HS5 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 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. 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 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 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; this is the case with HS5, for the Southampton, Eastbourne, Newhaven and Tunbridge Wells branches.

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.

Normally, two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic-compatible) 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 all its services are GC gauge, and travel on HS5's various routes for the whole of their journey. There are also 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.

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 HS5, 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 300kph, 187.5mph, and that public reaction to them is favourable, I would like to see all GC gauge services run with double deck trains. (The Swiss like them.)

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

Estimated Journey Times

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

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

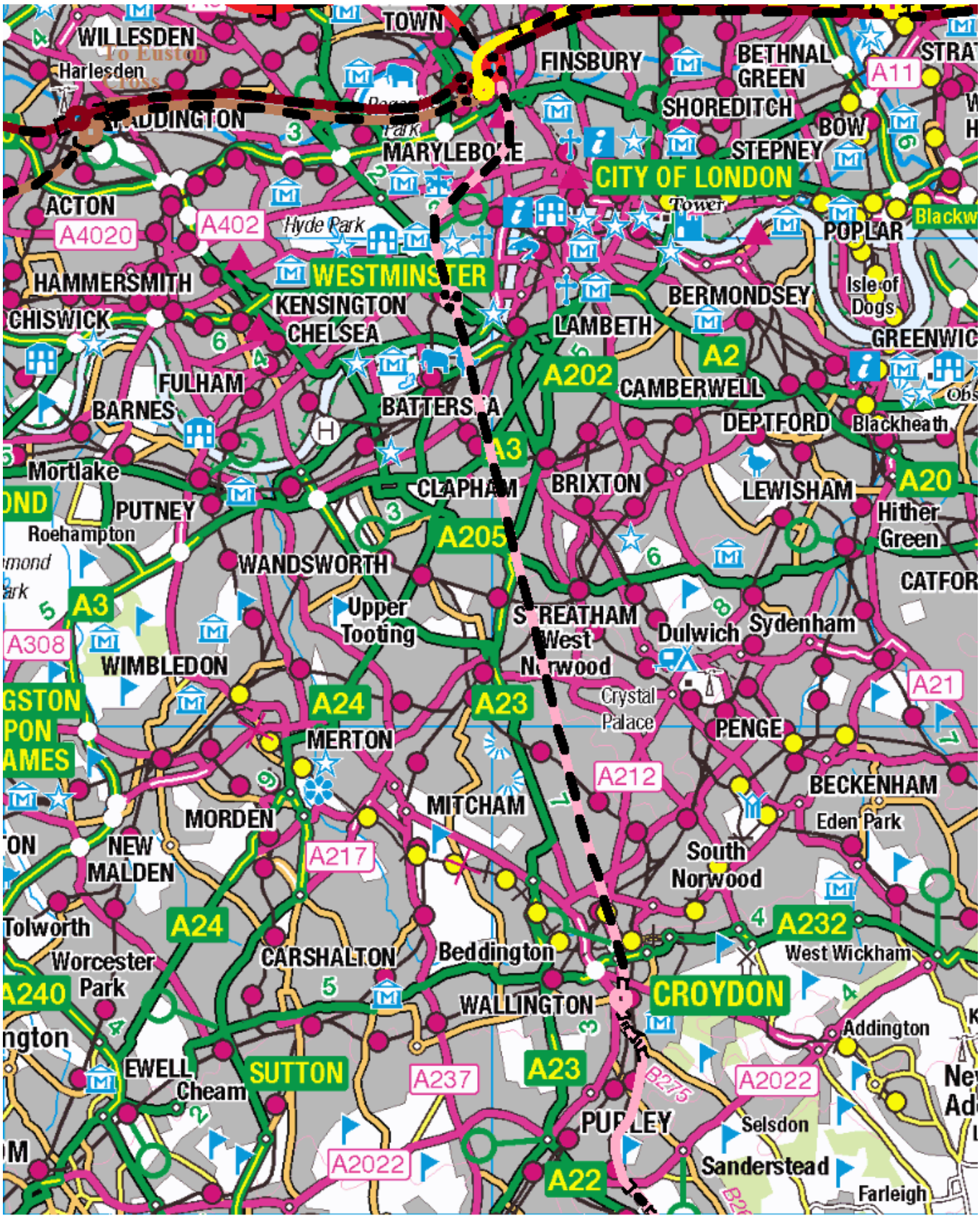
There are various junctions on the route of HS5, enabling it to divide for its several destinations. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading 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.
- Tortington TQ005050 HS5 Littlehampton branch diverges from the Southampton branch.
- Ford East TQ012035 HS5 joins and takes over the classic Littlehampton branch, enlarging it to GC gauge.
- Barnham HS SU962043 HS5 Bognor branch diverges from the Southampton branch.
- Barnham South SU955043 HS5 joins and takes over the classic Littlehampton branch, enlarging it to GC gauge.
- Hickstead TQ269197 HS5 Eastbourne / Newhaven branch diverges from the main line.
- Southerham HS TQ426091 HS5 Newhaven branch diverges from Eastbourne branch.

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*



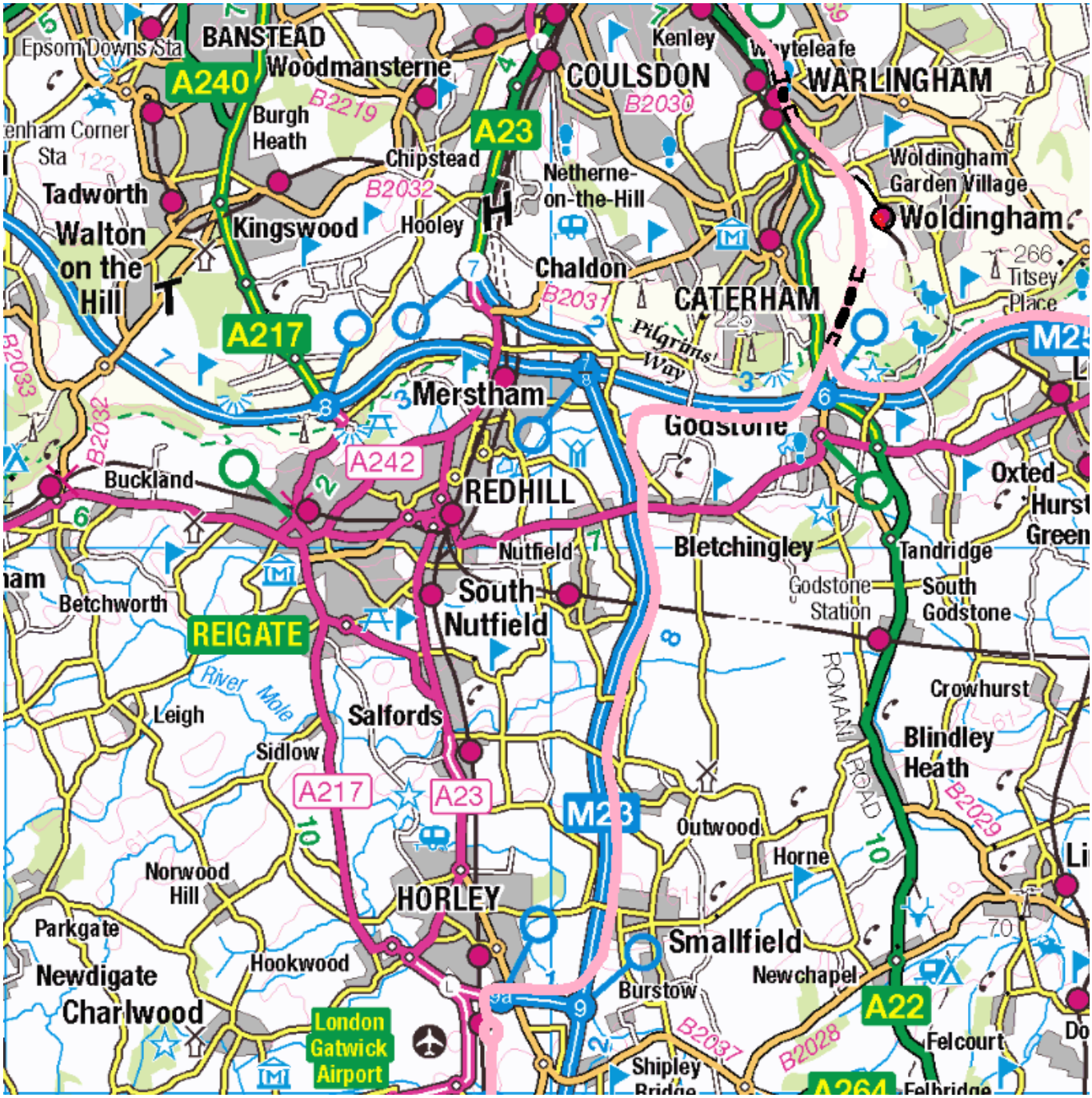
1.1 Pancras Cross – East Croydon

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



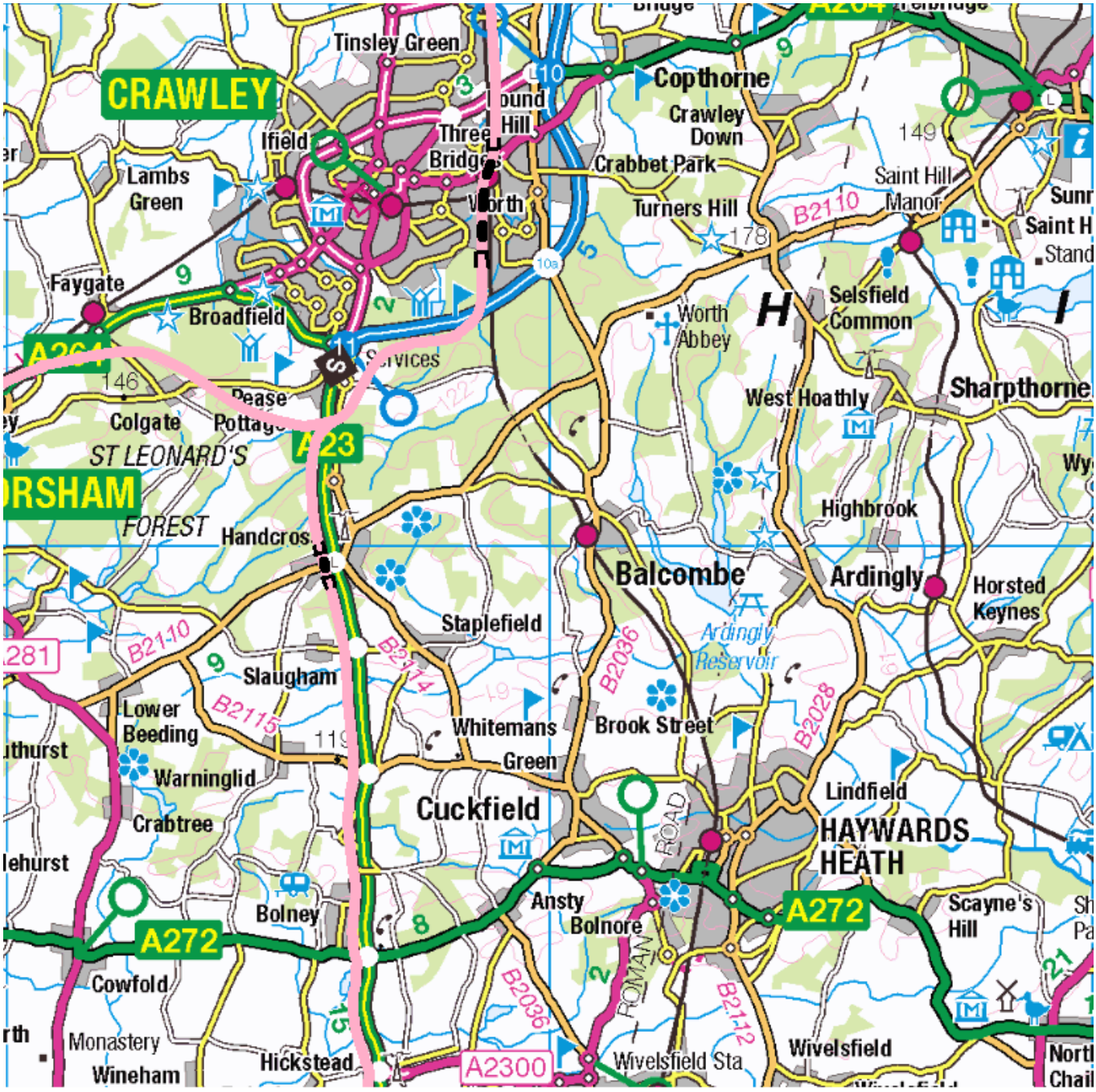
2.1 Kenley – Gatwick Airport

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.

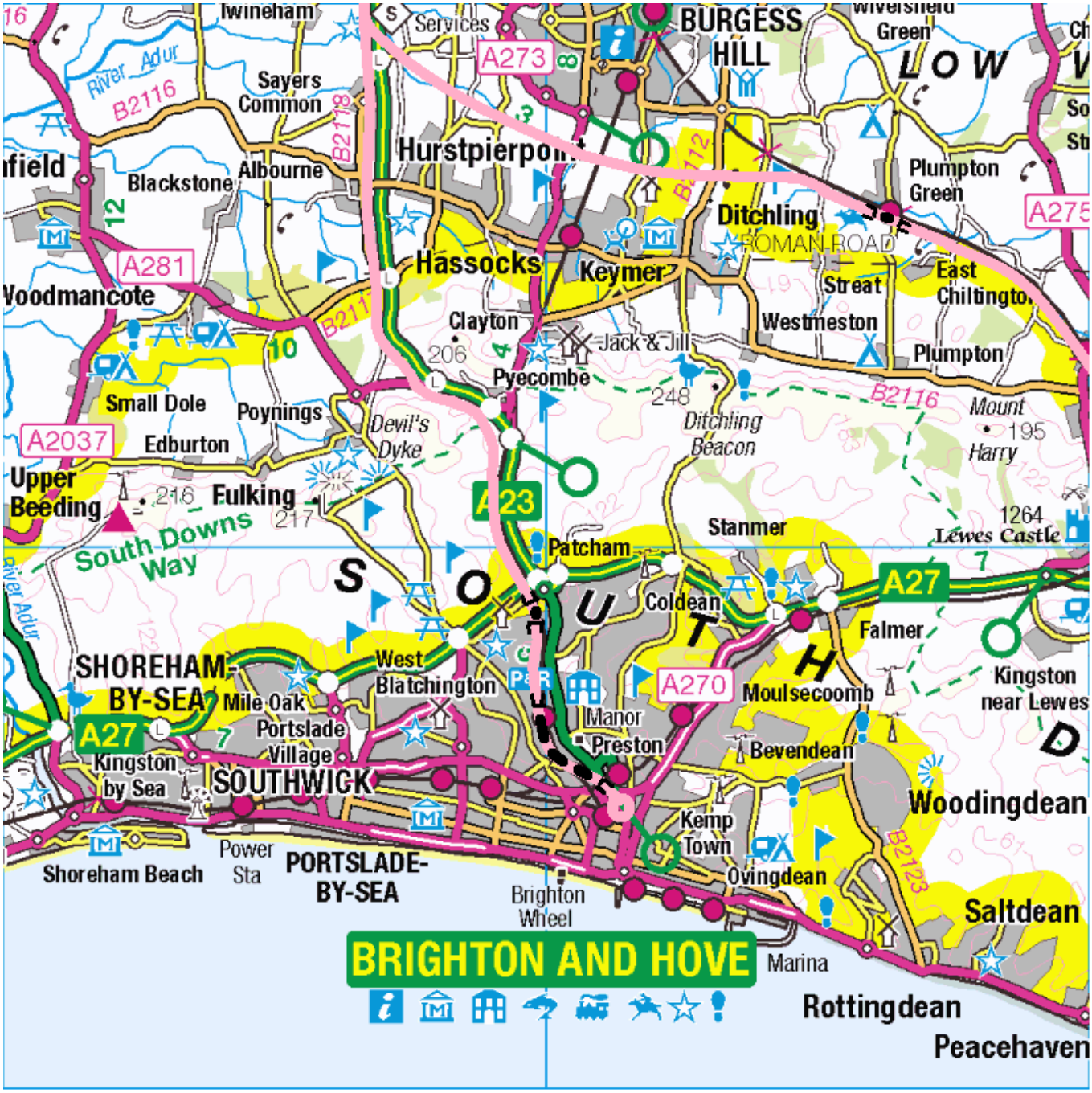
HS5 follows the east side of the Oxted line past Sanderstead (we're clipping the ends of substantial gardens on this stretch, but not threatening the houses; noise fences will be required) and Riddlesdown. A very short tunnel will be required under Upper Warlingham station, to avoid the station buildings 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, with a 1 mile tunnel thence to Brighton station, between TQ299069 and TQ308055, 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.



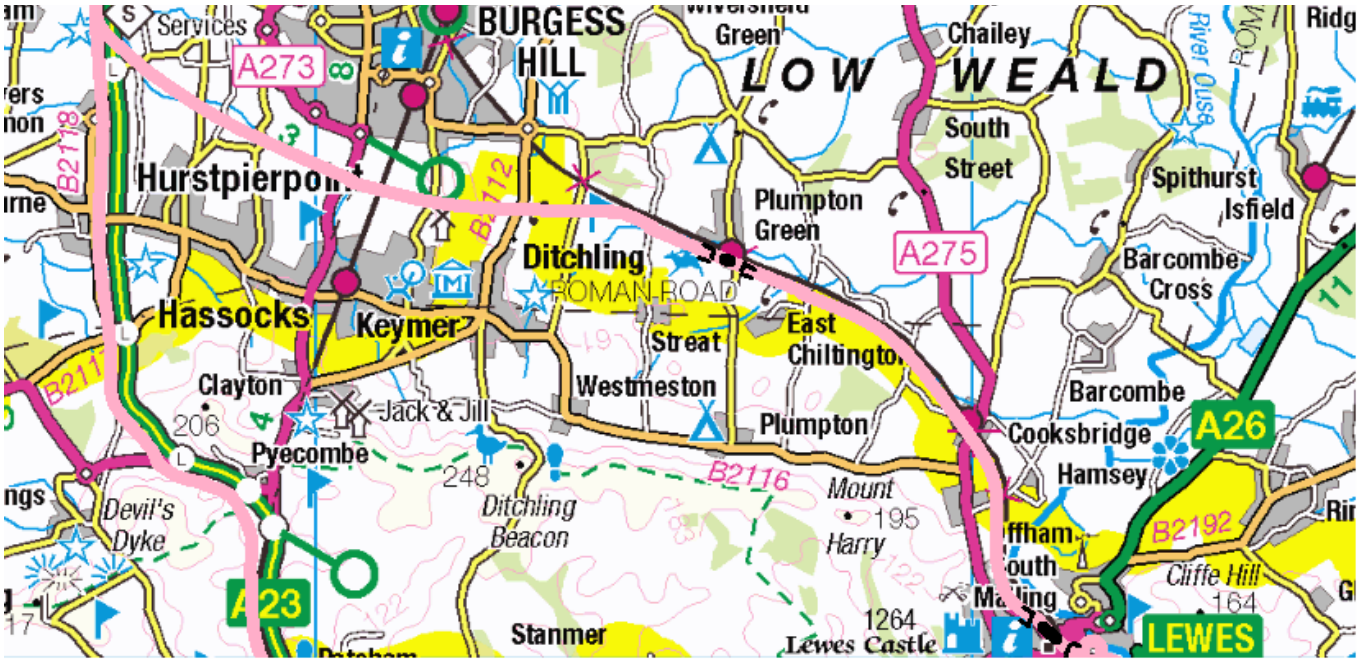
3.1 Tinsley Green – Hickstead



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



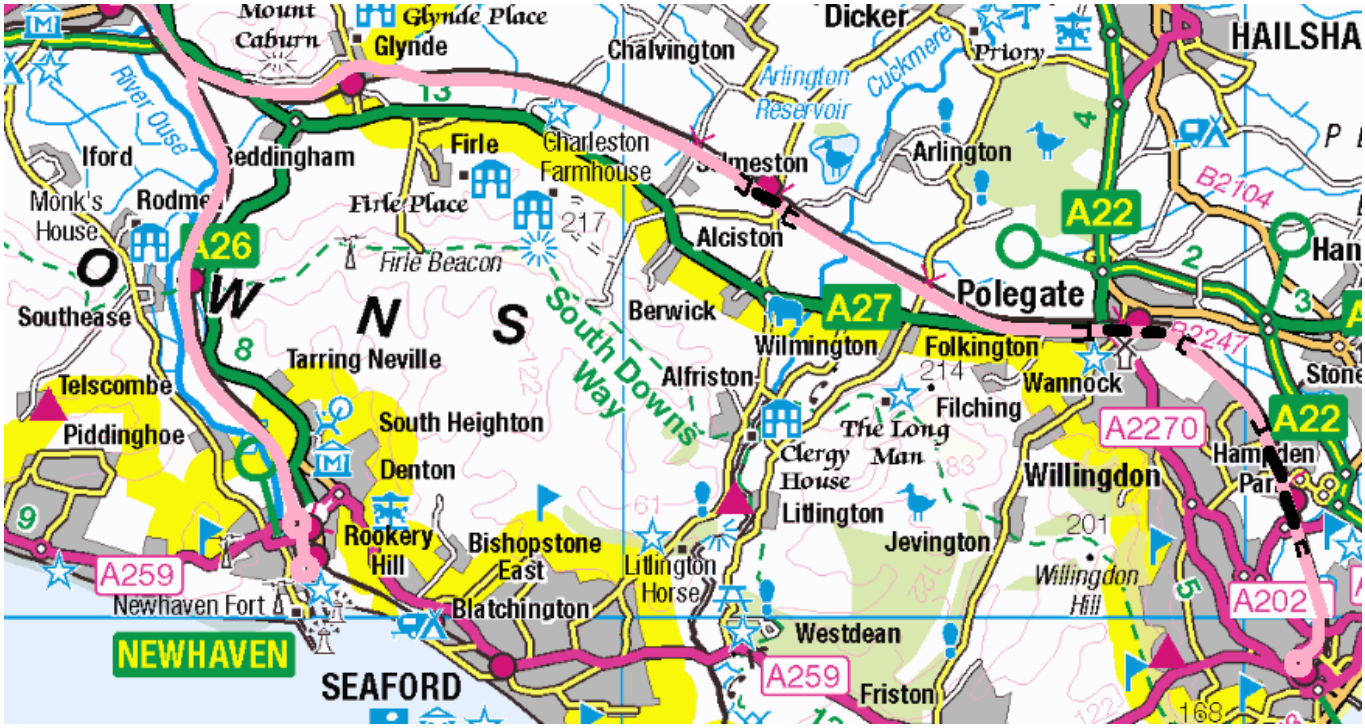
4.1 Hickstead Junction – Lewes Contains Ordnance Survey data © Crown copyright and database right 2013

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, rather than adding HS tracks to the alignment. It is proposed so to enlarge 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

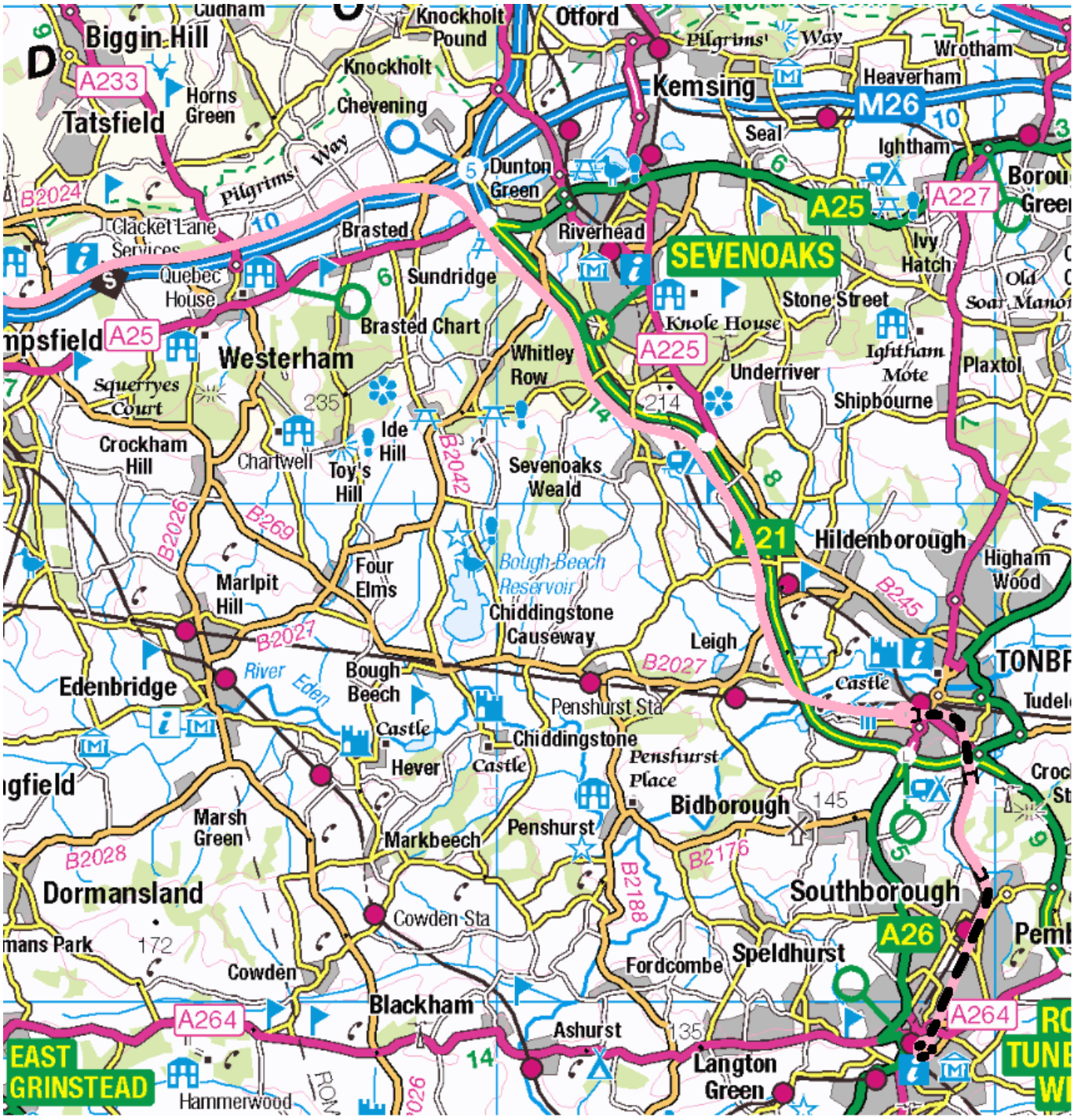
5. Winders Hill Junction – Tunbridge Wells

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 (enlarged to GC gauge as necessary). 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

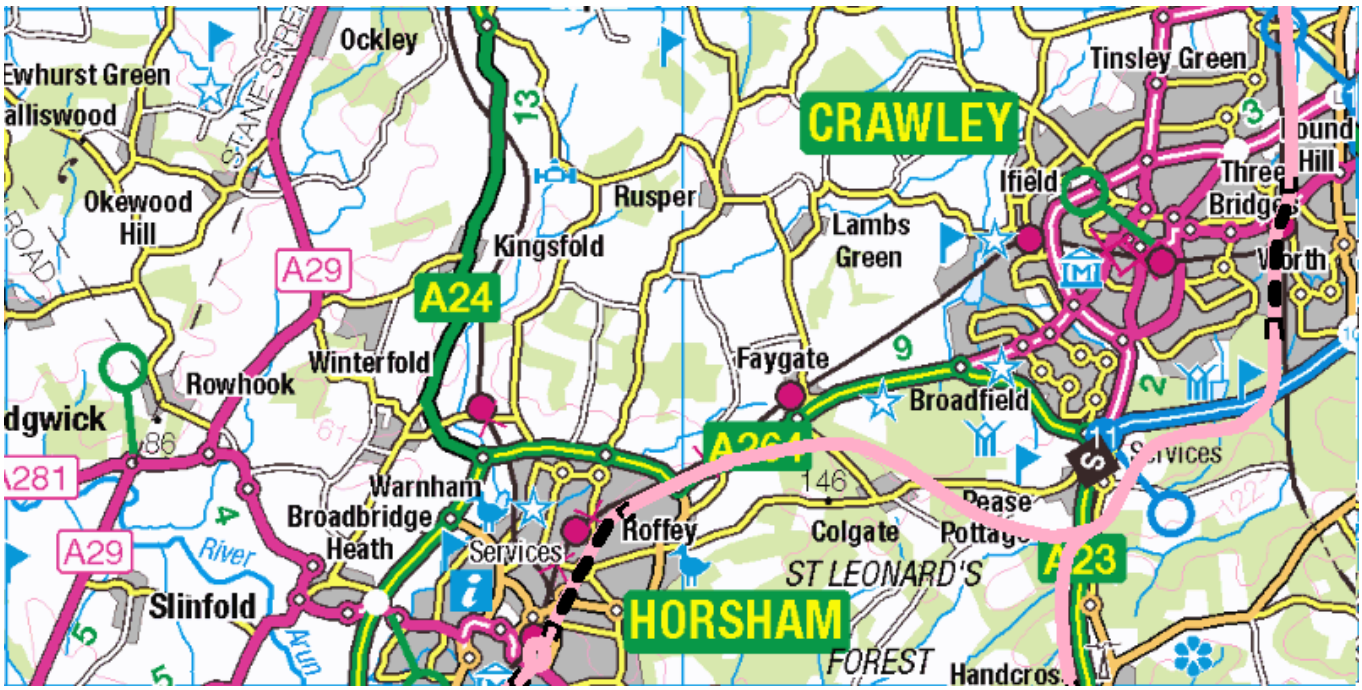
underground, actually beneath Mount Pleasant Road. It would require very little further tunnelling, passing underneath the classic route, to bring HS5 out to Tunbridge Wells West, and the Spa Valley Railway, who would, I imagine, be very happy to provide servicing facilities, and a joint station.



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 (a single island platform is adequate on this section) starting south of Station Road – lots of car parks there. Beyond the station is a ¾ mile tunnel between TQ177307 and TQ169299.

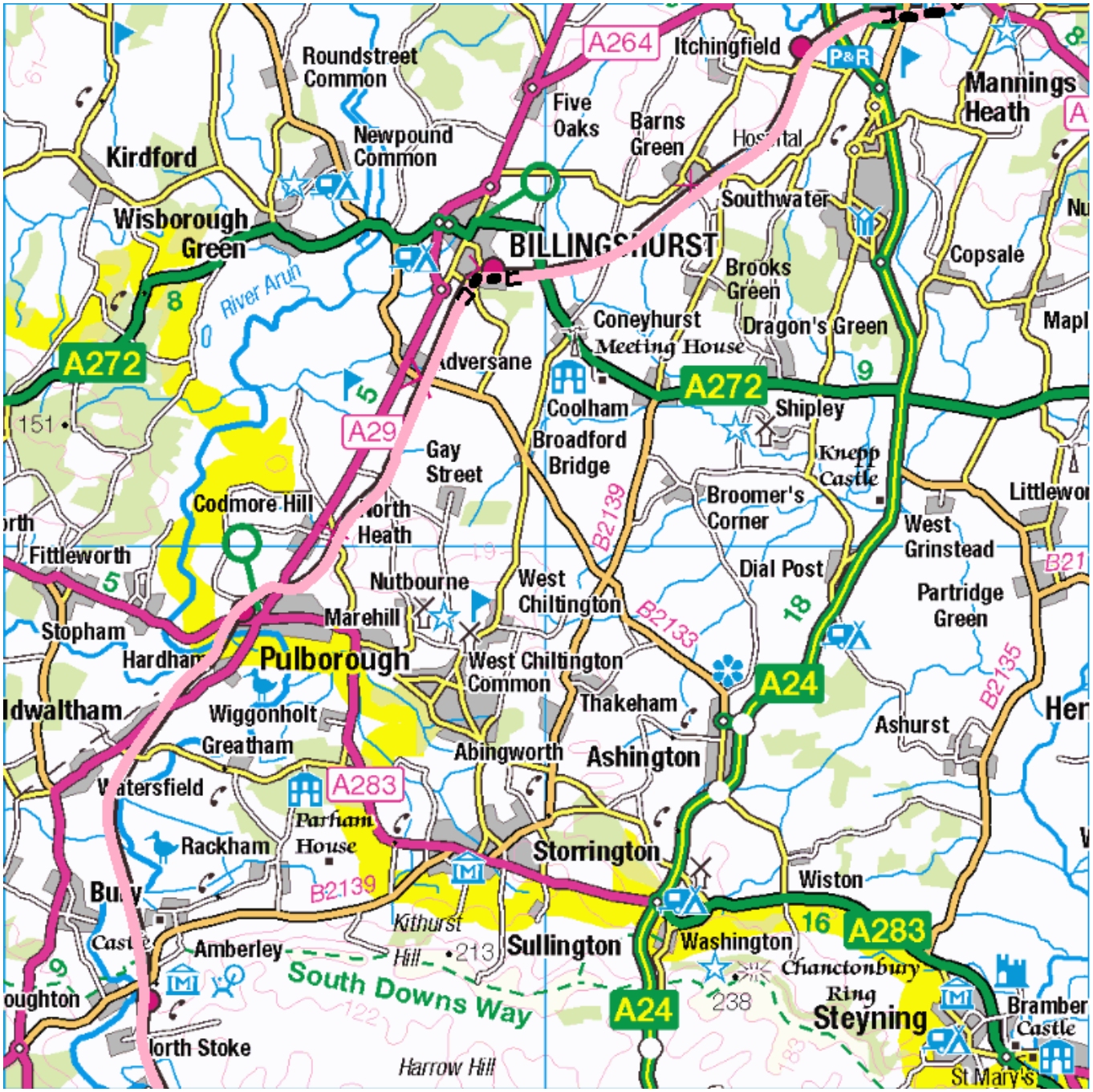


6.1 Tinsley Green – Horsham

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.

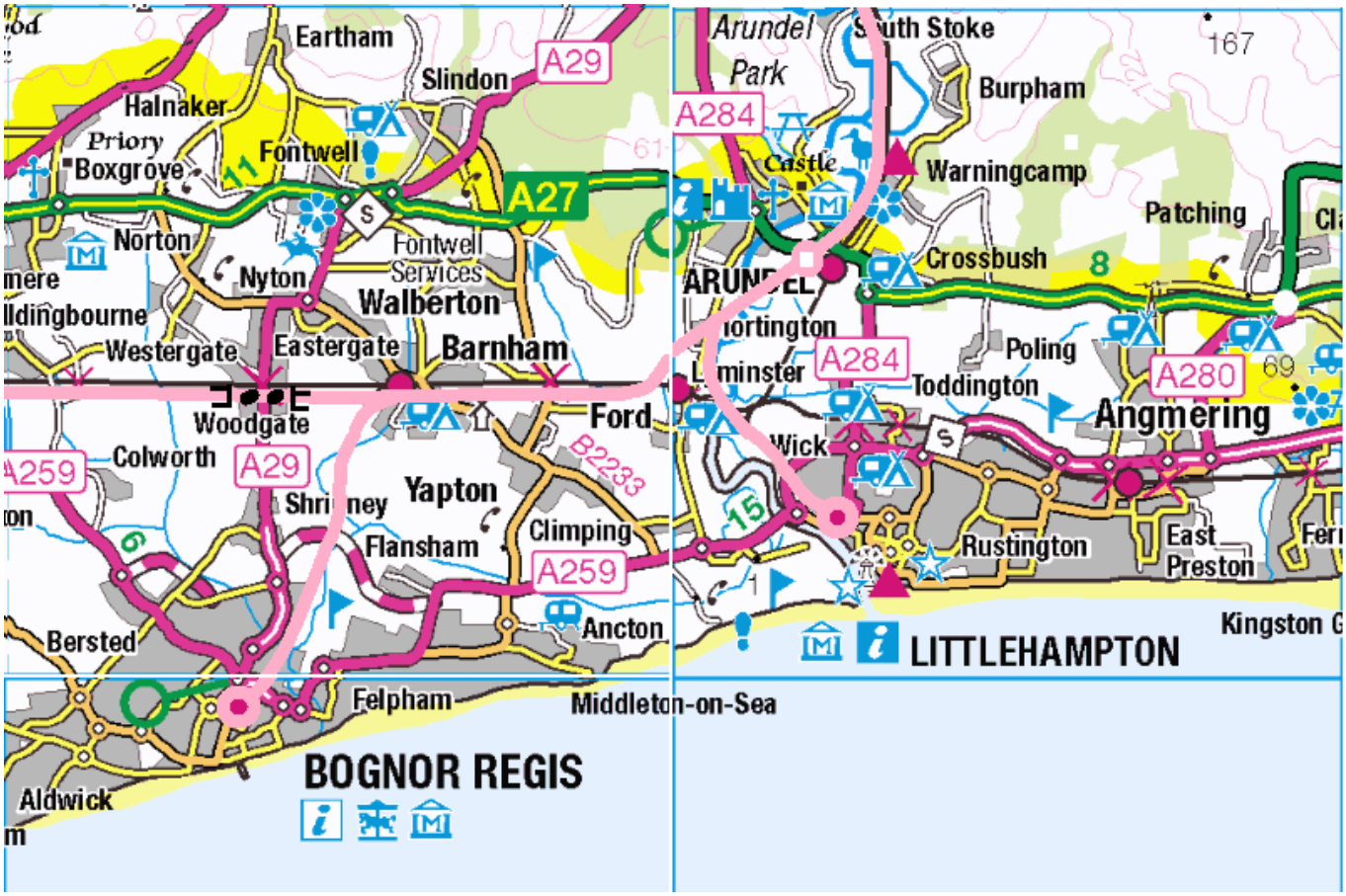
HS5 diverges from the alignment at TQ025065 and passes slightly to the north of the classic Arundel station, with the new HS station at TQ023063, avoiding the station buildings. It crosses the Arun at TQ011058. At Tortington Junction, TQ005050, the Littlehampton branch diverges, crossing over the classic lines just west of Ford, joining the Littlehampton branch at Ford East Junction, TQ012035, taking over the Littlehampton branch and enlarging it to GC gauge. (Variable platforms will be required at Littlehampton as the branch also carries classic trains.)

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 and enlarging it to GC gauge. (Variable platforms will be required at Bognor as the branch also carries classic trains.)

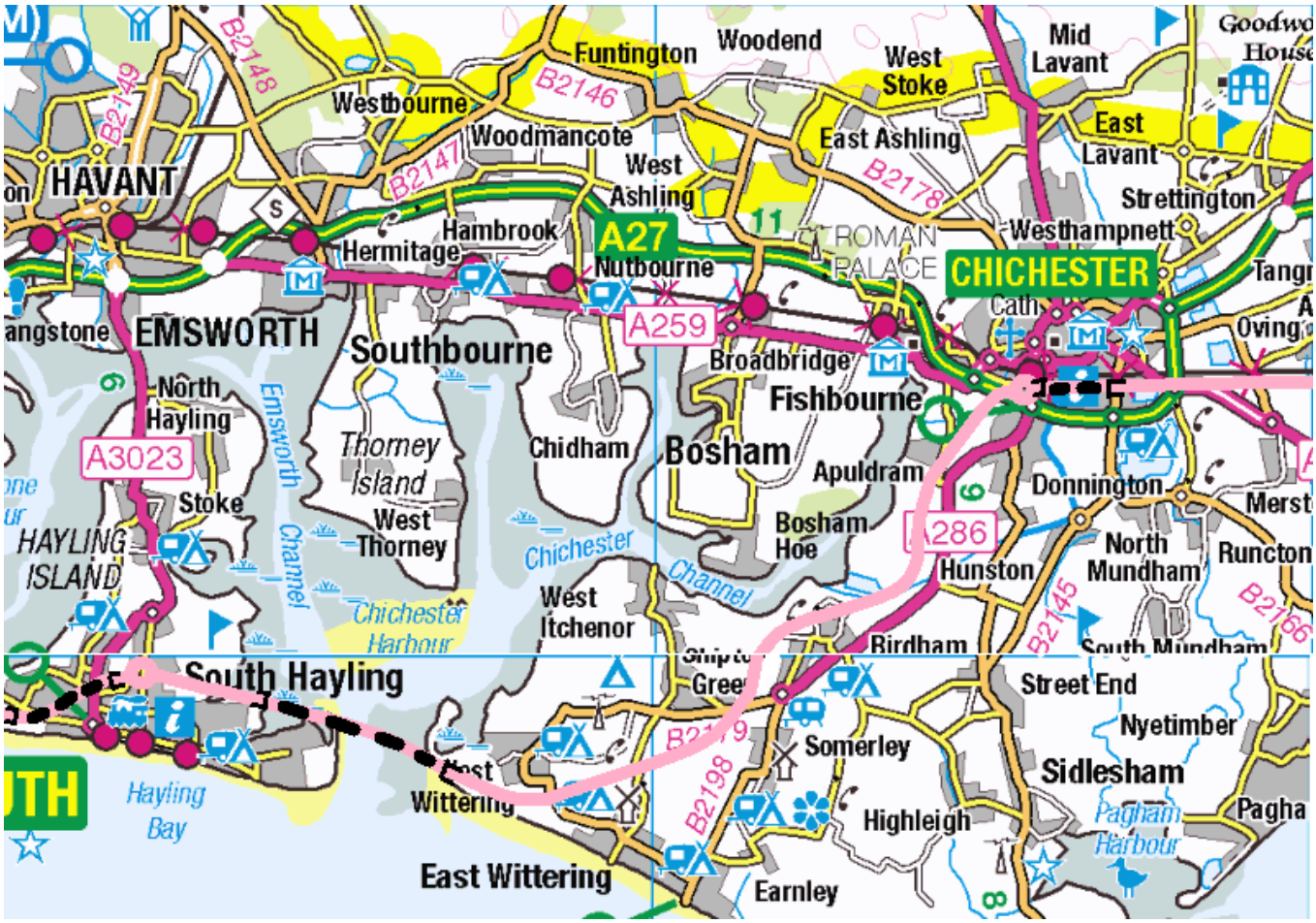


6.2 Itchingfield – North Stoke

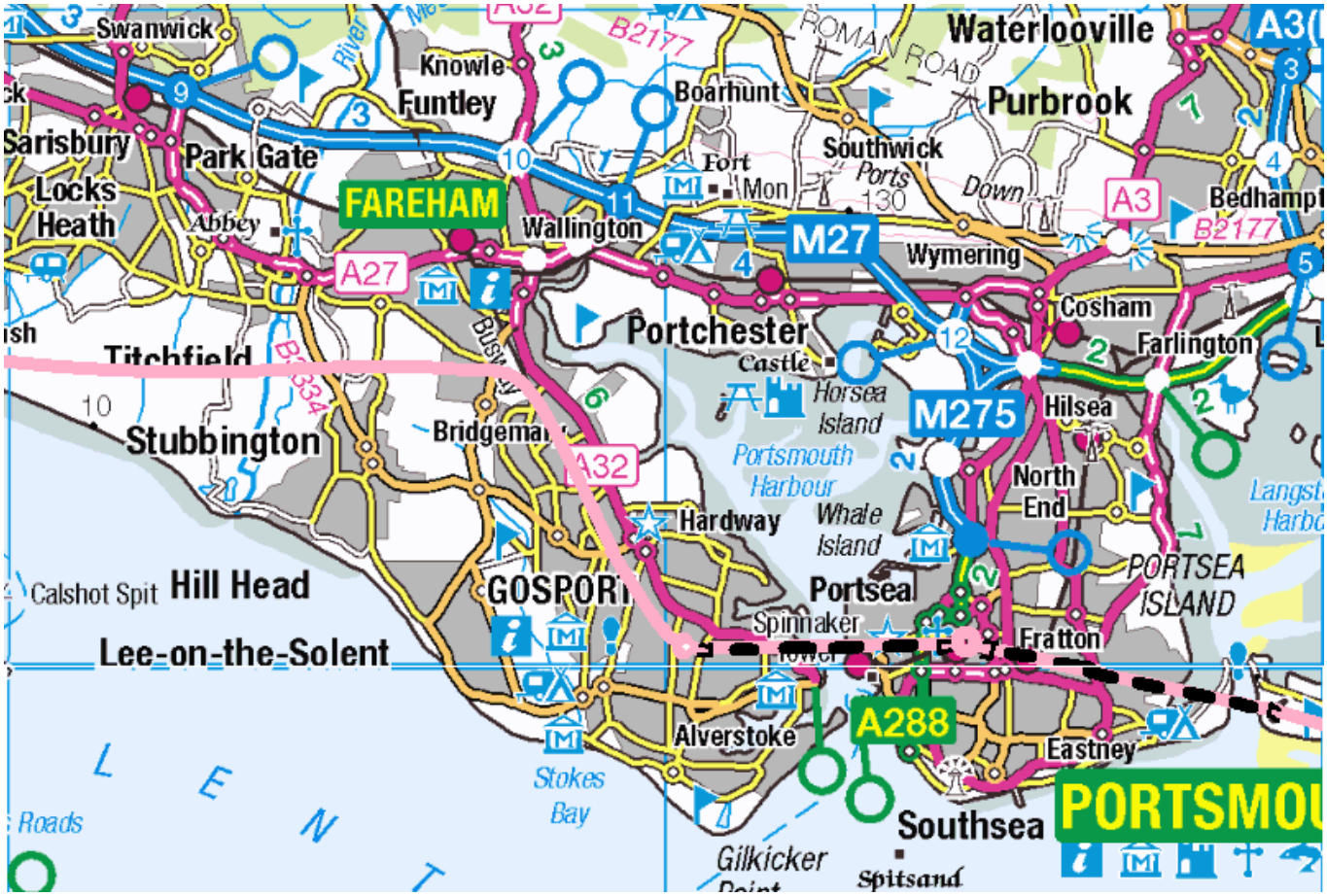
The Southampton branch follows the south side of the coast line alignment. A ¼ mile tunnel is required at Woodgate, between SU940043 and SU937043, and a ¾ mile tunnel under Chichester, between SU8700430and SU860043, to the HS platforms on the south side of Chichester station – plenty of room (car parks).



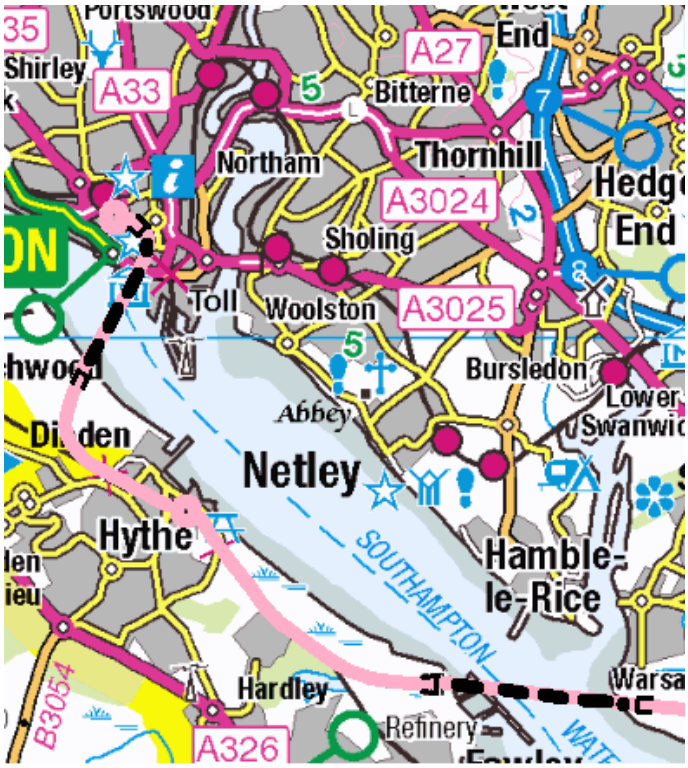
6.3 South Stoke – Alldingbourne



6.4 Chichester – South Hayling



6.5 Portsmouth – Titchfield Contains Ordnance Survey data © Crown copyright and database right 2013



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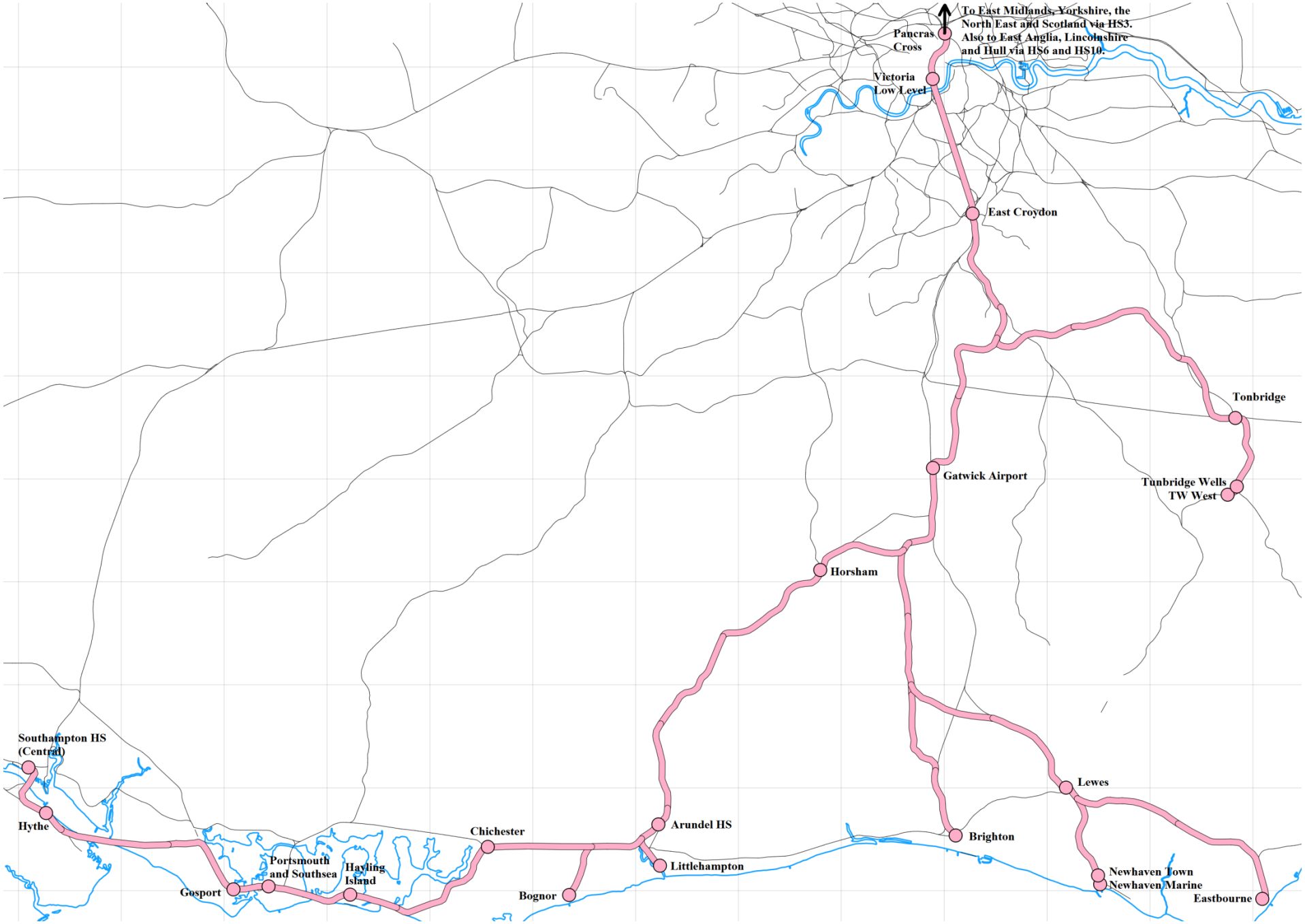
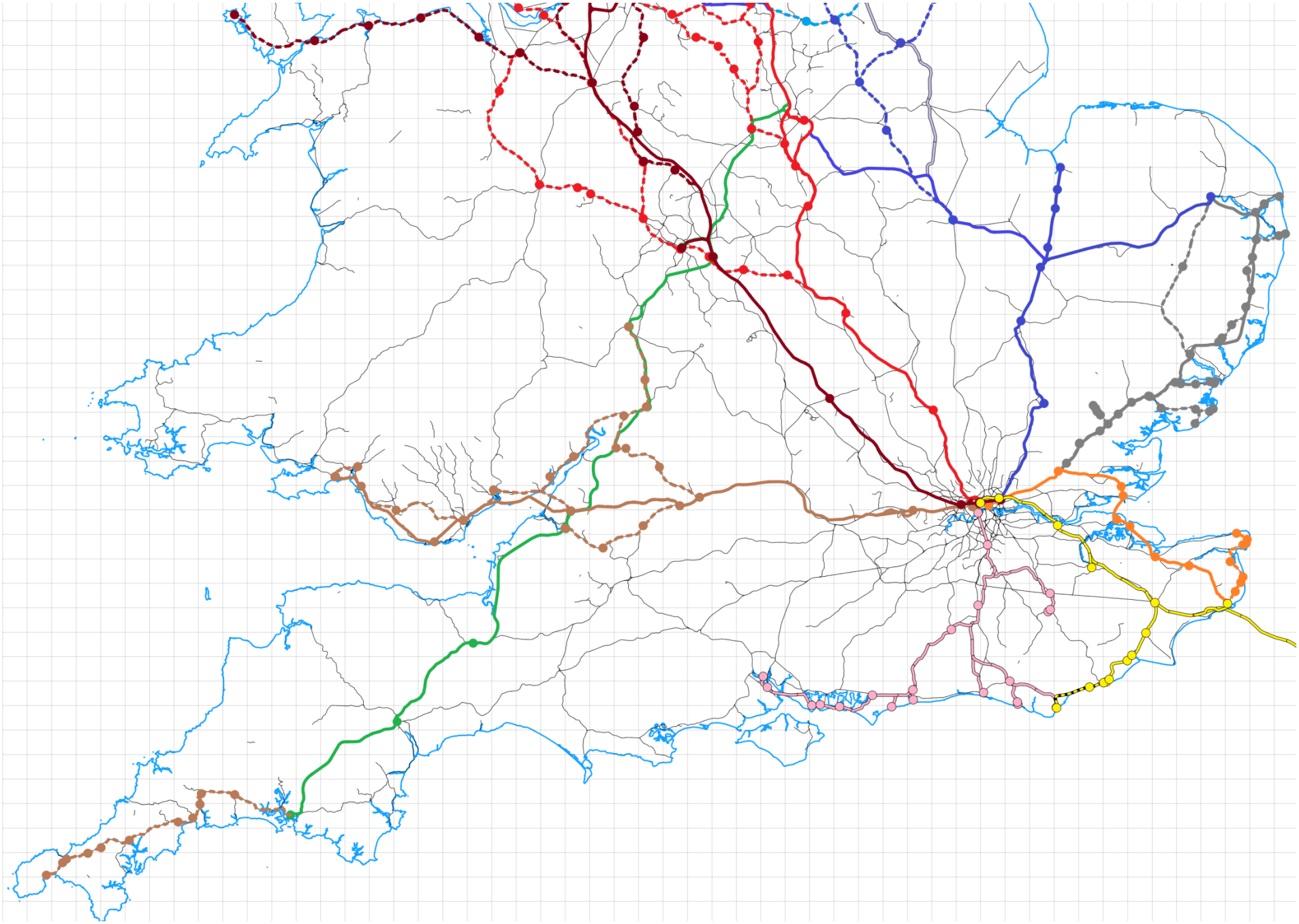
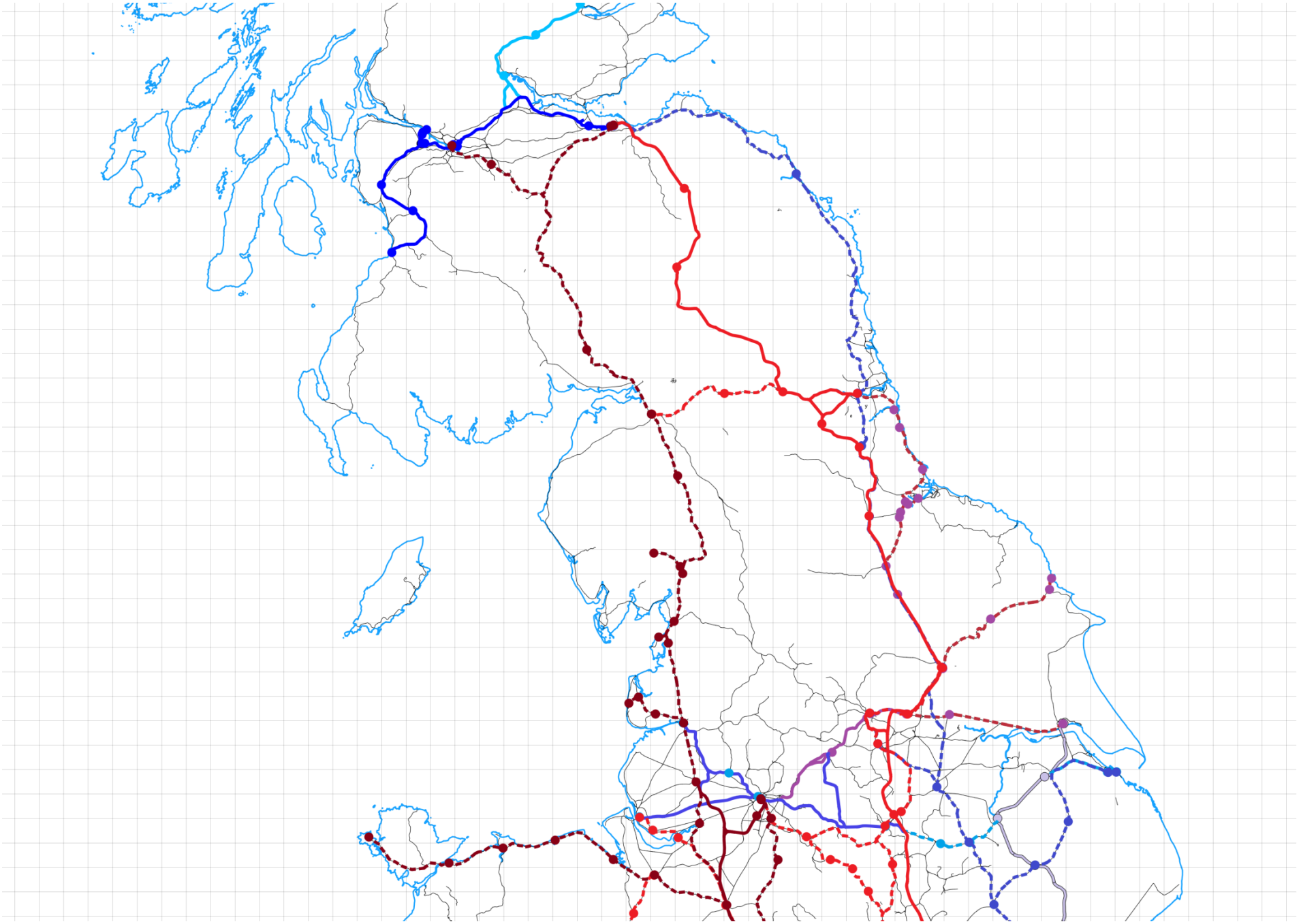
To the south west of Chichester station is an area of warehouses, which HS5 can either tunnel under or negotiate its way through. It crosses the A27 at SU851042, and heads south west, crossing Dell Quay Road at SU841027. It passes east of the marina at SU836010, (not forgetting to provide an adequate

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 enlarged to GC gauge and 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.

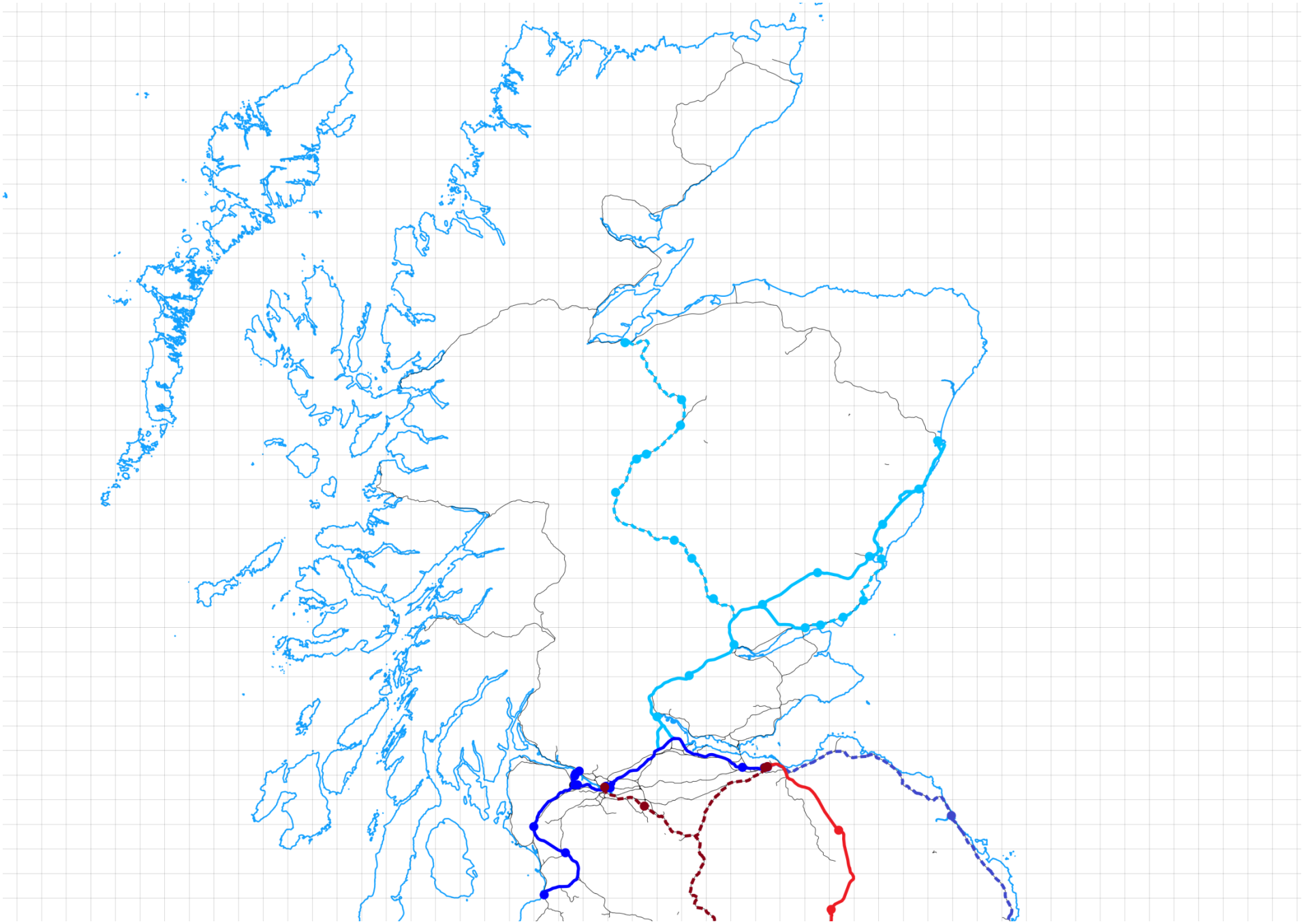




Complete HS Network, South Sheet



Complete HS Network, Central Sheet



Complete HS Network, North Sheet

The Service Plans

A new service plan comes into effect when some significant change takes place which causes a change to the service loadings of one or more sections of 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
- G GC gauge train
- GG GC gauge, double deck train
- C classic-compatible train
- R Regional Metro train, semi-fast service
- RS Regional Metro train, stopping service (all stations)

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

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

Service Plan 1

As has been explained, once Pancras Cross becomes a through station, **all** services are through services. There are 5 services north from Pancras Cross when HS5 opens, thus there must be 5 balancing services on HS5. All services on HS5 are GC gauge; there are no classic-compatibles.

Service Plan 1 comes into effect when HS5 opens to Brighton, Eastbourne and Newhaven. The following services are introduced:

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

The full, inter-regional HS services are:

- 2tphGG Brighton – Pancras Cross – York (HS Metro)
- 2tphGG Brighton – Pancras Cross – Preston
- 2tphG Eastbourne – Pancras Cross – Glasgow
- 2tphG Newhaven – Pancras Cross – Newcastle
- 2tphG East Croydon – Pancras Cross – York (UHS)
- 2tphG East Croydon – Pancras Cross – Liverpool (UHS)

Service Plan 1A

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

- 4tphG Pancras Cross – Victoria (LL) – East Croydon – Tonbridge – Tunbridge Wells

The full, inter-regional HS services are now:

- 2tphGG Brighton – Pancras Cross – York (HS Metro)
- 2tphGG Brighton – Pancras Cross – Preston
- 2tphG Eastbourne – Pancras Cross – Glasgow
- 2tphG Newhaven – Pancras Cross – Newcastle
- 2tphG Tunbridge Wells – Pancras Cross – York (UHS)
- 2tphG Tunbridge Wells – Pancras Cross – Liverpool (UHS)

Service Plan 1 overall imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	12tph
• Winders Hill Junction	– Tunbridge Wells	4tph
• Winders Hill Junction	– Finches Shaw Junction	8tph
• Finches Shaw Junction	– Southampton station	0tph
• Finches Shaw Junction	– Hickstead Junction	8tph
• Hickstead Junction	– Brighton station	4tph
• Hickstead Junction	– Southerham HS Junction	4tph
• Southerham HS Junction	– Eastbourne station	2tph
• Southerham HS Junction	– Newhaven station	2tph

Service Plan 2

Service Plan 2 comes into effect when the Southampton branch of HS5 opens as far as Bognor / Littlehampton, and, simultaneously, HS6 opens from Pancras Cross to King's Lynn.

The additional service is introduced:

- 2tphGG Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel HS (splits/joins) –:
  – Littlehampton
  – Bognor

The full, inter-regional HS services are now:

- 2tphGG Brighton – Pancras Cross – York (HS Metro)
- 2tphGG Brighton – Pancras Cross – Preston
- 2tphG Eastbourne – Pancras Cross – Glasgow
- 2tphG Newhaven – Pancras Cross – Newcastle
- 2tphG Tunbridge Wells – Pancras Cross – York (UHS)

- 2tphG Tunbridge Wells – Pancras Cross – Liverpool (UHS)
- 2tphGG Bognor / Littlehampton – Pancras Cross – King's Lynn

It imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	14tph
• Winders Hill Junction	– Tunbridge Wells	4tph
• Winders Hill Junction	– Finches Shaw Junction	10tph
• Finches Shaw Junction	– Arundel HS station	2tph
• Arundel HS station	– Tortington Junction	4tph
• Tortington Junction	– Ford East Junction and Littlehampton	2tph
• Tortington Junction	– Barnham HS Junction	2tph
• Barnham HS Junction	– Barnham South Junction and Bognor	2tph
• Barnham HS Junction	– Southampton	0tph
• Finches Shaw Junction	– Hickstead Junction	8tph
• Hickstead Junction	– Brighton station	4tph
• Hickstead Junction	– Southerham HS Junction	4tph
• Southerham HS Junction	– Eastbourne station	2tph
• Southerham HS Junction	– Newhaven station	2tph

(The extra 2tph between Arundel HS station and Tortington Junction is because the Littlehampton and Bognor services split at Arundel and travel separately over that section.)

Service Plan 3

Service Plan 3 comes into effect when:

- HS5's Southampton branch opens from Barnham HS Junction to Southampton.
- HS6 opens from Ely to Norwich.
- HS8 opens from Ely to Peterborough and Nottingham.
- All other connections in the triangle of junctions at Ely open.

The additional service is introduced:

- 4tphGG Pancras Cross – Victoria (LL) – East Croydon – Gatwick Airport – Horsham – Arundel HS – Chichester – Hayling Island – Portsmouth and Southsea – Gosport – Hythe – Southampton

The full, inter-regional HS services are now:

- 2tphGG Brighton – Pancras Cross – York (HS Metro)
- 2tphGG Brighton – Pancras Cross – Preston
- 2tphG Eastbourne – Pancras Cross – Glasgow
- 2tphG Newhaven – Pancras Cross – Newcastle
- 2tphG Tunbridge Wells – Pancras Cross – York (UHS)
- 2tphG Tunbridge Wells – Pancras Cross – Liverpool (UHS)
- 2tphGG Bognor / Littlehampton – Pancras Cross – King's Lynn
- 2tphGG Southampton – Pancras Cross – Norwich

- 2tphGG Southampton – Pancras Cross – Peterborough (temporary, until HS10 opens)

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.

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

- 2tphGG Brighton – Pancras Cross – York (HS Metro)
- 2tphGG Brighton – Pancras Cross – Preston
- 2tphG Eastbourne – Pancras Cross – Edinburgh – Glasgow
- 2tphG Newhaven – Pancras Cross – Newcastle
- 2tphG Tunbridge Wells – Pancras Cross – York (UHS)
- 2tphG Tunbridge Wells – Pancras Cross – Liverpool (UHS)
- 2tphGG Bognor / Littlehampton – Pancras Cross – King's Lynn
- 2tphGG Southampton – Pancras Cross – Norwich
- 2tphGG Southampton – Pancras Cross – Hull

Representative Hourly Cross-Platform Interchange Pattern at Pancras Cross:

00GG Brighton – York (HS Metro)
GG Southampton – Norwich
07G Newhaven – Newcastle (UHS)
G Tunbridge Wells – York (UHS)
15GG Brighton – Preston (HS Metro)
GG Southampton – Hull
23G Eastbourne – Glasgow (UHS)
G Tunbridge Wells – Liverpool (UHS)
GG Bognor / Littlehampton – King's Lynn

– repeating at 30, 37, 45 and 53minutes past. Note that all pairs except Newhaven – Newcastle and Tunbridge Wells – York have diverging routes from Pancras Cross.

Service Plan 3 overall imposes the following loadings on HS5:

• Pancras Cross	– Winders Hill Junction	18tph
• Winders Hill Junction	– Tunbridge Wells	4tph
• Winders Hill Junction	– Finches Shaw Junction	14tph
• Finches Shaw Junction	– Arundel HS station	6tph
• Arundel HS station	– Tortington Junction	8tph
• Tortington Junction	– Ford East Junction and Littlehampton	2tph
• Tortington Junction	– Barnham HS Junction	6tph
• Barnham HS Junction	– Barnham South Junction and Bognor	2tph
• Barnham HS Junction	– Southampton	4tph
• Finches Shaw Junction	– Hickstead Junction	8tph

- Hickstead Junction – Brighton station 4tph
- Hickstead Junction – Southerham HS Junction 4tph
- Southerham HS Junction – Eastbourne station 2tph
- Southerham HS Junction – Newhaven station 2tph

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, usually, is the assumption that, once line speed has been reached, that speed (300kph) is maintained until it becomes necessary to decelerate for a junction or a station stop. In fact, given the 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
- Gatwick Airport – Brighton 39km
- Gatwick Airport – Lewes 42km
- Lewes – Newhaven Town 10km
- Newhaven Town – Newhaven Marine 0.5km
- Lewes – Eastbourne 24km
- East Croydon – Tonbridge 42km
- Tonbridge – Tunbridge Wells 8km
- Tunbridge Wells - Tunbridge Wells West 1km
- Gatwick Airport – Horsham 18km
- Horsham – Arundel HS 33km
- Arundel HS – Littlehampton 6km
- Arundel HS – Bognor Regis 12km
- Arundel HS – Chichester 18km
- Chichester – Hayling Island 15km
- Hayling Island – Portsmouth & Sothsea 8km
- Portsmouth & Sothsea – Gosport 3km
- Gosport – Hythe 21km
- Hythe – Southampton 6km

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 Lewes to Newhaven Town (start to stop) is 327 seconds
- Time to travel from Newhaven Town to Newhaven Marine (start to stop) is 73 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 Arundel HS to Littlehampton (start to stop) is 253 seconds
- Time to travel from Arundel HS to Bognor Regis (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 & Sothsea (start to stop) is 292 seconds
- Time to travel from Portsmouth & Sothsea to Gosport (start to stop) is 179 seconds
- Time to travel from Hythe to Southampton (start to stop) is 253 seconds

The final 14 times need elucidation. When the distance between stations is less than 18.5km, (and the line speed is 300kph,) a train accelerating from the first station is not able to reach line speed, before it has to begin decelerating for the next station. 'Same Speed Railways' contains a table of times taken to travel between adjacent stations, for inter-station distances of up to 18.5km, and the above times are taken from this.

The procedure in calculating journey times between station stops is to take the two values of acceleration / deceleration distance, and the two times, as given in the first 2 lines of the above list, and sum them, thus acceleration / deceleration takes 11.57 + 6.95 = 18.52km and 278 + 167 = 445 seconds at line speed 300kph. The 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	12.5	32.3	41.3
Lewes - Newhaven Town	10	100	5.5	37.8	49.8
Newhaven Town - Newhaven Marine	1	101	1.2	39.0	54.0
Lewes - Eastbourne	24	114	8.5	40.8	52.8
East Croydon - Tonbridge	42	60	12.5	22.6	28.6
Tonbridge - Tunbridge Wells	8	68	4.9	27.5	36.5
Tunbridge Wells - Tunbridge Wells East	1	69	1.7	29.2	41.2
Gatwick Airport - Horsham	18	66	7.8	27.6	36.6
Horsham - Arundel HS	33	99	10.3	37.9	49.9
Arundel HS - Littlehampton	6	105	4.2	42.1	57.1
Arundel HS - Bognor Regis	12	111	6.0	43.8	58.8
Arundel HS - Chichester	18	117	7.3	45.2	60.2
Chichester - Hayling Island	15	132	6.7	51.8	69.8
Hayling Island - Portsmouth and Southsea	8	140	4.9	56.7	77.7
Portsmouth and Southsea - Gosport	3	143	3.0	59.7	83.7
Gosport - Hythe	21	164	7.9	67.6	94.6
Hythe - Southampton	6	170	4.2	71.8	101.8

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

- Gatwick Airport 29 [26]
- Brighton 54 [41]
- Lewes 60 [42]
- Newhaven 81 (1 change) [54]
- Eastbourne 61 [53]
- Tonbridge 40 [29]
- Tunbridge Wells 54 [42]
- Horsham 49 [37]
- Littlehampton 99 [57]
- Bognor Regis 98 [59]
- Chichester 88 [61]
- Portsmouth & Southsea 88 [78]
- Southampton 74 [102]

Appendix A – Pancras Cross and the Inter-Regional Connections

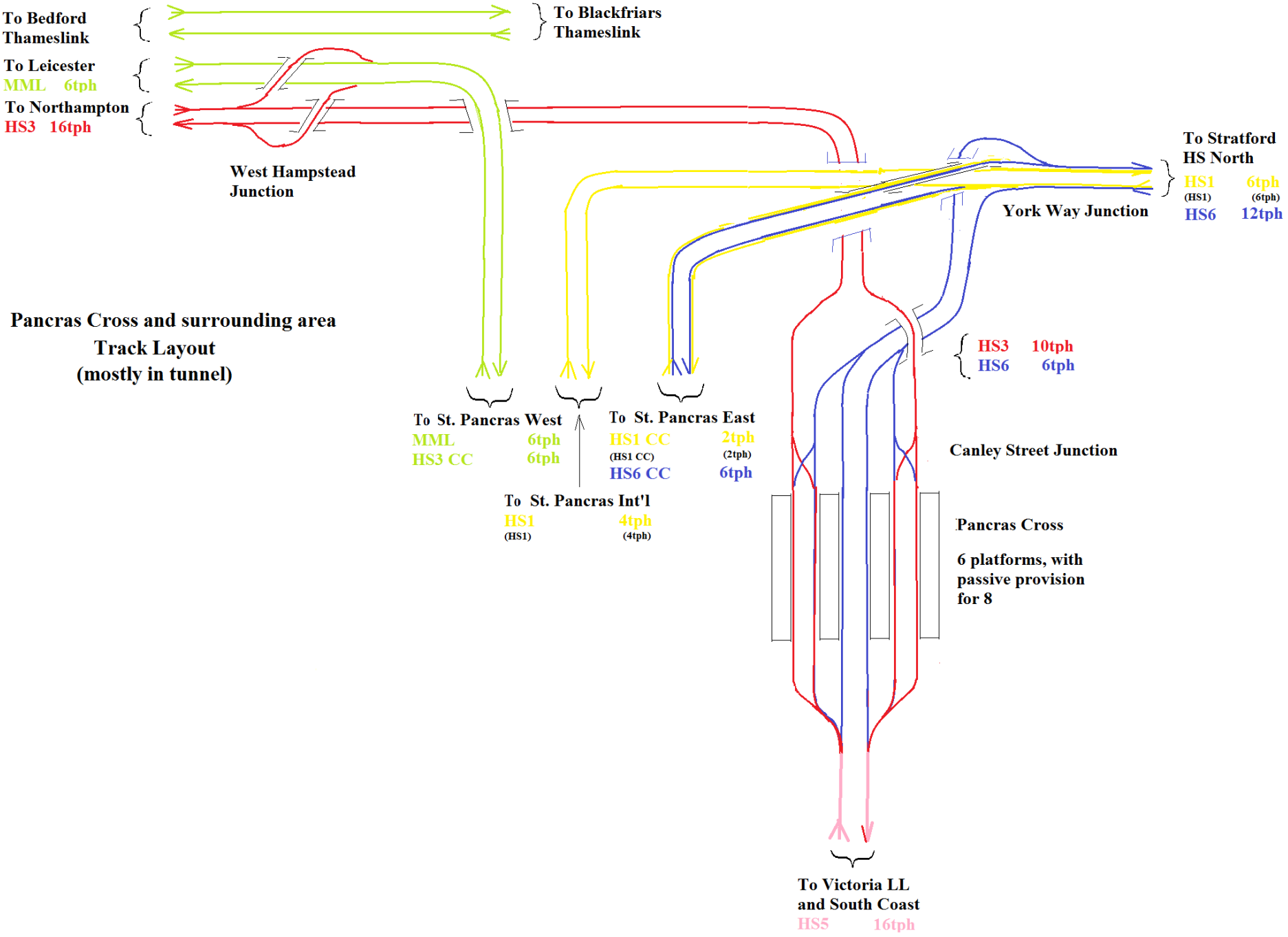
General

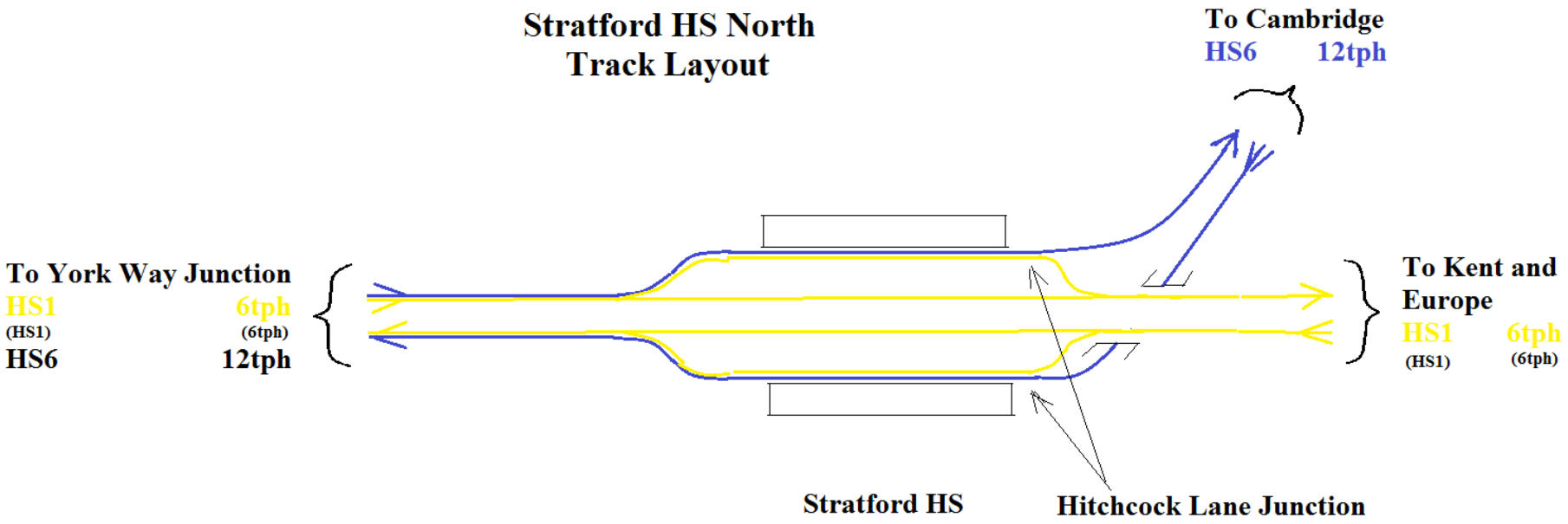
By routing the classic-compatible services of HS3 into St. Pancras West (the MML platforms), and of HS6 into St. Pancras East (the 'Javelin' platforms), and all the GC-gauge services of both routes through Pancras Cross and on to HS5 (which has no classic-compatible services), superlative cross-London 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 GC-gauge loadings of the London end of HS3 (10tph) and of HS6/HS10 (6tph), balancing exactly those of HS5(16tph) – these are at the final service plans of each route – a single tunnel in each direction and 6 platform faces, (passive provision for 8 recommended,) 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 page. The layout is not especially complicated, but there are a few points to note.

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 GC-gauge services from Pancras Cross, and its classic-compatible services from St. Pancras East, (and also HS1's single classic-compatible service,) all join HS1's GC-gauge 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, and also by HS1's single classic-compatible service. HS1's international services pass through the centre, as they always have. (HS1's GC-gauge 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. There is the existing connection from the platform lines to the main lines, used by HS1's classic-compatible service.


To Bedford
Thameslink
To Blackfriars
Thameslink
To Leicester
MML 6tph
To Northampton
HS3 16tph
West Hampstead
Junction
To Stratford
HS North
HS1 6tph
(HS1) (6tph)
HS6 12tph
York Way Junction
Pancras Cross and surrounding area
Track Layout
(mostly in tunnel)
HS3 10tph
HS6 6tph
To St. Pancras West
MML 6tph
HS3 CC 6tph
To St. Pancras East
HS1 CC 2tph
(HS1 CC) (2tph)
HS6 CC 6tph
Canley Street Junction
To St. Pancras Int'l
HS1 4tph
(HS1) (4tph)
Pancras Cross
6 platforms, with
passive provision
for 8
To Victoria LL
and South Coast
HS5 16tph


Stratford HS North
Track Layout
To Cambridge
HS6 12tph
To York Way Junction
HS1 6tph
(HS1) (6tph)
HS6 12tph
To Kent and
Europe
HS1 6tph
(HS1) (6tph)
Stratford HS
Hitchcock Lane Junction