High Speed Rail
London to the West Midlands and Beyond
A Report to Government
by High Speed Two Limited

PART 8 of 11
3.10 Train service specification and use of released capacity

Introduction

3.10.1 This section sets out key elements of the train service assumptions that we have used to plan and model HS2’s future operation. It is split into three sections, reflecting the three distinct elements included within the overall business case: the standard ‘captive’ high speed trains which would run solely on the new high speed line between London and Birmingham; the specially designed classic-compatible high speed trains which would run on HS2 and then beyond onto the classic network; and the reconfigured conventional services on the classic line, made possible with the capacity released by HS2.

3.10.2 The section also contains headline journey time information for services using HS2. More detailed information about the analysis and assumptions which underpin these results can be found in the HS2 Technical Appendix.

Status of the service specification

3.10.3 The service specification outlined here is indicative. It is a proposition that has been developed primarily for demand modelling and business case development. It is not a specific proposed timetable and has not, therefore, been subject to any degree of timetable validation. Whilst we have been able to adapt and refine it to a degree in response to emerging patterns of demand, there will clearly be further iterations as the project develops, not least so as to reflect changing circumstances on the existing railway.

General assumptions

3.10.4 The service specification that follows is an initial view and clearly much may change between now and the earliest HS2 could open. It is based on the preferred HS2 scheme, the component parts of which have been described earlier in this chapter, illustrated in Figure 3.10a with their interchange opportunities.

![Figure 3.10a Potential HS2 interchange locations](image-url)

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9 Timetable validation is the process of ensuring that all trains in a geographical area are correctly planned and timed for the type of rolling stock that is being used, and that there are no timetable conflicts at junctions or stations.
3.10.5 The specification also adopts our assumptions on the overall Day One capacity of HS2, as described in section 2.3: a provisional maximum line capacity of at least 10 trains per hour off peak, rising to 14 train paths in peak periods. At this stage, we have specified 11 of the 14 peak-hour train paths, thereby retaining ‘headroom’ of three paths, which we would expect to be used to meet naturally rising demand on whichever service most required it as seen at the time HS2 opens.

3.10.6 The specification has also been designed on the assumption that HS2 is likely to become the first stage in a longer term network. This assumption has particular ramifications for the classic-compatible services described later in this section.

3.10.7 All services using HS2 are scheduled to stop at Old Oak Common to maximise the interchange opportunities with Crossrail and the GWML. For the same reason (and as described in section 3.3) the modelling also assumes that Crossrail’s high-frequency service is extended to form part of the interchange, all Heathrow Express services stop there too as would, in some scenarios, all Great Western services as well. Calling at Old Oak Common offers greater choice for passengers to and from central London areas and therefore would reduce the pressure on transport networks around Euston.

**HS2 services between London and the West Midlands**

3.10.8 Under the provisional specification the following ‘captive’ high speed services would operate on HS2 between London and Birmingham:

- 3 trains per hour (tph) in each direction, rising to 4tph in the peak direction during the morning and evening three hour peak. In practice this may be extended and could be applied during other high-demand periods – for example on a Sunday evening.

- Each service would be formed of standard European-gauge high speed trains, consisting of one or two 200m sets, each with a capacity of up to 550 passengers, giving a maximum carrying capacity of 1,100 passengers per train when operating in pairs.

- The journey time between Fazeley Street and the Birmingham Interchange station would be 9 minutes; between the Interchange and Old Oak Common 31 minutes, and between Old Oak Common and Euston 5 minutes. With station dwell time, the total journey time between Fazeley Street and Euston would be 49 minutes.

- We have assumed that passengers would not be able to use HS2 to make short journeys between Euston and Old Oak Common, or between Fazeley Street and Birmingham Interchange. Ultimately this may be dictated by pricing.

3.10.9 A diagram of the hourly London-Birmingham service is shown at Figure 3.10b, together with a sample off-peak ‘timetabled’ hour. Southbound services would adopt the same pattern in reverse.
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Figure 3.10b Modelled London – Birmingham service pattern

<table>
<thead>
<tr>
<th>London - Birmingham</th>
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<th>Dep</th>
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<tbody>
<tr>
<td>Euston</td>
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<td>10:00</td>
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<tr>
<td>Old Oak Common</td>
<td></td>
<td>10:07</td>
</tr>
<tr>
<td>Birmingham Interchange</td>
<td>10:38</td>
<td></td>
</tr>
<tr>
<td>Birmingham Fazeley Street</td>
<td></td>
<td>10:49</td>
</tr>
</tbody>
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3.10.10 All HS2 Euston to Birmingham services also call at Birmingham Interchange, to provide access for passengers from the West Midlands wider area, particularly south and east of Birmingham.

Classic-compatible services using HS2

3.10.11 On the basis that demand for high speed services between London to Birmingham justifies the use of three train paths an hour (four in the peak) there are up to seven remaining paths on HS2 for other services (10 in the peak). In the long term with a wider network these would be taken up by mainly captive high speed trains to destinations further north; on Day One, in the absence of such a network, these paths can be used by specially designed classic-compatible trains.

3.10.12 In setting an objective to alleviate pressure on the WCML, and – by using the released capacity – to support housing growth and regeneration in the Milton Keynes/South Midlands Growth Area, our remit dictated an element of classic-compatible running back on to the WCML north of Birmingham. This also gives the opportunity for reductions in journey time to major cities on the WCML upon opening of HS2. We have adopted this as a core assumption in the project, and designed HS2 with a connection back on the WCML to the north west of Lichfield. We also reviewed the scope for classic-compatible running onto the MML and Chiltern Line.

Classic-compatible running onto the Midland Main Line

3.10.13 It would be possible to connect the northern end of HS2 to the Midland Main Line via an existing cross country route to Derby. This would create the possibility of routing London – Derby – Sheffield services via HS2. Initial work on this option suggested that journey time savings of about 30 minutes could be made on today’s timetabled intercity routes. This is predicated on an assumption that the Midland Main Line is electrified before HS2 begins operation, and that electrification and modernisation of the Lichfield Trent Valley - Wichnor Junction - Derby line could also be achieved.
3.10.14 While we would not wish to rule out this option completely, we have not pursued it as part of the preferred scheme for two reasons. Firstly if HS2 were be extended north via the East Midlands, this would overtake the need for such a connection, making the route upgrading and electrification of the link to Derby redundant and so reducing the potential return on such an investment. Secondly, while the MML may well be electrified in the coming years, a putative connection to HS2 would be entirely reliant on the timing of this and related electrification works proceeding.

**Classic-compatible running onto the Chiltern Line**

3.10.15 As a development of our intermediate station analysis, we also considered the possibility of running trains off HS2 at a point near Bicester and onto the Chiltern line, potentially to serve Oxford. Despite indications that there would be high commuting demand from Oxford (a reflection of the relatively slow journey times today), we ruled this option out on the basis that (were it technically feasible) it would leave a great deal of HS2’s capacity north of Bicester unused and would inhibit the growth of a longer term network by using up paths on the southern half of HS2.

**Classic-compatible running onto the WCML**

3.10.16 Having confirmed that the remaining paths would be devoted to trains running onto the WCML, the structuring of the sample service specification (and with it the recast WCML timetable) was essentially guided by the need to balance the achievement of fast journey times with the adequate provision of stops. The likely service pattern if HS2 were to be developed into a wider network was a further consideration, on the assumption that a wider network would include an extension to the North West. Given that under such a scenario we would expect the high speed network to be routed to serve only major cities and their hinterland (and not every intermediate station on the classic rail network) we have modelled a scenario in which the service pattern for the classic-compatible service mirrors the potential high speed service of the future. Therefore only the calling points that would be maintained or replicated on a wider network would be included in the Day One classic-compatible specification. Other WCML stations served by fast classic rail trains today would continue to be served by fast trains in the West Coast revised specification summarised in 3.10.22 below.
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3.10.17 Under the provisional service specification the following classic-compatible high speed services would operate on HS2 and the classic network between London and destinations further north. All would be formed of 200m units, capable of carrying 550 passengers.

a. **London – Manchester.** 3 trains per hour. These would replace the existing fast Pendolino services to Manchester, offering a journey time saving between Euston and Manchester Piccadilly of up to 29 minutes on today’s timetable (with a new best time of 1hr 40mins). The intermediate stations which are currently on the fast London – Manchester stopping patterns and not served by these HS2 trains (Milton Keynes, Macclesfield and Stoke-on-Trent) would be incorporated into reconfigured WCML fast classic specification. The Crewe stop is transferred into one of the London – Liverpool services.

b. **London – Liverpool.** 2 trains per hour, both calling at Old Oak Common with one following the route of the existing Pendolino service north of HS2 and the other routed via Warrington and the line via St Helens Junction into Liverpool recently authorised for electrification. These would replace the existing (hourly) fast direct Pendolino services between Euston and Lime Street, offering a journey time saving of just under 20 minutes on today’s timetable (with a new time of 1hr 50mins). Further modelling work would need to be undertaken to establish whether the benefits of making additional calls at either of Liverpool South Parkway and St Helens Junction outweighs the disbenefits arising from extended journey times.

c. **London – Preston – Glasgow.** 1 train per hour, with an additional hourly train from Preston to London during the morning peak and from London to Preston in the afternoon peak. With a combination of limited stops and acceleration over HS2 this service would offer a journey time saving of some 30 minutes on today’s regular service (with a new time of 4hrs). These would be complemented by fast classic line services for those intermediate stations which are currently on London – Glasgow stopping patterns and not served by HS2 trains (Lancaster, Oxenholme Lake District, Penrith, Carlisle), incorporated into a reconfigured WCML service. In modelling these services we identified high levels of demand resulting in some severe crowding during the peak. In reality there would be a number of ways in which to deal with this, which could include a reconfiguration of the timetable or minor upgrades to the route. These options would require further detailed analysis and planning but for simplicity we have modelled 400m-long trains on this route.

3.10.18 Figure 3.10c depicts the proposed specification of the classic-compatible HS2 services, alongside the captive services to Birmingham. This illustrates the services using HS2 in any given hour on Day One. The services are grouped together by destination for ease of presentation but in practice would be spread evenly throughout the hour.
For our modelling purposes, none of the HS2 classic-compatible services are assumed to call at the Birmingham Interchange station. It would be possible for some or all to do so en route to destinations further north, albeit with a journey time penalty of around 5 minutes. This option could be explored further in due course.

Whilst the HS2 classic-compatible trains have been specified, like the standard captive HS2 fleet, to travel at speeds of up to 360 kph on HS2, they would not be able to exploit the maximum classic line speeds on certain sections of the WCML north of Lichfield, as they would not be fitted with tilting equipment. So, over certain WCML route sections, there would be some time lost against today’s services. This has been assessed and allowed for in the modelled journey times with the assumption that classic-compatible trains would run at full classic line speed where line geometry and signalling systems permit. As the whole-route journey times demonstrate, for London journeys the limited time lost is far outweighed by the savings achieved on HS2.
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Reconfigured WCML services

3.10.21 By taking some of the non-stopping services off the WCML south of Lichfield, significant capacity is released on this section of the route, which can be used for expansion of existing and new services. This section of the report covers the reconfigured WCML service, including both remaining long distance services and the potential for increased freight, commuter and suburban traffic.

Remaining WCML long distance services

3.10.22 For modelling purposes, we have devised an altered service pattern for long distance services which would complement the classic-compatible HS2 services, and preserve fast classic trains for certain intermediate stations. The opportunity has been taken to propose re-establishment of regular connections from the north to the growth areas on the southern part of the WCML such as Milton Keynes. Broadly speaking, these remaining services fall into five categories:

a. London – Birmingham – Wolverhampton (– Liverpool)
b. London – Crewe – Glasgow
c. London – Crewe
d. London – Stoke – Manchester
e. London – Chester – North Wales

3.10.23 Further stopping pattern and journey time information for these services can be found in the HS2 Technical Appendix – Train Service Assumptions.

WCML commuter/suburban services

3.10.24 The capacity released by HS2 presents opportunities for commuter/suburban services on the way into Birmingham (along the WCML Coventry corridor) and into London. The service assumptions we have modelled are contained in the HS2 Technical Appendix. In summary:

- **Commuter capacity into London.** The released capacity has allowed us to model a substantially improved service for Milton Keynes, Northampton and Rugby, as well as additional services to commuter towns closer to London. Under these assumptions, Milton Keynes would receive 7 non-stop services to London in the peak hour, with 5 further stopping services. This reflects the substantial housing growth expected within the Milton Keynes/South Midlands Growth Area, which we expect to generate increased demand for commuter access to London.

- **Commuter capacity into Birmingham.** Removal of some of the Euston services along the Coventry corridor would give the opportunity to achieve a better separation of short-distance local flows and inter-urban flows, providing a higher degree of service regularity, frequency and improved journey times for both.

- **Other opportunities.** The service assumptions allow the diversion of a cross country service via Coventry and Birmingham International, and more generally may free up paths for services which run only briefly on the WCML as they cross from east to west. The enhanced service to Birmingham International would also give locations on that corridor good rail connections to HS2 via the Interchange station.
Freight

3.10.25 The WCML is Britain’s key trunk route for rail-borne freight, with over 50% of UK rail freight passing on the WCML during some part of its journey. The release of additional capacity on the southern section of the WCML would also cater for growth in the freight markets, particularly serving the distribution centres and intermodal terminals of Central England. The proposed additional passenger services on the WCML only make use of a proportion of the released capacity, so scope remains for additional freight paths to be added, according to market demands. However the scope for freight to benefit may be limited by the lack of capacity on the WCML north of Birmingham. If HS2 were extended to the North West the additional capacity released on this section of the WCML would likely generate a significant benefit to freight.

Summary and key recommendations

3.10.26 As designed, HS2 would offer journey times of 49 minutes between the centres of London and Birmingham, and within that journey, a timing of 31 minutes between the Heathrow interchange at Old Oak Common and the Birmingham Interchange near Birmingham International Airport. HS2 would also provide an opportunity to achieve up to 30 minutes journey time saving on today’s standard journey times between London and major destinations on the WCML north of Birmingham.

3.10.27 HS2 would also provide an opportunity to reconfigure services on the WCML, releasing paths for additional short and long-distance services, including commuter trains into London and Birmingham during the peak hours.

3.10.28 The specification described above comprises a set of assumptions for modelling purposes. There would be scope to refine and enhance the planned service levels as part of future design work and alongside the necessary timetable validation process. In particular further work will be required to refine the timetable proposals in the light of any changes to the configuration of the proposed HS2 route and associated stations, which might have an effect on journey times.
3.11 Maintenance and stabling locations

Introduction

3.11.1 This section explains our approach to identifying and assessing options for depots and other equipment sites. Such decisions are best taken once a preferred line of route is confirmed. The section describes the requirements of a rolling stock depot and an infrastructure depot and explains how we chose credible sites to assess and cost.

Rolling stock depot

3.11.2 A rolling stock depot would be required to maintain the captive and classic-compatible train fleet. On Day One of the HS2 route, we expect that only one maintenance depot would be required to maintain all trains, although other stabling activities could be elsewhere. The depot would be used for rolling stock inspection, repair, cleaning, light and heavy maintenance, re-watering and the replenishment of consumables.

3.11.3 Below are four factors that we believe would be key to assessing whether a site would be suitable. A full description of the requirements can be found in the Rolling Stock Maintenance Strategy.

- **Location.** A depot should be within 10 minutes rail travelling time of the high speed route and should take account of the wider network aspirations – for example by being in the middle of a longer term network rather than at one end.

- **Site.** Flat land of approximately 2000m by 500m would be required, with access to power and services and ideally with space for expansion if the network extended beyond the West Midlands. Any site would need to be in an area that was suitable to accommodate an industrial complex with 24 hours working, seven days per week.

- **Access to high speed routes, resources and supplies.** We recommend that a direct connection be provided from the high speed route to avoid capacity constraints arising from conflicting train movements. We also recommend that a site should be close to an appropriately skilled and available labour force that would be able to access the site ideally by public transport. The depot would employ about 300 people. Good road access, to enable heavy good vehicles to visit the site during the day or night, and good rail access would be required.

- **Sustainability design aims.** We recommend that a site is chosen in line with the sustainability design aims.
To fulfil these requirements, a depot in the West Midlands would seem an obvious starting place. It would be in the middle of the line of route if a longer term network was taken forward and it would be in an area that already has a appropriately skilled and available workforce. In order to understand the costs and likely impact of a depot we therefore reviewed a number of sites around the West Midlands. We concluded that a site in Washwood Heath area, which includes what was Alstom’s rolling stock manufacturing site, was a credible option to assess. A proposed layout is provided at Figure 3.11a. The depot would be adjacent to the Water Orton approach and appears to offer sufficient space with good road access. There would potentially be noise and light issues for local residents as the depot would be operating 24 hours a day with the majority of work being undertaken over night. Physical barriers would be required to mitigate local disturbance from noise and light. We estimated the cost for constructing the depot to be £200m excluding specific location-specific construction risks, ancillary items, environmental mitigation, land and TOC compensation, project HS2 costs, any routewide construction risks and any additional programme level risk provision.
3.11.5 We assessed to a lesser degree a number of alternative sites. This high level review of occupied and vacant sites in the West Midlands was carried out for areas in the proximity of Bordesley goods yard; Landor/Lawley Street freight depot; Tyseley goods yard; and sites near Elmdon, Castle Bromwich and Longbridge. Of these areas we were unable to identify a suitable site that was vacant and of sufficient size and proximity to the high speed line of route. We also reviewed two green field sites in the vicinity of Coleshill and Middleton. Both would be less attractive than Washwood Heath or another industrial site. If the project is to be taken forward, further work will be needed with external stakeholders in the West Midlands area to assess potential sites and define the preferred and alternative sites in more detail in time for a strategic consultation.

Infrastructure maintenance depot

3.11.6 To maintain the proposed route a number of infrastructure maintenance depots, situated at key points along the route would be required. The preferred location for the principal maintenance depot would be alongside the core route, provisionally midway between London and the West Midlands. The Infrastructure Maintenance Strategy includes high level requirements for each of these depots. Like the rolling stock depot, we believe a similar set of four factors would be key to assessing whether a site is suitable:

- **Location.** The site would need to be closely connected to the preferred line of route so that all parts of the route could be maintained with minimum inconvenience to high speed rail users. We would expect the depot to include reception lines connecting the route in different directions.

- **Site.** A flat site of at least 1000m x 500m would need to be available for use 24 hours a day, seven days a week. This would be the centre for all maintenance and renewal activities, which would include offices and workshop facilities, stabling for track plant, locomotives and maintenance wagons and storage of engineering components used on the route.

- **Access to classic rail freight routes, resources and supplies.** The site would need to be accessible for supplies delivered by rail, such as ballast, and therefore would require connections to the classic line. Good road access and closeness to an appropriately skilled and resourced labour market would be needed.

- **Sustainability design aims.** We recommend that a site is chosen in line with the sustainability design aims.
3.11.7 During our review of the lines of route, we noted that all the HS2 line of routes cross the Bletchley to Oxford rail route. This could act as the connection to the classic line by which equipment and materials could be brought to the HS2 line. If the project is to be taken forward, further work would needed to assess potential sites in time for a strategic consultation.

3.11.8 Other intermediate depots would be required along the route, providing local storage and staff facilities and remote access to the railway’s control system. It would be possible for the West Midlands depot to be co-located with the rolling stock maintenance depot, thereby providing additional stabling capability for on-track plant equipment.

Other equipment locations

3.11.9 The operation of a high speed line would require a number of other sundry equipment locations. These would require smaller sites than the rolling stock depot and we included notional capital costs in the business case for these elements, under the following broad categories:

- London terminal stabling.
- Control centre – housing signalling and control staff, communications and power.
- Air shafts and intervention shafts which are part of the tunneled sections.
- Auto transformer feeder stations and approximately four connections to the National Grid using existing connections linked by overhead or buried 25kV cables.

Summary and key recommendations

3.11.10 We identified that one rolling stock depot, servicing both captive and classic-compatible fleets, would be needed for Day One, and that it should be located in the West Midlands. There would also need to be a principal infrastructure maintenance depot between London and the West Midlands, with the crossing of the Bletchley – Oxford line a possible location.

3.11.11 For the rolling stock depot, we recommend that Washwood Heath is taken forward for further work, but also that further consideration is given to alternatives. We recognise that the identification and subsequent assessment of the potential depot locations have not been to the same level as the main components of the high speed route. We therefore recommend that further work is carried out before a strategic consultation.
### 3.12 Summary of the preferred scheme

#### 3.12.1
This section draws together and confirms our recommended individual components of the scheme, as described earlier in Chapter 3, thereby summarising the whole HS2 proposal as it has been appraised. This is illustrated in Figure 3.12a.

A link between HS2 and WCML near Lichfield to allow trains to serve cities further north - such as Manchester, Liverpool, Preston and Glasgow.

The line enters Birmingham via the existing Water Orton rail corridor leading to an entirely new station in the Eastside area, close to the city centre and New Street Station.

An interchange station be built near Birmingham International, connected to the WCML train station, the NEC and the Airport via a rapid transit people mover.

The line of route should follow a widened Chiltern route corridor out of London. From West Ruislip the route would pass over a long viaduct to reach the M25. As it passes thought the Chilterns a number of mitigatory measures are proposed to minimise its impact. North of the Chilterns the route would be mainly open with one tunnel near Cubbington. We recommended that the main line of route would not include an intermediate station.

All trains stop at Old Oak Common to offer an interchange with Crossrail, Heathrow Express and the GWML.

The main terminal station in London would be Euston. This station would be expanded to combine existing classic services and HS2 services.

*Figure 3.12a Preferred scheme summary*
3.12.2 Two increments to this package could be a direct link to Heathrow and a connection to HS1. The merits of these increments were described in sections 3.3 and 3.8 respectively.

3.12.3 A people mover linking Euston to St Pancras and King’s Cross would improve the journey time between the two stations and could be built as part of the Euston re-development. Figure 3.12b maps the preferred scheme in green alongside the alternatives in blue and red.

Figure 3.12b Summary of line of route options