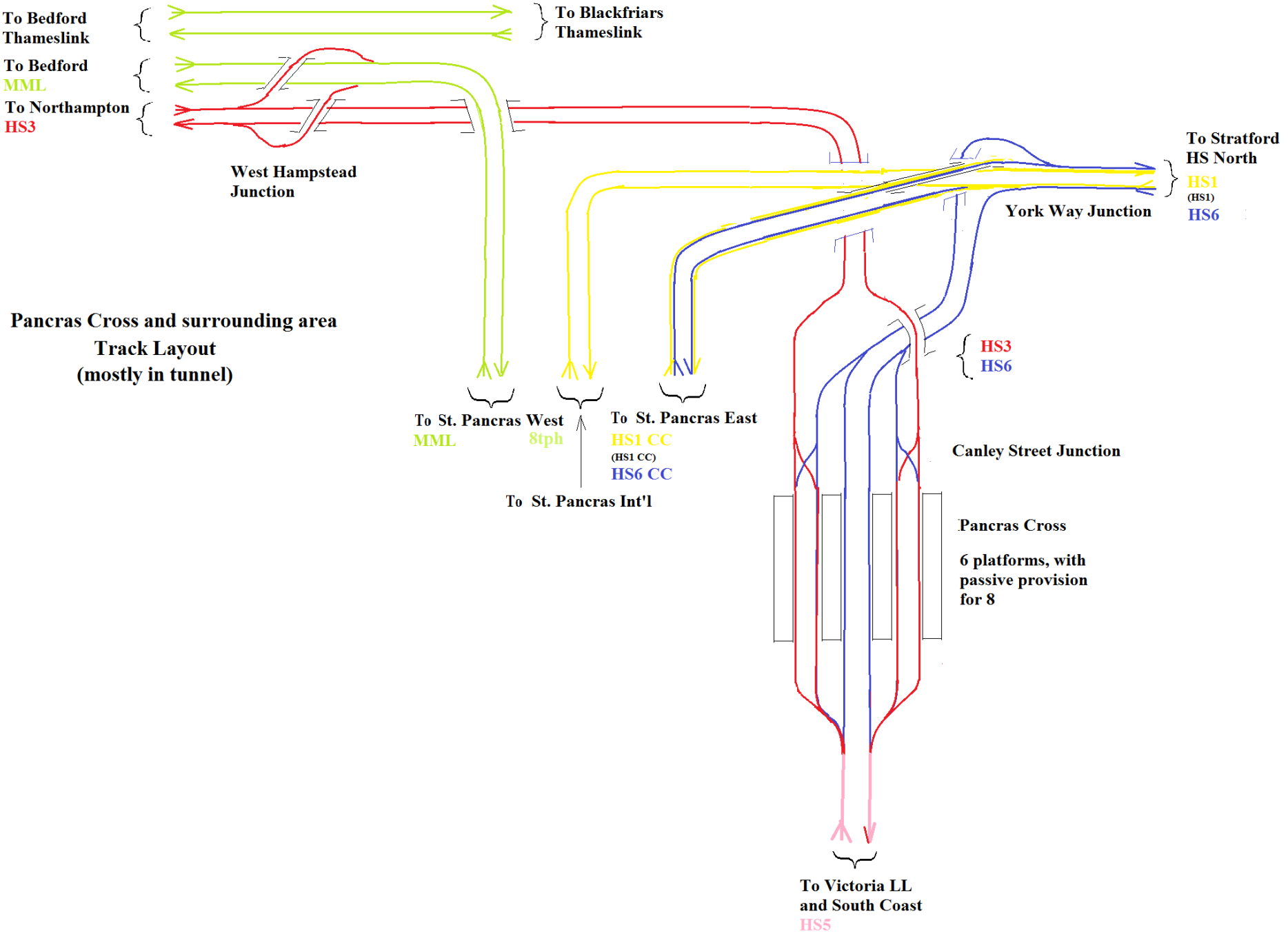
By routing the HS-C services of HS3 into St. Pancras West (the MML platforms), and of HS6 into St. Pancras East (the 'Javelin' platforms), and all the UHS and HS Metro services of both routes through Pancras Cross and on to HS5, superlative cross-London inter-regional HS services are enabled, between Scotland, the North East, Yorkshire and the East Midlands (HS3), likewise West Anglia and Lincolnshire (HS6/HS10), and Sussex, West Kent and Hampshire. Given the service loadings of the London end of HS3 and of HS6/HS10, balancing exactly those of HS5, a single tunnel in each direction and 6 platform faces, (passive provision for 8,) would suffice. That a single Pancras Cross station, with a single pair of approach tunnels, would serve two HS inter-regional routes should seriously enhance its business case.

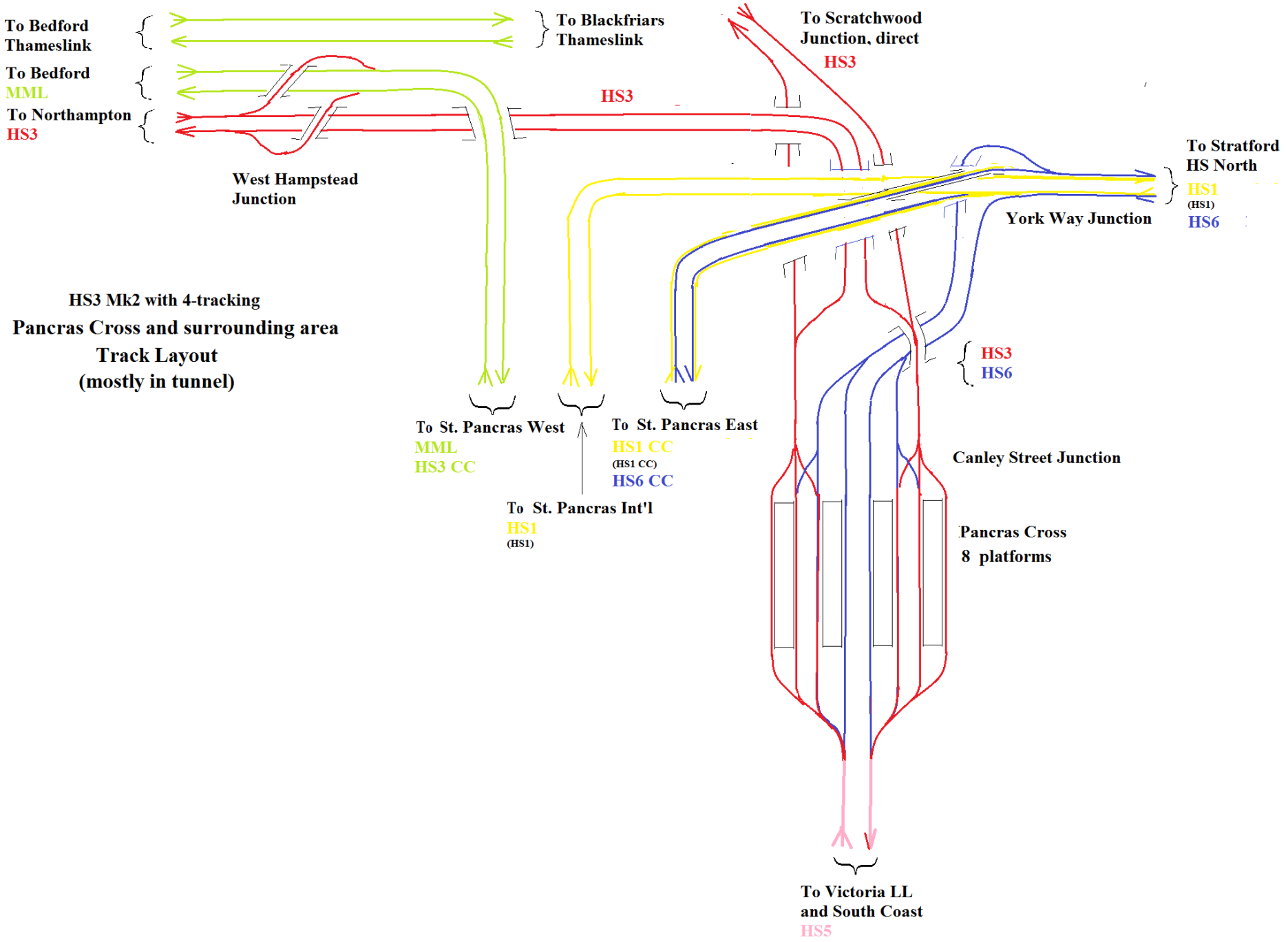
The track diagram of Pancras Cross and its surroundings is on the next two pages. The layout is not especially complicated, but there are a few points to note. The second version, for HS3 Mk2 with 4-tracking, is extra futuristic and speculative.

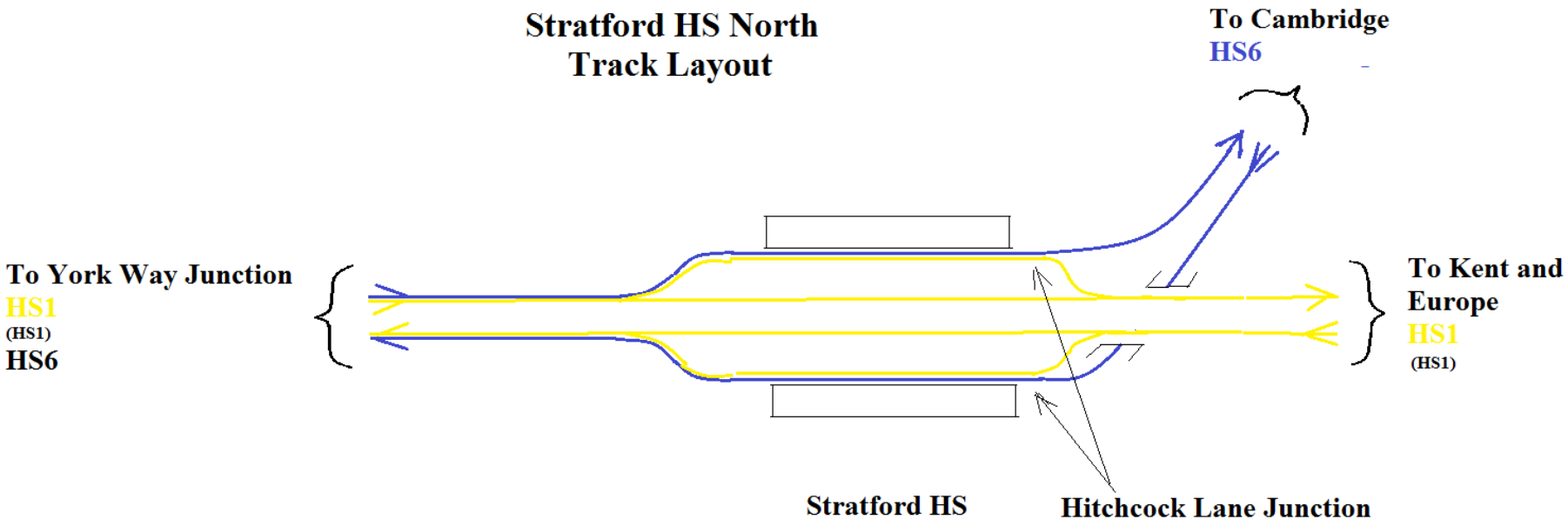
The middle two platform faces at Pancras Cross would ordinarily be used by HS6 trains and the two outer pairs by HS3. The scissors crossovers are provided for operational flexibility, but should not normally be used. I would like to see **passive** provision for 8 platforms, as is indicated in the diagram.

HS6's HS Metro services from Pancras Cross, and its HS-C services from St. Pancras East, all join HS1's route from St. Pancras International, at York Way Junction. They then all share the same tracks as far as Stratford HS North station (formerly Stratford International, which it never was). The track diagram for Stratford HS North is deliberately simplified, omitting the extra through tracks and the connection to Temple Mills. The station exists already, and has a single platformed track in each direction (a rather inadequate provision; it may well prove necessary to add extra platform faces on the outside). This is served by all HS6/HS10 services. HS1's international services pass through the centre, as they always have. (HS1's inter-regional services join HS1 later, from Euston Cross at Woodgrange Road Junction.) HS6 diverges from HS1 at Hitchcock Lane Junction, immediately east of the station, without rejoining the main lines of HS1.

Since (most of) the above was written, the Mk2 version of HS3's route has been developed. The first track diagram of Pancras Cross still accurately depicts HS3 Mk2 in its initial state, before 4-tracking. The second track diagram shows the enhanced provision after 4-tracking. It is assumed that by then (c.2060, perhaps), automatic train control will enable 24tph and more in each direction over the 2-track section south of Pancras Cross (all the way to East Croydon, in fact).


To Bedford
Thameslink
To Blackfriars
Thameslink
To Bedford
MML
To Northampton
HS3
West Hampstead
Junction
To Stratford
HS North
HS1
(HS1)
HS6
York Way Junction
Pancras Cross and surrounding area
Track Layout
(mostly in tunnel)
HS3
HS6
To St. Pancras West
MML
8tph
To St. Pancras East
HS1 CC
(HS1 CC)
HS6 CC
To St. Pancras Int'l
Canley Street Junction
Pancras Cross
6 platforms, with
passive provision
for 8
To Victoria LL
and South Coast
HS5


To Bedford
Thameslink
To Bedford
MML
To Northampton
HS3
To Blackfriars
Thameslink
HS3
To Scratchwood
Junction, direct
HS3
West Hampstead
Junction
To Stratford
HS North
HS1
(HS1)
HS6
York Way Junction
HS3 Mk2 with 4-tracking
Pancras Cross and surrounding area
Track Layout
(mostly in tunnel)
HS3
HS6
To St. Pancras West
MML
HS3 CC
To St. Pancras East
HS1 CC
(HS1 CC)
HS6 CC
Canley Street Junction
To St. Pancras Int'l
HS1
(HS1)
Pancras Cross
8 platforms
To Victoria LL
and South Coast
HS5


Stratford HS North
Track Layout
To Cambridge
HS6
To York Way Junction
HS1
(HS1)
HS6
To Kent and
Europe
HS1
(HS1)
Stratford HS
Hitchcock Lane Junction

Appendix B – Distance Table

Distance Table		
Victoria to:	miles/chains	km
East Croydon	10:28	16.7
Gatwick Airport	26:47	42.8
Brighton	50:49	81.4
Hove	50:56	81.6
Shoreham-by-Sea	55:10	88.7
Worthing	59:67	96.3
Chichester (via Hove)	77:72	125.3
Horsham	37:56	60.7
Arundel	59:33	95.6
Littlehampton	64:74	104.5
Bognor	69:74	112.5
Chichester (via Horsham)	72:50	116.9
Portsmouth and Southsea	88:49	142.6
Lewes	49:74	80.3
Newhaven Town	56:20	90.5
Newhaven Marine	56:67	91.5
Eastbourne	65:50	105.6

The source of the above data is ‘Track Atlas of Mainland Britain’ (TRACKmaps 2009). The values are given in miles and chains (80 chains = 1 mile). In contrast to many other exercises of this type, the distances were all relatively easy (most of them very easy) to derive. But it was still a sufficiently tedious process to make it worth preserving the results, so that I don’t ever have to do it again.

Appendix C – Changes at Mk1A and Mk2

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

- HS5 merges with the classic LBSC route between Horsham and Arundel Junction
- – also between Arundel Junction and Chichester
- – also between Chichester and Portsmouth and Southsea
- – also between Lewes and Eastbourne
- – also the Bognor, Littlehampton and Newhaven branches.

These changes will be partly reversed at Mk2 and Mk3:

- New infrastructure will be added between Horsham and Chichester, with connections to the Bognor and Littlehampton branches (Mk2).
- New infrastructure will be added between Chichester and Portsmouth and Southsea, via Hayling Island (possibly Mk2 but definitely Mk3).

It is considered unlikely that capacity constraints will justify new infrastructure east of Lewes.

Quadrupling is intended at Mk3, between Pancras Cross and Winders Hill Junction, possibly continuing to Finches Shaw Junction.

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

The article ‘Line Capacity vs. Speed for High Speed Railways’ points out (in the section ‘Consequences of the Results’) that a good case can be made for a line speed of 225kph, 140mph, because this offers a good compromise between speed and line capacity (theoretical capacity 49tph at 225kph with basic Train Separation Distance as compared with 29tph at 360kph with extended TSD). Even more important is the fact that this is just within the current (as at 2014) Turnout Limit Speed of 230kph, 144mph. This is the maximum speed at which trains can diverge from the main line of a HS railway, using the fastest available pointwork. What this means is that diverging trains can leave the main line at full line speed; there is no need to decelerate on the main line before diverging. This means that the Extended Train Separation Distance standard, which allows diverging trains to decelerate on the main line, without affecting a following straight-ahead train, which continues at full line speed, is no longer necessary, which allows major simplification in the operation of HS railways. (Note that these preceding remarks apply only to routes where **overtaking** takes place – specifically to HS2, HS3, HS4 and HS14. They do not apply to routes with an HS-Metro service pattern. But the journey times for line speed 225kph is of interest for all routes.)

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

Pancras Cross – Brighton / Newhaven / Eastbourne / Tunbridge Wells (3/5/4/4 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Pancras Cross - Victoria Low Level	5	5	3.9	3.9	3.9
Victoria Low Level - East Croydon	13	18	6.2	10.1	13.1
East Croydon - Gatwick Airport	30	48	10.8	20.8	26.8
Gatwick Airport - Brighton	39	87	13.2	34.0	43.0
Gatwick Airport - Lewes	42	90	14.0	34.8	43.8
Lewes - Newhaven Town	10	100	5.8	40.6	52.6
Newhaven Town - Newhaven Marine	1	101	1.5	42.1	57.1
Lewes - Eastbourne	25	115	11.5	46.3	58.3
East Croydon - Tonbridge	42	60	14.0	24.0	30.0
Tonbridge - Tunbridge Wells	8	68	4.9	28.9	37.9
Tunbridge Wells - Tunbridge Wells West	1	69	1.7	30.6	42.6

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

- Gatwick Airport 29 [26] {27}
- Brighton 54 [40] {43}
- Lewes 60 [41] {44}
- Newhaven Town 81 (1 change) [50] {53}
- Eastbourne 61 [55] {58}
- Tonbridge 40 [28] {30}
- Tunbridge Wells 54 [36] {38}

Pancras Cross – Littlehampton / Bognor / Southampton (5/5/10 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London, inc. Station Wait Times
Pancras Cross - Victoria Low Level	5	5	3.9	3.9	3.9
Victoria Low Level - East Croydon	13	18	6.2	10.1	13.1
East Croydon - Gatwick Airport	30	48	10.8	20.8	26.8
Gatwick Airport - Horsham	18	66	7.3	28.1	37.1
Horsham - Arundel HS	33	99	11.6	39.7	51.7
Arundel HS - Littlehampton	6	105	4.2	43.9	58.9
Arundel HS - Bognor Regis	12	111	6.0	45.7	60.7
Arundel HS - Chichester	18	117	7.3	47.0	62.0
Chichester - Hayling Island	15	114	6.7	53.7	71.7
Hayling Island - Portsmouth and Southsea	8	122	4.9	58.5	79.5
Portsmouth and Southsea - Gosport	3	125	3.0	61.5	85.5
Gosport - Hythe	21	146	8.4	69.9	96.9
Hythe - Southampton	6	152	4.2	74.1	104.1
Gatwick Airport - Hove	40	88	13.4	34.3	43.3
Hove - Shoreham-by-Sea	7.1	95	4.6	38.9	50.9
Shoreham-by-Sea - Worthing	7.6	103	4.8	43.7	58.7
Worthing - Chichester	29	132	12.9	56.6	74.6

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

- Gatwick Airport 29 [26] {27}
- Horsham 49 [36] {37}
- Littlehampton 99 [57] {59}
- Bognor Regis 98 [58] {61}
- Chichester 88 [60] {62}
- Portsmouth & Southsea 88 [77] {86}
- Southampton 74 [101] {104}