

Cross-London Inter-Regional Connections

Mk1A Changes

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

All of this has no effect whatever on the current article, beyond minor changes of nomenclature. Since GC-gauge is no longer proposed for new infrastructure, **all** services are now in effect classic compatible. Formerly, CC services from London were based on the relevant terminal station, and only GC-gauge services travelled across London via the inter-regional connections, serving either Euston Cross or Pancras Cross. This functional distinction now no longer applies, and any service could, in principle, be inter-regional. However, for the time being at least, the former service distribution is retained, (since there were and are non-arbitrary reasons for it). The inter-regional services are now called Ultra High Speed (UHS) for the long-distance, limited stop services, and HS Metro for the all-stations ones. The services based on the London terminals are now called HS-Compatible (HS-C).

The preceding remarks were written when only the first Route and Service Plans article – for HS3 – had been reworked for Mk1A. I've left them as they stand, but they are, in fact, completely non-operative. Even at the second such reworking – for HS4 – the opportunity to generate further cross-London services by merging former CC services, was just too attractive to resist. We thus face the possibility that most or all of the main-line terminal stations in London (and possibly in other metropolitan areas) will become redundant, while actual rail travel goes on increasing. I merely flag this up as a possibility; it isn't going to happen next year or even (probably!) next decade, but we should begin now to consider worthy alternative uses for some of the finest architecture in the UK. For what it's worth, I think Liverpool Street is likely to be the first to become available.

In practice, however, the rush hour would presumably not have gone away. There would still be a need for extra capacity at these times, and the existing terminal stations would provide this, leaving the inter-regional, cross-London connections carrying an essentially even base load throughout the day. The terminal stations would not be required for railway purposes outside the periods 7:30 – 9:30 and 16:30 – 18:30, say. So the above remark on finding worthy alternative uses for them still applies. My own initial ideas are for staging artistic and cultural events and small exhibitions in the passenger circulating areas. Most of the infrastructure required – cafes, toilets and retail units – is already there.

Mk2 Changes

In most cases, the Mk1A changes to the Route and Service Plans have little impact on the routes proposed, but much greater impact on the service plans. Mk1A may thus be viewed as a cut-down version of the original (Mk1) proposals, significantly quicker and less expensive to implement, but nonetheless delivering a large proportion of the benefits of those proposals.

This is expected to satisfy capacity requirements in the short to medium term. But, thinking in the longer term, most of the articles also propose a Mk2 version or versions., which reinstates some 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 done completely, we would end up with the original design, but having enjoyed years of service from the Mk1A version in the interim. In practice, this rarely happens, because much of the new, GC-gauge infrastructure was required simply to run GC-gauge services through to the final destinations, rather than to satisfy capacity demands there. (This is particularly true at the ‘country ends’ of services passing through London. Having cancelled GC-gauge, the new infrastructure is simply no longer required even for the longer-term capacity requirements.)

The Purpose, Background and Method

This article refers to and should be read in conjunction with the article ‘Towards a High Speed **Network**’. That article makes the case for developing a network plan for all the HS routes which will eventually be needed, and, as a contribution to getting the discussion started, gives my own thoughts of what such a network could look like. Naturally, this involves describing a number of routes, in varying but superficial detail. This lays me open to the charge, something on the lines of ‘That’s all very easy to say, but how would you actually go about doing it?’ Accordingly, a decent respect to the opinions of the interested public requires that I should go into more detail on the individual routes. The present article deals with the HS connections across London. Much of this information appears in the Route and Service Plans articles of the relevant lines, and is drawn together here to illustrate the overall plan.

Seven HS routes serve London:

- HS1 (existing route plus small extensions) Kent and East Sussex (Maidstone, Ashford, Margate, Dover, Eastbourne), also to Europe
- HS2 West Midlands and North West (Birmingham, Manchester, Liverpool, Preston)
- HS3 East Midlands, Yorkshire, North East and Scotland (Northampton, Leicester, Nottingham, Sheffield, Leeds, York, Newcastle, Edinburgh, Glasgow)
- HS4 South Wales and (in conjunction with HS7) the West Country (Cardiff, Swansea, Bristol, Exeter, Plymouth)
- HS5 Sussex, West Kent and Hampshire (Brighton, Eastbourne, Newhaven, Tunbridge Wells, Chichester, Portsmouth, Southampton)
- HS6 West Anglia and (in conjunction with HS10) Lincolnshire (Cambridge, Ely, Norwich, Peterborough, Lincoln, Hull)
- HS11 Essex, North Kent and (in conjunction with HS12) East Anglia (Southend, Faversham, Canterbury, Dover, Colchester, Ipswich, Norwich).

For all these routes, there are **no** UHS or HS Metro services which start/terminate in London itself (except for the very special case of HS1’s European services which do indeed start from and terminate at St. Pancras International). Each route instead leads to a new, underground, through station, where it links with another route serving the opposite side of London, and all services pass between them.

In fact, only two such stations are required for the entire seven high speed routes:

- Euston Cross, served by routes HS2, which connects with the (non-European) services of HS1, and HS4, which connects with HS11/HS12
- Pancras Cross, served by routes HS3 and HS6/HS10, which connect with HS5.

In both cases, a single pair of tunnels and 6 platform faces (ideally with passive provision for 8) are sufficient to accommodate all the services required at the ultimate maximum frequencies, as far ahead as the associated plans reach, around 50 years into the future. (But see also Appendix C concerning passenger volumes).

As far as line (as opposed to station) capacities are concerned, I used to take 16tph as the maximum throughput for a HS line, 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.) For the cross-London inter-connections, speeds are low, and the traffic conditions approximate to a metro. I am thus unfazed by line capacities in the 30s of tph. The best modern metros, like LT, (I admire London Transport greatly, even if the Londoners themselves are disgracefully ungrateful,) already deliver reliable performance in this range: the Victoria line, for example, has been delivering a peak capacity of 34tph for the last few years.

The load values which were formerly included in appendices A and B have now been restored. These were temporarily removed while the Route and Service Plans articles were being reworked as Mk1A/Mk2 versions. This work is now complete, and overall figures for cross-London traffic are again available. These are, however, now quoted in the main body of the text (just before the maps), rather than on the layout diagrams in the appendices, as previously, to simplify future updating.

In most cases the HS routes have some services which must remain HS-C indefinitely, since they serve locations off the new, HS sections, for which there is no conceivable justification for widening to GC gauge (that was the original justification, which is left in place for elucidation, though it no longer applies). These HS-C services all start/terminate at the appropriate classic terminal station, specifically:

- HS1 – this has no HS-C services
- HS2 – Euston (4 services)
- HS3 – St. Pancras West (the MML platforms – 3 services)
- HS4 – Paddington (4 services)
- HS5 – this has no HS-C services
- HS6/HS10 – St. Pancras East (the ‘Javelin’ platforms – 3 services)
- HS11/HS12 – these have no HS-C services

The UHS and HS-Metro services would need new or extensively rebuilt stations in any case, since there is simply no room for them in the existing stations. The choice is thus between adapting the existing stations, all of which are terminals, or of building new ones, which could and should be through stations.

Building new would certainly be very much less expensive overall than rebuilding and enlarging **all** the relevant classic terminals, and their approaches!) and involve very much less disruption. But even more importantly, it would enable truly superb cross-London inter-regional, mainline services, which is a completely new concept. These are:

- West Midlands / North West (HS2) – Euston Cross – Kent / East Sussex (HS1)
- South Wales / West Country (HS4/HS7) – Euston Cross – North Kent / East Anglia (HS11/HS12)
- Scotland / North East / Yorkshire / East Midlands (HS3) and West Anglia / Lincolnshire (HS6/HS10) – Pancras Cross – Sussex / West Kent / Hampshire (HS5).

This vision becomes clear and compelling when one considers the complete HS network which we will eventually need. If one is considering only HS2 in isolation, then it may seem an extravagant proposal, which was indeed the reaction of many commentators to the “Railway Lords” original proposal for Euston Cross – which is clearly acknowledged as its inspiration.

The Route Loadings at Euston Cross and Pancras Cross

The following route loadings have been accumulated from the various Route and Service Plans articles:

EUSTON CROSS			
HS Route	Mk1A	Mk2	Mk3
HS2 → HS1	16tph	16tph	20tph
HS4 → HS11	16tph	16tph	16tph
Total in each direction	32tph	32tph	36tph
PANCRAS CROSS			
HS Route	Mk1A	Mk2	
HS3 → HS5	16tph	24tph	
HS6 → HS5	10tph	10tph	
Total in each direction	26tph	34tph	

There are no changes in loading for Euston Cross between Mk1A and Mk2. This merely reflects that the main changes are away from London.

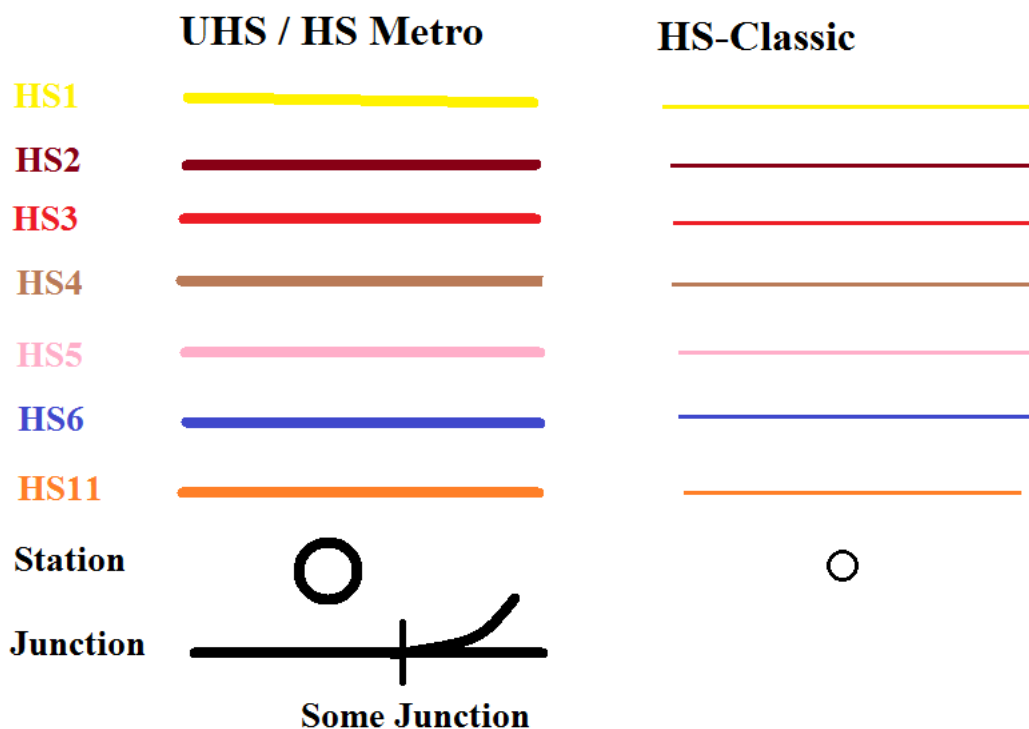
The Mk3 values for Euston Cross reflect the extra-futuristic ideas for the Coventry Variant and Scottish Extension of HS2.

At Pancras Cross, both routes from the north merge into the single route HS5.

The Maps

To illustrate the cross-London configuration, the following topological diagram is provided, together with a map of the Cross-London Interconnections.

In the topological diagram, the following symbols are used:

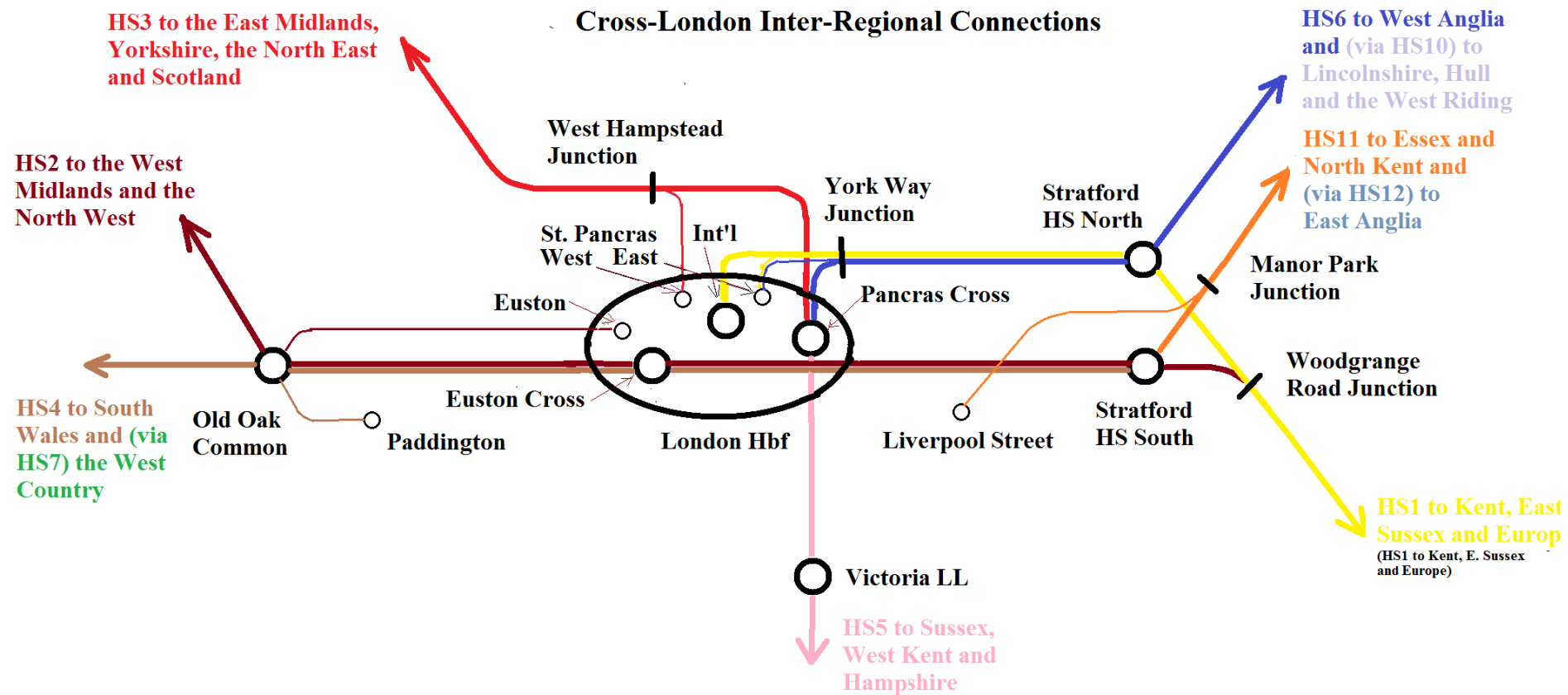


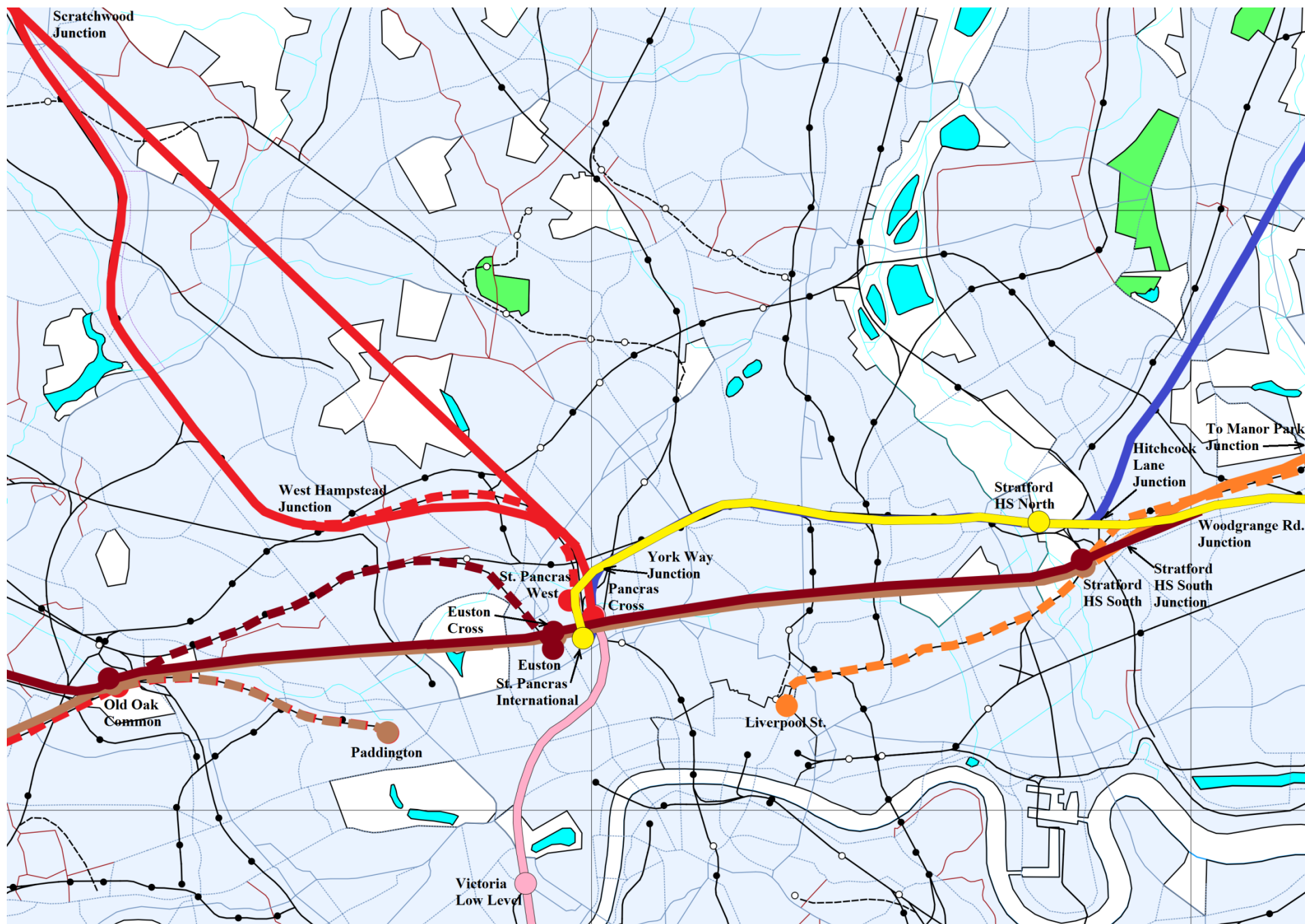
(London Hbf is my semi-humorous name for the unique transport mega-hub incorporating Euston Cross and Pancras Cross, and including Euston, St. Pancras – East, West and International – and also King’s Cross, together with Thameslink, Crossrail-2 and -3, and all the London Underground lines serving Euston and King’s Cross / St. Pancras. The name is an affectionate reference to one of my favourite stations, the magnificent new Berlin Hbf, which has some of the same characteristics.)

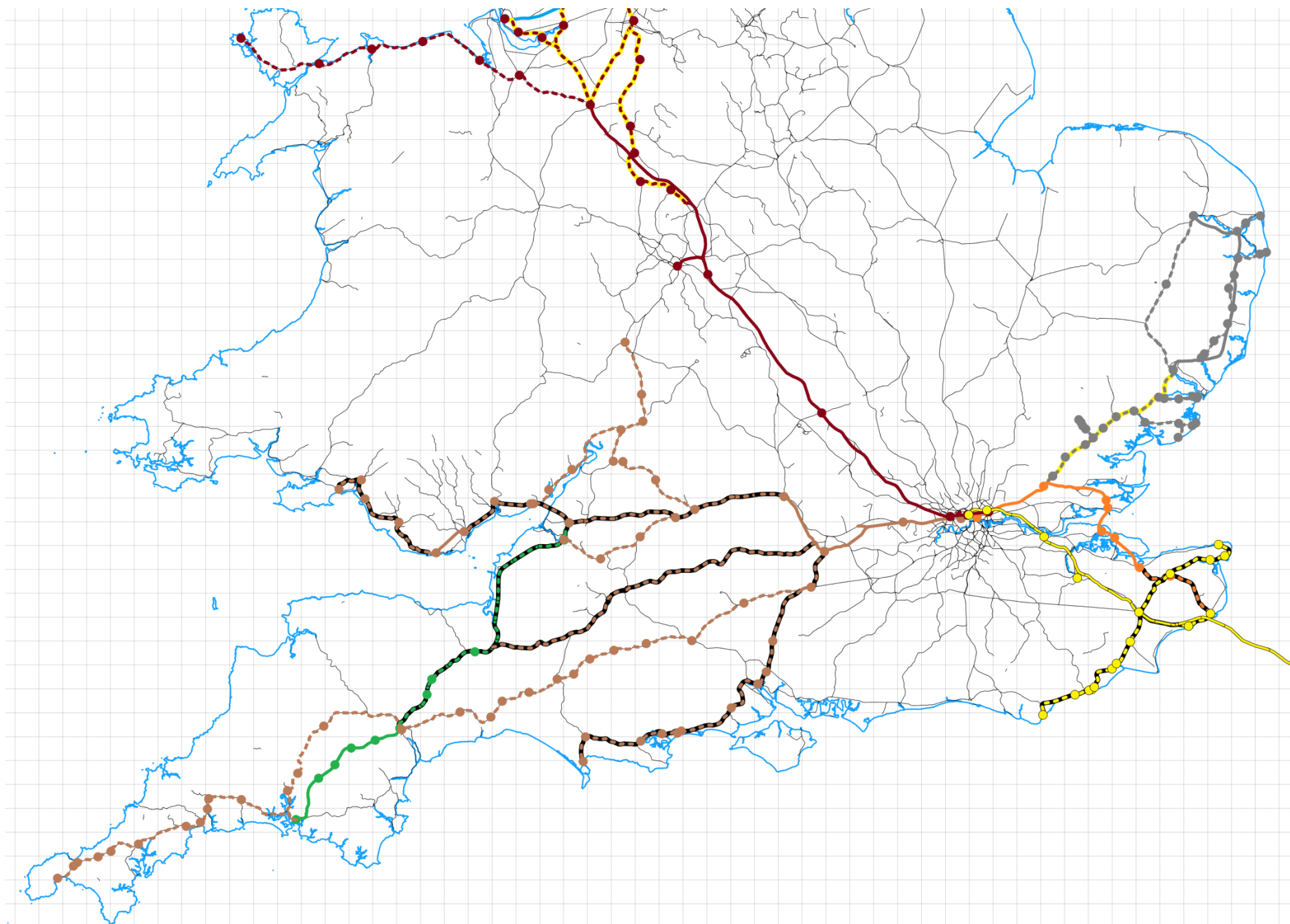
The map of the interconnection shows how it would look on (mainly under) the ground. (Tunnels are omitted, or they’d be everywhere.) This is produced using GIS (Geographical Information Systems) software, based on the Strategi dataset of the Ordnance Survey Open Data product.

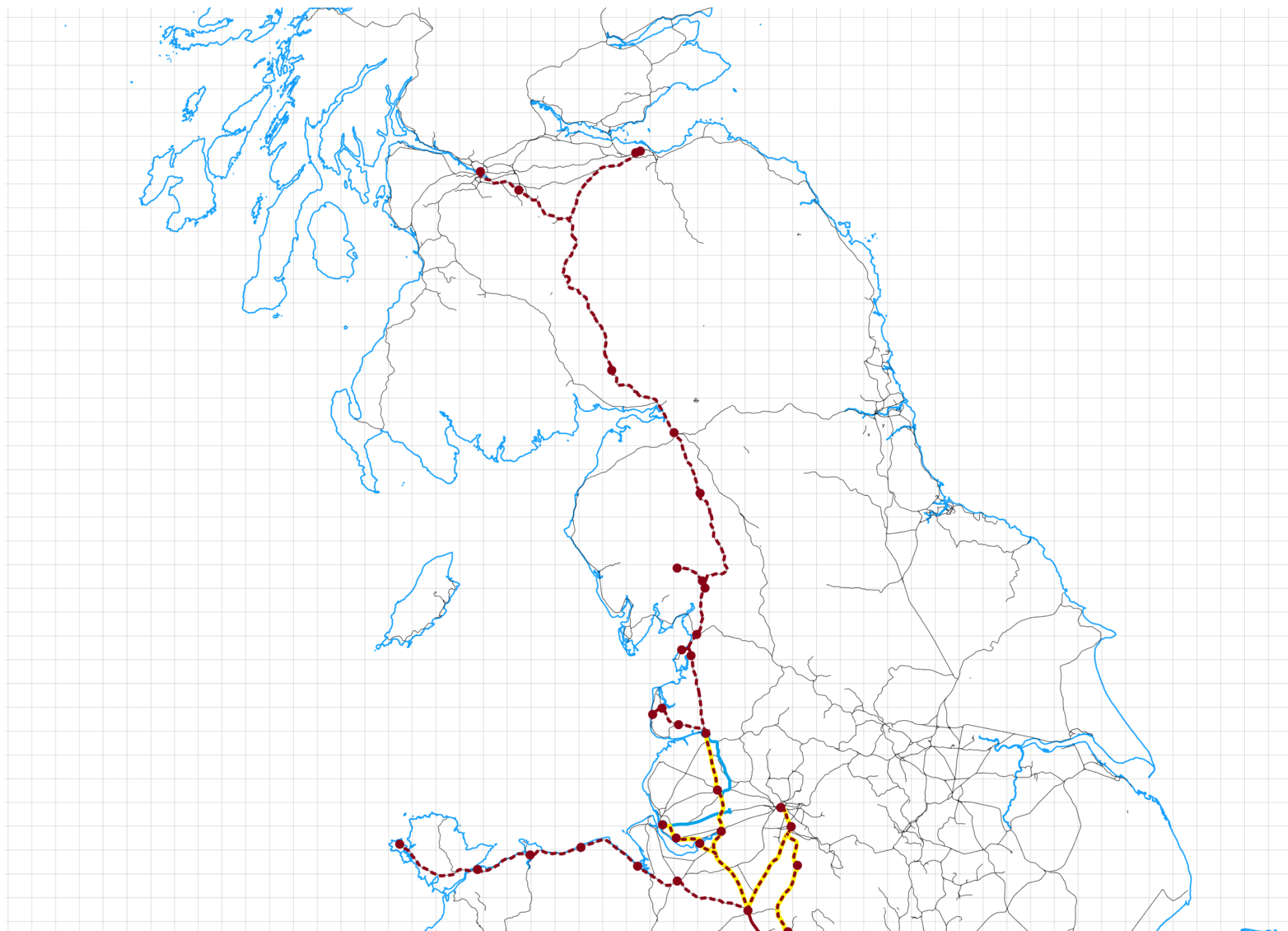
In addition, maps are provided of the HS routes served by Euston Cross and Pancras Cross, and also show the associated HS-C services on classic lines. These include sections of other HS routes over which the services run. These are produced in two versions, basic and extended. For Euston Cross, these correspond to Mk1A and Mk3. the latter including extra-highly-speculative extensions, which would probably not be seriously considered until the full HS network had been implemented and in service for a few years. (Full details of these further extensions are given in the relevant Route and Service Plans article for the HS route concerned.) For Pancras Cross they correspond to Mk1A and Mk2.

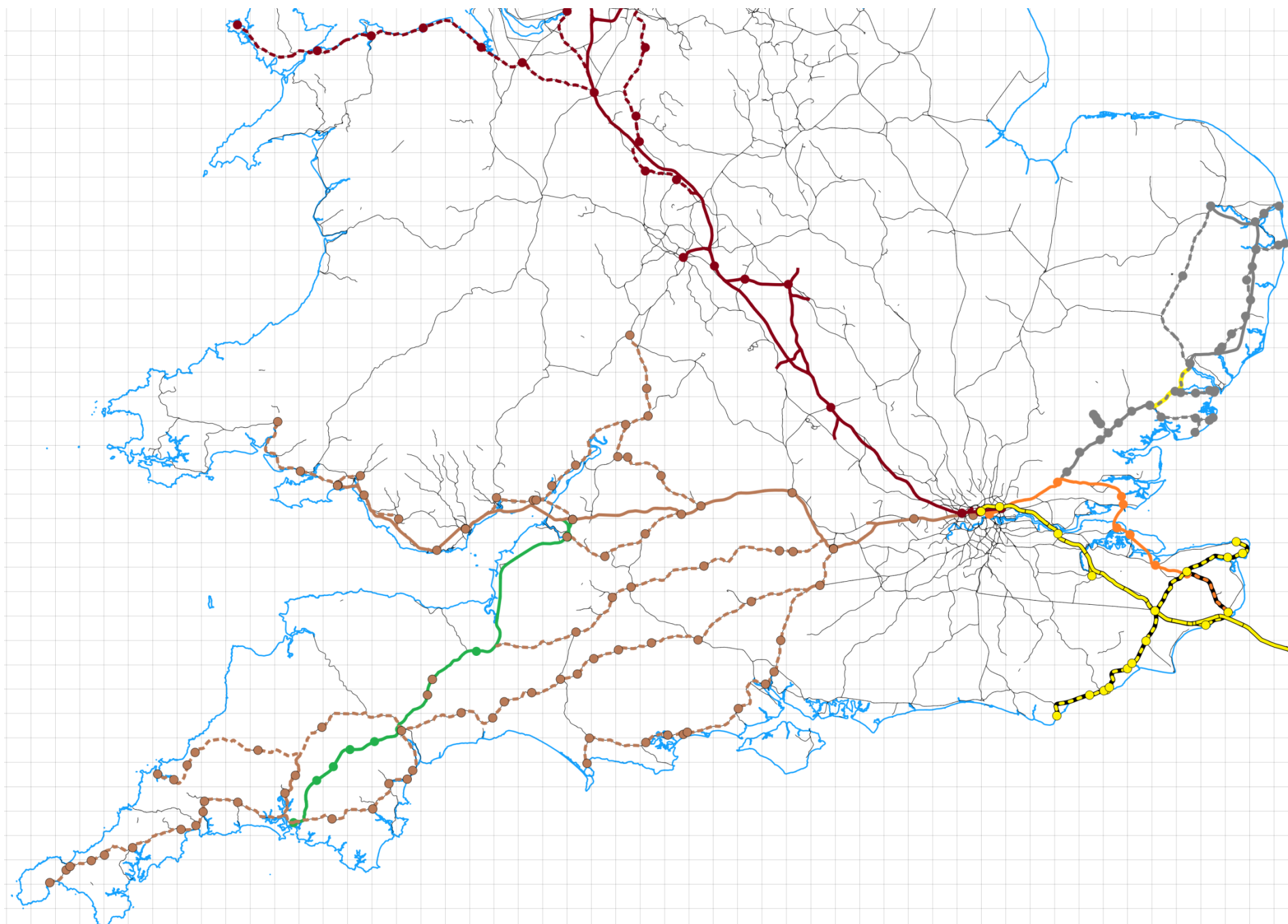
A couple of appendices give full network diagrams of the relevant locations. A third appendix considers aspects of how best to accommodate the very large passenger flows involved

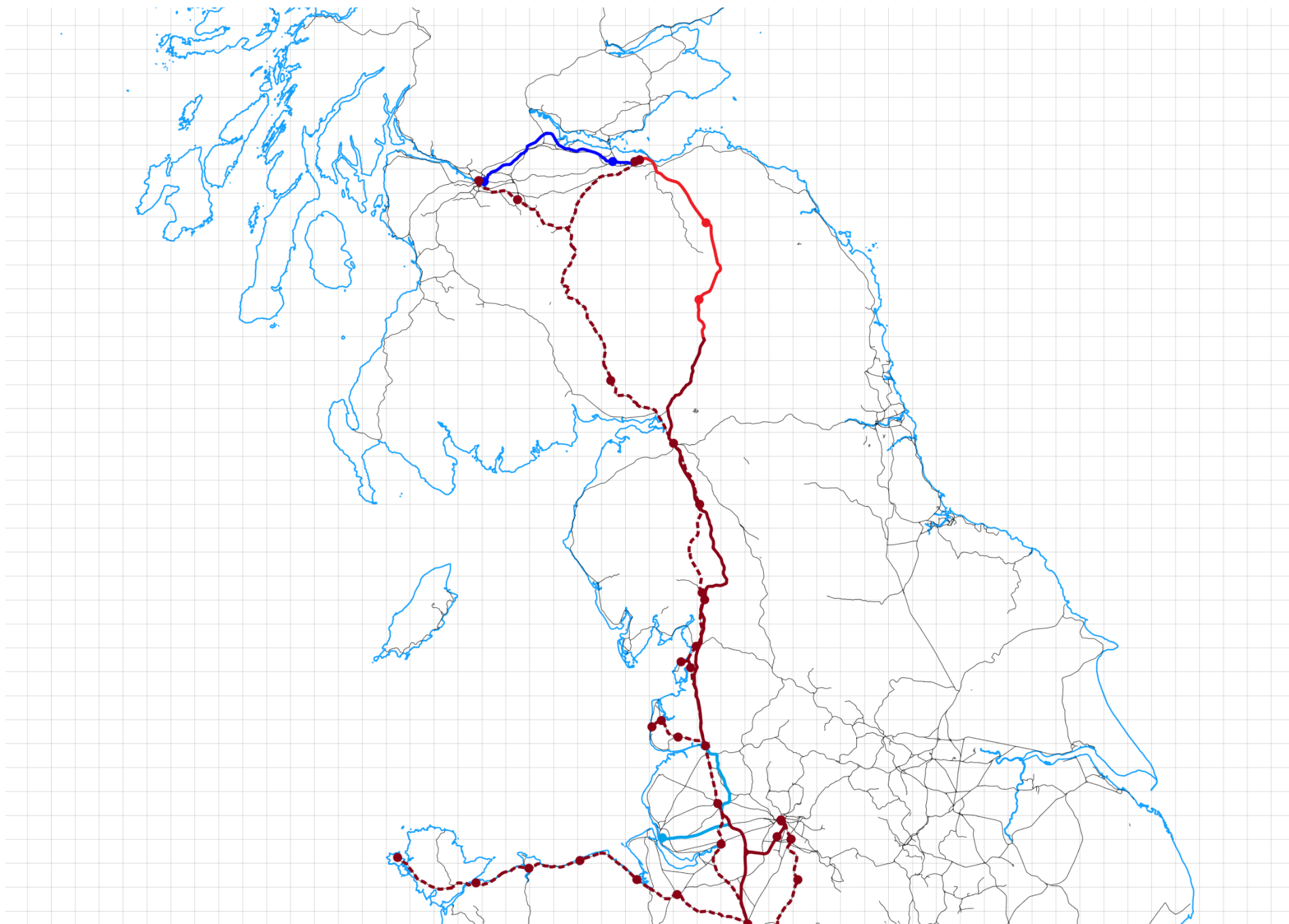


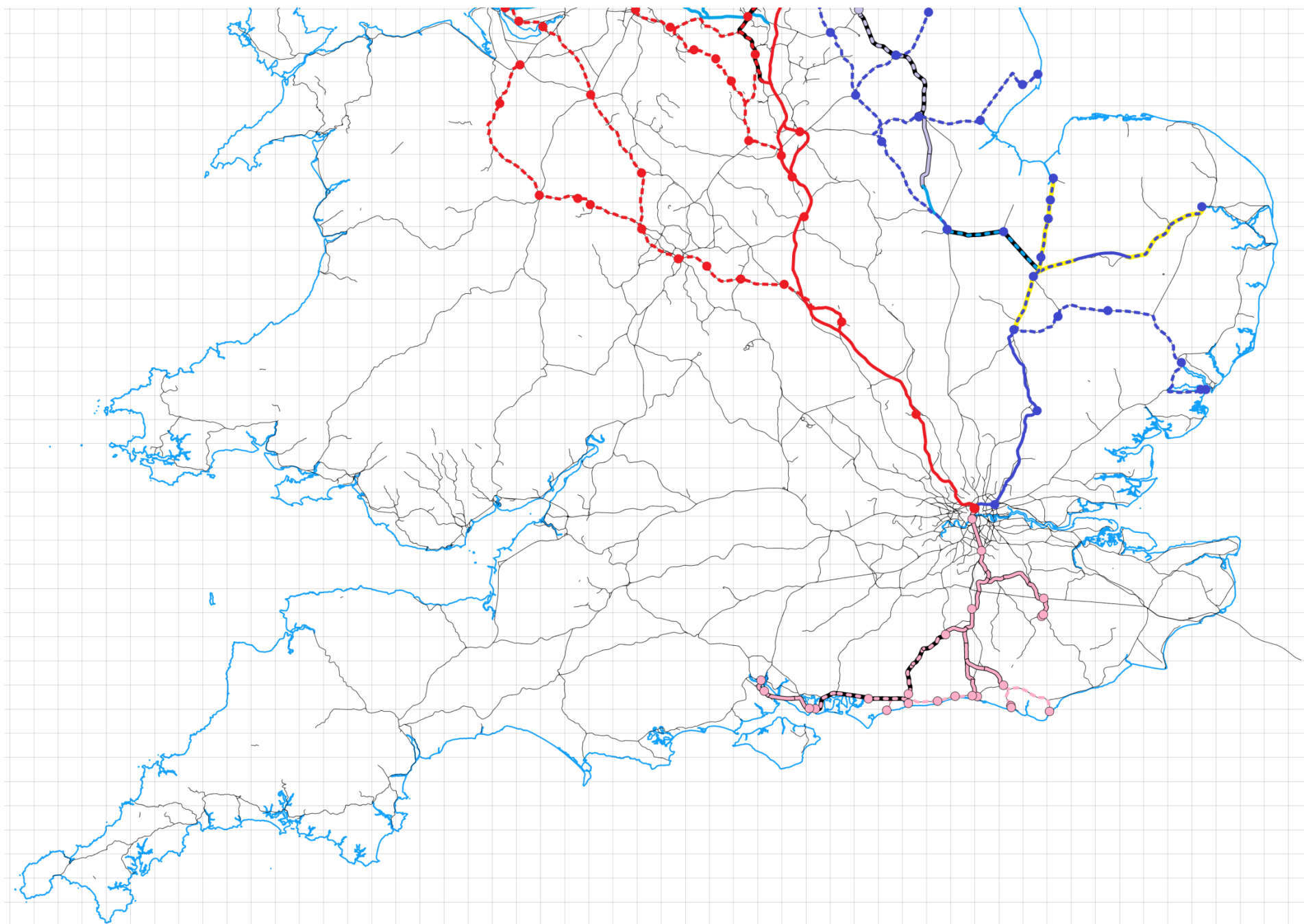


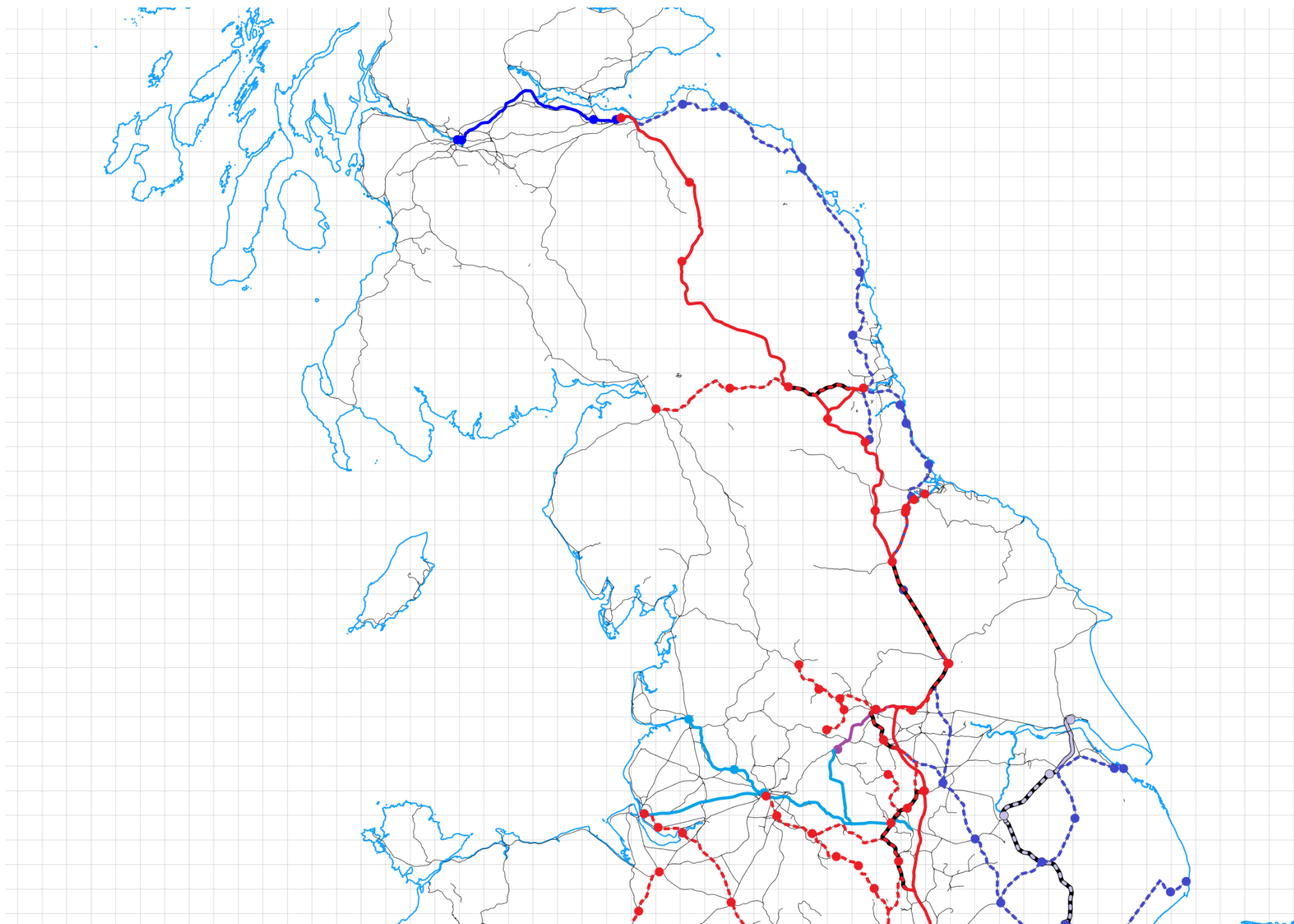


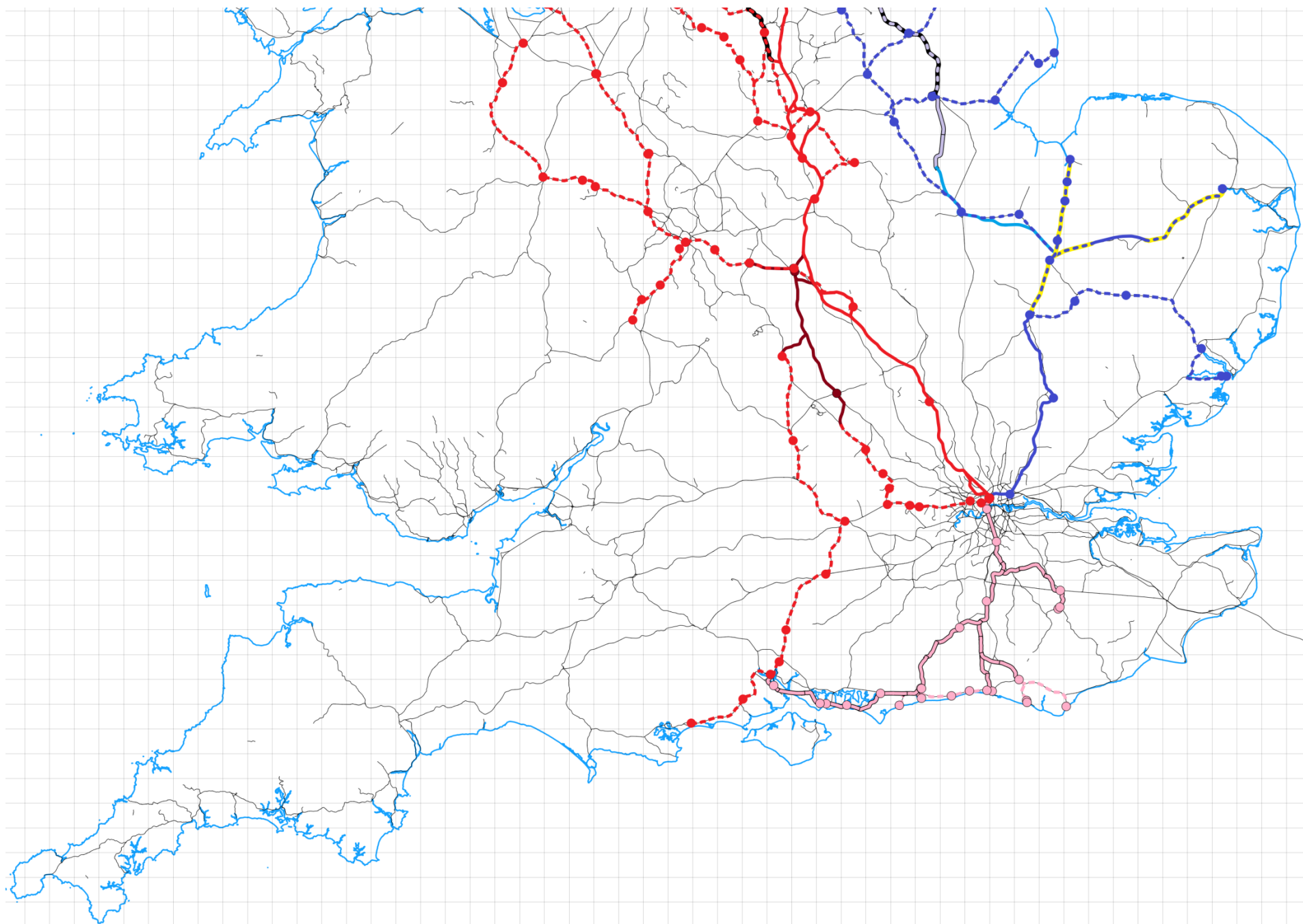


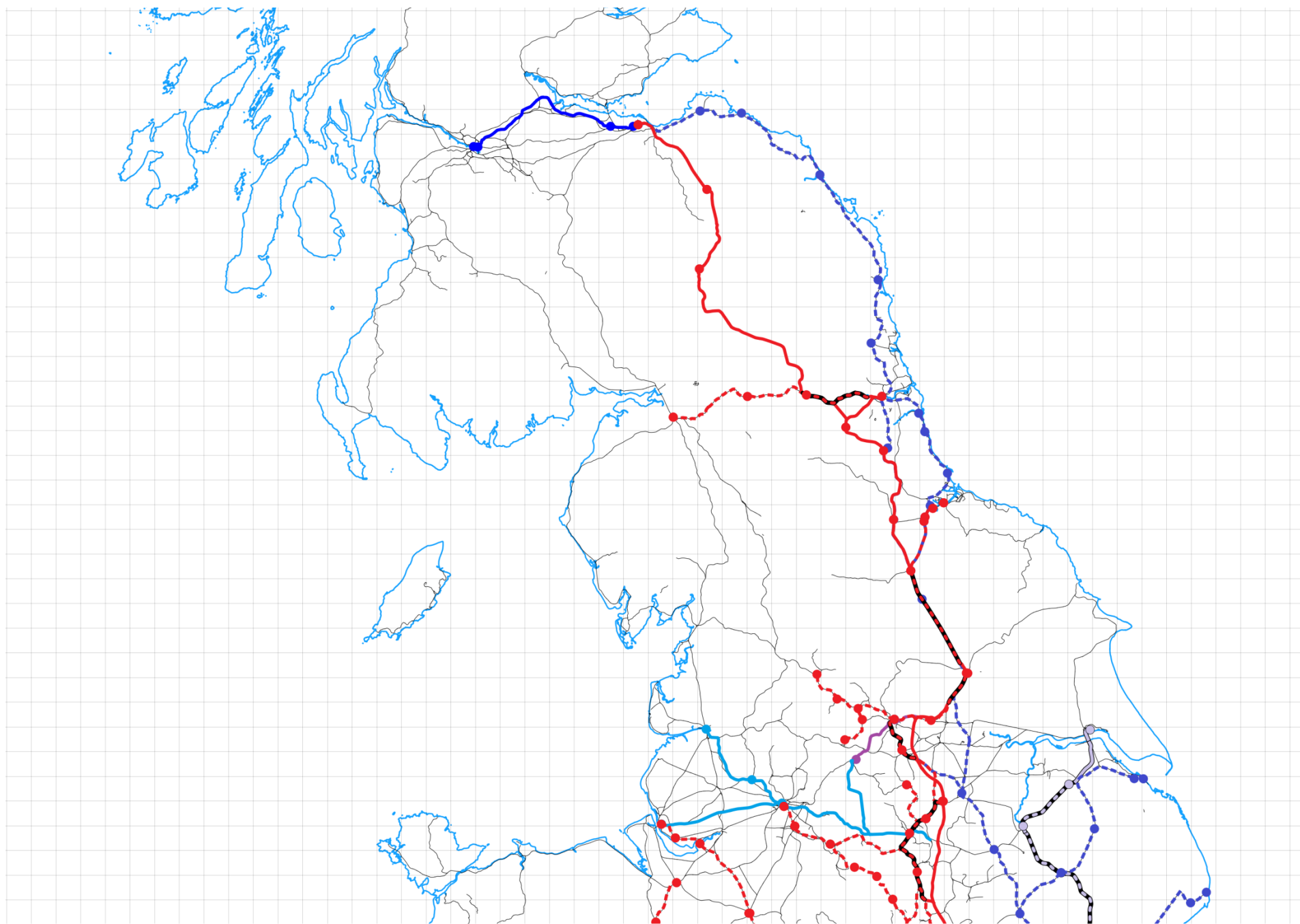












Appendix A – Euston Cross and the Inter-Regional Connections

General

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

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



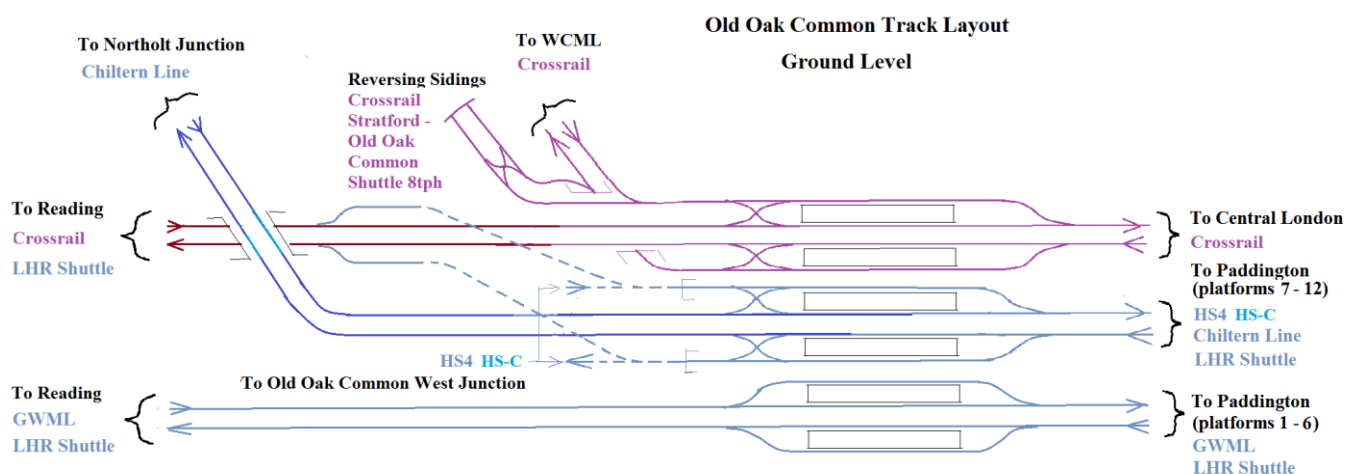
Old Oak Common

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

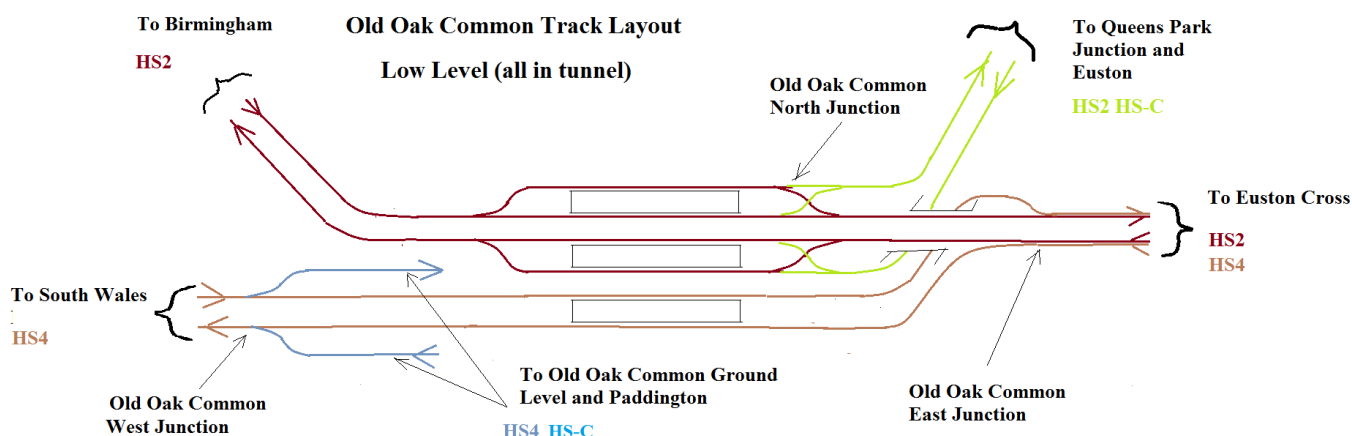
1. Ground Level, consisting of three sets of four platforms, serving the routes:
 - GWML (Classic, long distance, and Heathrow Shuttle services,) on the fast lines.
 - HS4 HS-C and Chiltern Line services, also some Shuttle services, on the relief lines, all of which diverge immediately west of the platforms, the HS-Cs to join HS4 at Old Oak Common West Junction, at the low level, the Chiltern Line services to Northolt Junction and the Shuttle services to join Crossrail on the relief lines west of Old Oak Common.
 - Crossrail, of which the arm to the WCML and the Stratford Shuttle reversing sidings, diverges immediately west of the platforms, and the GWML arm takes over the relief lines.

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

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

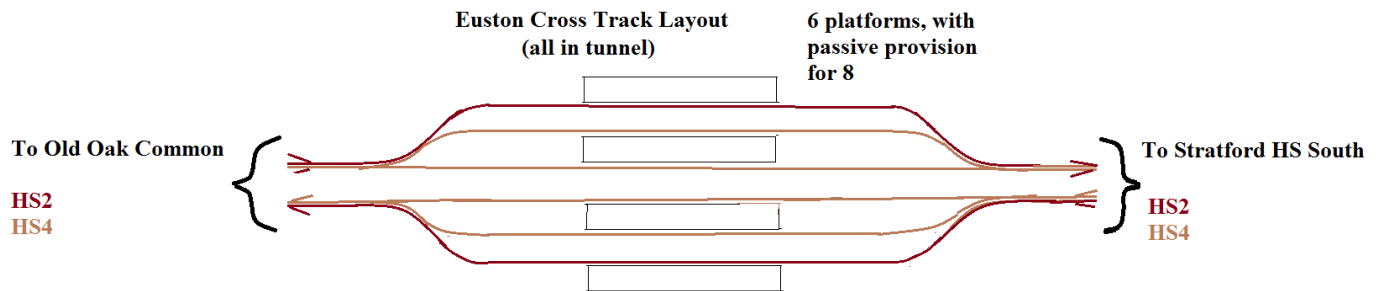


See the article 'GWML Service Plans' for a full explanation of the services between Paddington and Old Oak Common; as is clear from the diagram, the arrangement is rather complex.



Euston Cross

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



Stratford HS South

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

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

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

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

Appendix B – Pancras Cross and the Inter-Regional Connections

General

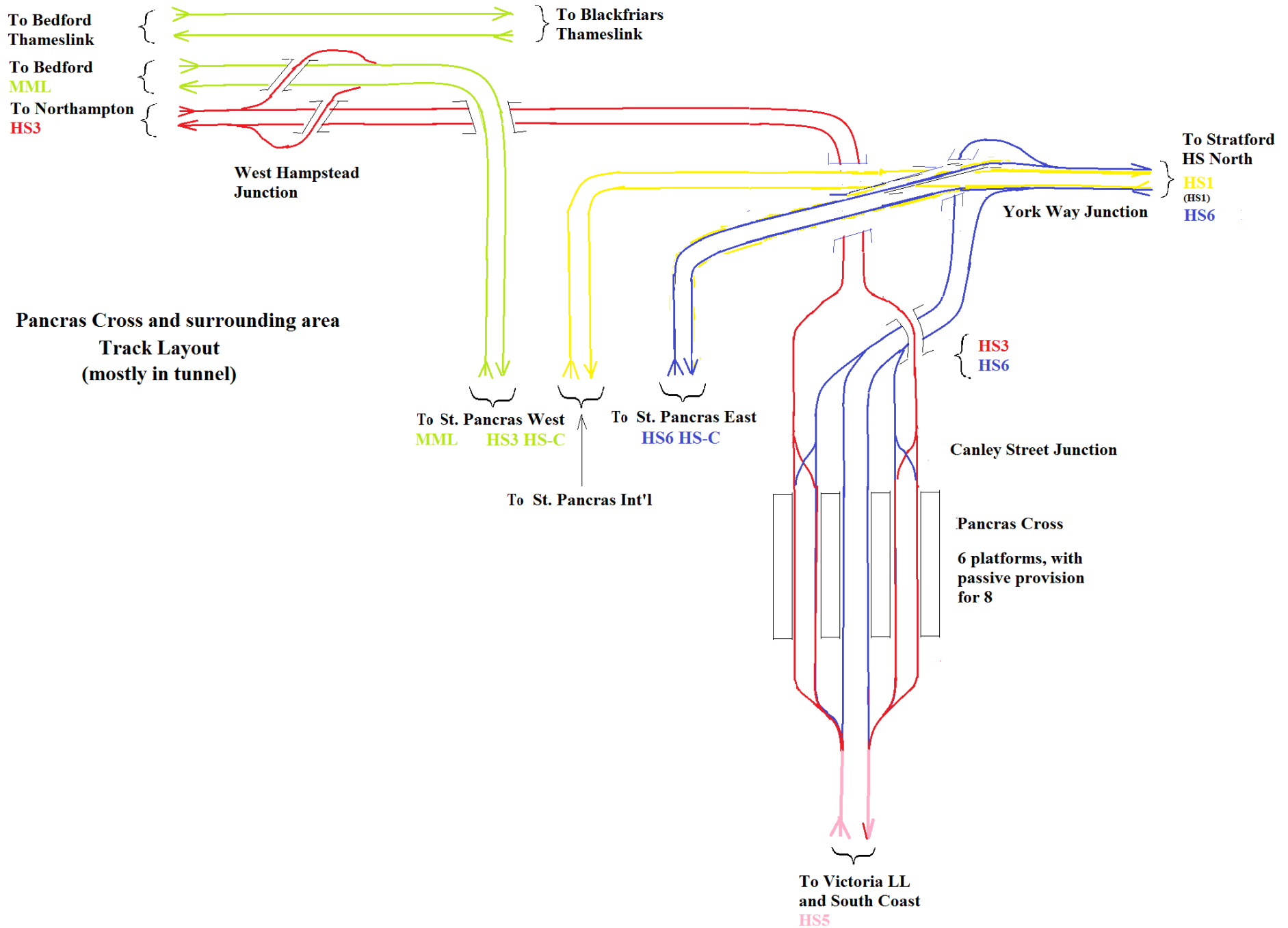
By routing the HS-C services of HS3 into St. Pancras West (the MML platforms), and of HS6 into St. Pancras East (the 'Javelin' platforms), and all the UHS and HS Metro services of both routes through Pancras Cross and on to HS5, superlative cross-London inter-regional HS services are enabled, between 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.

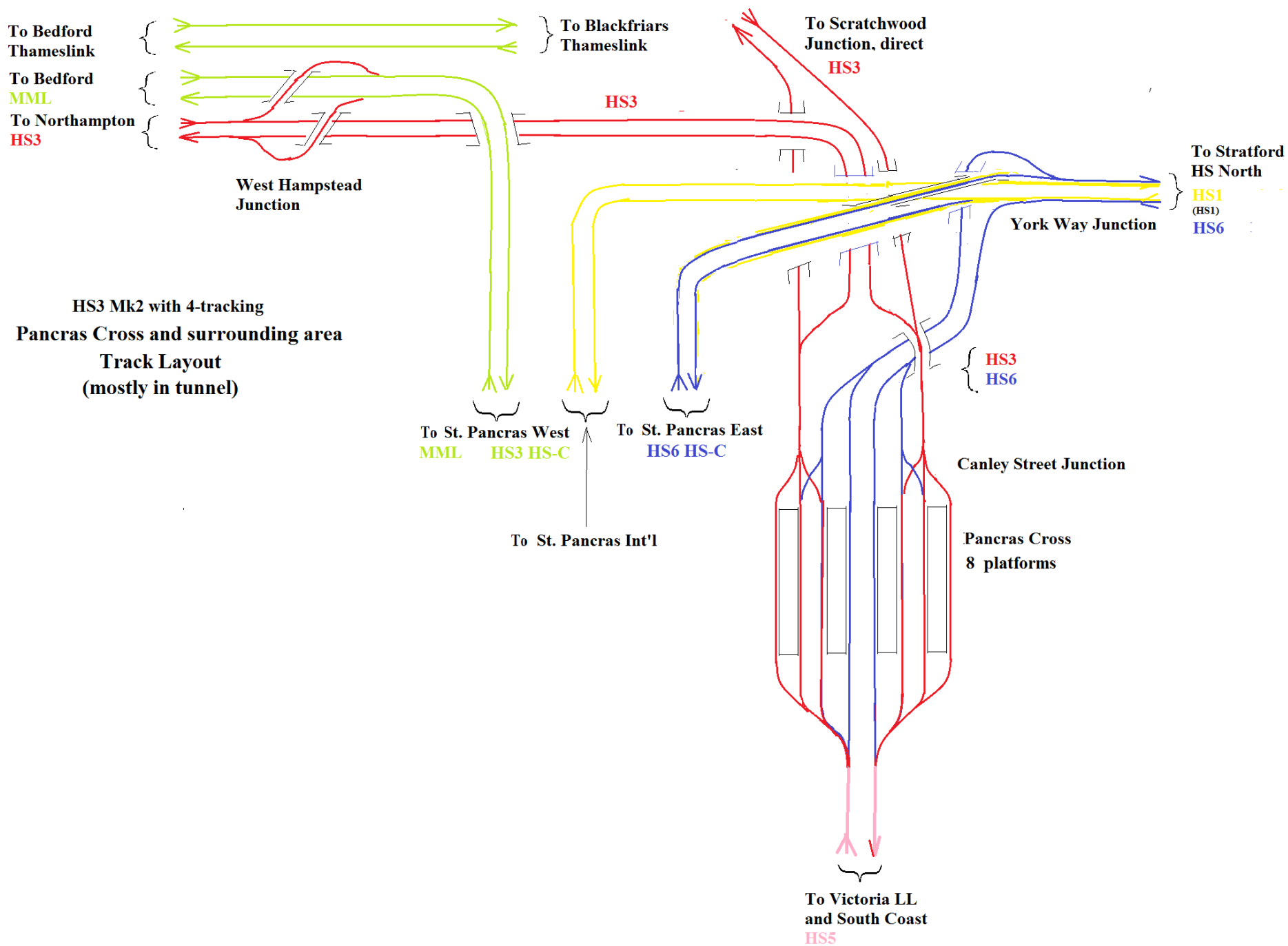
The track diagram of Pancras Cross and its surroundings is on the next two pages. The layout is not especially complicated, but there are a few points to note. The second version, for HS3 Mk2 with 4-tracking, is extra futuristic and speculative.

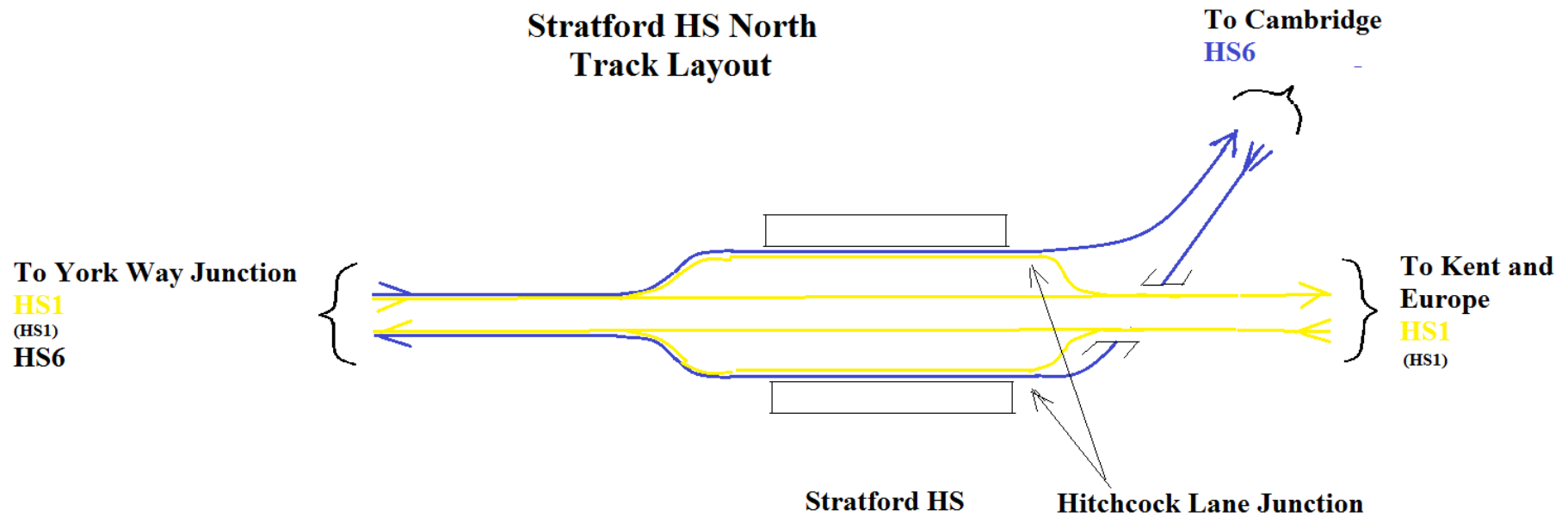
The middle two platform faces at Pancras Cross would ordinarily be used by HS6 trains and the two outer pairs by HS3. The scissors crossovers are provided for operational flexibility, but should not normally be used. I would like to see **passive** provision for 8 platforms, as is indicated in the diagram.

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. (The inter-regional services from HS2 join HS1 later, 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).







Appendix C – Accommodating the Passenger Flows

Whereas I am confident of the ability of the proposed cross-London inter-regional infrastructure to handle the service loadings of the trains, I am less sure of its ability to handle the very large passenger loadings. While the benefits of inter-regional travel are very real, it has to be recognised that, for the services south and east of London in particular, the bulk of the traffic will be commuters to and from London itself. The bulk of the long distance traffic on the other routes will also be to and from London. The **economic** case for the cross-London connections is that this is a much less expensive way of providing the new infrastructure, (which is unavoidably needed,) than the alternative of heavy, extensive, monstrously inconvenient and hugely unpopular rebuilding and enlargement of the classic terminals. This is the **deciding** reason. That this solution is more elegant and more efficient, and provides new facilities undreamed of previously, will not move the stony hearts at the Treasury. Nor, indeed, should it, as this is merely a **reinforcing** reason, not a deciding one.

We thus face the situation where trains will arrive in London full, empty almost completely and then refill, and proceed out to the other side. Two approaches are available to accommodate the passenger volume, the first is provided in any case, and the second is available if it is decided the first is not by itself sufficient.

All trains on the Euston Cross routes (both HS and the regional metro services on the relevant classic routes too,) stop at Old Oak Common and/or Stratford. The idea is that passengers for West End and City destinations switch to Crossrail at those points, reducing the passenger loading of Euston Cross (also of Euston, Paddington and Liverpool Street). Old Oak Common to Stratford (strictly, to Whitechapel, just short of Stratford, after which the Abbey Wood arm diverges,) will be the highest loaded section of Crossrail, so this strategy is endangered if the inbound trains are already full on arrival at these points, and passengers trying to make the connection (likely with luggage) are not able to. The envisaged service level on Crossrail's central section is 24tph, with 32tph intended later. If these extra 8tph were run as a shuttle between Old Oak Common and Stratford, then passengers connecting from high speed (and other) services would be **guaranteed a completely empty train** at least once every 7 / 8 minutes (thus an average wait of 4 minutes for it). The shuttle trains would be of special stock, with extra luggage capacity, and a clearly distinctive livery. The station displays at Old Oak Common and Stratford would include the time of the next shuttle, as a distinct item of information. This, I suggest, is terrific customer relations – telling connecting passengers 'these trains are specially for you!' In addition, the Jubilee line starts at Stratford, providing initially empty trains to Docklands, London Bridge (City), Waterloo and the West End. Likewise the Overground services to Richmond and Clapham Junction via Willesden, so these trains also are initially empty. If the Bakerloo (and likewise the Overground) were extended from Queens Park to Old Oak Common, then that would likewise provide initially empty trains to the West End and Waterloo. (I've never seen this suggested, which astonishes me. I can hardly believe nobody else has thought of it. Even the latest TfL plan deals at length with extending the Bakerloo southwards to Lewisham, and possibly later to Hayes, but says nothing about the northern end.) For the Overground services, 4tph would run from New Cross to Watford Junction, 4tph from Crystal Palace to Harrow & Wealdstone, and the remaining 8tph (4tph each from West Croydon and Clapham Junction) to Old Oak Common.

The equivalent provision on the Pancras Cross routes is the station at Victoria Low Level, connecting inter alia with Crossrail 2 and Crossrail 4, which provides a significant counterweight to Pancras Cross. I

Cross-London Inter-Regional Connections v6.0 Page 23 of 25

think the likelihood is that more inbound passengers (from south of London) will alight at Victoria, and outbound passengers join at Pancras Cross, and vice versa. I can't **prove** it, but I don't think there's the same likelihood of a train emptying and refilling at the same station on this route, as there would be at Euston Cross, without its Old Oak Common and Stratford satellites.

But the possibility must be faced that the above provision would still not be adequate for the passenger flows. There are two possible ways forward. If it's **nearly** adequate, then implementation of the extra 2 platforms (to 8) for which passive provision has been recommended, may do the trick. If it's **still** not adequate, then the ultimate solution must be used. This is to provide separate platforms for passengers joining and leaving the train, thus on both sides of each track. Passengers first alight on one side of the train, and then, (once they have alighted,) other passengers join from the other side. I know of only one instance of this extreme provision, on the Munich S-Bahn, at Hbf and the next two city centre stations to the east of it. (If there are any others, I would be pleased to hear of them.) Once passengers have grown accustomed to the arrangement, simultaneous alighting and joining may be practicable. A further refinement could be to open half the doors alternately, on one side of the train, for alighting passengers, and the other half, on the other side, for those joining. Joining and alighting passengers would thus form one continuous stream with no conflicting movements. The passengers would, of course, need to know in advance precisely which doors were which.

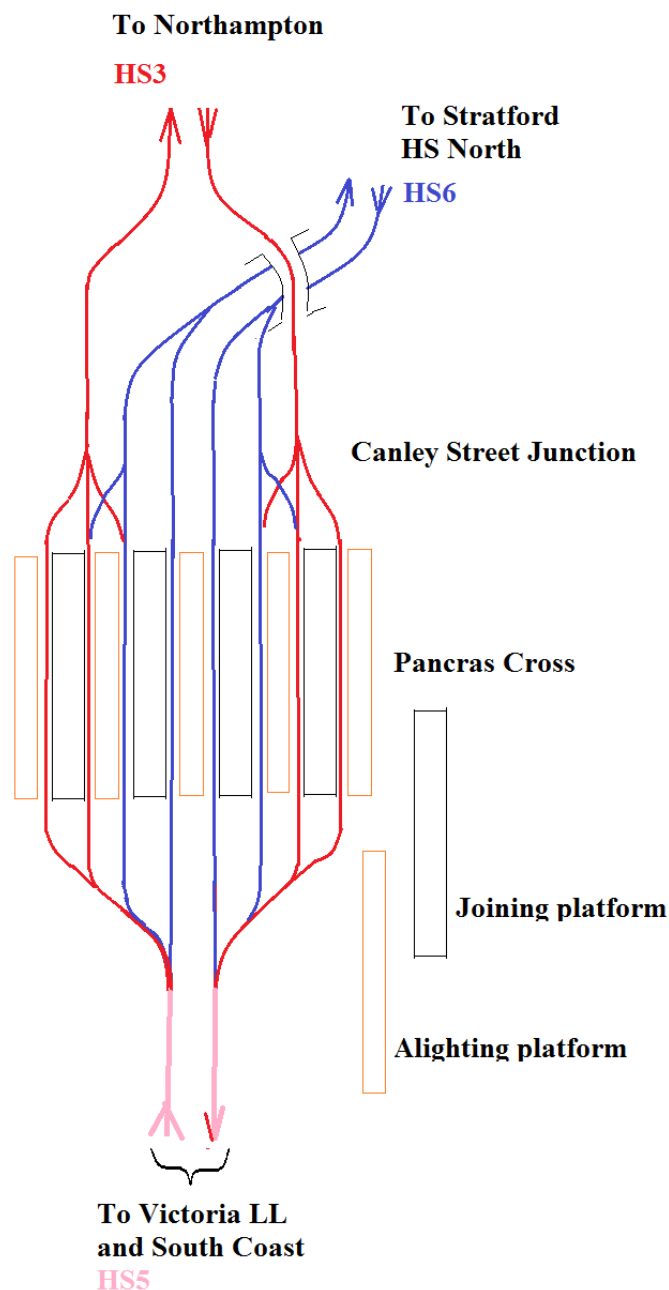
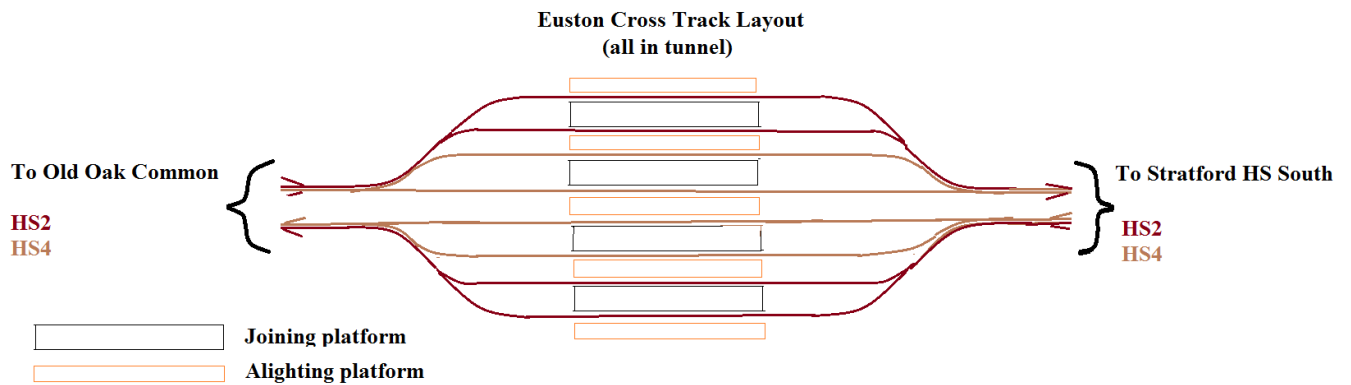
Each platform (except the two outermost) serves two adjacent tracks, and is either for passengers alighting, (from both tracks,) or for joining, (to both). The alighting platforms do not need to be as wide as those for joining, since passengers have no need to wait there, but they do need to be supplied with more means of ready egress, more escalators especially, since passengers need to clear the platforms as quickly as possible. The platforms will (of course) be gated, as at all modern, high-capacity, metro stations.

Naturally I can't say whether or not this extreme provision would in fact be necessary, but the possibility certainly needs careful consideration. It would definitely be prudent to make **passive** provision for it (again!) – leaving enough space between adjacent tracks for an alighting platform to be added later, if necessary. This applies to all the London through stations. Euston Cross, Old Oak Common, Stratford HS South, Pancras Cross and Victoria LL.

Note again that all this is concerned solely with accommodating the passenger volumes. The number of trains involved is unchanged, (so the same twin tunnels remain sufficient to accommodate them). By increasing the number of platforms, longer stopping times are available for the trains to empty and refill. By providing separate platforms for alighting and joining, the passenger flows are kept completely separate, out of each other's way, so the trains actually empty and refill more quickly.

Thinking ahead, and making passive provision for all recognised eventualities, is what it's all about.

Just for interest, the following diagrams show the two principal cross-London HS stations at their maximum extent, to accommodate maximum passenger flows, as described above:



Victoria LL would be similar to Euston Cross, and Stratford HS South similar to Pancras Cross. Old Oak Common is slightly more complicated, but the same principles apply.

Cross-London Inter-Regional Connections v6.0