

# East West Rail Hyperspeed Broadband Opportunity

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## Version Control

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## 1. The Opportunity

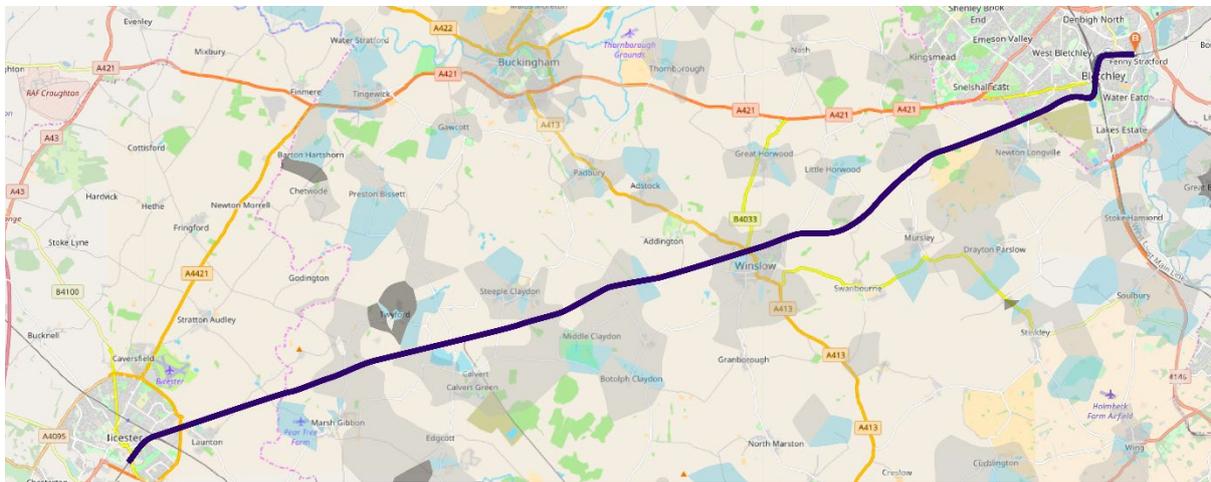
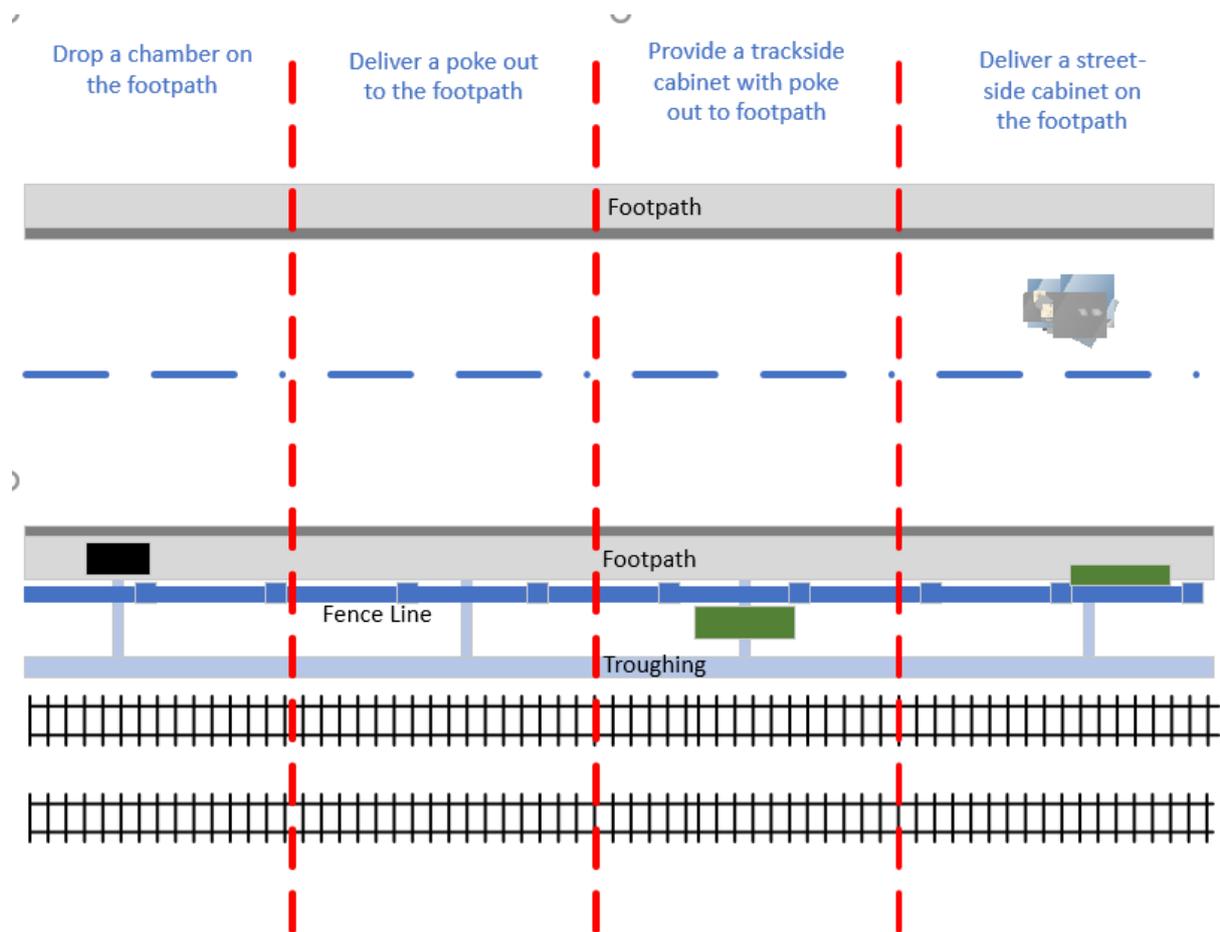


Figure 1: NGA broadband availability along the EWR route

### Key

|  |  |
|--|--|
|  | <i>Beige (white): no NGA network at present and none planned in next 3 years</i> |
|  | <i>Blue (blue): under review</i>   |
|  | <i>Dark beige (grey): one NGA network at present or planned in next 3 years</i>  |
|  | <i>Dark grey (black): multiple existing or planned NGA networks</i>              |

- 1.1 England's Economic Heartland (EEH) has an opportunity to either fund, or seek government funding, to pay for Network Rail's provision of Gigabit fibre backhaul to at least 21,600 future premises either side of the 19 mile (30km) East West Rail route between the stations of Bicester North and Bletchley, via Claydon and Winslow.
- 1.2 **To note:** this is the only available section where a cable upgrade can be installed inexpensively because it is the new build section of the EWR. Other segments including Aylesbury to Claydon have existing cabling or are already in operation e.g. Oxford to Bicester North.



- 1.3 During railway construction the Rough Order of Magnitude (ROM) cost would be £1.14m to install the basic 'dark fibre' and the provision of 10 basic handover points, reachable via drop-in points delivered by 48-core spur cables accessible via the highway footpath or railway perimeter footpath.
- 1.4 Basic interfaces provided would either be 'poke out points' or 'duct chambers'.
- 1.5 The cost of choosing to instruct Network Rail to lay the cable during railway construction is estimated to be less than 10% of the cost of retrofitting capacity later. The cost of adding a cabinet to this basic access would be £50,000 per cabinet. Network Rail recommends cabinet access be provided at least at the 3 stations along the route.
- 1.6 Paying for the additional cost of cabinet access would also secure the intermediate handover points because duct and poke out points have no protection from malicious attack. However, some telecoms companies prefer to fit their own cabinets, so what is provided may depend upon the coordination of provision with telecoms company demand during build.
- 1.7 Unlike traditional cable access, which is laid in concrete troughing close to the rail tracks – and which therefore mandates Personal Track Safety (PTS) training and full track access safety governance, with strictly controlled, time-limited access, subject to last minute postponement – EWR can support cable access by design outside areas under Personal Track Safety rail infrastructure scope i.e. outside the perimeter fence of the railway.

## 2. Strategic Context

- 2.1 Agreement to build an East West Rail corridor across the EEH Arc is predicated on the National Infrastructure Commission's (NIC) Interim Report in November 2016, which identified improved connectivity as being one of two critical issues that needed to be addressed in order to realise projected economic growth along the Arc. This was endorsed by the government in the 2016 Autumn Statement. The NIC's final report 'Partnering for Prosperity: a new deal for the Cambridge-Milton Keynes-Oxford Arc' was published in November 2017.<sup>1</sup>
- 2.2 The 'EEH Strategic Rail Investment Priorities' paper published in Dec 2017 endorsed the economic opportunity on this scale as being 'truly transformational in nature' and stated that this will have wider implications for both housing and economic geographies.
- 2.3 Although not mentioned in the NIC's report, high capacity internet connectivity, requiring Local Full Fibre Network infrastructure to be installed to deliver scalable Fibre To The Premises (FTTP) connections (commencing with delivery of 1 Gigabit per second, uncontended, to each premise) has been a focus for successive government initiatives.<sup>2</sup> The Queen's Speech on 19 December 2019 announced a continued commitment to enshrine the acceleration of the roll out of Gigabit broadband in legislation.<sup>3</sup>
- 2.4 The East West Rail opportunity seeks to exploit the delivery of the telecoms infrastructure along the rail route.

## 3. The Proposal

- 3.1 Network Rail's current offer<sup>4</sup> is to lay a 432-core fibre optic cable along the East West Rail route between Bicester North Station in Oxfordshire, just beyond the western edge of Buckinghamshire's county boundary, and Bletchley Station in Bedfordshire just beyond the eastern edge of Buckinghamshire's county boundary.
- 3.2 The choice of the termination points at stations at either end of the route is driven by ready access to Tier 1 internet backbone connectivity for Full Fibre Network providers seeking to light the fibre to carry internet services.
- 3.3 The choice to not extend the fibre provision along the EWR route either side of Bicester North and Bletchley is based on the recognition that:
  - The rest of the East West Rail route is relatively well-served by both fixed and mobile internet connectivity in comparison to rural northern Buckinghamshire;
  - Other segments of the railway already have fibre optic cable and ducting in situ to run the railway and therefore disruption to existing railway services, because of engineering works, and the cost of retrofitting these other segments would be much higher.
- 3.4 The estimate of the number of premises that could benefit is based on the following information and assumptions:
  - 48-core fibre laid to run the railway used by Network Rail to run the Railway.

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<sup>1</sup> <https://www.nic.org.uk/publications/partnering-prosperity-new-deal-cambridge-milton-keynes-oxford-arc/>

<sup>2</sup> <https://www.gov.uk/guidance/local-full-fibre-networks-programme>

<sup>3</sup> <https://www.gov.uk/government/speeches/queens-speech-december-2019>

<sup>4</sup> East to West Rail Fibre Connectivity Benefits Rough Order of Magnitude Costings, December 2019

- 432-core fibre laid simultaneously in the same troughing and under Network Rail Telecom management = 216 pairs full duplex provision.
- 21,600 Gbps at 100 Gbps per core pair = 1 Gbps per premise for 21,600 premises.

Note: Though it would entail additional expenditure by each provider, each broadband provider could optionally further increase capacity per fibre pair, at today's technology limits, using a process known as multiplexing. This divides the lit fibre into different wavelengths of light, or channels, each with its own discrete carrying capacity of 100mbps. Using Dense Wave Division Multiplexing (DWDM) capable of delivering 96 channels per fibre pair would create a theoretical maximum capacity that could deliver gigabit fibre to 2.073m premises, at the limits of today's commercially available equipment (e.g. Infinera switches), a figure that far exceeds likely demand. DWDM is currently probably (a lot) more costly than laying extra fibre.

#### **4. Anticipated Benefits**

- 4.1 Funding, howsoever sourced, will create a cutting-edge connectivity corridor.
- 4.2 The rail route is likely to become a backbone for connectivity in support of the delivery of planned growth (economic and housing).
- 4.3 This section of the EWR could (and probably should) seek greater parity with fibre capacity along the Oxfordshire<sup>5</sup> and Cambridgeshire<sup>6</sup> sections of the route.
- 4.4 Minimal current broadband and 4G data coverage between Bletchley and Bicester is likely to attract government grant support without State aid challenge via BDUK. (see Appendix 2 – Next Generation Access (NGA) Broadband Guidelines.)
- 4.5 Subject to further government funding of ~£6.4M this section of the EWR route can be further upgraded to provide enhanced telecoms masts to support 5G roll out by Mobile Network Operators (MNOs) along this section of the route. This would enhance the business case for laying the 432 fibre along the route. Government funding for this is likely provided because:
  - The present the EWR scope has excluded 5G mast provision, which does not align for the anticipated replacement of current GSM-R mobile rail telephony with future commercial 5G support for running the railway in the early years of EWR's live operation i.e. the standard model that all European rail is moving to ensure compatibility and future safe operation;
  - Passenger expectations regarding adequate WiFi availability on rail routes – which indicates that Network Rail and DfT need to consider the case for WiFi on trains along the EWR route.

#### **5. Recommendations**

- 5.1 Continue to work with East West Rail and the DfT Sponsor to provide input into the EWR Telecom Design process and provide Network Rail Telecom costs to DfT (and potentially DCMS) to allow them to investigate whether they might be able to provide any level of funding.

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<sup>5</sup> <http://www.betterbroadbandoxfordshire.org.uk/cms/>

<sup>6</sup> <https://www.connectingcambridgeshire.co.uk/>

- 5.2 Conduct a market study to gain more robust evidence of interest from telecoms providers and mobile network operators in using EWR Network Rail Neutral Host dark fibre, versus taking their own or wholesale fibre to new locations. Interest is likely to be driven by a calculation of the distance necessary along which a provider would have to lay new fibre, on a location-by-location basis.
- 5.3 Develop a full business case to support the initiative looking at:
- Strategic, Economic, Commercial, Financial, and Management cases;
  - the context of anticipated future broadband and 5G demand;
  - funding sources;
  - parallel opportunities;
  - options sift;
  - benefits.
- 5.4 Review what is proposed by Network Rail and submit a decision in principle in time for EWR timescales e.g. probably no later than March 2020.

## 6. Assumptions

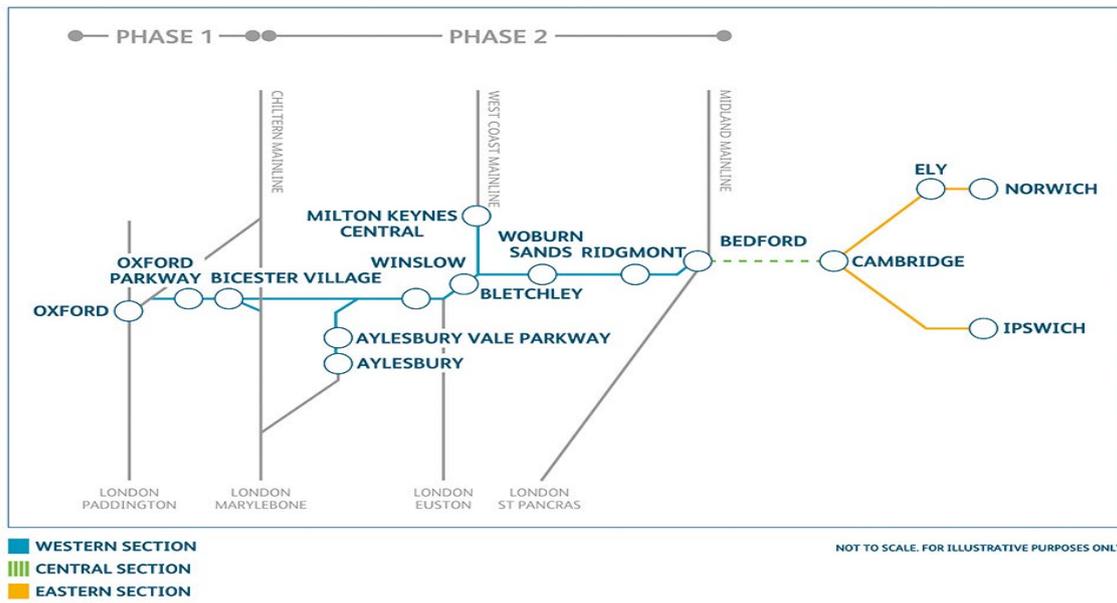
- 6.1 ISP interest in using the route is already evident. For example, Gigaclear has identified opportunities to trial ultrafast broadband solutions to communities along the Bicester/Bletchley route.
- 6.2 Whilst demand on the scale that the EWR opportunity would deliver is in its infancy, there is anticipated to be latent long-term demand based on an aggregate of:
- Delivery of planned economic and housing growth.
  - BT's (and KCOM's in Hull) designation as Universal Service Obligation (USO) for Broadband providers nationwide, which will drive more rural broadband delivery from March 2020 onwards<sup>7</sup> when consumer and business requests can be made under the Obligation. Note: this is a minimum standard with a connection 'speed' (capacity) of 10 Mbps, which could be delivered through a single fibre pair to the cabinet from the EWR 216 fibre pairs available. This could be onward distributed up to 1,000 households.
  - New commitments by telecoms providers to take FTTP to new premises in concentrations of more than 30 premises.
  - A government mandate that all new premises must have full fibre connectivity.<sup>8</sup>
  - Mobile Network Operators (MNOs) could use the backhaul for 5G along the route, which they can also use to provide rural 5G, given increased pressure on them to move from a per capita to a geographic coverage model.
- 6.3 These assumptions need to be further tested during business case development.

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<sup>7</sup> <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8146#fullreport>

<sup>8</sup> <https://www.gov.uk/government/news/forging-a-full-fibre-broadband-and-5g-future-for-all>

Appendix 1 – East West Rail Phases



## **Appendix 2 – Next Generation Access (NGA) Broadband Guidelines**

The guidelines are based on a classification of areas according to its existing or expected future broadband infrastructure<sup>9</sup>:

- **White areas:** no NGA network at present exists and is not likely to be built within the next three years by private investors. In this case the area is in principle eligible for State aid for NGA.
- **Grey areas:** only one NGA network is in place or planned within the next three years. In this case the EC will conduct a more detailed analysis to verify whether State aid is needed.
- **Black areas:** there are multiple existing or planned NGA networks. In this case State aid applications are unlikely to be successful unless they would bring a step change in quality (e.g. moving from superfast to ultrafast speeds).

The guidelines also set out a number of conditions that must be met, including basing funding decisions on a competitive process, making use of existing infrastructure, and to meet certain requirements as to wholesale access.

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<sup>9</sup> [https://ec.europa.eu/regional\\_policy/sources/conferences/state-aid/broadband\\_rulesexplained.pdf](https://ec.europa.eu/regional_policy/sources/conferences/state-aid/broadband_rulesexplained.pdf)

**Appendix 3 – Network Rail East to West Solution Summary**
*Extracted from East to West Solution and Cost Proposal 12 December 2019*


| Line Item       | Unit Cost    | Unit Descriptor   | Reqd Units | Total        |
|-----------------|--------------|-------------------|------------|--------------|
| Fibre Upgrade   | £ 11.00      | per metre         | 30000 £    | 330,000.00   |
| Access Fibre    | £ 5.00       | per metre         | 30000 £    | 150,000.00   |
| Handover Points | £ 20,000.00  | per site          | 10 £       | 200,000.00   |
| Mast Upgrade    | £ 30,000.00  | per existing mast | 8 £        | 240,000.00   |
| Infill Masts    | £ 156,000.00 | per new mast      | 23 £       | 3,588,000.00 |

EEH Contribution  
Plus £460k uplift for  
20% PMO, 7% Risk  
and 30% Contingency

| ROM COSTS             |                       |
|-----------------------|-----------------------|
| Build Cost            | £ 4,508,000.00        |
| PMO Costs             | £ 901,600.00          |
| Risk Contribution     | £ 378,672.00          |
| Contingency at 30%    | £ 1,736,481.60        |
| <b>Total RoM Cost</b> | <b>£ 7,524,753.60</b> |

Network Rail's proposal provides Rough Order of Magnitude (ROM) costs for a variety of options including:

- laying the basic 432-core fibre cable along the Bicester to Bletchley section of the route;
- adding handover points;
- options for adding 5G masts;
- adding a second 432-core cable route along the other side perimeter of the railway to increase resilience. To note: single cable resilience is based on time to repair via Network Rail Telecoms cover according to SLAs. Outages could be 4 hours or more and affect some or all of the fibre cores, leading to service degradation or service outage, depending on the severity of the infrastructure damage and the network architecture of adopted core topology.

**January 2020**