



# **East West Rail Bedford to Cambridge Route Option Consultation**

## Technical Report

January 2019

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**East West Rail**  
Technical Report

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# 1. Introduction

- 1.1.** East West Rail (EWR) will provide a new direct rail link between Oxford and Cambridge and join up key towns and cities across the region.
- 1.2.** The Department for Transport (DfT) established East West Railway Company Ltd (EWR Co) in December 2017 to drive forward the delivery of the western section between Oxford and Bedford and to take responsibility for delivering the central section between Bedford and Cambridge.
- 1.3.** The eastern section of EWR covers the services east of Cambridge through to East Anglia and east coast ports and is the subject of a separate Network Rail study.
- 1.4.** Phase one of the western section has now been completed. This involved upgrading track between Oxford and Bicester Village, enabling a new Oxford to London Marylebone service to be introduced in December 2016. In July 2018, Network Rail submitted a Transport and Works Act Order (TWAo) application for the second phase of the western section, which will enable new direct services between Oxford and Milton Keynes, Oxford and Bedford, and Milton Keynes and Aylesbury.
- 1.5.** The central section of EWR will deliver a new railway between Bedford and Cambridge, enabling new direct services between Oxford and Cambridge and other places in between, and is an important part of the government's plans for the Oxford-Cambridge Arc (the Arc). At Budget 2018, the government re-stated its ambition to accelerate the delivery of the EWR central section, with the aim for services to begin by the mid-2020s. The government announced £20 million of funding for EWR Co to develop a Strategic Outline Business Case (SOBC) for the central section.
- 1.6.** The government also announced that EWR Co would consult on route options for the central section in early 2019. This report describes the further work undertaken to develop and evaluate route options and the analysis which supports the five route options that are being taken forward for an initial, non-statutory public consultation. This follows previous work led by Network Rail to identify the preferred route corridor via the broad area around Sandy.<sup>1</sup>
- 1.7.** The route options within the preferred corridor on which EWR Co are now consulting are shown indicatively in this report and in some places cover an area up to several kilometres wide. Both the number and location of stations will be kept under review and are also shown indicatively at this stage. The exact alignments for new railway lines and station locations will be developed once a preferred route option has been identified and will be subject to further consultation. Not all of the land within the route corridor or route option areas will be required.
- 1.8.** At Budget 2018, the government noted that the Arc provides an opportunity to embody the ambitions of the government's 25 Year Environment Plan and has committed to explore options for a pan-Arc local natural capital plan.<sup>2</sup> EWR Co will continue to work with the government and other agencies, contributing

<sup>1</sup> The preferred corridor has been interpreted to cover the broad area between Biggleswade and St Neots rather than a narrow area around Sandy. More detail on the approach used to identify a preferred corridor is available at <https://cdn.networkrail.co.uk/wp-content/uploads/2017/03/Engineering-Summary-Report.pdf>.

<sup>2</sup> <https://www.gov.uk/government/publications/cambridge-milton-keynes-oxford-arc-study-government-response>

to their approach to exploring options for this local natural capital plan, which is expected to consider a wide range of natural capital benefits, such as biodiversity, flood protection, recreation and improved water and air quality.

- 1.9.** EWR Co intends to make an application for development consent under the Planning Act 2008 to authorise the construction and operation of the central section. The application for development consent will be supported by an Environmental Impact Assessment (EIA), which will appropriately identify, describe and assess the direct and indirect significant effects that the project may have on the environment. EWR Co will aim to avoid adverse environmental effects where reasonably practicable. However, where this is not reasonably practicable, EWR Co will consider measures to reduce, mitigate and compensate for these effects. In some cases, these measures may have the potential to provide an overall improvement in the environment over the longer term.
- 1.10.** The current anticipated programme for developing and consulting on the route and design of the central section is as follows:
- 2019: non-statutory consultation on route options, followed by a decision on the preferred route
  - 2020: design of the preferred route alignment and selection of station locations
  - 2021: statutory consultation
  - 2021: development consent application submitted
  - 2023: development consent secured
- 1.11.** In parallel to the public consultation on this project, the government and EWR Co will continue to engage with local authorities and other stakeholders to ensure the railway project supports their approach to realising the economic potential of the Oxford-Cambridge Arc, including through supporting the delivery of new homes. Each route option that is being consulted on presents a range of opportunities and challenges that will need to be considered together to ensure that the government's investment in EWR provides value for money.
- 1.12.** This current consultation focuses on selecting a preferred route for the EWR central section. Although EWR Co is engaging at a high level with major land owners and others with interests in the land affected by all routes being consulted upon, it is too early to engage in detailed discussions regarding potential acquisition or interference with interests. Once a preferred route announcement is made, detailed land referencing work can be undertaken to understand who is affected by the proposals. Based on this information, an acquisition strategy will be developed and made available, including (if necessary) proposals for promoting compulsory purchase powers and any schemes of discretionary compensation that may be developed.

## 2. Strategic objectives

### The strategic case for EWR

- 2.1.** The case for a new railway connecting Oxford and Cambridge was initially articulated by a group of local authorities and businesses known as the EWR Consortium and focused on creating a strategic rail link that would provide fast, inter-regional connectivity.<sup>3</sup>
- 2.2.** In March 2016, the government asked the National Infrastructure Commission (NIC) to consider how to maximise the potential of the Cambridge-Milton Keynes-Oxford corridor as a single, knowledge-intensive cluster that competes on a global stage, protecting the area's high-quality environment, and securing the homes and jobs that the area needs.<sup>4</sup>
- 2.3.** The NIC published its final report in November 2017, which included a case for EWR that focused on the potential to support the continued growth of the towns and cities across the Cambridge-Milton Keynes-Oxford corridor. The NIC concluded that within the Arc “there is powerful evidence that house prices are already diminishing firms’ ability to attract employees” and “difficulties in accessing labour are exacerbated by poor east-west transport connections”.<sup>5</sup> The NIC also recognised the strategic importance of connecting existing north-south rail links.
- 2.4.** At Budget 2018, the government confirmed the Oxford-Cambridge Arc has been designated as a key economic priority, reflecting the transformational opportunity to amplify the Arc’s position as a world-leading economic place. The Arc is already home to 3.3 million people, supports 1.8 million jobs and contributes £90 billion of Gross Value Added (GVA) to the UK economy each year.<sup>6</sup> However, without investment in new infrastructure designed to support additional homes and join up local communities, the area will struggle to attract or retain the talent that is needed to sustain its economic prosperity.

### Strategic objectives for the EWR central section

- 2.5.** An initial set of strategic objectives for the EWR central section was developed by the EWR Consortium and adopted prior to publication of the NIC report. These objectives informed the early analysis of potential broad route corridors. They were:
- Improve east west public transport connectivity;

<sup>3</sup> The EWR Consortium is distinct from the EWR Co established by the DfT. More detail on the EWR Consortium is available at <https://www.eastwestrail.org.uk/>.

<sup>4</sup> The ‘Oxford-Cambridge Arc’ was previously referred to as the ‘Cambridge-Milton Keynes-Oxford corridor’.

<sup>5</sup> The NIC’s report is available at <https://www.nic.org.uk/wp-content/uploads/Partnering-for-Prosperty.pdf>.

<sup>6</sup> GVA is a measure of the economic contribution of a producer, industry, sector or region, based on the value of its output net of what is used to produce that output. Figures are sourced from the government’s response at Budget 2018 to the NIC’s report, available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/752040/Government\\_response\\_to\\_Partnering\\_for\\_Prosperty\\_a\\_new\\_deal\\_for\\_the\\_Cambridge-Milton\\_Keynes\\_Oxford\\_Arc.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752040/Government_response_to_Partnering_for_Prosperty_a_new_deal_for_the_Cambridge-Milton_Keynes_Oxford_Arc.pdf).

- Increase economic growth, prosperity and employment within the South-East of England through improvements to east west rail links;
- Provide faster, more reliable and additional rail links from the west to Cambridge, Norwich and Ipswich;
- Improve journey times and reliability of inter-regional and commuter journeys;
- Increase capacity for inter-regional and commuter journeys;
- Maintain and enhance capacity for rail freight; and
- Contribute to tackling climate change.

**2.6.** These objectives were used to inform a set of conditional outputs for the EWR central section that were developed by the EWR Consortium in 2014 and included a target journey time between Oxford and Cambridge of 60 minutes.<sup>7</sup>

**2.7.** In response to the NIC report, the strategic objectives for EWR have been revised to take account of the stronger focus on supporting growth by providing better connectivity for short-distance journeys between towns and cities across the Arc and areas that could provide opportunities for new homes.

**2.8.** The strategic objectives set by the DfT for the EWR central section are now as follows:

- Improve east-west public transport connectivity by providing rail links between key urban areas (current and anticipated) in the Oxford-Cambridge Arc;
- Stimulate economic growth, housing and employment through the provision of new, reliable and attractive inter-urban passenger train services in the Oxford-Cambridge Arc;
- Meet initial forecast passenger demand;
- Consider and plan for future passenger demand, making provision where it is affordable;
- Contribute to improved journey times and inter-regional passenger connectivity by connecting with north-south routes and routes beyond Oxford and Cambridge;
- Maintain current capacity for rail freight and make appropriate provision for anticipated future growth; and
- Provide a sustainable and value for money transport solution to support economic growth in the area.

**2.9.** These strategic objectives have underpinned the development of route options that prioritise serving locations that could support growth and new homes over fast end-to-end journey times, while still resulting in significantly faster journey times than would otherwise be available (e.g. connections via London). The updated strategic objectives have resulted in the target journey time between Oxford and Cambridge being revised to around 80 minutes.

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<sup>7</sup> The initial conditional outputs developed by the EWR Consortium are available at [https://www.eastwestrail.org.uk/wp-content/uploads/2015/04/ewr-cs\\_-\\_cos\\_-\\_final\\_report\\_08-08-2014.pdf](https://www.eastwestrail.org.uk/wp-content/uploads/2015/04/ewr-cs_-_cos_-_final_report_08-08-2014.pdf).

## 3. Selecting a preferred route corridor

- 3.1.** Prior to EWR Co being established, twenty potential route corridors were considered at a high level by Network Rail based on the priority journey pairs and conditional outputs developed by the EWR Consortium.<sup>8</sup> These twenty corridors spanned the area from St Albans and Harlow to Peterborough and were discussed with a working group comprising representatives from DfT, the rail industry, local authorities and the EWR Consortium.
- 3.2.** Five potential route corridors were selected for further work after appraising the potential corridors against the initial strategic objectives and conditional outputs and a range of selection criteria agreed by the working group.<sup>9</sup> These five corridors, illustrated in Figure 1, were:
- Corridor C: Bletchley – Stewartby – Bedford – Sandy – Cambridge<sup>10</sup>
  - Corridor D: Bletchley – Stewartby – Bedford – Sandy – Hitchin – Cambridge
  - Corridor H2: Bletchley – Stewartby – Flitwick – Luton – Stevenage – Hitchin – Cambridge
  - Corridor M: Bletchley – Stewartby – Bedford – Hitchin – Cambridge<sup>11</sup>
  - Corridor N: Bletchley – Ridgmont – Harlington – Hitchin – Cambridge

<sup>8</sup> Journey-pair outputs were ranked by estimated passenger and freight value and economic priority.

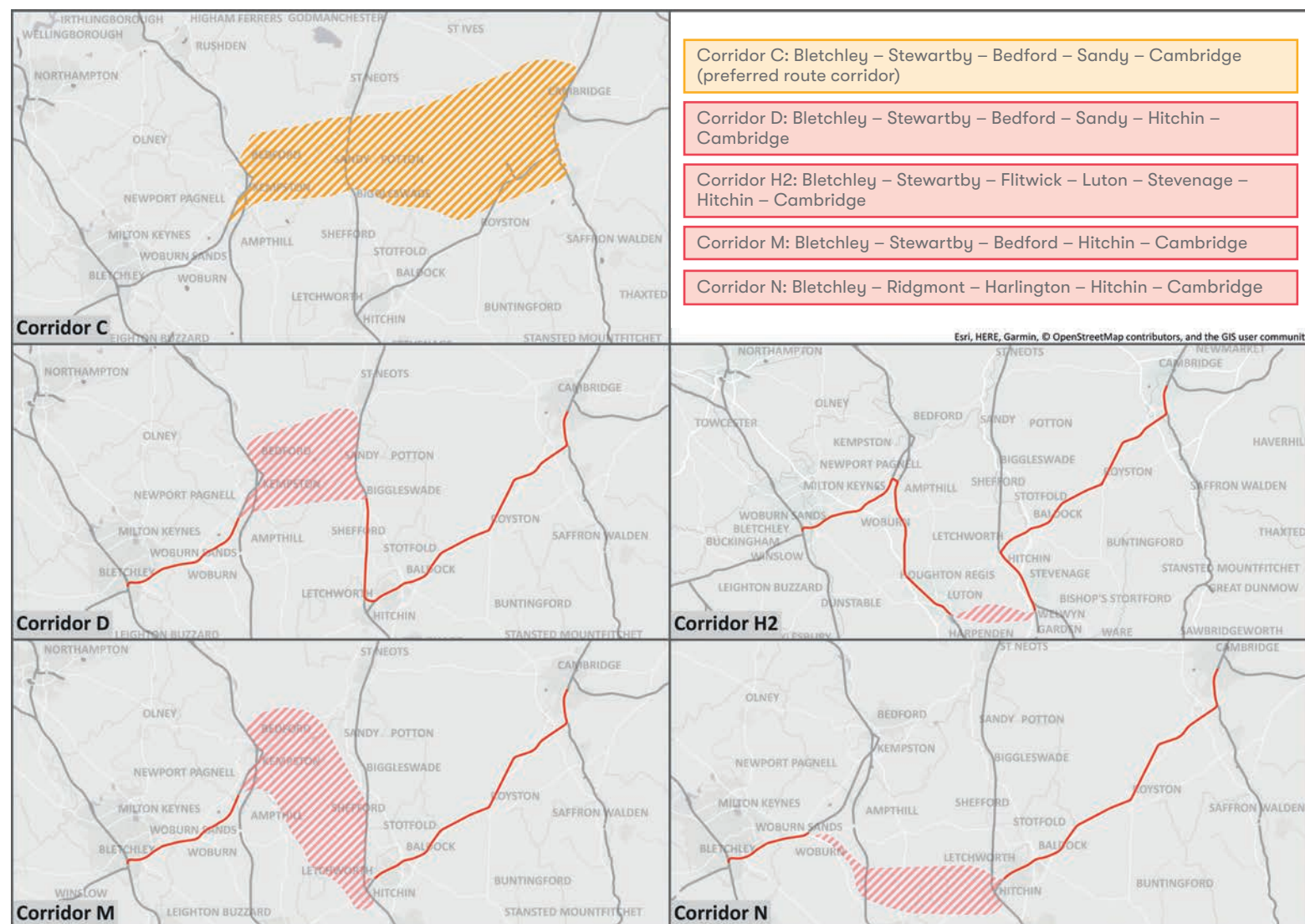
<sup>9</sup> The initial twenty corridors that were considered and the approach used to sift down to a single preferred corridor, including the full set of selection criteria, are described in more detail at <https://cdn.networkrail.co.uk/wp-content/uploads/2017/03/Engineering-Summary-Report.pdf>.

<sup>10</sup> Two variants of this corridor were considered: a corridor through the centre of Bedford and a corridor via the south of Bedford.

<sup>11</sup> Two variants of this corridor were considered: a corridor through the centre of Bedford and a corridor via the south of Bedford.



**Figure 1: map of the five potential route corridors subject to detailed analysis**



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- 3.3.** A quantitative assessment of the potential costs and benefits of these five corridors was undertaken, informed by engineering studies, which resulted in the potential route corridors being narrowed down to the corridor via Sandy or via Hitchin (corridors C and M).
- 3.4.** Further analysis of both corridors indicated that route options within the corridor via Sandy (corridor C) would generate higher benefits than route options within the corridor via Hitchin (corridor M), while incurring similar capital costs and lower operating costs, resulting in higher indicative benefit-cost ratios (BCRs). Journey times were estimated to be between 75 and 82 minutes for the corridor via Sandy (corridor C) and 85 and 106 minutes for the corridor via Hitchin (corridor M).<sup>12</sup>
- 3.5.** The corridor via Sandy (corridor C) was therefore selected as the preferred route corridor in 2016. Although this reflected the previous strategic objectives for the EWR central section, EWR Co's judgement is that given the opportunities for growth and housing within the preferred route corridor (and because the initial analysis considered future housing and employment developments), the choice of route corridor remains appropriate in the context of the revised strategic objectives. However, EWR Co continues to back-check decisions taken throughout the process of developing the EWR central section, and in selecting a preferred route option, will assure itself that the choice of the route corridor via Sandy (corridor C) remains sound.

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<sup>12</sup> These indicative journey times were based on estimated journey times for 'fast' services between Oxford and Cambridge.

## 4. Evaluating route options within the preferred route corridor

- 4.1.** Having identified the corridor via Sandy as the preferred route corridor, the next stage in developing the EWR central section has been to consider route options within that corridor. The route corridor has defined start and finish points, beginning around Stewartby near Bedford and ending at Cambridge. It increases to around 15km wide along the East Coast Main Line and through South Cambridgeshire. Not all of this land will be required for the new railway.
- 4.2.** The preferred route that will be selected within the preferred corridor will at this stage still cover a relatively broad area in some places of up to several kilometres, within which the final alignments of the new railway and stations along it will be located. The purpose of this report is to summarise EWR Co's analysis of the relative merits of the potential route options within the preferred corridor.
- 4.3.** A wide range of factors has been considered to inform the appraisal of route options within the preferred route corridor. The first set of factors that are described in paragraphs 4.4 to 4.7 might be given particularly substantial weight in decision-making, particularly where they differentiate strongly between route options.
- 4.4.** **Transport user benefits** – the potential benefits from improved journey times, lower fares and less road congestion have been assessed using a transport model that was initially developed for phase 2 of the EWR western section. The model's approach to estimating demand for EWR journeys between Oxford and Cambridge and other stations varies depending on the scale of the improvement in the Generalised Journey Time (GJT) that is expected.<sup>13</sup> Where rail journey times are estimated to reduce by 20% or more, a 'gravity model' is used to forecast demand. This approach is used to estimate demand between most potential EWR stations. This is because EWR will significantly reduce rail journey times compared to the current situation in which no direct rail services exist (between Bedford and Cambridge and other station pairs) and rail demand between these places is low. Simply growing current rail demand is likely to underestimate the potential passenger demand for EWR. Therefore the 'gravity model' estimates demand based on the attraction between places reflecting factors such as population and employment levels and the new, improved journey times. Standard GJT elasticity assumptions are, however, used to estimate demand for trips with smaller improvements in journey times.<sup>14</sup> More detail on this analysis is set out in Annex A.
- 4.5.** **Contribution to enabling housing and economic growth, including best serving areas benefitting from developable land** – EWR Co commissioned analysis to estimate the developable land capacity within a 3 kilometre radius of potential EWR stations. This indicates how many homes might theoretically be

<sup>13</sup> Generalised Journey Time (GJT) is a measure incorporating the total station-to-station journey time plus time penalties based on the frequency of service and the number of interchanges required. It is expressed in minutes of journey time.

<sup>14</sup> GJT elasticities are sourced from the Passenger Demand Forecasting Handbook version 6 and endorsed in the DfT transport appraisal guidance. More detail is available in Section 8 of the DfT TAG Unit M4 ([https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/712780/tag-unit-m4-forecasting-and-uncertainty\\_jul2017.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712780/tag-unit-m4-forecasting-and-uncertainty_jul2017.pdf)).

supported by potential EWR stations within their immediate catchment areas but does not imply those homes would be built or are all directly dependent on the railway. The analysis of land capacity has been supplemented with analysis of the potential net national economic benefits of additional housing along the central section routes.<sup>15</sup> This analysis of the potential economic benefits of additional housing was undertaken by KPMG and suggests that new homes along the route could, on average, generate additional economic benefits of around £40,000 to £64,000.<sup>16</sup> These benefits arise through a combination of land value uplift and improved housing affordability. The scale of benefit depends on the location of housing and how quickly it is delivered. Some of these benefits are likely to be offset by the costs of providing other infrastructure to support the new homes (e.g. local roads and schools), which could vary by location. While this analysis should be seen as illustrative at this stage, given several simplifying assumptions and the uncertainty about the scale, location and timing of additional homes, it can be used to help consider the potential value for money implications of choosing a more expensive route that might support additional growth and homes. More detail on the analytical approach is set out in Annex C. The same economic model has also been used by KPMG to estimate the potential wider employment and agglomeration (GVA) benefits of the EWR central section, with more detail set out in Annex B.

**4.6. Capital and operating costs and overall affordability** – at this early stage, the initial estimates of capital and operating costs are high-level and indicative and include an appropriately high level of optimism bias.<sup>17</sup> Cost estimates have been developed to a sufficient level of confidence to indicate how costs might vary across route options and to understand the potential value for money implications. However, where cost estimates have been developed in more detail for some route options, this additional detail is reflected in the cost estimates presented in this report. These estimates have been prepared for the purposes of assessing route options and identifying a preferred route, but should not be used to set expectations as to the final Total Capital Cost of the project. Cost estimates will continue to be refined as route development work progresses towards identifying a final preferred route alignment. All figures in this report are consistent with DfT appraisal guidance. They differ from headline costs in the consultation document as they include optimism bias, they are discounted present values (accounting for social time preferences) in 2010 prices, and are expressed in market prices (i.e. they include indirect taxes, such as VAT). While actual costs are likely to be higher, this presentation allows the estimated costs to be directly compared to the estimated benefits described elsewhere in this report. The overall affordability of the scheme may also benefit from the ability to capture a share of the increase in land values as a result of the railway, as well as the opportunities for private financing (where it would represent value for money). Where necessary, the DfT and EWR Co will consider the case for the eventual manager of the infrastructure comprised in EWR to be able to levy an Investment Recovery Charge on operators using the new and/or upgraded railway lines comprised, which would also help investment costs to be recovered.

**4.7. Environmental impacts and opportunities** – a wide range of potential environmental features have been mapped to inform potential route options, which are described further in Annex D. Route options have been developed to minimise potential adverse impacts on designated and sensitive sites, as well as impacts on existing housing. The initial cost estimates include provision for mitigating flood risk where the railway would cross the River Great Ouse, River Ivel and River Cam and their flood plains. The transport-related environmental benefits of the railway (noise and air quality benefits from reduced car usage and carbon emissions impacts) have been appraised in line with standard DfT guidance and do not vary significantly across route options.<sup>18</sup> EWR Co intends to continue working with the government and other agencies to contribute to their broader approach to exploring options for a local natural capital plan for the Oxford-Cambridge Arc and ensuring that the EWR central section aligns with the government's policy on biodiversity net gain.

<sup>15</sup> The benefits of additional housing are assessed for the five local authorities along the central section routes: Bedford, Cambridge, Central Bedfordshire, Huntingdonshire and South Cambridgeshire.

<sup>16</sup> This is the average benefit per 100 square metres of new housing. All housing benefit figures are net of any displacement in other parts of Great Britain and are expressed as a 2010 present value.

<sup>17</sup> 64% for capital costs and 41% for operating costs (sourced from DfT WebTAG unit A5-3). Costs are estimated over a standard 60 year appraisal period.

<sup>18</sup> The DfT guidance on appraisal of environmental impacts is available at <https://www.gov.uk/government/publications/webtag-tag-unit-a3-environmental-impact-appraisal-december-2015>.

- 4.8.** A second set of factors is also important but currently appear to be more likely to result in similar outcomes and therefore assist in differentiating between route options to a lesser degree. However, some of these factors may in due course be given greater weight should they become more relevant in differentiating between route options. These are described in paragraphs 4.9-4.15.
- 4.9. Short-distance passenger services and connectivity to support commuting into key employment hubs (current and future)** – existing analysis indicates that all route options would provide journey times of around 20 minutes between the Sandy area and Cambridge and less than 30 minutes between Bedford and Cambridge.<sup>19</sup> The transport demand modelling confirms that short distance journeys with fast journey times are likely to generate most of the demand for EWR services, with up to 300,000 trips each year between the Sandy area and Cambridge and up to 250,000 trips each year between Bedford and Cambridge.<sup>20</sup>
- 4.10. Rail passenger connectivity to existing mainlines** – all route options would provide good interchange connectivity with north-south links along the East Coast Main Line and with other services to and from Cambridge. Route options that serve Bedford Midland would provide more direct interchange with Midland Main Line services to destinations such as Leicester and Nottingham, whereas route options serving a new station to the south of Bedford would require an interchange via existing Thameslink services.
- 4.11. Long distance passenger services** – analysis to date indicates that all route options would provide for journey times between Oxford and Cambridge of around 80 minutes, which represents a significant improvement on existing journey times via London.<sup>21</sup> The transport demand modelling estimates that the total number of return trips each year between Cambridge and Oxford (in both directions) would increase from around 18,000 to around 50,000.
- 4.12. Satisfying existing and future freight demand (as anticipated by the freight industry) where affordable** – the current indicative cost estimates are based on providing capability for all types of freight, based on a maximum gradient of 1:125. We will review whether costs could be reduced by increasing the maximum gradient to 1:80. A steeper maximum gradient could be a constraint for heavy-haul freight but would still provide capability for intermodal freight. The implications of this will need to be considered further in the context of the national rail freight strategy. We will be evidence-led and will consider the likely value for money of the gradient options before coming to a conclusion on whether to recommend the specification of the railway should be altered in this regard.
- 4.13. Railway performance and alignment with wider railway strategy and infrastructure** – analysis to date indicates that all route options could provide an acceptable level of operational performance but EWR Co will review this as route development work continues.

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<sup>19</sup> Current journey time estimates do not include the impact of EWR services stopping at the proposed new Cambridge South station or a potential additional station at Bassingbourn for the relevant route options. A new 'Bassingbourn' station would only be built if the MoD Bassingbourn Barracks is developed. Journey times between Bedford and Cambridge are estimated from the Bedford station that EWR would serve, either Bedford Midland or a new station to the south of Bedford.

<sup>20</sup> Return journeys are included in these figures as two journeys from the station where the journeys were initiated. For example, a return journey from Sandy to Cambridge appears as two journeys from origin Sandy to destination Cambridge.

<sup>21</sup> Current journey time estimates do not include the impact of EWR services stopping at the proposed new Cambridge South station or a potential additional station at Bassingbourn for the relevant route options. A new 'Bassingbourn' station would only be built if the MoD Bassingbourn Barracks is developed.

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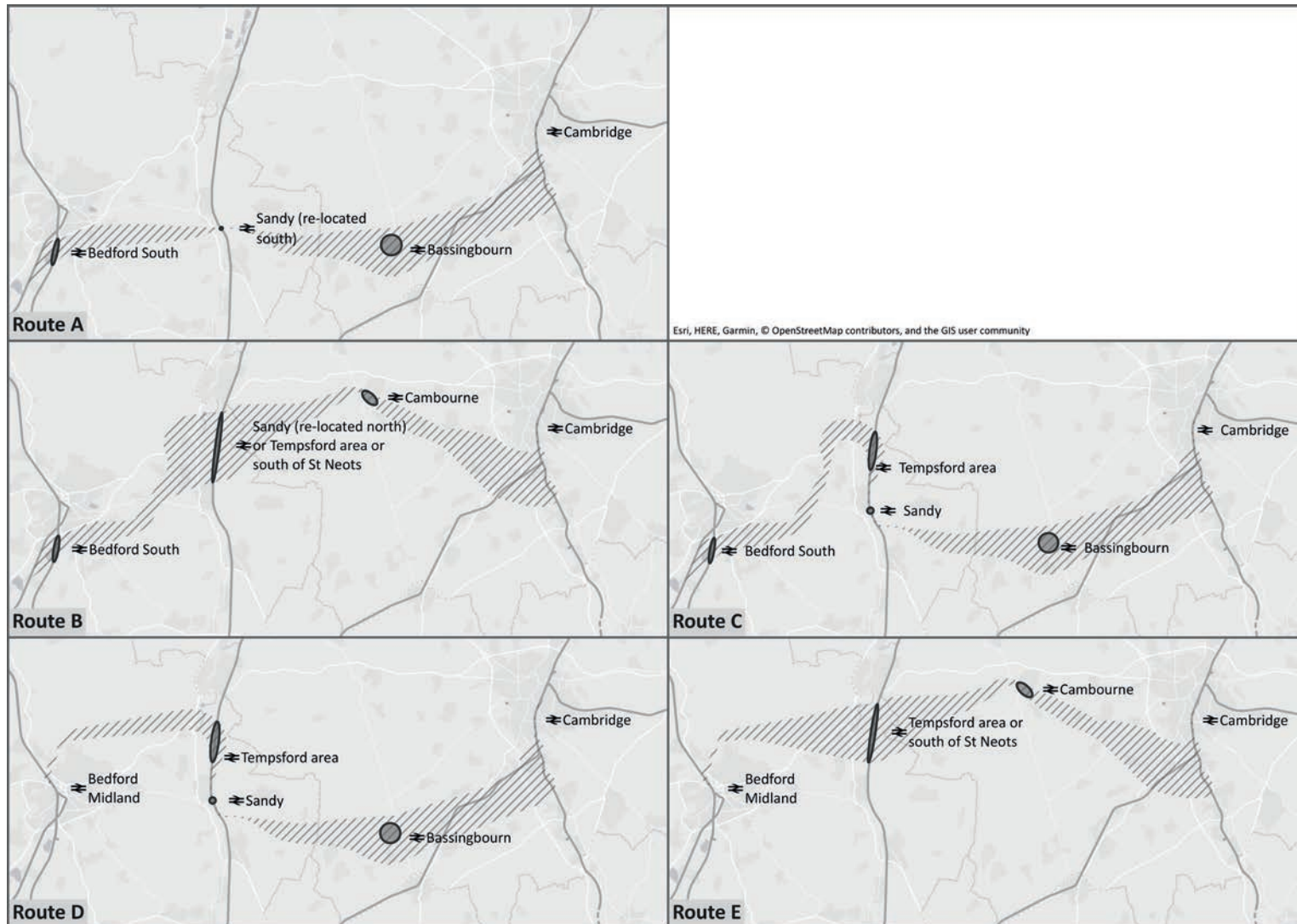
- 4.14. Safety risk (construction and operation)** – a range of potential safety issues during construction and operation have been considered at a high level in developing route options. This includes managing track possessions (the suspension of existing services) during infrastructure works and interfaces between EWR and the existing rail network. At this stage it is not necessary to rule out any route option for safety reasons.
- 4.15. Consistency with plans for the location of settlements** – EWR Co have reviewed existing published plans to understand the locations that are being prioritised for development and will continue to engage with a range of stakeholders including local authorities, the Cambridgeshire and Peterborough Combined Authority and government departments as further plans are developed.
- 4.16.** Given the strategic objectives for the EWR central section, **EWR Co have focused on the potential for route options to support growth and new homes, alongside the indicative cost estimates, benefits for transport users and environmental impacts** (see paragraph 4.3). The overall affordability, including the potential to capture some of the increase in land values resulting from the railway and opportunities for private financing, is also an important consideration.
- 4.17.** Other factors such as satisfying freight demand, railway performance and safety risk are not currently thought to be material differentiators between route options, but this will be kept under review as route development work progresses.
- 4.18. The factors set out in this chapter and the weight that they are expected to be given will be used by EWR Co and the DfT to decide on a preferred route later this year. Other important and relevant issues, including any that may be identified or raised in response to the consultation, will also be considered.**

## 5. Route options that have been considered

- 5.1.** The overall approach to identifying route options within the preferred route corridor via the broad area around Sandy for assessment against the factors in Chapter 4 has been framed around three questions:
- Where could EWR provide an interchange with the Midland Main Line?
  - Where could EWR provide an interchange with the East Coast Main Line?
  - What route could EWR take through South Cambridgeshire, including where any potential additional stations might be located?
- 5.2.** These questions, when combined with the strategic objectives for EWR and the route selection criteria, generated a set of route options within the preferred route corridor that are illustrated in Figures 2 and 3 and described in paragraphs 5.3-5.13.
- 5.3.** As set out in Chapter 1, the route options are shown indicatively and cover an area up to several kilometres in some places. The number and location of stations are also indicative. The exact alignments for new railway lines and station locations will be developed once a preferred route option has been identified and will be subject to further consultation.



**Figure 2: route options considered within the preferred route corridor via Sandy (Routes A-E)**





**Figure 3: route options considered within the preferred route corridor via Sandy (Routes F-L)**



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- 5.4. Route A: Bedford South – Sandy (re-located south) – Cambridge (via Bassingbourn):** EWR could serve a new station to the south of Bedford, providing an interchange with the Midland Main Line. The route could then provide an interchange with the East Coast Main Line via a new (re-located) Sandy station to the south of the existing station, before continuing eastwards and passing through South Cambridgeshire between Arrington and Bassingbourn. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.5. Route B: Bedford South – Sandy (re-located north) / Tempsford area / south of St Neots – Cambourne – Cambridge:** EWR could serve a new station to the south of Bedford, providing an interchange with the Midland Main Line. The route could then provide an interchange with the East Coast Main Line via a new station between Sandy and St Neots. This station could be a new (re-located) Sandy station slightly to the north of the existing station or a new station further north. The route could then run north-eastwards to a potential new station around Cambourne, before heading south-eastwards between Little Eversden and Comberton and connecting to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford.
- 5.6. Route C: Bedford South – Tempsford area – Sandy – Cambridge (via Bassingbourn):** EWR could serve a new station to the south of Bedford, providing an interchange with the Midland Main Line. The route could then loop round to serve a new station on the East Coast Main Line in the broad area around Tempsford, before continuing on or alongside the East Coast Main Line and providing a further interchange via the existing Sandy station. EWR could then diverge from the East Coast Main Line south of the existing Sandy station and continue eastwards across South Cambridgeshire between Arrington and Bassingbourn. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.7. Route D: Bedford Midland – Tempsford area – Sandy – Cambridge (via Bassingbourn):** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and loop round to serve a new station on the East Coast Main Line in the broad area around Tempsford, before continuing on or alongside the East Coast Main Line and providing a further interchange via the existing Sandy station. EWR could then diverge from the East Coast Main Line south of the existing Sandy station and continue eastwards across South Cambridgeshire between Arrington and Bassingbourn. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.8. Route E: Bedford Midland – Tempsford area / South of St Neots – Cambourne – Cambridge:** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and provide an interchange with the East Coast Main Line via a new station in the broad areas around Tempsford or to the south of St Neots. The route could then run north-eastwards to a potential new station around Cambourne, before heading south-eastwards between Little Eversden and Comberton and connecting to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford.
- 5.9. Route F: Bedford South – Sandy (re-located north) – Cambridge:** EWR could serve a new station to the south of Bedford, providing an interchange with the Midland Main Line. The route could then provide an interchange with the East Coast Main Line via a new (re-located) Sandy station to the north of the existing station. From there, the route could run more directly eastwards across South Cambridgeshire, north of the Wimpole Estate and south of the villages of Great

Eversden, Little Eversden and Harlton, and then to the south of the Radio Astronomy Observatory.<sup>22</sup> The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).

- 5.10. Route G: Bedford Midland – Tempsford area – Cambridge:** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and provide an interchange with the East Coast Main Line via a new station in the broad area around Tempsford. From there, the route could eastwards across South Cambridgeshire, north of the Wimpole Estate and south of the villages of Great Eversden, Little Eversden and Harlton, and then to the south of the Radio Astronomy Observatory. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.11. Route H: Bedford Midland – Sandy (re-located south) – Cambridge (via Bassingbourn):** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and provide an interchange with the East Coast Main Line via a new (re-located) Sandy station to the south of the existing station. The route could then continue eastwards across South Cambridgeshire between Arrington and Bassingbourn and connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.12. Route J: Bedford Midland – Sandy – Cambridge (via Bassingbourn):** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and loop round to provide an interchange with the East Coast Main Line via the existing Sandy station. EWR could then diverge from the East Coast Main Line south of the existing Sandy station and continue eastwards across South Cambridgeshire between Arrington and Bassingbourn. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.13. Route K: Bedford South – Sandy – Cambridge (via Bassingbourn):** EWR could serve a new station to the south of Bedford, providing an interchange with the Midland Main Line. The route could then loop round to provide an interchange with the East Coast Main Line via the existing Sandy station, before diverging from the East Coast Main Line south of the existing Sandy station and continuing eastwards across South Cambridgeshire between Arrington and Bassingbourn. The route could then connect to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.14. Route L: Bedford Midland – Tempsford area – Cambridge (via Bassingbourn):** EWR could continue along the Marston Vale Line and provide an interchange with the Midland Main Line via the existing Bedford Midland station. The route could then diverge from the Midland Main Line to the north of Bedford and provide an interchange with the East Coast Main Line via a new station in the broad area around Tempsford. From there, the route could run directly south-eastwards and pass between Arrington and Bassingbourn, before connecting to the West Anglia Main Line into Cambridge slightly to the north or south of Great Shelford (possibly via first connecting to the existing Hitchin-Cambridge line).
- 5.15.** Paragraphs 5.15 to 5.18 describe the key assumptions underpinning these route options.

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<sup>22</sup> The Wimpole Estate is a registered park and garden owned by the National Trust.

- 5.16.** A new station to the south of Bedford could be located either slightly to the south of the A421 or alternatively near the new settlement of Wixams. The eventual location would be a matter for more detailed consideration of route alignments after selecting a preferred route option. If EWR services were to serve a new station to the south of Bedford, this could have implications for the planned service between Oxford and Bedford Midland that it is currently anticipated will follow the completion of the EWR western section. This will be considered further in advance of selecting a preferred route.
- 5.17.** If EWR were to serve a new station slightly to the south or north of the existing Sandy station, the new Sandy station would replace the existing Sandy station. This is because the proximity to the existing station would make it unviable for Thameslink services on the East Coast Main Line to call at both stations. There would be a single station serving Sandy.
- 5.18.** Interactions between **potential alignments for the new A428 Black Cat dual carriageway** and EWR routes via Bedford Midland and potential stations between Sandy and St Neots and around Cambourne would be a matter for further consideration in advance of selecting a preferred route for the EWR central section and as part of the further work to develop detailed route and station alignments.
- 5.19.** **Routes through South Cambridgeshire between Wimpole Hall and Bassingbourn** could: (a) cross the southern end of the Wimpole Hall avenue, around 3 kilometres from Wimpole Hall itself; (b) run through the site of the Ministry of Defence (MoD) Bassingbourn Barracks, where an additional EWR station and development could be located; or (c) run slightly to the south of the MoD Bassingbourn Barracks site.<sup>23</sup> The more southerly alignments (through the MoD site or to the south of it) would result in longer journey times and incur additional costs compared to crossing the Wimpole Hall avenue at surface level. However, the more northerly alignment across the Wimpole Hall avenue would need to be developed in a way that addresses any impacts on Wimpole Hall and its estate, as well as National Trust land ownerships. Potential mitigation options could incur significant additional costs that might be comparable to the additional costs of alternative, more southerly alignments.
- 5.20.** For all route options, additional infrastructure works would be required for the **Marston Vale Line** to provide sufficient capacity for EWR services between Oxford and Cambridge once the EWR central section has been delivered. These additional works are not expected to affect the current route of the Marston Vale Line.

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<sup>23</sup> Wimpole Hall is a Grade 1 listed building owned by the National Trust within the Wimpole Estate. A new 'Bassingbourn' station would only be built if the MoD Bassingbourn Barracks is developed.

## 6. Route options that have been ruled out

- 6.1. Six of the eleven route options considered have been ruled out following an initial sift. These route options have been compared against similar routes that appear to perform better against the main criteria described in Chapter 4 and the strategic objectives for EWR in Chapter 2. The route options that have been ruled out at this stage are illustrated in Figure 4 and described in Paragraphs 6.2–6.7.<sup>24</sup>

Figure 4: route options that have been ruled out



<sup>24</sup> All cost and benefit figures in this chapter are Net Present Values in 2010 prices in line with DfT guidance



- 6.2. Route F: Bedford South – Sandy (re-located north) – Cambridge:** Route F is similar to Route B (which is being consulted on) but unlike Route B it does not serve Cambourne, which has been identified for growth in the South Cambridgeshire local plan. Initial cost estimates indicate that Route F would also incur slightly higher upfront capital costs than Route B (£2.3 billion and £2.2 billion respectively) despite the shorter route length, which reflects the more challenging topography to the east of the Sandy area. Route F is estimated to generate lower transport user benefits and lower fare revenues than Route B because it would not serve Cambourne.
- 6.3. Route G: Bedford Midland – Tempsford area – Cambridge:** Route G is similar to Route E (which is being consulted on) but unlike Route E it does not serve Cambourne, which has been identified for growth in the South Cambridgeshire local plan. Route G is currently estimated to incur slightly higher initial capital costs than Route E (£2.9 billion and £2.8 billion respectively) despite the shorter route length, which reflects the more challenging topography to the east of the Sandy area. Route G is estimated to generate lower transport user benefits and lower fare revenues than Route E because it would not serve Cambourne.
- 6.4. Route H: Bedford Midland – Sandy (re-located south) – Cambridge (via Bassingbourn):** Route H is similar to Route D (which is being consulted on), although Route D includes an additional station in the broad area around Tempsford that could support additional growth and new homes. Initial cost estimates indicate that Route H would incur upfront capital costs of around £2.4 billion compared to around £2.2 billion for Route D, which could also serve Bedford Midland and follow the southerly route through South Cambridgeshire. Route H and Route D are estimated to generate similar transport user benefits and fare revenues because the additional journey time penalty for EWR services stopping at a new station in the broad area around Tempsford on Route D would be offset by the additional benefits for passengers in the wider Sandy and St Neots area. Furthermore, it is assumed that unlike Route D, Route H would require the existing Sandy station to be re-located, which could impact adversely on the ability of the existing Sandy population to access north-south rail services into London and other destinations.
- 6.5. Route J: Bedford Midland – Sandy – Cambridge (via Bassingbourn):** Route J is estimated to generate similar transport user benefits to the similar Route D, which is being consulted on and could also serve Bedford Midland and follow the southerly route through South Cambridgeshire. However, unlike Route D, Route J would forego the opportunity to support additional growth and new homes in the broad area around Tempsford. Development in the immediate vicinity of Sandy is likely to be constrained by the A1 and environmental features including the Sandy Warren Site of Special Scientific Interest (SSSI) and RSPB nature reserve.
- 6.6. Route K: Bedford South – Sandy – Cambridge (via Bassingbourn):** Route K is similar to Route A (which is being consulted on). Initial cost estimates indicate the Route K would incur upfront capital costs of around £1.8 billion compared to around £1.7 billion for the similar Route A, which could also serve a station to the south of Bedford and follow the southerly route through South Cambridgeshire. Route K is also estimated to generate lower transport user benefits than Route A because of the slightly longer journey times and appears to offer relatively little additional housing potential given the constraints in the immediate vicinity of Sandy, including the A1 and environmental features such as the Sandy Warren SSSI and RSPB nature reserve.
- 6.7. Route L: Bedford Midland – Tempsford area – Cambridge (via Bassingbourn):** Route L is similar to Route D (which is being consulted on), but unlike Route D, would not serve Sandy. Initial cost estimates indicate that Route L would incur upfront capital costs of around £2.6 billion compared to around £2.2 billion for Route D, which could also serve Bedford Midland and a new station in the broad area around Tempsford and then follow the southerly route through

## **East West Rail**

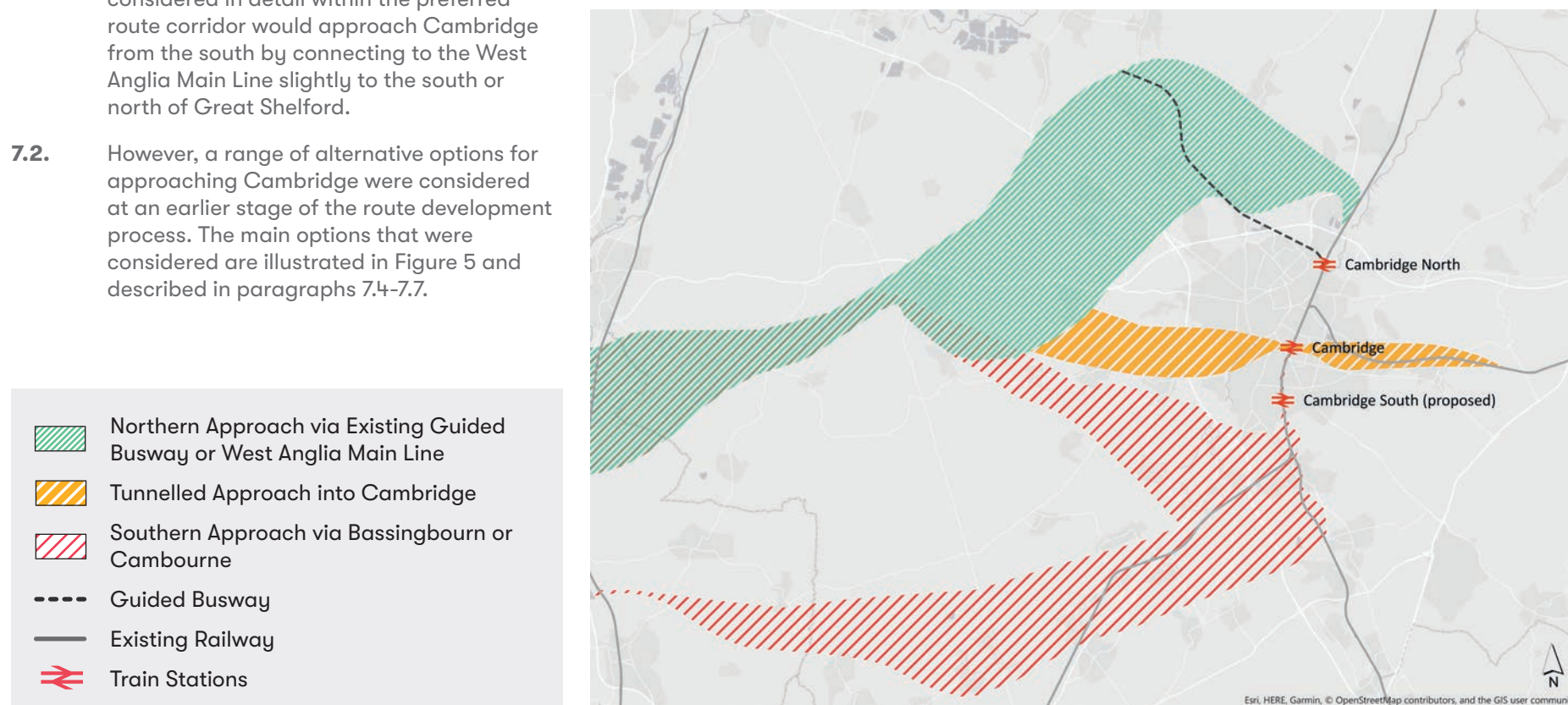
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South Cambridgeshire. While Route L would result in slightly faster journey times between Bedford and Cambridge than Route D, Route L would result in an additional journey time penalty for the existing population of Sandy that would need to use Thameslink services to interchange onto EWR services via a new station in the broad area around Tempsford.

## 7. Reviewing the approach into Cambridge

- 7.1.** All eleven of the route options that have been considered in detail within the preferred route corridor would approach Cambridge from the south by connecting to the West Anglia Main Line slightly to the south or north of Great Shelford.
- 7.2.** However, a range of alternative options for approaching Cambridge were considered at an earlier stage of the route development process. The main options that were considered are illustrated in Figure 5 and described in paragraphs 7.4-7.7.

**Figure 5: main options considered for approaching Cambridge**





- 7.3. Tunnelled approaches from the west** were considered within a corridor from near Barton through to Church End and Fulbourn. It was anticipated that a dual-track tunnel could provide an interchange with Cambridge station below ground. While a tunnelled approach was believed to be technically feasible, it was rejected due to the significant cost (estimated to be between £1 billion and £1.7 billion) and interchange journey time penalties at Cambridge station. The least cost tunnelled option that was considered would have required a tunnel of around 5.5 kilometres and result in potentially significant adverse impacts on Grantchester Meadows. In addition, a tunnelled approach would not provide direct east-west connectivity to the proposed new Cambridge South station serving the Cambridge Biomedical Campus, thereby foregoing an opportunity to support growth, housing and employment. It would also not directly serve Cambridge North and support growth in the surrounding area.
- 7.4.** The main options for **approaching Cambridge from the north** that were considered were using the route of the existing guided busway that links Cambridge to Histon, St. Ives and Huntingdon, or connecting to the West Anglia Main Line north of Milton. These options were rejected due to the additional route length resulting in journey time penalties and the need for a reversing movement at Cambridge for onward trains to Ipswich and Norwich. Routes that would use the existing guided busway would also be expected to impact adversely on existing users of the busway by requiring them to interchange between the bus and train if they were travelling to or from central Cambridge. Approaching Cambridge from the north would also not provide direct east-west connectivity to the proposed new Cambridge South station (unless trains could run on to the new Cambridge South station after serving Cambridge station, which would still result in longer journey times). It would therefore not maximise the opportunity to support growth, homes and jobs around the Cambridge South station (though it would provide better connectivity to support growth and development around Cambridge North station).
- 7.5.** EWR Co have re-visited the case for approaching Cambridge from the north in the context of the current strategic objectives for EWR and identified the following issues:
- It would require potential modifications to the new Cambridge North station and adding more tracks to a longer section of the West Anglia Main Line (four-tracking of the West Anglia Main Line immediately to the south of Cambridge is likely to be required anyway to support the proposed new Cambridge South station), both of which are likely to add significant cost.
  - It would be expected to incur higher capital and operating costs and result in slower journey times due to the greater route length. This would reduce the benefits for transport users and the wider economy across the Oxford-Cambridge Arc and also have an adverse impact on opportunities to support new homes.
  - Existing local transport infrastructure (the guided busway) appears to cater for growth opportunities to the north of Cambridge and therefore an additional railway service to improve local connectivity to the north of Cambridge may not be required.
  - Approaching Cambridge from the north would not directly serve the proposed new Cambridge South station, thereby foregoing an opportunity to support growth, housing and employment.
  - It would require a reversing move and journey time penalties for any onward journeys to and from Norwich, Ipswich and other destinations to the east of Cambridge.<sup>25</sup>

<sup>25</sup> Onwards services to and from the east of Cambridge (for example to and from Norwich and Ipswich) are not currently included in the indicative train service specification for EWR services and are not currently part of EWR Co's remit. However this could be considered at a later date if there was evidence of sufficient demand.

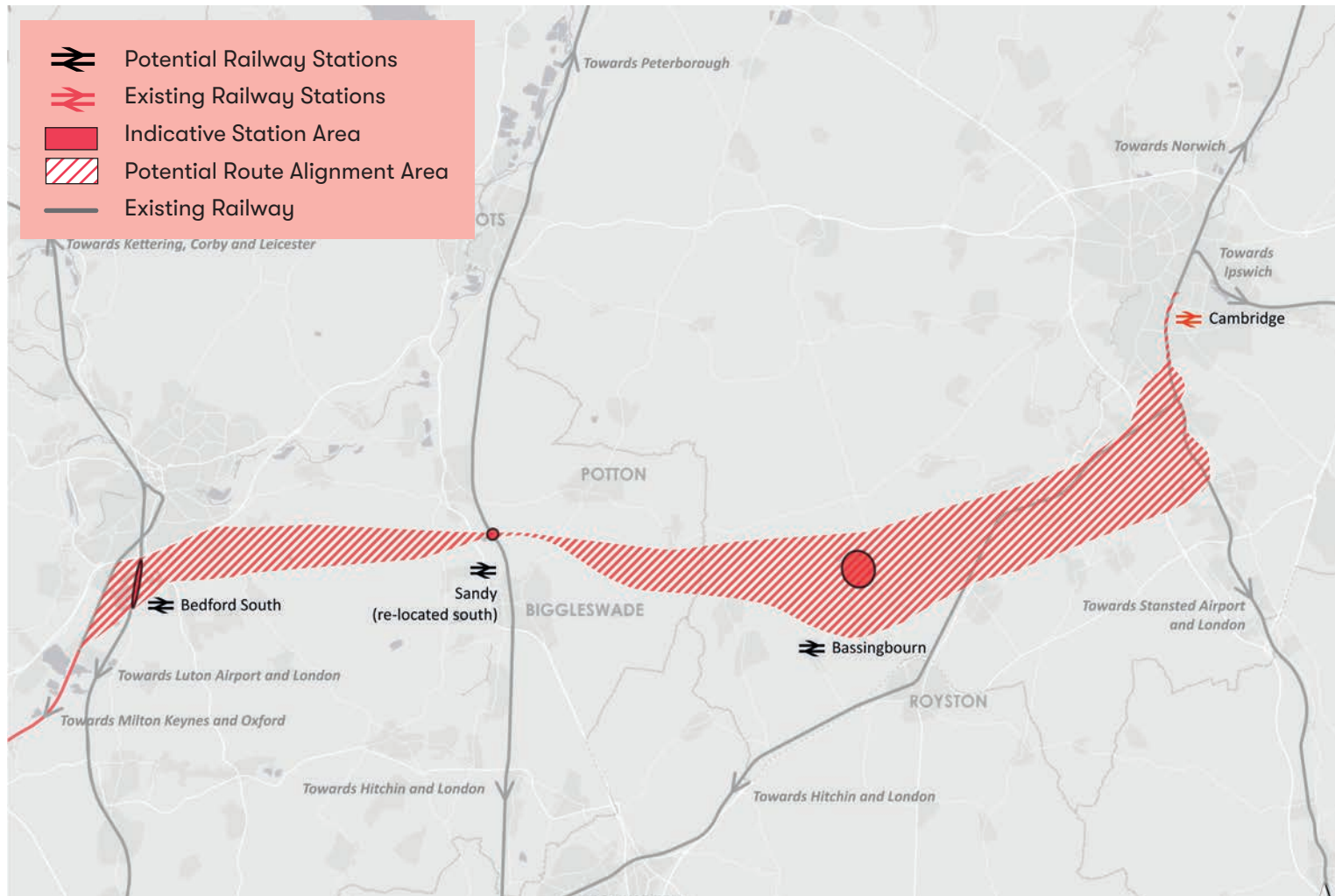
- 7.6.** The main option considered for **approaching Cambridge from the south** was to connect to the West Anglia Main Line slightly to the south or north of Great Shelford. This option performed best against the key evaluation criteria, including generating shorter journey times and greater transport user benefits, and would be expected to generate greater growth and housing opportunities across the Oxford-Cambridge Arc, for example around an interchange with the East Coast Main Line. Approaching Cambridge from the south would also provide the best connectivity for the proposed new Cambridge South station and the employment opportunities that it supports, as well as allowing for onward journeys to Ipswich and Norwich without a reversing move and significant journey time penalties. **Approaching Cambridge from the south was therefore selected as the preferred option.**
- 7.7.** Based on the further, recent analysis of the options for approaching Cambridge, **the previous decision to approach Cambridge from the south rather than the north is considered to remain sound when considered against the current strategic objectives for EWR.** However, of the five route options that are being taken forward for consultation, Routes B and E could alternatively approach Cambridge from the north if new information is provided to EWR Co through the consultation that suggests this would be better than approaching Cambridge from the south as currently shown in the indicative route maps.

## 8. Route options shortlisted for consultation

- 8.1.** This chapter sets out the five route options that have been shortlisted for consultation and their key features.
- 8.2.** As set out in Chapter 1, the route options are shown indicatively and cover an area up to several kilometres in some places. The number and location of stations are also indicative. The exact alignments for new railway lines and station locations will be developed once a preferred route option has been identified and will be subject to further consultation.

## Route A: Bedford South – Sandy (re-located south) – Cambridge (via Bassingbourn)

Figure 6: Route A area



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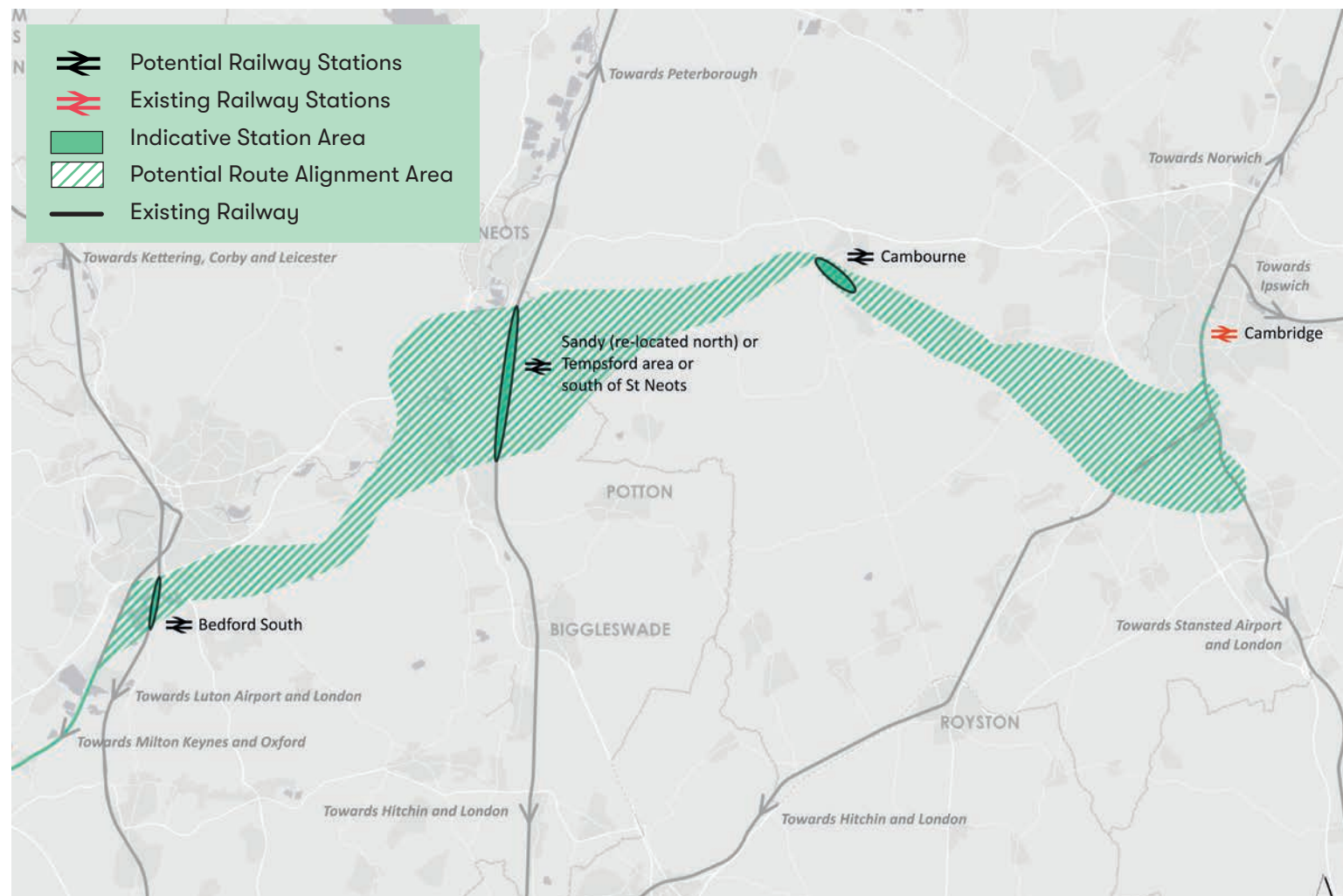
- 8.3.** EWR could diverge from the Marston Vale line around Stewartby near Bedford. It could then serve a new split-level ‘Bedford South’ station to the south of the A421, which could alternatively be located near Wixams (i.e. the EWR track and platforms could sit above the Midland Main Line). This could provide a direct interchange with Thameslink services along the Midland Main Line and other Midland Main Line services through a further interchange at Bedford Midland.
- 8.4.** From there, it could head eastwards and serve a new split-level Sandy station re-located to the south of the existing station, which could provide an interchange with the East Coast Main Line. The EWR track could then run between the Sandy Warren SSSI and Biggleswade Common.
- 8.5.** An additional station could be located on the MoD site at Bassingbourn if the MoD vacate the site and it can be developed. Alternatively, the route could run slightly north of the MoD site across the southern end of the Wimpole Hall avenue or to the south of the MoD site.
- 8.6.** The precise connection between EWR and the West Anglia Main Line around Great Shelford would be determined through detailed work on route alignments. One option would be for EWR to connect to the existing Hitchin-Cambridge Line before then connecting onto the West Anglia Main Line at Shepreth Junction. At least some EWR services would be expected to serve the proposed new Cambridge South station.
- 8.7.** Initial cost estimates indicate that Route A could incur upfront capital costs of around £1.7 billion and provide for a journey time between Oxford and Cambridge of 76 minutes.<sup>26</sup> Route A is currently estimated to generate transport user benefits of around £0.7 billion (though this is before consideration of wider transformational growth across the Oxford-Cambridge Arc), and could also support additional homes to the south of Bedford and on the site of the MoD Bassingbourn Barracks if it can be developed.<sup>27</sup> Development in the immediate vicinity of Sandy is likely to be constrained by the River Great Ouse, the A1 and environmental features.
- 8.8.** Route alignments would be developed to avoid direct impacts on significant environmental features. Environmental features within the indicative Route A area that could be affected include: a number of watercourses and associated flood zones that would be crossed by the route, including the River Great Ouse, Potton Brook, River Cam and associated flood zones; listed buildings; scheduled monuments; ancient woodland; Biggleswade Common; SSSIs including Sandy Warren SSSI; nature reserves including RSPB The Lodge; Ickwell Bury Registered Park and Garden; Eversden and Wimpole Special Area of Conservation (SAC); and the Wimpole Estate.

<sup>26</sup> The indicative cost estimates are Net Present Values in 2010 prices. The estimated journey time excludes potential journey time penalties from calling at the proposed Cambridge South station or a potential additional station at Bassingbourn.

<sup>27</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the ‘baseline’ population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>).

## Route B: Bedford South – Sandy (re-located north) / Tempsford area / south of St Neots – Cambourne – Cambridge

Figure 7: Route B area



- 8.9.** EWR could diverge from the Marston Vale line around Stewartby near Bedford. It could then serve a new split-level ‘Bedford South’ station to the south of the A421, which could alternatively be located near Wixams (i.e. the EWR track and platforms could sit above the Midland Main Line). This could provide a direct interchange with Thameslink services along the Midland Main Line and other Midland Main Line services through a further interchange at Bedford Midland.
- 8.10.** From there, it could head eastwards and serve a new split-level station between Sandy and St Neots that could provide an interchange with the East Coast Main Line. This station could be a new (re-located) Sandy station slightly to the north of the existing station or a new station further north.
- 8.11.** It could then serve a potential new station around Cambourne, the precise location of which would be considered further as part of the detailed work on route and station alignments.
- 8.12.** The route could then connect to the West Anglia Main Line around Great Shelford. At least some EWR services would be expected to serve the proposed new Cambridge South station.
- 8.13.** Initial cost estimates indicate that Route B could incur upfront capital costs of around £2.2 billion and provide for a journey time between Oxford and Cambridge of 80 minutes.<sup>28</sup> Route B is currently estimated to generate transport user benefits of around £0.6 billion (though this is before consideration of wider transformational growth across the Oxford-Cambridge Arc), and could also support additional homes to the south of Bedford, between Sandy and St Neots and around Cambourne.<sup>29</sup>
- 8.14.** Route alignments would be developed to avoid direct impacts on significant environmental features. Environmental features within the indicative Route B area that could be affected include: a number of watercourses and associated flood zones that would be crossed by the route, including the River Great Ouse and River Cam and associated flood zones; listed buildings; scheduled monuments; nature reserves; Moggerhanger Park Registered Park and Garden; ancient woodland; Eversden and Wimpole SAC; and SSSIs.

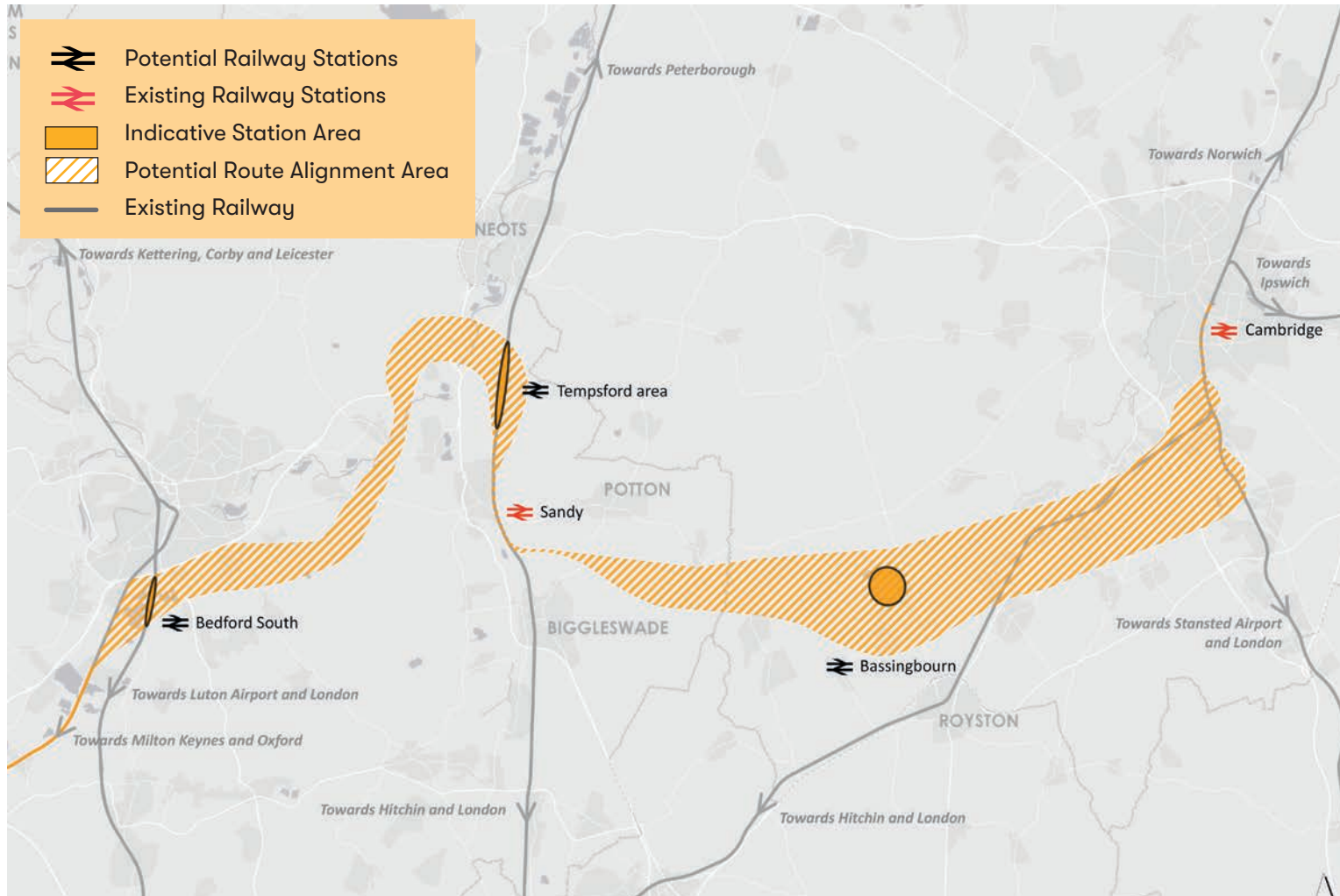
<sup>28</sup> The indicative cost estimates are Net Present Values in 2010 prices. The estimated journey time excludes the potential journey time penalty from calling at the proposed Cambridge South station.

<sup>29</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the ‘baseline’ population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>).



## Route C: Bedford South – Tempsford area – Sandy – Cambridge (via Bassingbourn)

Figure 8: Route C area





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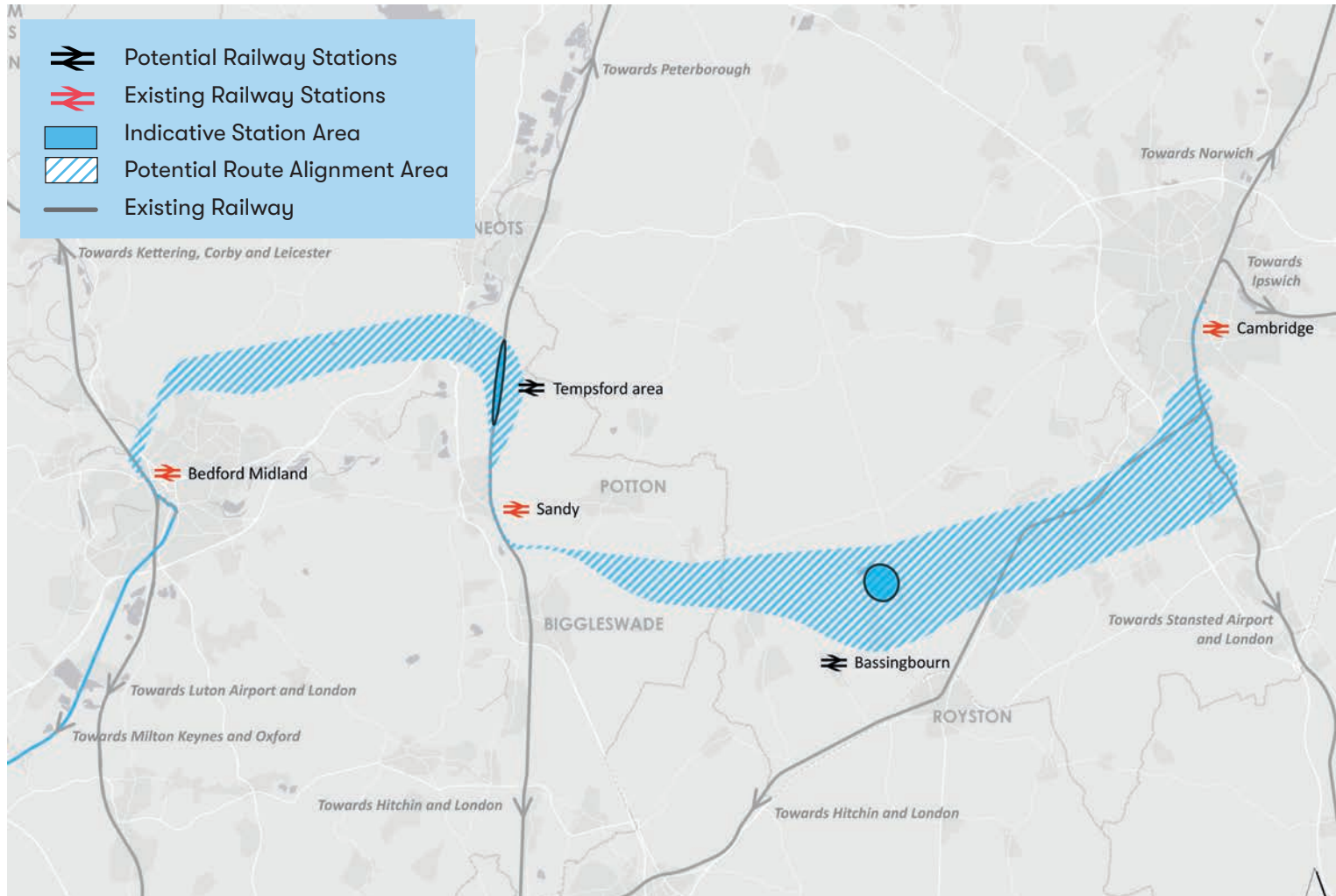
- 8.15.** EWR could diverge from the Marston Vale line around Stewartby near Bedford. It could then serve a new split-level ‘Bedford South’ station to the south of the A421, which could alternatively be located near Wixams (i.e. the EWR track and platforms could sit above the Midland Main Line). This could provide a direct interchange with Thameslink services along the Midland Main Line and other Midland Main Line services through a further interchange at Bedford Midland.
- 8.16.** From there, it could head north-eastwards before looping round and providing interchanges with the East Coast Main Line via a new station in the broad area around Tempsford and the existing Sandy station, before diverging away from the East Coast Main Line between the Sandy Warren SSSI and Biggleswade Common.
- 8.17.** An additional station could be located on the MoD site at Bassingbourn if the MoD vacate the site and it can be developed. Alternatively, the route could run slightly north of the MoD site across the southern end of the Wimpole Hall avenue or to the south of the MoD site.
- 8.18.** The precise connection between EWR and the West Anglia Main Line around Great Shelford would be determined through detailed work on route alignments. One option would be for EWR to connect to the existing Hitchin-Cambridge Line before then connecting onto the West Anglia Main Line at Shepreth Junction. At least some EWR services would be expected to serve the proposed new Cambridge South station.
- 8.19.** Initial cost estimates indicate that Route C could incur upfront capital costs of around £2.1 billion and provide for a journey time between Oxford and Cambridge of 80 minutes.<sup>30</sup> Route C is currently estimated to generate transport user benefits of around £0.5 billion (though this is before consideration of wider transformational growth across the Oxford-Cambridge Arc), and could also support additional homes to the south of Bedford, between Sandy and St Neots and on the site of the MoD Bassingbourn Barracks if it can be developed.<sup>31</sup> Development in the immediate vicinity of Sandy is likely to be constrained by the River Great Ouse, the A1 and environmental features.
- 8.20.** Route alignments would be developed to avoid direct impacts on significant environmental features. Environmental features within the indicative Route C area that could be affected include: a number of watercourses and associated flood zones that would be crossed by the route, including the River Great Ouse, Potton Brook, River Cam and associated flood zones; listed buildings; scheduled monuments; Biggleswade Common; SSSIs including Sandy Warren SSSI; The Lodge RSPB Nature Reserve; nature reserves including RSPB The Lodge and Lousey Bush; Moggerhanger Park Registered Park and Garden; Eversden and Wimpole SAC; and the Wimpole Estate.

<sup>30</sup> The indicative cost estimates are Net Present Values in 2010 prices. The estimated journey time excludes potential journey time penalties from calling at the proposed Cambridge South station or a potential additional station at Bassingbourn.

<sup>31</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the ‘baseline’ population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>).

## Route D: Bedford Midland – Tempsford area – Sandy – Cambridge (via Bassingbourn)

Figure 9: Route D area



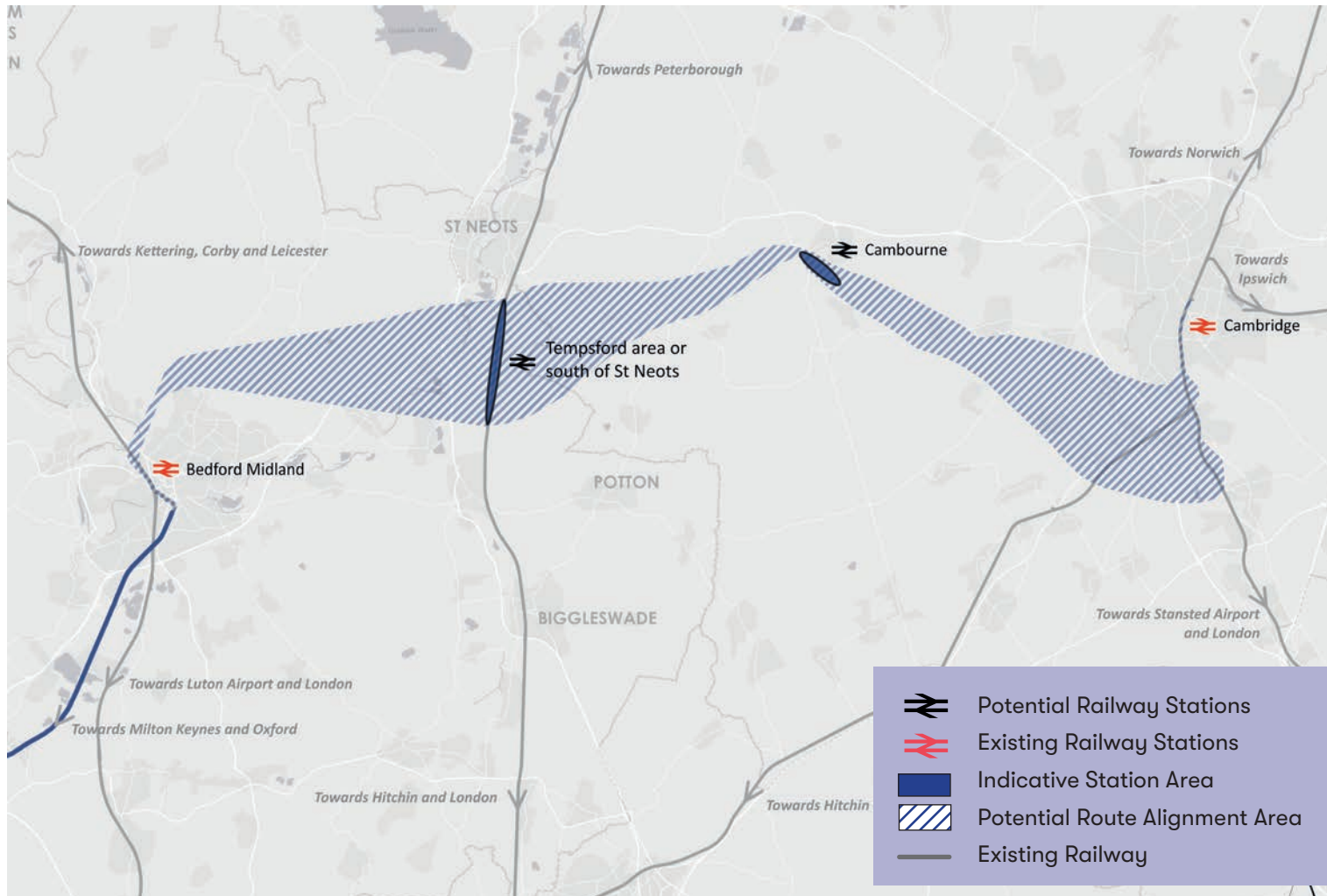
- 8.21.** EWR could run along the existing Marston Vale Line and then Midland Main Line through Bedford town centre, providing an interchange with the Midland Main Line via Bedford Midland station, before diverging eastwards north of Bedford.
- 8.22.** From there, it could head eastwards before looping round and providing interchanges with the East Coast Main Line via a new station in the broad area around Tempsford and the existing Sandy station, before diverging away from the East Coast Main Line between the Sandy Warren SSSI and Biggleswade Common.
- 8.23.** An additional station could be located on the MoD site at Bassingbourn if the MoD vacate the site and it can be developed. Alternatively, the route could run slightly north of the MoD site across the southern end of the Wimpole Hall avenue or to the south of the MoD site.
- 8.24.** The precise connection between EWR and the West Anglia Main Line around Great Shelford would be determined through detailed work on route alignments. One option would be for EWR to connect to the existing Hitchin-Cambridge Line before then connecting onto the West Anglia Main Line at Shepreth Junction. At least some EWR services would be expected to serve the proposed new Cambridge South station.
- 8.25.** Initial cost estimates indicate that Route D could incur upfront capital costs of around £2.2 billion and provide for a journey time between Oxford and Cambridge of 83 minutes.<sup>32</sup> Route D is currently estimated to generate transport user benefits of around £0.7 billion (though this is before consideration of wider transformational growth across the Oxford-Cambridge Arc), and could also support additional homes between Sandy and St Neots and on the site of the MoD Bassingbourn Barracks if it can be developed.<sup>33</sup> It might also support development and densification within Bedford town centre. Development in the immediate vicinity of Sandy is likely to be constrained by the River Great Ouse, the A1 and environmental features.
- 8.26.** Route alignments would be developed to avoid direct impacts on significant environmental features. Environmental features within the indicative Route D area that could be affected include: a number of watercourses and associated flood zones that would be crossed by the route, including the River Great Ouse, River Ivel, Potton Brook and River Cam and associated flood zones; listed buildings; scheduled monuments; ancient woodland; Biggleswade Common; SSSIs including Sandy Warren; The Lodge RSPB Nature Reserve; nature reserves including RSPB The Lodge and Lousey Bush; Eversden and Wimpole SAC; and the Wimpole Estate.

<sup>32</sup> The indicative cost estimates are Net Present Values in 2010 prices. The estimated journey time excludes potential journey time penalties from calling at the proposed Cambridge South station or a potential additional station at Bassingbourn.

<sup>33</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the 'baseline' population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>).

## Route E: Bedford Midland – Tempsford area / south of St Neots – Cambourne – Cambridge

Figure 10: Route E area



- 8.27.** EWR could run along the existing Marston Vale Line and then Midland Main Line through Bedford town centre, providing an interchange with the Midland Main Line via Bedford Midland station, before diverging eastwards north of Bedford.
- 8.28.** From there, it could head eastwards and serve a new split-level station between Sandy and St Neots that could provide an interchange with the East Coast Main Line (i.e. the EWR track and platforms could sit above the East Coast Main Line). This station could be located in the broad areas around Tempsford or to the south of St Neots.
- 8.29.** It could then serve a potential new station around Cambourne, the precise location of which would be considered further as part of the detailed work on route and station alignments.
- 8.30.** The precise connection between EWR and the West Anglia Main Line around Great Shelford would be determined through detailed work on route alignments. One option would be for EWR to connect to the existing Hitchin-Cambridge Line before then connecting onto the West Anglia Main Line at Shepreth Junction. At least some EWR services would be expected to serve the proposed new Cambridge South station.
- 8.31.** Initial cost estimates indicate that Route E could incur upfront capital costs of around £2.8 billion and provide for a journey time between Oxford and Cambridge of 82 minutes.<sup>34</sup> Route E is currently estimated to generate transport user benefits of around £0.7 billion (though this is before consideration of wider transformational growth across the Oxford-Cambridge Arc), and could also support additional homes between Sandy and St Neots and around Cambourne.<sup>35</sup> It might also support development and densification within Bedford town centre.
- 8.32.** Route alignments would be developed to avoid direct impacts on significant environmental features. Environmental features within the indicative Route E area that could be affected include: a number of watercourses and associated flood zones that will be crossed by the route, including the River Great Ouse and River Cam and associated flood zones; listed buildings; scheduled monuments; nature reserves including Begwary Brook; SSSIs; Eversden and Wimpole SAC; and ancient woodland.

<sup>34</sup> The indicative cost estimates are Net Present Values in 2010 prices. The estimated journey time excludes the potential journey time penalty from calling at the proposed Cambridge South station.

<sup>35</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the 'baseline' population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>).

## 9. How the shortlisted route options perform against the route selection criteria

**9.1.** Tables 1-4 compare how the five routes shortlisted for consultation perform against the factors identified in Chapter 4 that at this stage might attract particular weight, particularly where they appear to differentiate between route options.

**Table 1: summary of transport user benefits for the shortlisted route options**

	Estimated Oxford-Cambridge journey time <sup>36</sup>	Estimated Bedford-Cambridge journey time <sup>37</sup>	Estimated total transport benefits <sup>38</sup>	EWR connectivity to Bedford town centre	Impact on existing Sandy station
<b>Route A</b>	76 minutes	23 minutes	£0.6 billion	Interchange via Thameslink services	Existing station would be re-located to the south
<b>Route B</b>	80 minutes	27 minutes	£0.6 billion	Interchange via Thameslink services	Existing station could be re-located to the north if EWR were to serve a station slightly to the north of Sandy but not if the EWR station is further north
<b>Route C</b>	80 minutes	27 minutes	£0.5 billion	Interchange via Thameslink services	EWR would serve the existing station
<b>Route D</b>	83 minutes	25 minutes	£0.7 billion	Direct connectivity	EWR would serve the existing station

<sup>36</sup> Journey time figures exclude potential journey time penalties from calling at the proposed Cambridge South station or a potential additional station at Bassingbourn. A new 'Bassingbourn' station would only be built if the MoD Bassingbourn Barracks is developed.

<sup>37</sup> Journey time figures exclude potential journey time penalties from calling at the proposed Cambridge South station or a potential additional station at Bassingbourn. A new 'Bassingbourn' station would only be built if the MoD Bassingbourn Barracks is developed. Journey times between Bedford and Cambridge are estimated from the Bedford station that EWR would serve, either Bedford Midland or a new station to the south of Bedford.

<sup>38</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period. These figures correspond to the transport benefits in the 'baseline' population growth scenario, which reflect the population forecasts derived from the DfT National Trip End Model (NTEM) (available at <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem>). See Annex A for more detail.



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	Estimated Oxford-Cambridge journey time <sup>36</sup>	Estimated Bedford-Cambridge journey time <sup>37</sup>	Estimated total transport benefits <sup>38</sup>	EWR connectivity to Bedford town centre	Impact on existing Sandy station
<b>Route E</b>	82 minutes	24 minutes	£0.7 billion	Direct connectivity	Interchange onto EWR services would be via Thameslink and a new station in the broad areas around Tempsford or south of St Neots

**Table 2: summary of the potential for the shortlisted route options to contribute to enabling housing and economic growth**

	Housing potential in and around Bedford	Housing potential around the interchange with the East Coast Main Line	Housing potential in South Cambridgeshire	Estimated impact on wider economic growth
<b>Route A</b>	Could support significant additional housing to the south of Bedford (aligned with the recent strategic allocation of land at Wixams)	Development supported by a new (re-located) Sandy station is likely to be constrained by flood risk from the River Great Ouse, the A1 and environmental features including Biggleswade Common and the Sandy Warren SSSI and RSPB nature reserve	Could support significant additional housing on the site of the MoD Basingbourn Barracks if it can be developed (in line with the NIC recommendation)	Initial analysis indicates that route options serving a new station south of Bedford would generate slightly greater increases in jobs and productivity than routes serving Bedford Midland due to faster journey times across the Oxford-Cambridge Arc
<b>Route B</b>	Could support significant additional housing to the south of Bedford (aligned with the recent strategic allocation of land at Wixams)	A new station between Sandy and St Neots could support significant additional housing and would align with the previous consideration of land for development around Tempsford and plans to expand St Neots	Could support further development around Cambourne, which has already been identified as a growth location (though this might alternatively be provided for through plans for the Cambridge Autonomous Metro)	Initial analysis indicates that route options serving a new station south of Bedford would generate slightly greater increases in jobs and productivity than routes serving Bedford Midland due to faster journey times across the Oxford-Cambridge Arc
<b>Route C</b>	Could support significant additional housing to the south of Bedford (aligned with the recent strategic allocation of land at Wixams)	A new station in the broad area around Tempsford could support significant additional housing and would align with the previous consideration of land for development around Tempsford; additional development in the immediate vicinity of Sandy is likely to be constrained by environmental features including Biggleswade Common and the Sandy Warren SSSI and RSPB nature reserve	Could support significant additional housing on the site of the MoD Basingbourn Barracks if it can be developed (in line with the NIC recommendation)	Initial analysis indicates that route options serving a new station south of Bedford would generate slightly greater increases in jobs and productivity than routes serving Bedford Midland due to faster journey times across the Oxford-Cambridge Arc
<b>Route D</b>	Could support additional housing through the densification of Bedford town centre; however this is likely to offer significantly less potential than to the south of Bedford	A new station in the broad area around Tempsford could support significant additional housing and would align with the previous consideration of land for development around Tempsford; additional development in the immediate vicinity of Sandy is likely to be constrained by environmental features including Biggleswade Common and the Sandy Warren SSSI and RSPB nature reserve	Could support significant additional housing on the site of the MoD Basingbourn Barracks if it can be developed (in line with the NIC recommendation)	Initial analysis indicates that route options serving Bedford Midland would generate slightly smaller increases in jobs and productivity than routes serving a new station to the south of Bedford due to faster journey times across the Oxford-Cambridge Arc

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	Housing potential in and around Bedford	Housing potential around the interchange with the East Coast Main Line	Housing potential in South Cambridgeshire	Estimated impact on wider economic growth
<b>Route E</b>	Could support additional housing through the densification of Bedford town centre; however this is likely to offer significantly less potential than to the south of Bedford	A new station in the broad areas around Tempsford or south of St Neots could support significant additional housing and would align with the previous consideration of land for development around Tempsford and plans to expand St Neots	Could support further development around Cambourne, which has already been identified as a growth location (though this might alternatively be provided for through plans for the Cambridge Autonomous Metro)	Initial analysis indicates that route options serving Bedford Midland would generate slightly smaller increases in jobs and productivity than routes serving a new station to the south of Bedford due to faster journey times across the Oxford-Cambridge Arc

**Table 3: summary of the indicative cost estimates and overall affordability for the shortlisted route options<sup>39</sup>**

	Estimated upfront capital costs	Estimated total costs <sup>40</sup>	Interfaces with the existing rail network
<b>Route A</b>	£1.7 billion	£1.9 billion	Could avoid potentially complex interfaces with the Midland Main Line and East Coast Main Line, which would be expected to increase the likelihood of securing private financing that represents value for money
<b>Route B</b>	£2.2 billion	£2.4 billion	Could avoid potentially complex interfaces with the Midland Main Line and East Coast Main Line, which would be expected to increase the likelihood of securing private financing that represents value for money
<b>Route C</b>	£2.1 billion	£2.5 billion	Could involve potentially complex interfaces with the East Coast Main Line, which would be expected to reduce the likelihood of securing private financing that represents value for money
<b>Route D</b>	£2.2 billion	£2.6 billion	Could involve potentially complex interfaces with the Midland Main Line and East Coast Main Line, which might include re-modelling or re-locating the existing Bedford maintenance depot, and would be expected to reduce the likelihood of securing private financing that represents value for money
<b>Route E</b>	£2.8 billion	£3.0 billion	Could involve potentially complex interfaces with the Midland Main Line, which might include re-modelling or re-locating the existing Bedford maintenance depot, and would be expected to reduce the likelihood of securing private financing that represents value for money

<sup>39</sup> Figures are Net Present Values in 2010 prices over a standard 60-year appraisal period.

<sup>40</sup> Estimated total costs includes estimates of initial upfront construction costs, infrastructure renewal costs, operating costs and fare revenues.



**Table 4: summary of potential environmental features for the shortlisted route options<sup>41</sup>**

	Potential environmental issues that have been identified
<b>Route A</b>	<p>The route would cross several watercourses and associated flood zones</p> <p>The route would run close to the Sandy Warren SSSI, Biggleswade Common and the RSPB Nature Reserve (The Lodge) and might also impact on the Wimpole Hall avenue depending on the precise alignment selected</p> <p>Potential impacts on listed buildings, scheduled monuments, Ickwell Bury Registered Park and Garden, nature reserves, Eversden and Wimpole SAC, SSSIs and ancient woodland would depend on the precise alignment selected</p>
<b>Route B</b>	<p>The route would cross a number of watercourses and associated flood zones</p> <p>Potential impacts on listed buildings, scheduled monuments, nature reserves, Moggerhanger Park Registered Park and Garden, Eversden and Wimpole SAC, ancient woodland and SSSIs would depend on the precise alignment selected</p>
<b>Route C</b>	<p>The route would cross several watercourses and associated flood zones</p> <p>The route would run close to the Sandy Warren SSSI, Biggleswade Common and the RSPB Nature Reserve (The Lodge) and might also impact on the Wimpole Hall avenue depending on the precise alignment selected</p> <p>Potential impacts on listed buildings, scheduled monuments, nature reserves, Moggerhanger Park Registered Park and Garden, Eversden and Wimpole SAC, SSSIs and ancient woodland would depend on the precise alignment selected</p>
<b>Route D</b>	<p>The route would cross several watercourses and associated flood zones</p> <p>The route would run close to the Sandy Warren SSSI, Biggleswade Common and the RSPB Nature Reserve (The Lodge) and might also impact on the Wimpole Hall avenue depending on the precise alignment selected</p> <p>Potential impacts on listed buildings, scheduled monuments, nature reserves, Eversden and Wimpole SAC, ancient woodland and SSSIs would depend on the precise alignment selected</p>
<b>Route E</b>	<p>The route would cross several watercourses and associated flood zones</p> <p>Potential impacts on listed buildings, scheduled monuments, nature reserves, Eversden and Wimpole SAC, ancient woodland and SSSIs would depend on the precise alignment selected</p>

<sup>41</sup> Figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period.

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- 9.2.** As set out in Chapter 4, EWR Co intends to continue working with the government and other agencies as part of a strategic approach to exploring options for a local natural capital plan for the Oxford-Cambridge Arc and ensuring that the EWR central section aligns with the government's policy on biodiversity net gain.
- 9.3.** **In summary, all routes perform well against the strategic objectives for the EWR central section by providing fast journey times between key urban areas and significant opportunities for stimulating growth, housing and employment. Routes B, C, D and E are significantly more expensive than Route A but could be justified if the potential opportunities to support additional growth and housing that have been identified could be realised.**

## 10. Next steps

- 10.1.** This report has been published to inform a consultation with the public and key stakeholders on the shortlisted route options, which will run until 11 March. As part of the consultation, leaflets will be distributed to around 90,000 local households and EWR Co will hold 8 public exhibition events at locations along the potential routes.
- 10.2.** In parallel with the consultation and further engagement with local authorities and other stakeholders, EWR Co will continue to develop the evidence base to support the decision on a preferred route. This includes consideration of analysis to explore the potential for new and expanded settlements across the Oxford-Cambridge Arc that is being undertaken on behalf of the Ministry of Housing, Communities and Local Government (MHCLG).
- 10.3.** Once a preferred route option has been selected, EWR Co will begin detailed work to develop precise route and station alignments within the broad area covered by the preferred route. The detailed alignments will then be subject to further consultation, expected to take place in 2021, ahead of an application for development consent later in 2021.
- 10.4.** As part of this further work and to inform further consultation, EWR Co will prepare a detailed analysis of the potential environmental effects of the preferred route. An Environmental Impact Assessment (EIA) will identify, describe and assess the direct and indirect significant effects that the project may have on the environment. As part of the assessment, measures envisaged to avoid, reduce and potentially remedy the significant adverse effects of the project will be identified. EWR Co will also explore opportunities to enhance the natural environment in the context of the government's 25 Year Environment Plan and commitment to explore options for a natural capital plan for the Oxford-Cambridge Arc.

# Annex A

## Transport benefit modelling

- A.1.** The potential transport benefits of EWR have been assessed using a transport model that was initially developed for phase 2 of the EWR western section.
- A.2.** The model's approach to estimating the demand for EWR journeys varies depending on the scale of the estimated improvement in the Generalised Journey Time (GJT):<sup>42</sup>
- A gravity model is used where GJTs fall by 20% or more; and
  - Standard GJT elasticities are used for more modest journey time improvements.<sup>43</sup>
- A.3.** The gravity model forecasts the 'Do Something' demand by considering the attraction between origin-destination pairs, based on relevant factors such as their population and employment levels and journey times. It is calibrated through regression analysis on data for 17,000 station to station flows.
- A.4.** For journeys with GJT improvements of less than 20%, the model takes the current level of demand (the 'Do Nothing' scenario) as the starting point. It then estimates future demand considering other planned transport improvements (the 'Do Minimum' scenario) and the EWR central section (the 'Do Something' scenario). For both the 'Do Minimum' and 'Do Something' scenarios, elasticity scaling factors corresponding to the degree of improvement in journey times are applied to the base level of demand.
- A.5.** For all journey pairs, the demand in the 'Do Something' scenario is compared against the demand in the 'Do Minimum' scenario to estimate the overall transport user benefits that can be attributed to the EWR central section.<sup>44</sup>
- A.6.** Recognising the wider ambitions for the Oxford-Cambridge Arc, three population growth scenarios have been tested:
- A 'baseline' growth scenario using population forecasts derived from the DfT National Trip End Model (NTEM);<sup>45</sup>

<sup>42</sup> Generalised Journey Time (GJT) is a measure incorporating the total station-to-station journey time plus time penalties based on the frequency of service and the number of interchanges required. It is expressed in minutes of journey time.

<sup>43</sup> These elasticities are sourced from the Passenger Demand Forecasting Handbook (PDFH) and considered accurate for relatively small, incremental changes in GJT.

<sup>44</sup> These benefits are appraised over a 60 year period.

<sup>45</sup> Demand is forecast for a 20 year period until 2038-39 in accordance with DfT guidance, after which demand increases in line with the Office for National Statistics (ONS) forecast for national population growth.

- An ‘intermediate’ growth scenario that for each local authority uses the higher of NTEM household projections, the local assessment of housing need or the indicative MHCLG assessment of housing need;<sup>46</sup> and
- A ‘high’ growth scenario based on the NIC’s transformational growth scenario, including specific locations and levels of housing where indicated in the supporting documentation accompanying the NIC’s report.<sup>47</sup>

- A.7.** As set out in Chapter 9, the total transport user benefits for the five shortlisted route options in the ‘baseline’ population growth scenario are estimated to range from £0.5 billion to £0.7 billion.<sup>48</sup> The ‘intermediate’ population growth scenario is estimated to result in an uplift in transport user benefits of around 30% for the route options that have been modelled. However, the increase in population in the ‘high’ growth scenario generates a significant increase in transport demand, which in turn results in a very significant increase in the estimated transport user benefits of the EWR central section. Some of these additional benefits would be offset by the additional operating costs incurred to meet the higher level of demand.
- A.8.** The transport user modelling to date is primarily based on an indicative train service specification of 3 trains per hour in each direction: one fast service between Cambridge and Oxford; one stopping service between Cambridge and Oxford; and one service between Cambridge and Bletchley (providing connectivity to Milton Keynes). EWR Co are continuing to review the planned service specification and opening dates.
- A.9.** EWR Co will continue to refine the modelling of potential transport benefits as the Strategic Outline Business Case (SOBC) for the EWR central section is developed and previous assumptions are considered further.

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<sup>46</sup> Figures for MHCLG indicative housing need assessments and local assessments of housing need are as of September 2017.

<sup>47</sup> Potential locations for additional housing are set out in Table 3.3 of a report by Steer Davies Gleave (<https://www.nic.org.uk/wp-content/uploads/First-Last-mile-Strategy-Assessment-Reports-Transport-infrastructure-Assessment-First-Last-mile-Strategy-Assessment-Report-SDG-2017.pdf>).

<sup>48</sup> These figures are the Net Present Values in 2010 prices of the total estimated transport benefits over a standard 60-year appraisal period.

# Annex B

## Modelling of potential wider economic benefits (employment and productivity)

- A.10.** EWR Co's analysis to date has focused on the extent to which the wider economic benefits of the EWR central section might vary by route option, rather than attempting to produce a single, central estimate of the overall economic case for the scheme.
- A.11.** EWR Co therefore commissioned KPMG to estimate the potential increases in productivity (via agglomeration) and employment arising from changes in land use and business activity in response to the improvements in transport connectivity delivered by route options.
- A.12.** The analysis was undertaken using a Land Use Model Influenced by Transport (LUMIT) model, which is a form of supplementary economic model identified within DfT's appraisal guidance for assessing the impacts of transformational transport schemes on the wider economy given land use change.<sup>49</sup> The model draws on relatively conservative forecast data for future highway costs, together with rail transport costs, which have each been sourced from separate transport modelling.
- A.13.** The scenarios that have been modelled are:
- 'Do Minimum': estimated growth under a 'policy off' planning environment (i.e. in the absence of wider transformational growth across the Oxford-Cambridge Arc in line with the NIC's vision) with committed levels of transport investment, including the EWR western section;<sup>50</sup> and
  - 'Do Something': estimated growth under the same 'policy off' planning environment, but with the additional introduction of EWR central section services.
- A.14.** Comparing the results of these scenarios provides an estimate of the potential impacts of the EWR central section in the absence of additional housing. At this stage, the analysis suggests the EWR central section could generate up to around 3,000 additional jobs and £500 million of GVA each year across the Oxford-Cambridge Arc.<sup>51</sup> This is before consideration of wider transformational growth and additional homes in line with the NIC's vision, which if it were to materialise, would further increase the additional jobs and greater productivity supported by the railway. However, this analysis remains illustrative and these types of impacts will be considered further as the SOBC is developed.

<sup>49</sup> DfT WebTAG Unit M5-3, available at <https://www.gov.uk/government/publications/webtag-tag-unit-m5-3-supplementary-economic-modelling-may-2018>

<sup>50</sup> The 'policy off' planning inputs were derived using information on long-term delivery rates (2001-16) for the local authorities across the Oxford-Cambridge Arc and the rest of England, using the MHCLG historical net additional dwellings data, which is available at <https://www.gov.uk/government/collections/net-supply-of-housing>. Equivalent datasets published by Welsh and Scottish Governments were used to derive inputs for Scotland and Wales.

<sup>51</sup> GVA figures are 2061 values expressed in 2011 prices. At the national level, impacts on GVA arise primarily from changes in productivity via agglomeration, as the model assumes a fixed national labour supply in line with HM Treasury Green Book guidance, with increases in employment in one location displacing growth elsewhere.

# Annex C

## Analysis of developable land capacity and the potential economic benefits of additional housing

- A.15.** Given that housing plans across the Arc cannot yet be known, either with or without the new railway in place, it is not possible at this stage to estimate how many homes are directly dependent on EWR. Therefore, EWR Co commissioned analysis of the number of homes that could theoretically be built around potential EWR stations, given potentially developable land capacity.
- A.16.** The analysis is underpinned by a database that includes all live planning applications and permissions and current and proposed site allocations. For each site, it records the number of homes and amount of commercial floorspace, whether development has started, and if so, how much of the site has been built out. This information is used to establish where development is expected to come forward without the EWR central section. The remaining land is then overlaid with environmental and policy constraints to identify unconstrained land that may be available for development supported by EWR.
- A.17.** Development sites in Cambridge, Bedford and other nearby locations, as well as new urban extensions and development in the wider region, were reviewed to develop a set of density assumptions. A 50% discount was applied to estimated developable land, recognising, conservatively, that up to half of the unconstrained land may be needed for supporting uses (covering commercial, community, local infrastructure and green infrastructure).
- A.18.** Going forward, the analysis of developable land capacity for EWR Co will be considered in the context of wider analysis of the potential for new and expanded settlements across the Oxford-Cambridge Arc that is being undertaken on behalf of the Ministry of Housing, Communities and Local Government (MHCLG) and further conversations with local authorities and other stakeholders.
- A.19.** To help understand the potential value for money implications of choosing a more expensive route that might support additional homes, EWR also commissioned separate analysis by KPMG of the potential economic benefits of new housing for landowners and households. This analysis has estimated:
- Producer surplus benefits for landowners (i.e. land value uplift benefits), which reflect the difference between development costs in the broadest sense (including the initial land value based on its prior use) and the market value for housing;<sup>52</sup> and
  - Consumer surplus benefits for households, which reflect the difference between the amount that households are willing to pay for their housing and their actual housing costs, with significant increases in housing supply having the effect of reducing the overall cost of housing (all else equal).

<sup>52</sup> Some of these producer surplus (land value) benefits could accrue to the community through section 106 agreements or Community Infrastructure Levy (CIL) contributions to meet the costs of local infrastructure to support the new homes.



- A.20.** Estimates for the consumer and producer surplus benefits are based on illustrative ‘what if’ scenarios of additional housing permissions. At this stage, the analysis of the jobs and GVA benefits of the EWR central section and the analysis of the benefits of additional housing have been separated to avoid any risk of double-counting.<sup>53</sup>
- A.21.** The modelling suggests that an illustrative 150,000 additional homes spread evenly across the five local authorities through which the EWR central section might pass could generate total benefits (both consumer and producer surplus benefits) of around £5 billion to £9 billion. This translates into an average consumer surplus per home (100 square metres) of between £27,000 and £35,000 and an average producer surplus per home (100 square metres) of between £14,000 and £31,000.<sup>54</sup> The size of these benefits depends on the scale, distribution and phasing of housing that is built, as well as other modelling assumptions such as development costs. Some of these benefits are also likely to be offset by the costs of providing other infrastructure to support the new homes (e.g. local roads and schools), which could vary by location.

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<sup>53</sup> This is a simplifying assumption for modelling purposes. It does not imply that these additional planning permissions and homes could be granted and supported without EWR.

<sup>54</sup> All housing benefit figures are net of any displacement in other parts of Great Britain and are expressed as a 2010 present value. The unit value assumes an average home of 100 square metres (internal floorspace; Census 2011 data suggests the average size of a dwelling in the EWR central section route area was around 93 square metres. In practice, the size of new dwellings and the resulting quantum of additional floorspace that might be supported in the area cannot yet be known). Total consumer and producer surplus benefits relate to the total benefit over the appraisal period through to 2086. The benefits do not include the anticipated effect of EWR on the value of housing along the route. This conservative modelling assumption avoids the risk of double-counting with transport benefits.

# Annex D

## Environmental analysis

- A.22.** At this early stage of developing indicative route options, the appraisal of natural and cultural resources has considered statutorily-protected environmental features (of international and national importance) and other relevant non-statutory features where information is readily available. No site surveys have been undertaken at this stage.
- A.23.** EWR Co will in due course prepare a more detailed analysis of the potential environmental effects of the preferred route to inform further consultation. An Environmental Impact Assessment (EIA) will identify, describe and assess the direct and indirect significant effects that the project may have on the environment. Several factors will be included in this assessment including, but not limited to: biodiversity, with particular attention to European protected species and habitats; land, soil, water, air and climate; cultural heritage and the landscape; and the interaction between these factors. As part of the assessment, measures envisaged to avoid, reduce and potentially remedy the significant adverse effects of the project will be identified.
- A.24.** EWR Co will also explore opportunities to enhance the natural environment in the context of the government's 25 Year Environment Plan and commitment to explore options for a natural capital plan for the Oxford-Cambridge Arc.
- A.25.** The environmental features that have been considered to date are listed in Table 5.

**Table 5: features considered to date in appraising natural and cultural environmental resources**

Environmental sites	Proposed Ramsar
	Ramsar
	Special Areas of Conservation (SAC)
	Possible Special Areas of Conservation
	Special Protection Areas (SPAs)
	Proposed Special Protection Areas (pSPAs)
	Sites of Special Scientific Interest (SSSIs)
	Ancient Woodlands

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	National Nature Reserves (NNRs)
	Local Nature Reserves (LNRs)
	Areas of Outstanding Natural Beauty (AONB)
	National Parks
	RSPB Reserves
	NE Great Crested Newts EEP Surveyed GIS
<b>Landfill</b>	Authorised Landfill Sites
	Historic Landfill Sites
<b>Heritage</b>	World Heritage Sites
	Registered Battlefields
	Listed Building Locations
	Scheduled Monument Locations
	Registered Parks and Gardens
	Heritage at Risk 2016
	Building Preservation Notices
<b>Water</b>	Flood Zone 3
	Flood Zone 2
	Source Protection Areas
<b>Recreation Access</b>	CRoW Act 2000 – S4 Conclusive Open Country
	CRoW Act 2000 – S16 Dedicated Land
	CRoW All Access Land
	Country Parks

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# Glossary

Commonly used acronym	Main term	Description
	25 Year Environment Plan	Sets out the government's plan to leave the environment in a better state than what has been inherited.
	Agglomeration	Where the increased density of economic activity in an area increases productivity. Clustering benefits can occur either within or across industries. Density can be affected by physical proximity or where there is a reduction in travel time.
BCR	Benefit-cost ratio	Metric for assessing the value for money of a transport scheme. Ratio of benefits to cost indicating how much benefit is obtained for each unit of cost.
	Capital costs	Costs of building the railway and periodically renewing parts of the infrastructure.
	(EWR) central section	New railway to run between Bedford and Cambridge, enabling new services between Oxford and Cambridge and other places in between.
DfT	Department for Transport	UK government department responsible for transport.
	Developable land	Land that could in principle be used for new homes, subject to receiving the necessary planning consents.
	Development Consent Order	Order made by the relevant Secretary of State to authorise the development of a Nationally Significant Infrastructure Project (see term described below).
	'Do minimum' scenario	Scenario for the purposes of economic modelling in which all planned transport improvements (except the East West Rail central section) are included. Used as a baseline against which to measure the benefits of building the railway between Bedford and Cambridge (the 'do something' scenario).
	'Do something' scenario	Scenario for the purposes of economic modelling in which the East West Rail central section is assumed to be built.
	East Coast Main Line	Railway line running from London to Edinburgh through Sandy and St Neots.
EWR	East West Rail	Strategic railway connecting Oxford and Cambridge and the places in between as well as places in other parts of England.
EWR Co	East West Railway Company Ltd	Company set up by the Transport Secretary to oversee the delivery of East West Rail.
EWR Consortium	East West Rail Consortium	Group of local authorities and businesses working closely with the government, East West Rail Company and Network Rail.
	(EWR) eastern section	The existing rail network from Cambridge through to East Anglia and east coast ports. Currently being reviewed by Network Rail.
	Economic growth	Long-term expansion of the economy's productive potential and economic activity.

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Commonly used acronym	Main term	Description
EIA	Environmental Impact Assessment	Identifies the likely significant effects of a project on the environment so that these are considered in the decision-making process.
GJT	Generalised Journey Time	A measure incorporating the total station-to-station journey time plus time penalties based on the frequency of service and the number of interchanges required. It is expressed in minutes of journey time.
	Generalised Journey Time elasticity	The sensitivity of passenger demand to generalised journey times.
	Gravity model	Estimates rail demand between origin-destination pairs based on flows between places with similar characteristics (population, employment etc.).
GVA	Gross Value Added	Measure of the value of goods and services produced in an economy net of the inputs used to produce those goods and services.
	HM Treasury Green Book	Guidance on how to appraise and evaluate policies, projects and programmes.
LUMIT	Land Use Model Influenced by Transport	Model which estimates the impact of transformational transport schemes and the associated changes in land use on the wider economy.
	Market prices	Where prices include indirect taxes such as VAT.
	Marston Vale Line	Existing railway line running from Bletchley to Bedford.
	Midland Main Line	Existing railway line running from London to Leeds and Manchester through Bedford.
MHCLG	Ministry of Housing, Communities and Local Government	UK government department responsible for housing, community and local government matters in England.
NIC	National Infrastructure Commission	Independent commission providing the government with advice on major long-term infrastructure challenges.
NSIP	Nationally Significant Infrastructure Project	Large scale developments (relating to energy, transport, water, or waste) that can use a national development consent process as set out in the Planning Act 2008.
NTEM	National Trip End Model	Model published by the government that forecasts the growth in journeys between origin and destination pairs up to 2051 for use in transport modelling.
	Natural capital	The stock of natural assets upon which society depends such as ecosystems, air and seas. These assets provide a flow of benefits (e.g. wildlife, clean air and water) which are an essential basis for long term economic growth and productivity.
	Net gain approach	Development which provides an overall benefit to the environment or a specific environmental area e.g. biodiversity.
	Network Rail	Railway company owning and operating most of Great Britain's railway infrastructure. An arms-length body of the Department for Transport.



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	Operating costs	Ongoing costs of running the railway (e.g. railway maintenance and staff costs).
	Optimism bias	Uplift in estimated costs or reduction in estimated benefits of a transport scheme when it is being appraised, usually applied as a percentage. Reflects historic tendencies for costs to be underestimated and benefits to be overestimated.
	Oxford-Cambridge Arc (the Arc) and Cambridge-Milton Keynes-Oxford corridor	A region defined by the government and the National Infrastructure Commission covering local authorities across the counties of Northamptonshire, Cambridgeshire, Hertfordshire, Buckinghamshire and Oxfordshire and the unitary authorities of Bedford, Central Bedfordshire, Luton, Swindon and Milton Keynes.
	Present values	Where future costs and benefits are discounted (reduced) to reflect a societal preference for goods and services sooner rather than later. £1 today is valued higher than £1 next year, irrespective of inflation and interest rates.
	Route alignment	The exact route on which the new railway between Bedford and Cambridge would run.
	Route corridor	A wide area (up to around 15 kilometres) through which the railway could run.
	Route option	An area through which the line between Bedford and Cambridge could run, narrower than the route corridor. This is up to several kilometres in places.
RSPB	Royal Society for the Protection of Birds	Conservation charity.
MoD	Ministry of Defence	UK government department responsible for protecting the security, independence and interest of the UK. The Ministry of Defence owns the Basingbourn Barracks, which is located along some of the potential route options for the central section.
SSSI	Sites of Special Scientific Interest	Areas of high conservation value protected by Natural England, which is a public body sponsored by the Department for Environment, Food and Rural Affairs. Activities on SSSIs require approval from Natural England.
SAC	Special Areas of Conservation	Areas of conservation protected under the European Union's Habitats Directive.
SOBC	Strategic Outline Business Case	First stage of identifying the case for government investment in a scheme. Sets out the need for intervention ('case for change') and recommends a preferred way forward.
TWAO	Transport and Works Act Order	A type of legislation made to authorise new railway or tramway schemes in England and Wales, which are not nationally significant.
	Transport user benefits	Includes benefits to passengers (faster journey times and lower fares), benefits to road users (less congestion), environmental impacts of travel patterns (greenhouse gases, noise and air quality), reduced road accidents, disruption to rail and road users during construction of the railway and impacts on government tax revenues.
WebTAG	Web based Transport Appraisal Guidance	The Department for Transport's guidance on of transport modelling and appraisal.
	West Anglia Main Line	Existing railway line running from London to Cambridge.

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Commonly used acronym	Main term	Description
	(EWR) western section (phase one and phase two)	Infrastructure works to enable new railway services between Oxford and Milton Keynes, between Oxford and Bedford and between Milton Keynes and Aylesbury. Phase one refers to the completed upgrade of the track between Oxford and Bicester Village. Phase two refers to works between Bicester and Bedford to complete the western section.









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