Department for Transport Briefing Note:
Routing of Trains from Handsacre Junction to Colwich Junction

14 May 2019

Executive Summary

• Handsacre Junction will come into operation when HS2 Phase 1 opens in 2026. Up to seven HS2 trains per hour will transfer between HS2 infrastructure and the WCML at Handsacre Junction. From 2027, when HS2 Phase 2a becomes operational, that number will reduce to one HS2 train through Handsacre Junction. All other HS2 trains will continue to Crewe on the Phase 2a railway.

• Between 2026 and 2027, HS2 trains will join the WCML slow lines between Handsacre Junction and Colwich Junction, a distance of approximately six miles. HS2 trains will share the slow lines with one conventional passenger train on that section of the WCML. Freight trains will share the fast lines with two conventional passenger trains on that section of the WCML.

• Four freight trains per hour have been assumed on this section of the railway (at present 2-4 freight trains per hour operate here). Our assessment demonstrates that at least four freight trains and two conventional fast passenger trains can operate hourly on the fast lines on this section of the railway.

• On this basis, during the period of operation between HS2 Phase 1 opening in 2026 and Phase 2a opening in 2027, the Department for Transport and HS2 Ltd are confident that it will be possible for HS2 trains, conventional passenger trains and freight trains to be redistributed between the slow and fast lines through Handsacre Junction without any reduction in existing freight capacity.

• HS2 presents significant opportunities for rail freight capacity. From 2027 onwards, further released capacity on the West Coast Main Line will become available, allowing more freight and regional passenger trains to operate on the conventional railway.

Introduction

Handsacre Junction in Staffordshire will be the northern limit of Phase 1 of HS2. Handsacre Junction is where the HS2 lines join the Trent Valley section of the West Coast Main Line (WCML) and where up to seven HS2 trains per hour will transfer between HS2 infrastructure and the WCML. Handsacre Junction will be in use from when Phase 1 opens in 2026.

The Phase 2a Bill extends HS2 infrastructure northwards to Crewe. From Phase 2a’s opening in 2027, six of the seven HS2 trains will continue on the HS2 Phase 2a railway to Crewe, with only one HS2 train still transferring to the WCML at Handsacre Junction.

HS2 trains will replace a number of long distance passenger trains that currently run on the WCML for their entire journey. At Handsacre, from the opening of Phase 1 there will be seven HS2 trains per hour joining the WCML but the number of non-HS2 passenger trains running here will be reduced to three per hour compared to 7-8 per hour today.
From the opening of Phase 2a in 2027, the capacity released on the West Coast Main Line through Handsacre Junction will be available to run more freight and regional passenger trains than are possible today. Similarly, when Phase 2b opens in 2033, the benefits of released capacity will be extended further north, allowing more freight and passenger trains to run on the conventional lines towards Liverpool and Manchester. (See Appendix B: Phase 2b Released Capacity Scenarios.)

AP2 Design of Handsacre Junction

The AP2 design of Handsacre Junction brings HS2 trains onto the WCML southbound and northbound slow lines from the date of opening of Phase 1. The layout of the junction is shown in Figure 1. Although the junction is authorised by AP2 of the Phase 2a Hybrid Bill, the works will be carried out as part of the Phase 1 programme and the junction will enter into operation in 2026.

During the period of operation between HS2 Phase 1 opening in 2026 and Phase 2a opening in 2027, HS2 trains will travel on the slow lines between Handsacre Junction and Colwich Junction, a distance of approximately six miles.

At present during the daytime all fast passenger trains are timetabled to use the fast lines and all freight trains and stopping passenger trains are timetabled to use the slow lines. Freight operators have expressed concern that, with the AP2 design, there will be insufficient capacity to accommodate the HS2 trains plus freight trains on the slow lines.

![Figure 1: Handsacre Junction Layouts](image)

Based on the assessment set out in this note, the Department for Transport and HS2 Ltd are confident that it will be possible for HS2 trains, conventional passenger trains and freight trains to be redistributed between the slow and fast lines through Handsacre Junction without any reduction in existing freight capacity. The content below explains how this would work in practice.
Train Service

The following hourly (off-peak) train service is assumed between Handsacre Junction and Colwich Junction between HS2 Phase 1 opening in 2026 and Phase 2a opening in 2027. The colours in the table refer to the routes shown on the diagram at Appendix A.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Journey</th>
<th>Max Speed on WCML</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS2</td>
<td>London-Manchester via Stoke</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Manchester via Stoke</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Manchester via Crewe</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Liverpool</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Liverpool</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Glasgow</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>HS2</td>
<td>London-Preston</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>West Coast</td>
<td>London-Chester/Holyhead/Wrexham</td>
<td>125mph (tilt)</td>
<td>Fast</td>
</tr>
<tr>
<td>West Coast</td>
<td>London-Manchester via Stoke</td>
<td>125mph (tilt)</td>
<td>Fast</td>
</tr>
<tr>
<td>West Midlands</td>
<td>London-Crewe (slow)</td>
<td>110mph</td>
<td>Slow</td>
</tr>
<tr>
<td>Freight</td>
<td>South East-North West/Scotland</td>
<td>75mph</td>
<td>Fast</td>
</tr>
<tr>
<td>Freight</td>
<td>South East-North West/Scotland</td>
<td>75mph</td>
<td>Fast</td>
</tr>
<tr>
<td>Freight</td>
<td>South East-North West/Scotland</td>
<td>75mph</td>
<td>Fast</td>
</tr>
<tr>
<td>Freight</td>
<td>South East-North West/Scotland</td>
<td>60mph</td>
<td>Fast</td>
</tr>
</tbody>
</table>

Table 1

Seven HS2 trains are assumed to join the WCML per hour, in accordance with the Phase 1 business case. In addition, two conventional West Coast long-distance trains are assumed to continue operating: a London-Manchester train via Milton Keynes, Stoke-on-Trent and Macclesfield, and a London-Chester/Holyhead/Wrexham train equivalent to the existing Voyager. All other long-distance West Coast trains on this section of railway are assumed to be replaced by HS2 trains. The West Midlands (LNWR) London-Crewe slow train is assumed to continue operating as today. This must run on the slow lines as it stops at Rugeley Trent Valley which only has platforms on the slow lines.

At present 2-4 freight trains per hour operate on this section of railway. In this analysis, four freight trains per hour have been assumed, which not only retains all existing services but allows for some growth. Three of these are assumed to be intermodal (container) trains with a maximum speed of 75mph. One is assumed to be a heavier train (automotive or construction materials) with a maximum speed of 60mph. This is consistent with the existing balance of trains. It is assumed that the length, weight and motive power of freight trains will be the same as they are today. For robustness, the following values have been assumed:

- Max Weight: 1600 tonnes
- Max Length: 775m
- Least powerful locomotive: single class 66 (3300hp)

Assuming trains are routed as proposed in Table 1 above, the number of trains on each track will be as follows:

- **Slow Lines**: 8 trains per hour (7 HS2, 1 slow passenger)
- **Fast Lines**: 6 trains per hour (2 fast passenger, 4 freight)

**Speeds**

Freight trains are limited to either 100mph, 75mph or 60mph depending on the locomotive, load and wagon type – a relatively small number of trains (mainly carrying parcels) are able to travel at
100mph. The majority of freight trains on this section of the WCML can travel at 75mph but the presence of some 60mph trains must be allowed for.

The maximum permissible speed (‘speed limit’) for trains on the northbound slow and fast lines and the southbound fast line is 110mph for non-tilting trains (including HS2) and 125mph for tilting trains. The maximum permissible speed for all trains on the southbound slow line is 75mph.

Routing
The West Coast Main Line has four tracks from Handsacre Junction as far as Colwich Junction (approximately six miles). At Colwich Junction the line divides with two tracks going towards Stafford and two tracks going towards Stoke-on-Trent. Colwich Junction itself has a complex arrangement allowing any routing option. Trains arriving on either the slow line or the fast line can be routed to either Stafford or Stoke. Trains arriving from Stafford or Stoke can be routed onto either the slow line or the fast line. The layout of Handsacre Junction governs the routing of trains to and through Colwich Junction. Beyond Colwich Junction the number of trains taking each route is the same.

There are no technical restrictions which prevent any train (passenger or freight) being routed via either the fast or slow lines. Stopping passenger trains must use the slow lines as Rugeley Trent Valley station only has platforms on the slow lines. Express passenger trains normally use the fast lines as they have the highest permissible speed. Freight trains are normally routed on the slow lines during the day as the difference in speed between them and express passenger trains would otherwise cause conflicts. During the night when no passenger trains are running it is common for faster (intermodal) freight trains to use the fast lines, allowing them to overtake slower freight trains.

The diagram at Appendix A shows the likely routing of trains between Handsacre Junction and Colwich Junction with the Phase 2a AP2 layout – the colours used on the diagram correspond to those shown in Table 1. Freight trains would cross between the slow lines and the fast lines at Lichfield North Junction, which has a permissible speed of 75mph so freight trains would not have to slow down to cross over here.

Capacity
Slow Lines
With the Phase 2a AP2 layout of Handsacre Junction, eight trains are assumed to be routed via the slow lines: seven HS2 trains and one slow passenger train. These eight trains will be running at 110mph on the northbound line and 75mph on the southbound line. The capacity of a section of railway is maximised when all trains run at the same speed. On this assumption, the practical capacity of this section of railway is 17 trains per hour. On that basis, eight trains per hour falls within the capability of this section of railway.

Fast Lines
With the Phase 2a AP2 layout of Handsacre Junction, six trains are assumed to be routed via the fast lines: two conventional long-distance trains and four freight trains. There will be a significant speed differential between the fastest (125mph) and slowest (60mph) trains, but the short distance involved and the relatively low number of trains mean that these trains can be timetabled. This is shown in the time-distance graph in Figure 2.
Typical journey times for Lichfield North Junction to Colwich are as follows:

- Fast passenger train: 7 minutes
- Intermodal 75mph freight train: 17 minutes
- Heavy 60mph freight train: 21 minutes

![Figure 2: Concept Train Planning Graph for Lichfield North Junction to Colwich Junction](image)

The graph assumes that the fast passenger trains are timetabled 30 minutes apart. This is the worst-case scenario for capacity. In practice, reducing the interval between the fast passenger services within the hour would provide the opportunity for additional paths. While a single section of railway cannot be planned in isolation, and a number of other factors will influence the operability of the train service pattern, Figure 2 demonstrates that at least four freight trains and two conventional fast passenger trains can operate hourly on the fast lines on this section of railway.

**Alternative Design of Handsacre Junction**

The Select Committee have questioned whether an alternative design for Handsacre Junction might be feasible. The alternative in question would involve the HS2 lines joining the fast lines having crossed directly over the slow lines by means of a diamond crossing (middle diagram in Figure 3). This alternative is not feasible since the provision of diamond crossings on fast main lines is contrary to Network Rail’s track design rules. However, a layout producing almost identical functionality could be achieved by adding two slow-fast crossovers to the AP2 layout, as shown on the right diagram in Figure 3. This alternative would not produce any increase in capacity given the short distance between Handsacre and Colwich Junctions (approximately six miles).

![Figure 3: Alternative Layouts for Handsacre Junction](image)
Appendix A: Routing of Trains from Lichfield to Colwich Junction with Phase 2a AP2 Layout

Key
- HS2 via Stafford (5tph)
- HS2 via Stoke (2tph)
- Fast Chester (1tph)
- Fast Manchester (1tph)
- Slow Crewe (1tph)
- Freight (4tph)
Appendix B: Phase 2b Released Capacity Scenarios

As set out in the HS2 Phase 2 Strategic Case published in July 2017, HS2 presents significant opportunities for rail freight capacity. To illustrate how released capacity on existing lines could be utilised beyond 2033 post Phase 2b, the Department for Transport commissioned Steer Davies Gleave, who developed and made a preliminary assessment of six scenarios, each with different primary objectives. One of these scenarios was to use released freight paths to enhance long-distance freight services that use the West Coast Main Line and East Coast Main Line.

Network Rail’s most recent freight review forecasts freight tonne-kms growth of 3 per cent per year between 2011 and 2033 (August 2016 report). Increasing demand for intermodal freight is driven by increasing global trade and from growth in transportation within the UK as part of supply chains serving supermarkets and other retailers. Capacity released by HS2 Phase 2b on the existing network could be used to increase capacity for freight services. Capacity released by Phase 2b could be used to serve a number of important and growing freight markets including:

- Intermodal traffic: This is the largest segment of the freight market and accounts for most port traffic
- Car traffic: Traffic from the Jaguar Landrover facility at Halewood (near Liverpool) to Southampton (three trains per day)
- Biomass: There has been strong growth in biomass to Drax Power Station (located close to the ECML), which has been converted from coal to biomass as part of the national programme to reduce carbon emissions
- Thames Gateway: The development of the new London Gateway Port in Thurrock is generating intermodal rail freight traffic, including transfer from the Port of Tilbury
- Construction: This industry is still strong thanks in particular to construction activity in London and the South East. Most of this segment is served by the Midland Mainline (from Leicester/Trent Valley/Hope Valley) and by some on the Great Western Mainline (from the Mendips)
- Domestic intermodal: This industry, which includes supermarkets, is strong and makes up a significant proportion of freight trips between Thames Gateway, Daventry, North of England and Scotland. Additionally, the Royal Mail site at Wembley is responsible for four postal trains per day
- Steel: Teesside is generating more demand to resumed steel production at Redcar

However, the use of capacity released by Phase 2b on the WCML and ECML by freight may require investments on local lines, since freight services generally do not begin or end their journeys on the WCML or ECML themselves.

2 See Page 5 of ‘High Speed Two Phase Two strategic case appendix: HS2 released capacity study summary report’: