

A submission to Lord Mawhinney's Review

This paper is an addendum to "[Heathrow Hub: The UK's Global Gateway](#)", a document written by Arup which sets out our vision for a multi-modal transport interchange to serve Heathrow airport. It was submitted to HS2 Ltd in December 2009, but the proposal was not considered in "*High Speed Rail London to the West Midlands and Beyond: A Report to Government by High Speed Two Limited*", published in March 2010.

HS2 Ltd briefly considered an 'Iver Station', designed by them and located at the site proposed by Arup for the *Heathrow Hub*. However, but for its geographical location, the station featured in the report shared few of the characteristics and benefits of the *Heathrow Hub*. We would therefore ask Lord Mawhinney to include the *Heathrow Hub* proposal in his review of options for a station at or near Heathrow.

The High Speed Rail Alignment

All agree High Speed Rail will bring record journey times between Britain's large cities. But what else should it deliver for passengers, businesses and the environment? Such a holistic question has rarely been asked. The government tasked HS2 Ltd with investigating the best rail alignment for a fast connection between London and Birmingham. HS2 Ltd delivered on that remit. Subsequently, this review has been established to find a way of retrofitting a connection to Heathrow Airport from the alignment identified by HS2 Ltd. We believe this approach is deeply flawed. The issue of integrating High Speed Rail with Heathrow - the nation's only hub airport, and world's busiest international airport - is of such importance that it should have played a prominent role in identifying the preferred route alignment.

If the Government's vision for High Speed Rail is taken forward, Britain would be alone in the world as the only country where a new high speed rail network bypasses the national hub airport. If there was a compelling reason for the bypass, such as a 30 minute time penalty on all other services on the network, then a bypass would be justifiable. However, as HS2 Ltd concedes, the time penalty for through-services on a direct High Speed Rail alignment via Heathrow is only three to four minutes. Such a penalty pales into insignificance compared with the benefits a direct alignment would deliver for the UK.

The high speed route envisaged by the Hub proposal would be far less environmentally damaging. It would impact on a smaller section of the Chiltern's Area of Outstanding Natural Beauty¹ and reduce noise pollution for residential areas. Unlike a loop or a spur, a direct mainline connection to Heathrow would dramatically improve access to the airport by offering more frequent rail services, and would significantly improve modal shift from short-haul flights to rail and from road to rail. Moreover, a direct alignment would avoid the costly and harmful duplication of rail infrastructure and blight associated with loop and spur options, and it would be the least expensive option for connecting High Speed Rail and Heathrow. We estimate a direct alignment would be £0.4bn less expensive than the least costly loop or spur alignment connecting High Speed Rail and Heathrow.

We therefore welcome Lord Mawhinney's review. If it considers not only stations to serve Heathrow, but the route alignments which will serve them, it will produce the first comparative analysis of the various options available, including the individual businesses cases.

To this end, we would ask Lord Mawhinney to consider Arup's *Heathrow Hub* [REDACTED]

¹ Attachment A illustrates both Arup's direct line via the Heathrow Hub, [REDACTED]

² Attachment B illustrates the Heathrow Hub and HS2 Ltd proposals for the high speed route from London to Birmingham.

The Heathrow Hub

Arup's submission to HS2 Ltd was not a rail proposal or an aviation proposal, but a transport proposal. Its guiding principle is to connect, in as seamless a way as possible, the different transport modes of air, road and rail. The Hub itself could be thought of as a High Speed Rail station, but it is in fact an inter-modal interchange, which connects all the transport modes in one location. It would be a new entry point to the airport, located on the Great Western main line, and connected to HS1, HS2, Crossrail and the strategic road network. Such interconnectivity would be a radical addition to the UK's transport infrastructure, but, in reality, it would merely make Heathrow comparable to its European competitors.

An important but sometimes misunderstood element of the proposal is how the Hub connects to the existing airport infrastructure. The Hub would be fully integrated with the airport by automated passenger and baggage systems. Such systems work successfully throughout the world³, including at Heathrow. An Automated People Mover (APM) would transfer passengers between the Hub and other terminals every 2.5 minutes. There would be an estimated three minute travel time between the Hub and T5, and a 7 minutes travel time between the Hub and the furthest airport satellite. To avoid blight to residential property, the passenger and baggage systems would run along the margins of the M25 within the area of the Hub site and then in tunnel to the existing airport boundary. It would be the responsibility of the airport operator to fund and operate these as an integral part of the infrastructure that is currently being developed at the airport. The costs would form part of the airport's regulated asset base.

If high speed rail is to reach its full potential in substituting short-haul flights to domestic and European destinations, HS2 must directly and seamlessly connect with HS1 and Heathrow Airport. Arup's proposal does this, with the Hub accommodating dedicated platforms for high speed domestic and international services, as well as platforms for classic rail. All of these platforms would be on the same level as the existing Great Western main line which crosses the site.⁴ Brunel's 169 year old railway was constructed well above the floodplain, and has no issues with flooding. In contrast, HS2 Ltd rejected proposals to connect HS1 and HS2, either at Heathrow or elsewhere. The station they considered at Iver only had domestic platforms, no international platforms, limited Crossrail services (just 4 an hour) and was set below ground, in a cut and cover box in the floodplain.

The Hub holds a significant additional advantage in its ability to be phased, with the first phase potentially providing domestic rail connections from Wales, the West and South West. By phasing the development, demand for services could be established, and affordability enhanced. If required, the proposal could also accommodate the phased development of a station at Old Oak Common. It would work in tandem with the Hub in order to provide additional London dispersal via Crossrail⁵. In an advanced phase, the Hub could accommodate an integrated airport terminal. In doing so, it would replicate the world's most successful air-rail interchanges, as highlighted in the joint Arup/BAA submission to HS2 Ltd, by offering passengers from much of the UK a 'one seat ride' to the airport.

By linking the classic rail network to Heathrow, as well as High Speed Rail, surface access to the airport would also be radically improved. Those to the west and south west of Heathrow would have direct rail access to the airport for the first time, offering positive economic benefits for those regions. The Hub would attract by far the highest level of rail services at Heathrow.

³ As described in "Heathrow Hub: The UK's Global Gateway", Arup, December 2009, Appendix 3, p.90

⁴ Attachment C illustrates the route between the Hub and Old Oak Common and the link between the high speed line and Great Western main line at the Hub. Attachment D illustrates infrastructure provision at the Hub.

⁵ We believe it is not necessary for the station at Old Oak Common to be built initially, as provision can be made for its construction when its capacity is required e.g. when HS2 extends north of Birmingham. Attachment E describes the timetabling issues around calling HS trains at Heathrow Hub or at both Heathrow Hub and a new interchange station at Old Oak Common.

Over 50 trains per hour could stop, including up to 10 Crossrail trains per hour, enhancing its utility as a dispersal point for London. Importantly, the Hub could accommodate through-running, as well as stopping high speed trains at Heathrow.

New services would also be created. Connecting high speed infrastructure with the classic rail of the Great Western main line and the Chiltern line, as envisaged in the proposal, would also enable additional "Javelin" style services to run between the Thames Valley and the west, and the Thames Gateway. Additional services could also be created linking Heathrow to Milton Keynes, and other locations north of the Chilterns including Aylesbury, Bicester, Banbury, Leamington Spa, and Solihull.⁶

Conclusion

Britain should follow years of international experience, and place its Hub Airport on the mainline of its High Speed Rail network. Heathrow is a national asset - it should not be bypassed, or placed at the end of a cul-de-sac.

Stations are important, but they cannot be considered in isolation to the alignments which will serve them. The 'Iver Station' designed by HS2 Ltd is not the *Heathrow Hub* proposal. Arup's proposal is far more radical in both ambition and scale.

The direct alignment we propose via Heathrow is more environmentally friendly; it dramatically improves surface access to the airport; and it avoids costly and disruptive duplication of rail infrastructure.

The Hub could start life as a domestic station, offering those to the West of Heathrow access to the airport for the first time. It could evolve to become a fully integrated air/rail interchange – a new entry point to the airport, located on the Great Western main line, Crossrail and the strategic road network. It would attract the highest level of rail services, and offer a unrivalled solution for connecting HS1 and HS2.



Arup
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⁶ Attachment B illustrates these additional services.

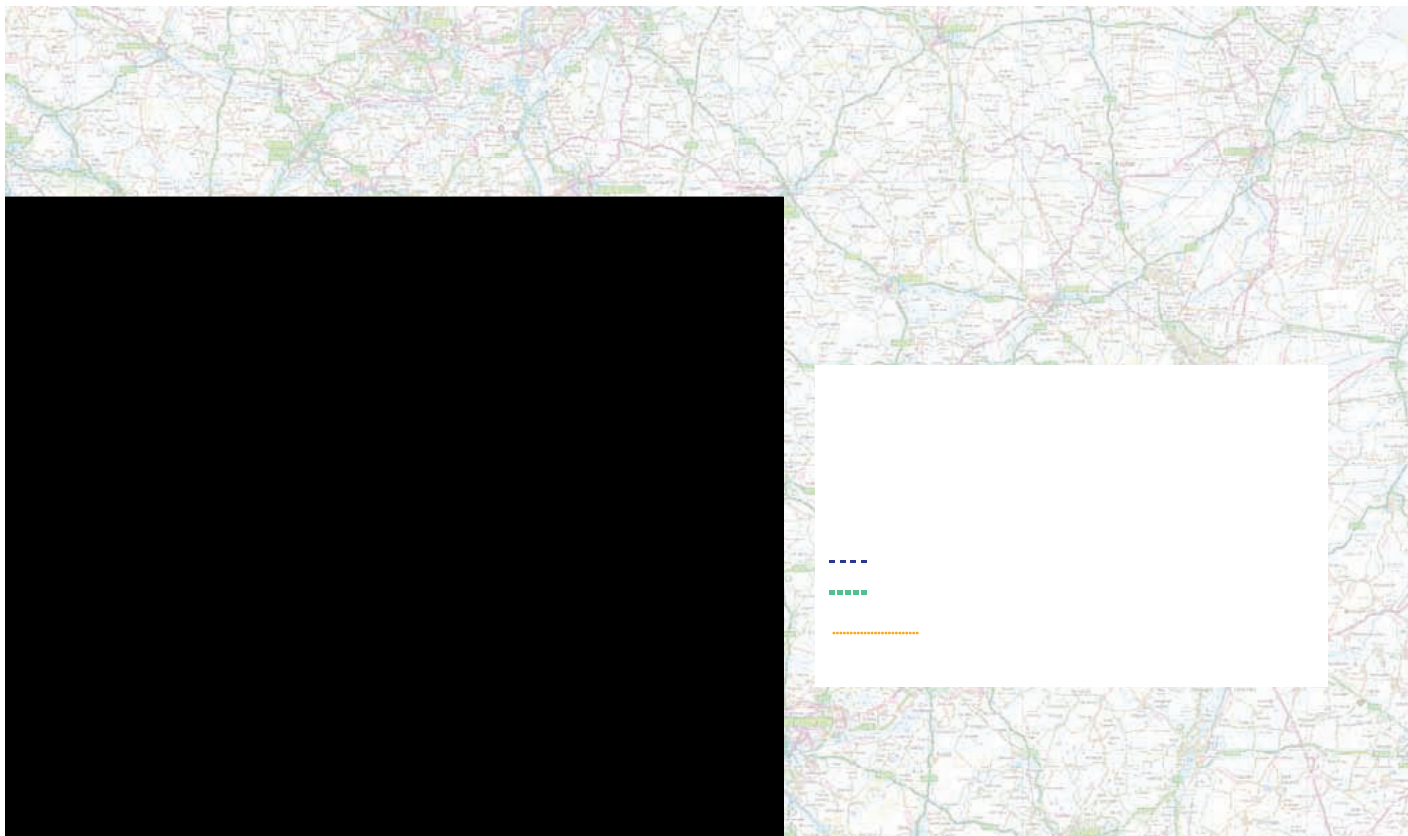
Attachment A

HS2 Alignments and the Chiltern's AONB

LEGEND

-  HS route via Heathrow Hub - surface
-  HS route via Heathrow Hub - tunnel
-  HS2 Ltd preferred route - surface
-  HS2 Ltd preferred route - tunnel
-  Common HS tunnel
-  Existing network electrified with regional trains to/from the HS route
-  APM into Heathrow
-  Area of Outstanding Natural Beauty

Attachment B London to Birmingham and Regional Connections



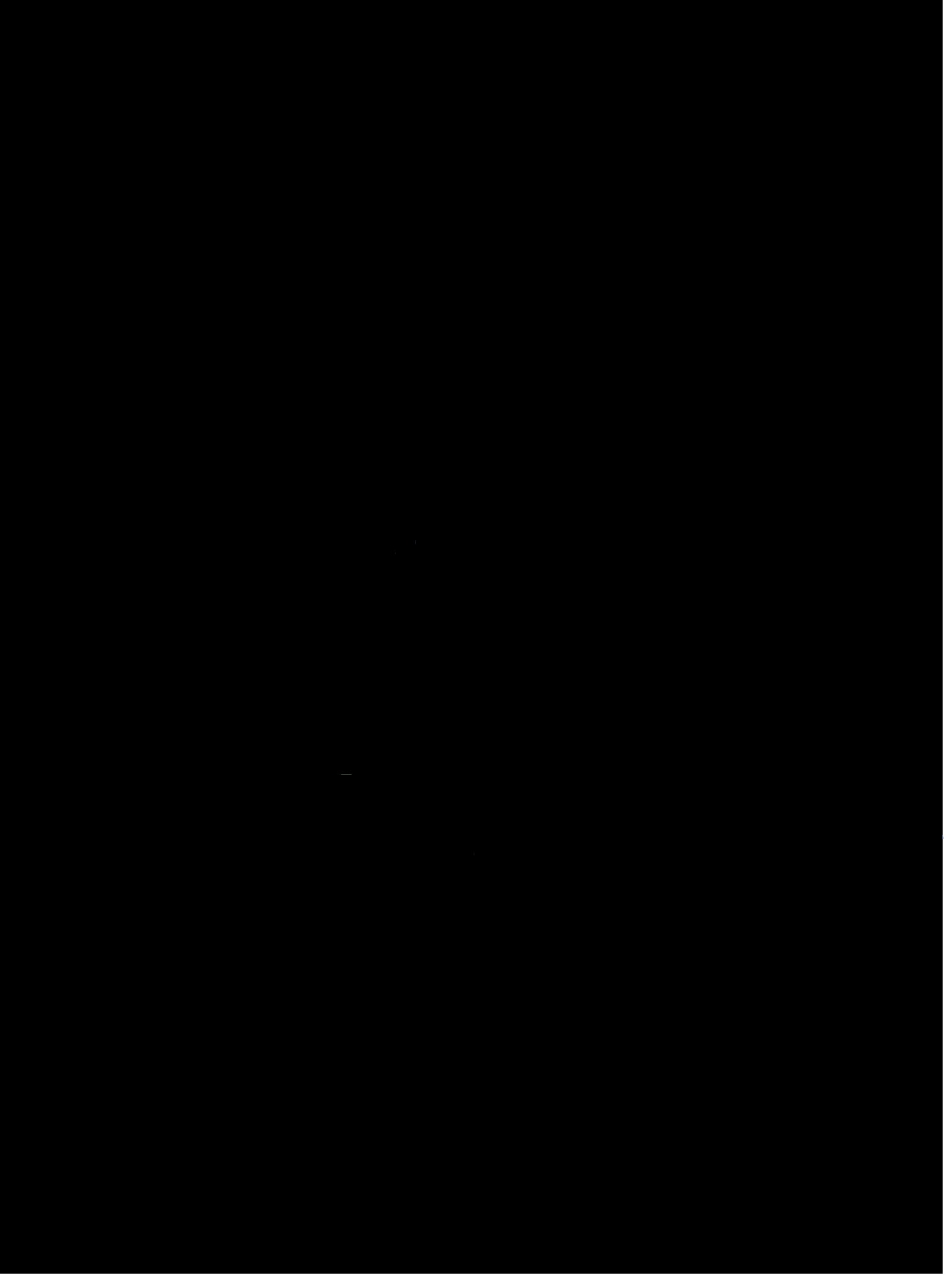
Attachment C

HS2 - London Area Connections

Legend

-  HS route via Heathrow Hub - surface
-  HS route via Heathrow Hub - tunnel
-  HS2 Ltd preferred route - surface
-  HS2 Ltd preferred route - tunnel
-  HS2 Ltd preferred route - viaduct
-  Common HS tunnel
-  Existing GW and Chiltern Lines
-  APM Heathrow Hub to T5 and Central Area
-  APM extension with R3

Attachment D
Infrastructure at Heathrow Hub



Attachment E - Heathrow Hub timetable issues

Introduction

Arup's December 2009 submission to HS2 Ltd showed how Heathrow Hub ("HH") could work on its own, as the only intermediate stop on HS2 between London and the West Midlands. Subsequent discussion with HS2 Ltd and Lord Adonis demonstrated the separate roles of HH and Old Oak Common ("OOC"). The two stations, working in tandem could produce benefits for passengers.

This technical note therefore refers to the arrangements that would apply with HS stations at HH and OOC. We believe that this configuration is feasible and could add to the overall benefits of the new high speed and conventional rail infrastructure. The note also considers Great Western and Crossrail service options at HH.

Summary

Viable timetable plans can be constructed so that HS stations can be served by HS2 at HH on its own and at both HH and OOC. These plans provide flexibility so that the overall case for high speed rail can be maximised. Many different timetables could be developed implying different patterns of stopping and non-stopping at OOC and HH. In this note we focus for illustration on two possible alternatives:

- All HS2 domestic trains calling at OOC and some calling at HH; or
- Some HS2 domestic trains calling at OOC and the others at HH.

We believe that this approach could go a long way to address the central London dispersal question which may be partly answered by OOC. The key point is the phasing of the provision of the additional dispersal capacity provided by OOC.

We would argue that Crossrail services west of central London should be enhanced. Our work concludes that there is an opportunity for more Crossrail trains and some shorter journey times, using the route capacity provided by the new station at Heathrow Hub as a terminating and overtaking location.

In summary, our conclusions from investigating these service possibilities are that:

- Overall benefits could be maximised with HS2 routed through the OOC site and HH; and
- The HH station should be built first. OOC would be provided later when it is required.

HS timetable structures

We expect both domestic and international trains to operate on HS2. We recommend a mix of domestic long distance and some high speed regional trains. International trains would run initially from the Channel Tunnel along HS1, a north London link between the HS1 London tunnel portal at St Pancras and OOC, then the section of HS2 from OOC as far as Heathrow Hub. Some of the domestic and all international services would call at HH. Only domestic trains would call at a station at OOC.

The means by which HS trains are to be pathed at high levels of capacity utilisation of HS2 would be by "flighting" them in groups of 3 or 4. In each flight, consecutive trains would have the same stopping pattern involving OOC and HH. The approach has been tested up to 16 and 18 trains per hour ("tph") on HS2. As an example, with 16 tph on HS2, it is possible to have a timetable with:

- 16 tph calling at OOC and 8 of these also calling at HH; or
- 8 tph calling at OOC and 8 calling at HH.

HS journey times

HS2 Ltd has worked up its own engineered version of the earlier alignment from Euston through the OOC and HH sites and on to a station near Birmingham International and Birmingham City Centre. HS2 Ltd has run this route through a train performance programme to model the journey times which could be achieved. These are summarised in the table below.

Journey times, Euston to Birmingham City Centre			
Route via	Stops	Journey time (minutes)	Note
Northolt	Non stop	41	1
Northolt	OOC B Intl	49	1
HH	Non stop	44	2
HH	B Intl	49	1
HH	HH B Intl	52	1
HH	OOC HH B Intl	56	2

Times were calculated to the half minute and are shown here rounded to the whole minute.

Note on sources: 1 – Information supplied by HS2 Ltd. 2 – Arup calculation.

The table shows that, for a non-stop train from Euston to Birmingham City Centre, the route via HH will take 3 minutes longer than the alternative using HS2 Ltd's preferred route via Northolt.

Great Western and Crossrail services at HH

We expect all off peak and many peak Great Western long distance trains would call at HH. These trains run on the 'Main lines' through the HH site. Electrification of GWML beyond Maidenhead to Bristol and Swansea and replacement of the rolling stock on long distance services has been announced by the Government. Our proposals for long distance services were described in last December's Arup submission to HS2 Ltd, so the rest of this section will focus on Crossrail services.

Local and medium distance passenger services and freight run on the 'Relief lines' through the HH site. Local diesel trains will be replaced by electric Crossrail trains out as far as Maidenhead. We would like to see a frequent and high capacity Crossrail service calling at Heathrow Hub.

The current Crossrail service proposal west of Paddington is for 10 tph in 3 service groups: 4 tph to Maidenhead, 2 tph to West Drayton and 4 tph to Heathrow Terminal 4. Generally these would have a 'stopping train' characteristic, calling at all or most stations. With the announced further Great Western electrification work, we would expect to see Crossrail operations extended beyond Maidenhead to Reading,

allowing Crossrail to replace the Great Western diesel medium distance services between Paddington, Slough, Maidenhead, Twyford and Reading. To respond to this extension, TfL advise us that we should assume Crossrail would run through the HH site with a minimum frequency of 6 tph.

We have considered the opportunities to further increase Crossrail services at HH involving:

- No change to Crossrail's planned and consented infrastructure east of Airport Junction;
- No change in the total Crossrail/ GW franchise total share of the available GW route capacity – so protecting trunk freight;
- Provision of Crossrail terminating and start back platforms at Heathrow Hub, also allowing faster Crossrail trains to overtake slower Crossrail and freight trains;
- Restructuring the Relief lines' route capacity currently proposed to be consumed by the 10 Crossrail stopping train paths west of Paddington into a mix of 14 semi fast and stopping Crossrail trains paths each hour; and
- Deployment of the 14 paths in these service groups – 4 tph from London to Heathrow T4, 4 tph stopping trains to HH and terminate, 6 tph semi fast paths via HH and Slough to Maidenhead and Reading – so providing 10 Crossrail trains in each direction each hour at HH.

This restructuring of services would provide higher frequency, more capacity and some shorter journey times between central London and HH.

Infrastructure

In our approach, at HH the infrastructure would be:

- 4 platforms for HS2 domestic services;
- 2 platforms for international trains via HS1 and HS2;
- Fast through lines for non-stopping HS2 services;
- Platforms and fast through lines for non stopping Great Western long distance trains; and
- Platforms for Crossrail, allowing trains to run through, terminate and start back or to be overtaken at HH station.

At OOC, if HS2 trains were to call the high speed infrastructure would be:

- 6 platforms; or
- 4 platforms and 2 through lines for non-stopping trains.

On the conventional railway, platforms would be provided at OOC for Crossrail trains to call. With HH providing the link from the West to Heathrow and into HS2, platforms would not be provided at OOC for Great Western long distance and Heathrow Express trains.

If HS2 trains were not to call at OOC then they would run through the site in a cutting at line speed – expected to be 225 kph – giving faster journey times to Birmingham and the north. This will particularly be valuable in the early stages of HS2 development, when trains are running over a relatively short section of HSL and completing their journeys to northern cities on the conventional network.