



High Speed 2 in London let's get it right

Jonathan Roberts of the JRC consultancy discusses the route of the new line in the capital

With 70-80% of all High Speed 2 travel being to or from the capital, it is vital to get HS2 proposals right in the London and Home Counties regions.

This article addresses the four conditions raised in the Mayor of London's 2011 consultation response on HS2 and shared by other London area stakeholders. They are:

- environmental mitigation along the north west London corridor;
- inclusion of more than just Crossrail in Old Oak Common interchange;
- solving the weaknesses of the HS2-HS1 link;
- mitigating Euston interchange pressures.

Environmental mitigation

London is no exception to the environmental imperative. Its population, heading towards 10 million over the next two decades with higher density, merits a lot of mitigation.

When HS2 Phase 2 opens around 2033 the first main lines will have been around for nearly two centuries. The quality of the new main line should also stand the test of time.

HS2 takes over part of the latest 'classic' main line built in north west London. The Great Western / Great Central Joint Railway opened in 1904-10 through Middlesex and the Chilterns, to shorten the journey to the West and East Midlands. HS2 is set to take over part of the route used by the GW from Paddington to reach the Joint line.

The Mayor is arguing about environmental factors on this North Acton to Northolt section of HS2, with 6,300 homes affected by noticeable noise increase. The desire is to put this section into tunnel. The current HS2 position is to mitigate, not tunnel.

Bolstering the Mayor's position is the fact that a re-engineered railway accommodating GC-gauge vehicles and a High Speed air-pressure-related 'kinematic' gauge doesn't fit

entirely within the present railway. Already it is proving simpler and no more expensive to put the new line into tunnel under the Chiltern line from Marylebone, between Northolt Junction and West Ruislip.

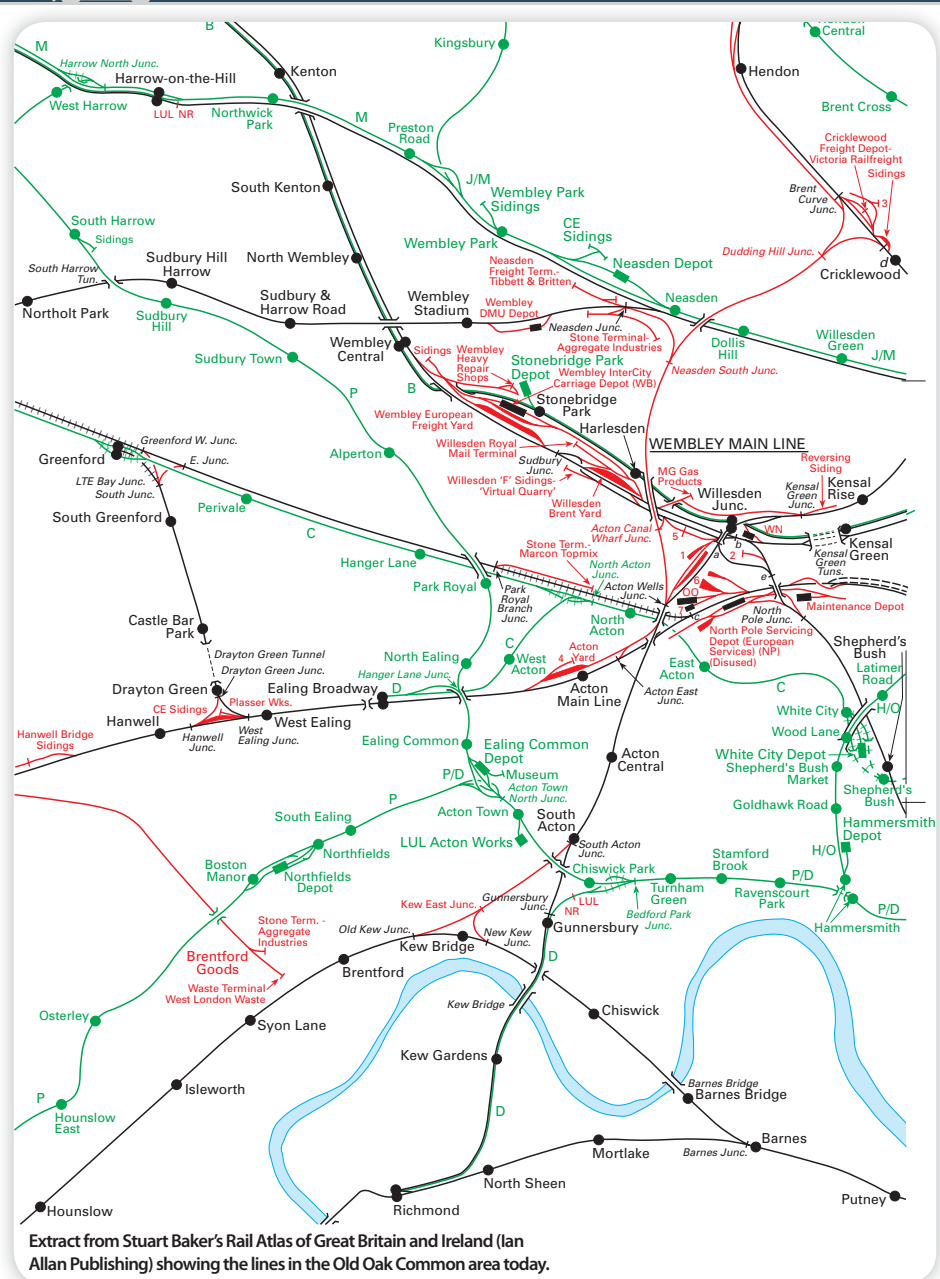
Old Oak Common: the future 'Park Royal City'

Old Oak Common is foreseen as large-scale in both development and railway terms. Space prevents elaboration of the full thinking for the development planning, but it aligns with one of HS2's core objectives, to stimulate economic growth.

Creation of 20,000 jobs was the ambition in early HS2 documentation. Now, a 150-hectare zone will be designated 'Park Royal City': a premier development at one of the country's largest interchanges. Over a 40-year timescale (about the history of the current Canary Wharf when complete) should see the creation of 100,000 jobs and 19,000



Euston: set to be adapted to handle high-speed trains under HS2 Ltd plans. Desiro in the station on 8 May 2009. Brian Morrison



homes directly and indirectly at London's largest Opportunity Area, with a Gross Value Added of £54 billion.

A transport working party including HS2, DfT, Network Rail, Transport for London and the local authorities has been involved alongside the property development planning work. Interchange and rail permutations will have to work in a complex environment. North Acton and Willesden Junction stations are nearby and can stimulate some early development zones; they may merit links to Park Royal City interchange. Stakeholders have also considered personal rapid transit (PRT) for local connections.

The Underground at Euston will not be able to accommodate all HS2 passengers coming into London, so Park Royal City will provide a safety valve with one-third of passengers interchanging here with Crossrail/Heathrow trains. 16 platforms will give a 'Stratford scale' of connectivity: two each way for HS2, two HS2-HS1, four Crossrail/GW local, four GW fast, 2+ for Overground. The station could eventually handle 200,000 daily passengers from its catchment area and rail interchange.

Crossrail 1-West Coast link via Park Royal City

Plans for only 10 Crossrail trains per hour (tph) west of Paddington are out-of-date. Crossrail and sponsors are reviewing a timetable with most of the 24tph from the central section heading further westwards. There is potential for a spur via Park Royal City, for trains towards Watford and Tring. This would relieve passenger and train pressures at Euston terminus. One option uses the tail of the GW Birmingham line then tunnels towards the West Coast main line. Another might be via the Dudding Hill line.

It may be too late for a scheme to be included in the HS2 Hybrid Bill, so needing separate powers to progress the scheme ahead of HS2. Stakeholders wait to hear from the Secretary of State as regards the extent of DfT support for this proposal.

Overground at Park Royal City

There is strong Mayoral, TfL and local authority support for an Overground interchange within Park Royal City. This would remove about 10% of HS2 flows from Euston, aiding access to HS2 from other parts of London. Projected Overground interchange volumes are high, eg

4,000 peak passengers with the West London line. Park Royal City would become a radial/orbital interchange improving public transport's appeal on the west side of London.

Options that were studied included a south-side station and Overground route from the West London line, or a central station. Of various links to the North London line, the most effective were 'Shoreditch-type' curves to minimise land use impact. The central station is now considered difficult to build concurrently with works for HS2 and Crossrail/GW.

The station options are now to the south or at Acton Wells Junction. The station would be shared by West London and North London line trains. There would be an option of Overground serving the Dudding Hill line. Also, Southern to West Coast trains could run via the Acton Canal Wharf route, which comes off the Dudding Hill line and joins the West Coast main line near Stonebridge Park (although journey times are likely to be slow and the alignment might need improving).

Network Rail has looked at these and many other options for both the Southern services and



Park Royal City, showing HS2 and Crossrail/GW stations, and a 'Poirot moustache' option for Overground links. In the east the moustache joins with the West London line from Willesden Junction to Clapham Junction, while on the west it joins with the North London line from Willesden Junction to Richmond. At the top left is the Dudding Hill line to Acton Canal Wharf Junction and Neasden. This is a long term view, with rail depots moved or built over. Source: GLA

the Crossrail to West Coast main line services. Passive provision for a south-side route was agreed in the Inter-city Express Programme (IEP) depot planning approval. To remind readers, in order from south to north, the planned layout at Old Oak is IEP maintenance in the former Eurostar North Pole depot adjoining Wormwood Scrubs, then the Great Western main lines, then the HS2 station and road access, then Crossrail maintenance depot, then Crossrail stabling sidings, then the Grand Union Canal.

The Mayor and TfL require the Overground at Park Royal City either to be included as part of the HS2 proposals, or have separate powers - a highly worthwhile element, which should be safeguarded and funded.

The HS2-HS1 link

HS2 is required to offer passenger services between north of London and mainland Europe. Section 40 of the 1987 Channel Tunnel

Act required similar services. The trains were built, the North London line was upgraded, but no services ever ran because low-cost airlines appeared. There still isn't much commercial case for slow, infrequent rail services.

HS2 Ltd's current plans are for two international-only platforms at Park Royal City. Trains would run in a single-track tunnel from Park Royal City to Camden Roundhouse ('the mousehole'), then surface to run via the existing Primrose Hill link to Camden Road on the North London line and then on an existing single-track chord into the HS1 tunnel. Traffic forecasts suggest little demand for these trains early on. However, a single-track route would constrain longer term, cross-London inter-connectivity.

HS2-HS1 domestic demand

Independent consultants working for Greengauge 21 are investigating the market for services that could use an HS2-HS1 link.

Greengauge 21 Director Jim Steer said 'There appears to have been no examination of the inter-regional demand that could be served by the link. So the case for investment has had to rest on the important, but smaller, international demand flows'. Greengauge will look at inter-regional and international demand levels, and ways of addressing border control. It expected to have initial results by 30 April.

JRC has already modelled HS2-based international services in various economic circumstances, for the East and South East London Transport Partnership (ESELTP) and others. This extrapolates airline travel flows between the UK and western Europe in 2010. Some domestic flows were modelled via HS1 and the East London quadrant, through a potential link to Queen's Park and on to the West Coast main line / Old Oak / HS2.

The JRC modelling suggested domestic demand in this corridor far outweighs the potential international flows. Long term demand forecasting points to a requirement for 4-6 Overground tph to be routed Camden Road-Queen's Park, four additional Javelin tph to link Kent with the West Coast main line, and up to 3tph for long-distance inter-city or international travel. This used a limited data base and didn't allow for extra passenger flows associated with the Railway Lords' Euston Cross proposal. (The Railway Lords' proposal - so called because House of Lords members Tony Berkeley and Bill Bradshaw are proposing it - was announced on p8 last month and is discussed further below.)

Greengauge's analysis may define additional or different flows in advance of the Davies Commission's aviation report in 2015. Overall a reasonable baseline is emerging for a better cross-London link specified for domestic flows



between Kent and the West Coast main line. International trains could be a slot requirement within an hourly domestic timetable.

HS2-HS1 international demand

Eurostar is now profitable thanks to HS1, with an average 550 passengers per train on the London-Paris/Brussels route, on a 750-seat train. There are three main problems in going further with international-only trains:

- trains cannot also carry domestic passengers in the UK;
- lower train and crew utilisation;
- more track access charges.

Trains going further afield need to carry more passengers than Eurostar's Three Capitals trains to be profitable. The international point-to-point travel demand will be less than that originating or transferring in London. Low frequency and low loading would cause high toll costs on an HS2-HS1 'mousehole'.

JRC forecasts a requirement in 2035 for no more than seven, and perhaps as few as three, commercially viable HS2 to the Continent trains, one-way per half-day.

Early Greengauge 21 results and JRC modelling may make the case to the Department for Transport for ministerial reconsideration of the HS2-HS1 link. Stakeholders are keen for a major review of the HS2-HS1 question and the cross-London and cross-Britain connectivity which is at stake.

HS2-HS1 next steps: project redefinition

In the Commons' debate following the HS2 Phase 2 route announcement on 28 January 2013, Transport Secretary Patrick McLoughlin said: 'It will be possible to run some services from Old Oak Common direct to the Continent

Problems with HS2-HS1

The HS2-HS1 element of the HS2 project is vulnerable as an Achilles heel in the forthcoming Hybrid Bill Select Committees.

Purpose of HS2

- National infrastructure investment.
- Opportunities for place-shaping.
- National-scale economic impacts, in the Midlands, North and in London.

Limitations of HS2 in London

- Under the HS2 Ltd plans, the high capacity effect of HS2 ends (like the West Coast main line) on the edge of central London, at Euston.
- HS2 Ltd is not planning for a high capacity main line continuation via Stratford-East/SE London, nor East Anglia/Kent. These are fast-growing catchment areas with 8.6million people (16% of England's population) and poor access to Euston.

Narrow planning vision for HS2-HS1

- HS2 Ltd's remit for the North London link is about international trains via HS2. This is the tail wagging the dog, with far greater domestic demand considered to exist.
- The link currently proposed by HS2 Ltd could cost £1.6 billion+ for a tunnel from

Old Oak and alterations in the Camden area.

- The benefit : cost ratio (BCR) of the HS2 Ltd proposal is profoundly negative. JRC has modelled the 'toll' per international passenger in the early years as over £40 on top of the rail fare.

A buffer stop in the national economy, a block to London

- A single-track line would be a virtual buffer-stop within the ultimate UK high-speed network.
- It would block London and Home Counties economic expansion. Already Crossrail will be heavily loaded through central London with a Park Royal City interchange, so there will be a need to relieve Crossrail with other cross-London services. The original HS2 Ltd plan interferes with high-growth London Overground and freight services on the North London line.
- Any new link should underpin further place-shaping, jobs and homes throughout the 20,000 sq km East/South of London. Stratford is the sixth busiest hub in Britain.
- A high-capacity HS2-HS1 link may be essential as an access route for a new hub airport for London and the South East.

if there is demand for that. We will certainly look at the issue, and at how the whole London interconnection works'. This suggests an appreciation of demand in relation to international services.

HS2 Ltd has been asked to explore different options to provide a more robust HS2-HS1 link.

There are several ways for HS2 Ltd and DfT to move forwards:

1. Continue with the present scheme, despite the expense and poor value, with no later scope for adaptation for more domestic flows. This implies significant risks during the Hybrid Bill Select Committees.
2. Adapt current HS2-HS1 tunnel proposals to allow passive provision for better connections, with later project review after the Davies Commission, seeking new powers in the Phase 2 Hybrid Bill. This may not satisfy emerging interests in non-HS2 domestic flows across London, and brings us back to the Hybrid Bill Select Committees.
3. Proceed within the Phase 1 Hybrid Bill with a longer double-track scheme to bypass bottlenecks. This increases costs and pre-empts the Davies Commission.
4. Revise the remit for the HS2-HS1 link, recognising the largest usage could be domestic travel. Is then a different 'project owner and leader' needed east of Park Royal City or from a junction between HS2 and the existing rail network?
5. Move the HS2 project towards some review of the best locations and means to create an interface with the existing and HS1 network. This review should consider a multi-way connection, with domestic trains also allowed to use the HS2-HS1 link, maybe restyled as a North London Express line to acknowledge its wider usefulness.

The yard at Old Oak Common on 10 May 2011. Great Western rolling stock maintenance is due to be moved to North Pole on the other side of the tracks (IEPs) and Reading (suburban stock), while the Crossrail depot will be built here. Brian Morrison





So far HS2 Ltd sees the interface point as the Primrose Hill/Camden area. JRC considers that Queen's Park is another suitable location. Connections may be achieved there to/from the West Coast main line tracks, the Primrose Hill link, Euston terminus lines and any form of tunnelling towards, or beyond, Euston.

Euston terminus: a national pressure point

There are three strategic issues.

- Environmental and economic impacts of demolishing some of the built-up area, combined with the impenetrable barrier of the 1960s Euston station.
- Passenger distribution impacts of more, larger-capacity trains plus new West

Coast main line services, and challenging operational issues during reconstruction.

- Congestion in the Underground, with passengers from HS2, the existing main lines, and new trains into Euston, King's Cross and St Pancras in slots freed up by HS2.

The interventions proposed so far are:

- Euston Area Plan: an 'Opportunity Area' to make the best of the proposed demolition and renew the entire urban quarter including the existing terminus. This is worthwhile anyhow to create new commercial activity and an improved public realm within the zone of the present Euston station.

- The Park Royal City interchange, covered above. Potentially also a Crossrail 2 to West Coast main line link to help commuters and reduce pressures at Euston during and after reconstruction (this is not yet authorised).
- A new link to Euston Square station, to relieve the most crowded tubes.
- However HS2 Phase 2 requires a new Euston St Pancras station on a Crossrail 2 line, neither authorised nor funded at present. Without this, time saved on inter-city journeys could be lost queuing for a tube train!

Euston can be made to work but only if Crossrail 2 goes ahead. Government needs to guarantee funding. Will that project and

Euston Cross concepts so far

- 500m passenger concourses link Euston and St Pancras, constructed under road alignments with Crossrail 'Paddington-style' excavation.
- Main platforms bored alongside, requiring adequate space for unequal, multidirectional passenger flows and their luggage.
- Requires third platform each way to handle higher train frequencies based on nominal 10-minute dwell, depart and refill time.
- Access to Thameslink and King's Cross North ticket hall relieves Euston passenger handling.
- Passenger emergency evacuation west to Euston, east to St Pancras, middle to Swiss-style evacuation point, then surface.
- Construction sensitivities
 - not all London clay, but below existing tubes and north of Crossrail 2;
 - goes south of Thameslink junctions;
 - British Library vaults avoided;
 - design care needed for Francis Crick Institute vaults.
- Passenger management
 - Travolator possible Euston/St Pancras;
 - less Euston congestion and connectivity to all northern termini;
 - effective platform information required, like airport gates.

Connections with HS1

- Routing and demand depend on Davies Commission and the next government.
- Current HS1 domestic flows offer possibility of merging through train operations.
- HS1 flexibility for flows via Euston Cross may open up St Pancras Kent-side platforms to other international trains.
- Potential requirement for additional tunnel as far as Stratford/Temple Mills chord – may build later when demand grows.
- Plan HS2 empty-stock reversal location options include Orient Way/Temple Mills/Ebbsfleet.

Queen's Park Junction

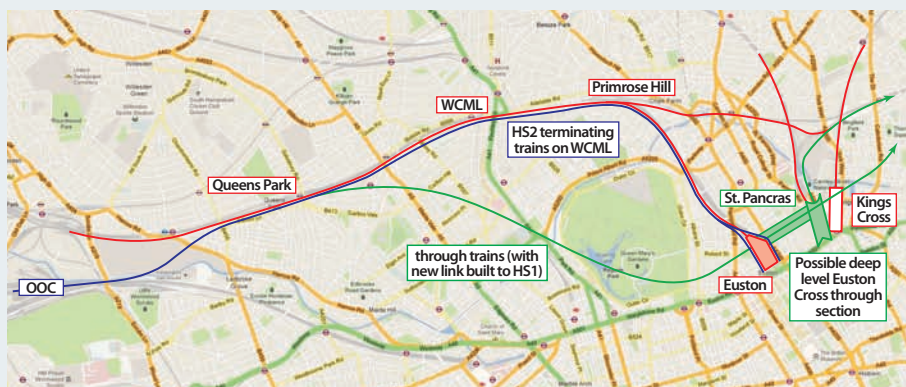
- Design QPJ for HS2 timetable priority,

West Coast main line given holding tracks between junction start and finish, in case of delays.

- Junction timetabling looks repeatable every 15 minutes, even with different headways on different routes.
- West Coast 'white space' is possible while spare capacity on West Coast slow lines

allows flexibility.

- Expect a more intensive timetable to be feasible once all lines have European Rail Traffic Management System.
- Engineering concept for Queen's Park Junction requires only three tunnel boring machines - as currently envisaged for HS2 east of Old Oak Common.



Euston Cross proposal, with HS2 line coming east from Old Oak Common and running to both Euston terminus (in blue) and via a Queen's Park Junction to Euston Cross underground platforms and then on to HS1 (in green).



Euston Cross: possible alignment of passenger concourses shown in green (500 metre length) north of potential Crossrail 2 route, shown by dotted line running south west to north east. Bored rail tunnels could be alongside concourses. Pink area is current HS2 expansion proposal for Euston terminus. Other rail alignments are shown.

funding be confirmed when the Phase 1 Hybrid Bill Select Committees sit?

Why a terminus, not a through station?

Why all the effort creating an even larger version of a Victorian railway terminus? We should have learnt the benefits of through city travel with capacity for multidirectional flow: Berlin's Hauptbahnhof provides valuable lessons which have been partially absorbed in the rebuildings of London Bridge and Reading.

The HS2 Ltd plans envisage building new platforms for fast inter-city trains to park in; this would require demolition of much of the housing west and north west of Euston. A through line could aim for fewer short stay platforms with low cost depots elsewhere, ie via HS1 to Temple Mills, Stratford and Ebbsfleet. Adapting the present Euston terminus might suffice for terminating trains.

Euston's main line station elements currently comprise:

- Virgin inter-city;
- commuter expresses, semi-fast and stoppers;
- Overground trains to Watford.

Under the HS2 Ltd plans, these would become:

Phase 1

- HS2 replacing inter-city - similar frequency;
- more commuter and shire expresses as West Coast main line fast services.
- commuter semi-fast trains, but not the stoppers (the latter would be diverted into Crossrail);
- Overground future unknown.

Phase 2

- Additional HS2 trains.

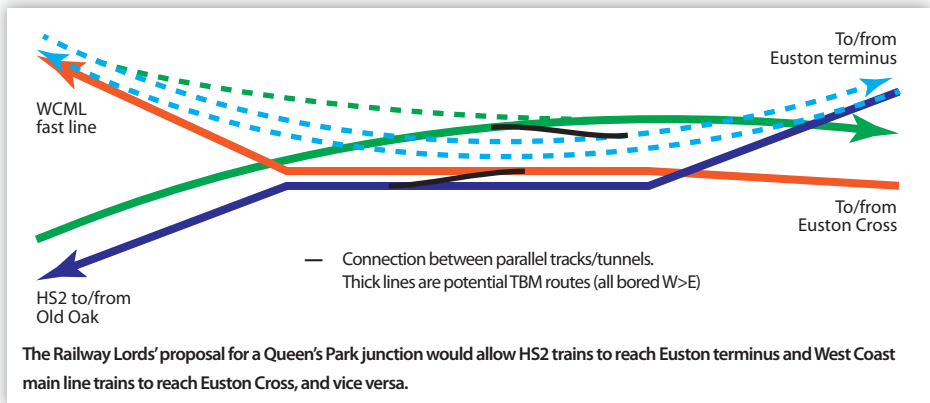
These train numbers are similar, although passenger volume would be bigger with larger trains. Passenger handling time would be greater, which influences the HS2 Ltd thinking about terminus design.

Euston Cross rationale

Combining the state of the HS2-HS1 link with foreseeable domestic demand and the political dissatisfaction with the current proposition, leads to the question that if you need a cross London route then 'why not via Euston, and east-west?' in a 'Euston Cross' tunnel. This would resolve issues mentioned in the HS2-HS1 'problem box' above.

The article in *Modern Railways* for April 2013 (pp8-9) shows the potential of Euston Cross. Specific opportunities are:

- through Javelin Kent to West Coast fast services: a new London - Home Counties - Midlands express network relieving the M25 and other motorways;
- joining Anglia/Kent to inter-city services, making them UK core regions and offering independence from London's dominance;
- Anglia connectivity could be improved in ways such as a better link (maybe a travolator) between Stratford International




and Stratford Regional station; by using the Temple Mills spur (or creating a new one) to join HS1 to the West Anglia main line; or with a new spur line into south Essex at Aveley, for example with a flying junction between HS1 and the c2c route to Southend via Grays where the two lines cross each other;

- with more passengers on more trains, charges would be lower and more HS2 to the Continent trains would be affordable.

Euston Cross practicalities

For once this could be a railway project solving genuine problems. HS2 Ltd is already

exploring different options to provide a more robust HS2-HS1 proposal. Crystallising possible locations for the interface with the 'classic' railway has led to the Railway Lords' concept of Euston Cross via an HS2 / West Coast main line junction. It would allow trains from both lines to access Euston terminus and a cross-London tunnel.

The concept needs to be developed into a precisely engineered solution, to be assessed on merit. The diagrams show initial thinking on questions already debated by stakeholders. The benefit of British democracy is the debate can begin, even now, on the best HS2 format for London. 



Overground connectivity is a key question at Park Royal City. Class 378/0 No 378014 arrives at a crowded Shepherd's Bush station on the West London line on 16 September 2010. Brian Morrison