

# West Midlands & Chilterns Route Study

## Technical Appendices



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## Introduction to Technical Appendices

These Technical Appendices provide the technical evidence to support the conclusions and choices for funders presented in the main Route Study document. The areas of technical analysis outlined in these appendices are capability analysis, concept development (at pre-GRIP level), cost estimation, business case analysis and passenger capacity analysis at stations.

The appendices are presented by geographical area with the exception of the business case analysis and passenger capacity analysis.

The areas of technical analysis are summarised below.

### Capability Analysis

Accommodating growth to 2043 presents a unique set of challenges to network capability and requires strategic and operational assumptions to be made. Capability and capacity analysis has been undertaken to assess the proposed ITSS against an assumed 2019 service level. This initial comparison allows questions to be addressed about the best use of current infrastructure, to feed choices for funders for future railway Control Periods and to support the strategic narrative.

In order to provide the most useful outputs, the general approach to capability analysis has been to divide the route into work packages. This allows a range of analysis techniques to be used, each varying in scope, approach and time horizon. The outline of how the analysis for the work packages has been approached is contained in section 2 of each technical appendix.

### Concept development

Where analysis indicates that the ITSS cannot be accommodated due to capability constraints on the network, potential interventions were identified and assessed. The engineering assessment undertaken has been at a high level and forms the pre-GRIP stage of development in terms of Network Rail's governance process for infrastructure project development. The aim of the assessment is to determine whether potential concepts identified are technically feasible, and capture some early thinking about risks, opportunities, deliverability and planning.

## Cost estimation

Cost estimates have been prepared for interventions or packages of interventions proposed in the Route Study. The estimates are based on the pre-GRIP data available, concept drawings and high level specification of the intervention scope. To reflect the level of information available to support the estimate production, a contingency sum of 60% has been added. The estimates do not include inflation. Indicative cost ranges have been provided based on this assessment.

### Business case analysis

Business case analysis has been undertaken to demonstrate to funders whether a potential investment option is affordable and offers value for money. The analysis takes into account the investment cost, including capital and operating expenditure, and benefits such as time savings for passengers, reduced road congestion as people shift to rail and revenue.

### Stations analysis

Concepts have been developed for interventions or packages of interventions at a number of shortlisted stations across the Route Study area. These concepts are high level and are based on pre-GRIP data available. The concepts do not include any pedflow analysis at this time but identify choices for funders in order to accommodate demand in CP6 and beyond. This analysis can be found in Appendix 6 and lists out the findings by station (alphabetically).

## Midlands Rail Hub: Central Birmingham

### Context

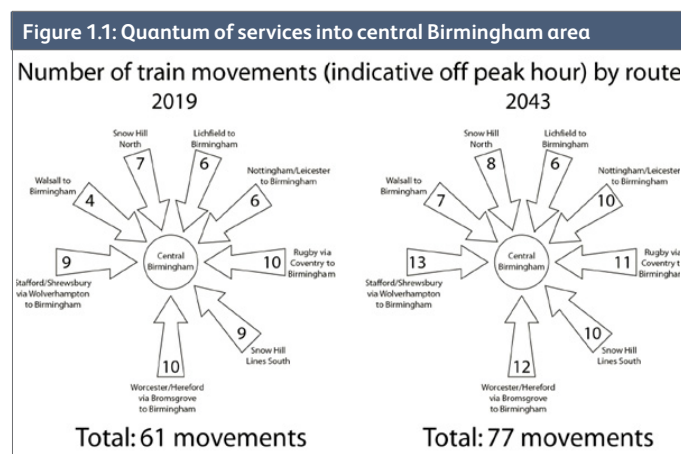
One of the fundamental challenges to be addressed is the need to accommodate forecast growth in passenger demand into central Birmingham (see Chapter 3 of Route Study). This appendix sets out the approach to address the challenge; the analysis performed, the constraints identified and the proposed options for funders.

Analysis has focused on the rail routes into central Birmingham, where services operate into the main stations of New Street, Moor Street and Snow Hill. The strategic conclusions of this analysis and the interventions proposed in this appendix are part of a wider package of works to improve rail capacity and connectivity in the Midlands area, known as the Midlands Rail Hub. Further interventions which are also included in this package are outlined in:

- Midlands Rail Capacity and Connectivity technical appendix: Birmingham to Nottingham/Leicester
- Midlands Rail Capacity and Connectivity technical appendix: Birmingham to Worcester/Hereford via Bromsgrove

### Constraints Analysis

Figure 1 shows the quantum of off-peak passenger train paths into central Birmingham in 2019 (based on the level of service in Dec 14) and in 2043 (unconstrained Route Study specification):



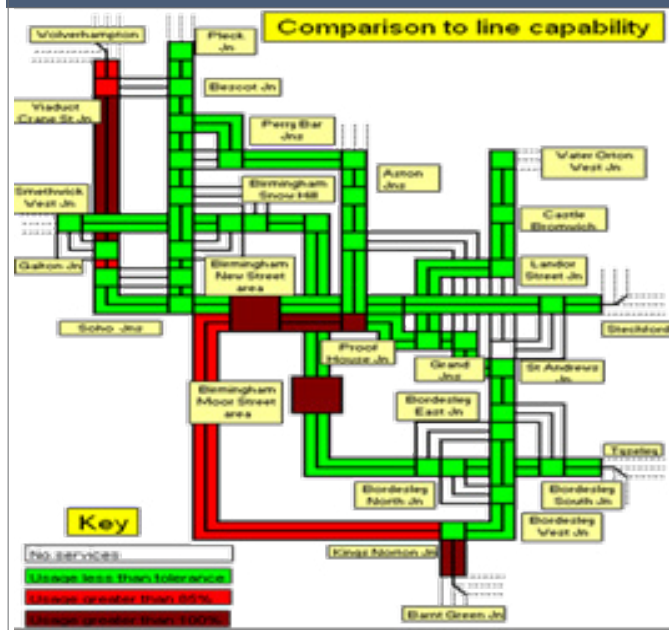
This shows that the 2043 service specification identifies 16 more inward bound movements into central Birmingham, which translates to 10 terminating services and 3 through services in each direction. If current train routeings are assumed, 14 out of the 16 additional movements are on routes which operate into New Street which presents a key challenge in capacity and performance terms. Figure 3 demonstrates the New Street area is currently over capacity based on the existing timetable and infrastructure. In order to accommodate this significant increase in services into New Street, additional platform capacity would be required as well as more intensive use of the approaches to the station, particularly in both throat areas.

Initial analysis undertaken has examined options to increase platform and throat capacity at New Street to accommodate the significant increase in services. There may be some opportunities to make better use of the existing infrastructure for the 2019 timetable as increased resilience and minimal capacity improvements could be achieved by recasting the timetable around New Street. The arrival of HS2 into central Birmingham in 2026 provides a potential opportunity to achieve this recast. It is also noted that improved signalling will enable more efficient operations in the future, however further work is needed to examine and quantify the benefits of these. The conclusions of this initial work indicate that these tactical improvements do not address the fundamental long term capacity issues in the central Birmingham area.

In order to meet the medium to long term capacity requirements in Central Birmingham, two key options were identified:

- Enhancing the capability of Birmingham New Street
- Providing additional capability at other central Birmingham stations

Figure 1.2: Central Birmingham capability overview (2043 service spec, 2019 infrastructure)



In order to deliver an enhanced capability at New Street to accommodate the 2043 quantum of services, significant infrastructure interventions would be required to increase platform, throat and approach capacity. High level analysis, based on the current occupation of the station, has been undertaken to establish the scope of these interventions in order to estimate the required footprint of the station. In summary these interventions include:

- Four tracking of the route towards Wolverhampton
- Six tracking of the route towards Coventry
- Widening of both throats
- Two to five new platforms on the current alignment, depending on the viability of a potential tunnelling solution.

The impact and cost of these scenarios are explored in Section 4 but it is also important to consider this scenario in terms of national performance impact. Increasing the number of services and the complexity of movements through a single Birmingham station is likely to increase the already significant impact that delays in the central Birmingham area have on national performance. Taking the performance impact into account, as well as the limitations of these interventions which are outlined in section 4.1 below, analysis has focused on the alternative option of increasing capacity at the other main central Birmingham stations (Moor Street and Snow Hill).

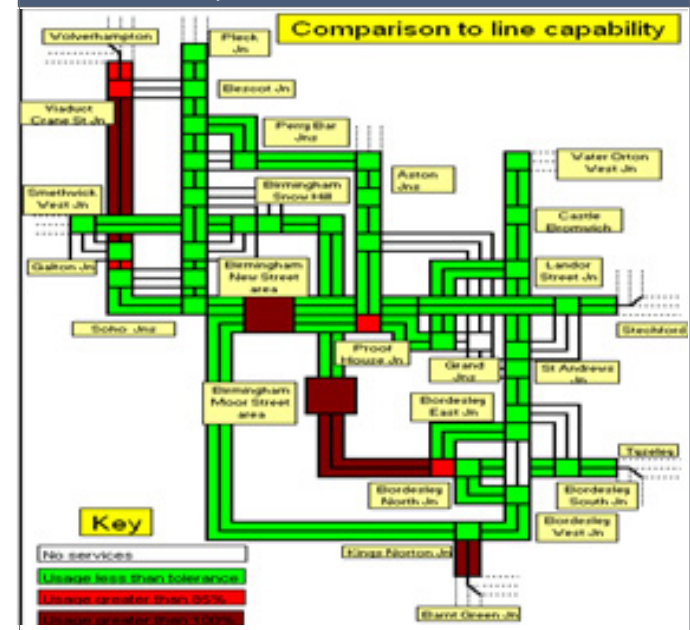
The methodology used to develop this alternative option and identify the optimum future service routings is outlined in the next section.

### Capability Assessment Methodology and Findings

Static capacity calculations have been used to assess the capability of the central Birmingham area and examine how to make best use of potential latent capacity available at Moor Street and Snow Hill stations. These calculations have been incorporated into an indicative capacity model for the area in order to illustrate the likely capability constraints of different routing options (see Figure 3).

This model was used, together with input from a stakeholder subgroup<sup>1</sup>, to assess the potential impact of changing the flows of passenger services in the central Birmingham area based on routing, economic and stakeholder criteria. Given the complex

Figure 1.3 - Central Birmingham capability overview (2043 service spec, 2019 infrastructure plus chords)



nature of the area, the number of potential timetable scenarios becomes exponentially larger as the number of different routing options increases. It would not be appropriate to construct a timetable for each of these scenarios at this stage of the process because each scenario would require many operational assumptions to be made. Some generalisations were therefore made to simplify the assessment of service types. 'Longer distance' was used to represent cross boundary and faster services, while 'local' represented shorter distance, stopping services. This allowed the stakeholder sub group to identify a number of services that have the potential to be rerouted.

<sup>1</sup> Central Birmingham sub group was established with representatives from the Working Group

The terminology used to demonstrate whether a service group met stakeholders' criteria is:

**Primary** – There is a clear consensus from the stakeholder sub group that these services would be candidates to be routed into an alternative central Birmingham station.

**Secondary** – These services have the potential to be rerouted but would not solve the immediate capability constraint. They should therefore be considered after the primary services have been assessed.

**No** – There is a clear consensus from the stakeholder sub group that these services are not candidates to be routed to an alternative central Birmingham station.

The results of this exercise are outlined in Figure 4. It is recognised that new connections would be required to allow the relevant primary service groups to be rerouted (these are investigated further in the next section below).

Figure 5 indicates how the rerouting of primary and secondary services would impact on the indicative number of services at Birmingham New Street.

**Figure 1.4: Summary of central Birmingham rerouting possibilities**

Corridor	Service type	Rerouted to..	Candidate to reroute?
Birmingham to Worcester/Hereford via Bromsgrove	Local	Snow Hill	No
Birmingham to Worcester/Hereford via Bromsgrove	Longer distance	Snow Hill	No
Birmingham to Worcester via Stourbridge	Local	New Street	Secondary
Birmingham to Bromsgrove/Redditch	Local	Moor Street	No
Birmingham to South West via Worcester	Longer distance	Moor Street	Primary
Birmingham to Leamington Spa/Stratford-upon-Avon via Tyseley	Local	New Street	No
Birmingham to Leamington Spa/Stratford-upon-Avon via Tyseley	Longer distance	New Street	No
Birmingham to Rugby via Coventry	Local	Moor Street	No
Birmingham to Rugby via Coventry	Longer distance	Moor Street	Secondary
Birmingham to Nottingham/Leicester	Longer distance	Moor Street	Primary
Birmingham to Lichfield	Local	Moor Street	No
Birmingham to Walsall	Local	Snow Hill	Secondary
		Moor Street	No

**Figure 1.5: Estimated maximum quantum of rerouted services**

Corridor	Service type	Number of diverted services per hour
Birmingham to South West via Worcester	Longer distance	5
Birmingham to Nottingham/Leicester	Longer distance	8
Birmingham to Walsall	Local	n/a
Birmingham to Worcester via Stourbridge	Local	n/a
<b>Total Movements</b>		13 (7 terminating, 3 through services)
<b>Total number of unique services</b>		10
<b>Change in number of services using New Street (compared to 2019)</b>		-10

It is expected that being able to divert this quantum of services would meet the short to medium term capacity gap in the central Birmingham area.

The penultimate step in the analysis work was to assess what capability is required in the central Birmingham area to support the proposed future service routeings, noting that the main station for the rerouting of primary services is identified as Moor Street. While the required capability depends on the quantum of services that are to be rerouted, there are a number of interventions which will be required in all scenarios. The infrastructure requirements identified from this are:

- Bordesley North chord, grade separation from the Snow Hill lines at Moor Street junction end
- Bordesley South chord, grade separation from the Snow Hill lines at Moor street junction end
- Four tracking between Bordesley and Birmingham Moor Street
- Appropriate crossovers in Birmingham Moor Street South throat/ approach
- Additional bay platforms at Birmingham Moor Street
- Additional platform at Birmingham Snow Hill.

In addition to the infrastructure interventions at Moor Street, analysis shows that in order for the re-routeing of services to be accommodated in planning terms the current services which terminate in the existing bay platforms at Moor Street would need to be extended through to Snow Hill. Further platform capacity at Snow Hill would be required in order to facilitate this. The extension of these services aligns with stakeholder strategic aspirations. These interventions are explored in more detail in section 4 below.

It is also worth noting that the arrival of HS2 into central Birmingham in 2026 will change the dynamics at the main stations, with Moor Street being located next to the HS2 station at Curzon Street. Routing more services into Moor Street station will enable passengers to benefit from a quicker interchange onto HS2 services at Curzon Street and provide access to the regeneration opportunities that are planned in the surrounding area.

Finally, it is acknowledged that in order to achieve the full 2043 specification in the central Birmingham area (with current technologies) further interventions may be required. These may include, but are not limited to, an additional chord in order to facilitate access to Snow Hill station from the Wolverhampton/ Walsall routes. It is important to state the following points regarding this option:

- This intervention would need extensive additional infrastructure in the area. It would require a chord between the Snow Hill and Perry Barr lines, four tracking of the Snow Hill approach and additional platforming capacity at Snow Hill.
- Routeing Snow Hill line services to New Street does not solve (and may exacerbate) the immediate or strategic constraints in Central Birmingham, as Birmingham New Street capacity is the primary constraint on growth in the area.
- Due to the demand flows and the geography of the central Birmingham area this potential solution will not provide sufficient capacity to be considered an alternative to the Moor Street options.

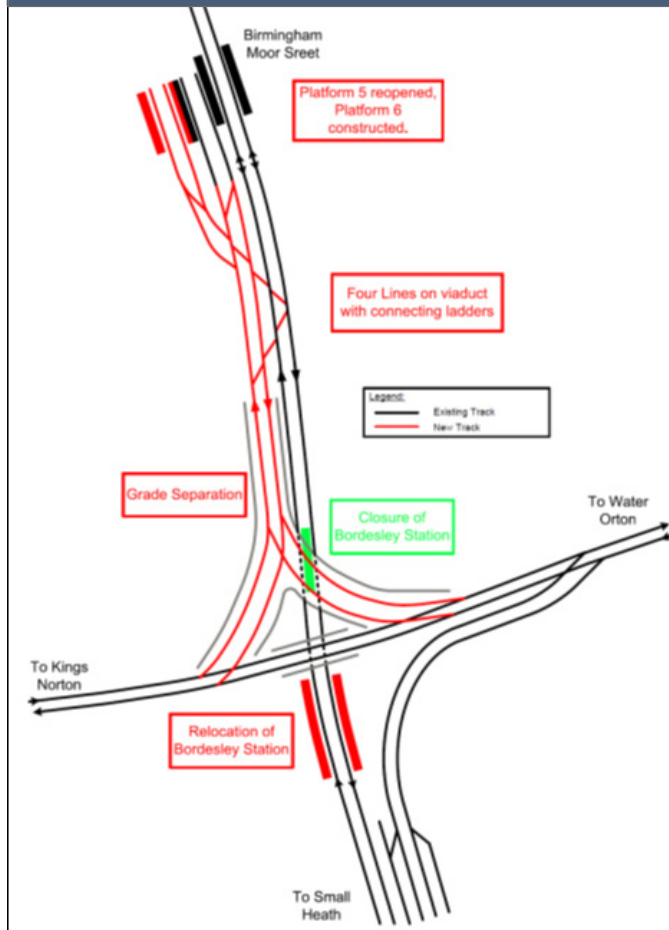
It has also been identified that the headway and junction margin reductions, enabled by new technologies, will be needed in order to meet service demand on the Wolverhampton and Walsall routes. Given that the mix of service speed and stopping patterns will be the limiting constraints on these corridors further work will be required in order to determine what trade-offs will be required in future.

### Concept development

The capability analysis outlined in the preceding sections showed that there are two potential concepts for addressing the capacity gap for central Birmingham: enhancing the capability of Birmingham New Street or providing additional capability at Birmingham Moor Street. The following section explains the concept development work undertaken to assess these options.



Figure 1.6: Bordesley Chords and associated infrastructure interventions



### Enhancing the capability of Birmingham New Street

In order to meet the capacity requirement at New Street station, initial development work considered the construction of new lines, either surface or subsurface, to increase capacity on approach to the station. This requirement stems from the need to accommodate additional train paths after all trains into Birmingham New Street are operating at maximum length, whilst the rail infrastructure at New Street is operating at full capacity with no spare paths.

The surface solution comprises up to 2km of new railway lines along the Wolverhampton to Coventry corridor and 1.6km along the Cross City South corridor with the potential of up to eight new platforms at New Street (taking the total number of platforms to 20). Assessment work indicates that a surface alignment would require significant demolition of socially, economically and strategically important buildings in the city centre, depending on the alignment selected. This concept was discounted from further analysis due to the extremely detrimental impact this demolition would have on the environment and economy of the City.

A subsurface solution was then assessed, requiring the construction of two tunnels along the Cross City and Wolverhampton to Coventry corridors (approximately 4.5km and 5.7km respectively) routed into four subterranean platforms approximately 25-30m beneath New Street station track level, to achieve acceptable gradients. A preliminary assessment of the geological conditions reveals a composition of the Birmingham Sandstone Ridge and Mercian Mudstone, both of which are suitable for tunnelling. However, the subsurface lines would require substantial engineering works estimated to cost in excess of £4bn.

The construction of new lines (subsurface) presents a possible longer term strategy to meet future demand into central Birmingham after the point at which additional capacity generated through enhancing Moor Street and Snow Hill (section 4.2) has been exhausted. In the medium term, however, this concept has not been explored further within the Route Study due to affordability considerations and the potential impact on performance of increasing services at New Street. The construction of a new station at Curzon Street by HS2 also creates a design risk around additional approach lines to New Street from the East, and further development would be required

subsequent to the HS2 design to determine optimal station approaches and corresponding timetable changes.

### Providing additional capability at Birmingham Moor Street and Birmingham Snow Hill

Taking account of the routeing strategy for central Birmingham outlined in section 3 above, concept development has focused on infrastructure interventions using latent capacity available at Birmingham Moor Street and Birmingham Snow Hill stations.

As outlined in section 3, the primary service groups proposed to be routed into Moor Street are from the South West via Worcester and the East Midlands (Nottingham and Leicester). To facilitate this routeing strategy, direct connectivity is required from Moor Street towards the Kings Norton and Water Orton areas. The concept developed to provide this connectivity comprises two new chord lines in the Bordesley area of Birmingham, referenced in the Route Study as the 'Bordesley Chords'. The two chords would meet at an elevated junction above the existing Birmingham Moor Street to Small Heath line to avoid capacity conflicts with the existing railway. From Bordesley to Moor Street the railway would be four-track, with the two new tracks proposed using the existing formation on the Bordesley viaduct into Moor Street, adjacent to the existing twin track railway. This concept is shown in Figure 6.

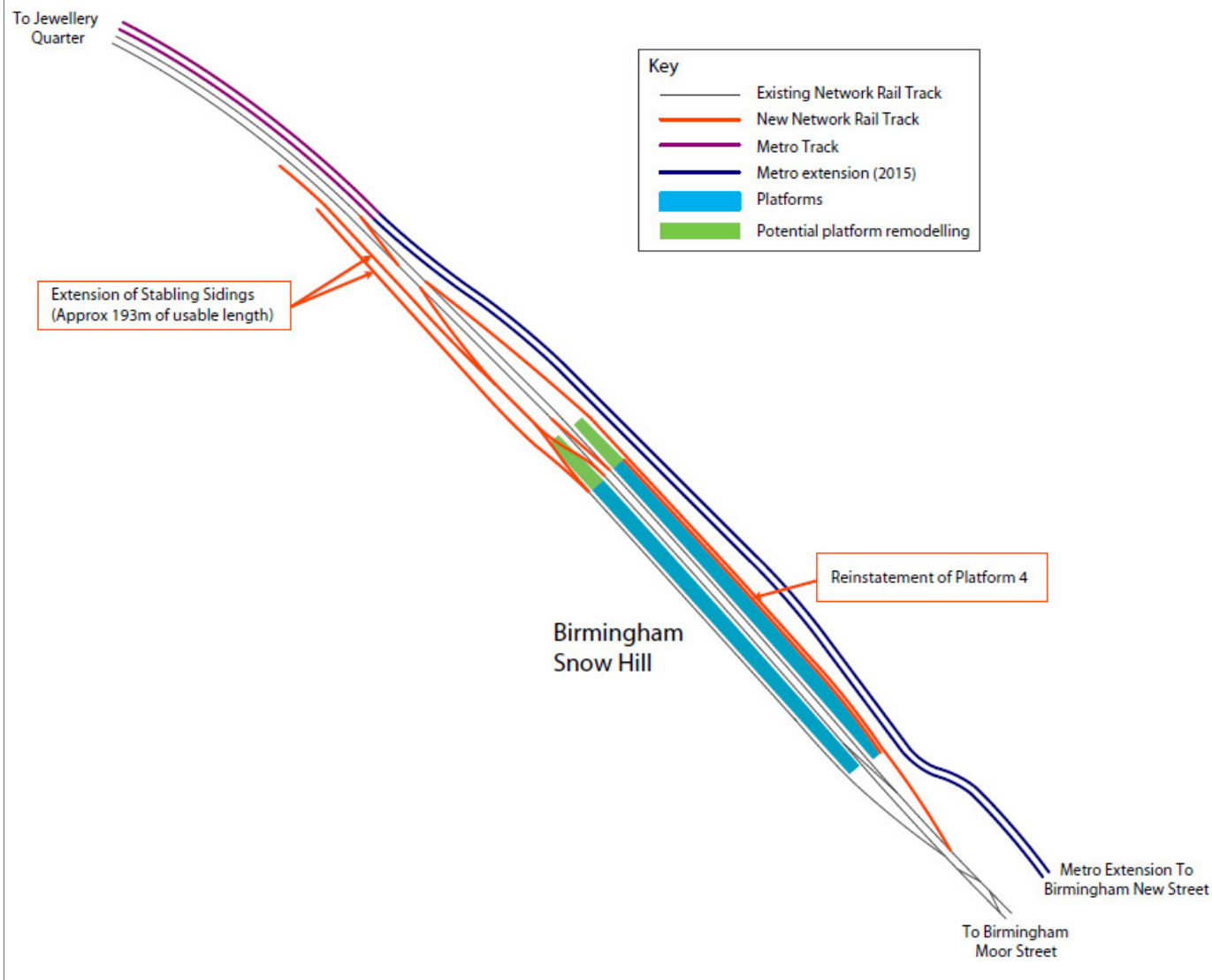
The alignment of the chord lines is through the existing site of Bordesley station. Bordesley station is a lightly used station which is served by one parliamentary train service call on a weekly basis, to provide rail connectivity to a local football stadium. The cost of relocating the station south of its current location has been assessed as a choice for funders to consider. Alternatively the West Midlands Integrated Transport Authority is considering transport links to the Bordesley area, via a potential extension of Metro services.

Based on the predicted levels of demand in the medium term, capability analysis work has identified a requirement for additional platforms at Moor Street to support the rerouted services. Interventions at Birmingham Snow Hill station should also be considered to deliver the full benefits of this rerouting strategy. In addition to two extra bay platforms at Moor Street (Platforms 5 and 6), the reinstatement of Platform 4 for heavy rail use is proposed at Snow Hill. This additional platform will enable the



## Midlands Rail Hub: Central Birmingham

Figure 1.7: Birmingham Snow Hill station area – concept development



extension of some existing services terminating at Moor Street terminating services to be extended to Snow Hill to which will release platform capacity at Moor Street for the new chord services to terminate at.

Due to the requirement for four tracks between Bordesley and Birmingham Moor Street, the current Chiltern Railways stabling sidings south of Birmingham Moor Street station would need relocating. In response, a concept for new sidings at Snow Hill station has been developed (see Figure 7), which comprises the extension of existing sidings off Platform 1 to accommodate 16 vehicles in total. Together, the extended sidings and reinstated Platform 4 at Birmingham Snow Hill generate the need for signalling enhancements in the station area.

The interventions in the Snow Hill station area also support the delivery of the 2043 ITSS for services operating on the Snow Hill route as they address the key constraints identified on the route (signalling constraints, restrictive overlaps and layout limitations within the Birmingham Snow Hill station area).

The interventions that comprise the Midlands Rail Hub will provide the physical connections and supporting infrastructure for the identified services to be routed into Moor Street station. It should be noted that in order to reroute the identified services, further interventions are required to improve capacity and connectivity in other parts of the Midlands area. Details of these interventions can be found in the following appendices:

- Midlands Rail Capacity and Connectivity technical appendix: Birmingham to Nottingham/Leicester
- Midlands Rail Capacity and Connectivity technical appendix: Birmingham to Worcester/Hereford via Bromsgrove

### Station capacity

To support these potential changes in service quantum at both Moor Street and Snow Hill stations, passenger capacity assessments will be required at both stations as part of the future development work to ensure that platform widths, waiting areas, vertical circulation and ticketing gatelines are sufficient to deal with passenger flows through the stations. The development work undertaken so far has assessed potential choices for funders to address station capacity requirements. These are presented in the stations technical appendix.

### Cost

As outlined above, the Route Study package of interventions to deliver improved capacity and connectivity in the Midlands in the medium term includes interventions in the following corridor areas: Central Birmingham (Bordesley to Moor Street and Birmingham Snow Hill), Birmingham to Nottingham/Leicester and Birmingham to Worcester/Hereford via Bromsgrove. This package is known as the Midlands Rail Hub and the interventions it includes are listed in Figure 1.8 below. The costs of the combined package has a range of £375m – 875m.

### Business Case

For medium term interventions identified, a socioeconomic business case has been conducted in line with funders' guidelines, in particular WebTAG, and the Department for Transport's appraisal guidelines have been used to test the value for money of the schemes.

A combined business case appraisal has been undertaken for the 2026 package of interventions (Midlands capacity and connectivity package) and is outlined in detail in the Economic Appraisal appendix. The point estimate for each intervention has been used for business case analysis. Based on the socio economic appraisal, the package currently offers medium value for money with a Benefit Cost Ratio (BCR) of 1.5, but it is expected that the business case will be higher when wider economic benefits have been factored in<sup>2</sup>.

<sup>2</sup>Wider economic benefits are being assessed by Midlands Connect partnership. It is anticipated that these will further strengthen the business case.

Figure 1.8: Midlands Rail Hub

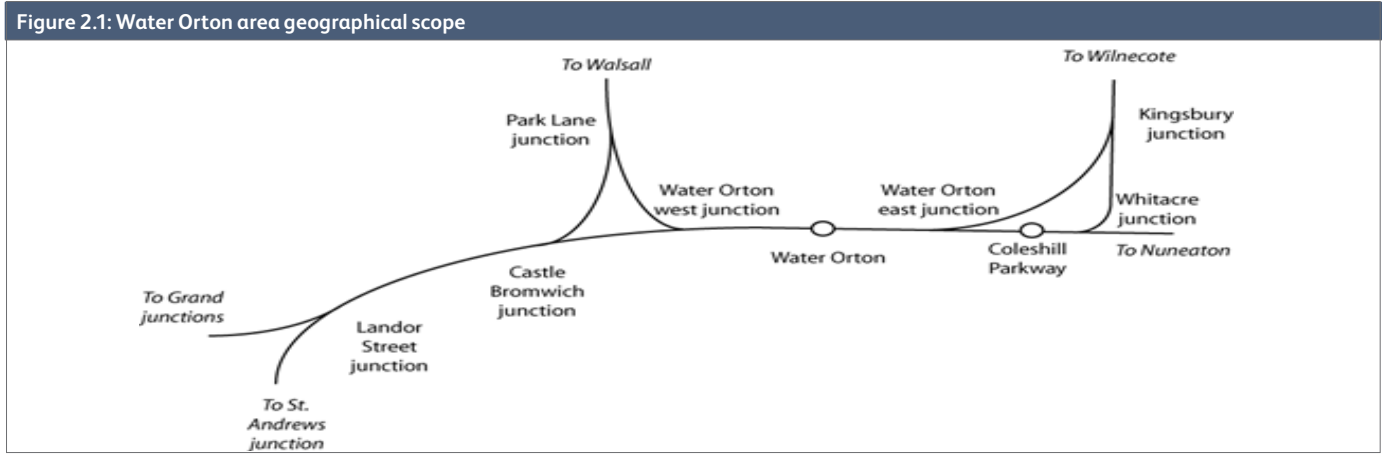
Intervention	Corridor	Cost range
Bordesley North Chord	Central Birmingham: Bordesley - Moor Street	£175-£375m
Bordesley South Chord	Central Birmingham: Bordesley - Moor Street	
Bordesley - Moor Street four tracking	Central Birmingham: Bordesley - Moor Street	
2 new bay platforms at Moor Street	Central Birmingham: Bordesley - Moor Street	
Demolition of Bordesley station (with potential option to relocate)	Central Birmingham: Bordesley - Moor Street	
Relocation of Moor Street stabling sidings	Central Birmingham: Birmingham Snow Hill	£5-£15m
Birmingham Snow Hill Platform 4 reinstatement	Central Birmingham: Birmingham Snow Hill	£10-20m
Birmingham Snow Hill signalling enhancements	Central Birmingham: Birmingham Snow Hill	£15-35m
Kings Norton reinstatement of Platforms 2 and 3	Birmingham - Worcester/Hereford via Bromsgrove	£10-20m
4th track Water Orton East Jn - Water Orton West Jn	Birmingham - Nottingham/Leicester	£100 - 250m
4th track Water Orton West Jn - Castle Bromwich Jn	Birmingham - Nottingham/Leicester	
Reconfiguration Castle Bromwich - Water Orton	Birmingham - Nottingham/Leicester	
Ladders S&C and parallel lines	Birmingham - Nottingham/Leicester	
Water Orton station relocation	Birmingham - Nottingham/Leicester	
Kingsbury access improvements	Birmingham - Nottingham/Leicester	£20-50m
4 aspect signalling enhancements: Wichnor Jn - Kingsbury Jn	Birmingham - Nottingham/Leicester	£5-15m
Total package		£375m-£875m

### Improved turnback facilities on the Snow Hill lines

In addition to the rerouteing strategy, options have been examined to improve capacity and connectivity into Birmingham Snow Hill station from Stourbridge Junction/Kidderminster /Worcester, taking into account the proposed new inner suburban services between Rowley Regis and Snow Hill in the Route Study ITSS. A concept has been developed for a new 6-car turnback at Rowley Regis station to support this service option. The preferred location for the new turnback is on the car park side of the station, where an old cattle dock remains. The Up Rowley Regis Goods Loop is removed and replaced with a shorter lead and turn back as part of this concept. The ITSS proposes a new inner suburban service operating between

Rowley Regis and Birmingham Snow Hill. The turn back would support this service operation and also offers potential journey time savings into Birmingham for fast services originating from Kidderminster, Stourbridge Junction and Worcester which may not need to call at inner Birmingham stations (stations which would be served by the new inner suburban service).

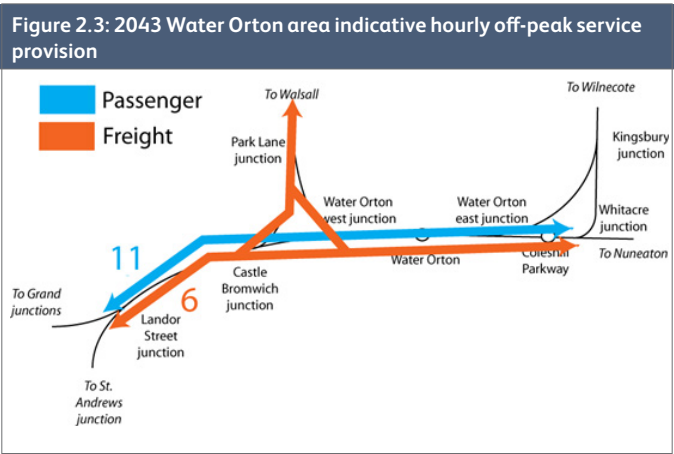
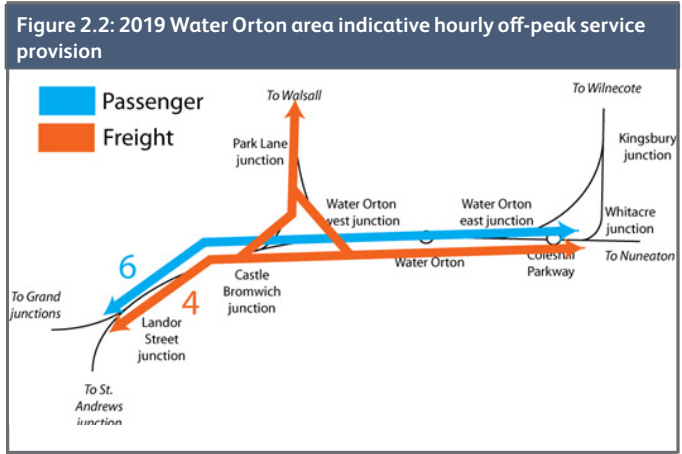
# Midlands Rail Hub: Birmingham to Nottingham/Leicester



## Context

The Birmingham to Nottingham and Birmingham to Leicester rail corridors form a key transport connection between the East Midlands and West Midlands regions, and in addition support longer distance travel to and from the East and North East. The area around Water Orton is a known network constraint in terms of capacity and connectivity on these corridors, as it includes key junctions, where there are significant crossing moves of both freight and passenger services. Furthermore, as demand forecasting predicts further growth in both freight and passenger services, more train movements will be required through these junctions, which will further increase their strategic significance.

Taking into account the changes in service levels between 2019 and 2043 proposed in the ITSS, analysis has focused on the section of route between Landor Street Junction, Whitacre Junction and Kingsbury Junction. Park Lane Junction, on the route to Walsall, has also been included. This analysis area is shown in Figure 2.1.



The passenger service level for indicative 2019 and 2043 off-peak hours are shown in Figures 2 and 3 below. It should be noted that freight routeing in the area is extremely complex, and the paths shown have been simplified for both 2019 and 2043 in order to provide an indicative comparison.

From these numbers it can be seen that there is an average increase of five passenger and two freight paths up to 2043, which translates to an indicative increase of seven movements per hour in each direction.



## Midlands Rail Hub: Birmingham to Nottingham/Leicester

While these numbers have been used as a starting point for this analysis, there are some additional issues that will affect the capability of the Water Orton area, which are explored further in the methodology section below:

1. Central Birmingham routeing
2. Unpredictability of freight forecasts
3. HS2 work bringing opportunities
4. Tactical freight demands

While the Water Orton area represents a significant standalone constraint, its capability is also intrinsically linked to that of central Birmingham. This will be increasingly the case based on the results of the stakeholder analysis work which identified Birmingham to Nottingham/Leicester as primary services to potentially reroute into Birmingham Moor Street. As such, the capability assessments conducted and the options for funders presented have been designed to address the direct constraints in the area and to feed into the wider strategy for Midlands capacity and connectivity.

### Methodology

#### Impact of central Birmingham routeing

The central Birmingham analysis has a critical bearing on how services are routed from the Birmingham to Nottingham/Leicester corridor. Analysis has considered how different scenarios would impact the area around Water Orton and drive infrastructure interventions:

- a) No further central Birmingham capacity is created

If no more passenger services could be accommodated into central Birmingham it would clearly not be possible to increase passenger services on the Birmingham to Nottingham/Leicester corridor. It follows that no capacity interventions are driven by passenger traffic in this scenario.

- b) Enhanced capacity at Birmingham New Street

If it were possible to enhance capacity at Birmingham New Street, capability analysis work indicates that four tracking of Water Orton West Junction to Castle Bromwich Junction and Water Orton West

Junction and the Castle Bromwich to Derby lines would be required to support additional passenger services through the area. There would also be an opportunity to reorder the running lines between Water Orton and Landor Street Junction as the freight and passenger services run on distinct routes (see figures 2.2&2.3).

- c) Enhanced capacity at Birmingham Moor Street

The Route Study strategy (as outlined in Midlands Rail Capacity and Connectivity Technical Appendix: Central Birmingham) is to enhance capacity at Birmingham Moor Street and reroute services. As the stakeholder group determined that the main candidate services for routeing into Moor Street are longer distance services on what can be considered the South West – North East axis, this will impact service routeings from the Birmingham to Nottingham/Leicester corridor. In this scenario, four tracking of the Water Orton West Junction to Castle Bromwich Junction and Water Orton West Junction and the Castle Bromwich to Derby line would also be required. The change in service flows towards Moor Street would drive the reordering of the running lines between Water Orton and Castle Bromwich Junction in all scenarios and between Landor St and Castle Bromwich in some scenarios; this will allow the best use of the available infrastructure based on the mix of services to be achieved.

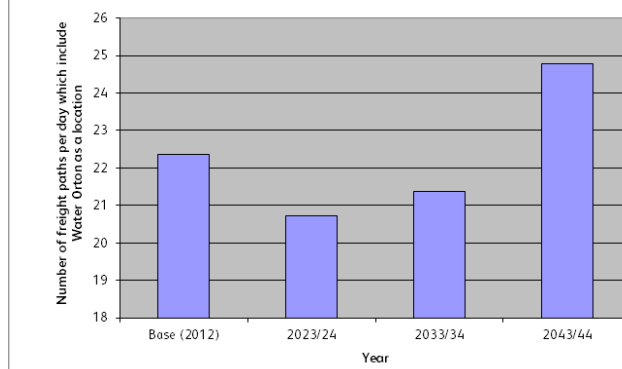
The benefits of the medium term interventions (outlined in section 3 below) are directly linked to the enhanced capacity in the central Birmingham area; therefore their costs and benefits are included in one central Birmingham business case.

#### Service mix

The capability of the Water Orton area is critical to regional and national freight operations. There are many origins, destinations and routeing priorities for freight in the area which will affect operational capacity. Understanding the interaction of freight and passenger movements in the area and growth of freight demand has been a significant part of the analysis work.

## Midlands Rail Hub: Birmingham to Nottingham/Leicester

**Figure 2.4: Freight movements in the Water Orton area (Source Freight Market Study)**



The diagram in Figure 2.4 is from the Freight Market Study and provides an overview of all the freight movements through the Water Orton area. It broadly shows that it has not been proven that demand for freight paths will increase traffic over this section in the medium term. As the origin and destinations and the interaction of the freight traffic have not been identified in detail, it is recommended that this is examined further within future development work. What can be seen is that this level of freight traffic, combined with an increase in the passenger service level of up to three trains per hour, drives the need to use capacity in the Water Orton area more efficiently and, in particular, drives the option to double the curve between Water Orton and the Sutton Park line.

While there would be obvious economies of scale and greater benefits in the short term in fully separating the flows in this area, the analysis undertaken has not demonstrated that this will be required in terms of capacity for the medium term.

In the longer term, forecast freight and passenger demand over this section drives the need to separate the flows, allowing freight movements to and from the Walsall area that are segregated from the main passenger and freight flow. One possible solution, based on the 2043 specification, is grade separation which is presented in the strategy as a longer term concept. Further development analysis

is needed within the industry to understand, map and quantify freight demand in order to quantify the benefits of this intervention.

### East Midlands – West Midlands Connectivity

In addition to capacity outputs, the Route Study has also identified opportunities to reduce journey times and improve connectivity between the East Midlands and West Midlands regions. Conditional Outputs are set out in the Long Distance and Regional Urban Market Studies for journey times and connectivity between Birmingham and Leicester, Birmingham and Nottingham, and Coventry and Leicester. Analysis has been undertaken to identify options to meet these outputs based on feasibility, affordability and value for money. The assessment has also taken into account the objectives of Midlands Connect initiative, principally to invest in transport infrastructure to improve east-west connectivity across the Midlands to help maximise economic growth.

The assessment has aimed to identify where changes in calling patterns, line speed or rolling stock could help to improve journey times and connectivity. As a first step, a geometric assessment has been undertaken on each of the routes to identify areas where there may be potential for the infrastructure to support a higher line speed. Route Runner – an Excel spreadsheet based tool – has been used to calculate journey time savings based on the outputs of the geometric assessment, rolling stock characteristics and calling patterns.

Further opportunities for journey time savings that may be delivered by infrastructure interventions on the routes are currently being analysed as part of ongoing Route Study analysis. These include options to reduce conflicts between freight and passenger journeys and interventions to speed up train movements at Junctions. Opportunities across the full route require further assessment, including capacity interventions identified in both the East Midlands and West Midlands and Chilterns Route Studies.

Additional work would be required to take a holistic view of interventions to improve journey time, which would integrate capacity and connectivity interventions in a timetable study and understand any trade-offs between capacity and connectivity. The assessments currently undertaken have focused on the LNW Route opportunities, but would need to consider impacts and

## Midlands Rail Hub: Birmingham to Nottingham/Leicester

opportunities on the LNE&EM Route as part of an East-West rail system. This is being progressed by Midlands Connect under the auspices of the Pan Midlands Corridors.

### Concept development

Concepts have been developed to support the predicted level of demand in the medium term. These concepts include new track sections between Water Orton and Castle Bromwich to deliver four-track capability from Water Orton Junctions to Landor Street Junction. The new four-track section between Water Orton Junctions and Castle Bromwich Junction will be configured to separate the flows of traffic from the Derby and Nuneaton directions.

For the medium term, doubling of the curve from Water Orton towards the Sutton Park line is proposed to support parallel movements for freight services operating between the main line and the Sutton Park line. This would be supported by new crossovers on the main line to maximise capacity for freight and passenger services.

Associated with the new layout is the proposal to remodel Water Orton station. The platforms are planned to be located on the Whitacre and Nuneaton lines to enable stopping services from the Nuneaton/Leicester direction to serve Water Orton station.

These concepts for the medium term are outlined in Figure 2.5.

### HS2

It is important to recognise the opportunity that HS2 construction affords in the Water Orton area. Developing coherent and deliverable strategy that is integrated with this work will bring many benefits in terms of both cost and limiting disruption for services in this area.

### Electrification

The electrification of the route between Derby and Birmingham was identified for further development as part of the Government's High level Output Specification for CP5. Work undertaken as part of the workstream updating the Electrification Route Utilisation Strategy has identified this route, together with the Leicester to Felixstowe route, as future priorities for electrification. In order to maximise

efficiency, cost and the overall benefits of the choices for funders, it is proposed that the opportunity to deliver these outputs in alignment with the future electrification programme is considered.

### Cost

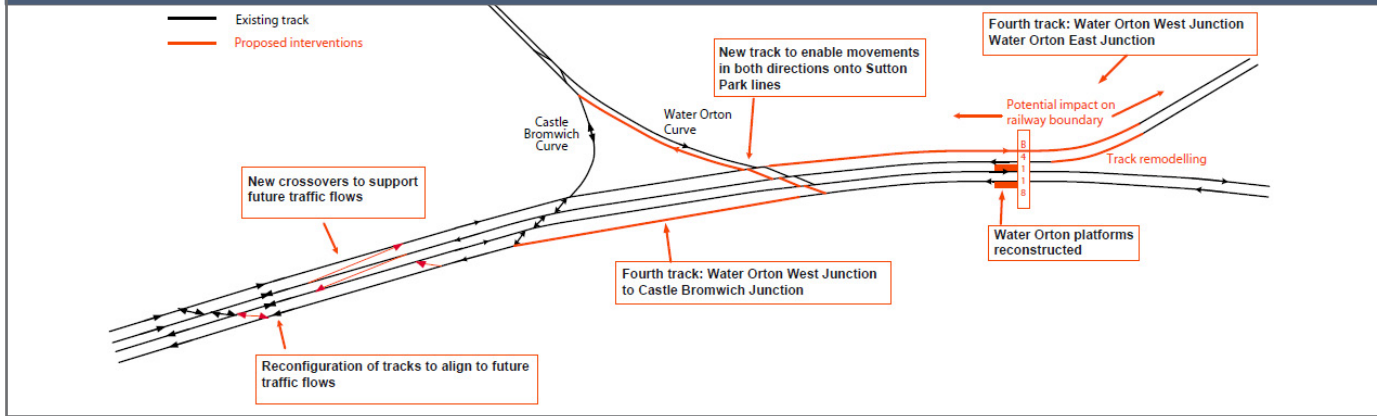
As outlined above, the Route Study package of interventions to deliver improved capacity and connectivity in the Midlands for the medium term includes interventions in the following corridor areas: Central Birmingham (Bordesley to Birmingham Moor Street and Birmingham Snow Hill); Birmingham to Nottingham/Leicester and Birmingham to Worcester/Hereford via Bromsgrove. This package is known as the Midlands Rail Hub which includes the following interventions:

- Bordesley north and south chord
- Bordesley – Moor Street four tracking
- 2 new bay platforms at Moor Street
- Demolition of (and option to relocate) Bordesley station
- Relocation of stabling sidings
- Birmingham Snow Hill Platform 4 reinstatement and signalling enhancements
- Water Orton area medium term interventions
- Reinstatement of Kings Norton Platforms 1 and 2 with electrification infill

The costs of the combined package has a range of £375m – 875m.



Figure 2.5: Medium term Route Study concepts in the Water Orton area



### Business Case

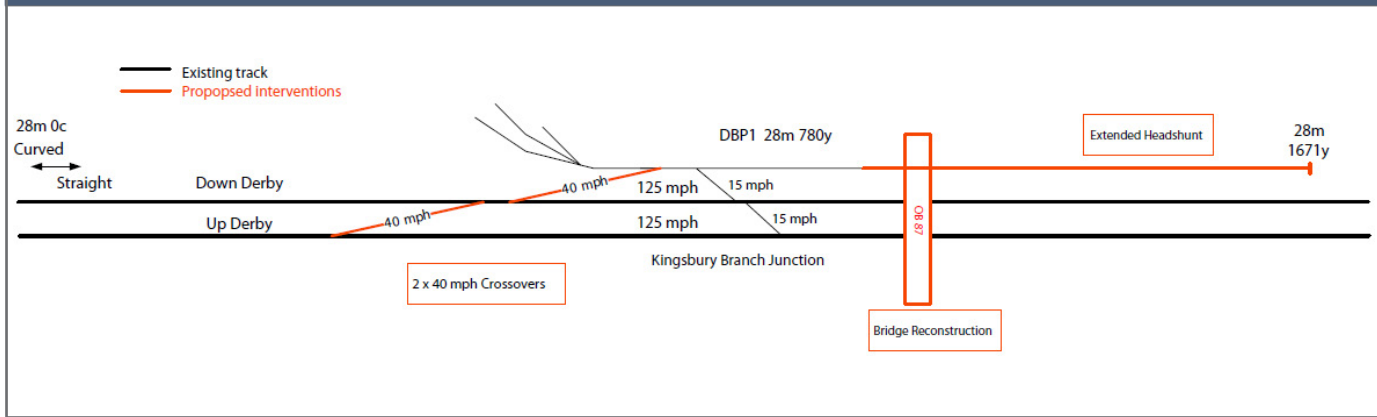
For medium term interventions identified in the Route Study, a socioeconomic business case has been conducted in line with funders' guidelines, in particular WebTAG, and the Department for Transport's appraisal guidelines have been used to test the value for money of the schemes.

A combined business case appraisal has been undertaken for the package of interventions (Midlands Rail Hub ) and is outlined in detail in the Economic Appraisal appendix. The point estimate for each intervention has been used for business case analysis. Based on the socio economic appraisal, the package currently offers medium value for money with a Benefit Cost Ratio (BCR) of 1.5, but it is expected that the business case will be higher when wider economic benefits have been factored in<sup>3</sup>.

### Longer term interventions

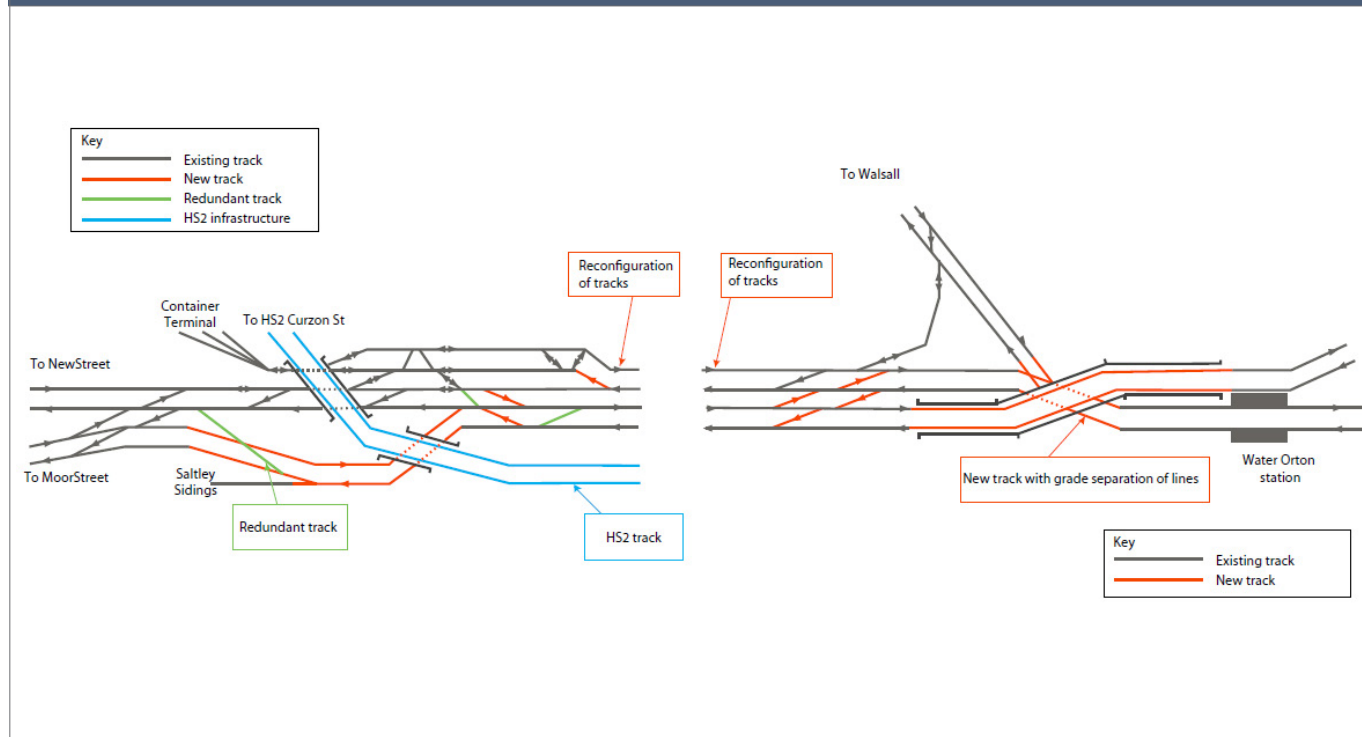
To address the demand for passenger and freight services in the longer term, analysis indicates that a flyover would be needed at Water Orton as this is likely to continue to be a critical junction for freight operations. Grade separation, with fast lines over slow, will help to maximise route capacity and reduce potential crossing moves between passenger and freight services. The concept developed is estimated at this early development stage to have a cost range of £250m-£500m. Further development work will recognise that the concept of grade separation must accommodate suitable infrastructure for freight services.

Figure 2.6: Kingsbury branch Junction interventions



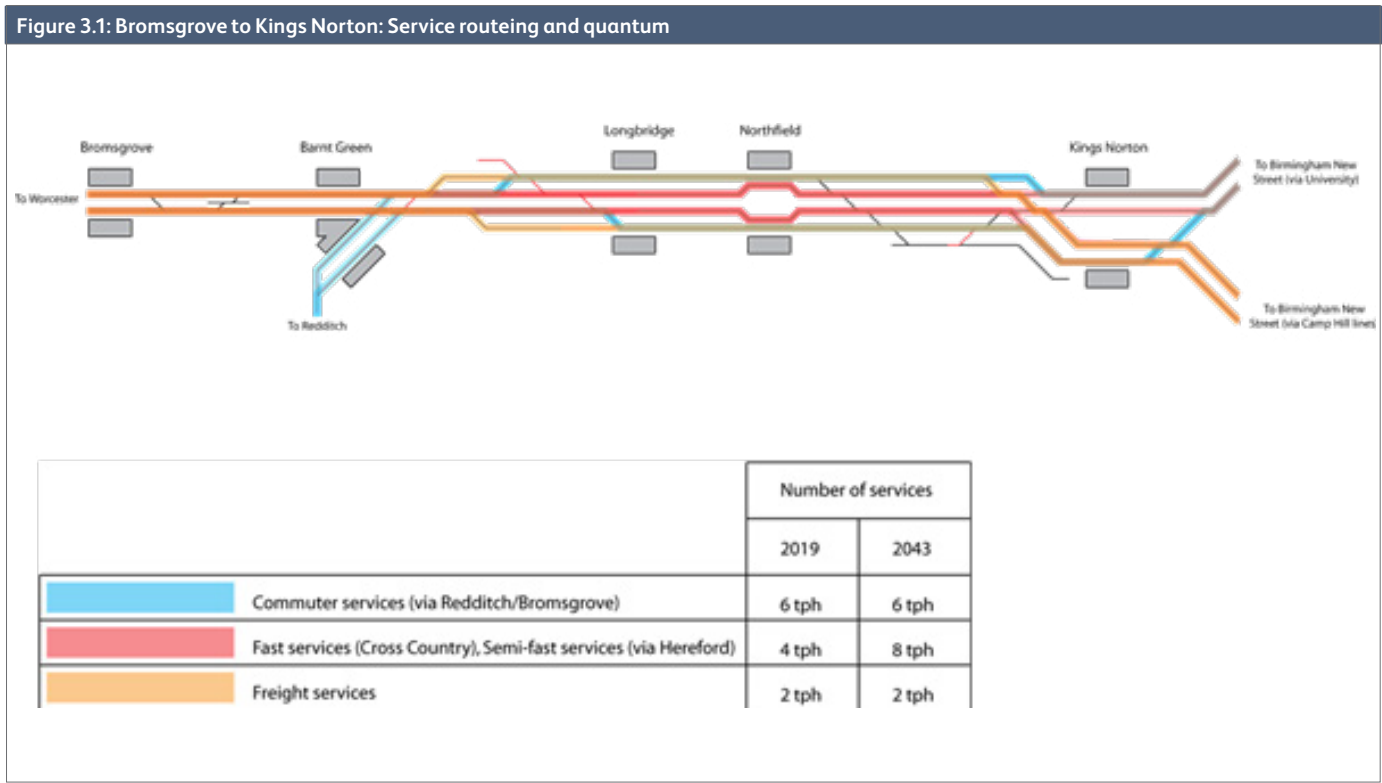
## Midlands Rail Hub: Birmingham to Nottingham/Leicester

Figure 2.7: Water Orton longer term intervention



<sup>3</sup> Wider economic benefits are being assessed by Midlands Connect partnership. It is anticipated that these will further strengthen the business case.

# Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove



## Context

This corridor area covers the route between Birmingham and Worcester/Hereford via the Cross City line. The route provides connectivity between South West England and South Wales, the West Midlands and beyond. The route also caters for key inter-regional and cross-country freight flows and is an important commuter corridor into Birmingham from the south of the city.

## Bromsgrove to Kings Norton

Due to the complex mix of services operating on the Bromsgrove to Kings Norton section of the route there are some significant capacity challenges. These are exacerbated by the track layout and the steep gradient of the Lickey incline, which is one of the steepest in the UK.

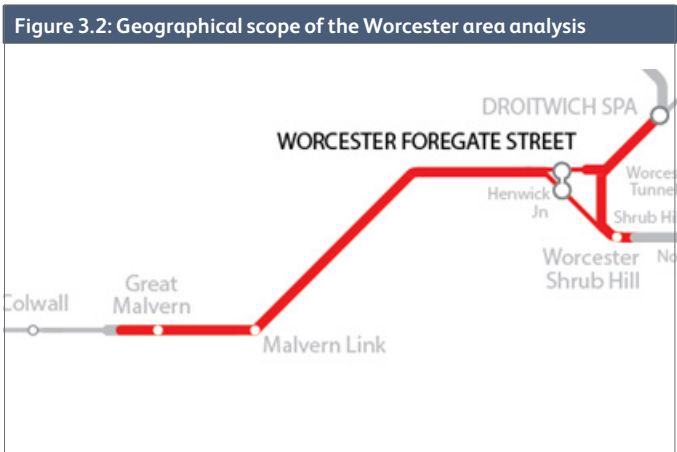
The following diagrams illustrate the quantum and standard routeing of the hourly off-peak service specification on this route.

Analysis shows that in 2019 the route will be operating at its maximum capacity, and interventions would be required to support any increase to this. It should be noted that the Central Birmingham routeing strategy, as described in the Midlands Rail Capacity and Connectivity Technical Appendix – Central Birmingham, drives other potential constraints in terms of future operations on this line. Currently, the majority of services travel to Birmingham New Street and are routed via University, as opposed to the route on the Camp Hill lines. The potential for routeing trains into Birmingham Moor Street would change this dynamic, leading to a greater usage of the Camp Hill lines. This would require a greater capability than is currently available in the Bromsgrove to Kings Norton section of the corridor to separate the flows of services to and from central Birmingham.

Analysis undertaken indicates that the mix of services is the key restriction on service growth on this corridor, which is ultimately limited by the capability of the different types of trains operated. It is important to cross reference the work conducted on this corridor with that of the cross boundary working group, which has assessed the feasibility of achieving the unconstrained 2043 service specification on the connecting routes.



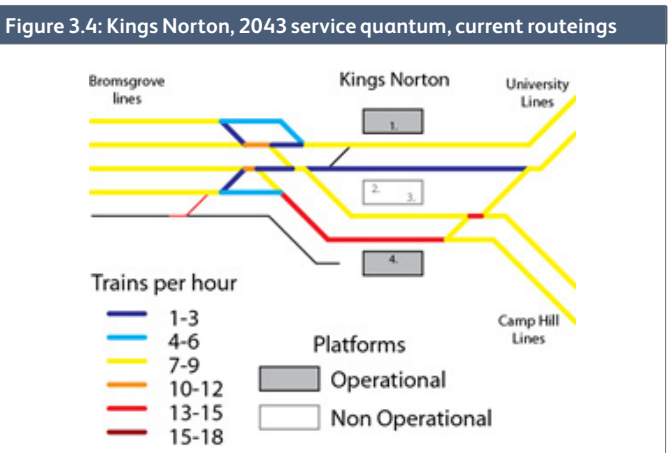
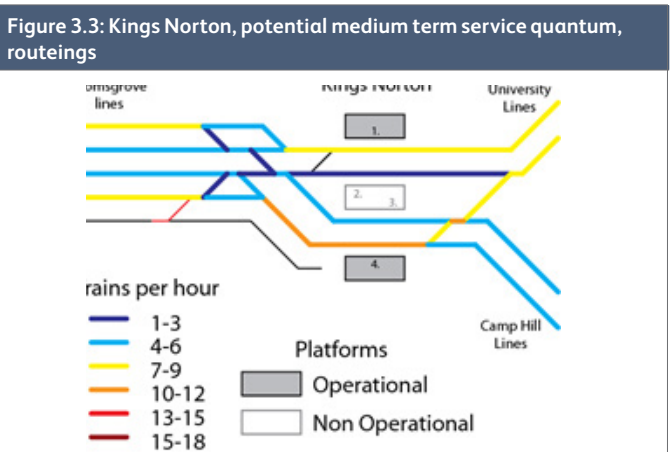
Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove



Worcester -Hereford

The corridor scope includes the line between Worcester and Hereford, connected to Birmingham via the Lickey Incline. The Worcester area, which includes Worcester Foregate Street and Worcester Shrub Hill stations, represents a key intersection between the routes from Birmingham, Bristol and South Wales, and London via Oxford. It is a highly constrained area in terms of infrastructure, with multiple single line sections and routeing constraints.

Worcester Foregate Street, Worcester Shrub Hill and, potentially in the future, Worcestershire Parkway stations cater for distinct passenger flows. It is a stakeholder aspiration to be able to serve these different stations as flexibly as possible to allow for a more even service pattern in the area. Currently, the service provision is not uniform and services are limited in both the number and order of station calls. The railway geography is such that it can be operationally challenging to serve both Worcester Foregate Street and Worcester Shrub Hill from Birmingham despite the fact that they cater for distinct passenger flows.



## Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove

### Methodology & findings

#### Kings Norton area capability

The Central Birmingham analysis has a critical bearing on how services are routed from the Birmingham to Worcester/Hereford via Bromsgrove corridor. The Route Study strategy (as outlined in Midlands Rail Capacity and Connectivity Technical Appendix: Central Birmingham) is to enhance capacity at Birmingham Moor Street and reroute services. As the Route Study stakeholder group determined that the main candidate services for routing into Moor Street are longer distance services on what can be considered the South West – North East axis, this will impact service routeings from the Birmingham to Worcester/Hereford via Bromsgrove corridor.

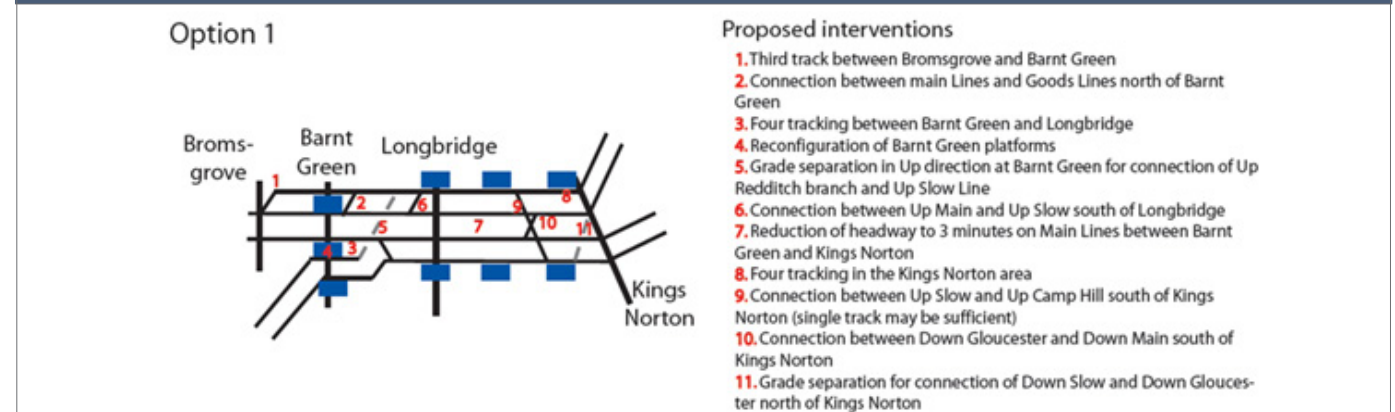
Mapping the quantum of hourly off-peak services through the Kings Norton area, both in terms of current routing and potential future routeings (split between New Street and Moor Street), has revealed a number of physical constraints to service level growth.

The partial electrification through the Kings Norton area, along with the central island platform being out of use, means that trains have to perform crossing moves that could be avoided. Analysis indicates that full electrification of the area, combined with the reopening of platforms 2 and 3 would remove the need for these moves, making best use of the available infrastructure by segregating flows, simplifying the layout and potentially improving performance. The potential redirection of some longer distance flows towards Birmingham Moor Street via the Camp Hill route and the increase in service level will drive the need to make further interventions in conjunction with the package of interventions identified in the Central Birmingham area (relating to the new Bordesley Chords). For this reason these additional interventions are included in the Midlands Rail Hub.

If implemented, the proposed service rerouteings, and interventions to support them, present opportunities to change the capability of the infrastructure in the Kings Norton area:

- In planning terms, the strategic change in routing removes the need for the crossover at Kings Norton Station Junction. During further development of the Midlands Rail Hub, the ongoing benefits of this crossover should be assessed against the disruption caused by, and the cost of, maintaining this asset.

Figure 3.5: Barnt Green - Kings Norton, one scenario of proposed interventions, for illustrative purposes



- If the Bordesley chords are constructed, there are known stakeholder aspirations to run shuttle services between Kings Norton and Birmingham Moor Street. It is recognised that interventions at Kings Norton offer the opportunity to examine and potentially provide the capability to support additional shuttle services, although this would be subject to funding and further development work.

#### Barnt Green to Kings Norton capability

Indicative service level analysis of the section between Barnt Green and Kings Norton has shown that the 2043 reduced specification is not sustainable on the current infrastructure. The key finding of the analysis is that, in order to accommodate this level of service, separation of flows will be required. There are a number of potential solutions proposed (see Figure 3.5), and some initial concept development is explored in section 3 below. Further development work is needed to define the achievable aspirations for this route in order to ensure these concepts meet future requirements.

#### Worcester area

The constraints in this area have been assessed through consultation with a subgroup of stakeholders from the Working Group. The subgroup's objective was to identify constraints in the Worcester area and develop tactical interventions that could potentially be

delivered as part of future signalling renewals which are provisionally planned for CP6.

The major constraints in the Worcester area identified by the subgroup relate to strategic flexibility, specifically regarding connectivity between Worcester Foregate Street and Worcester Shrub Hill stations, and operational flexibility, with regards to using platform capacity at these stations more effectively. Limited turnback capability in the Malvern area has also been identified as an area for analysis.

The main approach to the concept development work has been to identify and provide different routing opportunities through the use of new crossovers and small sections of additional track.

These scenarios have the potential to alter how Worcester stations are served in the future, both in terms of connectivity and service pattern. Further development work will be required to assess the viability of any future aspirational service specifications.

## Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove

### Concept development

#### Barnt Green to Kings Norton

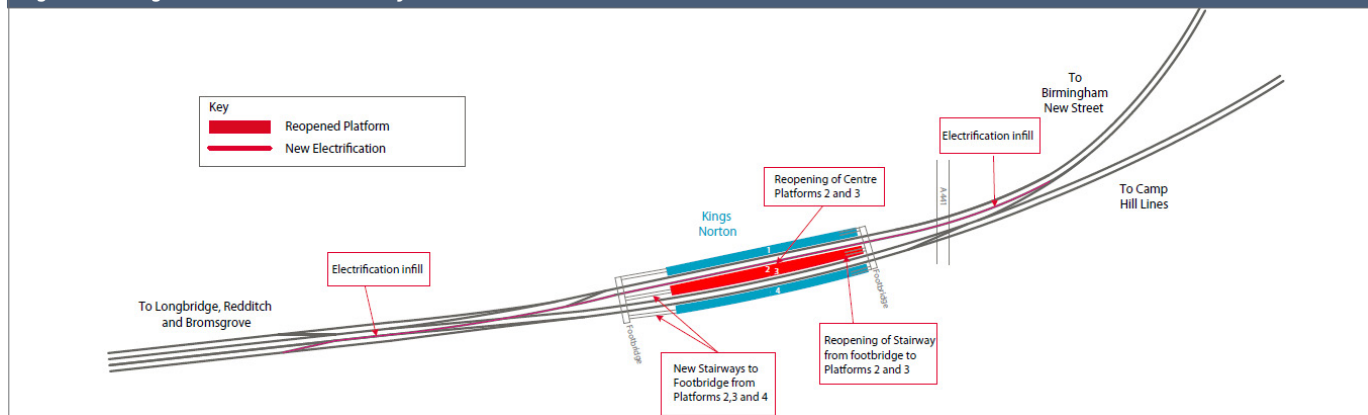
To support the routing of services from the Birmingham to Worcester/Hereford (via Bromsgrove) line into Moor Street in the medium term, capability analysis work has identified a need for infrastructure interventions in the Kings Norton station area. Assessing the longer term towards 2043, the analysis has indicated a need for significant further interventions on the route between Kings Norton and Barnt Green.

The proposed train routeings for the medium term indicates a requirement for the reinstatement of platforms 2 and 3 at Kings Norton (currently disused). This additional platform capacity is required so that Cross City services operating into Birmingham New Street can be separated from the longer distance services that are proposed to operate into Birmingham Moor Street via the Camp Hill line. Cross City services would operate into platforms 1 and 2 whilst Camp Hill line services would operate into platforms 3 and 4. The reinstated Platform 3 would provide an interchange opportunity on longer distance services, so that passengers could change to a Cross City service at Kings Norton in order to access University station and other stations which are on the route from Kings Norton to Lichfield Trent Valley via Birmingham New Street. Reinstating Platform 2 would require electrification infill (800m) as the Cross City services which would operate at the platform are electric services. A new accessible footbridge is also proposed at Kings Norton as part of the planned station interventions.

There are third party aspirations for operating local services from Kings Norton to Birmingham Moor Street, with new stations proposed on the Camp Hill line (at Kings Heath, Moseley, and Hazelwell). To operate these services, a bay platform or turnback siding would be required at Kings Norton. The platform and associated access improvements to the car park and platforms have been assessed within the Route Study to support the development of this option.

<sup>4</sup>Wider economic benefits are being assessed by Midlands Connect partnership. It is anticipated that these will further strengthen the business case.

Figure 3.6: Kings Norton area Route Study interventions



### Cost

As outlined above, the Route Study package of interventions to deliver improved capacity and connectivity in the Midlands in the medium term includes interventions in the following corridor areas: Central Birmingham (Bordesley to Moor Street and Birmingham Snow Hill), Birmingham to Nottingham/Leicester and Birmingham to Worcester/Hereford via Bromsgrove. This package is known as the Midlands Rail Capacity and Connectivity Package. The costs of the combined package have a range of £375m – £875m.

Section 1 of the Technical Appendix describes the elements of this package required to enhance capacity in central Birmingham, upon which the above interventions are predicated. The central Birmingham concepts within the package are:

- Bordesley north and south chord
- Bordesley – Moor Street four tracking
- 2 new bay platforms at Moor Street
- Demolition of (and option to relocate) Bordesley station
- Relocation of stabling sidings
- Birmingham Snow Hill Platform 4 reinstatement and signalling enhancements

- Water Orton area CP6/7 interventions (see Midlands Rail Capacity and Connectivity Technical Appendix – Birmingham to Nottingham/Leicester elements)
- Reinstatement of Kings Norton Platforms 1 and 2 with electrification infill

The costs of the combined package have a range of £375m – £875m.

### Business Case

For medium term interventions identified in the Route Study, a socioeconomic business case has been conducted in line with funders' guidelines, in particular WebTAG, and the Department for Transport's appraisal guidelines have been used to test the value for money of the schemes.

A combined business case appraisal has been undertaken for the medium term package of interventions (Midlands Rail Hub) and is outlined in detail in the Economic Appraisal appendix. The point estimate for each intervention has been used for business case analysis. Based on the socio economic appraisal, the package currently offers medium value for money with a Benefit Cost Ratio (BCR) of 1.5, but it is expected that the business case will be higher when wider economic benefits have been factored in<sup>4</sup>.

## Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove

### Interventions for the longer term

For the longer term, concepts have been developed on the route between Kings Norton and Barnt Green as any increase in services on this route would drive the need for further interventions. Capability analysis work has identified the need for grade separation and remodelling of the route so that the future flows of traffic between Barnt Green and Kings Norton can be separated to maximise route capacity.

The concepts developed during the Route Study are outlined in Figure 3.7.

A new track layout is proposed in the Worcester area to increase capacity from the Birmingham direction and to provide greater platform accessibility. The new layout would allow services from Worcester Shrub Hill to access Worcester Foregate Street Platform 2 and vice versa. The concept includes double tracking the Droitwich to Worcester Foregate Street curve with a trailing lead at the former Rainbow Hill Junction and facing crossover between Rainbow Hill Junction and Foregate Street station. By installing a new crossover on the Droitwich to Worcester Foregate Street curve, the existing turnback facility in Worcester Foregate Street Platform 2 can be retained. An enhanced speed from 25 to 40 mph from Tunnel Junction to Worcester Foregate Street is also proposed.

Dependent upon whether the Worcester Foregate Concept is developed in full, an option for relocating the crossover at Henwick after the Level Crossing has been included.

At Worcester Shrub Hill, interventions considered include an additional crossover after Tunnel Junction to enable access from the Droitwich direction into Platform 1. Modifications to the signalling around Worcester Shrub Hill would allow services from all three directions to access both platforms, which is constrained by the present arrangements. This would therefore enhance operational capability and increase timetable flexibility. Modifications to the signalling could be incorporated into the future signalling renewals plans for the Worcester area, provisionally planned for CP6, although this would be subject to funding and further development work.

Figure 3.7: Longer term Route Study interventions

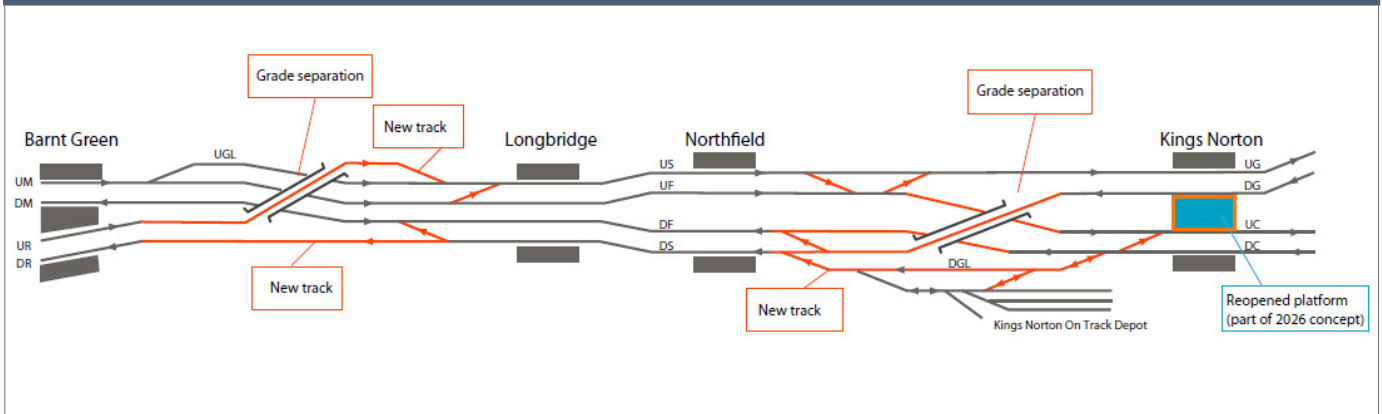
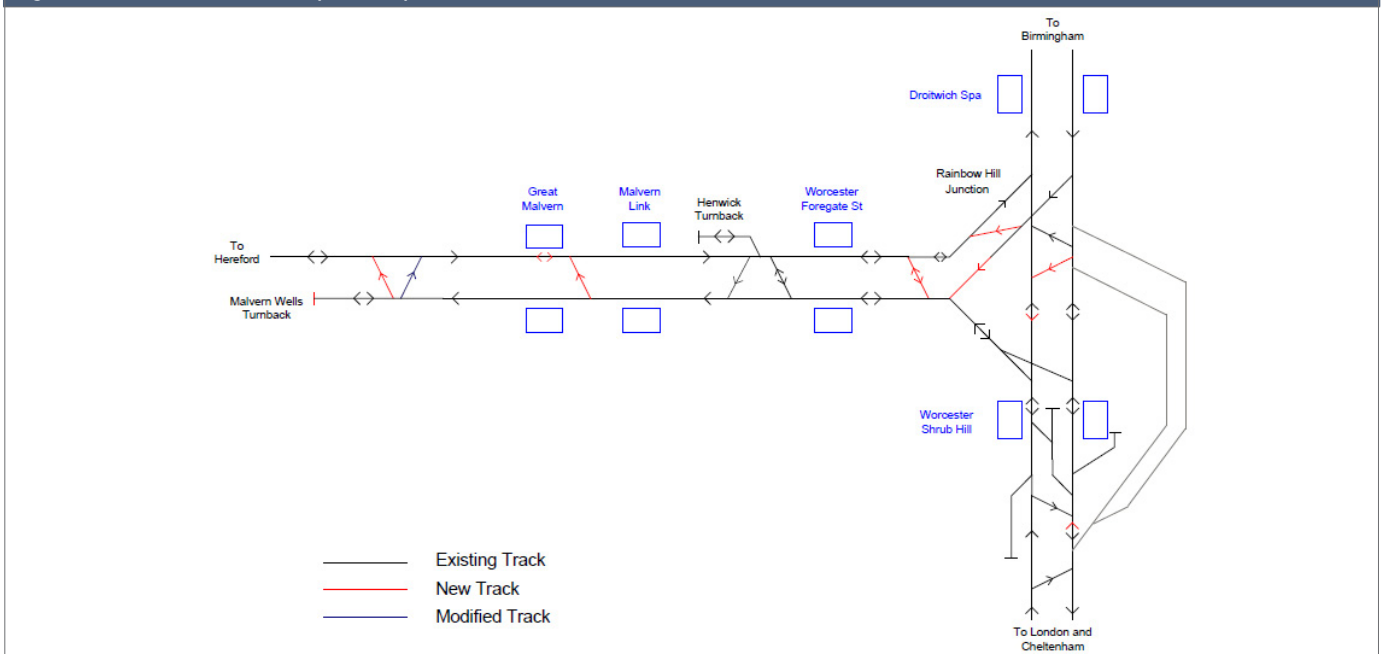


Figure 3.8: Worcester area concept development



*Midlands Rail Hub: Birmingham to Worcester/Hereford via Bromsgrove*

To support longer and multiple turnarounds of services operating to Great Malvern in the future ITSS, improved turnback capability in that area has been assessed. The installation of a facing crossover between Malvern Link and Great Malvern would allow services to turnback in Platform 1 at Great Malvern. A crossover is also proposed towards Malvern Wells to deliver a turnback siding of 300m length, providing the capability for splitting trains, multiple turnarounds from the east direction and shorter or longer turnarounds as required.

The cost range for the full set of concepts outlined for the Worcester area is £15m-£35m, although individual elements could be delivered as standalone enhancements. Further refinement of these concepts will be required as service assumptions are further developed, and as the signalling renewals scope and programme is developed in more detail.

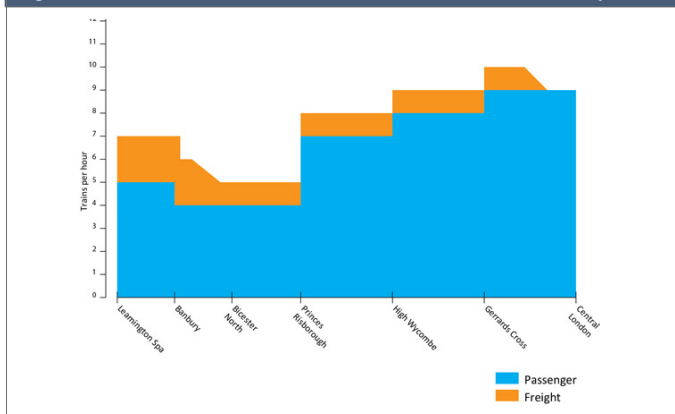
It is further noted that there are potential renewals planned at Norton Junction and Abbotswood Junction. The Western Route Study has considered the business case for enhancing these junctions at the time of renewal, with Abbotswood proposed for renewal as a double junction. These potential interventions would further increase the capacity and capability for services operating from the Western Route into Worcester, Great Malvern and Hereford.



# Appendix 4

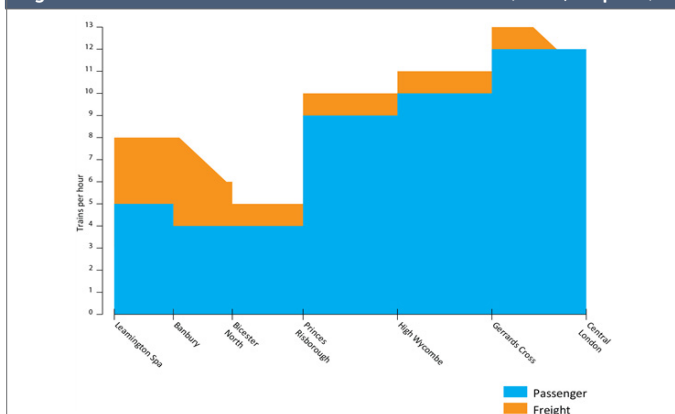
## Chilterns Route

Figure 4.1: Indicative Chiltern Main Line service level (2019, off peak)



The Working Group determined that another option to provide further capacity on this route would be to seek additional terminal

Figure 4.2: Indicative Chiltern Main Line service level (2043, off peak)



### Context

The Chiltern main line is a key route between Birmingham and London via Leamington Spa and Princes Risborough. The 2019 off-peak capability can be summarised as follows:

The unconstrained 2043 off peak service specification, based on the predicted demand is:

The main constraints to operating more services to meet future demand on this corridor are:

- Marylebone platform capacity
- Princes Risborough and Northolt junction capability

### Methodology & findings

#### Marylebone platform capacity and Old Oak Common

Analysis of operations on the Chiltern route indicates that Marylebone station platforming capacity, particularly in the peak, is the most significant constraint on this route. The first option considered was platform extensions within the existing station footprint. Analysis reveals, however, the limited benefits of minor train lengthening and provision of some increased service flexibility would still not meet capacity needs. The lengthening of platforms at Marylebone would also require alterations to the track layout and signalling which would be significantly costly have significant costs and disruptive to passengers, and would increase passenger walk times, both to the station exit and to the interchange with the London Underground.

In order to deliver the required capacity, additional services are needed which would require new platforms at Marylebone. Due to constraints at the constrained nature of the existing station site, these would need to be outside of the footprint of the station. The complete redesign of Marylebone station, platforms and track layout is considered too disruptive and unaffordable to meet the long term demand forecast and has not been evaluated further within the Route Study. The likely cost is driven by the need to acquire land in central London to achieve this enhancement. Line capacity between Neasden and Marylebone is also likely to constrain overall network capability if more services were to operate into Marylebone.

capacity at an alternative London location, in the Old Oak Common area. This link would provide connectivity benefits with access into Elizabeth Line (Crossrail), HS2 and GWML services otherwise not provided on the Chilterns network. The rail link between Northolt Junction and Old Oak Common the future Old Oak Common station site at Old Oak Common West Junction (the “Wycombe Single”) is an asset with latent capability which could be developed to support the routing of some Chiltern services away from the main line towards an alternative terminus. This strategy has been reflected in the ITSS which includes 4tph to Old Oak Common.

Analysis has been undertaken in order to determine what enhancements should be considered to run up to 4 tph on the section between Northolt Junction and Old Oak Common. This work forms the basis of the choices for funders outlined in section 3.

#### Princes Risborough and Northolt Junction capability

The section between Princes Risborough and Northolt Junction has the potential to be a future planning constraint due to the number and speed mix of services identified in the ITSS. In addition, the layouts of Princes Risborough and Northolt Junction are not optimal in capacity terms. In both areas track remodelling would partially alleviate the capacity constraints on the section and mitigate the performance risk of running more trains. Capability analysis work indicates that some additional interventions will be needed in the medium term to sustain the number of services predicted to operate on this section. A number of indicative timetable studies have been completed on this route in order to assess its capability limitations. The results of these studies have fed into the strategic narrative for the route and informed the options for funders for the medium term.

In conclusion, the interventions identified and detailed in section 3 may provide sufficient capacity to meet the demand in the medium term, but this is highly dependent on the timetable structure and service specification. Further consultation and development work will be needed to assess the ability of these concepts to sustainably support both demand and stakeholder requirements going forward.

Figure 4.3: Chiltern six-car platform lengthening

Station	Current length	Required length	Cost range
Sudbury & Harrow Road	3	6	£<10m
Sudbury Hill Harrow	3	6	£<10m
Northolt Park	5	6	£<10m
South Ruislip	6	6	£<10m
Monks Risborough*	4	6	£<10m
Little Kimble*	4	6	£<10m
Kings Sutton	4	6	£<10m
London Marylebone (Platform 4)	5	6	£15m - £35m

Figure 4.4: Chiltern nine-car platform lengthening

Station	Current length	Required length	Cost range
Seer Green	7	9	£<10m
Gerrards Cross	7	9	£<10m
Denham	7/8	9	£<10m
Saunderton	7	9	£<10m
West Ruislip	6/7	9	£<10m
London Marylebone (Platforms 3-6)	-	-	£20 - £50m

## Concept development

### Train lengthening

To meet forecast demand on the Chiltern route in CP6, longer trains are required. Two options have been identified in Chapter 5:

- lengthen platforms to accommodate six-carriage trains as a minimum for Chiltern suburban services, creating a more standardised service offering across the Chilterns network
- lengthen targeted platforms currently served by six-car trains to accommodate nine-carriage trains, and flex stopping patterns to alleviate loadings on trains serving stations with shorter platforms. This option may reduce the overall scope of platform lengthening work.

### Six-car platform lengthening

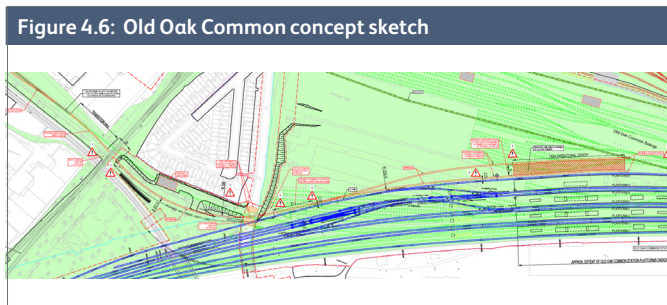
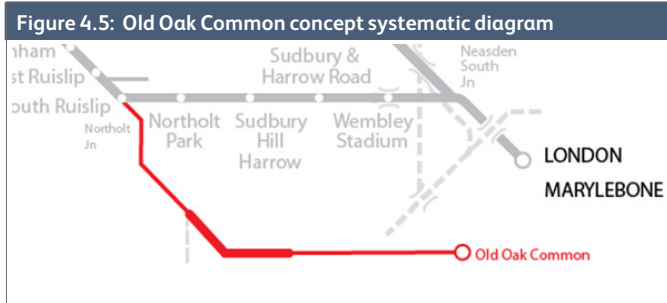
This option (Figure 4.3) enables lengthening of the shortest trains on the Chiltern suburban service group to a minimum of six carriages.

In this package, all platform extensions except London Marylebone are achieved by adding to the existing platform structure without alterations to the track layout or other railway systems. At London Marylebone, the platform extension can only be achieved with track layout alterations for the approaches to Platforms 4-6 and a minor structural adjustment to Platforms 5-6. The two platform extensions on the Princes Risborough-Aylesbury

### Nine-car platform lengthening

This option (Figure 4.4) redistributes station calls within the suburban service group and lengthens other trains to relieve pressure on those which call at stations with short platforms.

At London Marylebone, platforms 3,4,5 and 6 have been extended to the North which requires some alterations to the track layout to accommodate the platform extensions. This provides 9-car capability across all platforms at Marylebone. Where possible platform extension concepts at all other stations have been developed without impacting on other railway systems. However at Saunderton it was identified that is necessary to relocate signals to enable platform lengthening.



### Old Oak Common connectivity

As identified in section 2 above, the strategic concept developed is to route trains to a new station terminus in the Old Oak Common development area. This is to deliver capacity beyond that delivered through train lengthening required to meet demand in CP7 and beyond enabling demand to be met in 2043. An enhanced link to Old Oak Common is required to support this concept, comprising an upgrade of the existing 'Wycombe single' line. The single line would need to be enhanced to a two track railway in order to support a 4tph frequency with potential line speed improvements to support service operations into one or more and two turnback platforms are required at Old Oak Common, depending on the number of services to support a 4tph service without creating capacity constraints elsewhere. Transport for London have undertaken demand modelling of this service with a target journey time of 8.5 minutes between Northolt Junction and Old Oak Common. If this output is to be delivered, the linespeed would require upgrading to 80mph. Assessments have been undertaken to identify modifications to track, signalling, structures and earthworks needed to deliver two line speed options on the Wycombe line: this upgrade including redoubling single track sections and increasing the linespeed. This has also been assessed against the possibility of a TfL-promoted scheme to open a new station at Park Royal providing an additional interchange between Chiltern Railways and LUL services. 50mph and 90mph. Remodelling of Northolt Junction is also proposed to support the enhanced connection to the upgraded Wycombe line.

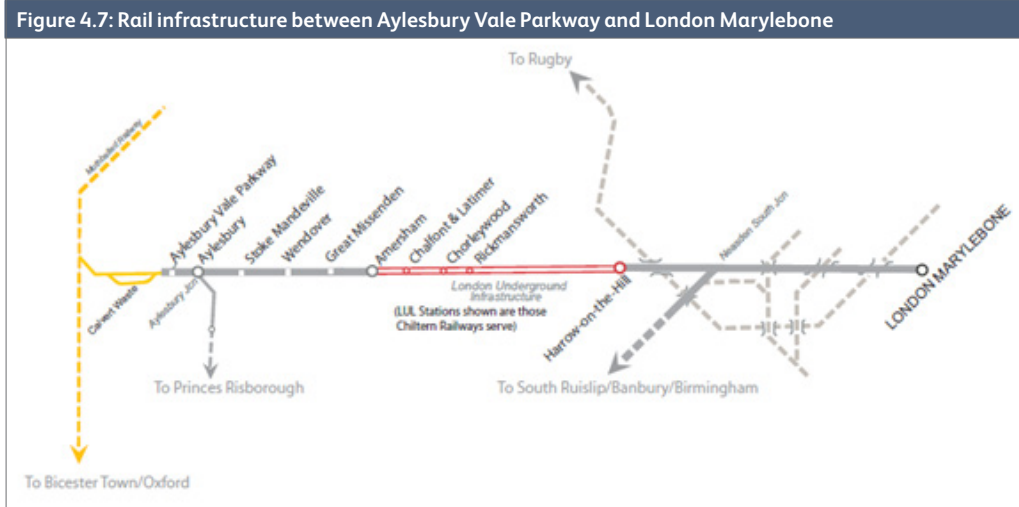
The current track layout between South Ruislip and Northolt Junction is also a constraint as both Up and Down services accessing the Wycombe Single are required to use a single platform at South Ruislip. Junction layout alterations to allow Down trains to use the existing Down platform and access the Wycombe single are required in order to sustain a frequent service on the Wycombe single.

Through engagement with the HS2 undertaking to develop a Crossrail-HS2 interchange at Old Oak Common, it has been possible to explore the practicality of constructing a Chilterns facility within the Old Oak Common development site, and a working concept has been developed based on preferred GWML options for Old Oak Common at the time of the study, which does not impact on the track layout required to support Crossrail services and does not

impact on HS2 construction. The concept developed is dependent on a 'not to preclude' instruction within the Old Oak Common development remit. The key criteria for achieving the benefits to this scheme is to locate the Chilterns facility within the Old Oak Common 'triangle' bounded by the Northern limit of the GW Relief Line development, the Southern edge of the HS2 'box', and the limit of existing housing development along Old Oak Common Lane to the West of the site. This location of a new Chilterns station will minimise walk times, and therefore interchange times, between Chilterns services and other rail services and providing the greatest connectivity. The option of locating the Chilterns facility to the West of Old Oak Common Lane was also examined, with the platforms between the GWML Relief Lines and the North London Line (overbridge); however, this location had the additional cost of an all-weather walkway between these platforms and the proposed Old Oak Common station as well as the dis-benefit of increased overall journey times for passengers interchanging from Chilterns services and was therefore discounted. There is also a trade-off between provision for future train lengthening beyond the current specification and impact on the Old Oak Common concept due to the increased land requirement.

### Interventions to meet demand up to 2043

To meet forecast service levels up to 2043, capability analysis work indicates that significant sections of four tracking would be required between Princes Risborough and Northolt Junction. Such a major enhancement would require significant land take and impact properties and the environment in the area. This is considered too disruptive and unaffordable to be taken forward in this Route Study. To deliver incremental capacity improvements to meet the medium term demand, it is proposed that four track sections are constructed at Denham, Beaconsfield and Princes Risborough as the formation at these locations can accommodate additional track sections. These additional tracks effectively create platform loops through the station areas to enable faster trains to overtake stopping services. Further timetable study and development work is required to confirm these to be optimal locations to construct loops to add capacity to the Chiltern Main Line as this is dependent on timetable structure. These particular locations have been selected due to their relative practicability of construction.



The 2043 ITSS also has additional services operating between Princes Risborough and Aylesbury, which exceed current track capacity. Current infrastructure is a single track with intermediate stations. Considering the diversification of rail traffic on this route in the 2043 ITSS double tracking throughout is proposed to deliver capacity, and a linespeed improvement is proposed to improve journey times for through train services.

Considering the extensive property development planned in the Princes Risborough area, an exercise has been undertaken by Network Rail supporting this Route Study to identify likely land requirements to deliver a two-track railway (including permanent and temporary requirements). This work has enabled engagement with the local authorities to safeguard land for this enhancement and enabling additional housing to be developed around.

The final section of analysis was the Princes Risborough station area, including the junction from the Aylesbury route. The concept developed remodels the track layout through the station and the station building to deliver increased capacity, including extension of Platform 1 and conversion from a terminating to a through platform.

### Future electrification

The refreshed Electrification RUS has identified the Chiltern main line as a priority route for future electrification. As the existing Chiltern fleet is due to be replaced in the 2020s, it is proposed that electrification plans are developed as part of an overall modernisation programme for the route incorporating rolling stock strategy and the introduction of digital railway. These upgrades to the route will help to support the improved capacity and connectivity outputs and provide increased service resilience. The interventions identified as part of this route modernisation form the Chiltern capacity and connectivity package outlined in the Route Study.

To maximise the benefits of the Chiltern capacity and connectivity package, analysis has considered potential electrification options for the line between Aylesbury and Marylebone (via Amersham) which does not form part of the main line scope. The line includes infrastructure between Amersham and Harrow on the Hill that is owned by London Underground Limited (LUL) but shared operationally with Chiltern Railways (highlighted in red in Figure 4.7).

Electrification options have been identified for this line, taking into account the DC 4th rail electrification on the section between Amersham and Harrow-on-the-Hill. As it would be challenging to operate and maintain an OLE (AC electrification) system alongside the 4th rail section, the introduction of AC electrification on part of the route (excluding the section between Amersham and Harrow-on-the-Hill) has been identified as a potential option. It is proposed that this should be considered as part of any future development work assessing main line electrification. Key to this development work will be understanding the impact of different options on the future Chiltern rolling stock fleet. Progressing the option to part electrify (AC) the Aylesbury – Amersham – Marylebone route would require assessment of dual voltage or bi-mode rolling stock options which could operate as a combined fleet on both this route and the main line. The potential to use an independently powered EMU has also been considered, with initial modelling work supporting further development of this option.

### Cost

The interventions presented in this appendix have been estimated to inform affordability and value for money analysis. The cost ranges are presented in Figure 4.8.

### Business case

The business case analysis for the packages outlined above is ongoing and benefits are still emerging as part of this work.

**Figure 4.8: Chiltern intervention costs**

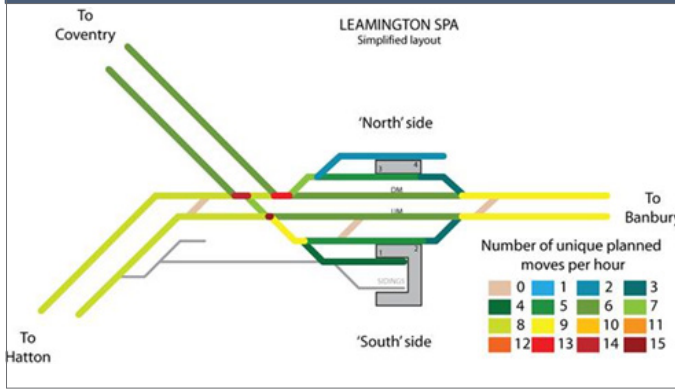
Scheme	Cost range
Platform extensions for six-carriage trains on the Chiltern Main Line Suburban services (excludes Princes Risborough-Aylesbury service extensions)	£20m - £50m
Platform extensions for nine-carriage trains on selected Chiltern Main Line Suburban services (alternative proposal)	£35m - 75m
Old Oak Common connectivity (Wycombe line upgrade at 80mph non-electrified and Northolt Junction enhancements)	£175m - £375m
4 tracking at High Wycombe	£35m - £75m
4 tracking at Denham	£20m - £50m
4 tracking at Beaconsfield	£20m - £50m
Princes Risborough enhancements (range does not change if platform extensions at Monks Risborough and Little Kimble which are <£10m when considered separately)	£20m - £50m



Figure 5.1: Indicative geographical scope of the area covered in the Leamington Spa to Birmingham New Street via Coventry analysis



Figure 5.2: Example analysis of the Leamington Spa area, highlighting the constraints at Leamington Spa Junction



Context

The geographical scope covered by this appendix is shown below. It can be summarised as Leamington Spa to Birmingham New Street via Coventry.

The aim of this document is to give an overview of how the Route Study has assessed the constraints on these corridors and developed a strategy for future growth.

Constraints analysis

Leamington Spa

Indicative service level analysis has been conducted to assess the capability of the 2019 infrastructure against the projected 2023 service level and the 2043 ITSS. This has shown that Leamington Spa Junction will be the primary constraint in the area. This is a result of the service quantum on the Chiltern Main line, the projected increase of services and timetable structure between Leamington Spa and Coventry.

Analysis undertaken within a separate GRIP 2 study assessing requirements between Leamington Spa and Coventry identified a potential new chord line into Platform 4 Leamington, known as Avenue Chord. This chord would segregate the local passenger services from the Coventry to Leamington Spa line from services operating into Leamington Spa from the Solihull route. This would help to reduce capacity constraints in the station area. Analysis indicates that although this option would not be required for capacity in the medium term, it would provide operational benefits and is required to support the increased service specification for the longer term.

In order to deliver the longer term ITSS, an enhancement to the capability of Leamington Spa Junction will be required to allow planning flexibility to and from the Leamington Spa to Coventry line. If train services on the routes into Leamington Spa are increased earlier than 2043, as a consequence of the projected increase in demand, it is recognised that this enhancement would be required to support this.

Leamington Spa to Coventry

The Leamington Spa to Coventry route is acknowledged as a capacity constraint and has been the subject of a GRIP 2 study in CP5. Analysis indicates that the projected 2019 service level represents the maximum capacity of the route, with any further growth necessitating infrastructure enhancements.

The GRIP 2 study assessed infrastructure requirements on the Leamington Spa to Coventry route in order to support an increase in service numbers. Timetable analysis undertaken indicated that capacity enhancements are required between Leamington Spa and Kenilworth North Junction to support an increased service specification (in addition to a new crossover in the Milverton area which is being delivered as part of the CP5 Kenilworth station project). The details of these interventions are outlined in section 3.2 below. As the Route Study medium term service requirements aligns to the specification of the GRIP 2 study, the interventions developed are proposed as an option to funders.

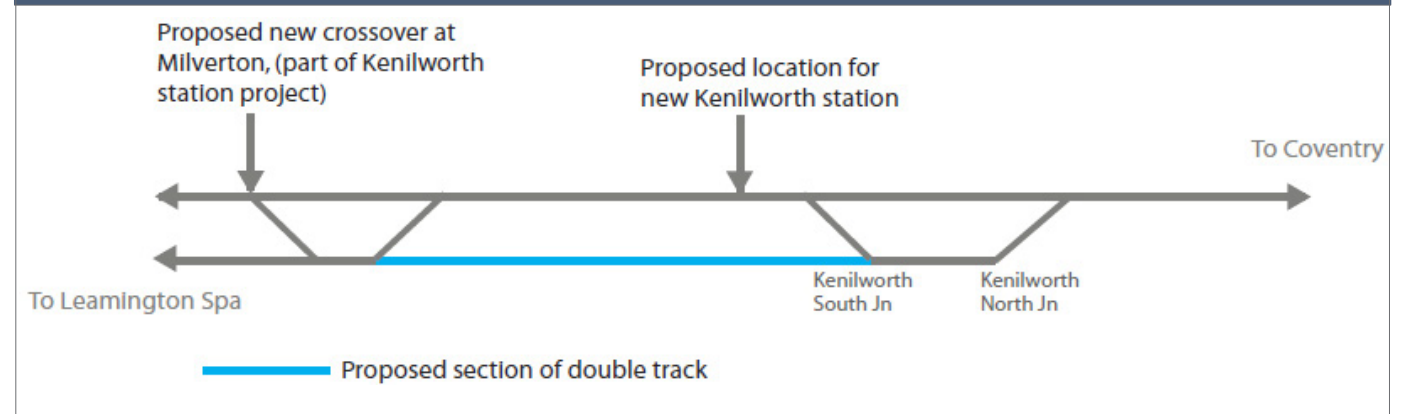
Coventry to Birmingham New Street

This corridor, and particularly the section between Stechford and Birmingham International, is a known constraint to service growth, in terms of both intercity and local passenger services. With the continued development of HS2 designed to address the former, the Route Study has focused on whether the current capability of the corridor is sufficient to accommodate the required demand and how best to use this capability to fulfil journey time, connectivity and other conditional outputs.

Analysis undertaken indicates that in order to fully accommodate the longer term service specification on this corridor four-tracking would be required between Stechford and Birmingham International. This is presented as a choice for funders; the alternative is to consider trade-offs in service quantum and stopping pattern.

There is a considerable body of previous analysis that have investigated options as to how to optimise the current capability of the corridor, which highlights the competing stakeholder aspirations in terms of service level. At a high level the emerging best use of the Birmingham New Street to Birmingham International section is in

Figure 5.3: Coventry to Leamington Spa redoubling



the region of 12 to 14 services per hour, dependant on service type, journey time requirements and calling patterns. Reduction of headways through digital solutions will provide a further opportunity to increase the capability and robustness of services on this corridor and should be incorporated into the development of future service specifications.

#### Capability summary

How this route is used in the future is intrinsically linked to the Central Birmingham strategy of rerouting services into Birmingham Moor Street and the impact of HS2. Changing the axis of how demand is met in Central Birmingham will present opportunities to balance service levels on the surrounding corridors. It is essential that this strategy continues to be developed in order to make best use of the available infrastructure, and to meet journey time, service quantum and connectivity conditional outputs.

#### Concept development

##### Leamington Spa to Coventry capacity enhancements

Analysis undertaken as part of a GRIP 2 study in CP5 has identified interventions required on the Leamington Spa to Coventry line to support additional services. Based on the service specification for the medium term (CP6/7), the Route Study proposes that these

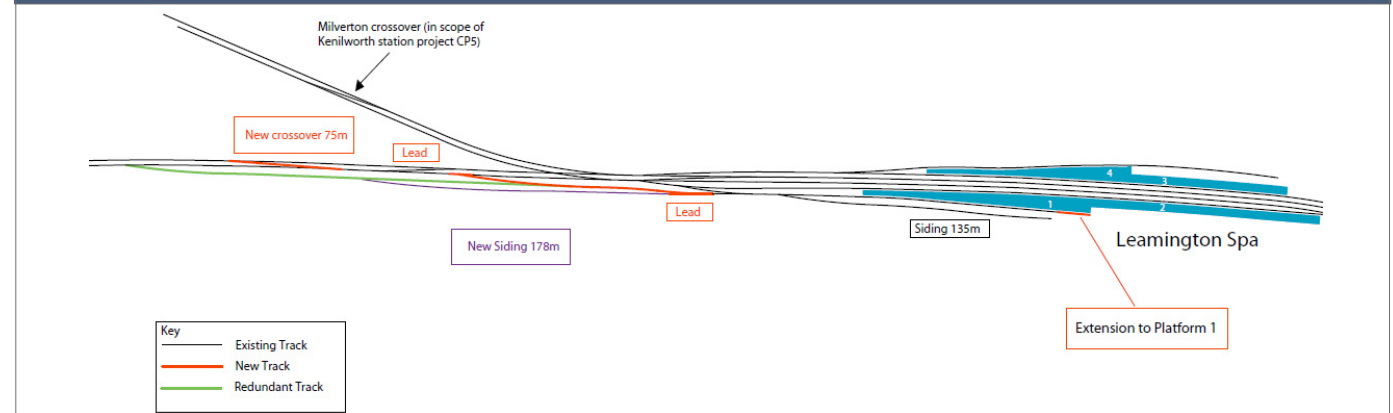
interventions are presented as an option for funders.

To deliver a service specification with two long distance passenger services, one local passenger service and one freight service per hour part of the route (between Leamington Spa and Kenilworth North Junction) would require redoubling. The proposed section of double track is shown in Figure 5.3. Some track lowering at overbridges on the route should form part of the future scope in any further development of the scheme as this would facilitate potential future electrification of this route.

##### Leamington Spa Junction enhancements

This concept comprises two new leads on the down side of Leamington Spa Junction. This would support future capacity requirements by enabling services to enter and exit Platform 1 from the Hatton direction independently to services entering the station from the Leamington Spa to Coventry route, thereby reducing the number of conflicting moves across Leamington Spa Junction. Platform 1 is extended in this concept to provide a length to support 6-car train operation. A new stabling siding is also included for services using Platform 1 which have long turnaround times and for overnight stabling.

Figure 5.3: Coventry to Leamington Spa redoubling



The concept provides an opportunity for segregation of services at the station, with the Leamington Spa to Stratford-Upon-Avon and Birmingham services operating into Platform 1, main line services operating into platforms 2 and 3 the Leamington to Coventry local services operating into Platform 4.

#### Coventry to Birmingham New Street

A study of options to increase capacity between Coventry, Central Birmingham and Wolverhampton was commissioned by members of the Route Study Working Group and reported in January 2013. This work assessed the option of four tracking between Stechford and Birmingham International, taking into account the impact on station platform arrangements. Consideration was given to the optimum configuration of the four track section based on future potential passenger and freight service flows. This study indicated a cost range for four tracking of £175m-375m, although it should be noted that the full Route Study 2043 ITSS was not available when this work was undertaken. A review of this work taking into account the Route Study longer term ITSS has identified two options to take forward in any future development work (fast lines on the outside and lines paired by speed).

Figure 6.1: WM&C Shortlisted Stations

Development timeline		
By 2019	By 2024	Longer term
Birmingham Moor Street	Birmingham International	Banbury
Birmingham Snow Hill	Coventry	Dudley Port
London Marylebone	Five Ways	High Wycombe
University	Selly Oak	Leamington Spa
	Solihull	Smethwick Galton Bridge
	Tamworth	Walsall
	Wolverhampton	
	Worcester Foregate Street	

A total of 19 stations were shortlisted across the Route Study area, each with different capacity constraints (includes consideration of Birmingham New Street - see separate note).

Station capacity is an important consideration in accommodating demand across the West Midlands and Chilterns area. Stations form an integral part of a passengers' journey and if sufficient capacity is compromised, walk times, inconvenience and congestion can impact on running an efficient operation. Providing the necessary space at stations is crucial to achieving higher frequency services, maintaining performance levels, running longer trains and ensuring passenger comfort.

The West Midlands and Chilterns Route Study set up a Stations Working Group (SWG) to undertake a strategic review of the impact of growth on stations within the Study area. The Group was represented by Centro, Network Rail and the appropriate station facility owners (Arriva Trains Wales, Chiltern Railways, London Midland, First Great Western and Virgin Trains).

The SWG has reviewed current and potential future capacity constraints in the form of a stations shortlist (see Figure 6.1). This shortlist was developed based on the following base data:

- stations previously identified within the 2011 Network RUS – Stations
- MOIRA data to identify the highest boarding/alighting numbers for individual train services during peak times
- annual footfall figures
- market study growth forecasts
- current station capacity constraints (e.g. entrance, footbridge, stairs, platforms, gate lines)
- train service level changes
- planned renewals and enhancements
- and the potential impact of HS2.

As part of this shortlisting exercise, site visits were carried out during peak times. This site information was used (together with the data listed above) to identify possible future capacity constraints in order to develop appropriate interventions, known as Route Study concepts or strategic options. The evidence gathered is captured in the following station templates (alphabetically by station).

The SWG undertook a prioritisation exercise to categorise the stations based on the current and anticipated capacity constraints identified. This prioritisation process took into account the strategy and themes emerging from the Route Study option development work, in particular capacity analysis in central Birmingham.

To evaluate and compare the shortlisted stations, a high level methodology was agreed based primarily on passenger safety and performance. This process produced a high level recommendation and timeline to when interventions may be required at each station.

Based on this methodology each station was categorised into the following timelines:

- **2014-2019** - it is recognised that work is required within the current control period but may not be possible due to funding reasons. If this is the case, then these should be prioritised for the next planning cycle.
- **By 2024** – stations to be placed within the national stations list to be recommended for funding during the next planning cycle.
- **Longer term** - stations to remain on the shortlist and reassessed at the end of the next planning cycle.

For those stations initially recommended for interventions up to 2024, detailed assessment work (through GRIP) will be required to estimate high level costs for the interventions identified.

For some stations this has already begun and initial option development can begin. Examples include Birmingham Snow Hill and Birmingham Moor Street. For the others, investment will be sought for further assessment - this being a choice for funders in the next planning cycle.

Birmingham New Street - the SWG recognised that whilst the opening of Birmingham Gateway provided substantial additional capacity at concourse level and increased circulation space on platforms, it was appropriate to understand passenger behaviours and flows in light of the new passenger experience. In particular, the SWG raised the importance of understanding what impact the new layouts and facilities are having on capacity and for this to be considered within any development work going forward.



#### Strategy and Choices for funders

Based on a number of station capacity factors, Banbury has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

#### Background

Banbury station is on the Cherwell Valley section of the Chiltern Main Line. It is served by a number of passenger markets (long distance between Birmingham and Marylebone, London and South East and commuter), along with a number of key strategic freight flows. It has four platforms, with platform 4 being a bay platform. Congestion is experienced particularly on platform 2 (down platform) with passengers alighting from trains during the pm peak, which then combines with boarding and interchanging passengers. The stepping distance between the train and platform (Platform 2) has been identified as an issue for passengers. The curved nature of platform 4 can also create an issue with dispatching trains, as crowds can obscure the view. Platform 3 has limited space for boarding passengers during the am peak.

#### Planned or recent works

#### Renewals

- Banbury resignalling is planned in 2016/17, including a new facing crossover at the south end of Banbury station and reconfiguration of platform 4 to create a new through platform. Other renewals include Oxford resignalling.

#### Enhancements

- Strategic Freight Network scheme (Southampton – WCML train lengthening).
- NSIP project : a masterplan is being developed for Banbury by Chiltern Railways in conjunction with industry partners.

#### Impact of forecast growth

The Route Study indicates that the 2043 indicative train service specification (off peak) is of a very similar service provision as today. It is anticipated that demand will be accommodated by train lengthening and targeted infrastructure interventions along the Chilterns corridor.

Banbury station		
Footfall figures (p/a) Source: ORR National Data	13/14	2.5m
	2023*	3.73m
	2043*	5.35m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,500
	Alighting	744
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	719
	Alighting	1,383
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	Greater passenger numbers are likely to increase the congestion experienced on platform 2 in the pm peak and platform 3 in the am peak.	



## Appendix 6 - Passenger capacity at stations

### Birmingham International

#### Birmingham to Rugby (via Coventry)

August 2017

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#### Strategy and Choices for funders

Birmingham International has been categorised as requiring further passenger capacity assessments by 2024, in particular to understand the impact of the new HS2 Birmingham Interchange station.

#### Background

Birmingham International Station serves the long distance, regional urban and freight markets. It is in close proximity to the NEC, Genting Arena, Resorts World and is adjacent to Birmingham Airport. It is also close to key junctions off the M6 and M42. The station concourse and platforms become congested with passengers interchanging for the airport - many with large items of luggage. Weekend flows are particularly high with passengers attending NEC/Arena events and in the pm peak on NEC event days. Narrow platforms mean that crowd management procedures are put in place during times of overcrowding; passengers are held at concourse level and released to the platforms once trains have arrived. Currently there is a concentrated number of facilities and retail units clustered in the main concourse area of the station. This can lead to a funnelling effect of passengers into a cluttered area of the station.

#### Planned or recent works

##### Enhancements

- A new ticket gateline has recently been provided at the station, a scheme promoted by Virgin Trains.
- 2026 - introduction of the new HS2 Birmingham Interchange station and proposed people mover system operating between the HS2 station and the NEC, Birmingham International Station and Birmingham Airport. The current concourse and platform capacity at Birmingham International will be protected throughout the works.

#### Impact of forecast growth

In the short term, the Study outlines the need for an efficient, balanced timetable – making best use of the capacity on this corridor for maximum benefit. By 2024, train lengthening should be considered to accommodate demand on this corridor.

Birmingham International station		
Footfall figures (p/a) Source: ORR National Data	13/14	4.5m
	2023*	6.4 - 6.7m
	2043*	8.5 - 9.6m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	4,198
	Alighting	1,874
pm Passenger flows Source: MORIA	Total peak	3 hours (16:00 - 19:00)
	Boarding	1,824
	Alighting	3,710
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	43-49%
	2013 - 2043	89-114%
2019 Service changes	None	
Potential future capacity issues	Any potential airport expansions, or developments at the NEC/Genting Arena complex will impact on this station. When the new HS2 station – Birmingham Interchange opens in 2026, it is anticipated that passenger numbers will significantly increase as they interchange between the existing network and the high speed line.	



#### Strategy and Choices for funders

Birmingham Moor Street has been identified as a high priority station for passenger capacity interventions. The Route Study presents a package of options to decongest and reduce safety risk across the station:

##### Platform 1 -

- de-clutter and widen London end
- provide additional platform shelter (in order to spread passengers along the platform)
- extension to the gate line
- Main gate line extension.

These interventions will bring safety benefits by decongesting the barrier lines and at the train/platform interface, reducing the safety risk. They will provide an overall enhanced passenger experience by reduced walk times and queuing.

A business case appraisal has been undertaken which indicates a financially positive value for money assessment. Funding will be sought for further development of potential interventions in the next planning cycle.

#### Background

Birmingham Moor Street serves the long distance (Birmingham to London Marylebone) and regional urban markets. It has four operational platforms, with Platform 1 being particularly narrow in places.

Congestion occurs during the pm peak as passengers wait to board services. This is caused by high numbers of boarding passengers waiting at the narrow Birmingham end of the platform, where Leamington Spa and London services stop. The main gate line struggles to accommodate passenger demand and the Platform 1 gate line does not have sufficient capacity to process current peak hour passenger demand.

#### Planned or recent works

##### Renewals

N/A

##### Enhancements

- 'One Station' - LEP funded scheme to improve the existing walkways and cycleways between Birmingham New Street and Birmingham Moor Street stations (and Curzon Street)

#### Impact of forecast growth

The ITSS for 2043 indicates the need for an additional 10 trains per hour into Birmingham New Street in the off peak. Birmingham New Street is recognised as 'at capacity' in train paths terms in 2019, based on the current 12 platform provision and service structure.

The strategy in the Route Study identifies an option to re-route a number of services from Birmingham New Street to Birmingham Moor Street and Snow Hill. As part of the re-routing strategy, the impact on passenger capacity at the station will need to be assessed.

A new HS2 station at Curzon Street will also impact on passenger numbers at the station, creating interchange opportunities with new high speed services.

Birmingham Moor Street station		
Footfall figures (p/a) <small>Source: ORR National Data</small>	13/14	6.0m
	2023*	8.9m
	2043*	12.8m
am Passenger flows <small>Source: MOIRA</small>	Total peak	3 hours (07:00 - 10:00)
	Boarding	2,132
	Alighting	5,103
pm Passenger flows <small>Source: MOIRA</small>	Total peak	3 hours (16:00 - 19:00)
	Boarding	4,727
	Alighting	1,809
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	Increase in passenger volumes means congestion on Platform 1 will increase beyond acceptable levels. Gate line capacity will be exceeded causing further queuing and delays. Passenger capacity will also increase with passengers interchanging between the new HS2 station and the existing network.	

## Appendix 6 - Passenger capacity at stations

### Birmingham New Street

Central Birmingham

August 2017

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#### Strategy and Choices for funders

With Birmingham Gateway recently opened, it is proposed that passenger behaviours and flows are reviewed between now and 2019, in order to assess what the impact of the new station layout and facilities are having to passenger capacity. A medium term assessment may be required by 2024, to monitor the impact of the Gateway project on passenger capacity at platform level.

Potential extension of shelter provision on lower numbered platforms at the station, may be a potential future option to decongest the platforms (by spreading passenger numbers across the full length).

#### Background

Birmingham New Street has recently completed an extensive upgrade, through the Birmingham Gateway project. This has massively transformed the passenger experience at Birmingham New Street. Whilst the Gateway project has significantly increased concourse and circulation space above platform level, platform circulation space may become a capacity constraint in the future.

#### Planned or recent works

##### Renewals

- Birmingham New Street resignalling project 2015-2018.

##### Enhancements

- Gateway Project completed in 2015
- 'One Station' - LEP funded scheme to improve the existing walkways and cycleways between Birmingham New Street and Moor Street stations (and Birmingham Curzon Street)
- Midland Metro expansion from Snow Hill to New Street.

#### Impact of forecast growth

The ITSS for 2043 indicates the need for an additional 10 trains per hour into Birmingham New Street in the off peak. Birmingham New Street is recognised as 'at capacity' in train paths terms in 2019, based on the current 12 platform provision and service structure.

The strategy in the Route Study identifies an option to re-route a number of services from Birmingham New Street to Birmingham Moor Street and Snow Hill. The impact on Birmingham New Street station will need to be assessed and passenger capacity at the station must be considered as part of the re-routing strategy.

Birmingham New Street station		
Footfall figures (p/a) Source: ORR National Data	13/14	32.0m
	2023*	47.7m
	2043*	68.5m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	15,859
	Alighting	27,170
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	27,652
	Alighting	14,448
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	There is the potential for congestion on platforms and on escalators in the future, particularly in times of special events.	

### Background

Birmingham Snow Hill station is in within the business district of central Birmingham and serves the long distance and regional urban commuter markets. Platform congestion is experienced during peak periods due to the width of the platforms being restricted by columns and buildings. Vertical circulation is constrained and can cause queuing following am peak arrivals.

Significant queuing is also experienced at the ticket gate lines following simultaneous am peak arrivals. This can lead to the gate line being opened fully to allow the volume of passengers to exit the station.

### Planned or recent works

#### Renewals

- Refurbishment to platform waiting rooms.

#### Enhancements

- Snow Hill Phase 1 scheme includes enhanced public realm (Local Growth Fund 2015-17)
- Midland Metro service extension through to Birmingham city centre (Birmingham New Street) from mid 2016.

### Impact of forecast growth

The ITSS for 2043 indicates the need for an additional 10 trains per hour into Birmingham New Street in the off peak. Birmingham New Street is recognised as ‘at capacity’ in 2019, based on the current 12 platforms provision and service structure.

The strategy highlights an option to re-open Platform 4 at Birmingham Snow Hill to heavy rail operation in order to accommodate forecast demand in capacity in the future.

#### Strategy and Choices for funders

The station has been identified as a high priority station for passenger capacity interventions. A third party scheme to regenerate the station is currently being developed, and funding streams are being sought to enhance the station area.

Bringing Platform 4 back into rail operation, is a choice for funders proposed in the Route Study to accommodate future demand. The enhancements being assessed in both the Route Study and third party proposal will provide a more comfortable passenger experience and additional space for the predicted growth in passenger numbers. Importantly, it will reduce safety risk at the key constrained areas and allow passengers to exit the station quickly and safely.

A GRIP 2 study is currently under away assessing the benefits and costs of increasing passenger capacity at Snow Hill station. The results of the GRIP 2 study will be reported in the Final Route Study document.

Birmingham Snow Hill station		
Footfall figures (p/a)  Source: ORR National Data	13/14	4.0m
	2023*	6.0m
	2043*	8.6m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,470
	Alighting	3,540
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	3,236
	Alighting	1,344
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	It is anticipated that congestion will increase at constrained areas of the station (in particular on platforms, vertical circulation and concourse) – with increased gate line queues and increased journey times through station. During 2014/15, a high level passenger capacity assessment was undertaken which identified the need to improve passenger capacity at a number of areas within the station.	





#### Strategy and Choices for funders

Due to significant investment at Coventry station (as part of the multi-funded Council led scheme), it is predicted that the current passenger capacity constraints will be alleviated. An assessment may be required by 2024, to monitor the impact of the enhancements at Coventry.

### Background

Coventry station is on the West Coast Main Line, serving long distance, regional urban and freight markets. It has 4 platforms and offers an interchange opportunity from the WCML to Nuneaton. Platform 1 is particularly busy during peak periods with commuters travelling in both directions to Wolverhampton and Birmingham New Street. Friday pm peak is identified as one of the busiest periods. Platforms 2 and 3 are also busy, particularly when passengers congregate at the bottom of the stairwell. The concourse area provides ticket machines, CIS screens and retail outlets - all located in one concentrated area. This can lead to queues spilling out from the concourse area onto the platforms, which has a knock-on effect in times of perturbation. Station staff operate a queuing system (based on a barrier grid) which helps reduce the length of queues.

### Planned or recent works

#### Enhancements

- NSIP scheme to improve existing facilities - installation of a Virgin Trains ticket gateline (2016)
- NUCKLE (phase 1 part 2) scheme - an additional bay platform for new shuttle services to Nuneaton (2016/17)
- Mutli-funded enhancement scheme (2019) – (Coventry City Council, LEP, ERDF) improving the station as follows:
  - new passenger footbridge with lifts and stairs, platform canopy extensions from the existing to the new footbridge, new passenger subway from the west at-grade car park to the new facilities
  - New station building on the current at-grade car park, a new MSCP on top of the new station building and improvements to the public realm.

### Impact of forecast growth

In the short term, the Study outlines the need for an efficient, balanced timetable on this corridor – making best use of the capacity for maximum benefit. By 2024, train lengthening will be required to accommodate demand on this route.

Coventry station		
Footfall figures (p/a) Source: ORR National Data	13/14	5.5m
	2023*	7.87 - 8.2m
	2043*	10.4 - 11.8m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	4,512
	Alighting	2,878
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	2,849
	Alighting	4,030
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	43-49%
	2013 - 2043	89-114%
2019 Service changes	NUCKLE (phase 1, part 2) – additional 1tph NUCKLE (phase 2) – additional 1tph	
Potential future capacity issues	An increase in passenger flows will mean platforms will become more crowded during peak times. The Virgin Trains gateline scheme has the potential to restrict flows within concourse.	





#### Strategy and Choices for funders

Based on a number of station capacity factors, Dudley Port has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

#### Background

Dudley Port station is on the Birmingham to Wolverhampton line, serving the commuter market to Birmingham, Walsall and Wolverhampton. There are a number of freight services that operate through this station.

The station consists of an island platform with a waiting shelter. The platforms are long but narrow in places. The staircase is also narrow - providing the only access point from platform level via a narrow corridor to the ticket office and car park. The waiting shelter and staircase are either side of each other on the platform and this limits capacity. Passengers cluster around the waiting shelter entrance and at the top of the staircase, extending queues and increasing journey time when boarding and alighting. This can cause performance issues on the line due to the dense concentration of passenger around these areas.

The busiest times at the station is in the am and pm peaks for services departing/arriving to/from Birmingham New Street. Station congestion is compounded in bad weather due to passengers congregating around the stairwell and waiting shelter. This increases the time taken by passengers to board/alight services.

#### Planned or recent works

##### Renewals

N/A

##### Enhancements

N/A

#### Impact of forecast growth

The ITSS for 2043 indicates the need for train lengthening on this corridor to accommodate demand in the future. This will involve the need to lengthen the platform at Dudley Port.

Dudley Port station		
Footfall figures (p/a) Source: ORR National Data	13/14	0.42m
	2023*	0.63m
	2043*	0.9m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	263
	Alighting	124
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	105
	Alighting	230
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes		
Potential future capacity issues	The staircase width is too narrow to accommodate peak time flows. The narrow platform island and staircase will become further crowded.	

Strategy and Choices for funders
Five Ways has been categorised as requiring further passenger capacity assessments by 2024.
An option for increasing the concourse space, widening the platform, access stairs and overbridge has been evaluated. These interventions would significantly ease congestion and reduce queuing during the busiest times, particularly at the existing gate line/ticket office.

Background

Five Ways station is on the Cross City South line and serves a large commuter market, south of Birmingham. It has experienced high passenger growth over recent years, following commercial developments along the Hagley Road corridor and residential developments in and around Park Central. The station has no car park with pedestrian access directly from the A4540 through a small foyer with a ticket office. This ticket office is elevated relative to the railway line and access to the two (narrow) platforms is via staircases (2m wide) and across an overbridge to Platform 1. Restricted ticket office space and narrow gate lines causes congestion in busy times. The busiest time at the station is weekday am peak arrivals between 0700-0900 hours and pm peak departures between 1700 and 1759 hours. The key capacity constraints in the am peak are the narrow staircase, footbridge and constrained location of the ticket office (resulting in funnelling of passengers alighting from services arriving on Platform 1).

Planned or recent works

Renewals  
N/A

Enhancements  
N/A

Impact of forecast growth

The Route Study proposes the re-routing of interurban services on the Cross City South route away from Birmingham New Street and into Birmingham Moor Street. There are no proposed changes to the local Cross City services which are operated at 10 minute intervals into Birmingham New Street, via Five Ways.

Interventions on the Cross City South route are required to meet demand into central Birmingham by 2043. These include track interventions between Barnt Green and Kings Norton.

Five Ways station		
Footfall figures (p/a)  Source: ORR National Data	13/14	1.5m
	2023*	2.2m
	2043*	3.2m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	649
	Alighting	551
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	470
	Alighting	588
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	No additional services up to 2019 but Longbridge terminating services will be extended through to the new station at Bromsgrove.	
Potential future capacity issues	The staircase and overbridge width is too narrow to process peak time flows. Concourse congestion and gate line queues worsen as passenger numbers increase.	

### Background

High Wycombe is on the Chiltern Main Line, serving the London commuter market and longer distance services to Birmingham Snow Hill. It is served by Chiltern Railways services and has three platforms. Due to the short distance between the gate line and Platform 1, the visibility of drivers to safely dispatch services is hampered by the number of passengers leaving the train. On Platform 3, most passengers arrive onto the same part of the platform to wait for services. Interchange times between Platforms 1 and 3, and Platform 1 and the car park are significant.

### Planned or recent works

#### Renewals

N/A

#### Enhancements

- HLOS capacity scheme including:
  - Platform lengthening scheme (9-car) completed in 2015
  - new footbridge (replacing the current subway) between platforms 1 and 3.

### Impact of forecast growth

The ITSS for 2043 indicates the need to train lengthen on this line in order to accommodate demand in the future. Platform extension works have recently been completed at High Wycombe and further platform lengthening is not required.

#### Strategy and Choices for funders

Based on a number of station capacity factors, High Wycombe has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

High Wycombe station		
Footfall figures (p/a)  Source: ORR National Data	13/14	2.7m
	2023*	3.3m
	2043*	3.9 - 4.8m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	2,440
	Alighting	417
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	658
	Alighting	1,831
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	22%
	2013 - 2043	44-76%
2019 Service changes	The East West Rail Phase 1 project (completed in 2015) introduced new journey opportunities for High Wycombe passengers. The current London Marylebone to Bicester North services have been extended across the new chord at Bicester, through to Oxford.	
Potential future capacity issues	Passenger journey times are increased by passengers queuing to alight/board services at Platform 3 and interchanging between Platforms 1 and 3.	

### Background

Leamington Spa supports the long distance market flows between the South and Manchester/the North East and forms a key component of the London Marylebone to West Midlands services. The station is situated on a busy freight route serving the Southampton to West Coast Main Line markets. Part of the route between Coventry and Leamington Spa is single track, which constrains capacity over the route.

High footfall figures at Leamington Spa station (2.4 million pa) and significant interchange numbers are experienced for services to Coventry, Birmingham, Oxford, South West and London. The station has a single entry/exit point which can become busy at peak times.

### Planned or recent works

#### Renewals

N/A

#### Enhancements

- NUCKLE phase 1 (part 2)
- NSIP including new passenger waiting room on platform level
- new station at Kenilworth.

### Impact of forecast growth

Increased footfall is expected with the introduction of a new service to/from Kenilworth in 2017/18. Additional flexibility at the station will be required in the future to accommodate demand going forward – particularly access to Platform 1.

#### Strategy and Choices for funders

Based on a number of station capacity factors, Leamington Spa has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

Leamington Spa station		
Footfall figures (p/a) Source: ORR National Data	13/14	2.4m
	2023*	3.6m
	2043*	5.1m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,752
	Alighting	883
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	903
	Alighting	1,445
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	The new station at Kenilworth (being delivered in 2017/18) will introduce one additional train per hour between Coventry and Leamington. Spa.	
Potential future capacity issues	Increased footfall could lead to queuing through single entrance point during peak times.	



### Background

London Marylebone is a busy terminal station in central London, with six platforms and an interchange facility to the London Underground.

The am peak sees passenger queues through the main gate lines from all platforms, meaning passenger journeys are delayed. Queuing space at the London Underground gate line is at capacity and is insufficient to accommodate interchanging passenger volumes during peak times, which causes further congestion and delays on the concourse. Congestion is also experienced on the concourse due to high passenger flows in the am peak, exacerbated when passengers contraflow between arrivals and departures at a number of platforms at the station.

### Planned or recent works

#### Renewals

N/A

#### Enhancements

- By 2024, a potential secondary entrance (at the country end of the platform) as part of a proposed residential development.

### Impact of forecast growth

It is recognised that London Marylebone is near to full capacity currently and will be at capacity by 2024. Based on forecast demand, services on this route will need to be train lengthened by 2024.

By 2043, capacity will need to be increased to support the ITSS and elements of four-tracking may be required on the corridor. There is potential for the corridor to link services into the Old Oak Common development area, in order to relieve congestion at London Marylebone.

#### Strategy and Choices for funders

London Marylebone has been identified as a high priority station for passenger capacity interventions. The Route Study presents a package of options to decongest and reduce safety risk across the station:

- main gate line extension and reconfiguration
- re-location of concourse facilities.

These interventions will bring safety benefits by decongesting the barrier lines and at the train/platform interface, reducing the safety risk. They will provide an overall enhanced passenger experience by reduced walk times and queuing.

A business case appraisal has been undertaken which indicates a financially positive value for money assessment. Funding will be sought for further development of potential interventions in the next planning cycle.

London Marylebone station		
Footfall figures (p/a) Source: ORR National Data	13/14	14.0m
	2023*	17.0m
	2043*	20.2 - 24.6m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,335
	Alighting	15,274
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	13,515
	Alighting	2,394
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	22%
	2013 - 2043	44-76%
2019 Service changes	A new service has recently been introduced - Oxford to London Marylebone (two trains an hour) which is an extension of existing services via Oxford Parkway station and the new Bicester chord.	
Potential future capacity issues	In future, increased congestion may be experienced at the gate line and increased delays for alighting passengers leaving platforms. Increased queuing at the London Underground gate line and further delays for interchanging passengers may also be experienced. Further congestion is also envisaged on the concourse at London Marylebone.	



### Background

Selly Oak has seen significant passenger growth over recent years due to the car park extension works, and the growth of student accommodation in the vicinity of the station.

The busiest times are experienced predominantly in the morning peak with passengers commuting into Birmingham and alighting in the evening, which causes crowding affecting the staircase and overbridge. Passengers tend to congregate around the ticket office entrance leading to some congested areas. Secondary access direct from Platform 2 into the car park (on Heeley Road) disperses alighting passengers more effectively.

Selly Oak also experiences high volumes at weekends due to the convenient park and ride opportunities into Birmingham city centre.

### Planned or recent works

#### Renewals

N/A

#### Enhancements

N/A

### Impact of forecast growth

Interventions on the Cross City South route are required to meet demand into Central Birmingham by 2043.

Central Birmingham 2026 choices for funders include (between Kings Norton – Barnt Green) Kings Norton centre platforms reinstatement (including electrification through platform 2), an option for turnback platform for local services and an assessment of Kings Norton station requirements (footbridge).

#### Strategy and Choices for funders

Selly Oak station has been categorised as requiring further passenger capacity assessments by 2024.

An option for widening the platforms and provision of continuous weatherproof shelter along the platforms has been evaluated. A new entrance to Platform 1 and provision of an additional footbridge would significantly ease congestion and reduce queuing during the busiest times.

Selly oak station		
Footfall figures (p/a)  Source: ORR National Data	13/14	2.4m
	2023*	3.6m
	2043*	5.1m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,045
	Alighting	585
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	495
	Alighting	951
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	No additional services to 2019 but Longbridge terminating services will be extended through to the new station at Bromsgrove.	
Potential future capacity issues	The staircase and overbridge width during peak times. Concourse space and revenue protection gate line capacity (if installed).	

# Appendix 6 - Passenger capacity at stations

## Smethwick Galton Bridge

### Birmingham to Stafford/Shrewsbury via Wolverhampton



Strategy and Choices for funders

Based on a number of station capacity factors, Smethwick Galton Bridge has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

#### Background

Smethwick Galton Bridge is an interchange station located on the Birmingham Snow Hill line (for services to Stourbridge Junction) and Birmingham New Street to Wolverhampton line (for local services to Wolverhampton and Shrewsbury). It has four platforms on two levels, supported by lifts, stairs and an overbridge. There are no major congestion issues identified but way-finding and interchange routeing is sometimes difficult for passengers due to the layout being spread over multiple levels. Transit time between platforms can be affected by passengers being unclear where to go.

#### Planned or recent works

Renewals

N/A

Enhancements

N/A

#### Impact of forecast growth

The ITSS for 2043 indicates the need to train lengthen on this line, in order to accommodate forecast growth.

Smethwick Galton Bridge station		
<div>Footfall figures (p/a)</div> <div>Source: ORR National Data</div>	13/14	0.99m
	2023*	1.5m
	2043*	2.1m
<div>am Passenger flows</div> <div>Source: MOIRA</div>	Total peak	3 hours (07:00 - 10:00)
	Boarding	980
	Alighting	874
<div>pm Passenger flows</div> <div>Source: MOIRA</div>	Total peak	3 hours (16:00 - 19:00)
	Boarding	905
	Alighting	1,022
<div>Market Study</div>	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	None	

### Background

Solihull station serves a busy commuter market into Birmingham and long distance travel into London Marylebone. The station has two platforms on an island design.

High passenger volumes wait on the single platform island, predominantly during the am peak. The island platform island is also narrow in places and waiting areas are limited adjacent to the platform buildings. The stairwell and subway are narrow and dark in places.

There are concerns in the am peak with platform-train interface issues due to the narrow platforms and with passengers queueing close to the platform edge as services pass through the station.

### Planned or recent works

#### Renewals

N/A

#### Enhancements

- NSIP funding being prioritised – potential to improve facilities on platforms
- Potential third-party funding for station enhancements.

### Impact of forecast growth

Based on forecast growth, services on this route will need to be train lengthened by 2024, although platform lengthening will not be required. As the station has fast links to Birmingham, it is anticipated that passenger numbers will increase due to Moor Street's close proximity and connections to the new HS2 Curzon Street station.

By 2043, a similar quantum of trains is envisaged as to today's timetable.

Solihull station		
Footfall figures (p/a)  Source: ORR National Data	13/14	1.69m
	2023*	2.5m
	2043*	3.6m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,544
	Alighting	751
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	739
	Alighting	1,486
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	Increased platform congestion as demand grows, with more passengers waiting within the same area of the platform. The station offers fast services into Birmingham Moor Street, which is seen to be an even more attractive flow in future with connecting to HS2 Curzon Street services close to Moor Street.	

#### Strategy and Choices for funders

Solihull station has been categorised as requiring further passenger capacity assessments by 2024.

An option for re-locating stop boards on the platforms has been evaluated, which will encourage passengers to spread along the platforms more evenly. Shelter extensions along the length of the platforms has also been assessed, which will decongest constrained areas of the station and platform.

## Appendix 6 - Passenger capacity at stations

### Tamworth

Birmingham to Nottingham/Leicester

August 2017

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#### Strategy and Choices for funders

Tamworth station has been categorised as requiring further passenger capacity assessments by 2024.

Options to increase high level platform access (either widening staircases or provision of additional access to/from platforms) and provision of a potential new entry/exit access to the station has been evaluated. These interventions would decongest the station, alleviating overcrowding on the stairwells and station exit during the evening peak.

#### Background

Tamworth station is located on the Birmingham to Derby line and is split over two levels (high and low). The station has four platforms, two on the high level (serving the West Midlands local services) and two on the low level (serving the West Coast Main Line - regional urban and long distance services).

Tamworth provides good interchange opportunities and connectivity to long distance and commuter markets, particularly between the East and West Midlands and from the North to the South West.

Stair widths on all platforms are narrow - causing congestion during peak times (particularly on Platform 3), during evening peak arrivals from Birmingham. Passengers alighting from Birmingham services (in surges) makes it difficult for contra-flowing passengers. Simultaneous train arrivals at high and low levels of the station can cause congestion, as a funnelling effect and queuing builds up when passengers leave through the only exit of the station.

#### Planned or recent works

##### Renewals

- CP4 NSIP, CP5 CCTV refurbishment, additional ticket machine at entrance and new café within main entrance.

##### Enhancements

N/A

#### Impact of forecast growth

Increased queuing and congestion will occur as passenger numbers rise in future, impacting on journey times through the station (particularly for alighting passengers in the evening peak).

Infrastructure interventions are required on the Water Orton corridor to meet forecast growth to 2026 and 2043 and to support East - West connectivity conditional outputs.

Tamworth station		
Footfall figures (p/a) Source: ORR National Data	13/14	1.4m
	2023*	2.1m
	2043*	3.0m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	855
	Alighting	463
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	467
	Alighting	800
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	Increased queuing and congestion on platforms and staircases, as passenger numbers increase. Increased journey times through the station, particularly for alighting passengers in the pm peak.	



## Background

University is located close to Birmingham and is on the busy Cross City South route. The station has seen significant passenger growth in recent years, primarily relating to travel to Birmingham University and Queen Elizabeth Hospital. The busiest times are in the am peak (between 0800-0900 hours) and the pm peak (between 1600-1800 hours).

Alighting flows from a high frequency service are restricted by the width of the platforms, staircases and the overbridge, and the fact there is only one exit to the station. The ticket hall is constrained and has a narrow gate line width which causes queuing outside the station. The restricted space on Platform 1, leads to heavy congestion of dwelling passengers during the pm peak.

## Planned or recent works

### Renewals

N/A

### Enhancements

- NSIP
- Local Growth Fund 2015-17.

## Impact of forecast growth

Current platform access (staircases and overbridge) is insufficient to deal with additional passenger growth. Congestion and queuing is likely following train arrivals and contra-flow will become more difficult. Passenger journey times will increase through the station.

### Strategy and Choices for funders

University has been identified as a high priority station for passenger capacity interventions. The Route Study presents a package of options to decongest and reduce safety risk across the station:

- widening of Platform 2
- extension of weatherproof shelter on Platform 1
- gate line extension
- wider footbridge and potential new station building.

These interventions will bring safety benefits by decongesting the train-platform interface, stairwells and footbridge - reducing the safety risk across the station. They will provide an overall enhanced passenger experience by reduced walk times and queuing.

A business case appraisal has been undertaken which indicates a challenge to achieve a value for money assessment due to high capital costs of the interventions. An industry wide Working Group is further developing options to increase capacity for current and future growth.

Birmingham City Council are leading on a masterplan for the area surrounding the station, which may include options to relocate the station.

University station		
Footfall figures (p/a) Source: ORR National Data	13/14	2.85m
	2023*	4.3m
	2043*	6.1m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	1,665
	Alighting	1,153
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	1,043
	Alighting	1,531
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	No additional services to 2019 but Longbridge terminating services will be extended through to Bromsgrove.	
Potential future capacity issues	Platform width, staircases and overbridge is insufficient to deal with additional passenger growth. Congestion and queuing is likely following train arrivals and contra-flow will become more difficult. Passenger journey times will increase through the station.	





#### Strategy and Choices for funders

Based on a number of station capacity factors, Walsall has been categorised as a station which needs to remain on the shortlist and be monitored/reviewed during the next planning cycle (with potential interventions required in the longer term).

#### Background

Walsall is a busy station on the Cannock Line. It serves the regional urban market into Rugeley Trent Valley and Birmingham New Street and consists of 3 platforms. Platforms 2 and 3 form two faces of a central island, with a pedestrian access ramp and staircase to the ticket office (located in the shopping centre above). Platform 1 is on the western side, with access via a separate entrance. It is recognised that the busiest flows occur during the am and pm peaks as passengers board and alight services to/from Birmingham on Platforms 2 and 3. Passengers congregate around the waiting room at the bottom of the main access ramp, causing congestion.

Starting/terminating services to Birmingham are the busiest services providing greater capacity (electric services) rather than the diesel services operating to Rugeley Trent Valley.

#### Planned or recent works

##### Renewals

- The Cannock Line has recently been resigalled and will be electrified by 2019.

##### Enhancements

- An additional hourly service (in the off peak) and journey time improvements are being proposed, also by 2019.

#### Impact of forecast growth

The proposed additional services will spread passenger loadings more evenly on the route (picking up passengers that currently originate and terminate at Walsall).

Walsall station		
Footfall figures (p/a) Source: ORR National Data	13/14	1.29m
	2023*	1.9m
	2043*	2.8m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	868
	Alighting	454
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	425
	Alighting	785
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	49%
	2013 - 2043	114%
2019 Service changes	The introduction of electrification and new rolling stock on the line, may provide an opportunity for extending certain services in the off peak to Rugeley Trent Valley.	
Potential future capacity issues	By 2019, plans to increase rolling stock capacity on Rugeley Trent Valley services will help to relieve passenger congestion in the peak times.	

## Appendix 6 - Passenger capacity at stations

### Wolverhampton

Birmingham to Stafford/Shrewsbury via Wolverhampton

August 2017

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#### Strategy and Choices for funders

Due to the significant investment planned at Wolverhampton station (as part of the LEP-funded scheme), it is predicted that the current passenger capacity constraints will be alleviated. An assessment may be required by 2024, to monitor the impact of the enhancements at Wolverhampton.

#### Background

Wolverhampton is on the West Coast Main Line, serving the long distance, regional urban and freight markets. It has six platforms and offers an interchange opportunity from the WCML to Shrewsbury and North Wales. Platforms 2, 3 and 4 are particularly busy during am peak periods, with commuter flows to Birmingham New Street, Stafford and London Euston.

Platforms 1 and 2 are the busiest parts of the station in the pm peak. The entrance/concourse area is quite narrow and restricted, with ticket sales, CIS screens and retail outlets all located in one concentrated area. Passengers can congregate and spill out onto the platforms in times of disruption, which presents a capacity issue particularly in the peaks. Station staff do operate a queuing system (based on a barrier grid) which reduces the length of the queue.

#### Planned or recent works

##### Renewals

N/A

##### Enhancements

- Centro are developing a LEP-funded project to transform Wolverhampton station, this will involve:
  - demolishing the old station and building a new, much larger station building
  - provision of a much larger concourse
  - extension of the current tram system to the station
  - expansion of the existing car parking facility
  - provision of TOC and British Transport Police accommodation, retail opportunities and automatic ticket gates.

#### Impact of forecast growth

Demand analysis indicates that Wolverhampton – Birmingham New Street – Walsall services will need to be train lengthened by 2024. This will involve platform lengthening at Platform 5.

By 2043, a number of capability constraints will need addressing, including the reduction of headways between Galton Bridge and Wolverhampton. This may be achieved through improved signalling technologies or additional infrastructure.

Wolverhampton station		
Footfall figures (p/a) Source: ORR National Data	13/14	4.75m
	2023*	6.8 - 7.1m
	2043*	9.0 - 10.2m
am Passenger flows Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	4,068
	Alighting	2,844
pm Passenger flows Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	2,708
	Alighting	3,663
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	43-49%
	2013 - 2043	89-114%
2019 Service changes	None	
Potential future capacity issues	An increase in passenger flows will mean platforms will become more crowded during peak times and the tram extension has the potential to increase interchange flows through the station. Introduction of automatic ticket gates (as part of the station scheme) has the potential to restrict flows within concourse at peak times.	

Strategy and Choices for funders
Worcester Foregate Street station has been categorised as requiring further passenger capacity assessments by 2024.
Options to decongest the station and allow passengers to exit the station quicker have been evaluated. These include interventions to widen the staircases and/or to provide secondary access points.

### Background

Worcester Foregate Street is situated close to Worcester town centre and serves the regional urban market to Birmingham and Hereford. It also offers a number of long distance services to London Paddington. The station has two platforms which are narrow in places and are accessed via a stairway (or lift) from the ticket office at street level.

The busiest times coincide with school traffic arriving (broadly 07.30 – 08.30 hours) in the am peak, where congestion is caused when passengers alighting onto Platform 2 are having to descend a narrow single staircase to exit the station. The platform can take 2.5 - 3.0 minutes to clear and passengers queue close to the platform edge. Boarding passengers face difficulties ascending the stairs and getting onto the platform for their service. The busiest area of the station (and the cause of the congestion problems) relates to the stairway access to both platforms. Other than the lifts, this represents the only access to and from platform level.

### Planned or recent works

#### Renewals

- NSIP improvements to the ticket hall area in CP4 (2009-2014).

#### Enhancements

- Resignalling proposed in 2023 (CP6), Norton Junction track layout changes (CP6).

### Impact of forecast growth

Increased congestion on platforms and staircases will create further journey time disbenefits and difficulty for contra-flowing passengers.

Opportunities will be taken to align enhancements with planned renewals, by 2024 (where an industry business case can be proven).

Worcester Foregate Street station		
Footfall figures (p/a)  Source: ORR National Data	13/14	2.0m
	2023*	3.0m
	2043*	4.3m
am Passenger flows  Source: MOIRA	Total peak	3 hours (07:00 - 10:00)
	Boarding	635
	Alighting	761
pm Passenger flows  Source: MOIRA	Total peak	3 hours (16:00 - 19:00)
	Boarding	927
	Alighting	611
Market Study	Based on the Regional Urban Market Study	
	2013 - 2023	495
	2013 - 2043	114%
2019 Service changes	None	
Potential future capacity issues	Increased congestion on platforms and staircases will create further journey time disbenefits through the station and provide further difficulty for contra-flowing passengers.	

# Appendix 7

## Business Case Analysis

The choices identified have been categorised from a financial and socioeconomic perspective.

In the context of the financial perspective, medium term choices have been categorised into those that: (a) worsen the rail industry's net operating position (in other words, the additional operating costs exceed the value of revenue generated); or

(b) choices which improve the industry's net operating position. For these schemes, the Route Study also indicates the extent to which this improvement is able to cover the capital cost of the initial investment.

The choices have also been appraised from a wider 'socioeconomic' perspective, which compares the value of benefits to users and non-users to the net financial cost to funders. The appraisals have been conducted in line with funders' guidelines, in particular WebTAG; the Department for Transport's appraisal guidelines.

Anticipated final costs (AFCs) have been displayed as ranges to reflect that the estimates produced through engineering feasibility assessments are pre: GRIP (Governance for Railway Investment Projects). If the option is progressed into GRIP, a more defined AFC will emerge.

Fixed bands have been used to express potential cost ranges. For example, if an option currently has an estimated price of £71m, it will currently be listed as £50m - £100m. Whilst this means that some options will have their 'potential' price significantly over or under stated against the current estimate, it is felt this wide range approach is most appropriate at this early stage of development.

Assessment of Option S1A – Train lengthening on the Rugby corridor via Coventry and Stafford/Shrewsbury corridor via Wolverhampton (10 additional vehicles option)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Rugby corridor via Coventry and Stafford/Shrewsbury corridor via Wolverhampton into Birmingham New Street.
Description	Capacity analysis reveals ten additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving into Birmingham New Street in the high peak period.
Infrastructure required	No infrastructure required.
Operational requirement	Services arriving in the high peak period are lengthened to four, five and six-car. Selective Door Opening (SDO) will be in operation for stations with short platforms. Additional vehicles are assumed to make between five and twelve trips a day depending on the rolling stock diagram.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S1B & S1C
Socio-economic Value for money categorisation	Low
	BCR = 1.2
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 2.5 (Assuming 2015 operating costs)
Note	Assumes SDO across the route to avoid infrastructure interventions. The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood. Results are based on a 30 year appraisal.

Option S1A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG Vfm category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		



Option S1A: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	26.84
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	6.10
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-3.53
<b>sub-total (a)</b>	<b>29.41</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.02
Revenue transfer*	-18.29
NR operating costs and TOC operating costs transfer**	43.29
<b>sub-total (b)</b>	<b>24.98</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>4.42</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.18</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	18.29
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	43.29

Assessment of Option S1B – Train lengthening for the Stafford/Shrewsbury corridor via Wolverhampton (8 additional vehicles)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Stafford/Shrewsbury corridor via Wolverhampton into Birmingham New Street.
Description	Capacity analysis reveals eight additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving into Birmingham New Street.
Infrastructure required	Platform lengthening to 6-car at: Albrighton, Bilbrook and Codsall Platform lengthening to 5-car at: Penkridge, Wolverhampton and Dudley Port AFC: £15M-35M
Operational requirement	Services arriving in the high peak period are lengthened to five and six-car. SDO will only be required on some of the Shrewsbury line stations under this option. Additional vehicles are assumed to make between five and twelve trips a day depending on the rolling stock diagram.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S1A & S1C
Socio-economic Value for money categorisation	Poor
	BCR = 0.9
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Low
	BCR = 1.3 (Assuming 2015 operating costs)
Note	Assumes SDO across the route to avoid infrastructure interventions. The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood. Results are based on a 60 year appraisal.

Option S1B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG Vfm category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Poor
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S1B: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	36.93
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	6.07
Rail user and non user disruption disbenefits during possessions	-1.17
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-3.13
<b>sub-total (a)</b>	<b>38.69</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	15.60
Non user benefits - road infrastructure cost changes	-0.02
Revenue transfer*	-17.24
NR operating costs and TOC operating costs transfer**	43.42
<b>sub-total (b)</b>	<b>41.76</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-3.06</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.93</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	-1.68
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	17.24
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	43.42

Assessment of Option S1C – Train lengthening for the Stafford/Shrewsbury corridor via Wolverhampton (6 additional vehicles)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Stafford/Shrewsbury corridor via Wolverhampton into Birmingham New Street.
Description	Six additional vehicles arriving into Birmingham New Street from the Stafford/Shrewsbury corridor via Wolverhampton have been identified for lengthening with a value for money categorisation at
Infrastructure required	Platform lengthening to 5-car at: Penkridge, Bilbrook and Codsall
	AFC: £5-15M
Operational requirement	Services arriving in the high peak period are lengthened to four and five-car. SDO will only be required on some of the Shrewsbury line stations under this option. Additional vehicles are assumed to make between five and twelve trips a day, depending on the rolling stock diagram.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S1A & S1B
Socio-economic Value for money categorisation	Low
	BCR = 1.2
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Medium
	BCR = 1.8 (Assuming 2015 operating costs)
Note	Assumes SDO on the Shrewsbury line to avoid further infrastructure inventions. The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood. Results are based on a 60 year appraisal.



Option S1C: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S1C: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	29.84
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	4.91
Rail user and non user disruption disbenefits during possessions	-0.53
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-2.54
<b>sub-total (a)</b>	<b>31.69</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	6.98
Non user benefits - road infrastructure cost changes	-0.02
Revenue transfer*	-13.98
NR operating costs and TOC operating costs transfer**	34.22
<b>sub-total (b)</b>	<b>27.20</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>4.49</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.17</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>-2.90</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	13.98
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	34.22

Assessment of Option S2A – Train lengthening for the Cross City (10 additional vehicles option)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Cross City service group into Birmingham New Street from both directions.
Description	Capacity analysis reveals ten additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving into Birmingham New Street in the peak periods.
Infrastructure required	No infrastructure required.
Operational requirement	Services arriving in the high peak period are lengthened from three to four and five-car. Additional vehicles are assumed to make 12 trips a day.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S2B
Socio-economic Value for money categorisation	Low
	BCR = 1.2
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 2.3 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.

Option S2A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG Vfm category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S2A: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	24.82
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	3.52
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-2.59
<b>sub-total (a)</b>	<b>25.75</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-12.96
NR operating costs and TOC operating costs transfer**	33.71
<b>sub-total (b)</b>	<b>20.74</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>5.02</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.24</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	12.96
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	33.71

Assessment of Option S2B – Train lengthening for the Cross City (six additional vehicles option)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Cross City service group into Birmingham New Street from both directions.
Description	Six services arriving into Birmingham New Street from the Cross City service group have been identified for lengthening by one vehicle each with a high value for money categorisation.
Infrastructure required	No infrastructure required.
Operational requirement	Services arriving in the high peak period are lengthened from three to four and five-car. Additional vehicles are assumed to make 12 trips a day.
Passenger impact	Provides additional capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S2A
Socio-economic Value for money categorisation	Medium
	BCR = 1.5
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 3.0 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.



Option S2B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Medium
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S2B: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	16.41
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	2.30
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-1.69
<b>sub-total (a)</b>	<b>17.01</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-8.47
NR operating costs and TOC operating costs transfer**	19.77
<b>sub-total (b)</b>	<b>11.29</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>5.72</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.51</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	8.47
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	19.77

Assessment of Option S3A – Train lengthening for the Snow Hill service group (13 additional vehicles option)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Snow Hill service group into Birmingham Snow Hill from both directions.
Description	Capacity analysis reveals 13 additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving into Birmingham Snow Hill and Moor Street in the high peak period.
Infrastructure required	No infrastructure required.
Operational requirement	Services arriving in the high peak period are lengthened from three to four and five-car. Additional vehicles are assumed to make eight trips a day.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S3B
Socio-economic Value for money categorisation	Medium
	BCR = 1.5
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 2.7 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.

Option S3A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG Vfm category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Medium
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S3A: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	59.16
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	9.93
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-4.92
<b>sub-total (a)</b>	<b>64.17</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-25.41
NR operating costs and TOC operating costs transfer**	67.84
<b>sub-total (b)</b>	<b>42.39</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>21.78</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.51</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	25.41
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	67.84

Assessment of Option S3B – Train lengthening for the Snow Hill service group (8 additional vehicles option)	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Snow Hill service group into Birmingham Snow Hill from both directions.
Description	Six services from the Snow Hill service group have been identified for lengthening with a high value for money categorisation.
Infrastructure required	No infrastructure required.
Operational requirement	Services arriving in the high peak period are lengthened from three to four and five-car. Additional vehicles are assumed to make eight trips a day.
Passenger impact	Provides additional capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S3A
Socio-economic Value for money categorisation	High
	BCR = 2.9
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Very high
	BCR = 6.7 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.



Option S3B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	High
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S3B: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	42.16
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	6.56
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-3.26
<b>sub-total (a)</b>	<b>45.46</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.02
Revenue transfer*	-16.85
NR operating costs and TOC operating costs transfer**	32.79
<b>sub-total (b)</b>	<b>15.91</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>29.56</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>2.86</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	16.85
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	32.79

Assessment of Option S4 – Train lengthening for the Mainline (fast ) service group (eight additional vehicles option)	
Conditional Output	CO6 (2024) - Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London Marylebone during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Mainline (fast) service group into London Marylebone.
Description	This option tests the value for money case for the 'Do Minimum' option of providing eight additional vehicles arrivals in to provide capacity for passengers arriving at London Marylebone in the high peak
Infrastructure required	Platform lengthening at Seer Green and Gerrards Cross.
	AFC: £1-10M
Operational requirement	Services are lengthened to their maximum length of seven and nine-car. Additional vehicles are assumed to make eight trips a day.
Passenger impact	Provides additional capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	See London Marylebone station platform lengthening and new services to Old Oak Common options
Socio-economic Value for money categorisation	Low
	BCR = 1.1
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 2.9 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.

Option S4: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S4: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	20.42
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	5.66
Rail user and non user disruption disbenefits during possessions	-0.45
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>25.63</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	5.93
Non user benefits - road infrastructure cost changes	-0.03
Revenue transfer*	-33.06
NR operating costs and TOC operating costs transfer**	50.12
<b>sub-total (b)</b>	<b>22.96</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>2.67</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.12</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>-2.88</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	33.06
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	50.12

Assessment of Option S5A – Train lengthening for the Mainline (Semi-fast ) service group (four additional vehicles option)	
Conditional Output	CO6 (2024) - Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London Marylebone during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Mainline (Semi-fast) service group into London Marylebone.
Description	Capacity analysis reveals four additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving at London Marylebone in the high peak period.
Infrastructure required	No infrastructure required.
Operational requirement	Three and four-car services to be lengthened to four and five-car. Additional vehicles are assumed to make eight trips a day.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S5B
Socio-economic Value for money categorisation	Poor
	BCR = 0.7
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Low
	BCR = 1.3 (Assuming 2015 operating costs)
Note	Rolling stock type changes and additional vehicles are to be deployed in 2019 to provide additional capacity. As lengthening is already planned for CP5 it reduces the requirement for lengthening in 2024.



Option 55A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Poor
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option 55A: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	7.03
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	0.95
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>7.98</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-6.31
NR operating costs and TOC operating costs transfer**	17.55
<b>sub-total (b)</b>	<b>11.23</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-3.25</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.71</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	6.31
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	17.55

Assessment of Option S5B – Train lengthening for the Mainline (Semi-fast ) service group (two additional vehicles option)	
Conditional Output	CO6 (2024) - Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London Marylebone during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Mainline (Semi-fast) service group into London Marylebone.
Description	Two services arriving into London Marylebone from the Mainline service group have been identified for lengthening with a value for money categorisation at medium or higher.
Infrastructure required	No infrastructure required.
Operational requirement	A three and four-car service to be lengthened to four and five-car. Additional vehicles are assumed to make eight trips a day.
Passenger impact	Provides additional capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S5A
Socio-economic Value for money categorisation	Low
	BCR = 1.1
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	High
	BCR = 2.1 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.

Option S5B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S5B: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	4.37
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	0.58
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>4.95</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	0.00
Revenue transfer*	-3.88
NR operating costs and TOC operating costs transfer**	8.58
<b>sub-total (b)</b>	<b>4.70</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>0.25</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.05</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	NA
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	3.88
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	8.58

Assessment of Option S6 – Train lengthening for the Aylesbury service group (three additional vehicles option)	
Conditional Output	CO6 (2024) - Consistent with the longer term strategy identified to meet CO2, to provide sufficient capacity for passengers travelling into central London Marylebone during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Aylesbury service group into London Marylebone.
Description	Capacity analysis reveals three additional vehicles are required by 2024 to provide sufficient total capacity for passengers arriving at London Marylebone in the high peak period.
Infrastructure required	No infrastructure required.
Operational requirement	Three out of the four services arriving in the high peak period are lengthened from five to six-car. Additional vehicles are assumed to make eight trips a day. Calling patterns at Rickmansworth station will have to be altered to avoid an infrastructure intervention to make the station 6-car capable.
Passenger impact	Provides sufficient total capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	None
Socio-economic Value for money categorisation	Low
	BCR = 1.0
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Medium
	BCR = 1.8 (Assuming 2015 operating costs)
Note	The sensitivity test assuming 2015 operating costs would be more appropriate in this case as operating costs for lengthening on this route are well understood.



Option S6: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S6: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	8.34
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	1.24
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>9.59</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-5.34
NR operating costs and TOC operating costs transfer**	15.02
<b>sub-total (b)</b>	<b>9.67</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-0.09</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.99</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	5.34
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	15.02

Assessment of Option S7A – Train lengthening for Plymouth to Edinburgh/Glasgow Central services (additional 18 vehicle option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Plymouth to Edinburgh and Glasgow Central long distance services.
Description	Capacity analysis reveals 18 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Plymouth to Edinburgh and Glasgow Central.
Infrastructure required	No infrastructure required.
Operational requirement	18 additional vehicles to lengthen services. Most four and five-car sets to be lengthened to five or six-cars with one service requiring seven-cars.
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S7B
Socio-economic Value for money categorisation	Low/Medium
	BCR = 1.5
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None

Option S7A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG Vfm category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low/Medium
Scheme decreases operating subsidies (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S7A: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	49.14
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	13.14
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-10.82
<b>sub-total (a)</b>	<b>51.46</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.09
Revenue transfer*	-55.52
NR operating costs and TOC operating costs transfer**	90.91
<b>sub-total (b)</b>	<b>35.30</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>16.16</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.46</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	55.52
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	90.91

Assessment of Option S7B – Train lengthening for Plymouth to Edinburgh/Glasgow Central services (additional eight vehicle option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Plymouth to Edinburgh and Glasgow Central long distance services.
Description	Only those additional vehicles with a medium, high or very high value for money business case are included. This option will not fully meet the crowding standards.
Infrastructure required	No infrastructure required.
Operational requirement	Eight additional vehicles to lengthen some services from four and five-cars to five or six-cars.
Passenger impact	Provides sufficient seated capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S7A
Socio-economic Value for money categorisation	Very high
	BCR = 10.1
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	<p>These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033.</p> <p>The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.</p>



Option S7B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Very high
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S7B: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	31.69
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	9.30
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-7.65
<b>sub-total (a)</b>	<b>33.33</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.06
Revenue transfer*	-36.04
NR operating costs and TOC operating costs transfer**	39.22
<b>sub-total (b)</b>	<b>3.12</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>30.21</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>10.68</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	NA
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	36.04
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	39.22

Assessment of Option S8A – Train lengthening for Southampton/Reading to Newcastle services (additional 15 vehicle option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Southampton/Reading to Newcastle long distance services.
Description	Capacity analysis reveals 15 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Southampton/Reading to Newcastle. The crowding is not focussed on any single area, but occurs at a variety of locations along the route.
Infrastructure required	No infrastructure required.
Operational requirement	15 additional vehicles to lengthen services. Most four-car sets to be lengthened to five-cars with a few being lengthened to six-cars
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S8B
Socio-economic Value for money categorisation	Poor
	BCR = 0.6
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None

Option S8A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Poor
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S8A: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	22.66
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	6.23
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-4.60
<b>sub-total (a)</b>	<b>24.29</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-26.28
NR operating costs and TOC operating costs transfer**	66.62
<b>sub-total (b)</b>	<b>40.30</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-16.01</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.60</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	NA
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	26.28
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	66.62

Assessment of Option S8B – Train lengthening for Southampton/Reading to Newcastle services (additional four vehicle option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Southampton/Reading to Newcastle long distance services.
Description	Only those additional vehicles with a medium, high or very high value for money business case are included. This option will not fully meet the crowding standards.
Infrastructure required	No infrastructure required.
Operational requirement	Four additional vehicles to lengthen services. Four-car sets to be lengthened to five-cars in each case
Passenger impact	Provides sufficient seated capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S8A
Socio-economic Value for money categorisation	Medium
	BCR = 1.7
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033. The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.



Option S8B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Medium
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S8B: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	9.03
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	2.91
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-2.17
<b>sub-total (a)</b>	<b>9.76</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.02
Revenue transfer*	-10.58
NR operating costs and TOC operating costs transfer**	16.31
<b>sub-total (b)</b>	<b>5.71</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>4.05</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.71</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	10.58
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	16.31

Assessment of Option S9A – Train lengthening for Bournemouth to Manchester Piccadilly services (17 additional vehicles option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Bournemouth to Manchester Piccadilly long distance services.
Description	Capacity analysis reveals 17 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Bournemouth to Manchester Piccadilly. The crowding is not focussed on any single area, but occurs at a variety of locations along the route.
Infrastructure required	No infrastructure required.
Operational requirement	17 additional vehicles to lengthen services. All four and five-car sets lengthened to six-car, with a few being lengthened to eight-car.
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S9B
Socio-economic Value for money categorisation	Low
	BCR = 1.4
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	<p>These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033.</p> <p>The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.</p>

Option S9A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S9A: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	32.26
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	13.58
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-11.74
<b>sub-total (a)</b>	<b>34.10</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.06
Revenue transfer*	-49.71
NR operating costs and TOC operating costs transfer**	74.32
<b>sub-total (b)</b>	<b>24.55</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>9.54</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.39</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	49.71
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	74.32

Assessment of Option S9B – Train lengthening for Bournemouth to Manchester Piccadilly services (12 additional vehicles option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Bournemouth to Manchester Piccadilly long distance services.
Description	Only those additional vehicles with a medium, high or very high value for money business case are included. This option will not fully meet the crowding standards.
Infrastructure required	No infrastructure required.
Operational requirement	12 additional vehicles to lengthen services. Some four and five-car sets lengthened to six-car.
Passenger impact	Provides sufficient seated capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S9A
Socio-economic Value for money categorisation	Very High
	BCR = 5.4
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033. The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.

Option S9B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Very high
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		



Option S9B: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	29.36
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	12.40
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-10.72
<b>sub-total (a)</b>	<b>31.04</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.05
Revenue transfer*	-45.39
NR operating costs and TOC operating costs transfer**	51.23
<b>sub-total (b)</b>	<b>5.79</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>25.26</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>5.37</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	45.39
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	51.23

Assessment of Option S10A – Train lengthening for Penzance/Newton Abbott to Manchester Piccadilly services (18 additional vehicles option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long distance high speed Plymouth to Edinburgh/Glasgow Central, Southampton/Reading to Newcastle, Penzance/Newton Abbott to Manchester Piccadilly and Bournemouth to Manchester Piccadilly services in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Bournemouth to Manchester Piccadilly long distance services.
Description	Capacity analysis reveals 18 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Penzance/Newton Abbott to Manchester Piccadilly. The crowding is not focussed on any single area, but occurs at a variety of locations along the route.
Infrastructure required	No infrastructure required.
Operational requirement	18 additional vehicles to lengthen services. All four and five-car sets lengthened to six-car, with a few being lengthened to eight-car.
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S10B
Socio-economic Value for money categorisation	Low
	BCR = 1.1
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033. The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.

Option S10A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S10A: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	31.08
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	13.16
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-11.38
<b>sub-total (a)</b>	<b>32.86</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.06
Revenue transfer*	-48.18
NR operating costs and TOC operating costs transfer**	79.53
<b>sub-total (b)</b>	<b>31.29</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>1.57</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.05</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	48.18
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	79.53

Assessment of Option S10B – Train lengthening for Penzance/Newton Abbott to Manchester Piccadilly services (11 additional vehicles option)	
Conditional Output	CO7 (2024) - Consistent with the longer term strategy identified to meet CO3, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of the long
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Bournemouth to Manchester Piccadilly long distance services.
Description	Only those additional vehicles with a medium, high or very high value for money business case are included. This option will not fully meet the crowding standards.
Infrastructure required	No infrastructure required.
Operational requirement	11 additional vehicles to lengthen services. All four and five-car sets lengthened to five and six-car.
Passenger impact	Provides sufficient seated capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S10A
Socio-economic Value for money categorisation	High
	BCR = 3.4
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	<p>These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The value for money business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033.</p> <p>The 2012 Department for Transport High Level Output Specification mentions the electrification of sections of this route. If this was delivered, this would present an opportunity for running electric services over part of this route. The issues outlined above, relating to rolling stock deployment, would then need to be considered for high-speed electric multiple units rather than diesel units.</p>

Option S10B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	High
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S10B: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	25.01
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	10.68
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-9.23
<b>sub-total (a)</b>	<b>26.46</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-39.09
NR operating costs and TOC operating costs transfer**	46.89
<b>sub-total (b)</b>	<b>7.75</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>18.71</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>3.41</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	39.09
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	46.89



Assessment of Option S11A – Train lengthening for Birmingham New Street – Leicester – Stansted Airport services (additional 10 vehicle option)	
Conditional Output	CO8 (2024) - Consistent with the longer term strategy identified to meet CO4, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of interurban services including Birmingham New Street – Leicester – Stansted Airport and Nottingham – Cardiff Central in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Birmingham New Street to Stansted Airport via Leicester interurban services.
Description	Capacity analysis reveals 10 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Birmingham New Street to Stansted Airport via Leicester. The crowding is heaviest into/out of Birmingham New Street in the peak periods, but is also expected to affect other sections of the route and some off peak periods services.
Infrastructure required	No infrastructure required.
Operational requirement	10 additional vehicles to lengthen services. Some two and three-car units to be lengthened to three or four-cars. Some platform lengths would be exceeded within and outside the East Midlands Route study area, but Selective Door Opening (SDO) is assumed to be used. (SDO is fitted on the current stock on the route.)
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S11B
Socio-economic Value for money categorisation	Low
	BCR = 1.4
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	

Option S11A: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Low
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S11A: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	42.80
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	6.12
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-6.74
<b>sub-total (a)</b>	<b>42.18</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.06
Revenue transfer*	-33.88
NR operating costs and TOC operating costs transfer**	64.95
<b>sub-total (b)</b>	<b>31.01</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>11.17</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.36</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	NA
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	33.88
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	64.95

Assessment of Option S11B – Train lengthening for Birmingham New Street – Leicester – Stansted Airport services (additional three vehicle option)	
Conditional Output	CO8 (2024) - Consistent with the longer term strategy identified to meet CO4, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of interurban services including Birmingham New Street – Leicester – Stansted Airport and Nottingham – Cardiff Central in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Birmingham New Street to Stansted Airport via Leicester interurban services.
Description	Only those additional vehicles with a very high value for money business case are included. This option will not fully meet the crowding standards.
Infrastructure required	No infrastructure required.
Operational requirement	Three additional vehicles to lengthen services to lengthen two-car units to three-cars in each case.
Passenger impact	Provides sufficient seated capacity to partially meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	Option S11A
Socio-economic Value for money categorisation	Very High
	BCR = 6.2
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	

Option S11B: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Very high
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S11B: Summary results of socio-economic appraisal (30 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	24.11
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	4.12
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-4.24
<b>sub-total (a)</b>	<b>23.99</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-19.94
NR operating costs and TOC operating costs transfer**	23.86
<b>sub-total (b)</b>	<b>3.88</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>20.10</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>6.18</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	NA
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	19.94
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	23.86

Assessment of Option S12 – Train lengthening for Cardiff Central – Birmingham New Street – Nottingham services (additional 14 vehicle option)	
Conditional Output	CO8 (2024) - Consistent with the longer term strategy identified to meet CO4, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of interurban services including Birmingham New Street – Leicester – Stansted Airport and Nottingham – Cardiff Central in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding on the Cardiff Central to Nottingham via Birmingham New Street interurban services.
Description	Capacity analysis reveals 14 additional vehicles are required by 2024 to provide sufficient total capacity for passengers on many services running from Cardiff Central to Nottingham via Birmingham New Street. The crowding is heaviest into/out of Birmingham New Street in the peak periods, but is also expected to affect other sections of the route and some off peak periods services.
Infrastructure required	No infrastructure required.
Operational requirement	14 additional vehicles to lengthen services. Some two and three-car units to be lengthened to three four and five-cars. Some platform lengths would be exceeded within and outside the East Midlands Route study area, but Selective Door Opening (SDO) is assumed to be used. (SDO is fitted on the current stock on the route.)
Passenger impact	Provides sufficient seated capacity to meet the anticipated demand growth to 2024.
Freight impact	None
Relates to other options	None, no medium or higher VfM business case could be found on this corridor due to high operating costs.
Socio-economic Value for money categorisation	Poor
	BCR = 0.2
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	None
Note	These services will be significantly affected by HS2 phase 2 causing a reduction in demand north of Birmingham New Street in 2033. For this reason the appraisal has been conducted over a 10 year appraisal period only. The business case is only valid if funders consider an appropriate re-deployment of the additional vehicles can be found from 2033.

Option S12: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Poor
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		



Option S12: Summary results of socio-economic appraisal (10 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	6.63
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	0.76
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-0.29
<b>sub-total (a)</b>	<b>7.10</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	0.00
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-6.64
NR operating costs and TOC operating costs transfer**	47.20
<b>sub-total (b)</b>	<b>40.56</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-33.45</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.18</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>NA</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	6.64
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	47.20

**Assessment of Option S13 – Midlands Rail Hub to relieve capacity constraints, improve performance and journey times with interventions at Birmingham Moor Street, Birmingham Snow Hill, Water Orton and Kings Norton.**

Conditional Output	CO8 (2024) - Consistent with the longer term strategy identified to meet CO4, to provide sufficient capacity throughout the day for passengers travelling on the West Midlands section of interurban services including Birmingham New Street – Leicester – Stansted Airport and Nottingham – Cardiff Central in 2024. CO9 - To provide capacity to accommodate forecast growth in intermodal container freight tonnes in the West Midlands & Chilterns Route Study area in 2024. CO14 – Improve connectivity to HS2. CO15 – To reduce the 'generalised' journey time between Birmingham New Street and Leicester/Stansted Airport. CO16 - To reduce the 'generalised' journey time between Birmingham New Street and Nottingham/Derby
Timeframe	Medium term
Objectives	There are several objectives to the scheme: 1. To decongest Birmingham New Street and facilitate future train paths from the 2043 ITSS 2. Improve journey times for passengers wishing to interchange onto HS2 at Curzon Street 3. To accommodate forecasted demand and reduce on-train crowding on the interurban services to and from Birmingham via Nuneaton and Tamworth 4. To improve east – west connectivity to potential unlock wider economic benefits as shown in the Midlands Connect study. 5. To facilitate freight growth in the Water Orton area 6. To improve performance and resilience of the network in central Birmingham.
Description	The scheme will provide the capability to reroute some existing services from Birmingham New Street to Moor Street station and relieve some of the capacity constraints in the area. The scheme would deliver the following outputs: <ul style="list-style-type: none"> <li>The ability to run new services into Birmingham New Street from the 2043 ITSS. In 2024/CP7 however, only two of these services offer strong VfM.</li> <li>A reduced walk time for passengers wishing to interchange onto HS2</li> <li>A 1tph shuttle service between Burton-on-Trent and Birmingham</li> <li>+1tph all day between Leicester and Birmingham</li> <li>+2tpd freight trains from Felixstowe and Southampton to Birmingham.</li> </ul>
Infrastructure required	A package of interventions are required to deliver the objectives listed above at the following areas: Bordesley to Moor Street, Birmingham Snow Hill, Kings Norton and Water Orton. AFC: £375-875M
Operational requirement	New train diagrams to enable +1tph Burton on Trent-Birmingham and +1tph Leicester-Birmingham to operate all day.
Passenger impact	Additional capacity, improved connectivity, journey time benefits and disbenefits (depending on origin and destination) and performance benefits.
Freight impact	Facilities freight growth in the Water Orton area. As a conservative estimate the infrastructure enhancements at Water Orton are expected to facilitate an additional 2tpd from Felixstowe and Southampton.
Relates to other options	None
Socio-economic Value for money categorisation	Medium BCR = 1.6
Rail Industry financial categorisations	Decreases operating subsidies
Sensitivity test	None
Note	The business case undertaken to assess this option does not include wider economic benefits at this stage. By rerouting some services it is likely to disrupt some passengers. The most disrupted journeys affected will be journeys to University and Birmingham International. However it should be noted that the new HS2 station at Curzon Street is likely to drive significant regeneration around the station site, thus making Moor Street a more attractive destination for passengers. As a result the number of people benefitting is potentially understated in this business case, as the scale of regeneration at this early stage in the Moor Street area is unknown.

Option S13: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		N/A	Medium
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	Yes	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case (> 100%)		

Option S13: Summary results of socio-economic appraisal (60 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	75.24
Rail user journey time benefits	243.39
Journey ambience inc. station amenity	0.00
Non user benefits - road decongestion	185.75
Non user benefits - noise, air quality, greenhouse gases & accident benefits	29.40
Rail user and non user disruption disbenefits during possessions	0.00
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-67.68
<b>sub-total (a)</b>	<b>466.10</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	368.54
Non user benefits - road infrastructure cost changes	-17.39
Revenue transfer*	-234.79
NR operating costs and TOC operating costs transfer**	176.47
<b>sub-total (b)</b>	<b>292.82</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>173.28</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>1.59</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>0.16</b>
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	234.79
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	176.47

Assessment of Option S14 – Additional 2tph Rowley Regis Shuttle service on the Snow Hill Lines	
Conditional Output	CO5 (2024) - Consistent with the longer term strategy identified to meet CO1, to provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024.
Timeframe	2024
Objectives	To accommodate forecasted demand and reduce on-train crowding for services heading East into Birmingham Snow Hill. An opportunity also arises to reduce journey times into Birmingham for the fast services originating from Kidderminster and Worcester by not calling at inner Birmingham stations (stations now served by the new shuttle service).
Description	Capacity analysis reveals six additional vehicles in the peak periods are required by 2024 to provide sufficient total capacity for passengers arriving into Birmingham Snow Hill in the east direction.
Infrastructure required	Turnback platform at Rowley Regis station.
	AFC: £15-35M
	To run the shuttle service, infrastructure is also required at Snow Hill station.
	The costs of these have not been included in this business case as they are already part of the Central Birmingham package Option S13.
Operational requirement	New train diagrams to enable a +2tph 3-car service between Rowley Regis and Birmingham Snow Hill.
Passenger impact	Additional capacity and improved connectivity for passengers at Rowley Regis and Smethwick Galton Bridge, and journey time benefits for passengers on fast services. However journey time disbenefits are also experienced as fast services not calling at inner Birmingham stations breaks direct connections to stations south of Birmingham.
Freight impact	None
Relates to other options	Option S13 interventions at Birmingham Snow Hill must be delivered first before the Rowley Regis
Socio-economic Value for money categorisation	Poor
	BCR = 0.8
Rail Industry financial categorisations	Increases operating subsidies
Sensitivity test	Medium
	BCR = 1.5 (operating costs halved assuming a timetable recast to maximise staff and stock utilisation).
Note	In the medium term train lengthening offers better VfM to meet the capacity conditional output on the Snow Hill Lines. However for the long term the scheme could become viable after a timetable recast to mix the shuttle service with existing Snow Hill services to maximise stock utilisation.

Option S14: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )		Yes	Poor
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )		

Option S14: Summary results of socio-economic appraisal (60 year appraisal)	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	51.47
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	9.99
Rail user and non user disruption disbenefits during possessions	1.01
Current TOC revenue benefits*	-1.31
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>-2.60</b>
	58.55
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	17.46
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-11.89
NR operating costs and TOC operating costs transfer**	65.80
<b>sub-total (b)</b>	<b>71.33</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-12.78</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.82</b>
Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^	-3.09
Notes	
*Total revenue benefits = revenue benefits to private sector + revenue transfer to government (d)	11.89
**Total change in operating costs = change in operating costs to private sector + change in operating costs to government (e)	65.80

Assessment of Option S15 – London Marylebone station capacity enhancement (reconfiguration and extension of gatelines, and relocation of concourse facilities)	
Conditional Output	CO6: To provide sufficient capacity for passengers travelling into central London Marylebone during peak hours in 2024
Timeframe	2024
Objectives	To reduce passenger congestion at the key constrained areas of the station, reduce queue time, and allow passengers to circulate within the station quicker.
Description	The morning peak sees passenger queues through the main gatelines from all platforms - congestion is then compounded by the location of information boards where passengers congregate for information and by the number of retail outlets on the concourse. A number of conflicting passenger flows occur in the peaks due to passengers interchanging onto the London Underground network and because the gateline funnels passengers into a constrained limited space.
Infrastructure required	Reconfiguration and extension of gatelines, and relocation of concourse facilities.
Operational requirement	None
Passenger impact	Reduces passenger congestion in the station.
Freight impact	None
Relates to other options	None
Socio-economic Value for money categorisation	Financially positive
Rail Industry financial categorisations	Decreases operating subsidies
Sensitivity test	N/A
Note	Assumes a one minute reduction in walk time for 50% of passengers travelling in the peak direction in the high peak hours, and a reduction in FWI. Results are based on a 60 year appraisal.



Option S15: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )			Financially positive
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )	Yes	

Option S15: Results of socio-economic appraisal	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	26.35
Station amenity and journey ambience	0.00
Non user benefits - road decongestion, noise, air quality, greenhouse gases & safety	18.46
Rail user and non user disruption disbenefits during possessions	3.65
Current TOC revenue benefits*	-0.14
Current TOC operating costs**	0.00
Indirect taxation impact on government	0.00
<b>sub-total (a)</b>	<b>-3.47</b>
	44.85
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	1.82
Non user benefits - road infrastructure cost changes	-0.04
Revenue transfer*	-18.72
NR operating costs and TOC operating costs transfer**	0.00
<b>sub-total (b)</b>	<b>-16.94</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>61.78</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>financially</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>10.28</b>

Assessment of Option S16 – University (Birmingham) station capacity enhancement (widening of platform, footbridge and stairwells, and other station works)	
Conditional Output	CO5: To provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024
Timeframe	2024
Objectives	To reduce passenger congestion at the key constrained areas of the station, reduce queue time, and allow passengers to circulate within the station quicker.
Description	University is a small but very busy station, on a busy commuter route close to Birmingham. Its recent passenger growth, serving Birmingham University and the nearby expanded Queen Elizabeth hospital, sees significant passenger numbers in both morning and evening peak times. The station is constrained in a number of areas - specifically narrow platforms, staircases and on the footbridge which 'funnel' passengers into a small ticket office/gateline area causing congestion and lengthy queuing times.
Infrastructure required	Widening of platform, footbridge and stairwells, and other station works.
Operational requirement	None
Passenger impact	Reduces passenger congestion in the station.
Freight impact	None
Relates to other options	None
Socio-economic Value for money categorisation	Poor
Rail Industry financial categorisations	Decreases operating subsidies
Sensitivity test	N/A
Note	Appraised benefits are a reduction in walktime during peaks and an improvement in FWI. Assumes a 30 second walktime saving for 100% of AM high peak arrivals and PM high peak departures, and a reduction in FWI. MOIRA counts are used. Results are based on a 60 year appraisal. A sensitivity for higher peak hour passengers (more than doubling number of affected passengers) does not increase the value for money categorisation.

Option S16: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )			Poor
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	Yes	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )	N/A	

Option S16: Results of socio-economic appraisal	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	1.42
Station amenity and journey ambience	0.00
Non user benefits - road decongestion	0.36
Non user benefits - noise, air quality, greenhouse gases & accident benefits	0.91
Rail user and non user disruption disbenefits during possessions	-0.69
Current TOC revenue benefits*	0.00
Current TOC operating costs**	0.00
Indirect taxation impact on government	-0.18
<b>sub-total (a)</b>	<b>1.82</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	9.15
Non user benefits - road infrastructure cost changes	0.00
Revenue transfer*	-0.95
NR operating costs and TOC operating costs transfer**	0.00
<b>sub-total (b)</b>	<b>8.20</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>-6.38</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>0.22</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>0.10</b>

Assessment of Option S17 – Birmingham Moor Street station capacity enhancement (extension of gatelines, and other station works)	
Conditional Output	CO5: To provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024
Timeframe	2024
Objectives	To reduce passenger congestion at the key constrained areas of the station, reduce queue time, and allow passengers to circulate within the station quicker.
Description	The main gateline struggles to accommodate demand in the peaks as this is the only entry/exit to the station. Platform 1 gateline also struggles to accommodate demand in the peaks. Both these factors cause longer walk times for passengers. Crowding occurs at the train/platform interface, particularly on platform 1 in the PM peak. High numbers of boarding passengers wait at the narrow Birmingham end of platform 1, where certain services stop. This causes a lot of congestion and bunching.
Infrastructure required	Extension of both gatelines, and other station works.
Operational requirement	None
Passenger impact	Reduces passenger congestion in the station.
Freight impact	None
Relates to other options	S13
Socio-economic Value for money categorisation	Financially positive
Rail Industry financial categorisations	Decreases operating subsidies
Sensitivity test	N/A
Note	Appraised benefits are a reduction in walktime during peaks and an improvement in FWI. Assumes a 1 min walktime saving for 50% of AM high peak arrivals and a 30 second walktime saving for 50% of PM peak departures, and a reduction in FWI. Results are based on a 60 year appraisal.

Option S17: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )			Financially positive
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	N/A	
	Positive financial case ( $> 100\%$ )	Yes	

Option S17: Results of socio-economic appraisal	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	7.07
Station amenity and journey ambience	0.00
Non user benefits - road decongestion	1.93
Non user benefits - noise, air quality, greenhouse gases & accident benefits	2.42
Rail user and non user disruption disbenefits during possessions	-0.27
Current TOC revenue benefits*	0.02
Current TOC operating costs**	0.00
Indirect taxation impact on government	-0.75
<b>sub-total (a)</b>	<b>10.42</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	3.56
Non user benefits - road infrastructure cost changes	-0.01
Revenue transfer*	-3.69
NR operating costs and TOC operating costs transfer**	0.00
<b>sub-total (b)</b>	<b>-0.14</b>
<b>Net Present Value (NPV) (a-b)</b>	<b>10.56</b>
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>financially</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>1.04</b>



Assessment of Option S18 – Birmingham Snow Hill station capacity enhancement	
Conditional Output	CO5: To provide sufficient capacity for passengers travelling into Birmingham stations during peak hours in 2024
Timeframe	CP6
Objectives	To reduce passenger congestion at the key constrained areas of the station, reduce queue time, and allow passengers to circulate within the station quicker.
Description	There is inadequate space on the platforms due primarily to platform buildings that restrict the flow of passengers along the platforms. There is also inadequate provision for vertical flow between the platforms and upper level concourse, and insufficient gates and space on both paid and unpaid side in the concourse area. These issues cause a lot of congestion and bunching during busy periods.
Infrastructure required	Removal of platform buildings, provision of new escalators, and re-modelling of the concourse level.
Operational requirement	None
Passenger impact	Reduces passenger congestion in the station.
Freight impact	None
Relates to other options	S13
Socio-economic Value for money categorisation	Very high value for money
Rail Industry financial categorisations	Decreases operating subsidies
Sensitivity test	A sensitivity test reducing the passengers benefiting from the walktime improvement to only 25% of AM high peak arrivals is high value for money.
Note	Appraised benefits are a reduction in walktime during peaks and an improvement in FWI. Assumes a 1 min walktime saving for 50% of AM high peak arrivals, and a 10% reduction in FWI. MOIRA counts are used. Results are based on a 60 year appraisal.

Option S18: Financial and socio-economic categorisation			
Rail industry financial impact (Categorisation of Revenue, Operating costs & Capital costs over appraisal period)			Socio-economic impact (WebTAG VfM category, see summary TEE table for further details)
Scheme increases operating subsidies (i.e. $R - O < 0$ )			Very high value for money
Scheme decreases operating subsidies  (i.e. $R - O > 0$ )	Low capital cost coverage (i.e. $(R - O) / C < 33\%$ )	N/A	
	Medium capital cost coverage (33-66%)	N/A	
	High capital cost coverage (66-100%)	Yes	
	Positive financial case (> 100%)	N/A	

Option S18: Results of socio-economic appraisal	
	£m PV
<b>Net benefits to consumers and private sector (plus tax impacts)</b>	
Rail user reliability benefits	0.00
Rail user journey time benefits	11.35
Station amenity and journey ambience	0.00
Non user benefits - road decongestion	2.34
Non user benefits - noise, air quality, greenhouse gases & accident benefits	0.97
Rail user and non user disruption disbenefits during possessions	-0.42
Current TOC revenue benefits*	0.08
Current TOC operating costs**	0.00
Indirect taxation impact on government	-0.72
<b>sub-total (a)</b>	<b>13.61</b>
<b>Costs to government (broad transport budget)</b>	
Capital costs (c)	4.99
Non user benefits - road infrastructure cost changes	0.00
Revenue transfer*	-0.01
NR operating costs and TOC operating costs transfer**	-3.35
<b>sub-total (b)</b>	<b>0.00</b>
	1.63
<b>Net Present Value (NPV) (a-b)</b>	
<b>Benefit Cost Ratio to Government (BCR) (a/b)</b>	<b>11.98</b>
<b>Commercial Benefit Cost Ratio (CBCR) ((d-e)/c)^</b>	<b>8.36</b>
	<b>0.69</b>

