HS East Anglia and North Kent Routes and Service Plans (HS11 and HS12)

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 HS11, the route from London to Southend, North Kent and Dover, and HS12, the route to Ipswich and Norwich, sharing the route of HS11 from London to Shenfield.

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 \sim 2778!) but it's not always possible to be certain, from above, of what an individual building actually is – I have, on one noted occasion, mistaken as warehouses what subsequently turned out to be purpose-built student accommodation; I refrain from further comment. (At the maximum magnification I have available, the cars are about 1" in length, probably good enough for someone familiar with the subject to identify make and model. But at these highest magnifications there is some loss of resolution - the edges of objects become increasingly fuzzy. As noted earlier, these scales are strange; this maximum is 1 in ~179.)

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

In general I try to follow an existing alignment, railway or motorway, (or, very occasionally, of a nonmotorway 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 very steep section where it follows the A2(T) between Faversham and Canterbury. Between Southend and Faversham the route is essentially level (except for the tunnels under the Thames and Medway, where the approach gradients are whatever we choose to make them, governed by the length of the approach).

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 HS11/HS12, including sections of other routes over which HS11/HS12's services run. These overall maps come at the end of the 'Route' description, and also show HS11/HS12'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 HS11/HS12.

The Service Plans

The Route section of this document describes the complete lines in their final, full configuration (as far ahead as the plans consider). The service plans explain how that final state is reached: the order in which sections are opened, and the services which run on these partial configurations. The aim is always to get useful services running as soon as possible, to maximise return on the investment.

The service plans deliberately envisage maximum frequencies, to give an impression of just how much the system **could** accommodate. Initial services would certainly not be so intensive, probably no more than half of the frequencies quoted.

A standard HS station has two island platforms, thus two platformed tracks in each direction. If some of the services passing through the station are non-stop, then the main line must pass through the layout without adjacent platforms, either through the centre of the alignment, in tunnel below or on viaduct above, or the station must be on a branch loop off the main line, which thus bypasses it completely. In fact, all HS11/HS12 stations are served by all services, so don't need overtaking/avoiding lines. At the ends of a multi-destination route, the traffic density on the branches may not be sufficiently high to warrant this level of provision, so a single island platform (or two single platforms within some other arrangement) would suffice – this is the case with HS11 beyond Southend Airport, (except at Faversham, which has four platforms, shared with the classic route,) and with HS12 throughout (i.e. beyond Shenfield), except for Beccles, which has cross-platform interchange for Lowestoft and Yarmouth. HS11/HS12 Route and Service Plans v3.2

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

In the present article, the northern half of HS7, the NE-SW route, must also be considered, as HS11/HS12 and HS7 are intimately linked, sharing the same route from Nuthall North Junction (Nottingham) to Newcastle. HS5, the route from London to Brighton and other Sussex / Hampshire / Kent locations, must also be considered, in the later service plans, as the HS11/HS12 services are all inter-regional with HS5.

Two types of services are contained in the plans, those featuring High Speed trains (GC gauge and classic compatible) which travel on HS11/HS12 for at least part of their journey, and those featuring Regional Metro (semi-fast) services on the corresponding classic route(s). Connections between the services (both HS and RM) are shown for the relevant interchange stations (the connections are usually cross-platform), together with the clock-face hourly departure plan. (Note that these plans are **representative**; the **actual** times are determined by the coordination of interchanges at multiple locations).

In the service plans I distinguish some of the GC gauge services as double deck. Originally this linked the Brighton services of HS5 with the HS Metro services of HS11/HS12, to York and Preston. It's all rather arbitrary, at present. Provided that there are no difficult technical issues in running double deck trains at 250mph, and that public reaction to them is favourable, I would like to see all GC gauge services run with double deck trains. (The Swiss like them.)

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

Estimated Journey Times

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

HS11/HS12 Route – Introduction and Assumptions

HS11 and HS12 closely follow existing alignments, railway and motorway, for most of the way. But HS11 has an entirely new alignment between Southend and Faversham (unsurprisingly), and HS12 has a new alignment for most of the way between (south of) Ipswich and Norwich..

HS11/HS12's long-term classic-compatible services begin at Liverpool Street, and the GC-gauge services of both HS11 and HS12 are all cross-London inter-regional, via Euston Cross. This is an underground station with 6 platforms, (with passive provision for 8,) located on a west-east axis between Euston and St. Pancras / King's Cross stations, the precise location, horizontal position and depth, to be determined HS11/HS12 Route and Service Plans v3.2 Page **4** of **45**

by the configuration of all the other tunnels in that area. Euston Cross and its approaches are shared by HS4 and HS2, GC-gauge services only. It is a through station; nothing starts or terminates there. HS11/HS12's services via Euston Cross are the continuation into East Anglia and North Kent, of HS4's services from South Wales and (in conjunction with HS7) the West Country. Appendix A gives full details of Euston Cross and its approaches. Full details of the services on HS4/HS7 are contained in the article 'HS4 Route and Service Plans'. Summary details of the inter-regional services are in the service plans of the present article.

HS11 begins at Stratford HS South Junction, where HS4 diverges from HS2, on the eastern route from Euston Cross, and metamorphoses into HS11. HS11/HS12's classic-compatible services begin at Liverpool Street, and join HS11 at Manor Park Junction, just after HS11 has emerged from tunnel on the north side of the GEML. HS12 itself begins at Shenfield HS Junction, where it diverges from HS11.

The maximum speed for HS11/HS12 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.

HS11 Route – Junctions

There are various junctions on the route of HS11, enabling connections with other HS and classic routes. These are identified in the description of the route, but it is convenient to list them all here, together with their map references and identifying remarks, since, when discussing the capacity/loading of different sections of route, the end points are usually junctions (occasionally stations). The junction names are my own suggestions.

•	Stratford HS South	TQ387847	HS4 diverges from HS2 immediately east of Stratford HS South, and metamorphoses into HS11. (The given location is approximate – it's underground!)
•	Manor Park	TQ422858	Allows classic-compatible services from Liverpool St. to join HS11.
٠	Shenfield HS	TQ624961	HS12 diverges from HS11.
•	Buckland	TR299432	Connects HS11 directly to the classic line from Dover to Margate
	West HS		via Deal. (There used to be a junction here between the classic lines,
			avoiding Dover.)

HS12 Route – Junctions

•	Shenfield HS	TQ624961	HS12 diverges from HS11.
٠	Shenfield	TQ629970	Connects HS12 to classic GE route just north of Shenfield.
	North		
٠	Colchester HS	STL995263	Connects HS12 to classic GE route just east of Colchester station.
٠	Pinewood	TM152413	Connects HS12 to classic GE route south of Ipswich station.
٠	Westerfield	TM178473	HS12 merges with the East Suffolk Line (converted to GC gauge)
	West		immediately after the Felixstowe branch has diverged).
•	Woodbridge	TM265477	HS12 diverges from East Suffolk Line.
٠	Belle Grove	TM402808	HS12 merges with the East Suffolk Line (redoubled and converted
			to GC gauge)

Beccles TM425906 Classic route to Lowestoft diverges from HS12 immediately north of Beccles station (see also Appendix B).
 Reedham TG423010 Classic route to Yarmouth diverges from HS12 (see also Appendix B).

There are various other links between HS11/HS12 and classic lines, for operational purposes and not intended for regular services, so not relevant in the present context. Although HS11 extends eventually to Dover, there are no junctions other than Buckland West HS carrying a scheduled, regular service.

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

1. Euston Cross – Shenfield

HS4 arrives at Stratford HS South in tunnel from Euston Cross, which it shares with HS2. It diverges from HS2 at Stratford HS South Junction (TQ387847), immediately east of the station, and changes its identity to HS11. (Appendix A gives full details.) It emerges from tunnel at TQ420858, on the north side of the GEML alignment. It is joined at Manor Park Junction (TQ422858) by a connection from the classic route, from Liverpool Street, used by classic-compatible services. It enters a 2 mile tunnel just past the North Circular Road, at TQ432864, emerging after Goodmayes station (TQ467875). It tunnels beneath Chadwell Heath station, emerging on the south side of the GEML alignment at TQ478876, and follows this to Waterloo Road, Romford, TQ57810882, entering a 1 mile tunnel and emerging at TQ522888, just after the Upminster branch has diverged. Finally it crosses to the north side of the alignment at TQ532895, just after Gidea Park.



1.1 Euston Cross - RomfordContains Ordnance Survey data © Crown copyright and database right 2013Note that this map is slightly wider than 20km (c21km).

Alternatively, cut the crap and take a 6¹/₂ mile tunnel from the North Circular Road at TQ432864, and emerge, still on the north side of the GEML at TQ532895 after Gidea Park. (This is the option illustrated on the map, above.)

HS11 follows the north / west side of the GEML from Gidea Park to Shenfield. There is a choice of a short tunnel or demolishing ~6 houses at TQ652944.



2. Shenfield – Southend Airport

HS11 has a very short (¼ mile) tunnel at Shenfield, because of encroachment of housing on the north / west side of the station. The two HS island platforms are immediately north of the Rayleigh Road bridge (where there is adequate room, currently a car park). It takes over and doubles the single line diverging and passing under the GEML, which I believe will no longer be required once Crossrail opens. HS12 diverges at TQ624961, Shenfield HS Junction, and joins the south east side of the GEML alignment.

HS11 follows the north side of the alignment of the Southend line. It tunnels under Billericay for 1 mile between TQ663953 and TQ681949. At TQ735944, shortly before Wickford, it diverges on a new alignment. The new alignment between Wickford and Hockley straightens out the long curve through Rayleigh. HS11 tunnels beneath Wickford for ³/₄ mile between TQ743944 and TQ755945. It crosses the River Crouch at TQ775942, crossing Hullbridge Road at TQ807936 and passing to the south of Hullbridge. It rejoins the north side of the Southend line at TQ823930, just before Hockley, following that to TQ850926, where it crosses to the south side, just past White Hart Lane (another one).

It follows the south, then west side of the alignment past Rochford, to Southend Airport. Here the standard double island station has the HS11 tracks on the outside, so the down track crosses the classic



2.2 Billericay - Southend

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line just north of the Airport station, and the up line crosses just to the south. The lines continue for a short way south, with a reversing siding between them. This allows trains to reverse here. Initially, HS11 opens to the airport, and all services terminate here until the next section, containing the Thames and Medway tunnels, opens. (This reversing facility may well be needed long-term, by a cross-London inter-airport night-time service, for example.)

3. Southend Airport – Faversham

HS11 continues beyond the airport station along the east side of the classic line as far as TQ881865, just north of Southend Victoria, where it enters the 6½ mile tunnel under the Thames to Grain. Southend HS station is located just inside the tunnel, under Southend High Street between Victoria and Central stations, with pedestrian connections at the ends to both. (If this distance significantly exceeds the HS station HS11/HS12 Route and Service Plans v3.2 Page **8** of **45** length, then it is located to give the best connection to Southend Central station, on the Tilbury line since the line to Southend Victoria already has a cross-platform connection with HS11 at Southend Airport.)



3.1 Allhallows - Uplees

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HS11 emerges from the Thames tunnel at TQ844780 on the Isle of Grain (or is it still the Hoo Peninsula?) It takes over and follows the trackbed of the long-closed line to Allhallows on Sea for a little over a mile, to TQ845784 then veers east to the new station of Grain, at TQ852758. This is envisaged as the focus of the new town of Grain, incorporating the villages of Allhallows, Stoke and Grain itself.

HS11 enters a further 3¹/₂ mile tunnel at TQ858756, passing under the Kent Oil Refinery and the River Medway and emerging at TQ911731, on the Isle of Sheppey, at the new station of Sheerness HS, adjacent to the existing classic branch from Sittingbourne to Sheerness, on which a new interchange station is opened. This is likewise envisaged as the focus of the new town of Sheerness, merging Minster, Halfway Houses and Queensborough into the existing town of Sheerness. HS11/HS12 Route and Service Plans v3.2

It may seem a bit like the tail wagging the dog to plan a new railway and then add a couple of new towns for it to serve, but demand for housing in the South East is intense, and Hoo and Sheppey have plenty of development space available and, (with respect to all those who love them,) neither could reasonably be described as being of outstanding natural beauty, which would be ruined by housing, so all that's holding them back is the lack of decent transport to London, which HS11 amply rectifies. Metroland for the 21st century?

From Sheerness HS station, HS11 follows the east side of the A249 to TQ928714. It then takes a straight line to TQ980688, near Spitend Point, where it enters a ½ mile tunnel under The Swale, emerging in mainland Kent at TQ990655. It joins the north side of the alignment of the North Kent line at TQ997613, just west of Faversham, and follows this to Faversham station. The station already has two island platforms. The down classic line crosses over HS11, which occupies the inner platform faces while the classic lines take the outer ones. The lines of HS11 continue for s short distance east, between the classic lines, with a reversing siding between them. This reversing facility will certainly be needed long term.

4. Faversham – Dover

HS11 follows the north side of the alignment as far as TR031600, just after the A2 has crossed, and then diverges, to join the southern side of the A2 alignment at TR036600, just before the M2 joins it. It continues along the south side of the A2(T) until TR127575, where the Faversham – Canterbury line crosses. It joins the north side of this and follows it to Canterbury East station. Canterbury East is on a cramped site, but there would be room on the north side for the single HS island if the station building were removed, and a new building, over the tracks, say, provided.



4.1 Faversham – Canterbury Contains Ordnance Survey data © Crown copyright and database right 2013

Following the A2(T) results in a significantly shorter route between Faversham and Canterbury, at the expense of steeper gradients. Actually the gradients are very steep: eastbound from Boughton Street to Dunkirk involves a climb of 101m in 3km - 1 in 30, which is close to the limit for HS trains, (the

Cologne – Frankfurt line has a maximum gradient of 4%, i.e. 1 in 25,) and much steeper than I like. (The corresponding gradient westbound is only 1 in 59.) Alternatively, HS11 could follow the north side of the classic line between Faversham and Canterbury (there are no obstructions), but this would be significantly slower because of the curvature (and the extra distance).



4.2 Adisham - Dover

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There are several obstructions in Canterbury, beyond East station, so HS11 enters a 1 mile tunnel at TR146573, emerging at TR166571, still on the north side of the classic alignment. It continues on the north side almost as far as Dover. There are surprisingly few obstructions. At Adisham station it is necessary to divert HS11 say 100yds to the east, to avoid the station buildings and a few others. At Shepherds Well there are obstructions, but the station is shortly followed by Lydden tunnel; HS11 commences its Lydden tunnel a little earlier, at TR257483. A very short (¼ mile) tunnel is required under Kearsney station, between TR288441 and TR291438. Buckland West HS Junction, at TR299432, allows classic-compatible trains to reach the line to Margate, via Deal, avoiding Dover; there used to be a

junction here, between the classic routes. HS11 crosses to the south west side of the alignment immediately afterwards, just before the classic Buckland Junction. It follows this to Dover Priory station, in tunnel (¼ mile) between TR313418 and the station. The HS station is on the west side, and has 4 platforms, being shared by HS11 and HS1.

5. Shenfield – Ipswich

HS12 diverges from HS11, after crossing under the GEML, at Shenfield HS Junction (TQ620962). Shortly after, at Shenfield North Junction (TQ625966) there is a connection between HS12 and the classic route to allow classic-compatible services to reach the GEML.

HS12 follows the south / east side of the GEML alignment until Chelmsford. It diverges from this by ~100yds to the east past Ingatestone station, to avoid buildings there (there's plenty of space available behind them). It enters a 1 mile tunnel at TL696052, at the boundary of Chelmsford, and emerges on the north / east side of the alignment at TL700062. There is ample room for the HS platform island on the north west side of Chelmsford station, but it will be necessary to demolish a few buildings (3? Houses? Shops?) on Duke Street, immediately before the station. There is unobstructed room beyond the station all the way out of Chelmsford, but just one track width on either side of the alignment. So the classic lines will need to be slewed one track width to the south east, to accommodate the two HS tracks on the north west side.

A short tunnel (¹/₄ mile) is needed at Boreham, between TL759106 and TL762107, and another, (1 mile,) under Witham station, between TL809141 and TL823154, just past where the Braintree branch diverges.

A short (½ mile) tunnel, between TL905231 and TL911237, is needed on the approach to Marks Tey. Marks Tey station is relocated, a little to the north at TL920241, to allow a connection from the Sudbury line of the Colne Valley Metro to link to the up line of the GEML, enabling cross-platform interchange on both sides. HS12 crosses to the south / east side of the alignment at TM916240, sharing the overbridge with the link from Sudbury. (Appendix C gives a possible layout.)

HS12 runs between the GEML and the A12 for 2 miles then crosses back to the north side of the GEML alignment at TL946253, and follows that to Colchester station. There's plenty of space for the HS platforms on the north side, presently car parking. A Connection between HS12 and the classic route at TL995263 (Colchester HS Junction) allows classic-compatible services to reach the classic route.

HS12 continues along the north / west side of the GEML alignment almost to Ipswich. It passes through a 1 mile tunnel under a built-up residential area between TM010264 and TM025270, and is then completely unobstructed to Manningtree. Several warehouses or industrial buildings need to be relocated around TM107328, on a promontory into the Stour estuary, south of Cattawade. A short tunnel (¼ mile) is required, under Station Road, Bentley, between TM119367 and TM120370, or demolish several houses. HS11 connects to the GEML at Pinewood Junction, TM152413, allowing classic-compatible services to reach Ipswich. HS12 diverges from the GEML at Pinewood Junction, and enters a 3½ mile tunnel under Ipswich, at TM155423. Ipswich HS station is in tunnel, directly beneath the classic station, and at a right angle to it.







6. Ipswich – Norwich

HS12 emerges from its tunnel under Ipswich at TM166462, and curves gently to the east to join the East Suffolk Line at TM178473, Westerfield West Junction, just after the Felixtowe branch has diverged. It takes over the trackbed, still double as far as Woodbridge, and extends it to GC gauge for the next 5½ HS11/HS12 Route and Service Plans v3.2 Page 15 of 45

miles. The classic-compatible service to Yarmouth and Lowestoft, via the East Suffolk Line, shares the GC gauge route under Ipswich, via the underground HS station (which must therefore have variable platforms). GC-gauge and classic-compatible services thus avoid the freight traffic from Felixstowe.



6.1 Rushmere – Yoxford Contains Ordnance Survey data © Crown copyright and database right Note that this map is slightly wider than 20km (c.22km)

The East Suffolk Line is not particularly well aligned, and the area through which it passes is essentially flat and very sparsely populated, outside the few, small towns that the line serves. HS12 accordingly takes a new alignment, for high speed. The alignment given here is a suggestion; it could doubtless be significantly improved by ground surveys.

HS12 diverges from the East Suffolk alignment at TM265477, Woodbridge Junction. It crosses the Deben and passes over the disused Woodbridge Airfield, crossing the B1084 at TM352502. It passes to the west of Butley, crossing the B1078 Orford Road at TM366550, then to the east of Blaxhall, and passes close to the East Suffolk Line for a short distance around TM378592. It passes to the east of Saxmundham, and rejoins the East Suffolk Line at TM397660, following it on the east side until TM405709. It passes to the east of Halesworth, crossing the B1123 at TM410774. It rejoins the East Suffolk Line at TM402808, Belle Grove Junction, and again takes over the trackbed, redoubled and extended to GC gauge. It then follows the East Suffolk route to north of Beccles. (Enlarging to GC gauge is really no big deal – there isn't a single overbridge until Beccles, though several new overbridges will need to be built, to replace level crossings.)



6.2 Darsham - Beccles

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Beccles is a standard HS station with 2 island platforms. Normally HS12 (GC gauge) will take the two inner platform faces, and the Yarmouth and Lowestoft service the outer ones, but variable platforms and

scissors crossovers are provided for operational flexibility. The Lowestoft line diverges at Beccles Junction, TM425906, immediately north of the station. The Yarmouth service continues along HS12 for a few miles. Above Beccles, HS12 again has a completely new alignment. My first thoughts were to use the former alignment to Haddiscoe on the Norwich – Lowestoft line. But there is almost no trace of it on the ground; it has been more comprehensively obliterated that any other former alignment I have considered. Therefore HS12 heads due north, passing to the west of Haddiscoe village and crossing the B1136 at TM437972. The classic route to Yarmouth diverges from HS12 at Reedham South Junction, TG423012, and joins the Norwich – Lowestoft line, serving a new station, Reedham South, at TG422016, immediately after crossing the River Yare, after which it diverges over a restored, former connection to the Yarmouth line via Berney Arms. Appendix B depicts the configurations at Beccles and Reedham.



6.3 Beccles - Bramerton

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HS12 keeps on the south side of the Yare, crossing a minor road at TG367021, it passes north of Ashby St. Mary, south of Rockland St. Mary and Bramerton, entering a 1 mile tunnel at TG254065, just before

the A47(T), emerging at Carrow Road, TG243080, just before Norwich station, where it joins HS6 in the HS platforms on the south side.



HS11/HS12 Route and Service Plans v3.2



HS11/HS12 Route and Service Plans v3.2







HS11/HS12 Route and Service Plans v3.2

Page 23 of 45

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 HS11/HS12 itself. This most commonly occurs when a new section of HS11/HS12 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 HS11 and the first few yards of HS12 open from Manor Park Junction to Shenfield North Junction (thus independent of Euston Cross). Only classic-compatible services from Liverpool Street are involved, and these replace the classic services to Norwich, Lowestoft, Harwich, Clacton/Walton and Braintree. There are no dependencies on any other HS route. The following services are introduced:

- 2tphC Liverpool Street Stratford Shenfield HS Colchester Ipswich Diss Norwich
- 1tphC Liverpool Street Stratford Shenfield HS Colchester Ipswich Westerfield Woodbridge – Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles – Oulton Broad South – Lowestoft
- 2tphC Liverpool Street Stratford Shenfield HS Colchester Manningtree Mistley Wrabness Harwich Parkeston Quay Dovercourt Harwich Town.
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Witham Kelvedon Marks Tey – Colchester – Wivenhoe – Thorp le Soken (splits/joins) – : – Clacton
 - Frinton Walton
- 2tphC Liverpool Street Stratford Shenfield HS –Ingatestone Chelmsford Hatfield Peverel Witham White Notley Cressing Braintree.

Regional Metro:

 6tphRS (Colne Valley Metro) Sudbury – Bures – Chappel & Wakes Colne – Marks Tey – Colchester – Colchester Town (reverse) – Hythe – Wivenhoe – Alresford – Great Bentley – Weeley – Thorpe-le-Soken (splits/joins) – - Clacton

- Kirby Cross Frinton Walton-on-Naze
- 2tphRS (Felixstowe Metro) Ipswich Westerfield Derby Road Trimley Felixstowe
- 2tphR Harwich Town Harwich International Ipswich Bury St. Edmunds Ely March Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street
- 2tphRS Ipswich Needham Market Stowmarket Elmswell Thurston Bury St. Edmunds (split/join) –:
 - Kennett Newmarket Dullingham Cambridge
 - $\, Kennett Soham Ely Manea March Whittlesey Peterborough$

Representative Hourly Non-Cross-Platform (but see Appendix C) Interchange Pattern at Marks Tey:

- 00C Liverpool Street Clacton / Walton
 - RS Clacton / Walton Sudbury (thus connecting Liverpool Street Sudbury)

- repeating at 30 minutes past.

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

- 00C Liverpool Street Norwich RS Sudbury – Clacton / Walton
- 10C Liverpool Street Lowestoft RS Sudbury – Clacton / Walton
- 20C Liverpool Street Harwich RS Sudbury – Clacton / Walton

- repeating at 30 and 50 minutes past (NB no connection at 40 minutes past as the Lowestoft service is only hourly at this service plan).

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

- 00C Liverpool Street Norwich
 - R Harwich Town Birmingham New Street
 - RS Ipswich-Felixstowe
 - RS Ipswich Cambridge / Peterborough

- repeating at 30 minutes past (see Appendix D for elucidation of this interchange pattern, as there is much hidden detail).

With this service plan, all the stations on the GEML beyond Shenfield retain their existing services at the same or better frequencies, but a little faster. The accelerations will not be huge; it's not far between Manor Park and Shenfield. Further accelerations will come when HS12 is extended to Norwich, but this is not foreseen for the immediate future; attention will initially be focused on HS11.

It imposes the following loadings on HS11:

•	Euston Cross	- Stratford HS South Junction	10tph
•	Stratford HS South Junction	– Manor Park Junction	0tph

•	Liverpool Street	– Manor Park Junction	9tph
•	Manor Park Junction	- Shenfield HS Junction	9tph
•	Shenfield HS Junction	- Southend Airport station	0tph
•	Southend Airport station	– Faversham station	0tph
•	Faversham station	- Buckland West HS Junction	0tph
•	Buckland West HS Junction	– Dover Priory station	0tph

The 10tph between Euston Cross and Woodgrange Road West Junction are HS2, at service plan 3.

It imposes the following loadings on HS12:

•	Shenfield HS Junction	- Shenfield North Junction	9tph
•	Shenfield North Junction	- Colchester HS Junction	0tph
•	Colchester HS Junction	- Pinewood Junction	0tph
•	Pinewood Junction	- Woodbridge Junction	0tph
•	Woodbridge Junction	- Belle Grove Junction	0tph
•	Belle Grove Junction	– Beccles Junction	0tph
•	Beccles Junction	– Norwich station	0tph

Service Plan 2

Service Plan 2 comes into effect when:

- HS11 opens from Manor Park Junction to Stratford HS South Junction, and thus connects to the route to Euston Cross, which is already in service for HS2.
- HS11 opens from Shenfield HS Junction to Southend Airport.
- HS4 opens from Old Oak Common West to East Junction, and thus connects to the route to Euston Cross, which is already in service for HS2.
- HS4 opens from Swindon (Magic Roundabout Junction) to Cardiff.
- HS7 opens from Birmingham HS (Curzon St.) to Bristol Temple Meads.

As has been explained, Euston Cross is a through station, **all** services are through services. There are 3 (HS4) services west from Euston Cross, thus there must be 3 balancing services east on HS11. All services (at this plan) on HS11 are GC gauge, except for those classic-compatibles which run on to HS12.

The following GC gauge services are introduced (including their HS4 origins):

- 2tphG [HS4 Cardiff HS ->] Euston Cross Stratford HS South Shenfield HS Southend Airport.
- 2tphG [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Stratford HS South Shenfield HS –Southend Airport.
- 2tphG [HS4 Cardiff HS ->] Euston Cross Stratford HS South Shenfield HS

(BT means Brunel Trainshed, which are terminal platforms, as opposed to Bristol Temple Meads HS which is on the through route to the West Country.)

The service terminating at Shenfield HS will eventually extend to Norwich, when HS12 opens.

We assume the following RM service to Southend Victoria:

• 4tphRS Liverpool Street – Stratford – Shenfield – Wickford – Rayleigh – Hockley – Rochford – Southend Airport – Prittlewell – Southend Victoria

Representative Hourly Cross-Platform Connections at Southend Airport:

- 00G [HS4 Cardiff HS ->] Euston Cross Southend Airport RS Liverpool Street – Southend Victoria
- 15G [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Southend Airport
 RS Liverpool Street Southend Victoria

- repeating at 30 and 45 minutes past. (As an interchange facility this is currently no big deal, but will be, when HS11 is extended.)

Service Plan 2A

This service plan comes into effect when HS11 opens to Faversham. The Southend Airport trains are extended, so the GC gauge services are now:

- 2tphG [HS4 Cardiff HS ->] Euston Cross Stratford HS South Shenfield HS Southend Airport Southend HS Grain Sheerness Faversham.
- 2tphG [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Stratford HS South Shenfield HS –Southend Airport Southend HS Grain Sheerness Faversham.
- 2tphG [HS4 Cardiff HS ->] Euston Cross Stratford HS South Shenfield HS

We assume the following RM services to North Kent and Dover:

- 2tphR Charing Cross Waterloo East London Bridge Ebbsfleet Rochester Chatham Gillingham – Rainham – Newington – Sittingbourne – Teynham – Faversham (split/join) –:
 - Whitstable Chestfield and Swalecliffe Herne Bay Birchington on Sea Westgate on Sea
 Margate Broadstairs Dumpton Park Ramsgate
 - Selling Canterbury East Bekesbourne Adisham Aylesham Snowdown Shepherd's Well – Kearsney – Dover Priory
- 2tphR Victoria Bromley South Strood Rochester Chatham Gillingham Rainham Newington Sittingbourne Teynham Faversham (split/join) –:
 - Whitstable Chestfield and Swalecliffe Herne Bay Birchington on Sea Westgate on Sea
 - Margate Broadstairs Dumpton Park Ramsgate

– Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's Well – Kearsney – Dover Priory

Representative Hourly Cross-Platform Connections at Faversham:

- 00G [HS4 Cardiff HS ->] Euston Cross Faversham
 - $R \quad \ Charing \ Cross-Ramsgate \ / \ Dover \ Priory$
- 15G [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Faversham
 R Victoria Ramsgate / Dover Priory

- repeating at 30 and 45 minutes past.

Service plan 2 overall imposes the following loadings on HS11:

•	Euston Cross	- Stratford HS South Junction	18tph
•	Stratford HS South Junction	- Manor Park Junction	6tph
•	Liverpool Street	- Manor Park Junction	9tph
•	Manor Park Junction	- Shenfield HS Junction	15tph
•	Shenfield HS Junction	- Southend Airport station	6tph
•	Southend Airport station	– Faversham station	6tph
•	Faversham station	- Buckland West HS Junction	0tph
•	Buckland West HS Junction	– Dover Priory station	0tph

The 18tph between Euston Cross and Stratford HS South Junction are 12tph for HS2 (at service plan 4) and 6 for HS4 (at service plan 4) extending on to HS11. 18tph is a little high, but HS2 Ltd. seem perfectly happy with such a loading.

There are no further loadings on HS12 – still the 9tph classic compatibles over the short section to Shenfield North Junction.

Service Plan 3

This service plan comes into effect much later, when the final sections of the HS network are being tidied up. HS4 is extended from Cardiff HS to Swansea. HS11 is extended from Faversham to Dover, and HS12 from Shenfield North Junction to Norwich. The GC-gauge service from Cardiff to Shenfield is extended to Norwich, and now starts from Swansea. The various CC services on HS12 make maximum use of the available GC-gauge route, and the CC service to Lowestoft becomes 2tph and also serves Lowestoft, splitting/joining at Beccles and making cross-platform connections there with the GC-gauge Norwich service; it uses the HS station at Ipswich. A new classic-compatible service to Margate is introduced on HS11.

- 2tphG [HS4 Swansea ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester – Ipswich HS – Beccles – Norwich
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Colchester Ipswich HS Woodbridge – Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles (split/join) –:

– Oulton Broad South – Lowestoft

- Reedham South - Berney Arms - Yarmouth

 2tphC Liverpool Street – Stratford – Shenfield HS – Southend Airport – Southend HS – Grain – Sheerness – Faversham – Canterbury East – Martin Mill – Walmer – Deal – Sandwich – Ramsgate – Dumpton Park – Broadstairs – Margate.

Representative Hourly Cross-Platform Interchange Pattern at Beccles:

00G [HS4 Swansea ->] Euston Cross - Norwich

C Liverpool Street – Lowestoft/Yarmouth

repeating at 30 minutes past.HS11/HS12 Route and Service Plans v3.2

(The Colne Valley Metro service also makes a connection at 40 minutes past the hour at Colchester, now that the Lowestoft/Yarmouth service is 2tph.)

Service plan 3 imposes the following loadings on HS11:

•	Euston Cross	- Stratford HS South Junction	18tph
•	Stratford HS South Junction	– Manor Park Junction	6tph
•	Liverpool Street	- Manor Park Junction	12tph
•	Manor Park Junction	- Shenfield HS Junction	18tph
•	Shenfield HS Junction	- Southend Airport station	6tph
•	Southend Airport station	– Faversham station	6tph
•	Faversham station	- Buckland West HS Junction	6tph
•	Buckland West HS Junction	– Dover Priory station	4tph

It imposes the following loadings on HS12:

•	Shenfield HS Junction	 Shenfield North Junction 	12tph
•	Shenfield North Junction	- Colchester HS Junction	8tph
•	Colchester HS Junction	- Pinewood Junction	6tph
•	Pinewood Junction	- Woodbridge Junction	4tph
•	Woodbridge Junction	 Belle Grove Junction 	2tph
•	Belle Grove Junction	– Beccles Junction	4tph
•	Beccles Junction	- Reedham South Junction	4tph
•	Reedham South Junction	 Norwich station 	2tph

The extra 2tph between Pinewood and Woodbridge Junctions, and between Belle Grove and Beccles Junctions is the classic-compatible service to Yarmouth and Lowestoft, and between Beccles and Reedham South Junctions the Yarmouth portion thereof, which share tracks with HS12 between those points.

Service Plan 3 Summary

It is worth summarising the full set of services at service Plan 3, as this represents the final, complete state of these plans, and the services have so far been introduced piecemeal, at the various stages.

HS11:

- 2tphG [HS4 Cardiff HS ->] Euston Cross Stratford HS South Shenfield HS Southend Airport – Southend HS – Grain – Sheerness – Faversham – Canterbury East – Dover Priory.
- 2tphG [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Stratford HS South Shenfield HS –Southend Airport – Southend HS – Grain – Sheerness – Faversham – Canterbury East – Dover Priory.
- 2tphC Liverpool Street Stratford Shenfield HS Southend Airport Southend HS Grain Sheerness – Faversham – Canterbury East – Martin Mill – Walmer – Deal – Sandwich – Ramsgate – Dumpton Park – Broadstairs – Margate.

Regional Metro:

- 4tphRS Liverpool Street Stratford Shenfield Wickford Rayleigh Hockley Rochford Southend Airport Prittlewell Southend Victoria
- 2tphR Charing Cross Waterloo East London Bridge Ebbsfleet Rochester Chatham Gillingham – Rainham – Newington – Sittingbourne – Teynham – Faversham (split/join) –: – Whitstable – Chestfield and Swalecliffe – Herne Bay – Birchington on Sea – Westgate on Sea – Margate – Broadstairs – Dumpton Park – Ramsgate
 – Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's
 - Selling Canterbury East Bekesbourne Adisham Aylesham Snowdown Shepherd's Well – Kearsney – Dover Priory
- 2tphR Victoria Bromley South Strood Rochester Chatham Gillingham Rainham Newington Sittingbourne Teynham Faversham (split/join) –:
 - Whitstable Chestfield and Swalecliffe Herne Bay Birchington on Sea Westgate on Sea
 - Margate Broadstairs Dumpton Park Ramsgate

– Selling – Canterbury East – Bekesbourne – Adisham – Aylesham – Snowdown – Shepherd's Well – Kearsney – Dover Priory

Representative Hourly Cross-Platform Connections at Southend Airport:

00G [HS4 Cardiff HS ->] Euston Cross – Dover Priory RS Liverpool Street – Southend Victoria

- 15G [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Dover Priory
 RS Liverpool Street Southend Victoria
- repeating at 30 and 45 minutes past.

Representative Hourly Cross-Platform Connections at Faversham:

00G [HS4 Cardiff HS ->] Euston Cross – Dover Priory

- R Charing Cross Ramsgate / Dover Priory
- 15G [HS7/HS4 Bristol Temple Meads BT ->] Euston Cross Dover Priory
 R Victoria Ramsgate / Dover Priory

- repeating at 30 and 45 minutes past.

HS12:

- 2tphG [HS4 Swansea ->] Euston Cross Stratford HS South Shenfield HS Chelmsford Colchester Ipswich HS Beccles Norwich
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Colchester Ipswich Diss Norwich
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Colchester Ipswich HS Woodbridge – Wickham Market – Saxmundham – Darsham – Halesworth – Brampton – Beccles (split/join) –:
 - Oulton Broad South Lowestoft
 - Reedham South Berney Arms Yarmouth
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Colchester Manningtree Mistley Wrabness Harwich Parkeston Quay Dovercourt Harwich Town.
- 2tphC Liverpool Street Stratford Shenfield HS Chelmsford Witham Kelvedon Marks Tey – Colchester – Wivenhoe – Thorp le Soken (splits/joins) – :
 - Clacton
 - Frinton Walton
- 2tphC Liverpool Street Stratford Shenfield HS –Ingatestone Chelmsford Hatfield Peverel Witham White Notley Cressing Braintree.

Regional Metro:

- 6tphRS (Colne Valley Metro) Sudbury Bures Chappel & Wakes Colne Marks Tey Colchester – Colchester Town (reverse) – Hythe – Wivenhoe – Alresford – Great Bentley – Weeley – Thorpe-le-Soken (splits/joins) –
 - Clacton
 - Kirby Cross Frinton Walton-on-Naze
- 2tphRS (Felixstowe Metro) Ipswich Westerfield Derby Road Trimley Felixstowe
- 2tphR Harwich Town Harwich International Ipswich Bury St. Edmunds Ely March Peterborough – Stamford – Oakham – Melton Mowbray – Leicester – Hinckley – Nuneaton – Coleshill Parkway – Birmingham New Street
- 2tphRS Ipswich Needham Market Stowmarket Elmswell Thurston Bury St. Edmunds (split/join) –:
 - Kennett Newmarket Dullingham Cambridge
 - Kennett Soham Ely Manea March Whittlesey Peterborough

Representative Hourly Non-Cross-Platform (but see Appendix C) Interchange Pattern at Marks Tey:

00C Liverpool Street – Clacton / Walton

RS Clacton / Walton - Sudbury (thus connecting Liverpool Street - Sudbury)

- repeating at 30 minutes past.

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

00C Liverpool Street – Norwich RS Sudbury – Clacton / Walton

- 10C Liverpool Street Lowestoft / Yarmouth RS Sudbury – Clacton / Walton
- 20C Liverpool Street Harwich RS Sudbury – Clacton / Walton
- repeating at 30, 40 and 50 minutes past.

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

- 00C Liverpool Street Norwich
 - R Harwich Town Birmingham New St.
 - RS Ipswich-Felixstowe
 - RS Ipswich Cambridge / Peterborough

- repeating at 30 minutes past (see also Appendix D).

Representative Hourly Cross-Platform Interchange Pattern at Beccles:

- 00G [HS4 Swansea ->] Euston Cross Norwich
 - C Liverpool Street Lowestoft/Yarmouth

- repeating at 30 minutes past.

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 Chelmsford – Colchester my estimate 34km, actual 35.2km, Colchester – Ipswich, my estimate 26km, actual 27.2km,) leads me to believe they are accurate to within 4%.

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 excellent alignments of this particular route, I am considerably more confident of this assumption than on certain other routes (Trans-Pennine, in particular).

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

My estimated distances (between stations) are:

•	Euston Cross – Stratford HS South	8km
•	Stratford HS South – Shenfield HS	26km
•	Shenfield HS – Southend Airport	27km
•	Southend Airport – Southend HS	4km
•	Southend HS – Grain	10km
•	Grain – Sheerness HS	бkm
•	Sheerness HS – Faversham	16km
•	Faversham – Canterbury East	14km
•	Canterbury East – Dover Priory	24km
•	Shenfield HS – Chelmsford	14km
•	Chelmsford – Colchester	34km
•	Colchester – Ipswich HS	26km
•	Ipswich HS – Beccles	64km
•	Beccles – Reedham Junction	11km
•	Beccles – Norwich	30km

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 Euston Cross to Stratford HS South (start to stop) is 292 seconds
- Time to travel from Southend Airport to Southend HS (start to stop) is 207 seconds
- Time to travel from Southend HS to Grain (start to stop) is 327 seconds
- Time to travel from Grain to Sheerness HS (start to stop) is 253 seconds
- Time to travel from Sheerness HS to Faversham (start to stop) is 413 seconds
- Time to travel from Faversham to Canterbury East (start to stop) is 386 seconds
- Time to travel from Shenfield HS to Chelmsford (start to stop) is 386 seconds

• Time to travel from Beccles to Reedham Junction (start to stop) is 343 seconds

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

The procedure in calculating journey times between station stops is to take the two values of acceleration / deceleration distance, and the two times, as given in the first 2 lines of the above list, and sum them, thus acceleration / deceleration takes 11.57 + 6.95 = 18.52km and 278 + 167 = 445 seconds at line speed 300kph. The appropriate 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.

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Preston, inc. Station Wait Times
Euston Cross - Stratford HS South	8	8	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26	34	8.9	13.8	16.8
Shenfield HS - Southend Airport	27	61	9.1	22.9	28.9
Southend Airport - Southend HS	4	65	3.5	26.4	35.4
Southend HS - Grain	10	75	5.5	31.9	43.9
Grain - Sheerness HS	6	81	4.2	36.1	51.1
Sheerness HS - Faversham	16	97	6.9	43.0	61.0
Faversham - Canterbury East	14	111	6.4	49.4	70.4
Canterbury East - Dover Priory	24	135	8.5	57.9	81.9

1. Euston Cross – Dover (8 stops):

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

٠	Shenfield	22		[17]
•	Southend Airport	52		[29]
•	Southend	51		[36]
•	Faversham	63	(Javelin)	[61]
•	Canterbury East	77	(56 to Canterbury West by Javelin)	[71]
٠	Dover	83	(Javelin – 1 change)	[82]

Section	Distance (km)	Cumulative Distance (km)	Start - Stop Time (minutes)	Cumulative Journey Time (minutes)	Elapsed Time from Liverpool, inc. Station Wait Times
Euston Cross - Stratford HS South	8	8	4.9	4.9	4.9
Stratford HS South - Shenfield HS	26	34	8.9	13.8	16.8
Shenfield HS - Chelmsford	14	48	6.4	20.2	26.2
Chelmsford - Colchester	34	82	10.5	30.7	39.7
Colchester - Ipswich HS	26	108	8.9	39.6	51.6
Ipswich HS - Beccles	64	172	16.5	56.2	71.2
Beccles - Norwich	30	202	9.7	65.9	83.9
Beccles - Lowestoft			18	74.2	92.2
Beccles - Reedham South Junction (HS12)	11		5.7	61.9	79.9
Reedham - Yarmouth			16.0	77.9	95.9

2. Euston Cross – Norwich (6 stops)

The Lowestoft and Yarmouth times are by cross-platform connection at Beccles. Both the Norwich and Lowestoft trains can depart Beccles simultaneously, and the Yarmouth portion immediately afterwards. 18 minutes is the current time Beccles – Lowestoft; with HS12 this would presumably be reduced as the connection would be with the CC service Liverpool St. – Lowestoft/Yarmouth, serving the East Suffolk Line stations and splitting/joining at Beccles. The Yarmouth portion travels along HS12 until Reedham South Junction, then switches to the classic route to reach Yarmouth via Berney Arms.

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

- Shenfield 22 [17]
- Chelmsford 32 [27]
- Colchester 46 [40]
- Ipswich 67 [52]
- Beccles 145 (1 change) [72]
- Lowestoft 155 (1 change at Norwich) [93]
- Yarmouth 159 (1 change at Norwich) [96]
- Norwich 108 [84]

Appendix A – Euston Cross and the Inter-Regional Connections

General

By routing the classic-compatible services of HS2 and HS4 into Euston and Paddington, respectively, and all the GC-gauge services of both routes through Euston Cross, and on to HS1 and HS11/HS12, superlative cross-London inter-regional HS services are enabled, between the West Midlands / North West and Kent / East Sussex, and between South Wales / West Country and North Kent / East Anglia. The classic compatible services of HS1 (there's only one) and HS11/HS12 are likewise routed into St. Pancras East (the 'Javelin' platforms) and Liverpool Street respectively. The GC-gauge services of HS1 (not the international ones) and HS11/HS12 balance exactly those of HS2 and HS4. There is thus no need for any rebuilding work at the four terminal stations to accommodate GC-gauge trains. (Euston certainly needs rebuilding because it's such a disgusting mess, but it need not expand significantly beyond its current footprint, Paddington needs nothing more than a good clean and a fresh coat of paint, St. Pancras and Liverpool Street probably need nothing at all.) Given the GC-gauge loadings of the London end of HS2 and HS1 (12tph) and of HS4 and HS11/HS12 (6tph) - these are at the final service plans of each route – a single tunnel in each direction, with a minimum of 6 platforms, (passive provision for 8,) at Euston Cross, would suffice. That a single Euston Cross station, with a single pair of approach tunnels, would serve two HS inter-regional routes should seriously enhance its business case. I would like to see **passive** provision for 8 platforms, as is indicated in the diagrams.

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

HS1	
HS2	
HS4	
HS11	
Crossrail	
WCML	
GWML	

Old Oak Common

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

Ground Level, consisting of three sets of four platforms, serving the routes:

• GWML (Classic, long distance, and Heathrow Shuttle services,) on the fast lines

- HS4 Classic Compatibles and Chiltern Line services on the relief lines, both of which diverge immediately west of the platforms, the CCs to join HS4 at Old Oak Common West Junction, at the low level and the Chiltern Line services to Northolt Junction
- Crossrail, of which the arm to the WCML and the Stratford Shuttle reversing sidings diverges immediately west of the platforms, and the GWML arm takes over the relief lines

Low Level, consisting of HS2 (all services, so variable platforms will be required) and HS4 (GC-gauge services).

Ideally, these should be one above the other, with the passenger entrances and circulating area between them, with lifts, escalators and stairs directly to all platforms. In order for HS2 and HS4 GC-gauge services to share the same pair of tracks, the classic-compatible services must first diverge, those of HS4 **before** the LL station (heading east), at Old Oak Common West Junction (then using the GWML platforms at ground level), and those of HS2 immediately after the LL station, at Old Oak Common North Junction. HS2 and HS4 merge shortly after that, at Old Oak Common East Junction. HS2's London-bound classic-compatible trains join the WCML at Queens Park Junction. In the original Euston Cross plans, this was seen as actually at Queens Park (since there was then no need to get them off HS2 as soon as possible after Old Oak Common). In fact Queens Park Junction (I'll keep the name as it's already in the literature) would best be located immediately west of the Kensal Green tunnels – there's plenty of room for it there, and it's only about ¹/₂ mile from Old Oak Common North Junction.



Euston Cross

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



Stratford HS South

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

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

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

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



Appendix B – Track Layouts at Beccles and Reedham South Junctions

HS12 and the East Suffolk Line share tracks, (enlarged to GC gauge, obviously,) between Belle Grove and Beccles Junctions. HS12 and the Yarmouth branch of the East Suffolk Line further share tracks (on a new alignment) between Beccles and Reedham South Junctions.



HS12 GC to Norwich would normally occupy the inside tracks and the classic compatible to Lowestoft and Yarmouth (splitting/joining at Beccles) the outer. But scissors crossovers are provided for operational flexibility.



Appendix C – Cross-Platform Interchange at Marks Tey

The requirement at Marks Tey is to provide cross-platform interchange between London and Sudbury, and vice versa. This is possible by a contraflow arrangement (compare with HS3 and Tees Valley Metro interchange at Darlington), but whether or not it would be worthwhile is arguable. HS12 crosses the GEML south of the station, and the down track of the Colne Valley Metro shares the bridge.



To Colchester

Appendix D – Interchange at Ipswich

The classic station at Ipswich is an appalling mess – inadequate provision on a cramped site with no scope for expansion. (It's not in a very convenient location for the city it purports to serve, either, but there are many worse.) The HS station is located underneath it because there's no room for it anywhere else; this does also allow for a nice alignment, avoiding all the congestion of Ipswich and its junctions.

Ipswich currently has 3 through platforms and one bay. There is an existing siding on the south side which could serve another terminating platform. The current layout, simplified to show only the features relevant to the present argument, is:



Platforms 1-4 exist already, with those numbers. Platform 5 is new, but on an existing siding.

In order to provide each-way connections between two through services, with only three through platforms available, at least one platform must provide for reversible working. Platform 3 is selected as the reversible platform, because of the existing crossovers 'A', which allow it to be used for Harwich-bound trains without impact on the route through platform 4. Platform 4 is currently used by stopping services to destinations such as Cambridge. This function is taken over by platform 5, access to which is by crossover and connection 'C', and platform 4 then serves the down HS12 classic compatible service to Norwich, via connections 'B'. Platform 2 serves the up London trains, (HS12 classic-compatible service from Norwich), as it does at present. Platform 1 currently serves the Felixtowe and East Suffolk Line services. The latter becomes an HS12 classic-compatible service from London, and uses the underground HS station. Trains can reach Felixstowe without using the classic GEML, so the line into platform 1 is shown in the above diagram as completely disconnected.

The complete (because it has to provide for both directions) hourly interchange pattern at Ipswich is:

- 00C Norwich Liverpool Street (platform 2)
 - R Birmingham New St. Harwich Town (platform 3)
 - RS Cambridge / Peterborough Ipswich (platform 5)
 - RS Felixstowe Ipswich (platform 1)
- 10C Liverpool Street Norwich (platform 4)
 - R Harwich Town Birmingham New St. (platform 3)
 - RS Ipswich Cambridge / Peterborough (platform 5)
 - RS Ipswich Felixstowe (platform 1)
- repeating at 30 and 40 minutes past.

Note how the all-stations services from Cambridge and Felixstowe connect into the fast services to London and Harwich, and how the fast services from London and Harwich connect into them. The services from Cambridge and Fexlixstowe have a 10 minute layover in Ipswich (actually a few minutes longer, 15 minutes say, as they arrive before the up through services, and depart after the down throughs). The up London service arrives before the up Harwich, and departs after it, likewise for the down services. This, obviously, is because they share the same GEML track either side of Ipswich, and also because I regard it as good practise to minimise the occupancy of a reversible track. Hence the Harwich trains have the shortest wait time at Ipswich (passengers from the other services will already be waiting for them at platform 3, and passengers changing from the Harwich trains have time to reach the others. In the down direction, though not in the up, London – Norwich and Harwich – Birmingham actually have a cross-platform connection!

(This interchange could indeed advantageously be implemented immediately, involving just classic services.)