HS Scottish Routes and Service Plans

(HS13 and HS14)

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 HS13, the route from Edinburgh to Glasgow, and from Glasgow to Kilmarnock and Ayr, and HS14, the route to Dundee and Aberdeen, sharing the route of HS13 from Edinburgh and Glasgow.

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.)

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 gradients for the new alignment between Burrelton Junction and Dundee, and diversions to gain improved alignments approaching Stonehaven and Aberdeen; the gradients involved are stated in every case, but these are pretty trivial.

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 HS13/HS14, including sections of other routes over which HS13/HS14's services run. These overall maps come at the end of the 'Route' description, and also show HS13/14's classic compatible services on classic lines (these are shown as dotted lines). Also included there are maps of the overall HS Network.

In all the maps I use the following colour scheme for the various routes:

As the various route plans have been developed, the maps have been updated, so now they show all routes, as relevant. The maps in the present article are thus not limited to HS13/HS14.

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.

HS13/HS14 GC gauge services fall into three categories:

1. Limited Stop: Edinburgh – Glasgow, Edinburgh/Glasgow – Dundee/Aberdeen, Glasgow – Ayr
2. Stopping: Stirling – Aberdeen (provides a GC-gauge service to the intermediate stations on the reopened Strathmore line)
3. High Speed Metro: (Edinburgh –) Glasgow – Dalmuir via Glasgow Airport

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. (Access to the platforms is via ‘slip-lines’, which diverge from the main line some distance before the station, and rejoin the main line some distance after, allowing stopping services to diverge from the main line at full line speed, and to rejoin it at full line speed, so not impeding non-stopping services. The behaviour is exactly analogous to that at motorway junctions.) 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 HS13's Kilmarnock and Ayr stations, and HS14's Coupar Angus, Forfar and Bridge of Dun (the last three are the only GC-gauge stations with some services not stopping; the main lines pass through the centre of the alignment).

Several service plans are developed, as noted earlier, 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 HS13/HS14 for at least part of their journey, and those featuring Regional Metro (semi-fast or stopping) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS3, to York and Preston. It's all rather arbitrary, at present. Provided that there are no difficult technical issues in running double deck trains at 360kph, 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 the connections between HS services and 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.

HS13/HS14 Routes – Introduction and Assumptions

HS13 and HS14 closely follow existing alignments, railway and motorway, for most of the way. But HS14 has an entirely new alignment between Burrelton Junction and Dundee. They reinstate, extended to GC gauge, several long closed routes, most importantly the Strathmore line.

HS13/HS14's long-term classic-compatible services begin at Edinburgh Waverley (west-facing bays) or points further east, and Glasgow Queen St. The GC-gauge provision is necessarily limited in both cities, because of space restrictions, so is reserved for those services actually needing it. The appendices give details of station layouts. The maximum speed for HS13/HS14 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.

HS13 Route – Junctions

There are various junctions on the route of HS13, 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). Some junctions exist at present, or existed formerly, and have their given names. The names of new junction are my own suggestions.

• Gyle	NT178728	Westbound classic-compatible and Regional Metro services from Edinburgh Waverley's terminal platforms, or from points further east, join HS13
• Kirkliston	NT116744	A spur to the classic line approaching the Forth Bridge (western arm) diverges from HS13
• Humbie	NT120752	The above spur joins the classic line
• Kinnaird	NS855849	The eastern arm of HS14 (Edinburgh services) diverges from HS13
• Bankhead	NS802801	The western arm of HS14 (Glasgow services) diverges from HS13
• Robroyston	NS630675	Eastbound classic-compatible services from Glasgow Queen St. join HS13
• Glasgow Airport	NS475662	Dalmuir branch diverges from main line to Ayr
• Brownhill	NS310516	HS13 joins alignment of classic route, for cross-platform interchange at Dalry
• Dalry	NS298480	HS13 diverges from alignment of classic line, after Dalry interchange

HS14 Route – Junctions

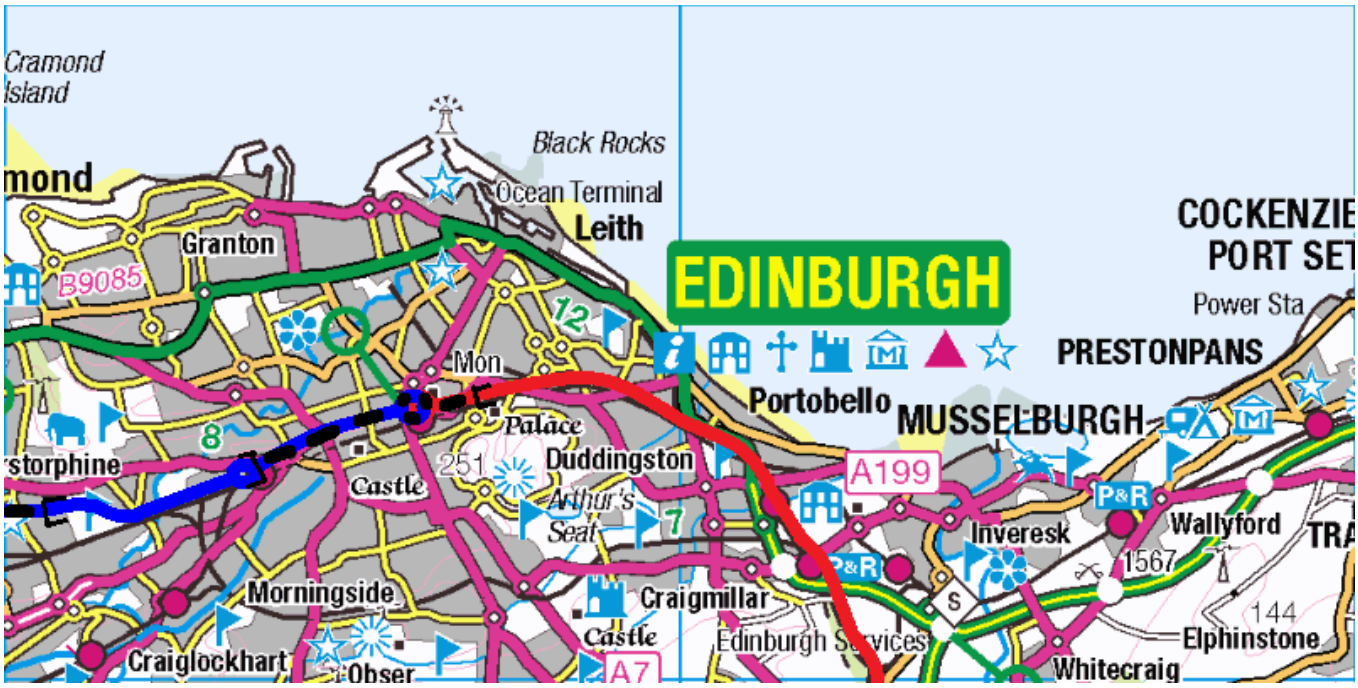
• Bannockburn	NS818907	The two arms of HS14 from Edinburgh and Glasgow join south of Stirling
• Dunblane	NN784028	HS14 joins the alignment of the classic Strathallan line, possibly taking it over and widening to GC gauge
• Stanley	NO112337	The Highland Line to Inverness diverges from HS14's Strathmore route
• Burrelton	NO205380	The Dundee branch diverges from HS14's Strathmore route
• Ninewells	NO362299	HS14 joins and takes over the classic Perth – Dundee line, widening it to GC gauge between there and Dundee Tay Bridge station
• Craigo	NO690642	HS14's Strathmore line joins the alignment of the classic line to Aberdeen north of Montrose, possibly taking it over and widening to GC gauge

There are various other links between HS13/HS14 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context.

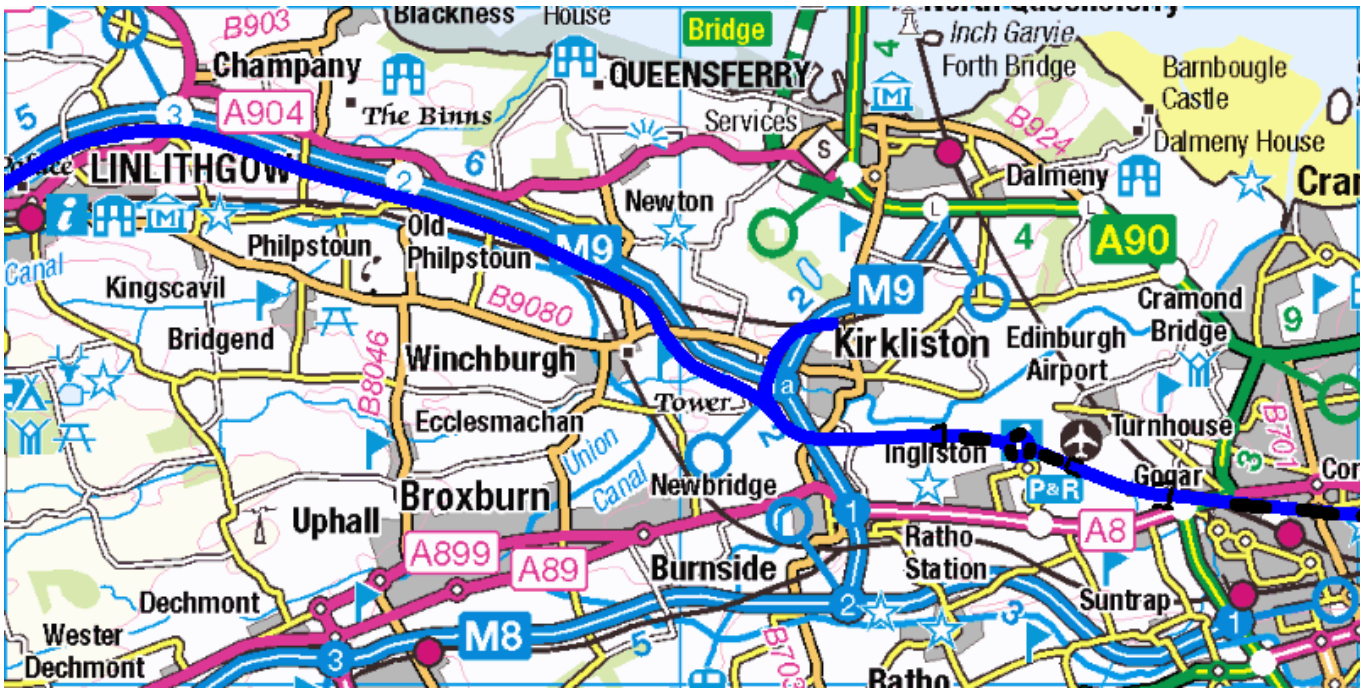
There now follows the definition of the actual route, in several logical sections.

1. *HS13 Edinburgh – Glasgow*

HS13 commences at Edinburgh HS – an extension of Waverley on the north side, underneath Princes St. It continues in tunnel, beneath Princes St. and Shandwick Place, as far as Haymarket, where, just west of the classic station, it emerges from tunnel at NT239732 and the HS platforms immediately follow. It follows the north side of the classic alignment as far as NT220724, where is diverges and takes over the trackbed of the former Corstorphine branch, which, from satellite maps, is still unobstructed. This it follows to near its former terminus, and enters a 1½ mile tunnel at NT207727, re-emerging at NT178728, Gyle Junction, immediately west of the A8, where there is a connection from the classic line, allowing classic-compatible, and local Fife services, to join. It crosses under the Airport, in a 1¼ mile tunnel between NT160732 and NT139739, with a station at NT150736, under the Airport Terminal building.

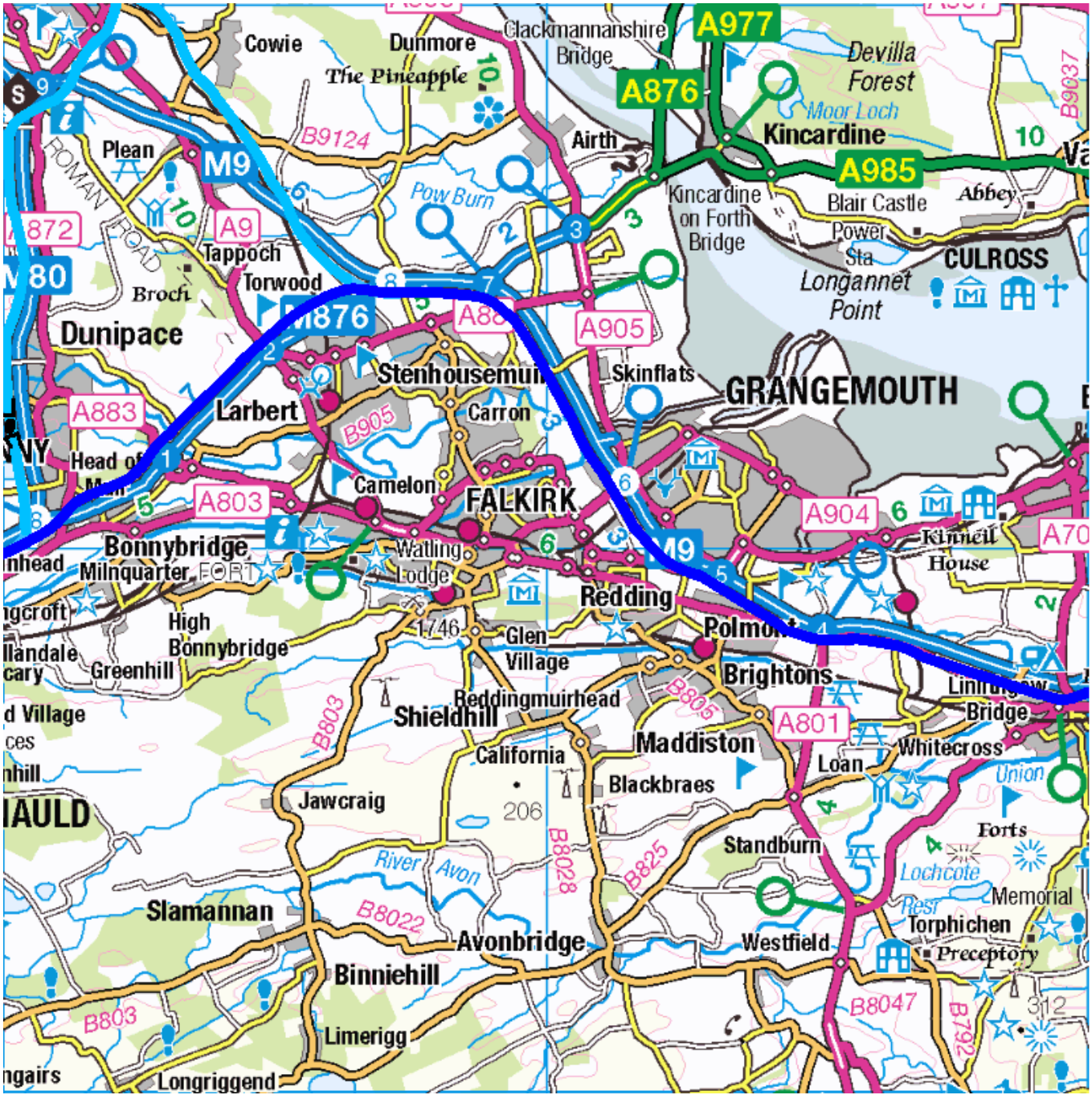


1.1 Musselburgh – Corstorphine Contains Ordnance Survey data © Crown copyright and database right 2013



1.2 South Gyle – Linlithgow Contains Ordnance Survey data © Crown copyright and database right 2013

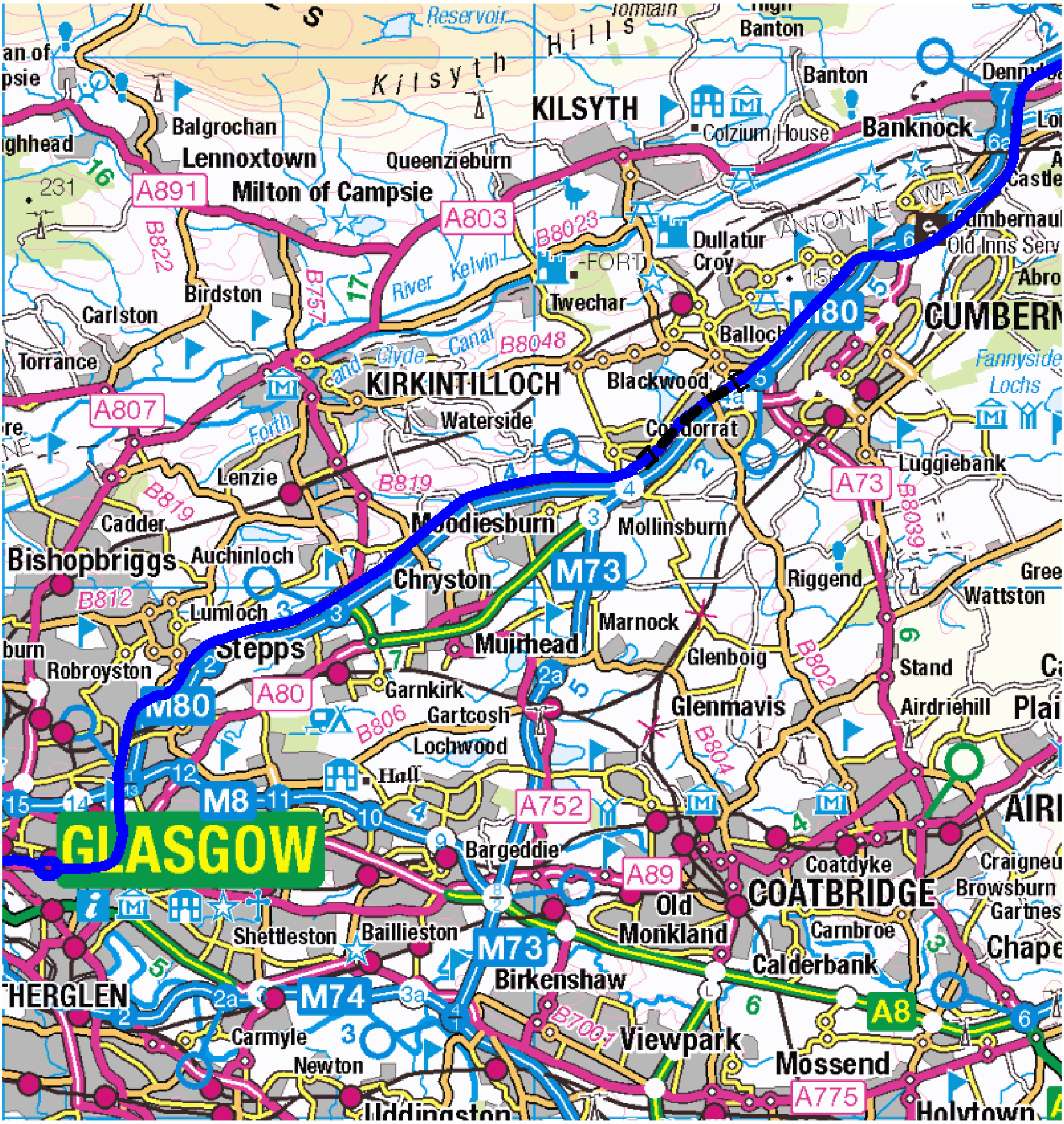
HS13 proceeds south of the River Almond, to where the M9 crosses the river, where it passes over and joins the west side of the motorway alignment. Shortly afterwards, at Kirkliston Junction, NS116744, a spur diverges and follows the M9 spur from junction 1a, following the north side of this as until it crosses the classic line approaching the Forth Bridge from the west side, where it diverges and joins the classic line at Humbie Junction, NS120752. This is to enable RM services to Fife via the bridge to serve the airport too. HS13 follows the west / south side of the M9 to Kinnaird Junction, at NS855849, where the eastern arm of HS14, to Stirling from Edinburgh, diverges, close by the motorway junction 8, where a similar divergence occurs. HS13, by following the M9 to this point, has thereby crossed over the M876, which diverges from it at junction 8. But from then on, for the next few miles, HS13 follows the north side of the M876, whereas the diverged HS14 continues to follow the west side of the M9. Almost no obstructions are encountered on the section to Kinnaird Junction; one or two warehouses may need to be relocated, but, (according to the satellite maps,) absolutely no housing is threatened.



1.3 Linlithgow Bridge – Denny

HS13 follows the north side of the M876 for only about 5 miles, before switching back to the south side at Bankhead, NS811804, shortly before Bankhead Junction, NS802801, where the western arm of HS14, from Stirling to Glasgow, crosses the M80 and joins it. This is close to the M80's junction 8, where, in similar fashion, the M876 is joined by the M80. The entire point of HS13's temporary switch is to avoid housing. There is a significant amount of housing in Bonnyfield, close to the south side of the M876, but none whatever on the north side.

HS13 switches to the west / north side of the M80 at NS770767, the Old Inns interchange (junction 6) and stays on this side until the M80's junction 1, where it joins the M8, in its section as the Glasgow Orbital. A 1 mile tunnel is required between NS732734 and NS719721, as buildings crowd in on the motorway on both sides, leaving no room to fit HS13 on the surface, without a lot of demolition.



1.4 Dennyloanhead – Glasgow

It diverges from the motorways at NS624664, crosses the Glasgow Orbital, heads across Alexandra Park and joins the east side of the alignment of the Springburn branch at Alexandra Parade station. It follows this alignment round to Bellgrove station (crossing over to the south side when the line from Airdrie joins. From the satellite maps, I judge there is sufficient room for 4 tracks on the Springburn branch, if the Springburn branch itself is slewed west / north (i.e. there's room for two more tracks, but it's not all on one side of the present alignment). The HS station at Bellgrove is on the south side and, again, has two islands.

Proceeding beyond Bellgrove, HS13 takes over (obviously widened to GC-gauge,) the Glasgow Union line, which it follows to Bellahouston (?) Junction, NS568639, where it diverges to join the M8 south of the Clyde.

St. Enoch would have been the perfect Glasgow station for HS13. Unfortunately it's now a shopping centre – a very nice one, I'm sure, but not quite in the same league as the Glasgow Terminus of the High Speed lines to Edinburgh, (and on to London, maybe on to Europe,) Aberdeen, Dundee and Ayr. While it's true that shopping centres don't have the same permanence as more dignified buildings, and that the site may well become available for re-redevelopment some time in the future, that's not much help now. My suggested solution for the proper HS station for Glasgow is indeed St. Enoch, but a new St. Enoch, (much smaller, 4 platforms – 2 islands – only,) slightly to the north and east of the shopping centre and incorporating the existing Argyle St. station, thus with interchange to the metro services via Central Low Level – it becomes St. Enoch Low Level! The St. Enoch subway station is also very close, and even Central and Queen St. stations are only a few minutes walk away. St. Enoch's being a terminus isn't a problem, as all services start there.

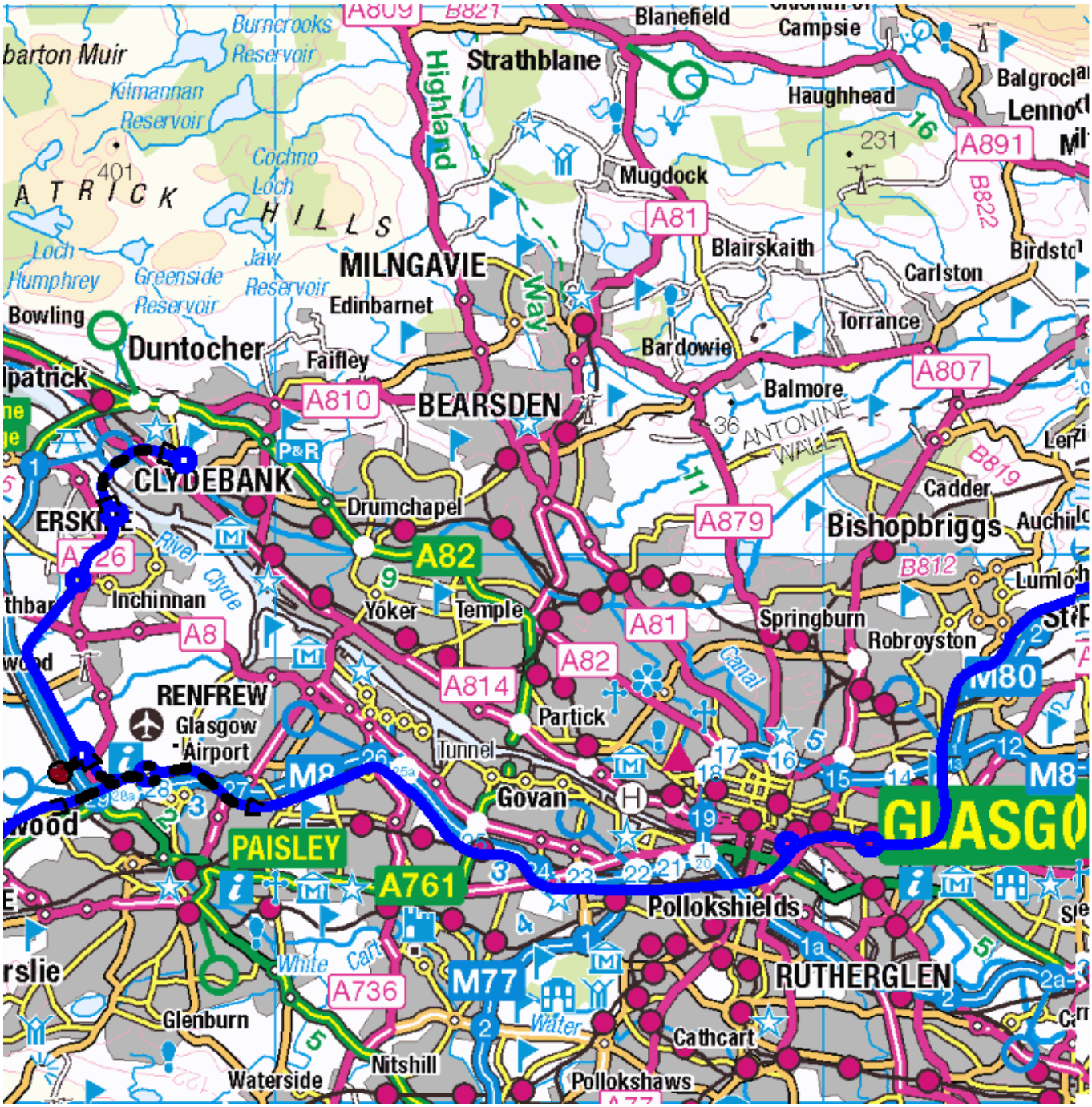
Bellgrove just isn't good enough for Glasgow's **only** HS station – it's fine in its way, and valuable in any case as providing interchange with the metro services via Queen St. Low Level – it certainly justifies its provision as **a** Glasgow HS station, but not as the only one.

St. Enoch is, admittedly, a solution with problems of its own, but that's inevitable, given the myopic stupidity of our immediate forebears, and the mess they've left us. I'm reminded, as so often, of the perceptive reply of the Irishman asked the way to Dublin: "If I were you, I wouldn't start from here".

The later maps section, containing (Strategi-based) maps of the overall network and routes, contains a large-scale map of the traverse of Glasgow, which should clarify the above description. Readers are asked to note that this is generated to a larger scale than that at which the data were originally input, so please not to be too censorious of sections of railway line that don't quite meet, or of stations which seem to be located a little to the side of the line they purport to serve. Note also that the motorways (highlighted in purple) have very obviously been drawn as straight-line segments, and these are exactly as supplied by the Ordnance Survey. At the sort of scales this stuff is intended to be viewed, it's smooth enough.

2. *HS13 Glasgow – Glasgow Airport – Dalmuir*

As mentioned previously, HS13 continues from St. Enoch along the widened Glasgow Union line to Bellahouston Junction, and then joins the south side of the M8 at NS55861. (The Glasgow Union is not used for much more than stock movements at the moment, and west from Port Eglinton Junction it is actually lifted, but it is completely unobstructed.) HS13 follows the south side of the motorway alignment until NS495657, just before M8's Junction 27, where it enters a 2 mile tunnel under Glasgow Airport, emerging at NS463660, on the east side of the M8, just after the A726 (Barnsford Rd.) has diverged from the motorway.



2.1 Stepps – Dalmuir

There are no obstructions in this section, beyond a few warehouses (especially at the start of the section), which are easily relocated. No housing is encountered until the A741 crosses, at junction 27. The airport tunnel is thus commenced a little earlier than would be required on purely infrastructure grounds, to avoid

the housing. The airport station is at NS479662, directly under the terminal. The Airport station is of two island platforms, in the usual way, albeit underground. Immediately to the west of it is Glasgow Airport Junction, at NS475662, say, where the main line continues straight ahead to Ayrshire destinations (see next section) and the Dalmuir branch diverges.

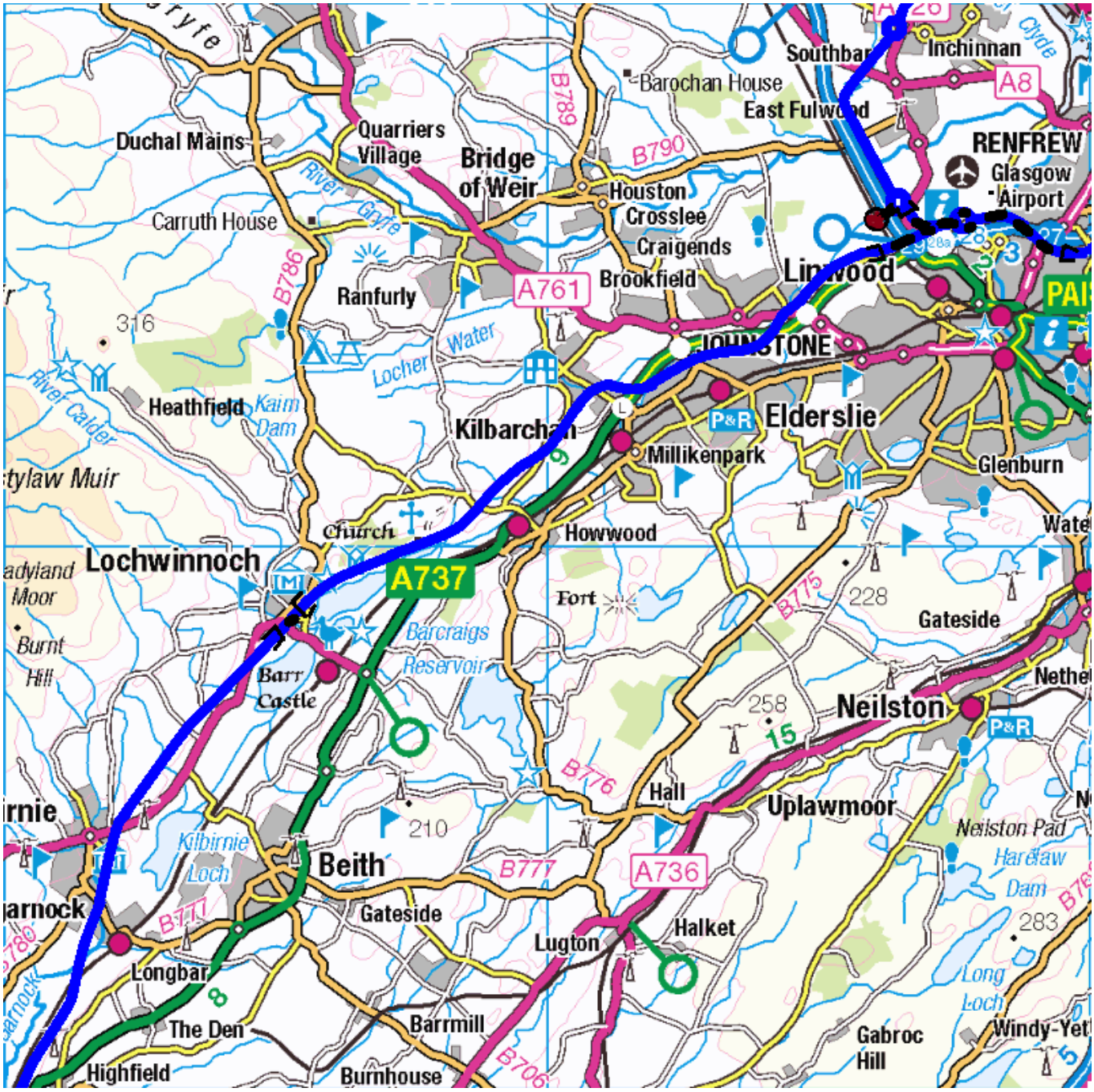
The Dalmuir branch emerges from tunnel at NS463660, and immediately enters Glasgow Airport Parkway station. This is on the east side of the M8, and is accessed from junction 29 of the M8, via the A726. A station is also opened on the classic route to Gourock and Wemyss Bay at NS461660, on the **west** side of the motorway. The two stations are linked by a fully enclosed bridge over the motorway, with escalators and travelators. Access to the station is on the east side, from the A726, then over the bridge for the classic line; there is no direct access on the west side. Both sides of the station have two platforms. The Dalmuir branch is in no sense a HS line, but it is a HS Metro. It finally implements the Glasgow Airport Rail Link project, for both HS and classic lines.

The Dalmuir branch follows the east side of the M8 until NS451680, where it diverges and travels in a straight line to join the west side of the A726 at NS462690, which it follows to the Erskine Parkway South station, at NS465697. It crosses to the east side of the A726 at NS46970703, and shortly afterwards is Erskine Parkway North station, at NS469706. After that it diverges from the A726, and curves round to Dalmuir, entering a tunnel under the Clyde at NS470710 and emerging at NS481717, just before Dalmuir station. The HS platforms (2) are just north west of the classic ones.

3. HS13 Glasgow Airport – Kilmarnock and Ayr

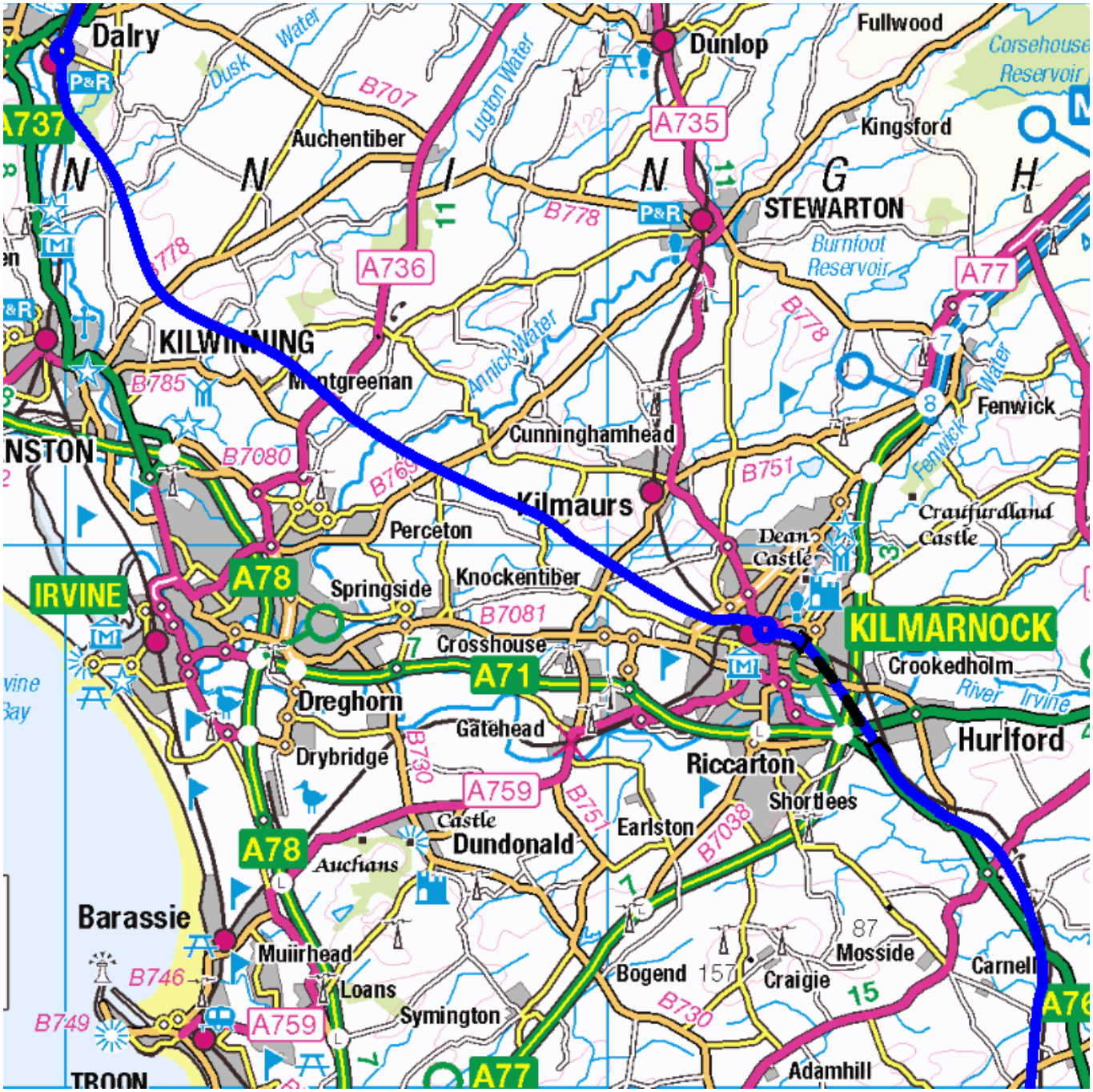
The main line of HS13 continues from Glasgow Airport Junction, emerging from tunnel at NS465654, on the north side of the A737, immediately to the west of the classic line to Gourock. It switches to the south side of the A737 at NS440640, to avoid housing, and almost immediately (at NS433637) joins and takes over the alignment and trackbed of the currently disused duplicate line to Dalry, via the north west side of the lochs. A new bridge will be required to cross the A737 at NS417630, since the road was opened after the line had closed, and was built straight across it. A ½ mile tunnel is required in Lochwinnoch, between NS357590 and NS353585, to avoid new housing which has encroached on the alignment. With those two exceptions, there are no obstructions on the route to Dalry. HS13 joins the current classic route to Dalry at Brownhill Junction, NS310516. This was a grade-separated junction, with HS13's down line (I presume 'up' in these parts is towards Glasgow?) passing over the classic line. This arrangement is re-implemented, and the line quadrupled over the two miles to Dalry station, and the further ¾ mile to Dalry Junction, (NS298480,) HS13 occupying the outer tracks. Dalry station is rebuilt with two island platforms, providing cross-platform interchange between HS13 and the classic routes to Largs and Ayr via the coast.

At Dalry Junction, HS13 diverges, HS13's up line crossing over above the classic tracks, and takes over the alignment and trackbed of the currently disused line to Kilmarnock. (This was the original G&SW main line, so the alignment is pretty good.) There are no obstructions before Kilmarnock. Kilmarnock station currently has 4 platforms, two north-facing bays (1,2) and two through platforms, 3, which is the one generally used, and 4, rarely used, which is the south face of an island platform, on the north side of the station. HS13 takes over this island platform, and rebuilds the north face as platform 5. It crosses over the classic line from Glasgow via Stewarton, and takes over the north side of the station.

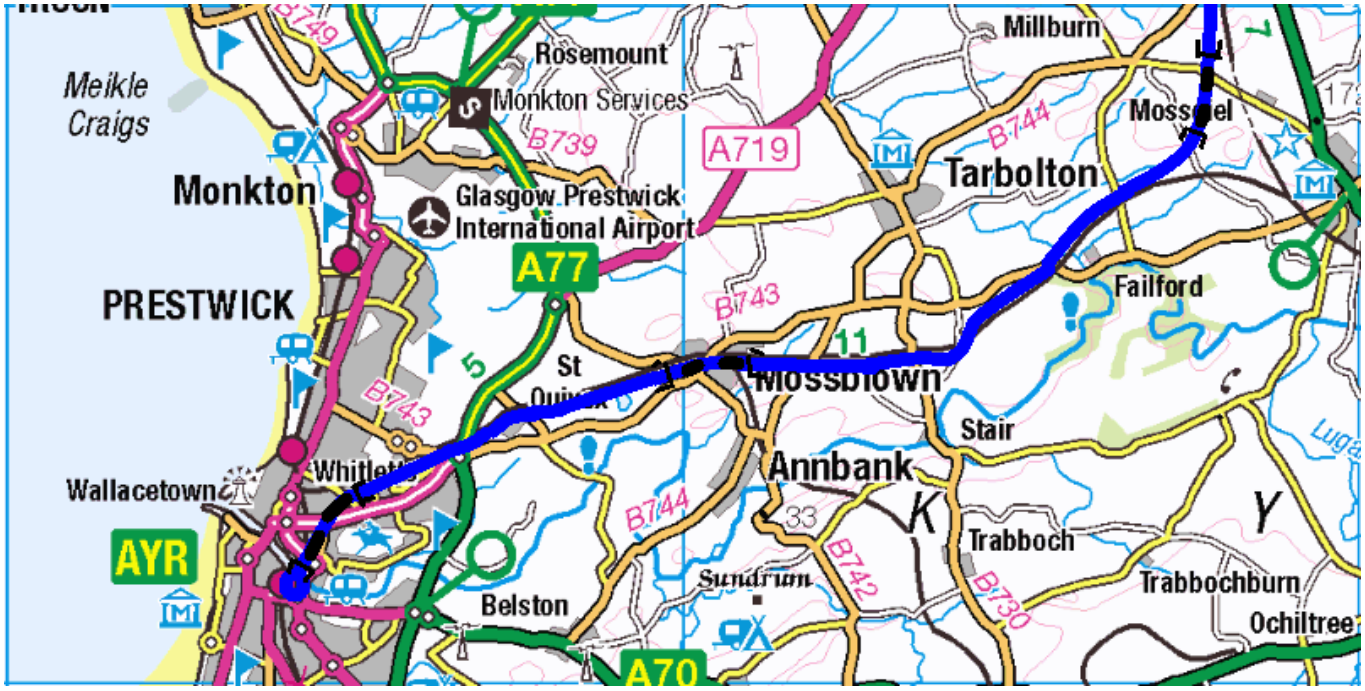


3.1 Glasgow Airport – Highfield

HS13 follows the classic alignment for the next few miles until NS479300, initially on the north / east side. A new viaduct is required immediately to the east of the station, but there's plenty of room for it. A 1½ mile tunnel is provided between NS434381 (Key Park Terrace) and NS451362, south of Hurlford, emerging opposite the local distillery, on the south / west side of the alignment. This avoids a built-up area. At NS479300, it diverges on a completely new alignment, joining the north side of the Mauchline – Ayr line at NS464272, via a ¾ mile tunnel between NS476296 and NS475284. HS13 switches to the south side of the alignment at NS441260, to avoid a striking collection of farm buildings (it needs to be on that side at Annbank, a few miles further on, anyway, to avoid housing). A ½ mile tunnel is required at Mossblown, between NS406249 and NS398248, to avoid housing. HS13 continues on the south side of the alignment, almost into the centre of Ayr. The area is mainly warehousing, some of which will need to be relocated. No housing is encountered until NS348229, at which point HS13 enters a 1 mile tunnel, emerging at NS341215, immediately before Ayr station. There is room on the east side of the station (currently a car park) for a single island platform with 2 faces, for HS13.



3.2 Dalry – Kilmarnock



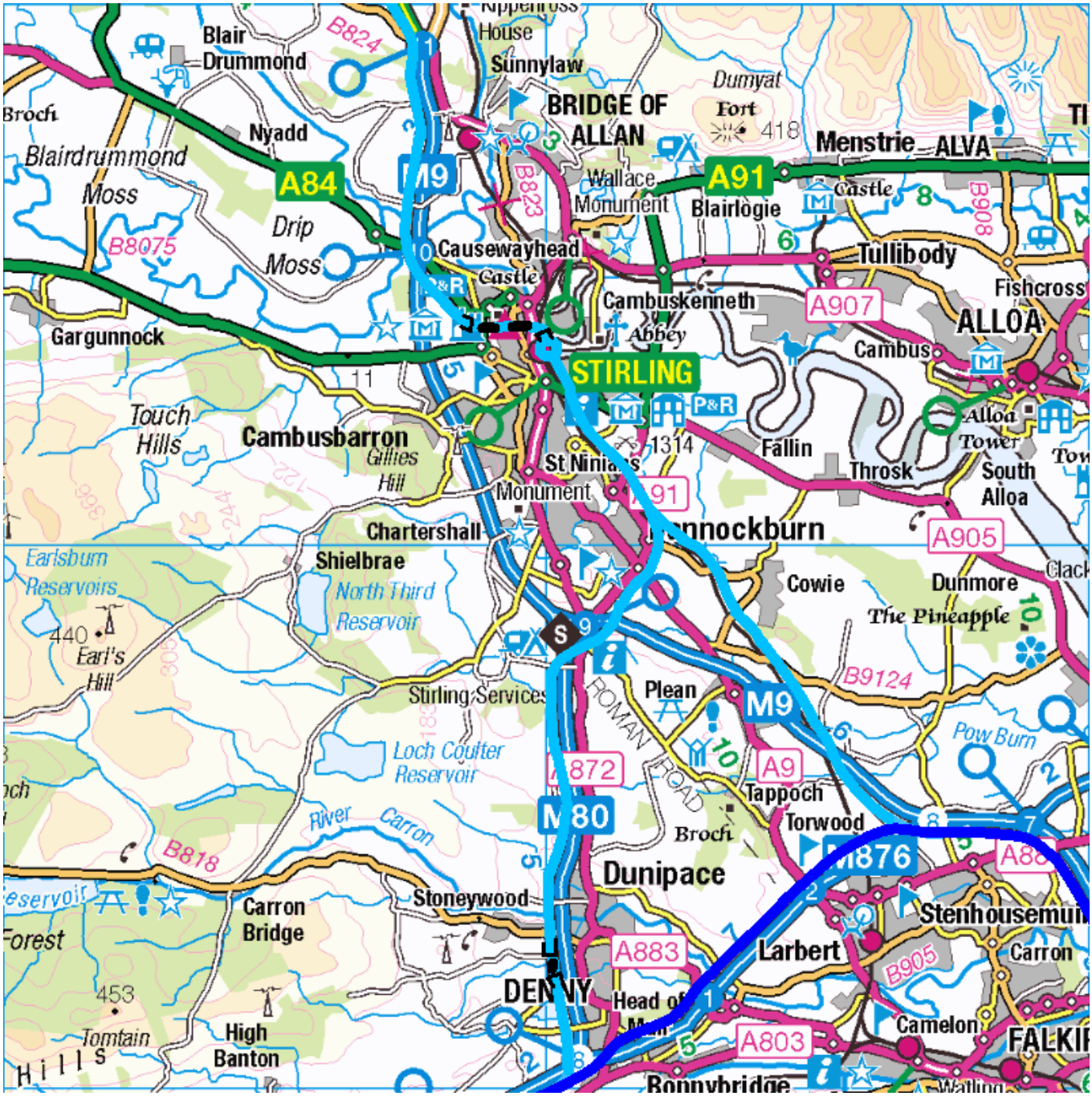
3.3 Mossgiel – Ayr

4. HS14 (Edinburgh –) Kinnaird Junction and (Glasgow –) Bankhead Junction – Perth

The eastern arm of HS14 diverges from HS13 at Kinnaird Junction, and follows the western side of the M9 for just over 1 mile, then diverges and joins the eastern side of the classic line from Larbert, at NS851862. It then follows the classic line all the way to Stirling station; there are no significant obstructions.

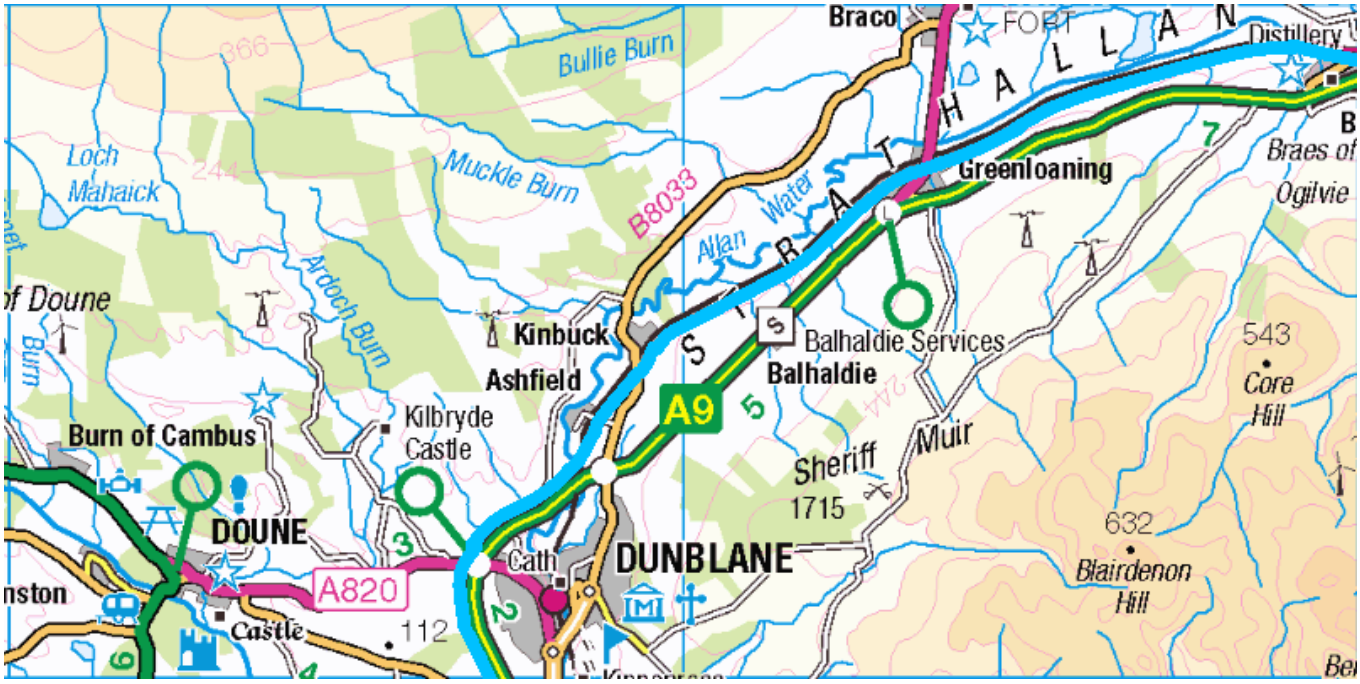
The western arm of HS14 diverges from HS13 at Bankhead Junction, and follows the western side of the M80 until NS804878, just before the M80 merges with the M9. In this section, it requires a ¼ mile tunnel between NS802825 and NS802829 to avoid some housing unusually close to the motorway (pre-existing it, I imagine). From NS804878 it crosses the M80 and follows the A91 round to join the eastern arm of HS14, on the eastern side of the classic alignment, at NS818907, Bannockburn Junction.

There is plenty of room on the east side of Stirling station for HS14's two island platforms. Immediately north of Stirling station, HS14 enters a 1 mile tunnel at NS798938, just before the Forth Place road bridge. It curves to the west and emerges from tunnel at NS785941, just west of the B8051 (Reploch Rd.) It follows the west side of the B8051, which joins the A84 at the next roundabout, until it reaches the M9 again, joining the west side of the motorway at NS775955, just north of junction 10. It follows this until it changes into the A9(T) at the next roundabout, and follows this around the west side of Dunblane until it crosses the classic line to Perth. HS14 leaves the A9(T) and joins the east / south side of the classic alignment at Dunblane Junction, NN784028. No obstructions have been encountered.

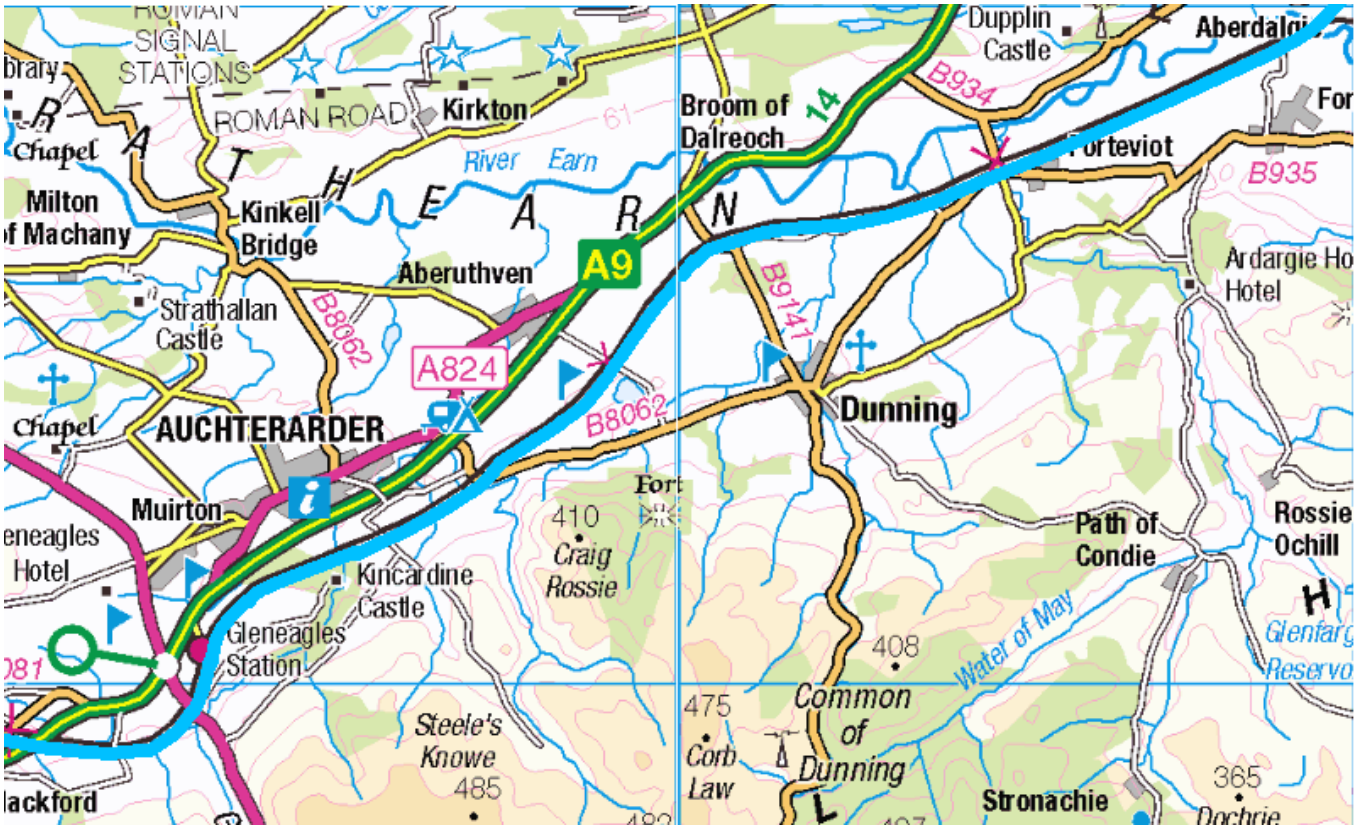


4.1 Falkirk – Bridge of Allan

HS14 follows the classic Perth line as far as NO093198, at which point it diverges, crosses the classic line, and heads directly for Perth station. The classic route via Hilton Junction is so hemmed about with buildings as it approaches Perth (all the way north of Moncrieff Tunnel in fact) that there's no possibility of fitting in HS14 on the surface. The only option is a direct approach by tunnelling. HS14 enters a 2 mile tunnel (that's all!) at NN098201 and emerges on the west side of the alignment, just south of Perth station, at NN112228. This is exactly where it wants to be. Perth station has 7 through platforms (still!). Numbers 1 and 2 serve the Dundee line (and Aberdeen), heading directly east. Platforms 3-7 are on the northbound line, serving, since the closure of the Strathmore line in 1967, only the Highland Line trains to Inverness. HS14, reopening the Strathmore line, will take over four of them, for HS services to Aberdeen and Dundee. It's really amazing that all this useful infrastructure is still there after nearly 50 years of disuse. What a contrast to St. Enoch! Thank goodness the worthy citizens of Perth didn't want a new shopping centre!



4.2 Dunblane – Blackford Contains Ordnance Survey data © Crown copyright and database right 2013

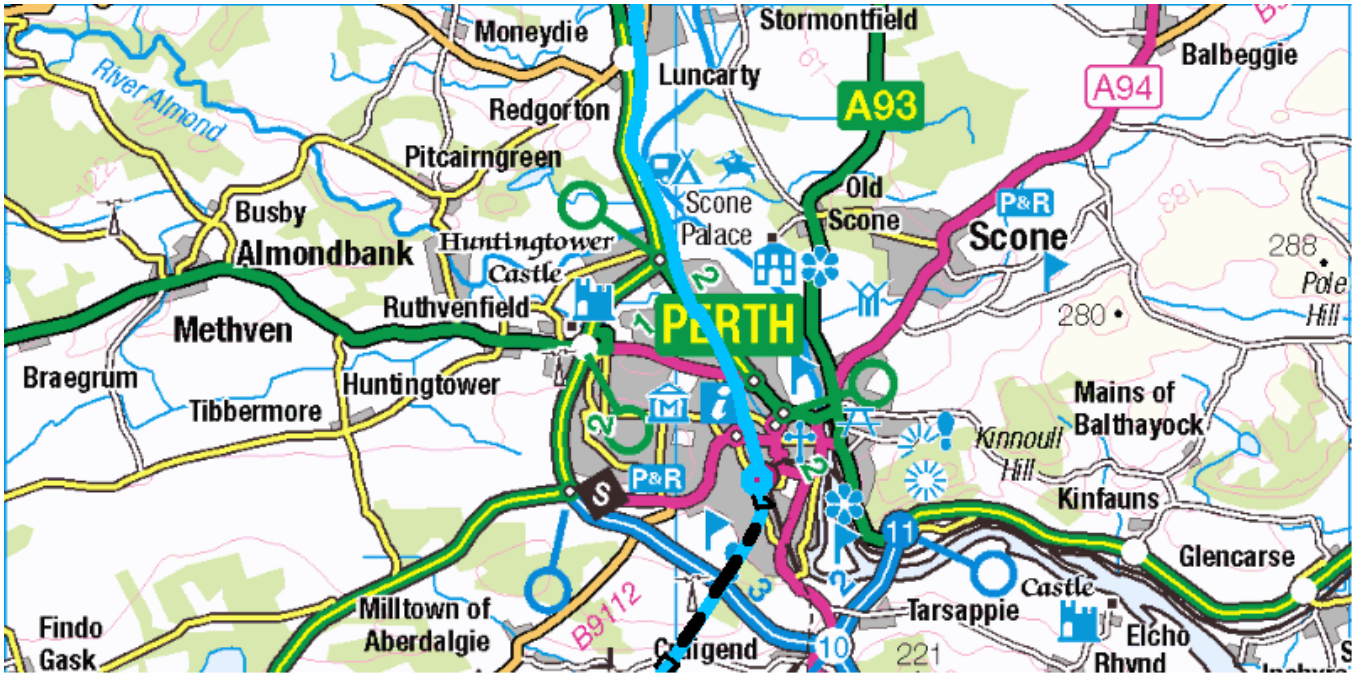


4.3 Blackford – Forgandenny Contains Ordnance Survey data © Crown copyright and database right 2013

It is an undecided question whether to build a new HS line, of GC-gauge, between Stirling / Dunblane and Perth, on the south side of the classic alignment, or whether simply to take over the existing line and enlarge it to GC-gauge (with a few minor improvements in alignment). The deciding issue is what traffic the classic line would carry, once the HS line was in service. The costs would not be very different. For present purposes it is not necessary to reach a conclusion on this, merely to flag up the question.

If the existing line were enlarged, then Gleneagles would become a GC-gauge station, but with variable platforms, to be able to handle classic-compatibles and regional metro trains also. Not all services would

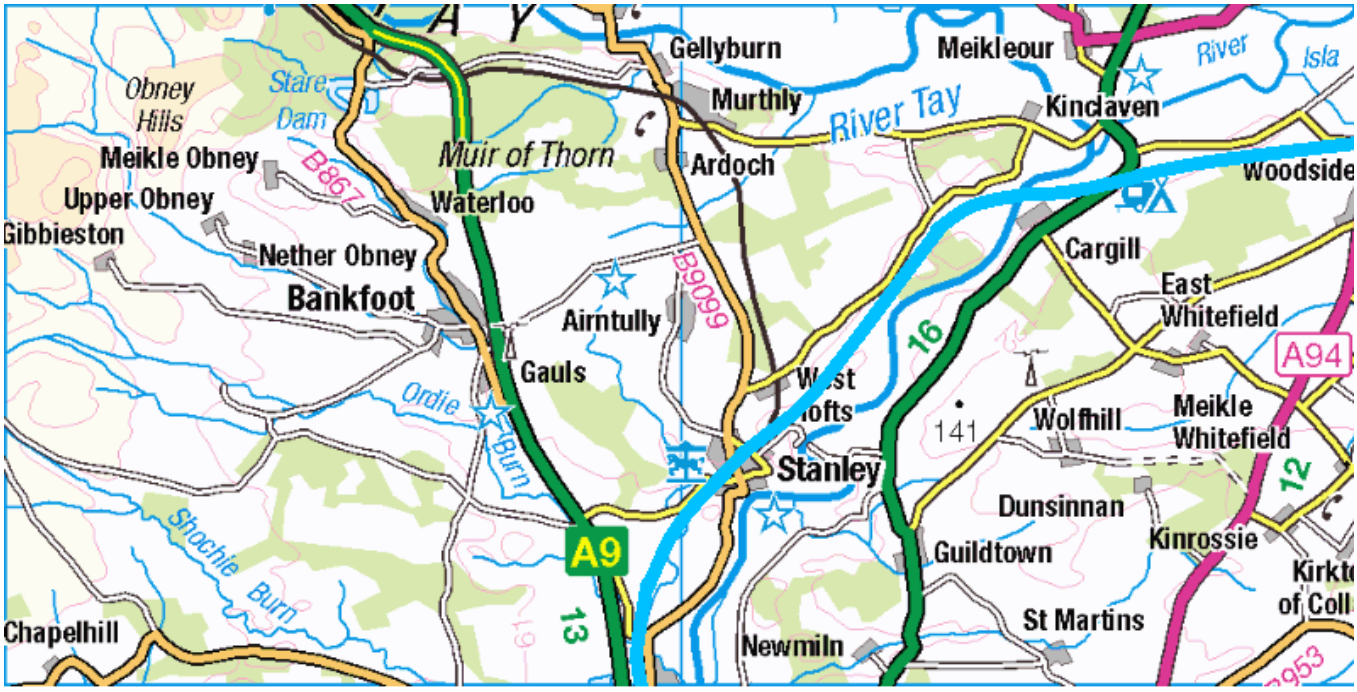
stop there; Gleneagles would have two platforms, and the main lines pass through the centre of the alignment.



4.4/5.1 Craigend – Luncarty

5. *HS14 Perth – Dundee*

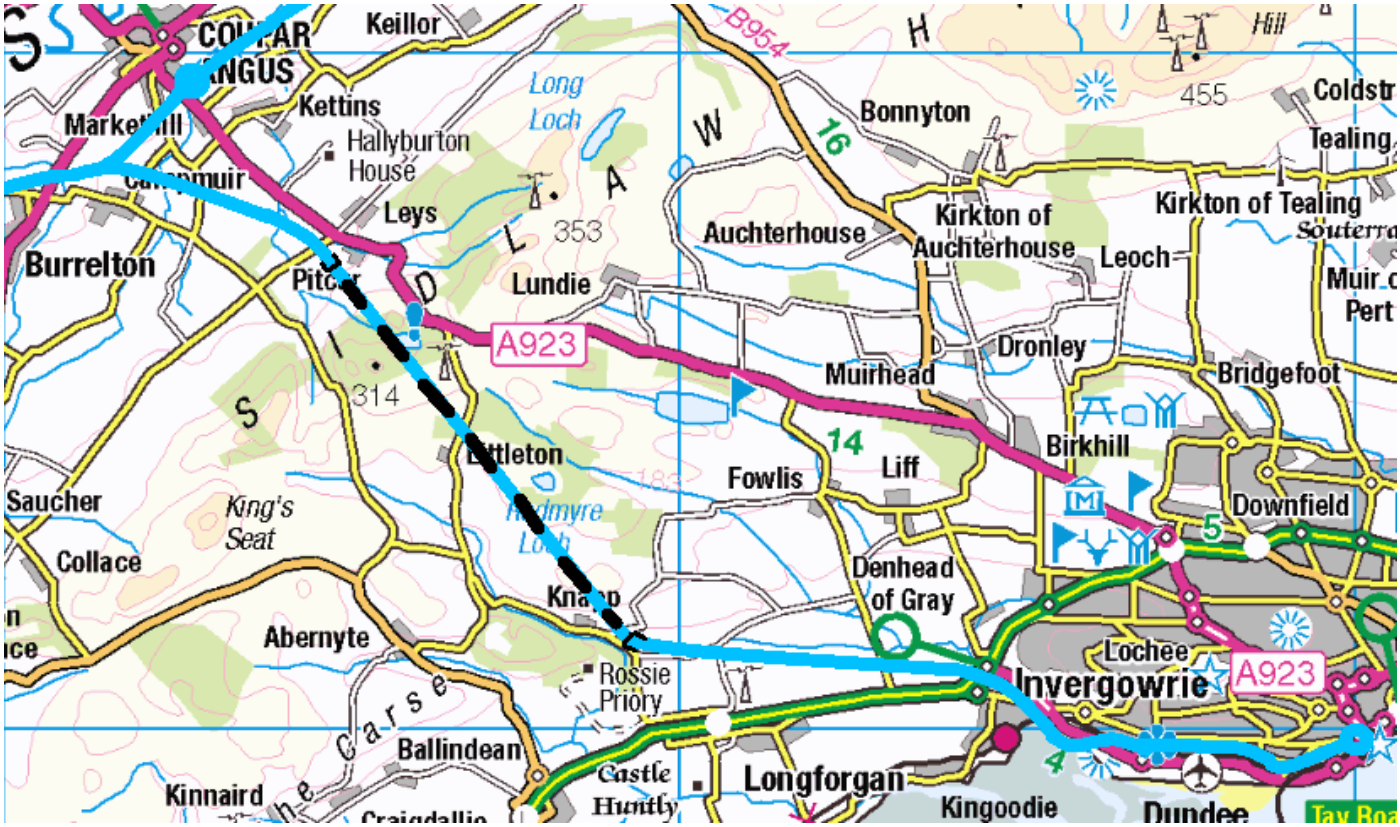
As just mentioned, north of Perth, HS14 reopens the Strathmore route, as a HS line at full GC-gauge. The short surviving section, as far as Stanley Junction, is likewise widened to GC-gauge (the Highland line trains won't mind). Perth station must of course have variable platforms (3-7), to handle both types of train.



5.2 Stanley – Woodside

On the section from Perth to Burrelton Junction, where the Dundee branch diverges, there are no obstructions until Burrelton itself, at NO200379, where some new building has encroached slightly. Accordingly, HS14 diverges from the former alignment at Layston, NO186379, and runs slightly to the north of it, crossing the A94 at NO205380, slightly to the south of where the original (which was curving to the north there) did. At that point is Burrelton Junction.

The Dundee branch is a completely new alignment. It curves to the south to Pitcur, where, (at NO245370,) it enters a 4 mile tunnel, emerging at NO290312, near Knapp. The height of Burrelton Junction is 200ft, and that at the tunnel entrance 300ft, giving, over the intervening 3 miles an ascending gradient of 1 in 160. On emerging from the tunnel the height is 180ft, thus a descending gradient of 1 in 176.

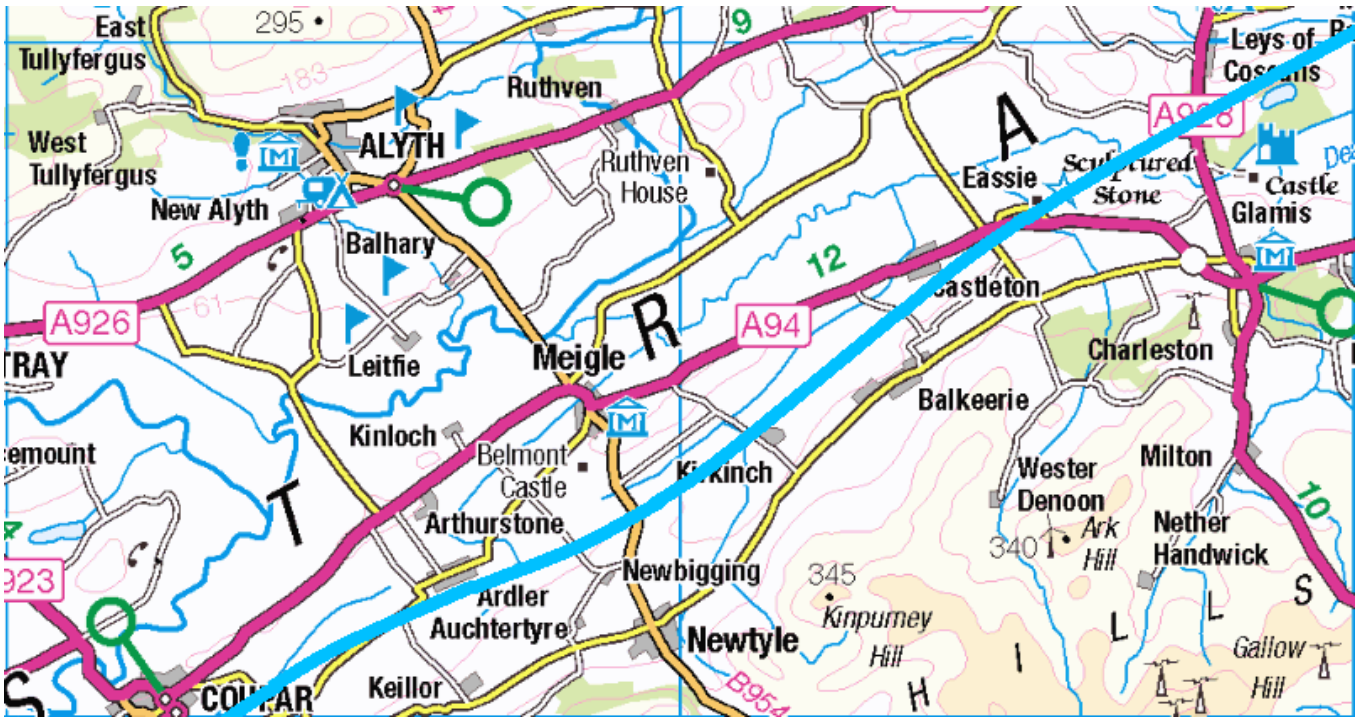


5.3/6.1 Burrelton – Dundee Contains Ordnance Survey data © Crown copyright and database right 2013

HS14 approaches the Dundee ring road at NO346308, then follows the south side of the A85, Riverside Avenue, crossing over the classic line from Perth to Dundee. It diverges from the A85, crosses over the road, and joins the classic alignment at Ninewells Junction, NO362299, taking it over and widening it to GC-gauge, as far as Dundee Tay Bridge station. There are no obstructions. The station is redeveloped, shifted slightly to the west, where there is considerably more space available. The new station has six platforms in all, two islands, (four platform faces,) and two single platforms on the outside. The islands provide cross platform interchange between HS14 services, GC-gauge (terminating) in the centre, and Aberdeen services on the outer faces, either classic-compatible (from Glasgow) or Regional Metro (from Edinbugh, via the bridges). The outer, single platforms accommodate a stopping service between Perth and Arbroath. Full details are in the service plans.

6. *HS14 Burrelton Junction – Craigo Junction*

From Burrelton Junction, the new alignment passes around Coupar Angus, about a ½ mile south of the original. It crosses the A923 at NO228392, and a new station for Coupar Angus is provided there. There is some encroachment by new building in Ardler. Accordingly HS14 rejoins the original alignment a little to the east of Ardler, at NO270420. The new alignment, from Layston to east of Ardler (5½ miles) is actually better than the original (it's very slightly straighter – no big deal, but still an improvement).



6.2 Coupar Angus – Glamis Contains Ordnance Survey data © Crown copyright and database right 2013

6.3 Mains of Ballindarg – Friockheim Contains Ordnance Survey data © Crown copyright and database right 2013

No further problems are encountered until Forfar, where the alignment has been almost completely obliterated. From NO4005002, HS14 diverges from the original alignment, veering to the north of Padanaram. It crosses the A90 at NO439521, just north of its junction for Forfar. It curves gently round

6.4/7.1 Glasterlaw – Dykelands

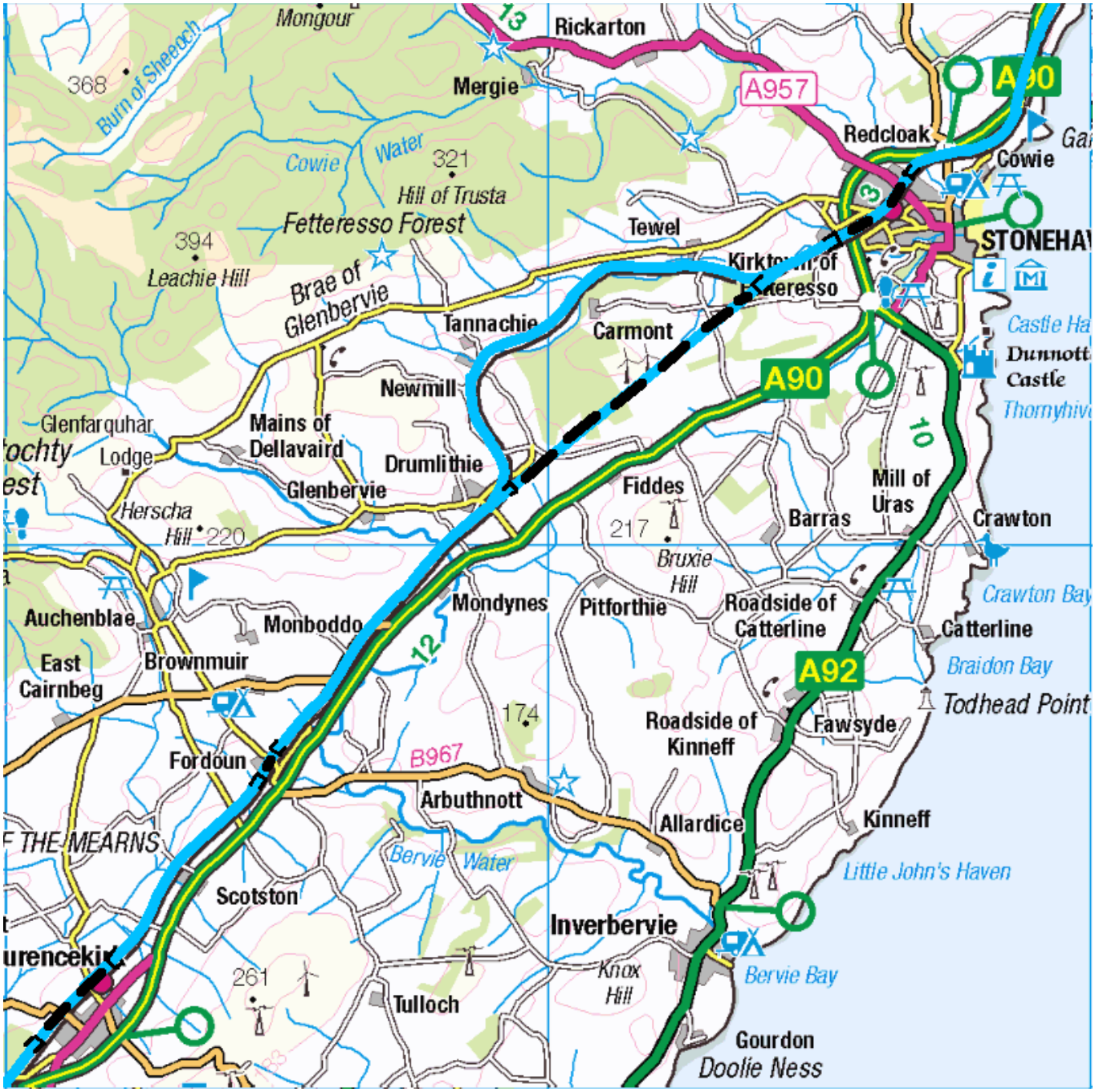
the north of Forfar, crossing the B9128 at NO453520, and a new station for Forfar is provided there, about a ½ mile north of the original and a ¼ mile east. It crosses the original alignment to pass slightly further to the south of Lunanhead, where there has been some encroachment, and rejoins the original at NO480520. This new alignment (5 miles) is very much better than the original, which had a severe kink in reaching the original Forfar station.

There is nothing further of note until Bridge of Dun. The original station is now owned by the Caledonian Railway, which operates the branch to Brechin. HS14 will open a new station, on the north side of the original, and invite the Caledonian to provide a connecting service for Brechin (steam-hauled, if they wish). HS14 does not take over the existing alignment beyond there, but leaves it to the Caledonian for a future extension into Montrose, via Dubton Junction, to be able to provide connections there, too.

Beyond that, Bridge of Dun is a parkway station for the surrounding area, and has extensive parking.

HS14 does not, in fact, restore the original route via the historic Kinnaber Junction, but eliminates the sharp curve into the North Esk valley by a diversion from NO695604 to Craigo Junction, NO690642, where it joins the line from Dundee. There is a 1 mile tunnel between NO699609 and NO697630.

7. HS14 Craigo Junction – Aberdeen



7.2 Laurencekirk – Stonehaven Contains Ordnance Survey data © Crown copyright and database right 2013

From Craigo Junction, HS14 follows the classic alignment, initially on the north / west side. There are no obstructions except as noted below:

A 1½ mile tunnel is required under Laurencekirk, between NO708708 and NO717720.

A ½ mile tunnel is required under Fordoun, between NO749757 and NO751760.

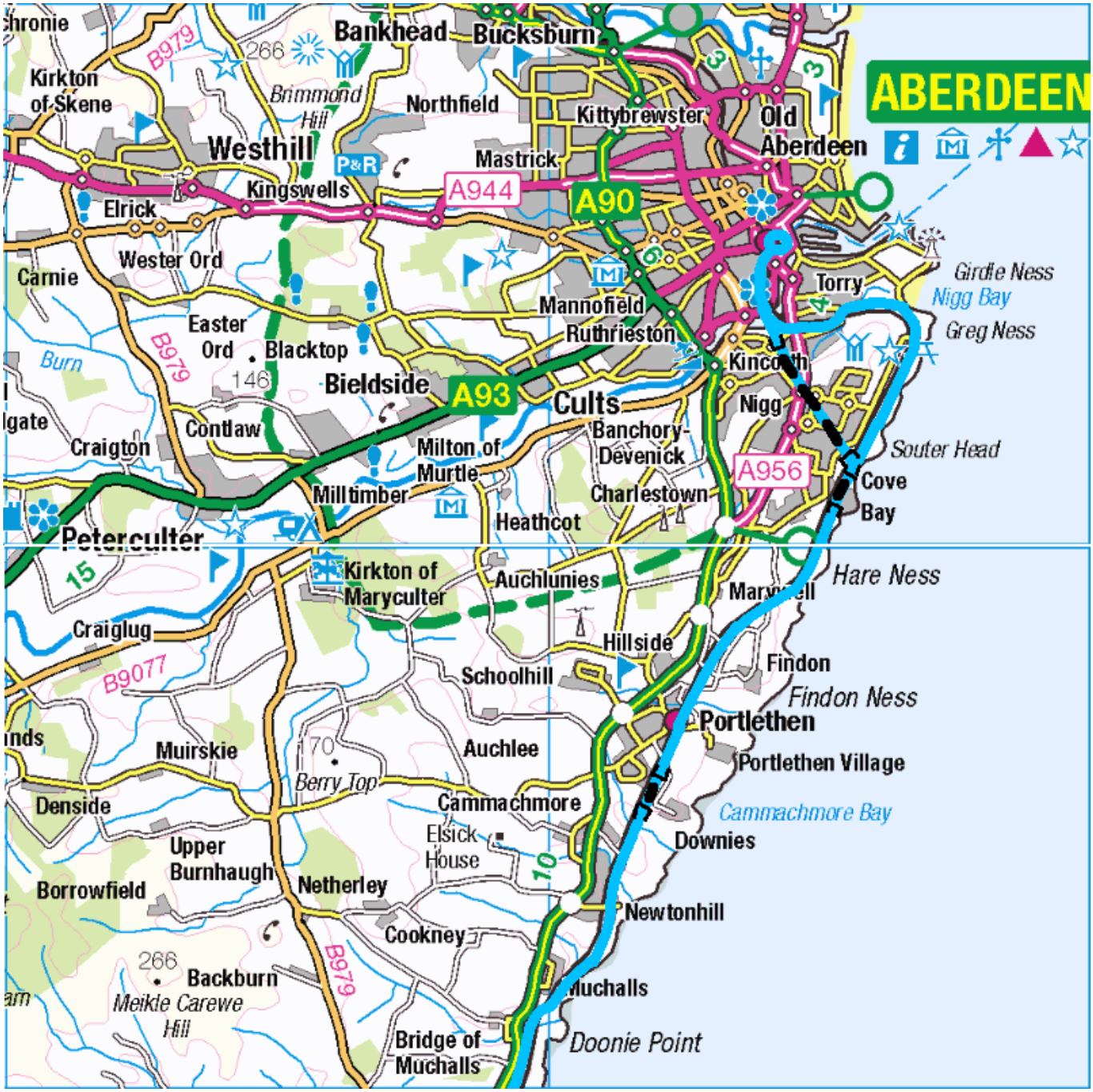
Farm buildings (not the farmhouse) encroach at East Mondynes (NO778794) and Newmill (NO788831). These will need to be relocated.

A 1 mile tunnel is required under Stonehaven, between NO856856 and NO866865.

HS14 switches to the north / east side of the classic alignment at NO901918, just before Muchalls. In the next several miles, especially at Port Lethen, there is a lot of housing on the west side, but remarkably little on the east.

A ½ mile tunnel is required at Newtonhill, between NO910933 and NO911940.

A ¼ mile tunnel is required at Cove Bay, between NJ953007 and NJ954012.



7.3 Muchalls – Aberdeen

It is necessary to switch sides again, to the south / west side, finally on the approach to the Dee bridge, on entering Aberdeen, say at NJ950042, as the area between railway and river is completely built up (mainly new developments, by appearance). The approach to Aberdeen Union station is then completely clear.

A couple of diversions are desirable, albeit not essential, to avoid strongly curved sections of the classic line (the maps show both these, as well as the original route):

- a 4 mile diversion between NO791008 and NO840855, on the approach to Stonehaven, on a falling gradient of 1 in 350, in tunnel essentially throughout,
- a 2 mile diversion between NJ956015, just north of Cove Bay, and NJ942044, just north of the Dee, on the west side of the existing bridge, on a falling gradient of 1 in 50, in tunnel essentially throughout (depending on precisely where it emerges from tunnel, some warehouses may need relocation; the area is an industrial estate). Actually, continuing it in tunnel under the river, would avoid any obstructions, and be a more elegant solution (saving on a bridge, too).

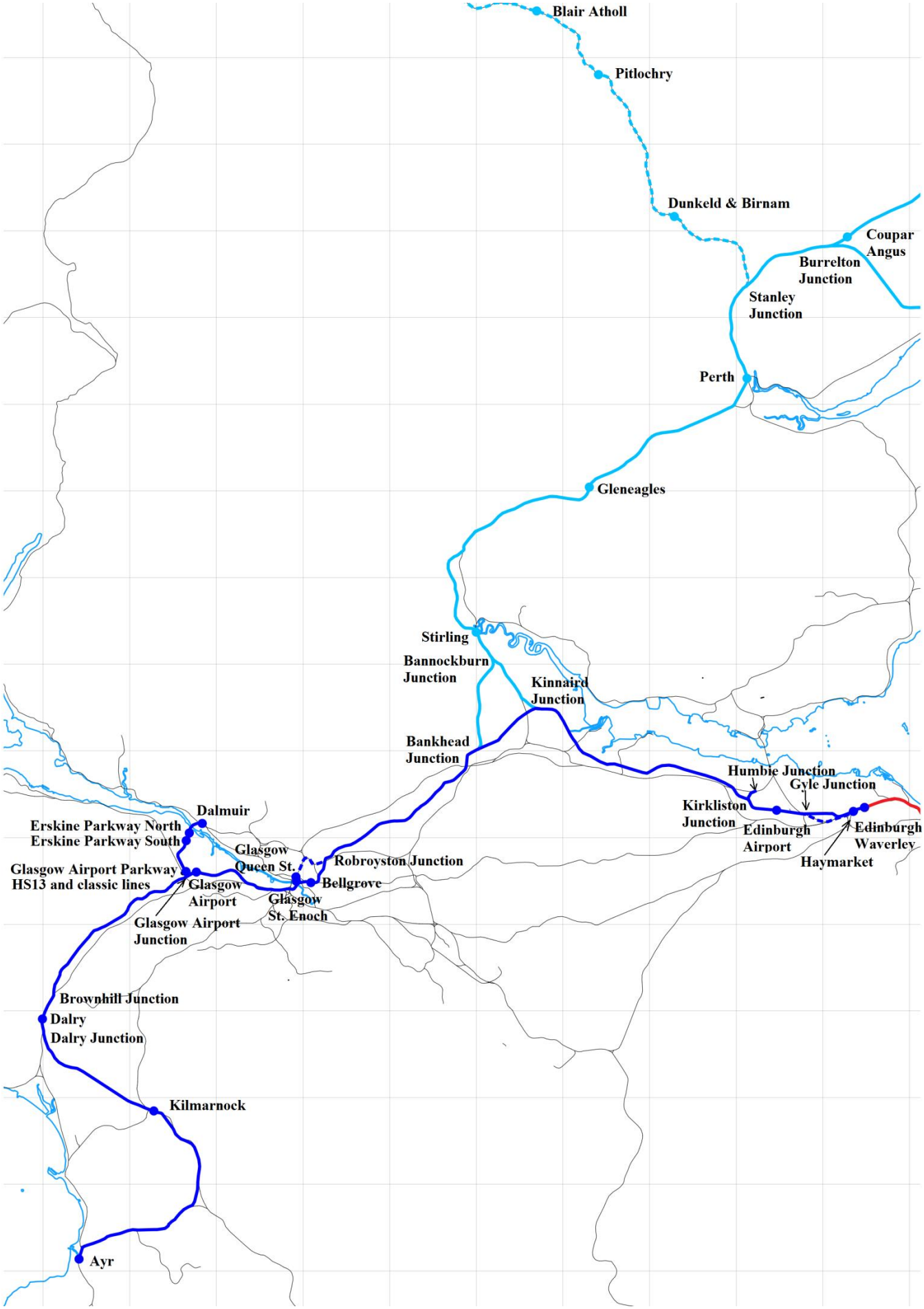
As with the Strathallan line between Stirling / Dunblane and Perth, it is an undecided question whether to build a new line, of GC gauge, between Craigo and Aberdeen, as described above, or whether simply to take over the existing line and enlarge it to GC gauge (with possibly the above diversions to improve the alignment). The deciding factor is what the anticipated traffic levels are (in particular, what the requirements are for freight).

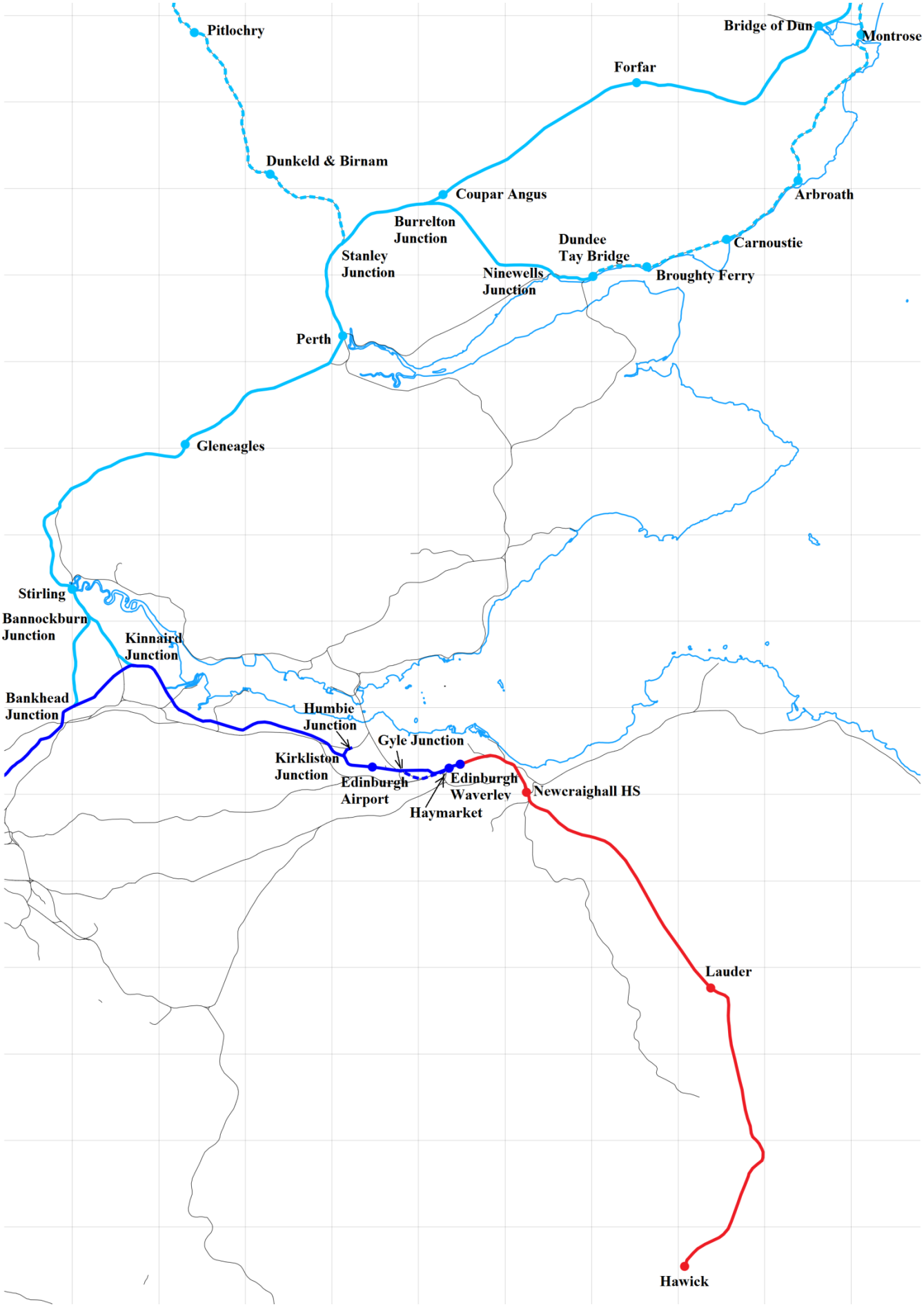
It may seem that widening the existing line is the straightforward option. But it isn't, necessarily. Widening to GC gauge involves rebuilding most, if not all, overbridges. It may require rebuilding underbridges (and viaducts!) also, since the tracks need to be further apart. All stations require extensive modification. It's not a simple job. Many of the changes are very difficult to implement on a working railway (especially modification of viaducts).

(The Strathallan line is a simpler proposition, with few overbridges and only one station.)

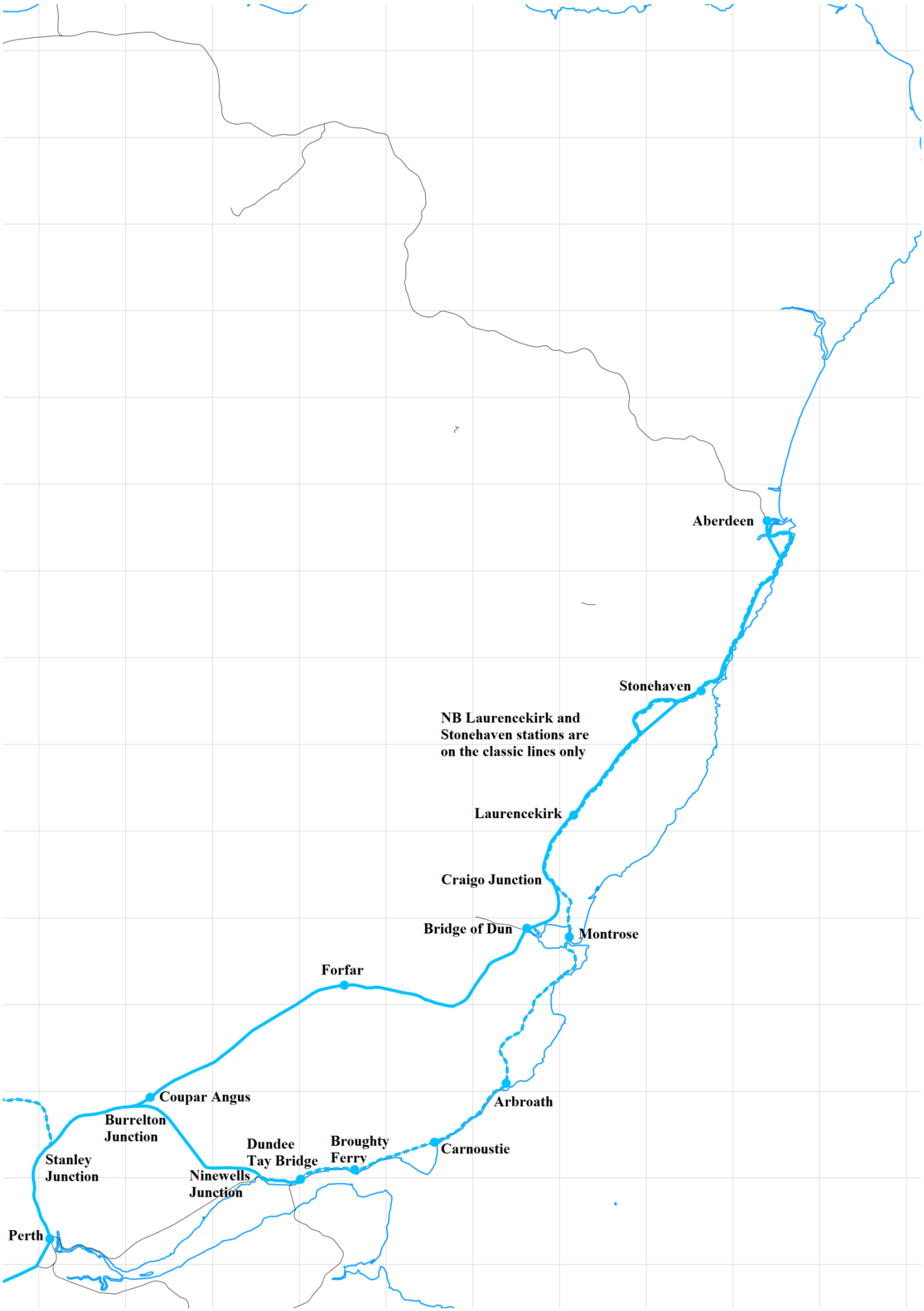
On the other hand, widening an existing line in principle avoids the need for all diversions (in particular, of tunnels under built-up areas). In principle. But it may be considered very desirable on environmental grounds to retain the tunnels; I doubt if Stonehaven, in particular, would be very happy at HS trains going at full speed across the town centre at ground level.

It is important for present purposes only to recognise that this is an issue which needs to be addressed. HS14's services to Aberdeen will initially be classic-compatible in any case. The service plans section explains how the services evolve, as the sections of new line progressively open. It may even be decided, on the basis of the experience of classic-compatible services, that these represent an entirely satisfactory long term solution. Other things being equal (which they rarely are) I tend to favour conversion, replacing the badly aligned sections approaching Stonehaven and Aberdeen with straight lines in tunnel, and retaining the proposed tunnels under Laurencekirk and Stonehaven for non-stop services; the stations would become GC-gauge, but with variable platforms to be able to handle classic-compatible and regional metro trains also.

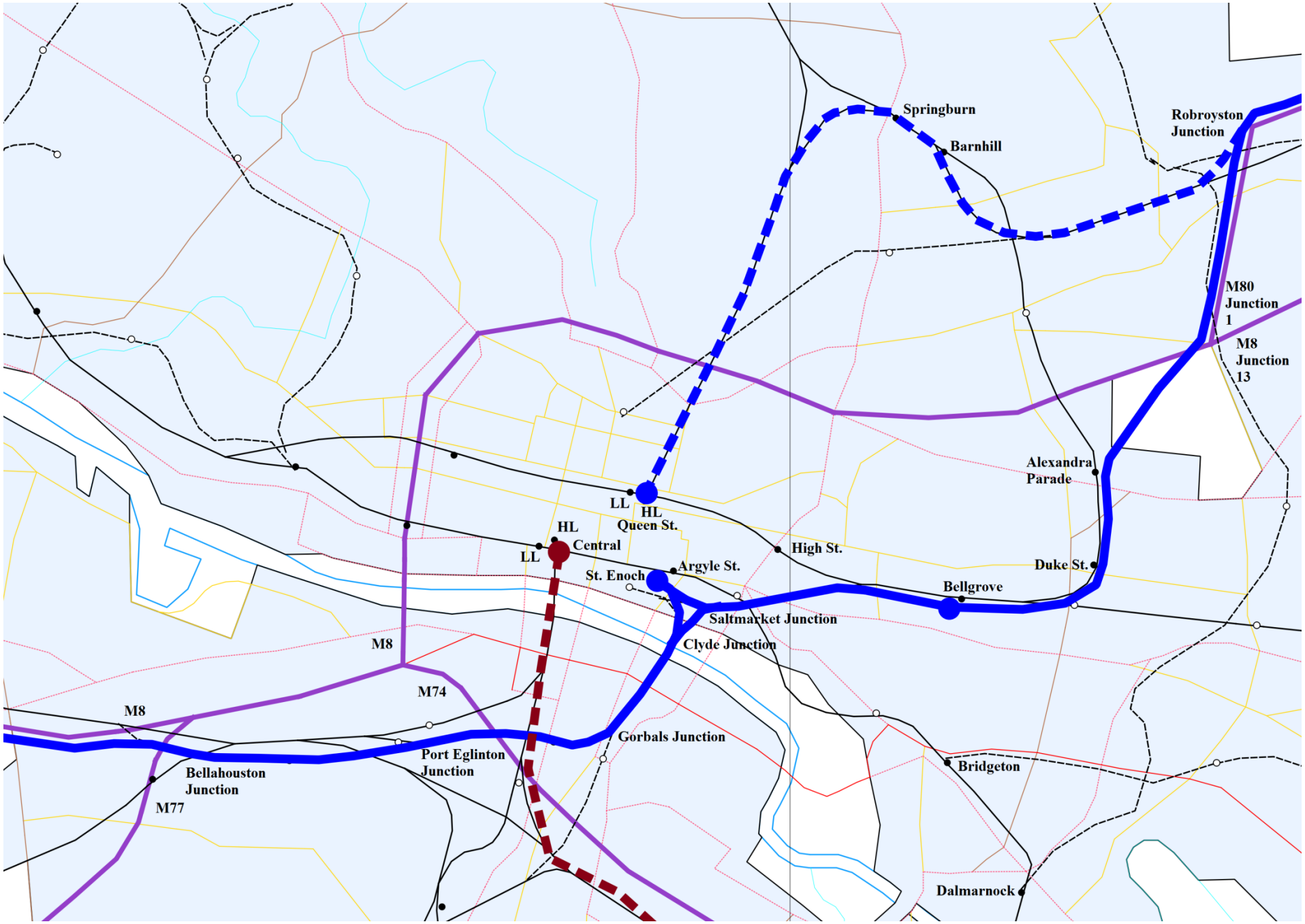


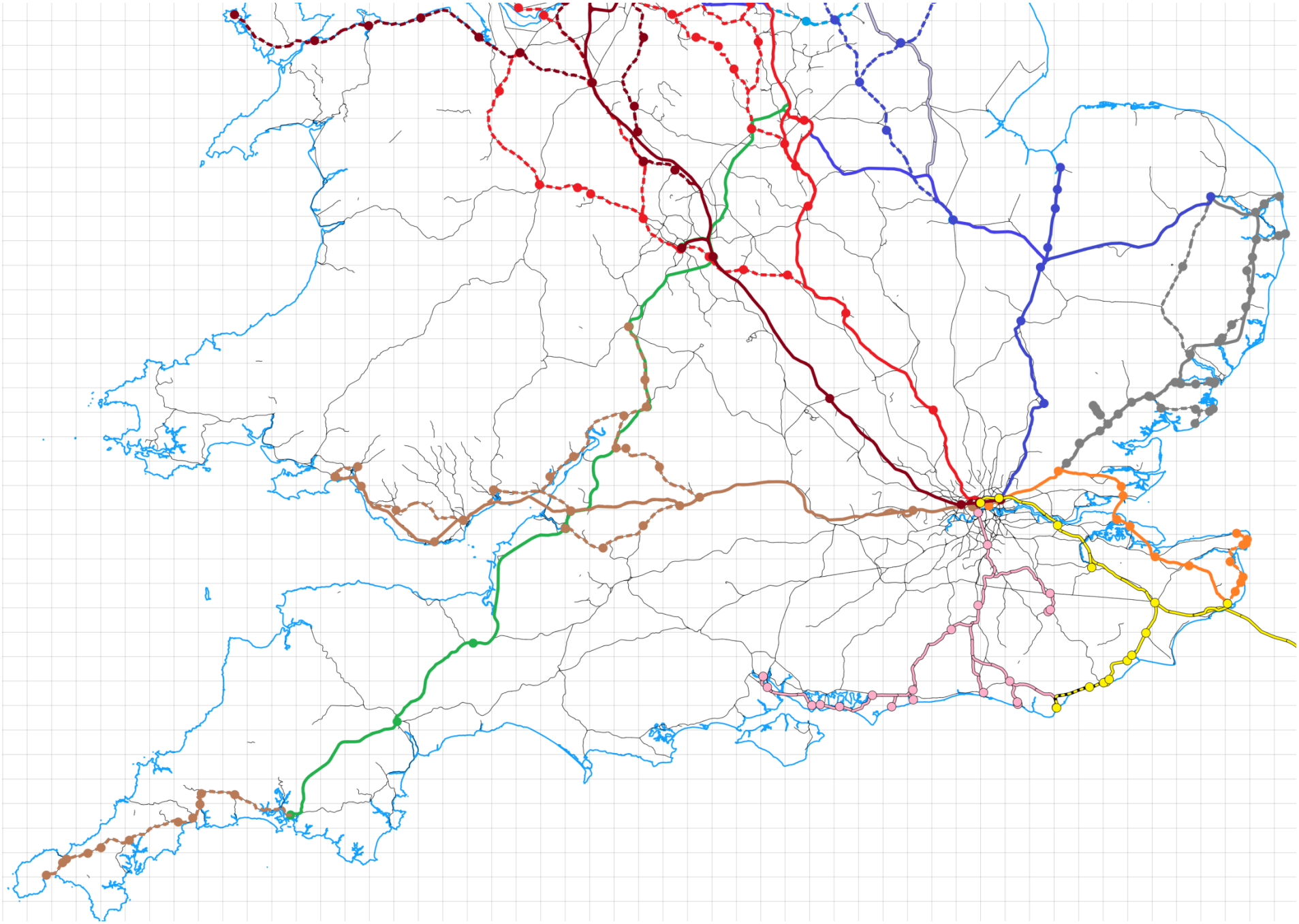


HS13/HS14 South East Sheet

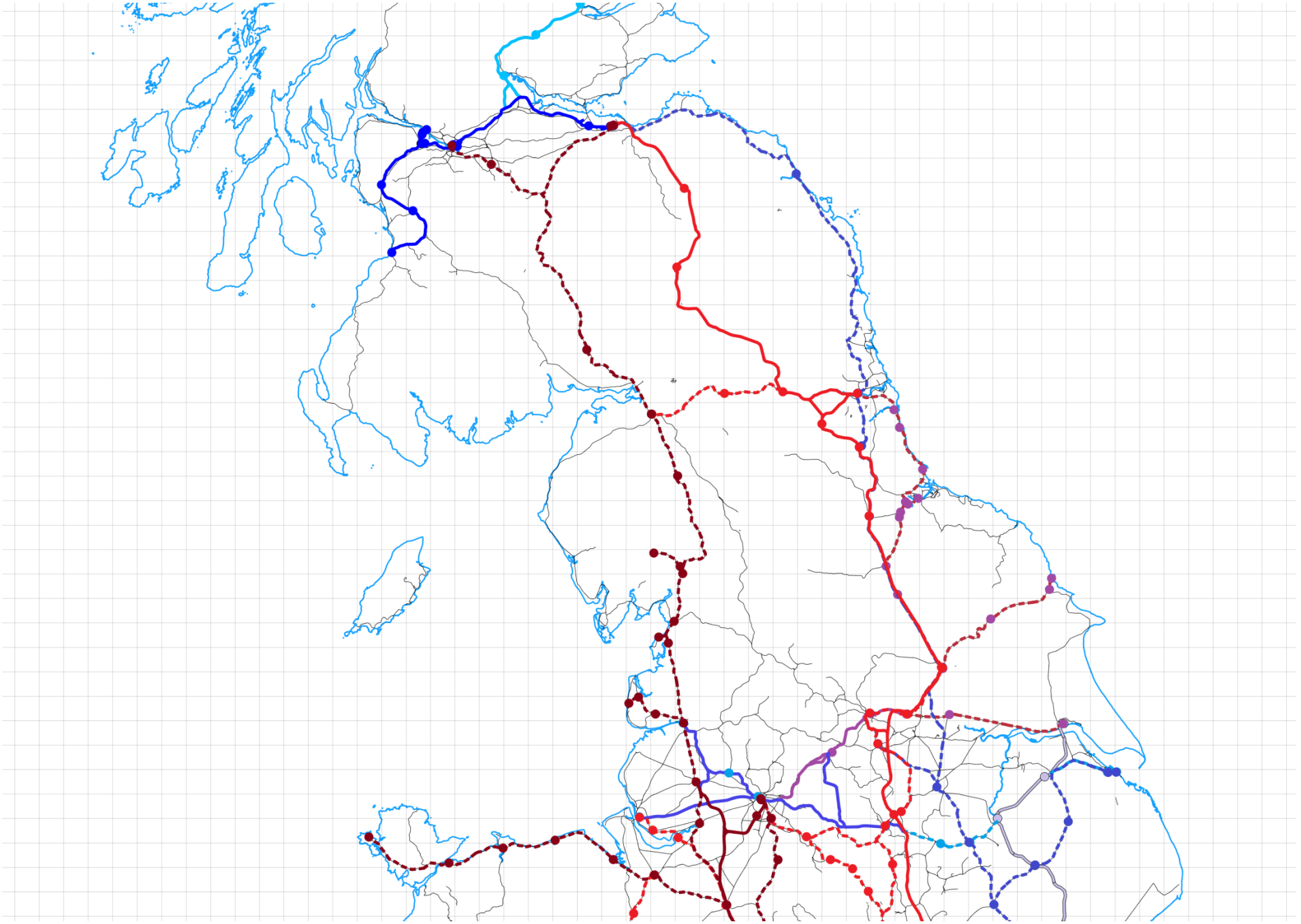


HS13/HS14 North East Sheet

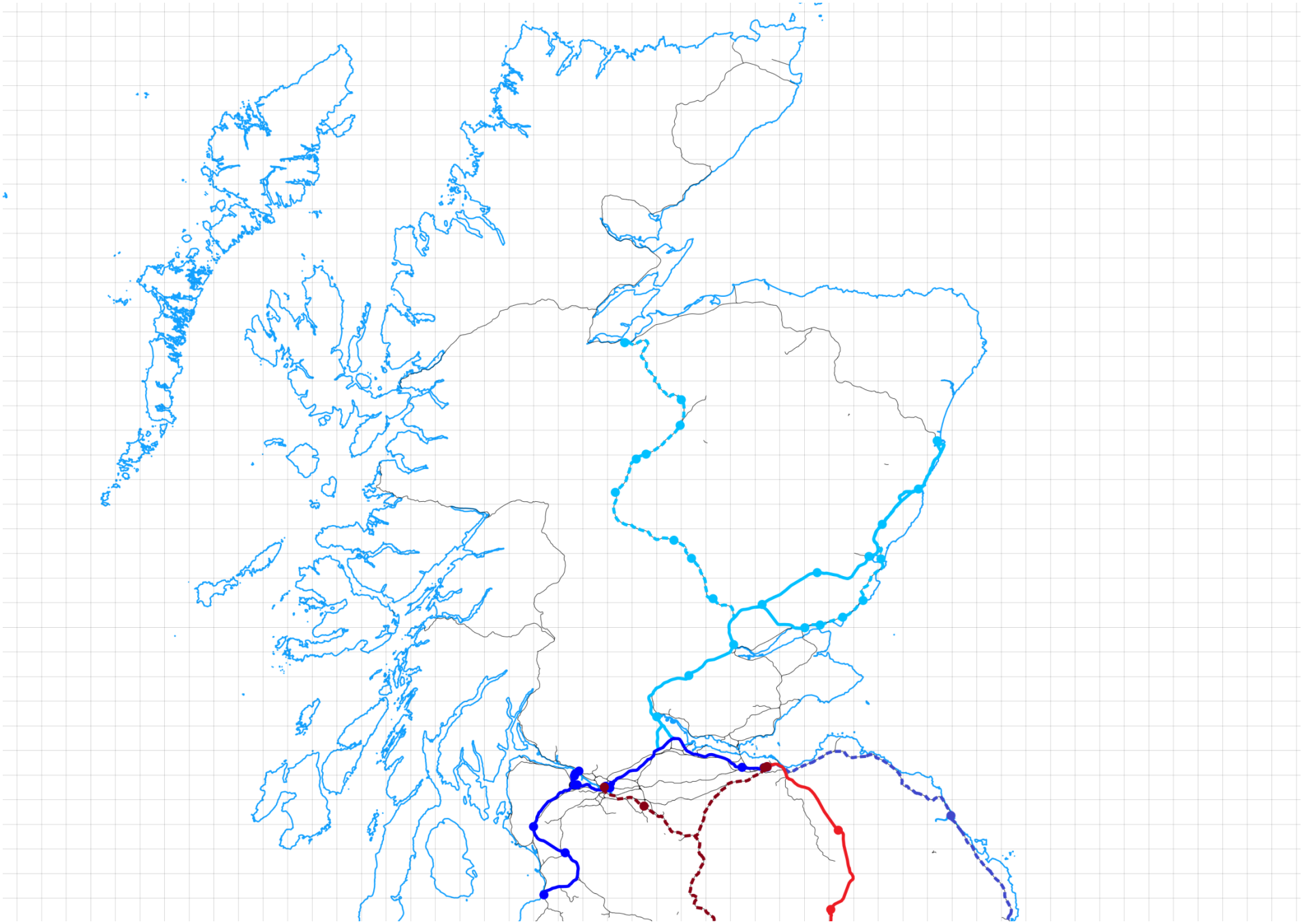




Complete HS Network, South Sheet



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 HS13 or HS14 themselves. This most commonly occurs when a new section of HS13 or HS14 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

Service Plan 1 comes into effect when HS13 opens between Gyle Junction and Glasgow Bellgrove, then on to Glasgow Airport Parkway station, bypassing the not-yet-available St. Enoch, and travelling directly between Saltmarket and Clyde Junctions. The spur between Kirkliston and Humbie Junctions is included. The new infrastructure is (of course!) all built to full GC gauge, although all services will initially (and for some time thereafter) be classic-compatible.

GC gauge provision at Edinburgh Waverley is foreseen as an extension to the north of the station, under Princes St. (But see Appendix A for a discussion of alternative possibilities. See Appendix B for a similar discussion of Glasgow St. Enoch. I foresee no problems in Aberdeen or Perth, but Dundee needs to be redeveloped, as explained earlier, in the Routes section.) This will not in fact be built until HS3 arrives from London, (or at least from Newcastle,) and this will not be in the immediate future. It is likely that a significant portion of the Scottish HS network will be in place and functioning, before (GC-gauge) HS services arrive from the south.

The point of the spur between Kirkliston and Humbie junctions is to allow classic, Regional Metro services from Edinburgh (and point east) to serve the airport, before rejoining the (western) approach to the Forth Bridge, and on to destinations in Fife, Perth, Dundee and Aberdeen. The airport station is initially of two islands, allowing cross-platform interchange between HS13 and RM services. The section between Gyle and Kirkliston junctions is certain to be the busiest on HS13, and passive provision should be made for its eventual quadrupling, as also for the widening of the airport station, which will likewise eventually need two island platforms, thus four platform faces, in both directions.

There are no dependencies in this service plan on any other HS route. The following service is introduced:

- 8tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Glasgow Bellgrove – Glasgow Airport – Glasgow Airport Parkway

The associated Regional Metro services are:

- 2tphR Edinburgh Waverley – Haymarket – Edinburgh Airport – Kirkcaldy – Dundee – Broughty Ferry – Carnoustie – Arbroath – Montrose – Laurencekirk – Stonehaven – Aberdeen
- 2tphR Edinburgh Waverley – Haymarket – Edinburgh Airport – Dunfermline Town – Glenrothes with Thornton – Markinch – Ladybank – Springfield – Cupar – Leuchars for St. Andrews – Dundee
- 2tphR Edinburgh Waverley – Haymarket – Edinburgh Airport – Dunfermline Town – Glenrothes with Thornton – Markinch – Ladybank – Newburgh – Abernethy – Bridge of Earne – Perth
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Rosyth – Dunfermline Town – Dunfermline Queen Margaret – Crossgates – Cowdenbeath – Lochgelly – Cardenden – Glenrothes with Thornton – Kirkcaldy – Kinghorn – Burntisland – Aberdour – Dalgety Bay – Inverkeithing –> Edinburgh (Fife Circle, clockwise)
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Dalgety Bay – Aberdour – Burntisland – Kinghorn – Kirkcaldy – Glenrothes with Thornton – Cardenden – Lochgelly – Cowdenbeath – Crossgates – Dunfermline Queen Margaret – Dunfermline Town – Rosyth – Inverkeithing –> Edinburgh (Fife Circle, counterclockwise)
- 2tphR Glasgow Central – Paisley Gilmout St. – Glasgow Airport Parkway – Bishopton – Port Glasgow – Whinhill – Drumfrochar – Branchton – IBM – Inverkip – Wemyss Bay
- 2tphR Glasgow Central – Paisley Gilmout St. – Glasgow Airport Parkway – Bishopton – Port Glasgow – Greenock Central – Greenock West – Port Matilda – Gourock
- 2tphRS Glasgow Central – Cardonald – Hillingdon East – Hillingdon West – Paisley Gilmout St. – Paisley St. James – Glasgow Airport Parkway – Bishopton – Langbank – Woodhall – Port Glasgow – Bogston – Cartsdyke – Greenock Central – Greenock West – Port Matilda – Gourock

Service Plan 1a

Service Plan 1a comes into effect when HS13 opens between Glasgow Airport Parkway and Dalmuir, and Glasgow St. Enoch opens.

The new St. Enoch will be very much smaller than the original, due to space constraints, with, probably, just 4 platforms (2 islands). It will eventually be served by GC-gauge trains, exclusively, but for now, all trains remain classic-compatible. (St. Enoch's platforms will therefore need to be raised, temporarily, to serve classic-compatible trains.) See appendix B for more on St. Enoch.

Of the 8tph from Edinburgh, 4tph will continue on to Dalmuir, avoiding St. Enoch, and the other 4tph will terminate at St. Enoch. There will be a service of 4tph between St. Enoch and Dalmuir, thus:

- 4tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 4tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Glasgow Bellgrove – Glasgow Airport – Glasgow Airport Parkway – Erskine Parkway South – Erskine Parkway North – Dalmuir
- 4tphC Glasgow St. Enoch – Glasgow Airport – Glasgow Airport Parkway – Erskine Parkway South – Erskine Parkway North – Dalmuir

The associated Regional Metro services are unchanged.

Representative Hourly Cross-Platform Interchange Pattern at Edinburgh Airport:

00C Edinburgh Waverley – Glasgow St. Enoch
R Edinburgh Waverley – Aberdeen

07C Edinburgh Waverley – Dalmuir via Glasgow Airport
RS Edinburgh Waverley – Dundee

15C Edinburgh Waverley – Glasgow St. Enoch
RS Edinburgh Waverley – Fife Circle, clockwise

23C Edinburgh Waverley – Dalmuir via Glasgow Airport
R Edinburgh Waverley – Perth

25RS Edinburgh Waverley – Fife Circle, counterclockwise
(no connection)

– repeating at 30, 37, 45, 53 and 55 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Glasgow Airport Parkway:

00C Edinburgh Waverley – Dalmuir
R Glasgow Central – Gourock semi-fast

07C Glasgow St. Enoch – Dalmuir
(no connection)

15C Edinburgh Waverley – Dalmuir
RS Glasgow Central – Gourock stopping

23C Glasgow St. Enoch – Dalmuir
RS Glasgow Central – Wemyss Bay

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

Service plan 1 overall imposes the following loadings on HS13:

• Edinburgh Waverley	– Kirkliston Junction	18tph
• Kirkliston Junction	– Humbie Junction	10tph
• Kirkliston Junction	– Saltmarket Junction	8tph
• Saltmarket Junction	– Glasgow St. Enoch	4tph
• Saltmarket Junction	– Clyde Junction	4tph
• Glasgow St. Enoch	– Clyde Junction	4tph
• Clyde Junction	– Dalmuir	8tph

Service Plan 2

Service Plan 2 comes into effect when HS14 opens between Kinnaird Junction and Bannockburn Junction, between Bankhead Junction and Bannockburn Junction, and between Bannockburn Junction and Dunblane Junction

The services of plan 1 are unchanged, and the following services are introduced:

- 2tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth – Dundee –Broughty Ferry – Carnoustie – Arbroath – Montrose – Laurencekirk – Stonehaven – Aberdeen
- 2tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Perth – Dundee
- 1tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness
- 1tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness

The associated Regional Metro services are:

- 2tphRS Glasgow Queen St. – Stepps – Gartcosh – Greenfaulds – Cumbernauld – Larbert – Stirling – Bridge of Allan – Dunblane – Gleneagles – Perth – Invergowrie – Dundee – Broughty Ferry – Balmossie – Monifieth – Barry Links – Golf St. – Carnoustie – Arbroath
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Rosyth – Dunfermline Town (reverse) – Cairneyhill – Torryburn – Culross – Kincardine – Kilbagie – Clackmannan – Alloa – Cambus – Causewayhead – Stirling
- 2tphRS Edinburgh Waverley – Haymarket – Edinburgh Park – Linlithgow – Polmont – Falkirk Grahamston – Falkirk Camelon – Larbert – Stirling

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

00C Glasgow St. Enoch – Aberdeen
RS Edinburgh Waverley – Stirling via Larbert

15C Edinburgh Waverley – Dundee
RS Glasgow Queen St. – Arbroath

25RS Edinburgh Waverley – Stirling via Alloa
(no connection)

– repeating at 30, 45 and 55 minutes past.

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

00C Glasgow St. Enoch – Aberdeen
C Edinburgh Waverley – Inverness
R Edinburgh Waverley – Perth
RS Glasgow Queen St. – Arbroath

– repeating at 30 minutes past (Glasgow St. Enoch – Inverness; runs immediately before the Aberdeen service).

Interchange possibilities at Dundee must await the redevelopment of Tay Bridge station.

HS14 is extended from Dunblane Junction to Perth with all deliberate speed, but while this will speed up the services, it makes no change to the service pattern.

Service Plan 2a

Service Plan 2a comes into effect when HS14 opens between Perth and Dundee via Burrelton Junction. This includes the redevelopment of Tay Bridge station. The classic-compatible services, above, are amended as appropriate to travel to Dundee by the new route.

Representative Hourly Cross-Platform Interchange Pattern at Perth (with the Strathmore line reopening to Burrelton Junction, cross-platform interchange is enabled between Aberdeen and Inverness services):

00C Glasgow St. Enoch – Aberdeen
C Edinburgh Waverley – Inverness
R Edinburgh Waverley – Perth (**not** cross-platform)
RS Glasgow Queen St. – Arbroath (**not** cross-platform)

– repeating at 30 minutes past (Glasgow St. Enoch – Inverness; runs immediately before the Aberdeen service).

Representative Hourly Cross-Platform Interchange Pattern at Dundee Tay Bridge:

00C Glasgow St. Enoch – Aberdeen
RS Glasgow Queen St. – Arbroath

15C Edinburgh Waverley – Dundee
R Edinburgh Waverley – Aberdeen

– repeating at 30 and 45 minutes past.

Service plan 2 overall imposes the following loadings on HS13:

• Edinburgh Waverley	– Kirkliston Junction	23tph
• Kirkliston Junction	– Humbie Junction	12tph
• Kirkliston Junction	– Kinnaird Junction	11tph
• Kinnaird Junction	– Bankhead Junction	8tph
• Bankhead Junction	– Saltmarket Junction	11tph
• Saltmarket Junction	– Glasgow St. Enoch	7tph
• Saltmarket Junction	– Clyde Junction	4tph
• Glasgow St. Enoch	– Clyde Junction	4tph
• Clyde Junction	– Dalmuir	8tph

– and the following loadings on HS14:

- Kinnaird Junction – Bannockburn Junction 3tph
- Bankhead Junction – Bannockburn Junction 3tph
- Bannockburn Junction – Dunblane Junction 6tph
- Dunblane Junction – Perth station 6(8)tph *
- Perth station – Stanley junction 6tph
- Stanley junction – Burrelton Junction 4tph
- Burrelton Junction – Ninewells Junction 4tph
- Ninewells Junction – Dundee Tay Bridge station 6tph

The loading of the section Edinburgh Waverley – Kirkliston Junction is clearly high, however 16 of the 23tph form 8 pairs, and each pair makes a cross-platform connection at the airport station, so the two trains of the pair can approach and depart that station on a very short (1 minute) headway. The two diverge at Kirkliston Junction, so are no longer in each others' way. When GC-gauge services commence, the two trains of each pair will not approach each other until Gyle Junction, just before the airport. The length of the section with the 19tph loading is thus a matter of just 4 miles. As was mentioned in service plan 1, passive provision should be made for quadrupling this 4-mile section.

* If implementation of the line between Dunblane Junction and Perth were by taking over the existing line and enlarging it to GC-gauge, then the section loading would include an extra 2tph for the service from Glasgow Queen St. to Arbroath.

Service Plan 3

Service Plan 3 comes into effect when HS14 opens between Burrelton Junction and Craigo Junction.

The services of plan 1 are unchanged, and the following services are introduced, or amended from service plan 2:

- 1tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth –Aberdeen
- 1tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Gleneagles – Perth – Coupar Angus – Forfar – Bridge of Dun – Laurencekirk – Stonehaven – Aberdeen
- 1tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth –Dundee
- 1tphC Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness
- 1tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Perth – Aberdeen
- 1tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Gleneagles – Perth – Coupar Angus – Forfar – Bridge of Dun – Laurencekirk – Stonehaven – Aberdeen
- 1tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Perth – Dundee
- 1tphC Edinburgh Waverley – Haymarket – Edinburgh Airport – Stirling – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness

Representative Hourly Cross-Platform Interchange Pattern at Perth (note that this has changed very significantly from service plan 2):

00C Glasgow St. Enoch – Aberdeen (nonstop from Perth)
C Edinburgh Waverley – Inverness
R Edinburgh Waverley – Perth (**not** cross-platform)
RS Glasgow Queen St. – Arbroath (**not** cross-platform)

15C Glasgow St. Enoch – Aberdeen (stopping at Strathmore stations)
C Edinburgh Waverley – Dundee

30C Edinburgh Waverley – Aberdeen (nonstop from Perth)
C Glasgow St. Enoch – Inverness
R Edinburgh Waverley – Perth (**not** cross-platform)
RS Glasgow Queen St. – Arbroath (**not** cross-platform)

45C Edinburgh Waverley – Aberdeen (stopping at Strathmore stations)
C Glasgow St. Enoch – Dundee

Representative Hourly Cross-Platform Interchange Pattern at Dundee Tay Bridge:

00C Glasgow St. Enoch – Dundee
R Edinburgh Waverley – Aberdeen
RS Glasgow Queen St. – Arbroath

30C Edinburgh Waverley – Dundee
R Edinburgh Waverley – Aberdeen
RS Glasgow Queen St. – Arbroath

Service plan 3 overall imposes the following loadings on HS13:

- Edinburgh Waverley – Kirkliston Junction 24tph
- Kirkliston Junction – Humbie Junction 12tph
- Kirkliston Junction – Kinnaird Junction 12tph
- Kinnaird Junction – Bankhead Junction 8tph
- Bankhead Junction – Saltmarket Junction 12tph
- Saltmarket Junction – Glasgow St. Enoch 8tph
- Saltmarket Junction – Clyde Junction 4tph
- Glasgow St. Enoch – Clyde Junction 4tph
- Clyde Junction – Dalmuir 8tph

– and the following loadings on HS14:

- Kinnaird Junction – Bannockburn Junction 4tph
- Bankhead Junction – Bannockburn Junction 4tph
- Bannockburn Junction – Dunblane Junction 8tph
- Dunblane Junction – Perth station 8(10)tph *
- Perth station – Stanley junction 8tph
- Stanley junction – Burrelton Junction 6tph
- Burrelton Junction – Ninewells Junction 2tph
- Ninewells Junction – Dundee Tay Bridge station 4tph
- Burrelton Junction – Craigo Junction 4tph
- Craigo Junction – Aberdeen 6tph

A little clarification may help: The 2tph to Aberdeen from each of Edinburgh and Glasgow at service plan 2 travelled between Burrelton Junction and Craigo Junction via Dundee and Arbroath. With the opening of the direct Strathmore line they now travel directly, 1tph nonstop and 1tph stopping at Coupar Angus, Forfar and Bridge of Dun. A new service of 1tph is introduced, terminating at Dundee. The loadings between Burrelton Junction and Dundee thus show a net decrease of 2tph, while the routes from Edinburgh and Glasgow to Burrelton Junction each have an extra 1tph, the new Dundee service.

* If implementation of the line between Dunblane Junction and Perth were by taking over the existing line and enlarging it to GC-gauge, then the section loading would include an extra 2tph for the service from Glasgow to Arbroath.

Service Plan 4

Service Plan 4 comes into effect when HS13 opens between Glasgow Airport Junction and Ayr.

The services of plan 3 are unchanged, and the following service is introduced

- 8tphC Glasgow St. Enoch – Glasgow Airport – Dalry – Kilmarnock – Ayr

The associated Regional Metro services are:

- 2tphR Glasgow Central – Paisley Gilmour St. – Johnstone – Milliken Park – Howwood – Lochwinnoch – Glengarnock – Dalry – Kilwinning – Stevenston – Saltcoats – Ardrossan South Beach – Ardrossan Town – Ardrossan Harbour
- 2tphR Glasgow Central – Paisley Gilmour St. – Dalry – Kilwinning – Ardrossan South Beach – West Kilbride – Fairlie – Largs
- 2tphR Glasgow Central – Paisley Gilmour St. – Johnstone – Milliken Park – Howwood – Lochwinnoch – Glengarnock – Dalry – Kilwinning – Irvine – Barassie – Troon – Prestwick Intl Airport – Prestwick Town – Newton on Ayr – Ayr
- 2tph Glasgow Central – Paisley Gilmour St. – Dalry – Kilwinning – Irvine –Troon – Prestwick Intl Airport – Prestwick Town – Ayr

Representative Hourly Cross-Platform Interchange Pattern at Dalry:

00C Glasgow St. Enoch – Ayr
R Glasgow Central – Ardrossan Harbour

07C Glasgow St. Enoch – Ayr
R Glasgow Central – Ayr (semi-fast)

15C Glasgow St. Enoch – Ayr
R Glasgow Central – Ayr (all stations)

23C Glasgow St. Enoch – Ayr
R Glasgow Central – Largs

Service plan 4 overall imposes the following loadings on HS13:

• Edinburgh Waverley	– Kirkliston Junction	24tph
• Kirkliston Junction	– Humbie Junction	12tph
• Kirkliston Junction	– Kinnaird Junction	12tph
• Kinnaird Junction	– Bankhead Junction	8tph
• Bankhead Junction	– Saltmarket Junction	12tph
• Saltmarket Junction	– Glasgow St. Enoch	8tph
• Saltmarket Junction	– Clyde Junction	4tph
• Glasgow St. Enoch	– Clyde Junction	12tph
• Clyde Junction	– Glasgow Airport Junction	16tph
• Glasgow Airport Junction	– Dalmuir	8tph
• Glasgow Airport Junction	– Ayr	8tph

– with no change to the loadings of HS14.

Service Plan 5

Service Plan 5 comes into effect when HS3 opens through to Edinburgh and GC-gauge services from the south begin. The HS13 GC-gauge section between Edinburgh Waverley HS and Gyle Junction opens, as does HS14 from Craigo Junction to Aberdeen as GC gauge. Rather than having GC-gauge trains starting / terminating in Waverley HS station, all such services begin from a station at Newcraighall HS, adjacent to the classic Newcraighall station, on the line of HS3. (This is counted as an HS13 station since although it's actually on HS3, being a north / west-facing terminal station, it can't in fact be served from HS3!) The 4tph Edinburgh – Glasgow St. Enoch service is taken over by HS3 services, terminating in Glasgow.

At service plan 5 the services are completely recast, so, for clarity, rather than listing the new services / changes from service plan 4, the entire service plan is expounded in its totality. Note that St. Enoch becomes entirely GC gauge, so classic-compatible services from Glasgow now start from Queen St.

Classic- compatible services from routes other than HS3 which terminate in Edinburgh are included, and also ECML regional metro services.

HS13 Services:

- 2tphG HS3: [HS5 Eastbourne –>] Pancras Cross – York – Darlington Bank Top – Durham Relly Mill – Consett – Hexham – Hawick – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 2tphG HS3: Newcastle – Hexham – Hawick – Lauder – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Glasgow Bellgrove – Glasgow St. Enoch
- 4tphGG Newcraighall HS – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Glasgow Bellgrove – Glasgow Airport – Glasgow Airport Parkway – Erskine Parkway South – Erskine Parkway North – Dalmuir
- 4tph GG Glasgow St. Enoch – Glasgow Airport – Glasgow Airport Parkway – Erskine Parkway South – Erskine Parkway North – Dalmuir
- 8tphG Glasgow St. Enoch – Glasgow Airport – Dalry – Kilmarnock – Ayr

HS14 Services:

- 2tphG Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth – Aberdeen ('fast')
- 2tphG Newcraighall HS – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Stirling – Perth – Aberdeen ('fast')
- 2tphG Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Perth – Coupar Angus – Forfar – Bridge of Dun – Aberdeen ('stopping')
- 2tphG Newcraighall HS – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Stirling – Perth – Coupar Angus – Forfar – Bridge of Dun – Aberdeen ('stopping')
- 2tphG Glasgow St. Enoch – Glasgow Bellgrove – Stirling – Gleneagles – Perth – Dundee Tay Bridge
- 2tphG Newcraighall HS – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Stirling – Gleneagles – Perth – Dundee Tay Bridge
- 2tphC Glasgow Queen St. – Stirling – Gleneagles – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness

- 2tphC HS3 Hawick – Lauder – Edinburgh Waverley HS – Haymarket HS – Edinburgh Airport – Stirling – Gleneagles – Perth – Dunkeld & Birnam – Pitlochry – Blair Atholl – Dalwhinnie – Newtonmore – Kingussie – Aviemore – Carrbridge – Inverness
- 2tphC Glasgow Queen St. – Stirling – Perth – Dundee Tay Bridge – Broughty Ferry – Carnoustie – Arbroath – Montrose – Laurencekirk – Stonehaven - Aberdeen

Classic-Compatible Services from Routes Other Than HS3:

- 2tphC HS6 London –> York – Darlington – Durham – Newcastle – Berwick – Ed. Waverley
- 1tphC HS2 Birmingham –> Carlisle – Lockerbie – Haymarket – Edinburgh Waverley
- 1tphC HS2 Liverpool –> Carlisle – Lockerbie – Haymarket – Edinburgh Waverley

Regional Metro Services:

- 2tphR York – Thirsk – Northallerton – Darlington – Durham – Chester le Street – Newcastle – Morpeth – Alnmouth – Berwick – Dunbar – Drem – Edinburgh Waverley
- 2tphR Hawick – St. Boswells – Melrose – Tweedbank – Galashiels – Edinburgh Waverley – Haymarket – Edinburgh Airport – Kirkcaldy – Dundee Tay Bridge – Broughty Ferry – Carnoustie – Arbroath – Montrose – Laurencekirk – Stonehaven – Aberdeen
- 2tphR Hawick – St. Boswells – Melrose – Tweedbank – Galashiels – Stow – Gorebridge – Newtongrange – Eskbank – Shawfair – Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – Edinburgh Airport – Dunfermline Town – Glenrothes with Thornton – Markinch – Ladybank – Springfield – Cupar – Leuchars for St. Andrews – Dundee Tay Bridge
- 2tphR Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – Edinburgh Airport – Dunfermline Town – Glenrothes with Thornton – Markinch – Ladybank – Newburgh – Abernethy – Bridge of Earne – Perth
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Rosyth – Dunfermline Town – Dunfermline Queen Margaret – Crossgates – Cowdenbeath – Lochgelly – Cardenden – Glenrothes with Thornton – Kirkcaldy – Kinghorn – Burntisland – Aberdour – Dalgety Bay – Inverkeithing –> Edinburgh (Fife Circle, clockwise)
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Dalgety Bay – Aberdour – Burntisland – Kinghorn – Kirkcaldy – Glenrothes with Thornton – Cardenden – Lochgelly – Cowdenbeath – Crossgates – Dunfermline Queen Margaret – Dunfermline Town – Rosyth – Inverkeithing –> Edinburgh (Fife Circle, counterclockwise)
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – South Gyle – Edinburgh Airport – Dalmeny – North Queensferry – Inverkeithing – Rosyth – Dunfermline Town (reverse) – Cairneyhill – Torryburn – Culross – Kincardine – Kilbagie – Clackmannan – Alloa – Cambus – Causewayhead – Stirling
- 2tphRS Newcraighall – Brunstane – Edinburgh Waverley – Haymarket – Edinburgh Park – Linlithgow – Polmont – Falkirk Grahamston – Falkirk Camelon – Larbert – Stirling
- 2tphRS Glasgow Queen St. – Stepps – Gartcosh – Greenfaulds – Cumbernauld – Larbert – Stirling – Bridge of Allan – Dunblane – Gleneagles – Perth – Invergowrie – Dundee – Broughty Ferry – Balmossie – Monifieth – Barry Links – Golf St. – Carnoustie – Arbroath
- 2tphR Glasgow Central – Paisley Gilmout St. – Glasgow Airport Parkway – Bishopton – Port Glasgow – Whinhill – Drumfrochar – Branchton – IBM – Inverkip – Wemyss Bay

- 2tphR Glasgow Central – Paisley Gilmout St. – Glasgow Airport Parkway – Bishopton – Port Glasgow – Greenock Central – Greenock West – Port Matilda – Gourock
- 2tphRS Glasgow Central – Cardonald – Hillingdon East – Hillingdon West – Paisley Gilmout St. – Paisley St. James – Glasgow Airport Parkway – Bishopton – Langbank – Woodhall – Port Glasgow – Bogston – Cartsdyke – Greenock Central – Greenock West – Port Matilda – Gourock
- 2tphR Glasgow Central – Paisley Gilmour St. – Dalry – Kilwinning – Ardrossan South Beach – West Kilbride – Fairlie – Largs
- 2tphRS Glasgow Central – Paisley Gilmour St. – Johnstone – Milliken Park – Howwood – Lochwinnoch – Glengarnock – Dalry – Kilwinning – Stevenston – Saltcoats – Ardrossan South Beach – Ardrossan Town – Ardrossan Harbour
- 2tphR Glasgow Central – Paisley Gilmour St. – Dalry – Kilwinning – Irvine –Troon – Prestwick Intl Airport – Prestwick Town – Ayr
- 2tphRS Glasgow Central – Paisley Gilmour St. – Johnstone – Milliken Park – Howwood – Lochwinnoch – Glengarnock – Dalry – Kilwinning – Irvine – Barassie – Troon – Prestwick Intl Airport – Prestwick Town – Newton on Ayr – Ayr

[It is worth noting that, if HS provision between Craigo Junction and Aberdeen were by conversion of the existing line, rather than newbuild, as discussed at the end of the Route section, then the stations at Laurencekirk and Stonehaven would likewise be converted, and would be served by the GC-gauge Aberdeen stopping services, from both Glasgow and Edinburgh, as well as by the classic-compatible and regional metro services via Dundee.]

Representative Hourly Cross-Platform Interchange Pattern at Edinburgh Airport:

00G [HS3 from London] – Edinburgh Waverley HS – Glasgow St. Enoch
R Hawick – Aberdeen via the bridges

03G Newcraighall HS – Dundee
RS Newcraighall – Edinburgh Waverley – Fife Circle, clockwise

07C Hawick – Inverness
(no connection)

10GG Newcraighall HS – Dalmuir
R Hawick – Dundee via the bridges

13G Newcraighall HS – Aberdeen fast
RS Newcraighall – Edinburgh Waverley – Stirling via Alloa

17G Newcraighall HS – Aberdeen stopping
RS Newcraighall – Edinburgh Waverley – Fife Circle, counterclockwise

20G [HS3 from Newcastle] – Edinburgh Waverley – Glasgow St. Enoch
RS Newcraighall – Edinburgh Waverley – Stirling via Larbert

25GG Newcraighall HS – Dalmuir
RS Edinburgh Waverley – Perth via the Forth Bridge

– repeating at 30, 33, 37, 40, 43, 47, 50 and 55 minutes past.

Representative Hourly Non-Cross-Platform Interchange Pattern at Glasgow Airport Parkway:

00C Edinburgh Waverley – Dalmuir
R Glasgow Central – Gourock semi-fast

07C Glasgow St. Enoch – Dalmuir
(no connection)

15C Edinburgh Waverley – Dalmuir
RS Glasgow Central – Gourock stopping

23C Glasgow St. Enoch – Dalmuir
RS Glasgow Central – Wemyss Bay

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

Representative Hourly Cross-Platform Interchange Pattern at Dalry:

00C Glasgow St. Enoch – Ayr
R Glasgow Central – Ardrossan Harbour

07C Glasgow St. Enoch – Ayr
R Glasgow Central – Ayr (semi-fast)

15C Glasgow St. Enoch – Ayr
R Glasgow Central – Ayr (all stations)

23C Glasgow St. Enoch – Ayr
R Glasgow Central – Largs

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

Representative Hourly Cross-Platform Interchange Pattern at Stirling:

00G Glasgow St. Enoch – Aberdeen fast
RS Edinburgh Waverley – Stirling via Larbert (**not** cross-platform)

05G Glasgow St. Enoch – Aberdeen stopping
G Newcraighall HS – Dundee (*)

10C Glasgow Queen St. – Aberdeen via Dundee
C Glasgow Queen St. – Inverness (*)

15G Newcraighall HS – Aberdeen fast
RS Glasgow Queen St. – Arbroath via Larbert (**not** cross-platform)

20G Newcraighall HS – Aberdeen stopping
G Glasgow St. Enoch – Dundee (*)

25C Hawick – Inverness (*)
(no connection)

– similarly at 30, 35, 40, 45, 50 and 55 minutes past.

Some clarification is clearly required! Stirling is not the primary interchange point – that's Perth. The main interest of the above is in departure times from Stirling. Those HS services marked (*) stop at Gleneagles, and are thus allowed an extra 5 minutes to get to Perth. The interactions at 05 and 20 minutes past thus do provide a connection to Gleneagles, from Edinburgh and Glasgow respectively, and the interaction at 15 minutes past does provide a connection from Edinburgh to Bridge of Allan and Dunblane (and, for that matter, Gleneagles). The interactions at 00 and 15 minutes past do provide seriously useful connections to Perth and Aberdeen, for stations via Larbert, from Edinburgh and Glasgow respectively. The interaction at 10 minute past is amusing, but of little significance.

Representative departures from Gleneagles:

00C Hawick – Inverness. Connects at Perth into Glasgow – Aberdeen fast.

10G Newcraighall HS – Dundee. Connects at Dundee into Glasgow – Aberdeen via Arbroath.

15C Glasgow Queen St. – Inverness. Connects at Perth into Edinburgh – Aberdeen fast.

~20RS Glasgow Queen St. – Arbroath

25G Glasgow St. Enoch – Dundee. Connects at Dundee into Edinburgh – Aberdeen via Arbroath.

– similarly at 30, 40, 45, 50 and 55 minutes past.

(This is a quite remarkably good service for Gleneagles! As well as the golf, it is of course also the railhead for Crieff, and bus connections will be provided, for the Dundee trains, and thus also for Inverness, 5 minutes later, and for Aberdeen, by a change at Perth).

Representative Hourly Cross-Platform Interchange Pattern at Perth:

00G Glasgow St. Enoch – Aberdeen fast
C Hawick – Inverness
R Edinburgh Waverley – Perth (**not** cross-platform)
RS Glasgow Queen St. – Arbroath via Invergowrie (**not** cross-platform)

05G Glasgow St. Enoch – Aberdeen stopping
(no connection)

10G Newcraighall HS – Dundee
C Glasgow Queen St. – Aberdeen via Dundee (also at Dundee)

15G Newcraighall HS – Aberdeen fast
C Glasgow Queen St. –Inverness

20G Newcraighall HS – Aberdeen stopping
(no connection)

25C Glasgow St. Enoch – Dundee
(no connection – connects at Dundee into Hawick – Aberdeen via the bridges)

Representative Hourly Cross-Platform Interchange Pattern at Dundee Tay Bridge:

00G Newcraighall HS – Dundee
C Glasgow Queen St. – Aberdeen
R Hawick – Dundee via the bridges (**not** cross-platform)
RS Glasgow Queen St. – Arbroath (**not** cross-platform)

15G Glasgow St. Enoch – Dundee
R Hawick – Aberdeen via the bridges
R Hawick – Dundee via the bridges (**not** cross-platform)

(It is expected that Glasgow Queen St – Arbroath and Hawick – Dundee will share the same platform, Glasgow – Arbroath arriving first!)

Service plan 5 overall imposes the following loadings on HS13:

• Newcraighall HS	– Gyle Junction	16tph
• Newcraighall	– Edinburgh Waverley	14tph
• Edinburgh Waverley	– Gyle Junction	12tph
• Gyle Junction	– Kirkliston Junction	28tph
• Kirkliston Junction	– Humbie Junction	12tph
• Kirkliston Junction	– Kinnaird Junction	16tph
• Kinnaird Junction	– Bankhead Junction	8tph
• Bankhead Junction	– Robroyston Junction	18tph
• Robroyston Junction	– Glasgow Queen St.	4tph
• Robroyston Junction	– Saltmarket Junction	14tph
• Saltmarket Junction	– Glasgow St. Enoch	10tph
• Saltmarket Junction	– Clyde Junction	4tph
• Glasgow St. Enoch	– Clyde Junction	8tph
• Clyde Junction	– Glasgow Airport Junction	12tph
• Glasgow Airport Junction	– Dalmuir	8tph
• Glasgow Airport Junction	– Ayr	4tph

– and the following loadings on HS14:

• Kinnaird Junction	– Bannockburn Junction	8tph
• Bankhead Junction	– Bannockburn Junction	10tph
• Bannockburn Junction	– Dunblane Junction	18tph
• Dunblane Junction	– Perth station (GC)	12tph

- Dunblane Junction – Perth station (classic, CC and RM) 8tph
- Perth station – Stanley junction 18tph
- Stanley junction – Burrelton Junction 14tph
- Burrelton Junction – Ninewells Junction 6tph
- Ninewells Junction – Dundee Tay Bridge station 8tph
- Burrelton Junction – Craigo Junction 8tph
- Dundee Tay Bridge station – Arbroath station 6tph
- Arbroath station – Craigo Junction 4tph
- Craigo Junction – Aberdeen (GC) 8tph
- Craigo Junction – Aberdeen (classic, CC and RM) 4tph

It is recognised that the section between Gyle Junction and Kirkliston Junction will have to be quadruple track, paired by direction. In ordinary service, the two centre tracks would be HS (including CCs) and the outer two for classic (RM) services, but crossovers would be provided at both junctions, and possible each side of the airport station also, for operational flexibility. All platforms at the station would of course be variable.

The above loadings suggest that new-build would be preferable for the Strathallan line, Dunblane to Perth, but that the question remains open for Craigo Junction – Aberdeen.

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 Perth – Coupar Angus, my estimate 25km, actual 25km, Coupar Angus – Bridge of Dun, my estimate 50km, actual 50km,) leads me to believe they are pretty accurate!

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 generally good alignments of these particular routes, 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:

- Newcraighall HS – Edinburgh Waverley 7.2km
- Edinburgh Waverley – Haymarket HS 2.1km
- Haymarket HS – Edinburgh Airport 9km
- Edinburgh Airport – Glasgow Bellgrove 68km
- Glasgow Bellgrove – Glasgow St. Enoch 1.8km
- Glasgow St. Enoch – Glasgow Airport 12km
- Glasgow Airport – Dalry 26km
- Dalry – Kilmarnock 17.5km
- Kilmarnock – Ayr 29km
- Edinburgh Airport – Stirling 44km
- Glasgow Bellgrove – Stirling 41km
- Stirling – Gleneagles 28km
- Gleneagles – Perth 22km
- Stirling – Perth (non-stop) 50km
- Perth – Dundee Tay Bridge 48km
- Perth – Coupar Angus 25km
- Coupar Angus – Forfar 25km
- Forfar – Bridge of Dun 25km
- Bridge of Dun – Aberdeen 59km
- Perth – Aberdeen (non-stop) 134km

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 Newcraighall HS to Edinburgh Waverley (start to stop) is 277 seconds
- Time to travel from Edinburgh Waverley to Haymarket HS (start to stop) is 148 seconds

- Time to travel from Haymarket HS to Edinburgh Airport (start to stop) is 310 seconds
- Time to travel from Glasgow Bellgrove to Glasgow St. Enoch (start to stop) is 142 seconds
- Time to travel from Glasgow St. Enoch to Glasgow Airport (start to stop) is 358 seconds
- Time to travel from Dalry to Kilmarnock (start to stop) is 432 seconds

The final six 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. 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 sections 'The Effect of Junctions' and 'Adjacent Junctions'. These penalties apply only at junctions which are taken at high speed, and not those on the approach to stations. Specifically:

- Edinburgh Airport – Stirling incurs a time penalty of 53 seconds at Kinnaird Junction, where HS14 (Edinburgh – Perth) diverges from the main line of HS13.
- Glasgow Bellgrove – Stirling incurs a time penalty of 53 seconds at Bankhead Junction, HS14 (Glasgow – Perth) diverges from the main line of HS13.

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

1. Newcraighall HS – Glasgow / Dundee / Aberdeen (4/6/8or5 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Newcraighall, inc. Station Wait Times
Newcraighall HS - Edinburgh Waverley	7	7	4.6	4.6	4.6
Edinburgh Waverley - Haymarket HS	2	9	2.5	7.1	10.1
Haymarket HS - Edinburgh Airport	9	18	5.2	12.3	18.3
Edinburgh Airport - Glasgow Bellgrove	68	86	17.3	29.6	38.6
Glasgow Bellgrove - Glasgow St. Enoch	2	88	5.5	35.1	47.1
Edinburgh Airport - Stirling	44	62	13.4	25.7	34.7
Stirling - Gleneagles	28	90	9.3	35.0	47.0
Gleneagles - Perth	22	112	8.1	43.1	58.1
Stirling - Perth	50	112	13.7	39.4	51.4
Perth - Dundee Tay Bridge	48	160	13.3	56.4	74.4
Perth - Coupar Angus	25	137	8.7	48.1	63.1
Coupar Angus - Forfar	25	162	8.7	56.8	74.8
Forfar - Bridge of Dun	25	187	8.7	65.5	86.5
Bridge of Dun - Aberdeen	59	246	15.5	81.1	105.1
Perth - Aberdeen	134	246	30.5	69.9	84.9

Note: The service to Dundee stops at Gleneagles; the services to Aberdeen do not.

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

- Glasgow 48 [43]
- Stirling 51 [30]
- Gleneagles 65 [43]
- Perth 74 [47]
- Dundee 67 [70]
- Aberdeen 140 [81]

Edinburgh Waverley (so subtract 4.6 minutes) to Glasgow by HS takes 42.5 minutes with 3 stops, which is good going over such a short distance. Edinburgh Waverley to Dundee by HS takes 70 minutes via Stirling and Perth, with 5 stops, so not quite as fast as a two-stop dash across the bridges!

2. Glasgow – Edinburgh / Dundee / Aberdeen / Kilmarnock / Ayr (3/4/7or4/2/3 stops):

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Glasgow, inc. Station Wait Times
Glasgow St. Enoch - Glasgow Airport	12	12	6.0	6.0	6.0
Glasgow Airport - Dalry	26	38	8.9	14.9	17.9
Dalry - Kilmarnock	34	72	7.2	22.1	28.1
Kilmarnock - Ayr	29	101	9.5	31.6	40.6
Glasgow St. Enoch - Glasgow Bellgrove	2	2	5.5	5.5	5.5
Glasgow Bellgrove - Edinburgh Airport	68	70	17.3	22.8	25.8
Edinburgh Airport - Haymarket HS	9	79	5.2	28.0	34.0
Haymarket HS - Edinburgh Waverley	2	81	2.5	30.5	39.5
Edinburgh Waverley - Newcraighall HS	7	88	4.6	35.1	47.1
Glasgow Bellgrove - Stirling	41	43	12.8	18.3	21.3
Stirling - Gleneagles	28	71	9.3	27.6	33.6
Gleneagles - Perth	22	93	8.1	35.7	44.7
Stirling - Perth	50	93	13.7	32.0	38.0
Perth - Dundee Tay Bridge	48	141	13.3	45.3	54.3
Perth - Coupar Angus	25	118	8.7	40.7	49.7
Coupar Angus - Forfar	25	143	8.7	49.4	61.4
Forfar - Bridge of Dun	25	168	8.7	58.1	73.1
Bridge of Dun - Aberdeen	59	227	15.5	73.7	91.7
Perth - Aberdeen	134	227	30.5	62.5	71.5

Note: The service to Dundee stops at Gleneagles; the services to Aberdeen do not.

Edinburgh – Glasgow has 4 stops whereas Glasgow – Edinburgh has only 3 because all Edinburgh's services start at Newcraighall HS (so Waverley itself counts as a stop).

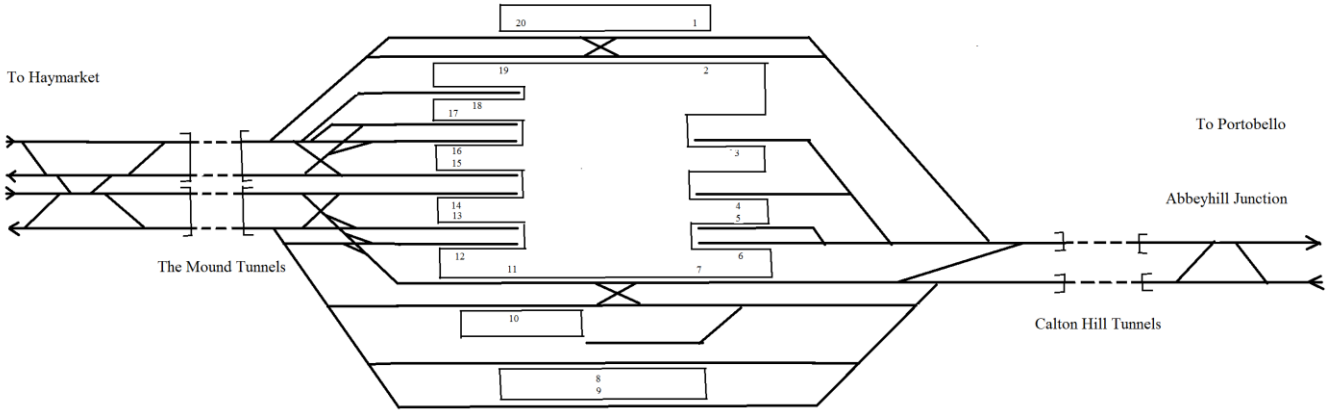
Current fastest time (minutes) from Glasgow [and the above values] to:

- Edinburgh 48 [40]
- Stirling 26 [22]
- Gleneagles 41 [34]
- Perth 54 [38]
- Dundee 78 [55]
- Aberdeen 153 [72]
- Kilmarnock 37 [28]
- Ayr 49 [41]

Appendix A – Edinburgh Waverley HS

Initial thoughts, (when working on the design of HS3, where the main point of interest was in reaching Edinburgh, rather than on what it found when it got there,) were to have the Waverley HS station (2 islands, 4 platform faces) on the north side of the existing station, underneath Princes St., then continuing in tunnel under Princes St. and Shandwick Place to Haymarket and on to Glasgow (though no plans were developed west of Waverley, at that time). It may still be decided that this represents the best solution, (I can't see **any** location other than at Waverley having **anything** to commend it,) but it does deserve rather more serious thought.

This, to the best of my understanding, is the current layout at Waverley. The diagram is strictly topographical, seeking only to show the connections; no distance or orientation information should be inferred from it. It is a really horrid mess. However, the platform numbering scheme, while unusual, does have its own, pawky logic.



Edinburgh HS station, at service plan 5, must support the following services:

- 2tphG (HS3) London – Glasgow
- 2tphG (HS3) Newcastle – Glasgow
- 2tphG Newcraighall HS – Aberdeen fast
- 2tphG Newcraighall HS – Aberdeen stopping
- 2tphG Newcraighall HS – Dundee
- 4tphGG Newcraighall HS – Dalmuir
- 2tphC Hawick – Inverness

Edinburgh Waverley classic, at service plan 5, must support the following services:

- 2tphC HS6 London – Edinburgh
- 1tphC HS2 Birmingham – Edinburgh
- 1tphC HS2 Liverpool – Edinburgh
- 2tphR York – Edinburgh
- 2tphR Hawick – Aberdeen via the bridges
- 2tphR Hawick – Dundee via the bridges
- 2tphR Edinburgh – Perth via the Forth Bridge

- 2tphRS Newcraighall – Fife Circle (clockwise)
- 2tphRS Newcraighall – Fife Circle (counterclockwise)
- 2tphRS Newcraighall – Stirling via Alloa

and also:

- 2tphRS Edinburgh – Stirling via Larbert, which is part of the plan, but doesn't contribute to HS13's loadings.

In addition, consulting current timetables, there are the following services, independent of the current considerations, but still needing to be accommodated at Waverley:

- 2tphR Edinburgh – Glasgow via Falkirk High (stopping pattern 1)
- 2tphR Edinburgh – Glasgow via Falkirk High (stopping pattern 2)
- 2tphRS Edinburgh – Helensburgh via Bathgate, all stations
- 2tphR Edinburgh – Milngavie via Bathgate, semi-fast
- 1tphRS Edinburgh – Glasgow via Shotts, all stations
- 1tphR Edinburgh – Glasgow via Shotts, semi-fast
- 1tphRS Edinburgh – North Berwick, all stations
- 1tphR Edinburgh – Dunbar stopping only at Musselburgh

I think it will readily be conceded that there is no way that the HS GC-gauge services can be accommodated in the existing Waverley. A service of 16tph needs a minimum of two platforms (in each direction); even then each train must be processed within 7½ minutes – which is tight, but certainly manageable, since they're all through trains; nothing starts from or terminates there. The airport station, handling an additional 16tph regional metro trains, needs another two platforms in each direction. These must be arranged so that cross-platform interchange, at both the islands in each direction, is between HS and classic trains.

Since the existing station cannot accommodate the extra services, there are two possibilities:

- A new HS station on the north side, under Princes St.; the original idea.
- Redevelopment of Waverley, keeping the existing roof, (the only architectural feature worth preserving,) but scrapping all the buildings on the large, central island platform, and redeveloping the area as through platforms exclusively (all built to full GC gauge). I reckon the space should comfortably accommodate 14 through platforms, as 7 islands. They wouldn't need to be quite as long as the existing platforms, space for a 12-car train, 300m say, should be sufficient.

In theory, of course, a new station could be built elsewhere, but I think this a thoroughly retrograde solution, and so offer no suggestions.

HS services would not start from or terminate at Waverley. They would start either from London (actually from Eastbourne!), Newcastle or Hawick, or from the HS terminal station at Newcraighall. The longer-distance Regional Metro services, would also start from Hawick via the reopened classic Waverley route, or from an ECML location such as Dunbar. Local services to Fife would begin at the classic Newcraighall station, as they do at present, extended as necessary with a few terminal platforms (since the through platforms would be used by the Waverley route trains). Other local services would begin at existing or new/restored locations east of Edinburgh, such as North Berwick, Haddington and Gullane. So here is the suggested overall service plan for the redeveloped Waverley:

- 2tphG HS3 [Eastbourne –] London – Glasgow
- 2tphG HS3 Newcastle – Glasgow
- 2tphG Newcraighall HS – Aberdeen fast
- 2tphG Newcraighall HS – Aberdeen stopping
- 2tphG Newcraighall HS – Dundee
- 4tphGG Newcraighall HS – Dalmuir
- 2tphC Hawick – Inverness

– the HS services.

- 2tphC HS6 London – Edinburgh
- 1tphC HS2 Birmingham – Edinburgh
- 1tphC HS2 Liverpool – Edinburgh
- 2tphR York – Edinburgh
- 2tphR Hawick – Aberdeen via the bridges
- 2tphR Hawick – Dundee via the bridges
- 2tphR Dunbar – Perth via the Forth Bridge
- 2tphRS Newcraighall – Fife Circle, clockwise
- 2tphRS Newcraighall – Fife Circle, counterclockwise
- 2tphRS Newcraighall – Stirling via Alloa
- 2tphRS Newcraighall – Stirling via Larbert
- 2tphR North Berwick – Glasgow via Falkirk (stopping pattern 1)
- 2tphR North Berwick – Glasgow via Falkirk (stopping pattern 2)
- 2tphR Haddington – Milngavie via Bathgate semi fast
- 2tphRS Haddington – Helenburgh via Bathgate stopping
- 2tphR Gullane – Glasgow Central via Shotts semi fast
- 2tphRS Gullane – Glasgow Central via Shotts, stopping

– the terminating classic-compatible, and regional metro semi-fast and stopping services.

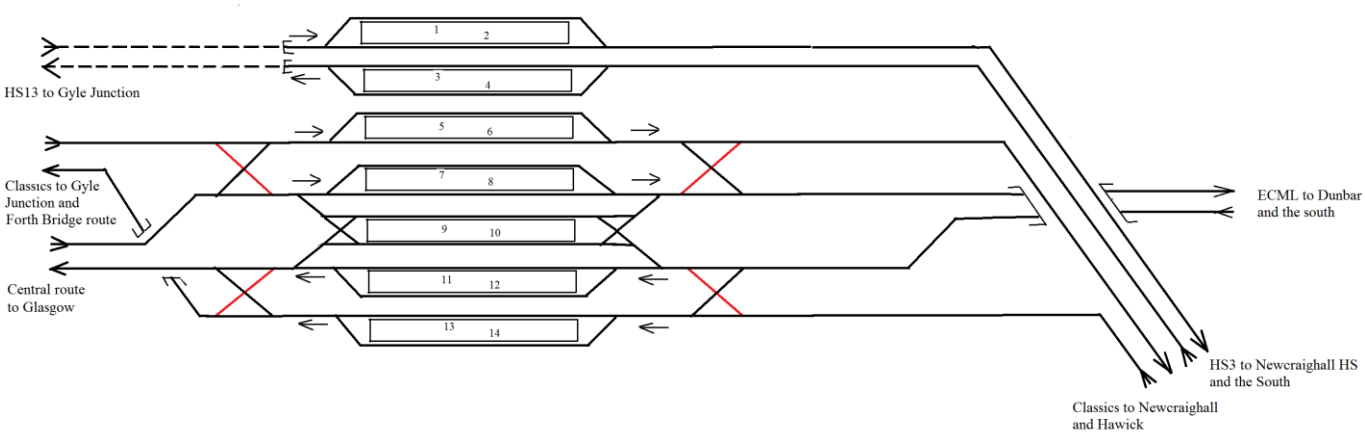
Assuming the 14 through platforms are numbered starting from 1 at the top, the platform usage is:

- 1&2 HS eastbound
- 3&4 HS westbound
- 5&6 HS2 CC from B'ham and Liverpool (*)
  Aberdeen – Hawick
  Dundee – Hawick
  Fife Circle clockwise – Newcraighall
  Fife Circle counterclockwise – Newcraighall
  Stirling – Newcraighall via Alloa
  Stirling – Newcraighall via Larbert
  Perth – Dunbar
  — to Waverley route (* to Millerhill)
- 7&8 Glasgow – North Berwick via Falkirk (1)
  Glasgow – North Berwick via Falkirk (2)
  Helenburgh – Haddington stopping
  Milngavie – Haddington semi-fast
  — to ECML

Glasgow – Gullane via Shotts stopping
Glasgow – Gullane via Shotts semi-fast

- 9 HS6 CC to London, RM to York, Cross-Country — to ECML
- 10 HS6 CC from London, RM from York, Cross-Country — to Central route
- 11&12 North Berwick – Glasgow via Falkirk (1)
  North Berwick – Glasgow via Falkirk (2)
  Haddington – Helensburgh stopping — to Central route
  Haddington – Milngavie semi-fast — (* from Millerhill)
  Gullane – Glasgow Central stopping
  Gullane – Glasgow Central semi-fast
- 13&14 HS2 CC to Birmingham and Liverpool (*)
  Hawick – Aberdeen
  Hawick – Dundee
  Dunbar – Perth — to Forth Bridge route
  Newcraighall – Fife Circle clockwise
  Newcraighall – Fife Circle conterclockwise
  Newcraighall – Stirling via Alloa
  Newcraighall – Stirling via Larbert — to Central route

The revised layout is:



The classic part of the layout it essentially the crossover of two routes – Waverley route to the Forth Bridge and ECML to Central routes to Glasgow – with minimal exchange of services between them (but plenty of exchange of passengers). There is a slight exchange of services between ECML/Central and Waverley/Forth Bridge, via the Forth Bridge platforms, (specifically Dunbar – Perth and Newcraighall – Stirling via Larbert,) but none at all, in normal service, between them via the Central platforms. In the two pairs of scissors crossovers on each side, the connections shown in red are for operational flexibility, but are not used in normal operation.

This layout, in normal usage, eliminates all conflicting movements. Platforms 5&6 and 13&14 are for services between the Waverley route and Fife and points north, via the Forth Bridge. The Forth Bridge lines join HS13 at Gyle Junction, and cross-platform interchange is provided at the airport station, always between HS13 (GC or CC) and classic services. The classic services then diverge from HS13 at Kirkliston Junction and rejoin the Forth Bridge route (western arm) at Humbie Junction. Platforms 7&8 and 11&12 are for services between the ECML and the Central route, (all of them to/from Glasgow, by

one of three routes). Platforms 9&10 are for the long distance classic-compatible and regional metro services from the ECML, terminating at Edinburgh and also for Cross-Country services. Such trains are not serviced at the platforms, but continue onto the Central route, to the servicing facility. These platforms allow for each-way working – again, for operational flexibility, not required in normal operation. The terminating HS2 classic-compatible services from Birmingham and Liverpool (marked * in the platform usage table) of course approach Edinburgh from the west, but are routed into the Forth Bridge platforms, in order to travel through to Millerhill, on the Waverley route, for servicing.

Cross platform interchange is provided at all island platforms. On the Forth Bridge route platforms, the convention, similar to that at the airport, is for interchange between a faster and slower service, between semi-fast and stopping. No such pattern applies to the Central route platforms.

Representative Hourly Cross-Platform Interchange Pattern for platforms 11&12:

00R North Berwick – Glasgow Queen St. via Falkirk High (stopping pattern 1)
RS Haddington – Helensburgh

07R Gullane – Glasgow Central via Shotts, semi-fast
(no connection)

15R North Berwick – Glasgow Queen St. via Falkirk High (stopping pattern 2)
R Haddington – Milngavie, semi-fast

23RS Gullane – Glasgow Central via Shotts, all stations
(no connection)

Representative Hourly Cross-Platform Interchange Pattern for platforms 13&14:

00R Hawick – Aberdeen
RS Newcraighall – Fife Circle clockwise

07R Hawick – Dundee
RS Newcraighall – Stirling via Alloa

15C HS2 service to Birmingham or Liverpool (* originating from Millerhill)
RS Newcraighall – Fife Circle counterclockwise

23R Dunbar – Perth
RS Newcraighall – Stirling via Larbert

On the HS platforms 1&2 there is no planned interchange; the two platforms are needed to lengthen the available wait time to 7½ minutes, which is not needed by the Dalmuir metro, but is for the long distance trains.

Appendix B – Glasgow St. Enoch

Glasgow St. Enoch is envisaged as a 2 island, 4 platform station. There's unlikely to be room for any more. Is has only GC-gauge services, all, obviously, starting at St. Enoch:

- 2tph London
- 2tph Newcastle
- 2tph Aberdeen fast
- 2tph Aberdeen stopping
- 2tph Dundee

– from the northern two platforms

- 8tph Ayr
- 4tph Dalmuir

– from the southern two platforms.

These give available times per train of 12 minutes for the northern two faces and 10 minutes for the southern two. Clearly the trains cannot be serviced and prepared for the next journey at the platforms.

This is not a problem for the Ayr and Dalmuir trains, as their journeys are not long, and they can adequately be serviced as required at Ayr or Dalmuir; all that's required at St. Enoch is to collect the rubbish the passengers will have left behind, and the train is then ready for its next departure.

But the trains to England and to northern Scotland will need to be serviced in Glasgow prior to their next departure, and for this there must be an out-of-station servicing facility to which they can be sent. (I don't know Glasgow sufficiently well to suggest a suitable location for such a facility. But, consulting satellite maps, the area south of the Clyde around where Shields Rd. crosses HS13 looks quite promising.)