HS Eastern Routes and Service Plans

(HS6 and HS10)

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 HS6, the route from London to Norwich, and HS10, the Lincolnshire route, from London to Hull and Cleethorpes, sharing the route of HS6 from London to Ely and HS8 thence to north of Peterborough.

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

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

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

When I am following an existing alignment, (this obviously includes taking over the route and trackbed of a former railway, now closed,) I don't generally worry about gradients, confident that they will be well within the capacity of HS trains. Very occasionally, when following a motorway or (more likely) non-motorway road, the contour pattern suggests that there might be a problem, and then I do check the gradients, (and state what these are, in the route plan). When I am obliged to design a completely new alignment, then the gradient profile forms part of the design, and will be stated, (unless, from the contours, it's obviously essentially level, or undulating but with no significant underlying change of level). The present article contains no gradients, as the new alignments – north of Thetford and in south Lincolnshire – are essentially level.

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 HS6/HS10, including sections of other routes over which HS6/HS10's services run. These overall maps come at the end of the 'Route' description, and also show HS6's classic compatible services on

classic lines (these are shown as dotted lines; there are none for HS10). 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 HS6.

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 HS6/HS10 stations are served by all services, so don't need overtaking/avoiding lines. At the end(s) of a route, the traffic density may not be sufficient to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice; this is the case with HS10 (i.e. north of Thurlby Junction) throughout. At the end(s) of a route, the traffic density may not

be sufficient to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice; this again is the case with HS10 throughout.

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

In the present article, HS5, the route from London to Brighton and other Sussex / Hampshire / Kent locations, must also be considered, in the later service plans, as the HS6/HS10's GC-gauge services are all inter-regional with HS5.

Two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic compatible) which travel on HS6/HS10 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS6, 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 250mph, 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.

HS6/HS10 Routes – Introduction and Assumptions

HS6 and HS10 closely follow existing alignments, railway and motorway, for the most part.

HS6 begins at Pancras Cross, which it shares with HS3. Between there and Stratford HS North, the former International, it shares the route of HS1; HS6's own route begins at Stratford. By the time HS6 opens, Pancras Cross will be a through station, and all northbound services will originate from locations in Sussex, West Kent and Hampshire. St. Pancras East, (the 'Javelin' platforms,) will accommodate the

long-term classic-compatible services of HS6, and the GC-gauge services will use Pancras Cross. St. Pancras East is already connected to HS1.

Appendix A gives full details of Pancras Cross and its surroundings.

HS6 is extended from Ely to Peterborough and beyond by HS8, and HS10 diverges from HS8 above Peterborough, to serve Lincoln and Hull.

The maximum speed for HS6 and HS10 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.

HS6 Route – Junctions

There are various junctions on the route of HS6, enabling connections with other HS and classic routes. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

- Canley St. TQ300831 HS6 diverges from HS3 immediately north of Pancras Cross (in tunnel).
- York Way TQ302841 HS6 joins HS1 just before entrance to London Tunnel.
- Hitchcock Lane TQ387848 HS6 diverges from HS1 at platform ends at Stratford International (i.e. without rejoining HS1 main line).
- Ely HS:
  - South TL562812 HS8 branch to Ely HS North Junction diverges from HS6 main line to Ely HS East Junction and Norwich. Also at this location, HS6 takes over the classic line to King's Lynn.
  - East TL573818 HS8 joins HS6 to Norwich.
  - North TL554820 HS8 branch from Ely HS South Junction joins HS8 main line to Peterborough, and on to HS10.
- Pellett Hall TF148042 Connection to classic ECML.

HS10 Route – Junctions

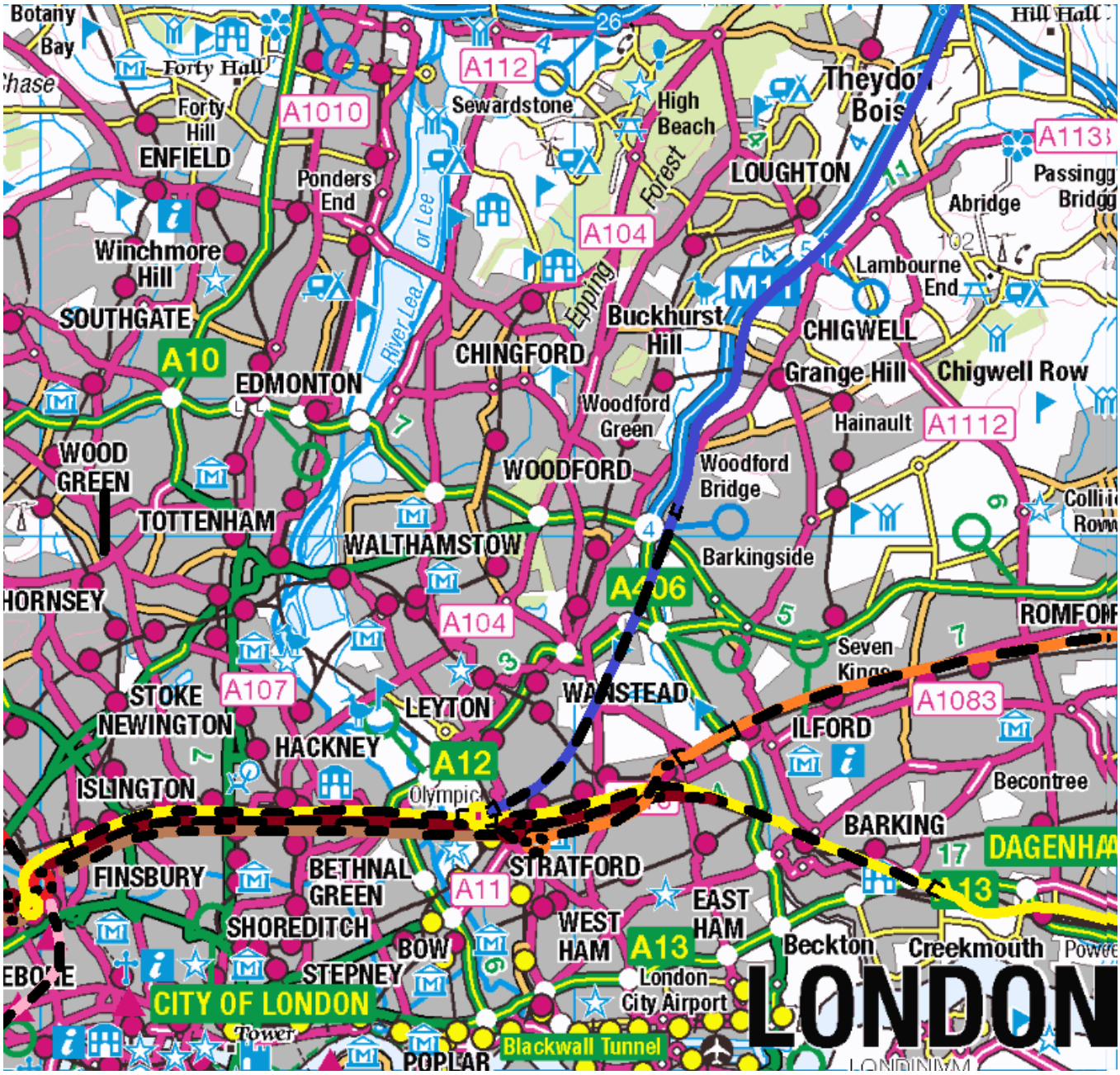
- Thurlby TF084168 HS10 diverges from HS8 main line from Peterborough to Nottingham.
- Gainsborough HS SK819895 Classic route from Retford joins HS10, which takes it over.
- Brigg TA030079 Classic route to Grimsby diverges from HS10.
- Goxhill TA097218 Local metro services between North Lincolnshire and Hull join HS10.

There are various other links between HS6/HS10 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 / St. Pancras East – Cambridge*

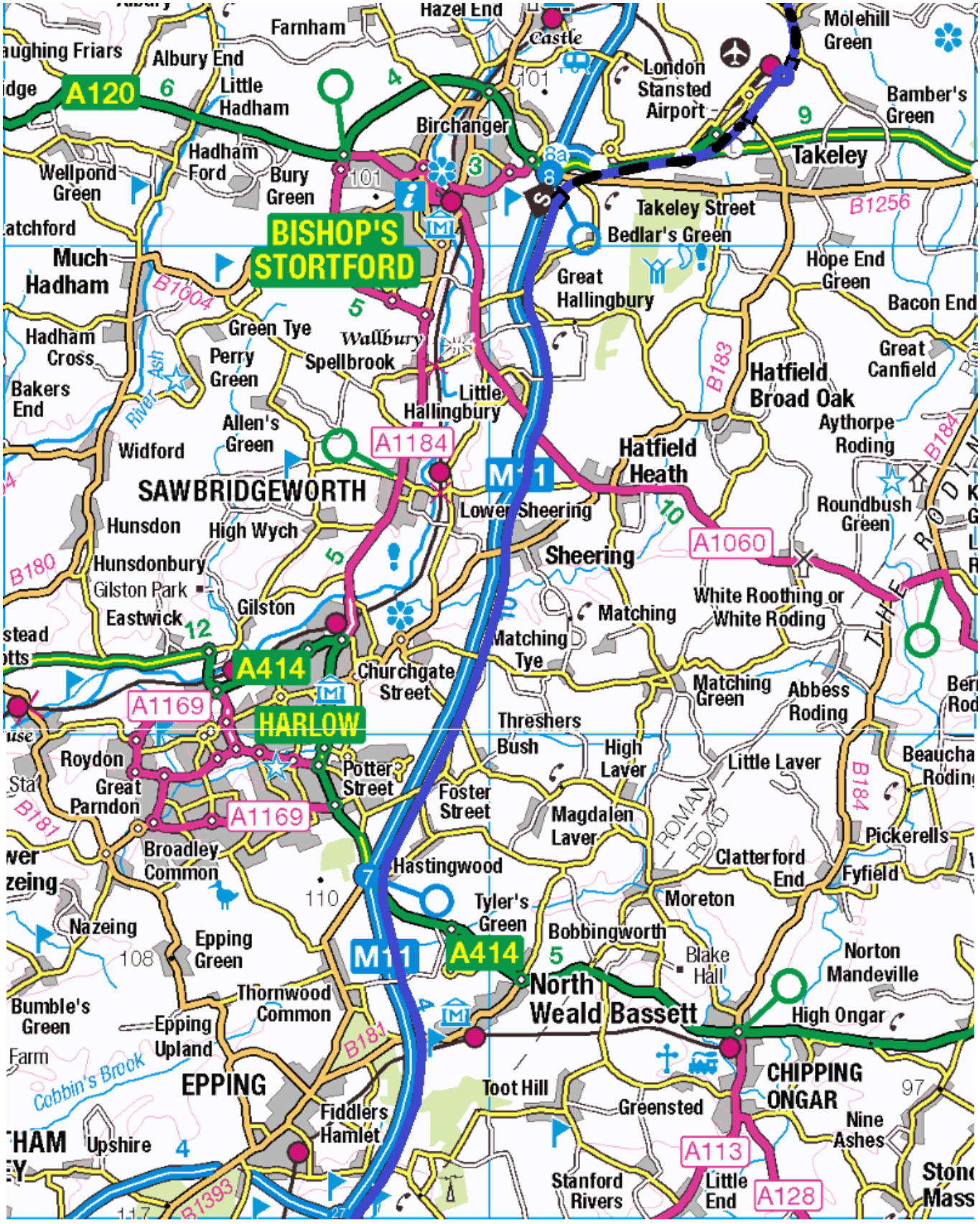
HS6 begins at Pancras Cross station, diverging immediately from HS3 at Canley St. Junction, (TQ300831, in tunnel,) emerging from tunnel and joining HS1 at York Way Junction, (TQ302841,) immediately before the entrance to the London Tunnel. It shares the route of HS1 as far as Stratford HS North, (the former Stratford International, which it never was,) taking the platform lines and diverging from HS1 at the platform ends, at Hitchcock Lane Junction, at TQ387848, so it doesn't rejoin the HS1 main lines. It then enters its own 4½ mile tunnel, emerging at TQ419911, on the east side of the alignment of the M11. It follows the east side of the M11 all the way to Cambridge, with one significant diversion, for Stansted Airport.



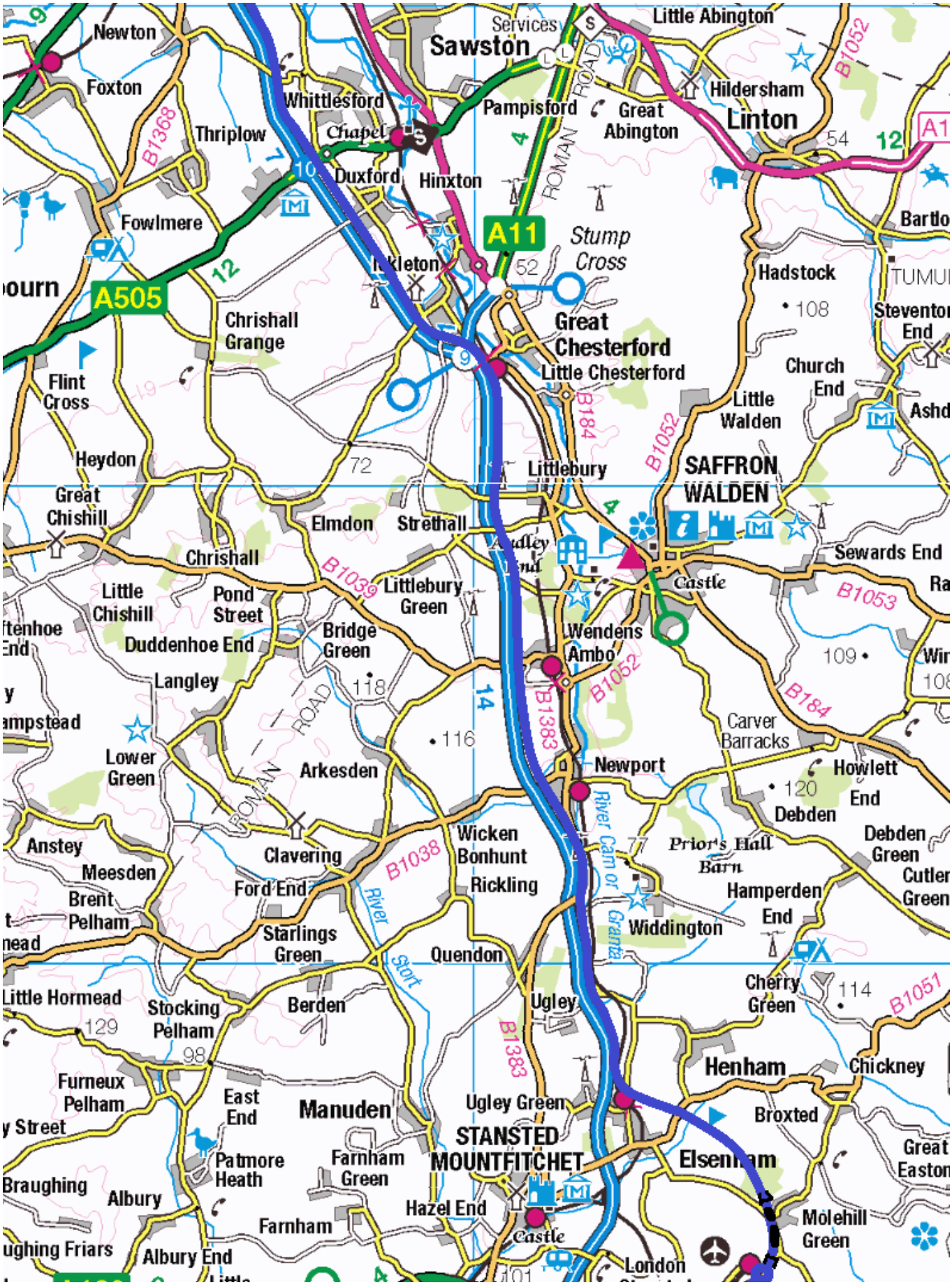
1.1 Pancras Cross – Theydon Bois

Diverging at TL514210 and immediately entering a 2½ mile tunnel, it emerges at TL550228, shortly before the existing airport station, and then continues from TL557236 in a further 1 mile tunnel, emerging at Molehill Green, TL561248. It curves to the west, crossing the B1051 at TL544270 and rejoins the east side of the M11 at TL529276, and stays with that until Cambridge, where it diverges at Junction 11 and

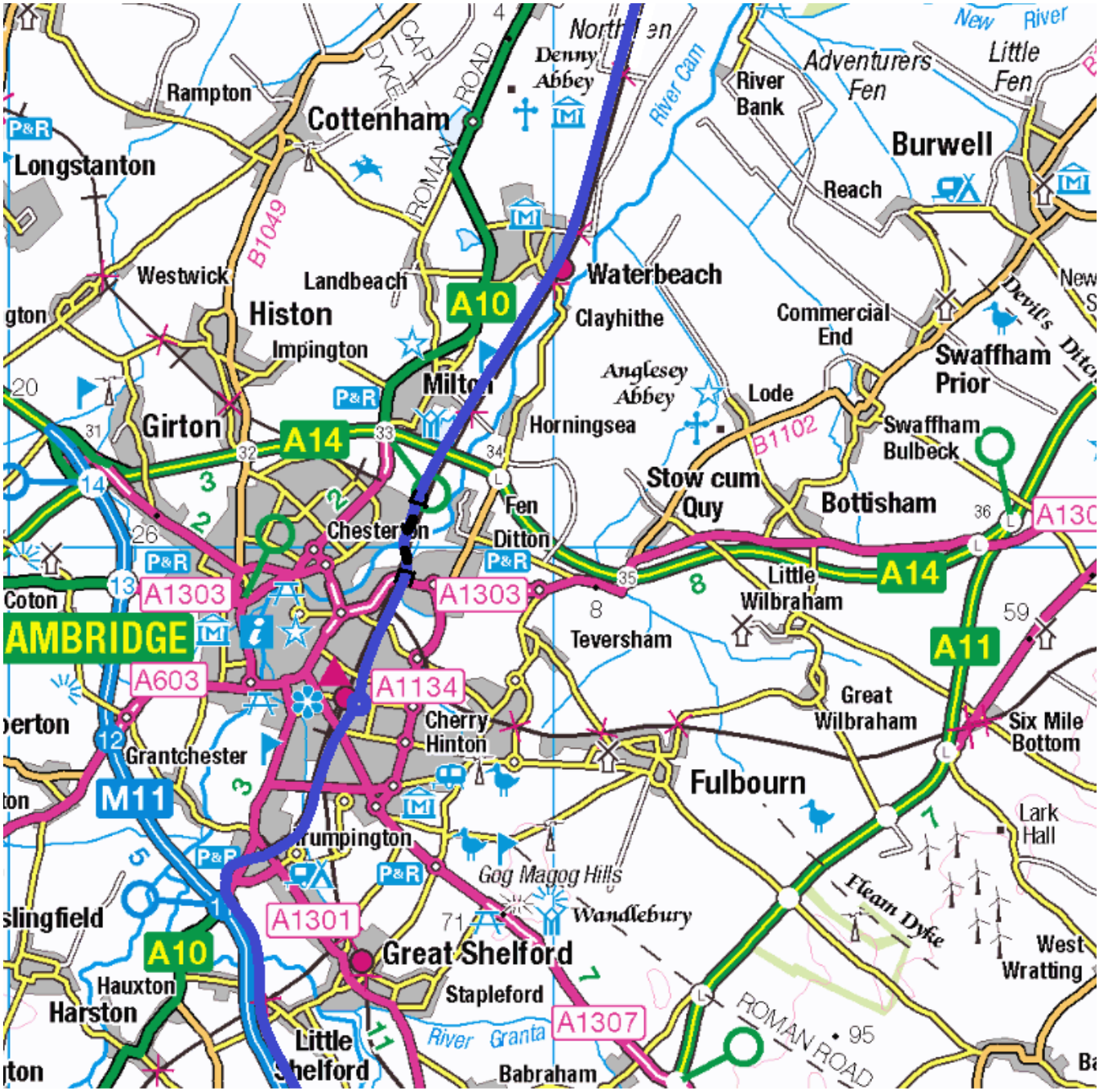
follows the west side of the A1309, past Trumpington Park & Ride to TL444544, where it joins the south side of the (presumably reopened by then!) line from Bedford to Cambridge, switching to the east side of the overall alignment as this merges with the line from London. The HS platforms are on the east side of Cambridge station.



1.2 Epping – Stansted Airport



1.3 Stansted Airport – Duxford

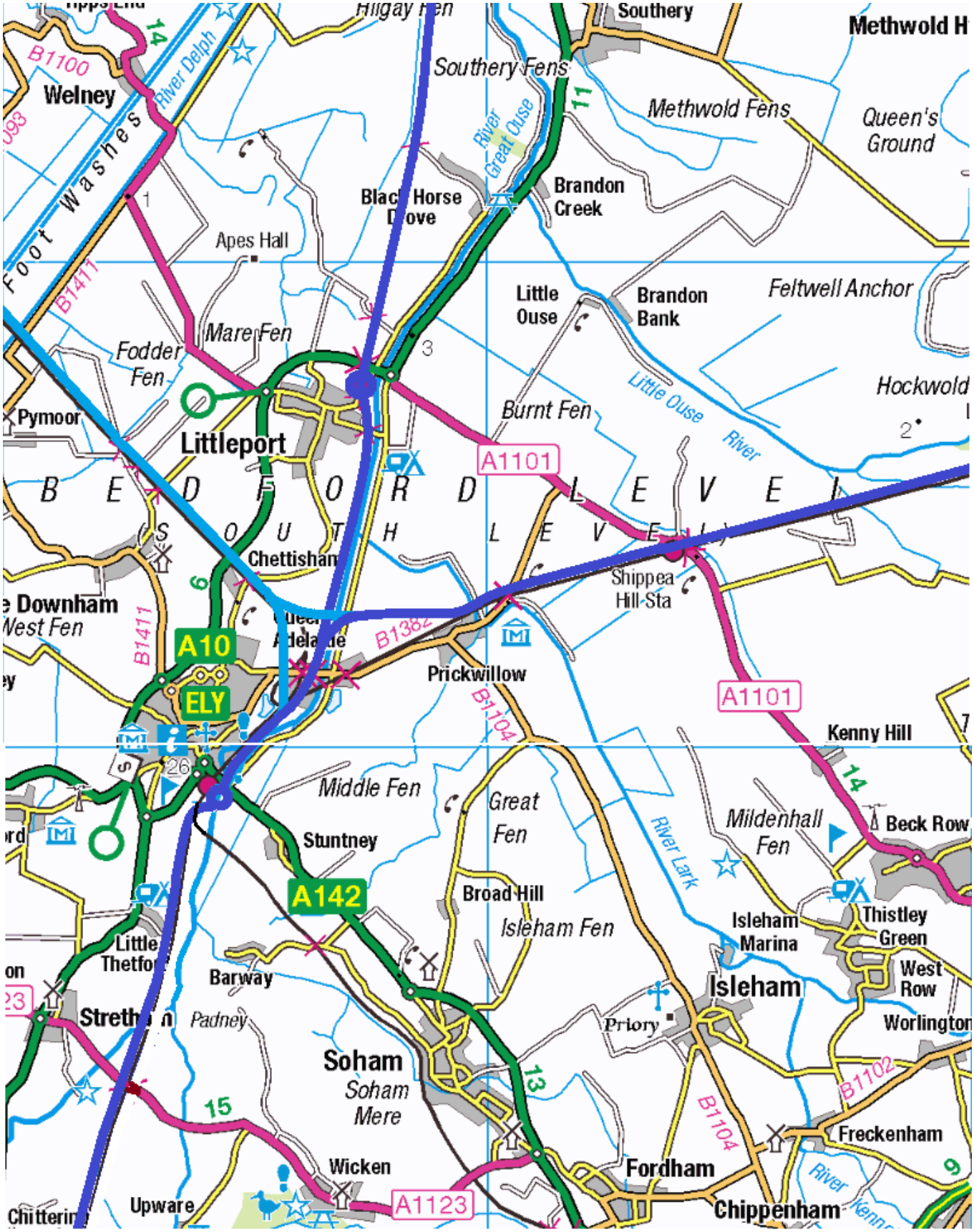


1.4/2.1 Little Shelford – Waterbeach Contains Ordnance Survey data © Crown copyright and database right 2013

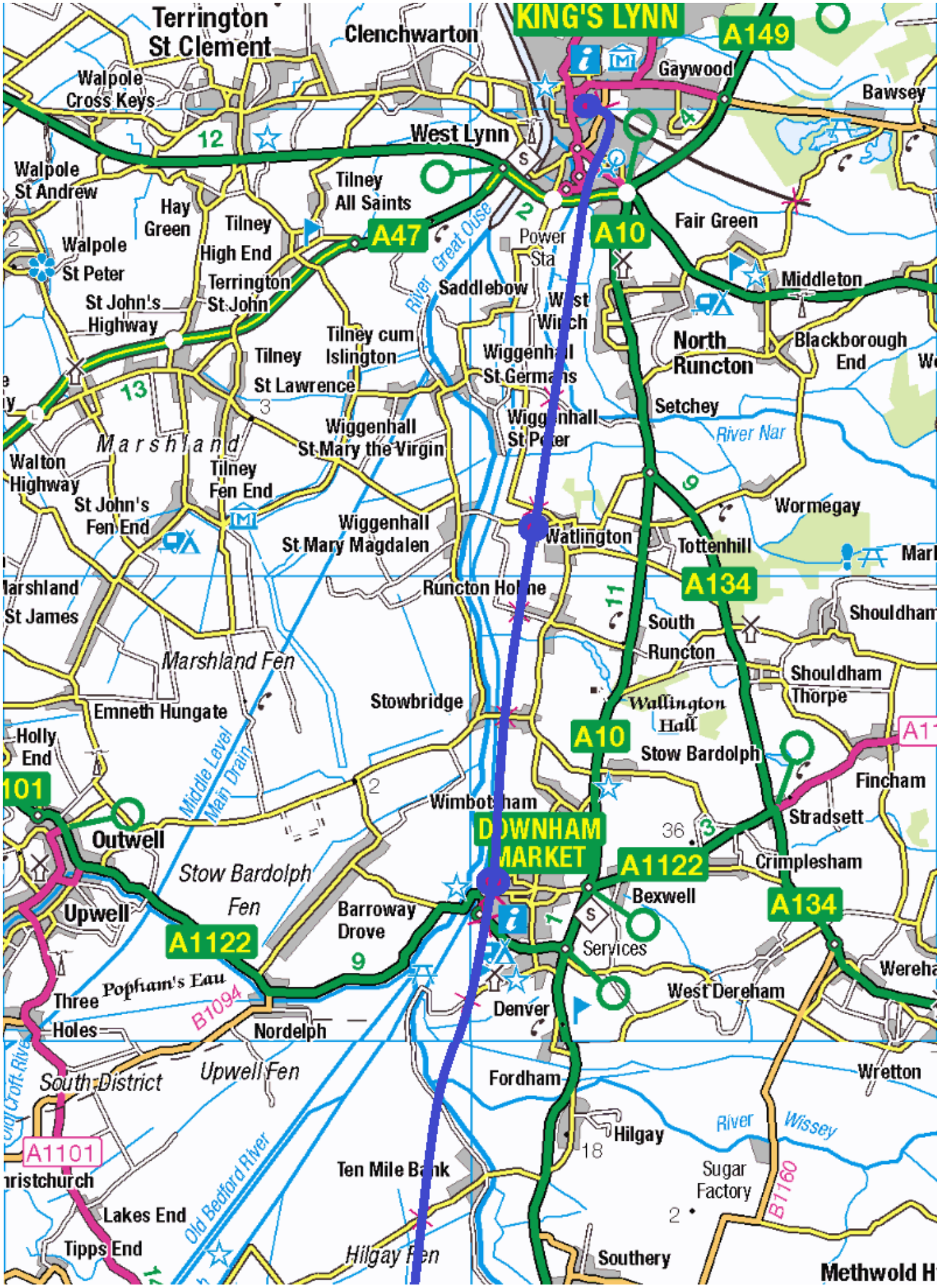
2. *HS6 Cambridge – Ely, King's Lynn and Norwich*

Leaving Cambridge on the east side of the classic alignment, HS6 enters a ¾ mile tunnel under the Cam at TL472595, emerging at TL474606, on the west side of the alignment. It follows the west side until TL539785, where it switches to the east side of the alignment, just after the line from Ipswich has joined. The HS platforms are on the east side of Ely station,

HS6 proceeds north of Ely on the east side of the classic alignment. At Ely HS South Junction (TL562812), HS6 crosses over the diverging classic route to Norwich, HS8 diverges from HS6 (for Ely HS North Junction and Peterborough, and for HS10 at Thurlby Junction,) and HS6 takes over (as a branch) the classic route to King's Lynn, redoubled as necessary and enlarged to GC gauge throughout.

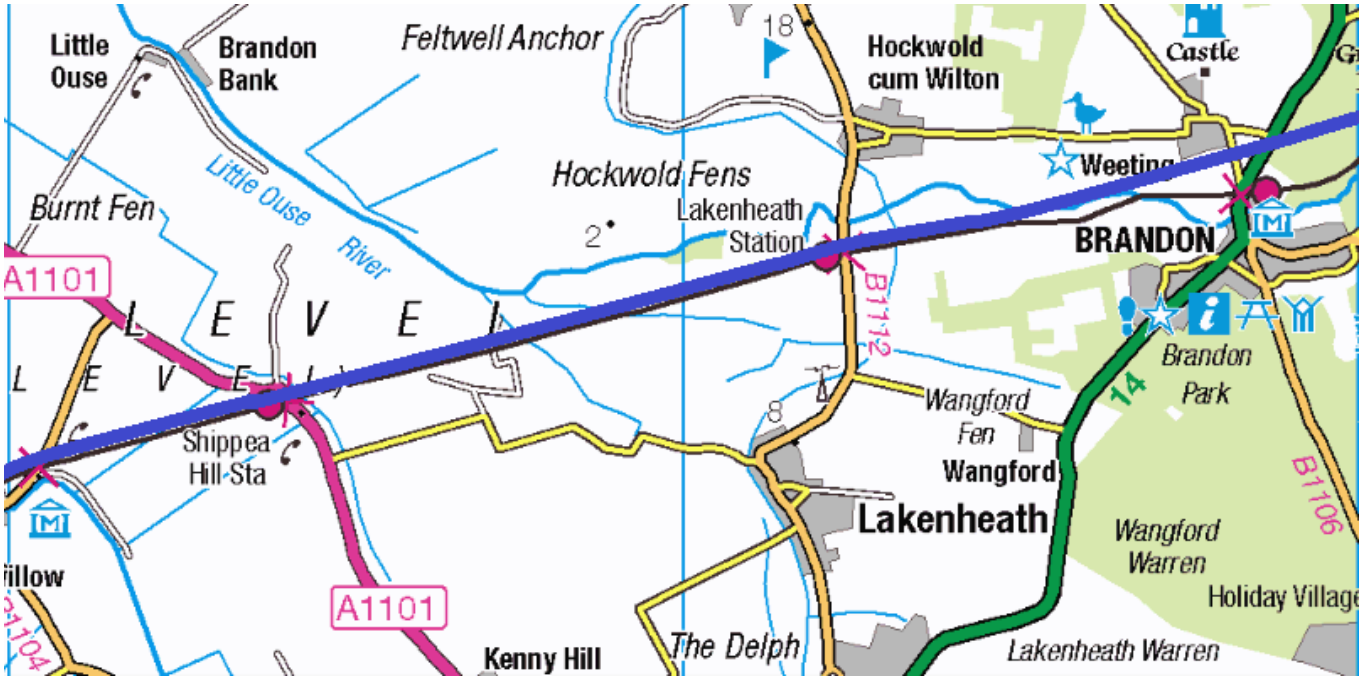


2.2 Chittering – Southery



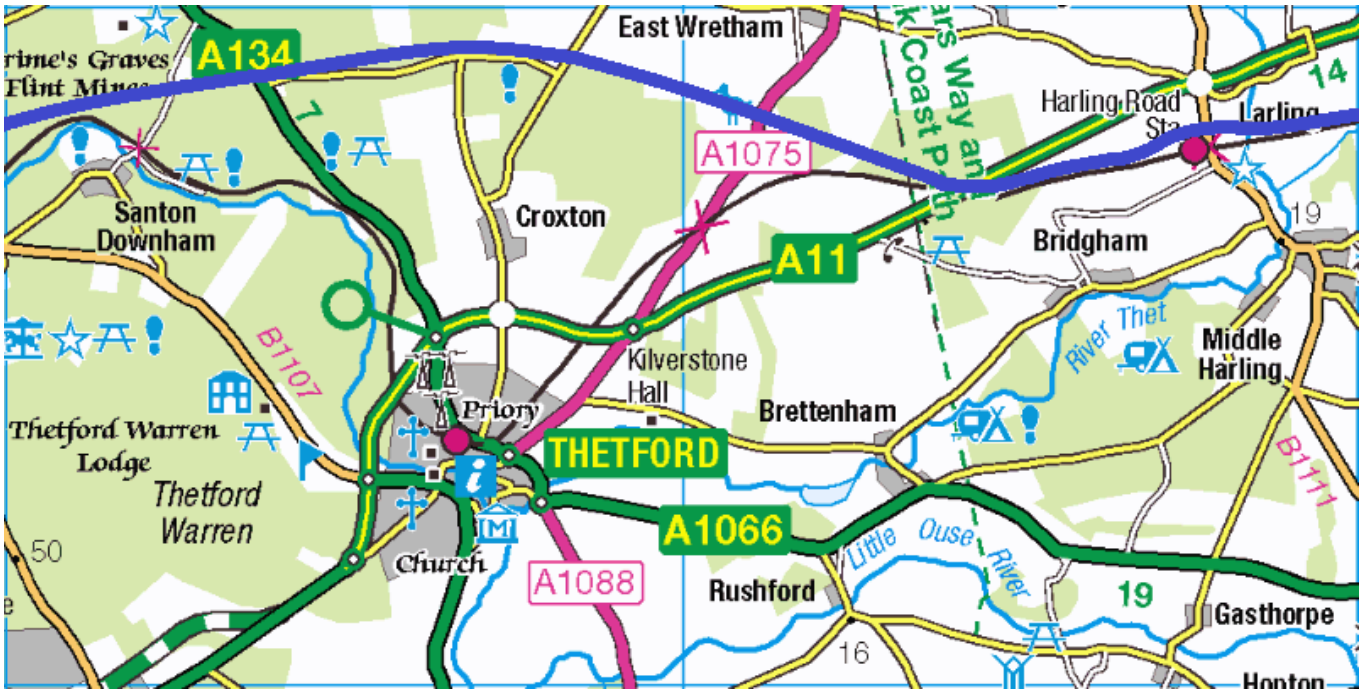
2.3 Ten Mile Bank – King's Lynn

The main line of HS6 follows the north side of the classic route to Norwich, and is joined by HS8 (to Norwich) at Ely HS East Junction (57380820).



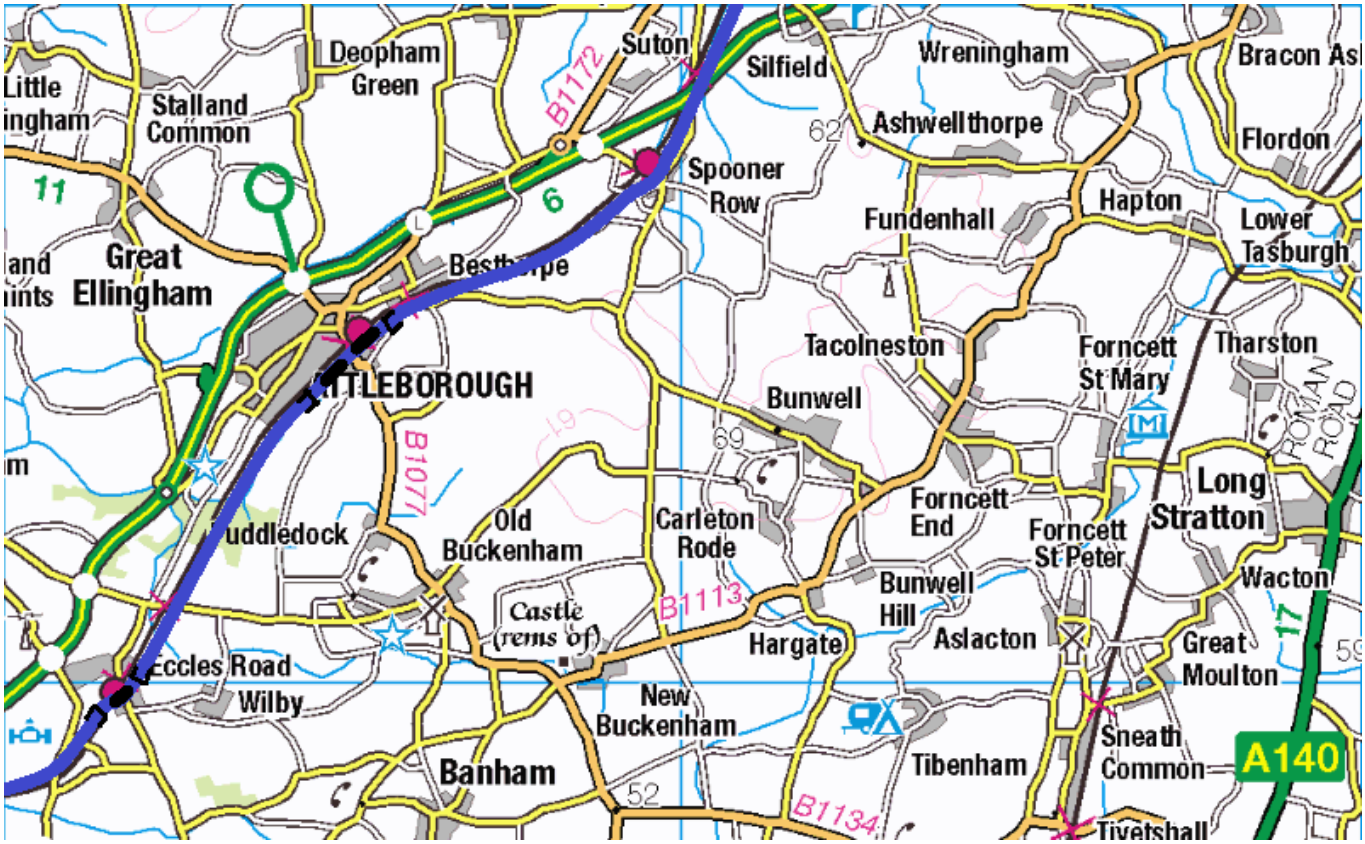
2.4 Shippea Hill – Brandon Contains Ordnance Survey data © Crown copyright and database right 2013

HS6 follows the north side of the classic alignment to Norwich as far as Brandon. There is a major diversion between Brandon and east of Thetford to improve the alignment. It diverges from the classic alignment at TL770872, passing to the north of Brandon station, crossing the A1065 at TL788881 and thereafter following closely the Harling Drove track, crossing the A134 at TL839879, the 1075 at TL911883 and finally rejoining the classic alignment at TL935874. A slight slewing to the north at Harling Road station avoids the houses there. (This route passes to the north of Croxton Hill, whereas the line through Thetford passes to the south.)

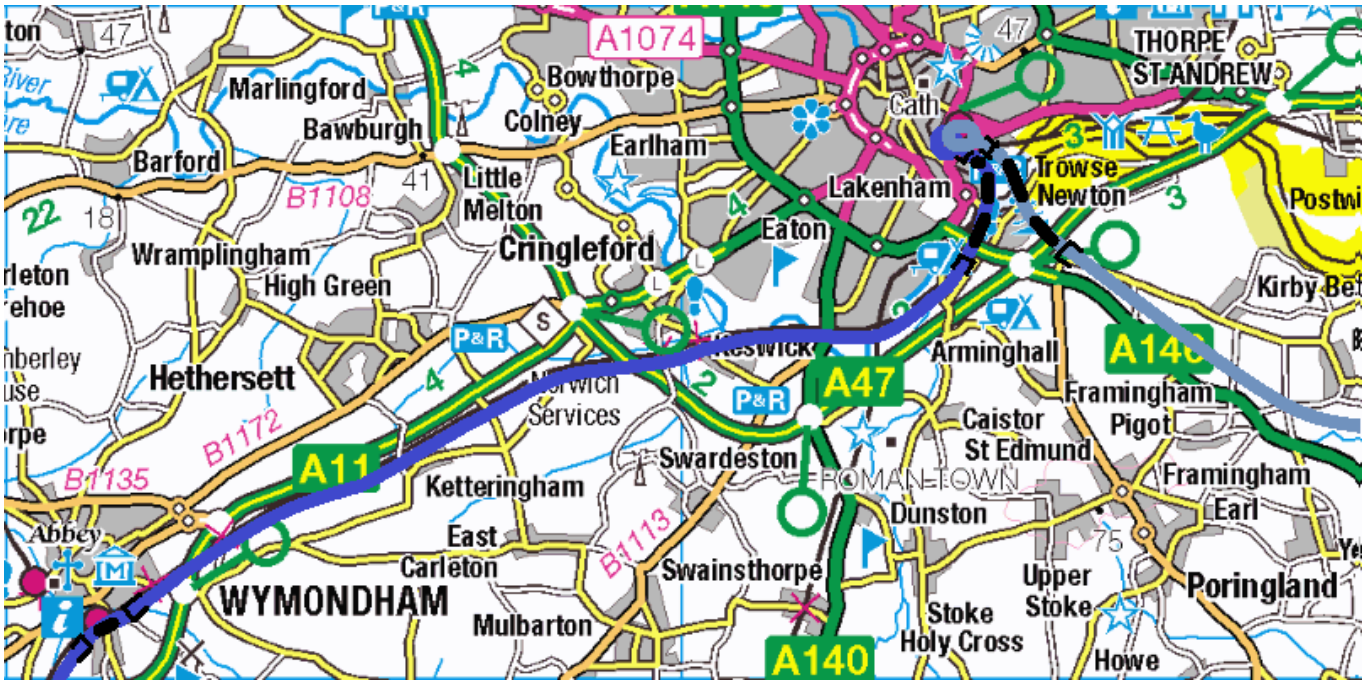


2.5 Santon Downham – Harling Road Contains Ordnance Survey data © Crown copyright and database right 2013

I believe it will be unavoidable to demolish perhaps 2 houses at Heath Crossing (TM015896).



2.6 Eccles Road – Suton Contains Ordnance Survey data © Crown copyright and database right 2013



2.7 Wymondham – Norwich Contains Ordnance Survey data © Crown copyright and database right 2013

At Eccles Road, a short, ¼ mile tunnel under the station between TM018900 and TM019902 allows HS6 to switch to the south side of the alignment, and avoid a few houses there, and a **lot** of houses on the north side at Attleborough, a few miles later. Attleborough also needs a ½ mile tunnel under the station itself, between TM047946 and TM053951. HS6 slews slightly to the south east at Spooner Row, to avoid a row of (non-domestic) buildings, and has a ½ mile tunnel under Wymondham, between TG112009 and TG118012. It continues along the south side of the alignment to Trowse Newton, where it enters a 1 mile tunnel at TG241064, emerging at Carrow Road, TG243080, just before Norwich station, where the HS platforms are on the south side. These are shared with the (much later) HS12.

3. *HS10 Thurlby Junction – Lincoln*

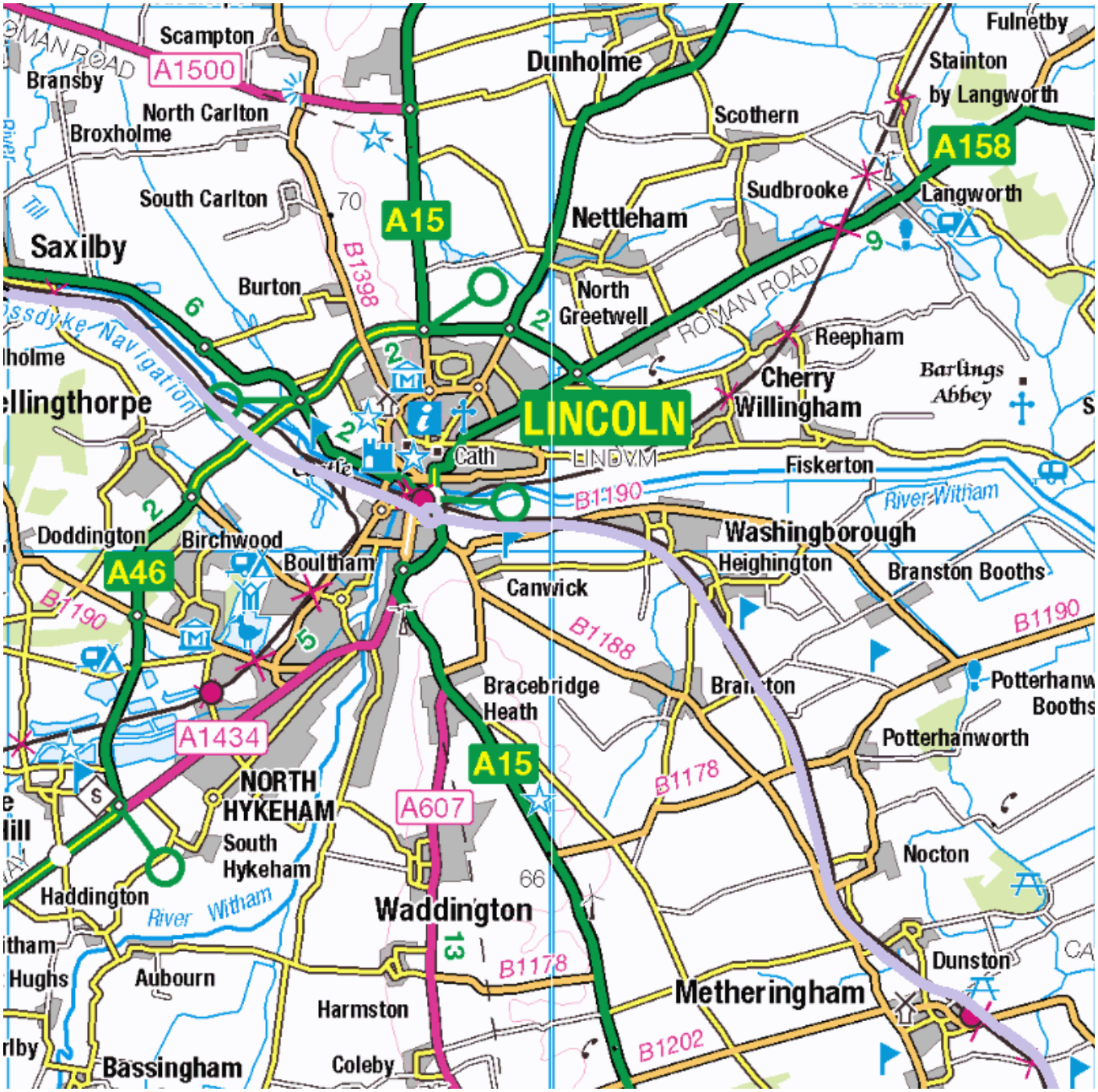
HS10 shares the routes of HS6, from London to Ely HS South Junction, and HS8 thence to Thurlby Junction (TF084168).

3.1 Thurlby Junction – Spanby

It diverges from HS8 and curves around the west side of Bourne, on a new alignment, crossing the A151 at TF080198, and the A15 at TF096221. It joins the alignment and takes over the trackbed of the long

closed line between Bourne and Sleaford at TF104228. This it follows to Sleaford, with a few minor variations, to avoid demolitions. It is slewed a short distance east at Morton (TF106268), and again at Poynton (TF121318). It takes a more substantial diversion at Billingborough, also straightening the alignment, between TF117332 and TF093392, crossing Birthorpe Road at TF110338. It diverges finally from this alignment at TF086439, veering right and crossing to the east side of the Spalding – Lincoln line, and joining the alignment at TF087450. It follows east side of the alignment until Dunston, with a diversion at Ruskington, to avoid demolitions, diverging at TF088489, crossing minor roads at TF090504 and TF092512, rejoining the alignment at TF089520. Just before Dunston, at TF065623, it crosses to the south west side of the alignment (thus far, the obstructions have been overwhelmingly on the west side, but from now on they are overwhelmingly on the north east side). It will be necessary to relocate the odd warehouse on the approach to Lincoln, but no houses.

3.2 Scredington – Blankney

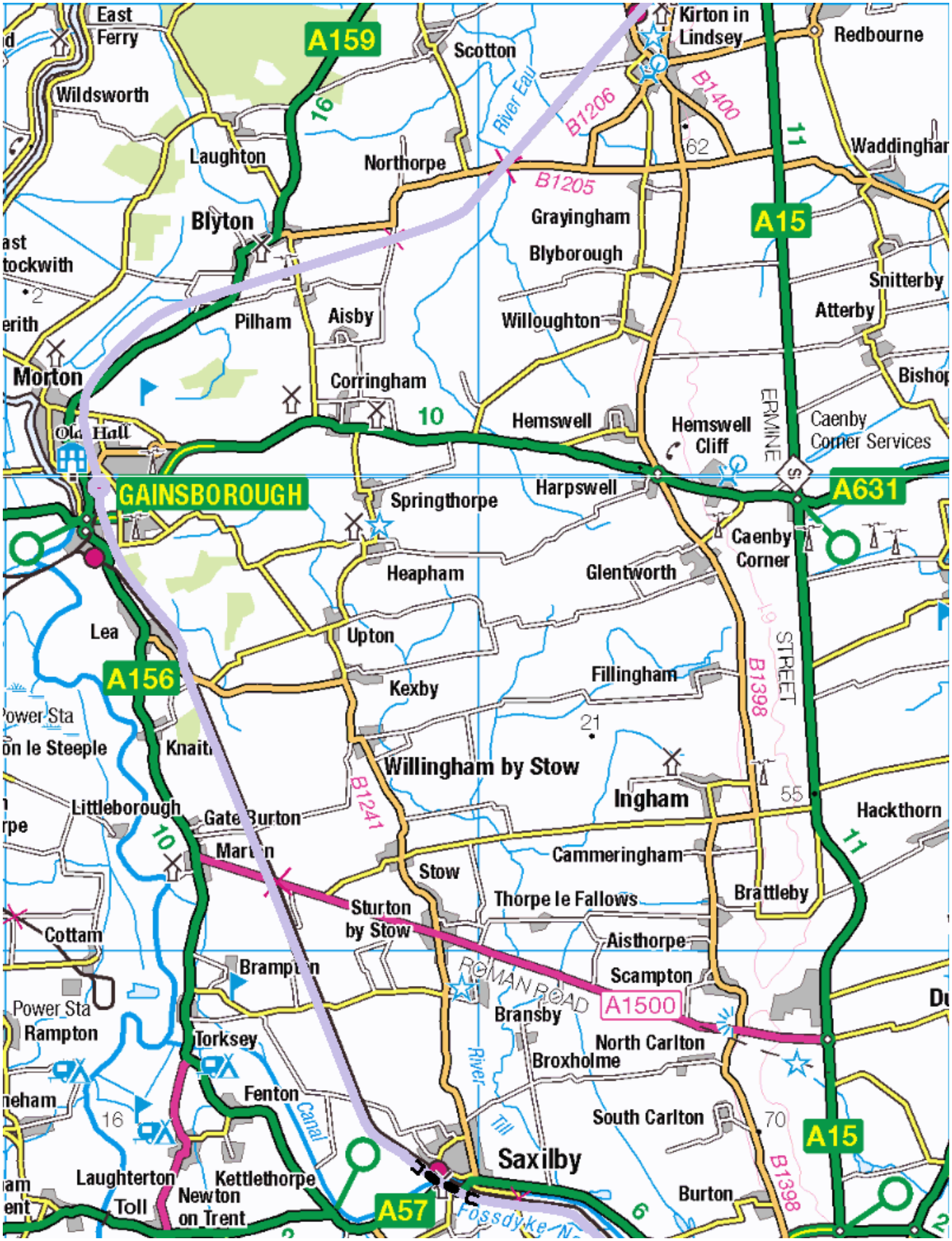


3.3 Metheringham – Saxilby

4. HS10 Lincoln – Hull

The HS platforms are located on the south side of Lincoln station. A small amount of demolition is unavoidable, in the critical section between High Street and Brayford Wharf East. Beyond there, the line is 4 track, but in this critical section, the line is just double track. A few commercial properties in the High Street will have to be relocated, and also, astonishingly, a couple of buildings belonging to the University of Lincoln. These are, presumably, fairly new buildings, and have been built far too close to the railway – particularly as there seems to be ample unused space behind them.

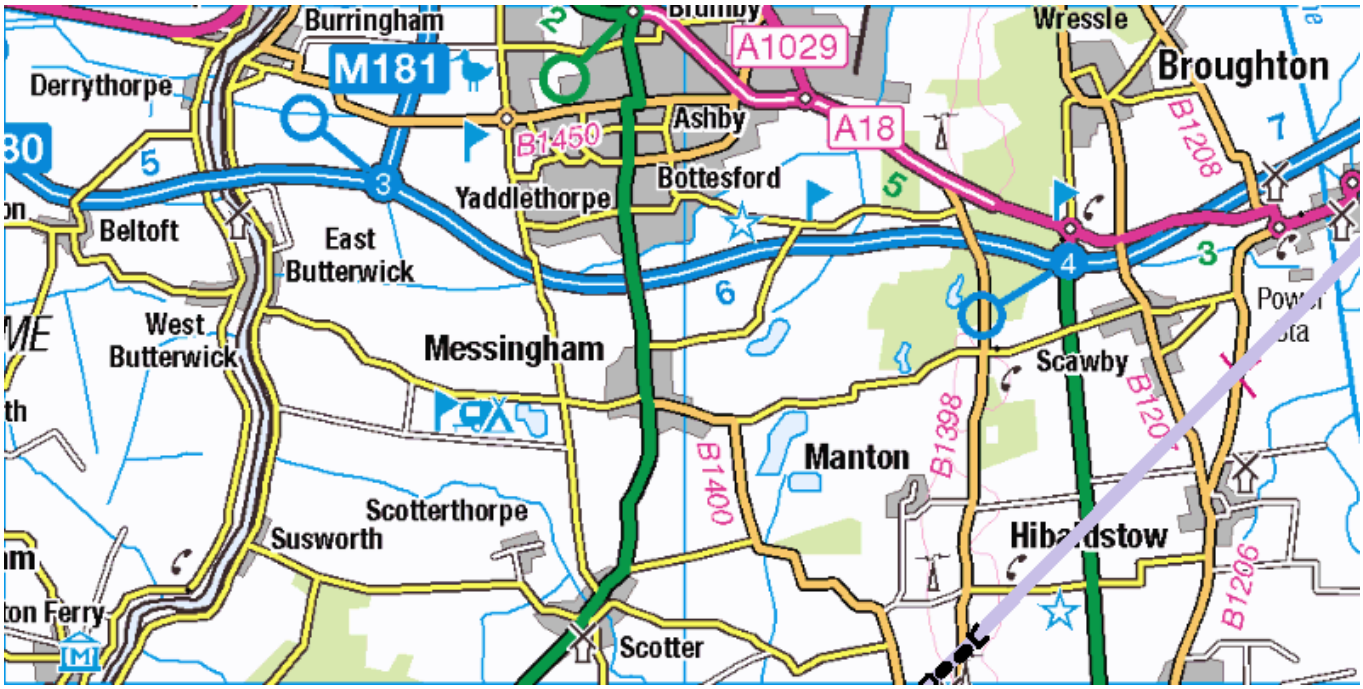
HS10 follows the south side of the alignment (with a bridge over the route to Newark) until Saxilby. Here a ¾ mile tunnel is required under the Fossdyke navigation, (and to avoid significant demolition,) between SK900750 and SK890753. It continue along the south / west side of the alignment until just before Lea, at



4.1 Saxilby – Kirton in Lindsey

SK535865, where it crosses to the east side. It diverges just before Gainsborough Lea Road station, at SK825879, crossing Foxby Lane at SK822865 and the A631 at SK820892, before joining and taking over the alignment of the Gainsborough – Grimsby line at Gainsborough HS Junction, SK819895, just before

Gainsborough Central station (enabling connections from the classic route). This line is currently almost disused, but it has a good alignment and it's in the right place, so enlarge it to GC gauge and take it over. And provide a HS service for Gainsborough and Brigg, which is now quite a reasonable size.

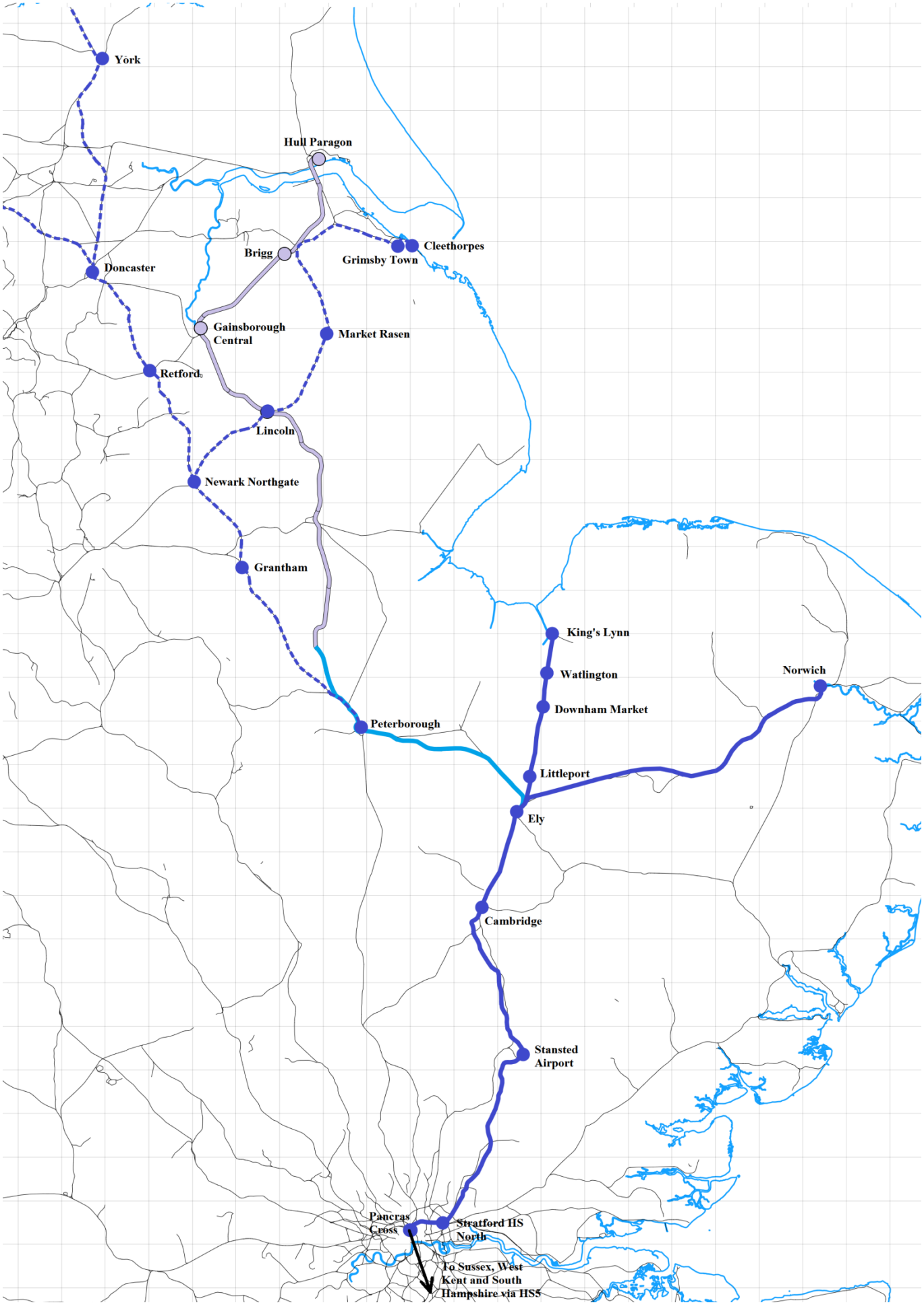


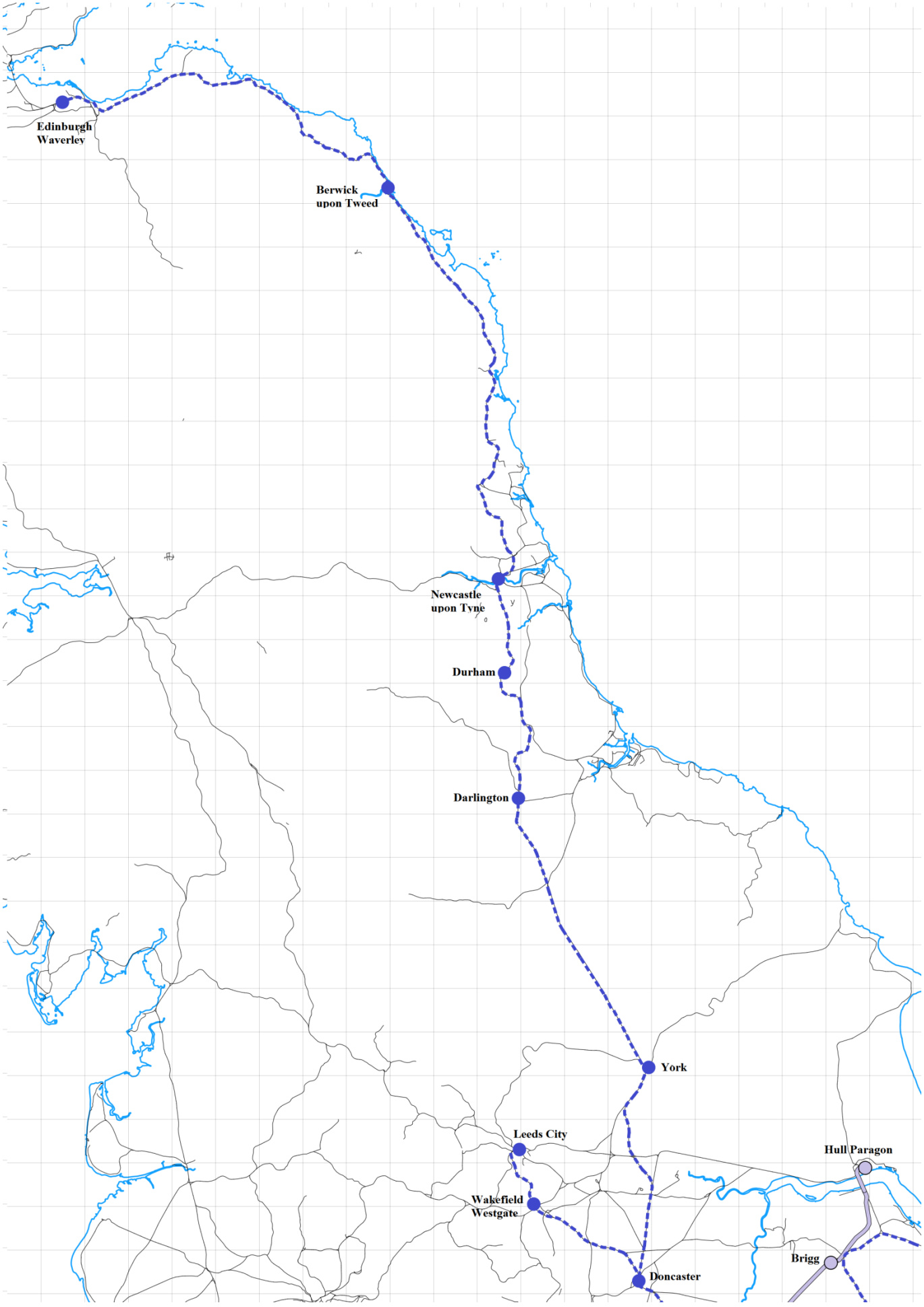
4.2 Hibaldstow – Scawby

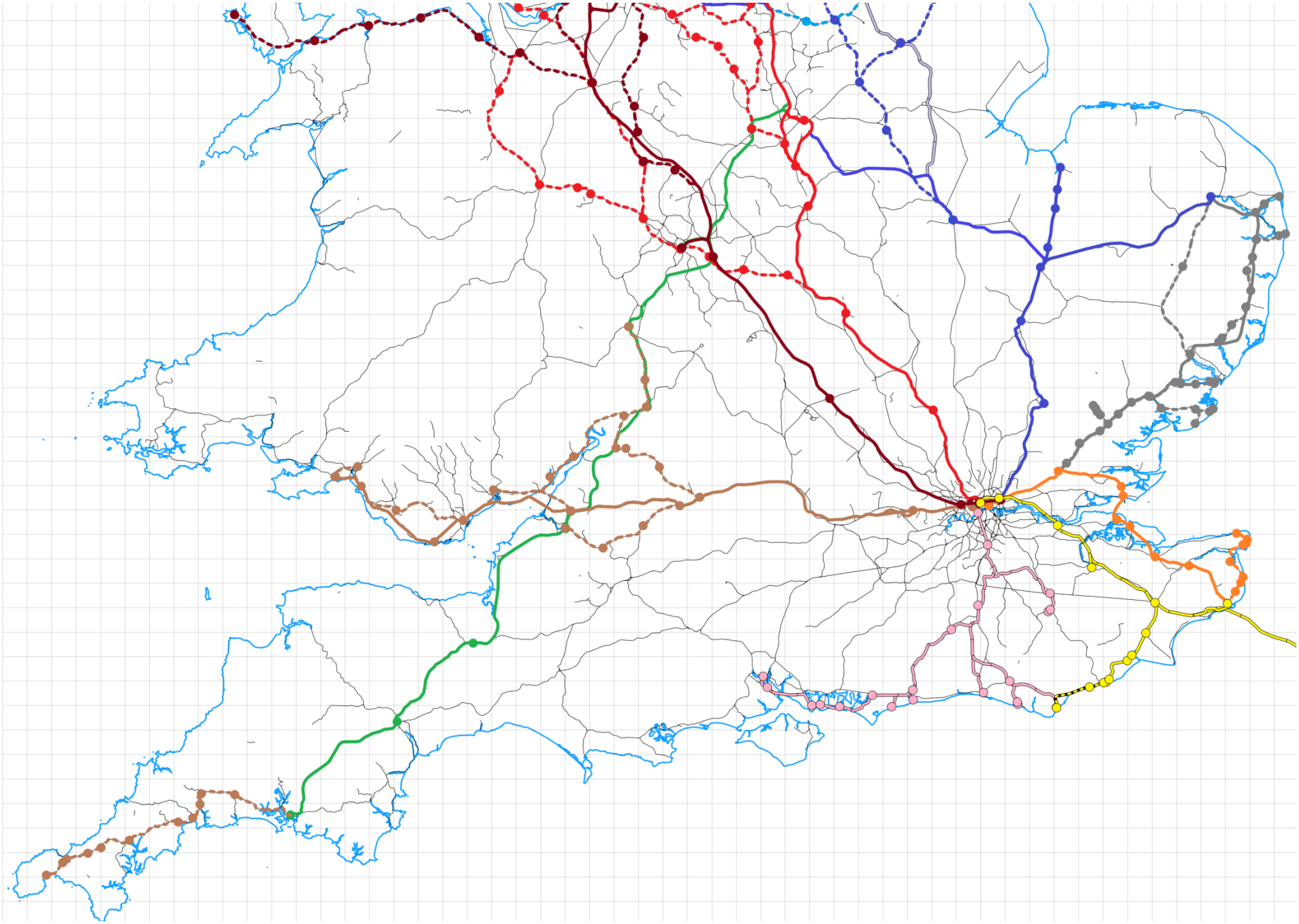
HS10 diverges from the Classic trackbed at Brigg Junction, TA030079, just before the junctions at Barnetby; a classic compatible service to Cleethorpes diverges from HS10 here. HS10 crosses the line from Doncaster via Scunthorpe, and heads on a new alignment directly to Goxhill Junction, on the line from Grimsby to New Holland and Barton-upon-Humber. It crosses the A180 at TA058114, a minor road at TA065134, the A1077 at TA099150, Thornton Road at TA091189, and College Road at TA090202, arriving at Goxhill Junction (TA097218) where there is a connection from the classic route. HS10 immediately enters a 4½ mile tunnel under the Humber, emerging at TA080288, just before Paragon station.

Although built to GC gauge, this last section under the Humber is shared with classic traffic, in particular, a metro service between Cleethorpes and Hull.

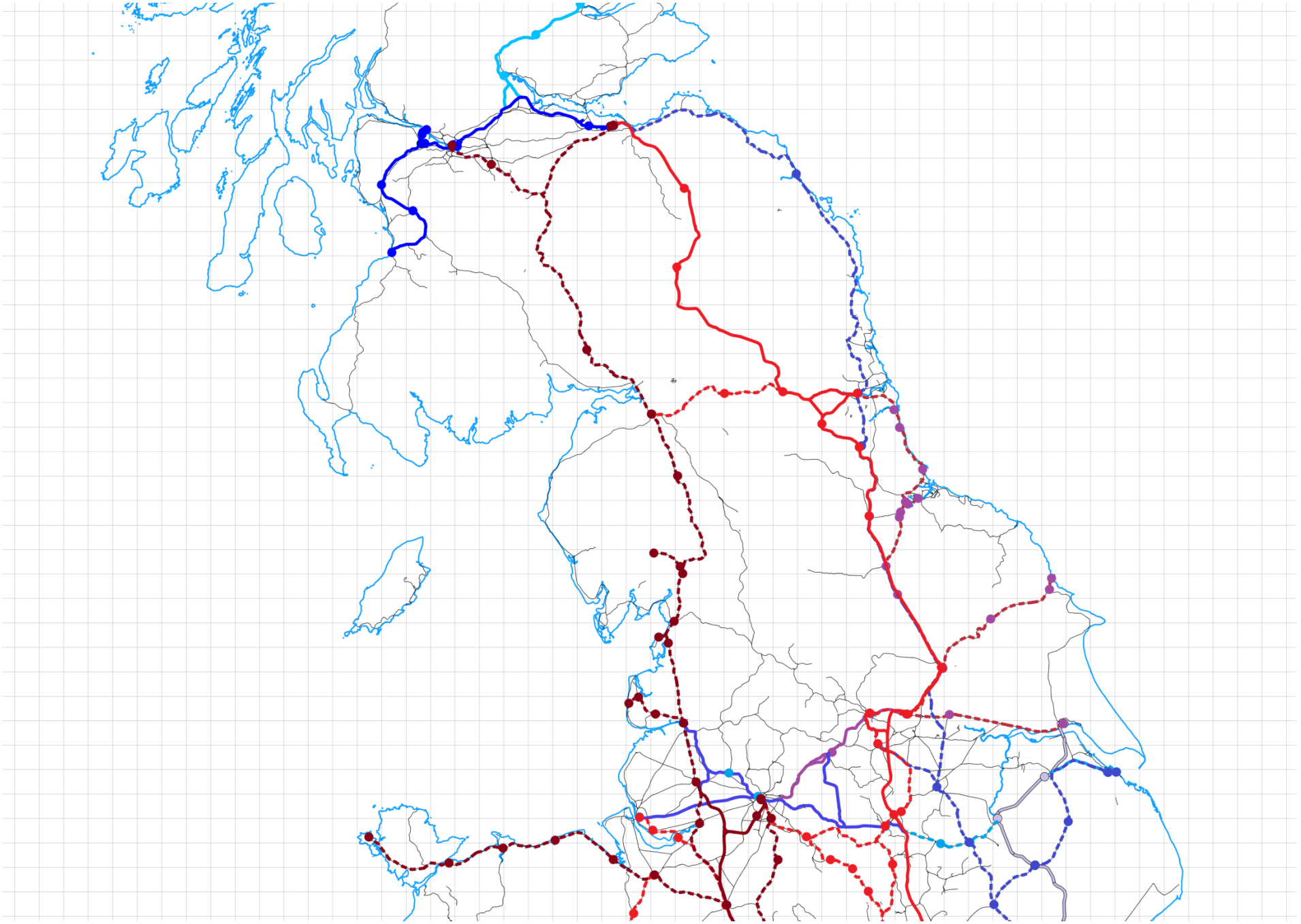
4.3 Brigg – Hull



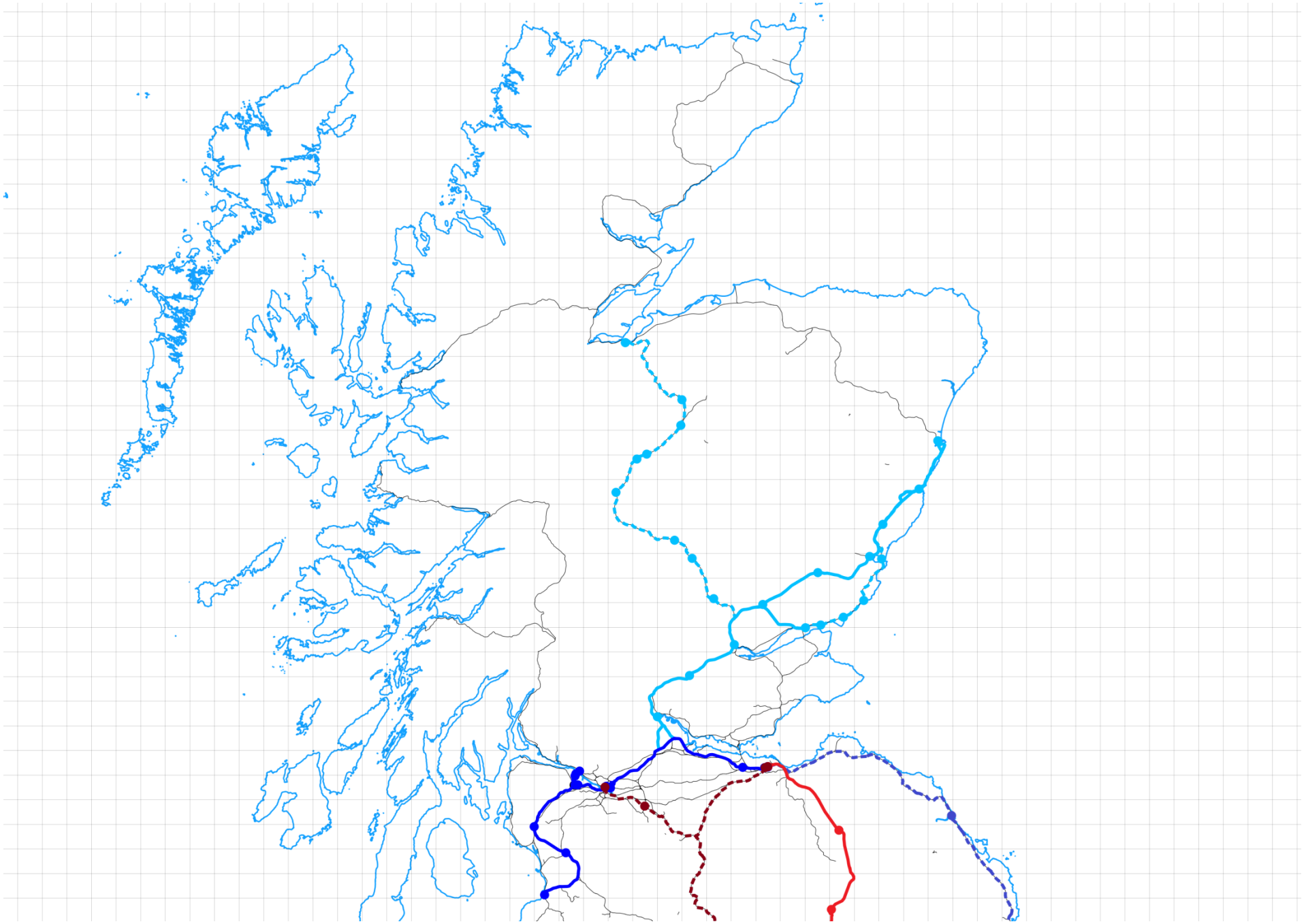




Complete HS Network, South Sheet



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 HS6 itself. This most commonly occurs when a new section of HS6 opens, but it may also be a consequence of a change on some other HS route.

The service plans use the following notation:

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

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

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

Service Plan 1

The first service plan comes into operation when:

- HS6 opens in full between Pancras Cross and King's Lynn
- the Southampton branch of HS5 opens, as far as the branches to Littlehampton and Bognor

The single service is provided:

- 2tphGG [Bognor / Littlehampton –>] Pancras Cross – Stratford HS North – Stansted Airport – Cambridge – Ely – Littleport – Downham Market – Watlington –King's Lynn

(As always, we open a new section as soon as possible, to get services running.)

Regional Metro:

- 2tphR Harwich Town – Harwich International – Ipswich – Bury St. Edmunds – Ely – March – Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street
- 2tphR Morecambe – Lancaster – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. – Manchester Piccadilly – Stockport – Chinley – Sheffield Midland (reverse) – Chesterfield – Alfreton and Mansfield Parkway – Langley Mill – Nottingham – Melton Mowbray – Oakham – Stamford – Peterborough – March – Ely (split/joins):
  – (reverse) Thetford – Wymondham – Norwich
  – Cambridge – Stansted Airport

Representative Hourly Non-Cross-Platform Interchange Pattern at Ely:

00GG [Bognor / Littlehampton –>] Pancras Cross – King's Lynn
R Harwich Town – Birmingham New St.
R Morecambe –Norwich

It imposes the following loadings on HS6 (the sections shared with HS1 and HS3 include all the other services using those sections):

- Pancras Cross – Canley Street Junction 12tph
- Canley Street Junction – York Way Junction 2tph
- St. Pancras (East) – York Way Junction 2tph*
- York Way Junction – Hitchcock Lane Junction 8tph*
- Hitchcock Lane Junction – Ely HS South Junction 2tph
- Ely HS South Junction – Ely HS North Junction 0tph
- Ely HS South Junction – King's Lynn 2tph
- Ely HS South Junction – Ely HS East Junction 0tph
- Ely HS East Junction – Norwich 0tph
- Ely HS East Junction – Ely HS North Junction 0tph
- Ely HS North Junction – Pellett Hall Junction 0tph
- Pellett Hall Junction – Thurlby Junction 0tph
- Thurlby Junction – Gainsborough HS Junction 0tph
- Gainsborough HS Junction – Brigg Junction 0tph
- Brigg Junction – Goxhill Junction 0tph
- Goxhill Junction – Hull Paragon station 0tph

(* I'm allowing for 4tph international traffic on HS1, and also HS1 has a single classic-compatible service of 2tph.)

Service Plan 2

This service plan comes into operation when:

- HS6 opens between Ely HS South Junction and Norwich
- HS8 opens between Ely HS South and East Junctions and Nottingham
- HS5 opens between Barnham HS Junction and Southampton

The remaining services are introduced. The full service is:

- 2tphG [Southampton –>] Pancras Cross – Stratford HS North – Stansted Airport – Cambridge – Ely – Norwich
- 2tphG [Southampton –>] Pancras Cross – Stratford HS North – Stansted Airport – Cambridge – Ely – Peterborough (temporary, until HS10 opens)
- 2tphG Norwich – Peterborough (temporary, until HS10 opens)
- 2tphGG [Bognor / Littlehampton –>] Pancras Cross – Stratford HS North – Stansted Airport – Cambridge – Ely – Littleport – Downham Market – Watlington –King's Lynn

- 2tphGG HS8/HS3 Norwich – Peterborough – Nottingham – Sheffield HS – Manchester HS – Manchester Victoria LL – Bolton – Preston
- 2tphG HS8/HS7/HS4 Norwich – Peterborough – Nottingham – Derby – Birmingham Interchange – Worcester Shrub Hill – Cheltenham Spa – Bristol Parkway HS – Cardiff HS – Cardiff (Rhoose) Airport – Port Talbot – Swansea
- 2tphC St. Pancras (East) – Stratford HS North – Stansted Airport – Cambridge – Ely – Peterborough – Doncaster – York – Darlington – Durham – Newcastle – Berwick – Edinburgh Waverley
- 2tphC St. Pancras (East) – Stratford HS North – Stansted Airport – Cambridge – Ely – Peterborough – Grantham – Newark – Retford – Doncaster – Wakefield Westgate – Leeds City
- 2tphC St. Pancras (East) – Stratford HS North – Stansted Airport – Cambridge – Ely – Peterborough – Grantham – Newark – Lincoln – Market Rasen – Grimsby Town – Cleethorpes

(Note that the HS8 services were already, prior to this service plan, running west of Nottingham.)

Regional Metro:

- 2tphR Harwich Town – Harwich International – Ipswich – Bury St. Edmunds – Ely – March – Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street
- 2tphR Morecambe – Lancaster – Preston – Leyland – Chorley – Horwich Parkway – Bolton – Salford Crescent – Manchester Oxford Rd. – Manchester Piccadilly – Stockport – Chinley – Sheffield Midland (reverse) – Chesterfield – Alfreton and Mansfield Parkway – Langley Mill – Nottingham – Melton Mowbray – Oakham – Stamford – Peterborough – March – Ely (split/joins):
  – (reverse) Thetford – Wymondham – Norwich
  – Cambridge – Stansted Airport
- 2tphRS Cambridge – Chesterton – Waterbeach – Ely – Shippea Hill – Lakenheath – Brandon – Thetford – Harling Road – Eccles Road – Attleborough – Spooner Row – Wymondham – Norwich
- 2tphRS Cambridge – Chesterton – Waterbeach – Ely – Manea – March – Whittlesea – Peterborough

Service Plan 2A

This service plan comes into operation when HS10 opens between Thurlby Junction and Hull.

The Southampton – Peterborough service is extended to Hull:

- 2tphG {Southampton –>] Pancras Cross – Stratford HS North – Stansted Airport – Cambridge – Ely – Peterborough – Lincoln – Gainsborough Central – Brigg – Hull Paragon.
- 2tphG Norwich – Peterborough – Lincoln – Gainsborough Central – Brigg – Hull Paragon.

Representative Hourly Non-Cross-Platform Interchange Pattern at Ely:

00GG [Bognor / Littlehampton –>] Pancras Cross – King's Lynn
R Harwich Town – Birmingham New St.
R Morecambe –Norwich

05C St. Pancras East – Edinburgh Waverley (no connection)

10G [Southampton –>] Pancras Cross – Hull Paragon
RS Cambridge – Norwich

15C St. Pancras East – Leeds City (no connection)

20GG [Southampton –>] Pancras Cross – Norwich
RS Cambridge – Peterborough

25C St. Pancras East – Cleethorpes (no connection)

Representative Hourly Cross-Platform Interchange Pattern at Peterborough:

00G [Southampton –>] Pancras Cross – Hull Paragon
GG Norwich – Swansea
RS Cambridge – Peterborough (not cross-platform)

15G Norwich – Hull Paragon
C St. Pancras (East) – Cleethorpes

– repeating at 30 and 45 minutes past.

It is recognised that there is unlikely to be much demand to travel from London to Birmingham and South Wales via Peterborough, but connections for Nottingham and Derby are still worthwhile.

Representative Hourly Cross-Platform Interchange Pattern at Lincoln:

00G [Southampton –>] Pancras Cross – Hull Paragon
C St. Pancras (East) – Cleethorpes

15G Norwich – Hull Paragon
C HS7 Birmingham HS – Cleethorpes

– repeating at 30 and 45 minutes past.

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

Service plan 2 overall imposes the following loadings on HS6 and HS10 (the sections shared with HS1 and HS3 include all the other services using those sections):

- Pancras Cross – Canley Street Junction 16tph
- Canley Street Junction – York Way Junction 6tph
- St. Pancras (East) – York Way Junction 8tph
- York Way Junction – Hitchcock Lane Junction 18tph
- Hitchcock Lane Junction – Ely HS South Junction 12tph
- Ely HS South Junction – Ely HS North Junction 8tph
- Ely HS South Junction – King's Lynn 2tph
- Ely HS South Junction – Ely HS East Junction 2tph
- Ely HS East Junction – Norwich 8tph
- Ely HS East Junction – Ely HS North Junction 6tph
- Ely HS North Junction – Pellett Hall Junction 14tph
- Pellett Hall Junction – Thurlby Junction 8tph
- Thurlby Junction – Gainsborough HS Junction 4tph
- Gainsborough HS Junction – Brigg Junction 8tph
- Brigg Junction – Goxhill Junction 6tph
- Goxhill Junction – Hull Paragon station 14tph*

(* Allowing 8tph local services Cleethorpes / Barton upon Humber to Hull.)

The section from Gainsborough to Brigg Junction and Goxhill Junction is also carrying HS8 classic-compatible services, 2tph Liverpool – Hull and 2tph Liverpool – Cleethorpes.

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 Cambridge – Ely, my estimate 23km, actual 22.4km; Lincoln - Gainsborough my estimate 25km, actual 25.6km; Gainsborough - Brigg, my estimate 26km, actual 26.4km) 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 – Stratford HS North 8km
- Stratford HS North – Stansted Airport 45km
- Stansted Airport – Cambridge 37km
- Cambridge – Ely 23km
- Ely – Norwich 80km
- Ely – Peterborough 45km
- Norwich – Peterborough 121km
- Peterborough – Lincoln 85km
- Lincoln – Gainsborough Central 25km
- Gainsborough Central – Brigg 26km
- Brigg – Hull Paragon 25km

The above are all distances on HS6 or HS10 themselves.

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 Stratford HS North (start to stop) is 292 seconds

The final time needs 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 time is 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.

We now proceed to the results.

1. Pancras Cross – Norwich (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 - Stratford HS North	8	8	4.9	4.9	4.9
Stratford HS North - Stansted Airport	45	53	12.7	17.6	20.6
Stansted Airport - Cambridge	37	90	11.1	28.7	34.7
Cambridge - Ely	23	113	8.3	37.0	46.0
Ely - Norwich	80	193	19.7	56.8	68.8

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

- Stansted Airport 45 [21]
- Cambridge 46 [35]
- Ely 67 [46]
- Norwich 108 [69]

2. Pancras Cross / Norwich – Hull Paragon (8/4 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from London/Norwich, inc. Station Wait Times
Pancras Cross - Stratford HS North	8	8	4.9	4.9	4.9
Stratford HS North - Stansted Airport	45	53	12.7	17.6	20.6
Stansted Airport - Cambridge	37	90	11.1	28.7	34.7
Cambridge - Ely	23	113	8.3	37.0	46.0
Ely - Peterborough	45	158	12.7	49.8	61.8
Peterborough - Lincoln	85	243	20.7	70.5	85.5
Lincoln - Gainsborough Central	25	268	8.7	79.2	97.2
Gainsborough Central - Brigg	26.0	294	8.9	88.1	109.1
Brigg - Hull Paragon	25.0	319	8.7	96.8	120.8
Norwich - Peterborough	121	121	27.9	27.9	27.9
Peterborough - Lincoln	85	206	20.7	48.6	51.6
Lincoln - Gainsborough Central	25	231	8.7	57.3	63.3
Gainsborough Central - Brigg	26.0	257	8.9	66.3	75.3
Brigg - Hull Paragon	25.0	282	8.7	75.0	87.0

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

- Stansted Airport 45 [21]
- Cambridge 46 [35]
- Ely 67 [46]
- Peterborough 45 [62]
- Lincoln 118 [86]
- Gainsborough 112 (1 change) [98]
- Brigg 187 (1 change) [109]
- Hull Paragon 148 [121]

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

- Peterborough 86 [28]
- Lincoln 176 (1 change) [52]
- Gainsborough 223 (2 changes) [64]
- Hull Paragon 238 (2 changes) [87]

Okay so even a HS train can't, travelling via Cambridge and Ely, and with 4 intermediate stops, beat a current non-stop dash to Peterborough, straight up the ECML (actually it could, if it were non-stop or 1 stop, since each station stop imposes a time penalty of c.7 minutes), but it beats the best current to Hull, even travelling via Cambridge, Ely **and Lincoln**, and with 8 intermediate stops, by a very comfortable margin.

Appendix A – Pancras Cross and the Inter-Regional Connections

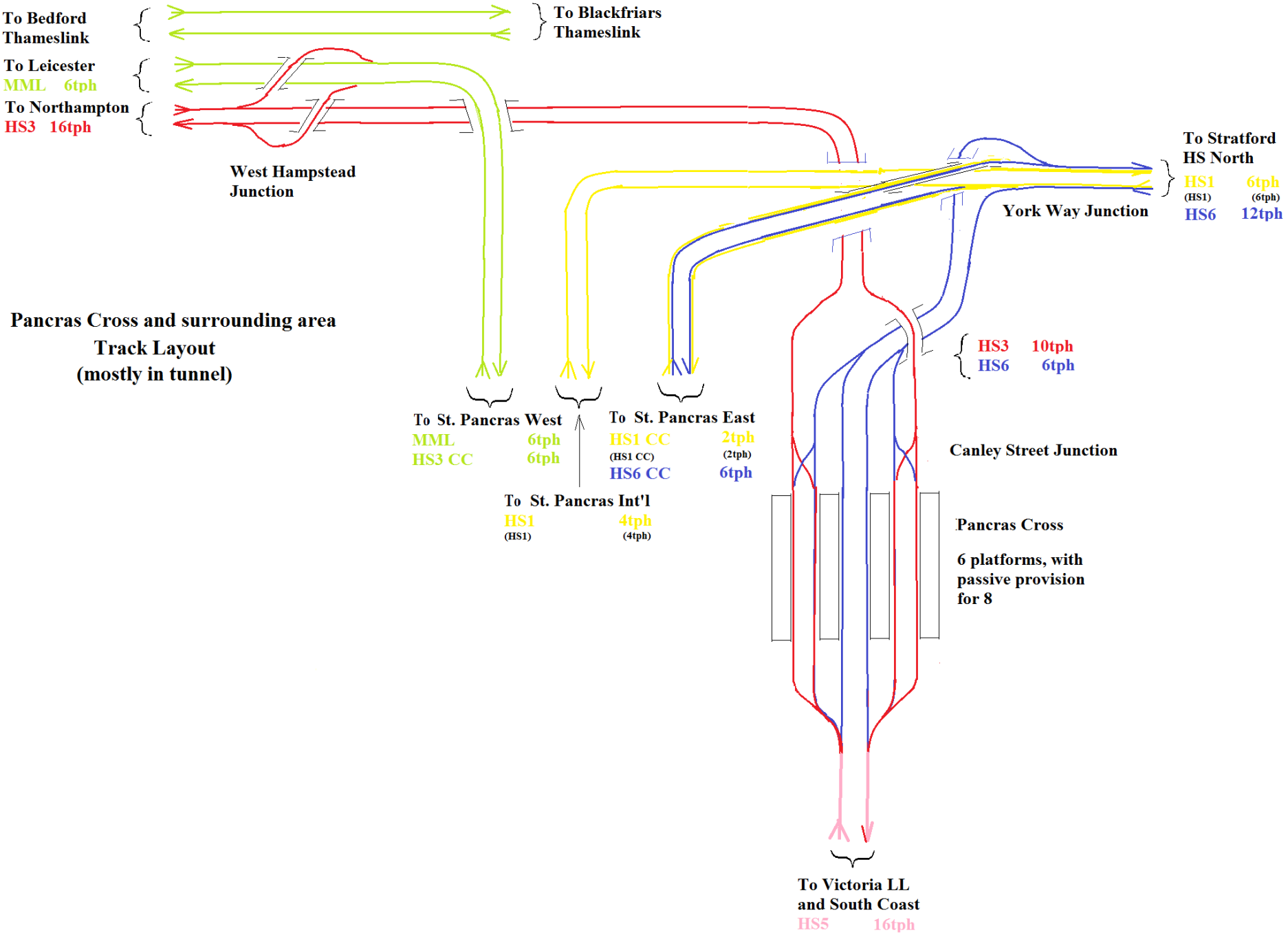
General

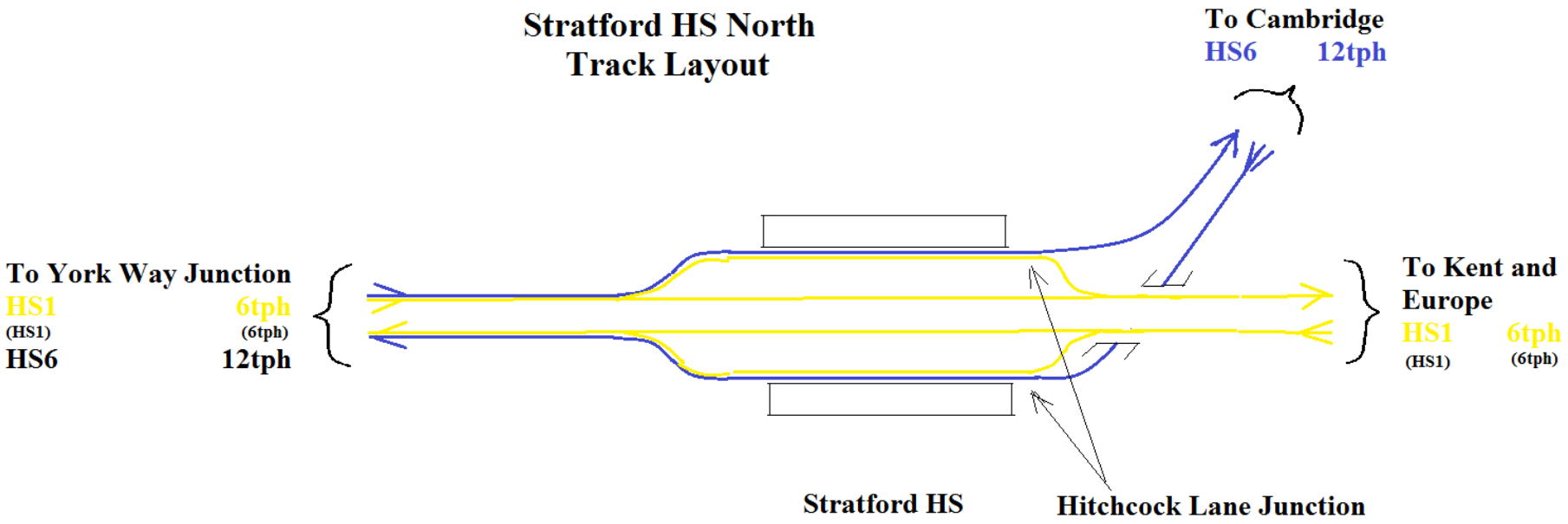
By routing the classic-compatible services of HS3 into St. Pancras West (the MML platforms), and of HS6 into St. Pancras East (the 'Javelin' platforms), and all the GC-gauge services of both routes through Pancras Cross and on to HS5 (which has no classic-compatible services), superlative cross-London 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. I would like to see **passive** provision for 8 platforms, as is indicated in the diagram.

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.

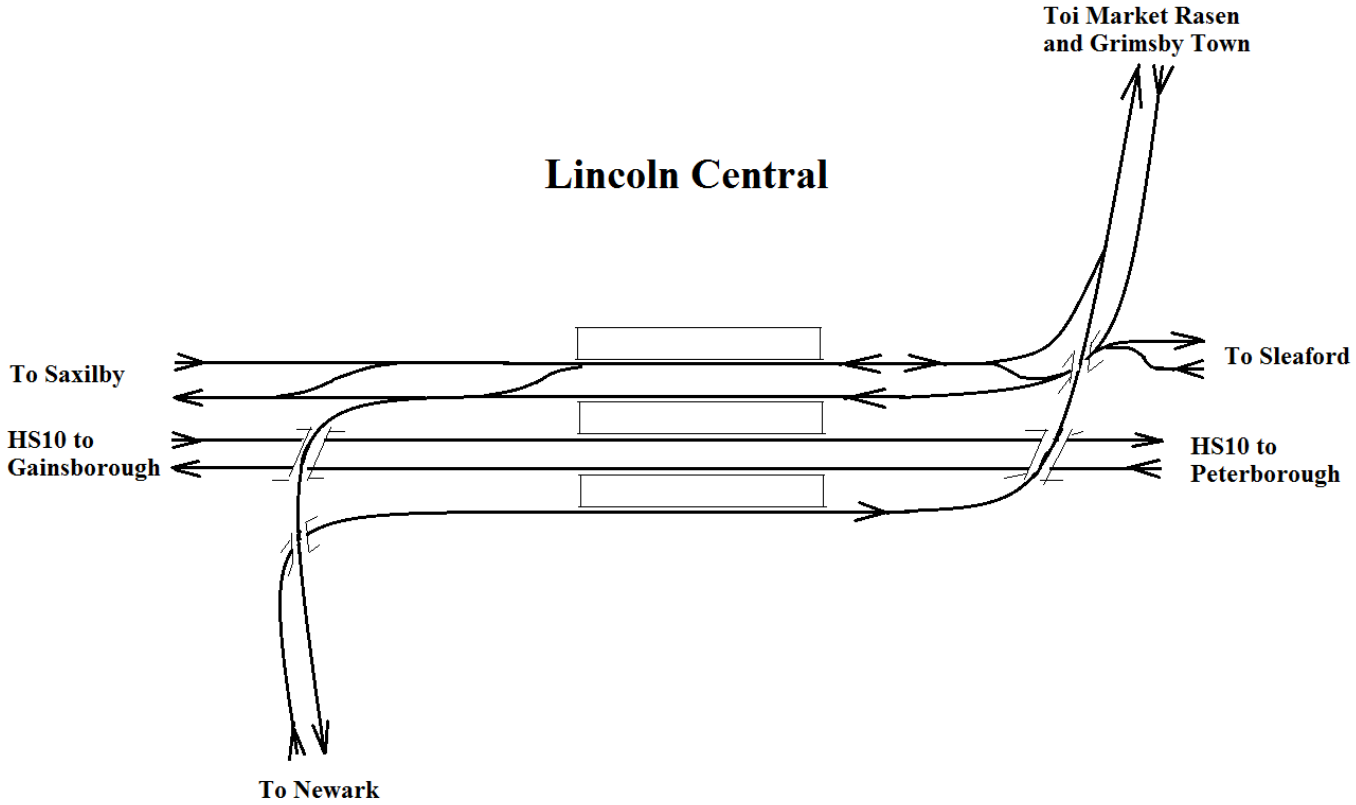
The middle two platform faces at Pancras Cross would ordinarily be used by HS6 trains and the two outer pairs by HS3. The scissors crossovers are provided for operational flexibility, but should not normally be used. I would like to see **passive** provision for 8 platforms, as is indicated in the diagram.

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

Appendix B – Lincoln Central Track Layout



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