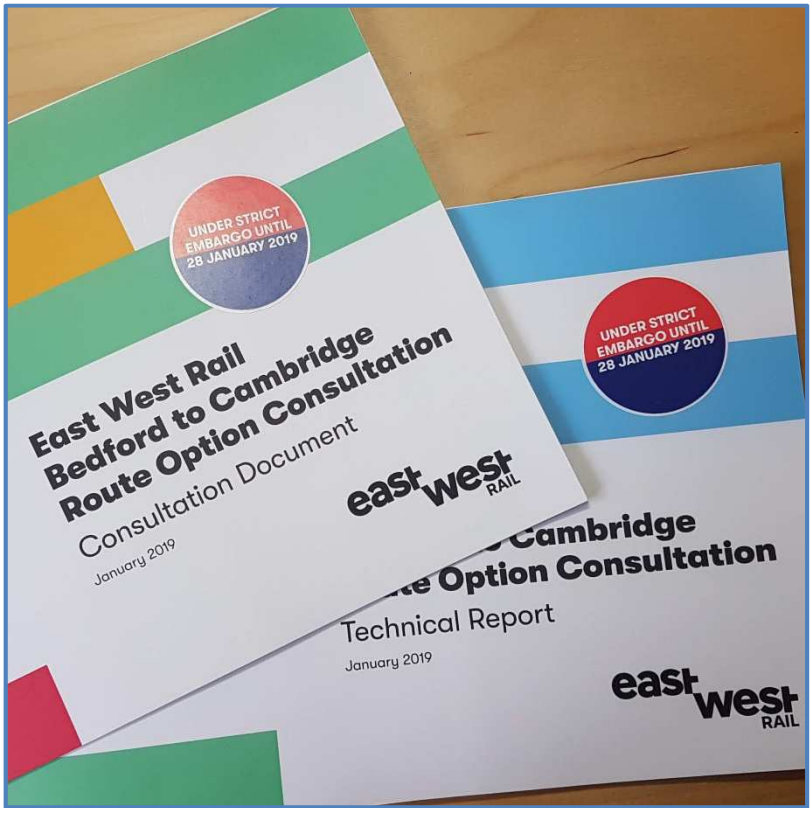
East West Rail Consultation Support

BBC Technical Response

Document No.1661-TR-003

Revision: 1-2 Issue

March 2019



Prepared for

BEDFORD BOROUGH COUNCIL

Revision Schedule

Preliminary options review
February 2019

Rev	Date	Details	Prepared by	Reviewed by	Approved by
0-1	13.03.2019	Internal issue for comment	Julian Sindall Director, Cadenza Transport Consulting Ltd	Paul McSharry Principal Consultant Kilborn Consulting Ltd	
0-2	18.03.2019	Internal issue for comment	Julian Sindall Director, Cadenza Transport Consulting Ltd	Paul McSharry Principal Consultant Kilborn Consulting Ltd	
0-3	21.03.2019	Final Draft	Julian Sindall Director, Cadenza Transport Consulting Ltd	Ian Ross Signalling Engineer Kilborn Consulting Ltd	
1-0	25.03.2019	Issue	Julian Sindall Director, Cadenza Transport Consulting Ltd	Paul McSharry Principal Consultant Kilborn Consulting Ltd	
1-1	25.03.2019	Issue	Julian Sindall Director, Cadenza Transport Consulting Ltd	Paul McSharry Principal Consultant Kilborn Consulting Ltd	
1-2	26.03.2019	Issue	Julian Sindall Director, Cadenza Transport Consulting Ltd	Paul McSharry Principal Consultant Kilborn Consulting Ltd	

Client Approval			
Rev	**Date**	**Approved of behalf of Bedford Borough Council**	**Signature**

CONTENTS

Table of Figures

Table of Tables

Glossary of Terms

Acronym or Term	Meaning
BBC	Bedford Borough Council
ECML	East Coast Main Line
EWR	East West Rail
EWRCo	East West Rail Company
FOC	Freight Operating Company
KCL	Kilborn Consulting Ltd
MML	Midlands Main Line
OLE	Overhead Line Electrification
TOC	Train Operating Company

Note on image sources

Aerial photography background mapping has been taken from Google Earth Pro throughout. The consultation route maps are taken from East West Rail's consultation document. Other sources are identified in the relevant figures or are provided by Kilborn Consulting Ltd.

1. Executive Summary

The East West Rail company (EWRCo) released its non-statutory consultation documents on 28 January 2019 for the Bedford to Cambridge Route Option Consultation. It proposed five routes for consideration, which may be grouped into 'Bedford South' options (Routes A, B and C), and 'Bedford Midlands' options (Routes D and E).

Bedford Borough Council (BBC) asked Kilborn Consulting Ltd to provide an initial technical review of the five options proposed and to answer some specific questions around related opportunities and challenges identified by EWRCo.

BBC has a clear goal that the East West Rail (EWR) route should connect with 'the centre of Bedford' and considers that any Bedford South solution would not achieve this objective. Therefore, the only EWR options considered acceptable to BBC are Routes D and E.

The Bedford South options as described in the consultation are typically more direct, less complex, and draw upon demand from the Wixams development, Sandy / Tempsford, and either Cambourne or Bassingbourne future developments. However, in practice, the area on each side of the Midland Main Line (MML) is highly constrained by several approved developments for residential, commercial or educational land use, as well as a landfill site and other difficult construction constraints. We would expect a Bedford South option to become an interchange with the Wixams station, but the location of this station is now fixed by railway and developer constraints, and this restricts the options available for a Bedford South station.

The Bedford Midland options cause the route to divert north through Bedford and around the northern extremities of Bedford before crossing the East Coast Main Line. The most likely means of accessing Bedford Midland is from the Marston Vale (Bletchley Lines) via Bedford St Johns and through two new platforms on the east side of Bedford Midland.

Of the two Bedford Midland Routes, Route E has the widespread support of BBC and other local authorities because it connects with Bedford Midland, the region south of St Neots and Cambourne. However, the route assumptions and consequential costs for EWRCo's indicative route incur significant cost and interface complexity with the local highway network. BBC has developed its own preliminary Route E design that reduces the cost differential to Route A by nearly half and avoids much of the highway disruption.

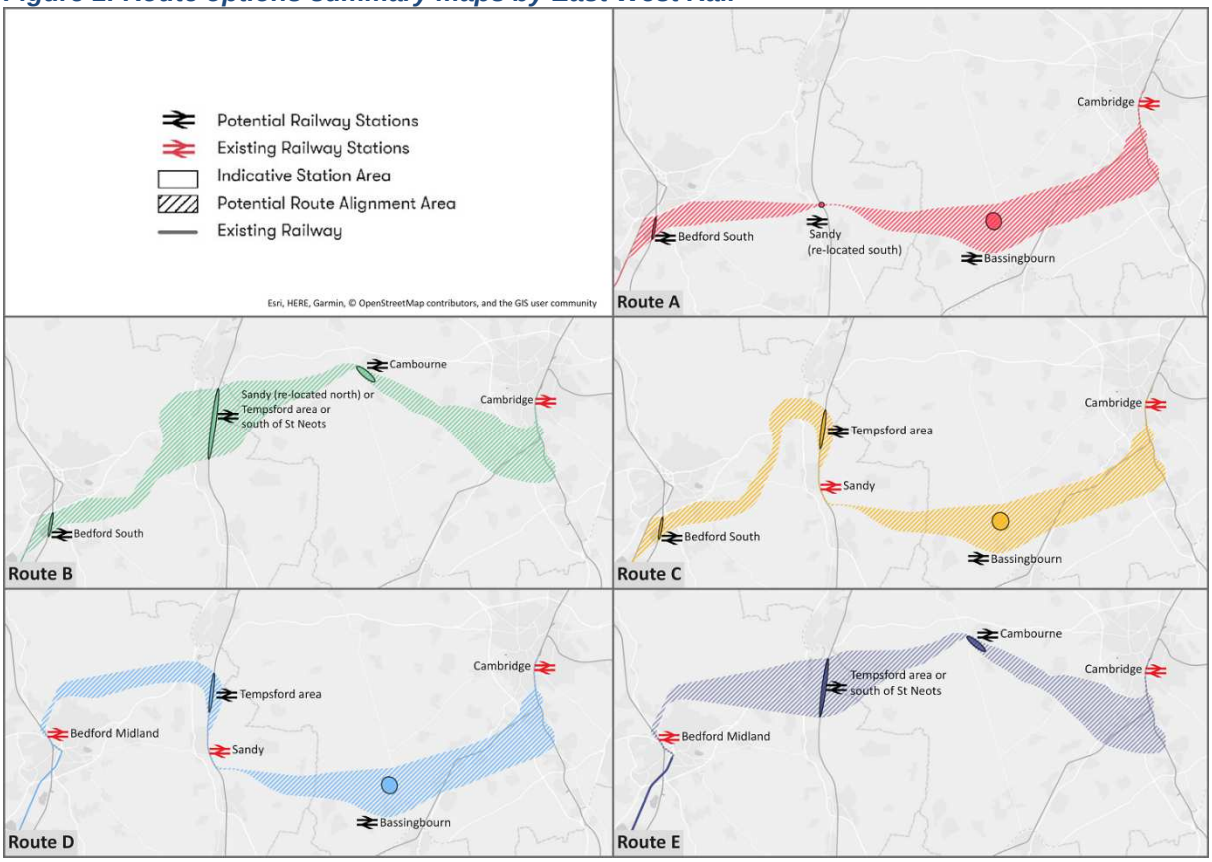
BBC has welcomed the discussions and documents provided by EWRCo to date, but considers that EWRCo has underestimated the complexity of connecting a Bedford South station, and overestimated the complexity of a Bedford Midland station connection. BBC has presented an alternative preliminary design for its preferred option (Route E) that offers significant savings over the EWRCo version, and BBC would welcome the opportunity to work closely with EWRCo on improving its design accordingly.

2. General

1.1 Context

The East West Rail company (EWRCo) released its non-statutory consultation documents on 28th January 2019 for the Bedford to Cambridge Route Option Consultation. The documents primarily consist of the Consultation document, with the accompanying Technical Report and Route Options Map, shown below in Figure 1.

Figure 1: Route options summary maps by East West Rail



Representatives from EWRCo subsequently produced the 'East West Rail - Central Section Bedford Midland Cost Drivers Briefing Paper' which was received on 26 February 2019 and met with representatives from Bedford Borough Council (BBC) on 1 March 2019. The Cost Drivers Briefing paper was subsequently updated on 13 March 2019.

1.2 Methodology

BBC has reviewed the two documents provided by EWRCo and considered the high level implications by reference to publicly available material including mapping such as Google Earth. We have also carried out site visits on 7th February and 27th February 2019 to specific locations of relevance to understand, first hand, some of the likely constraints and opportunities.

We have focussed solely on the section from the Marston Vale Line to the East Coast Main Line (ECML) near Sandy, since the connections to the East of the ECML are largely a function of the selected route at Bedford.

1.3 Purpose and Structure of this Document

The purpose of this document is to provide BBC's response to the technical report on the five options EWR has identified.

Section 2 sets out BBC's stated objectives and some of the general principles that need to be considered when evaluating the routes.

Section 3 reviews the ways in which stations might be located and connected at Bedford South and Bedford Midlands options.

Section 4 provides a commentary on each route proposed by EWRCo.

Section 5 sets out our conclusions.

2 BBC objectives and principles for EWR

2.1 Objectives

BBC has clear ambitions for the East West Rail (EWR) route to have a station in 'the centre of Bedford' in order to provide a direct interchange to the Midland Main Line (MML) and avoid losing the connection to the centre of Bedford.

2.2 Principles

BBC recognises that EWRCo needs to balance stakeholder influence with an acceptable financial and business case. The business case is strengthened by increased economic benefit, increased demand, increased revenue and reduced journey times but it is weakened by increased construction and operational costs. Therefore BBC is keen to work with EWRCo to optimise the options that pass through the centre of Bedford and thus improve their business case.

3 Bedford station locations commentary

3.1 Introduction

The five routes proposed by EWRCo and shown in Figure 1 may be grouped by the two Bedford station locations identified. Routes A, B and C adopt a 'Bedford South' strategy and Routes D and E adopt a Bedford Midland strategy. Therefore this section covers those issues that relate to the two Bedford station locations proposed and are common to the routes that adopt each one. The following section will build on this to discuss the differentiating factors for each of the five routes.

3.2 Bedford South (for routes A, B and C)

3.2.1 Bedford South interchange options

The proposed location for any of the Bedford South station options is somewhere on the MML broadly between the crossing points of the A421 in the north to Stewartby Way in the south. We understand that EWRCo intends the new station to provide an interchange with the MML and therefore there are in principle four Bedford South station types that EWR may choose. These are:

- A flyover interchange at the Wixams station
- A parallel interchange at the Wixams station
- A flyover interchange away from the Wixams station
- A parallel interchange away from the Wixams station

Of these Bedford South options, an interchange away from the Wixams station would not be acceptable to BBC because an interchange with the MML away from the Wixams would create demand abstraction and a watered down service for both stations. It is very unlikely that Thameslink services will stop at both stations in one journey and this implies that services would be distributed (perhaps unequally) between the two stations. In the worst case, this would make the delivery of two stations in such a short stretch undeliverable. The same principle could apply to Bedford South and Bedford Midland, with some services stopping at one or the other.

Whether a Bedford South interchange is parallel with the Wixams station or crosses over it is likely to be driven by adjacent route constraints but BBC expresses no opinion on the differences of these two options.

3.2.2 Bedford South interfaces

All potential Bedford South station locations and their connecting routes will have to take account of several significant constraints in the region on each side of the MML as shown in Figure 2, including:

- The presence of land already in use by domestic and business owners
- The location of the Wixams station, which has been fixed by recent work for BBC and is tightly constrained by signalling, electrification and developer requirements. In order to capture funding from the developer, the Wixams station will be built well before the EWR is under construction

- The presence of various development schemes that have been granted planning permission. In particular, the Wixams development is under construction with internal highway route substructures in place for construction of the homes. Similarly the large distribution warehouses to the north of the Wixams are built or being built and will be in place long before EWR is able to confirm its route selection

- The presence of historic clay pits, some of which are empty or hold water, some of which are planned for development or already in the process of being developed upon, in particular the new £400m Energy From Waste site at Rookery Pit, currently under construction

- A former domestic / hazardous waste landfill site which will difficult to construct upon because of settlement and methane gas emissions

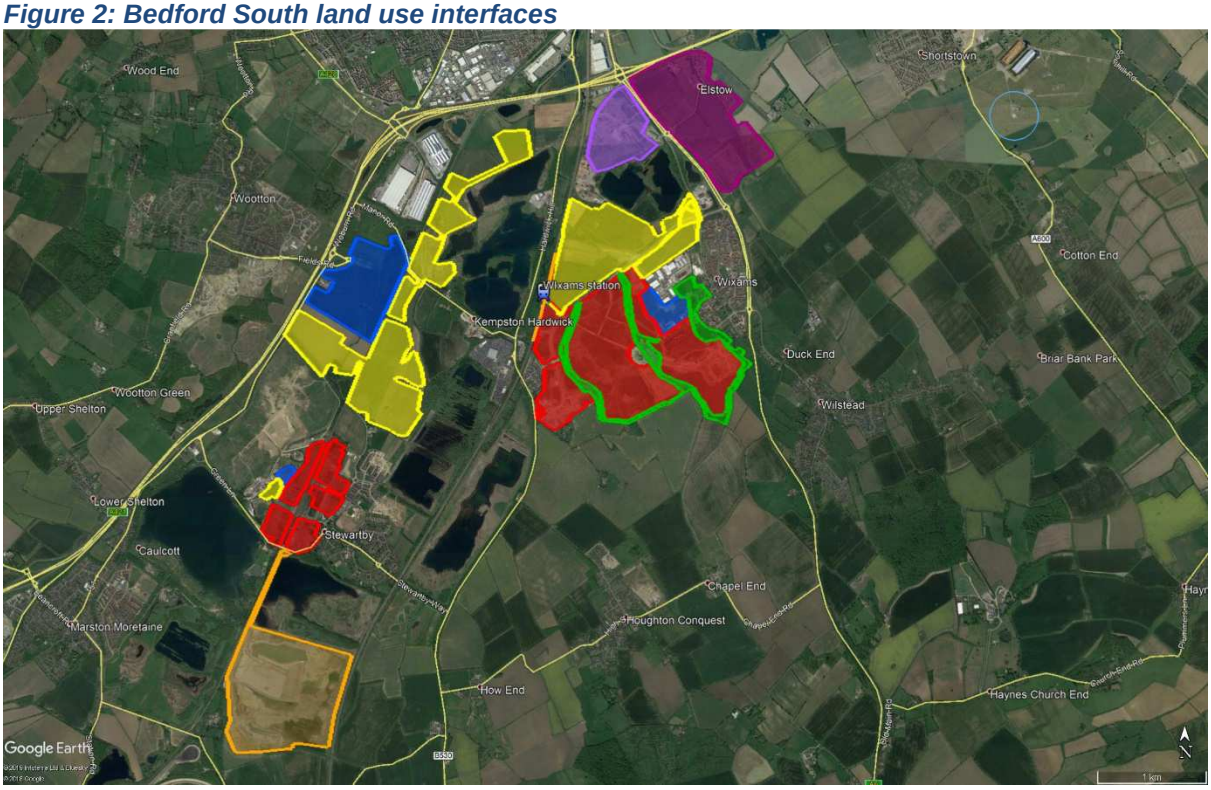
- Major utilities including electricity, gas and pipeline systems around the area

- A meteorological testing station of national significance and one of only two in the country

- Geometrical and operational constraints of the new and existing railways

Our preliminary investigations suggest that any route through these constraints is likely to be highly disruptive to committed plans and/or existing land use and hence will result in significant additional costs that do not currently appear to have been accounted for and may affect the viability of certain route configurations.

Figure 2: Bedford South land use interfaces



Legend: Red = Planned residential use; Yellow = planned commercial use; Blue = planned school; Green = planned greenway; Pink = landfill site; Purple = Medbury Farm development; Orange = Energy From Waste site and access; Blue circle = Met Office data station (influence zone unknown)

Any Bedford South station would be dependent on a significant car parking provision to accommodate users coming from the Bedford area. Although we do not know the extent of car parking required, it will stimulate more road traffic in the surrounding highway network, particularly at peak times, and BBC would like to be assured that sufficient parking provision and relief of traffic bottlenecks have been fully considered and accounted for. There is also a probable interface with car parking developed as part of the Wixams development

3.2.3 Bedford South options connectivity

Further to the East, the Bedford South routes to Cambridge picks up Bassingbourne (Routes A and C) which does not have wide local support for development or (Route B) passes to the north of Sandy to connect with Cambourne and with a similar distance overall to that of Routes D and E.A Bedford South station would not provide a direct connection to Bedford town centre and hence does not meet BBC's objectives or achieve the National Infrastructure Commission's objective to connect communities with large centres of employment such as Bedford centre (see quote below). Any Bedford South station might require mitigations such as dedicated shuttle bus services to the centre of Bedford or an agreement with Train Operating Companies (TOCs) that tickets to 'Bedford South' / Wixams would include free connecting travel to/from Bedford Midland. These represent an operational cost that should also be included in the assessment model.

> "The value of East West Rail rests, in part, on its ability to connect communities with centres of employment. It can also play a vital role in unlocking land for development. It is important that the railway be designed with these objectives in mind. End-to-end journey times should not, therefore, be the driving force behind design, especially where such decisions are at the cost of local links."
>
> *P35, "Partnering for Prosperity", National Infrastructure Commission*

3.2.4 Bedford South options summary

Whether or not a Bedford South station is at the Wixams, it is not clear that EWRCo has fully accounted for the complexity of avoiding existing and consented development constraints on both sides of the MML between Millbrook and the A421. In particular, a railway through the Wixams will have significant impacts on the masterplan and properties shortly to be constructed as well as the facilities that are already built or under construction.

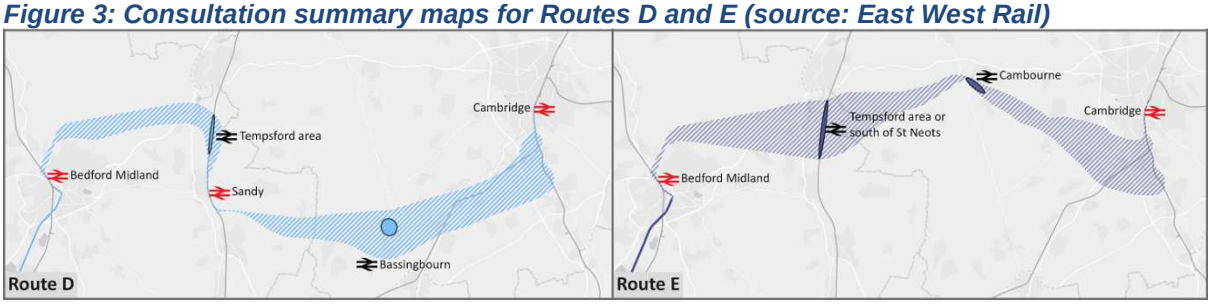
Nevertheless, in all variations of Bedford South options, the route does not meet BBC's fundamental objective that the route should connect with 'the centre of Bedford' because of the economic benefits that result as set out in BBC's previous submission to EWRCo and hence these routes do not have BBC's support.

3.3 Bedford Midland (for routes D and E)

3.3.1 Bedford Midland overview

EWRCo's route diagrams (Figure 3) indicate that the Bedford Midland location for Routes D and E is connected from the Marston Vale line, through Bedford St Johns and into Bedford Midland station. From there, it follows the MML north before breaking off to the north-east and around the northern boundary of Bedford.

Figure 3: Consultation summary maps for Routes D and E (source: East West Rail)



BBC has investigated different ways in which this might be achieved and concluded that the most appropriate solution includes double tracking the single line section through Bedford St Johns station and the carriage sidings, taking the line into two new through platforms to the east of the Bedford Midlands station before reconnecting with the Slow lines north of Bedford Midland station.

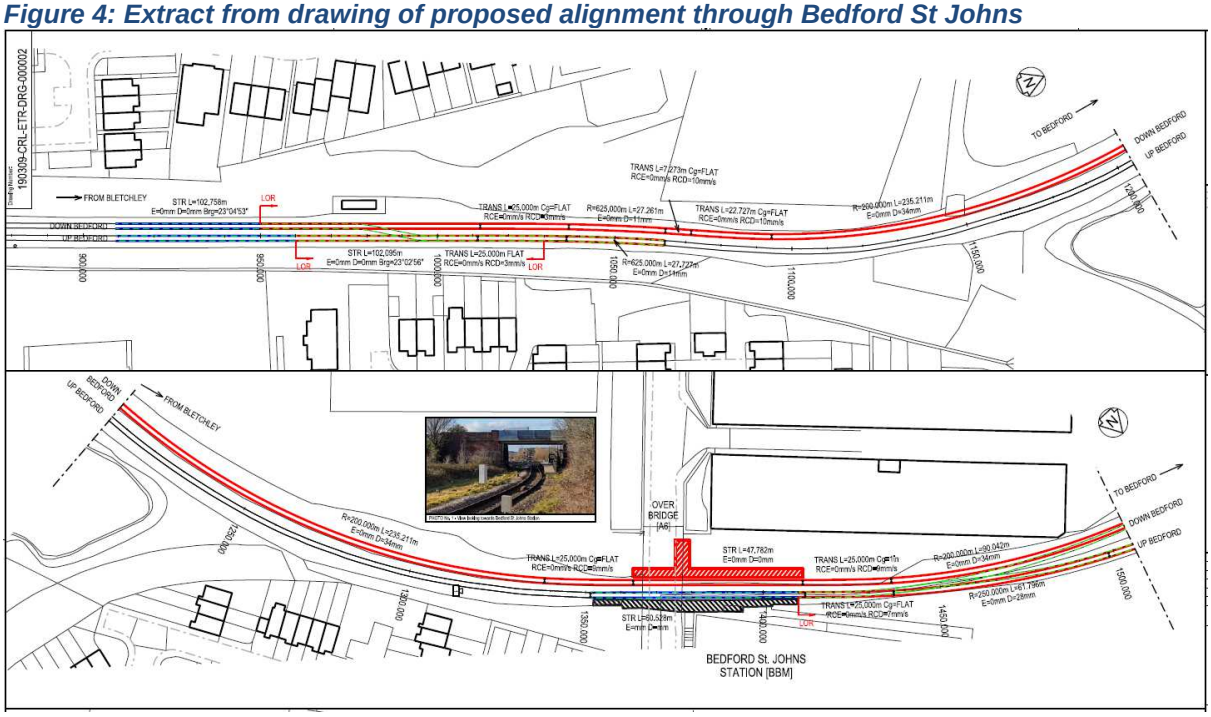
A preliminary design has been developed for this section of the route with extracts below that demonstrates viability of this modification without the need to relocate the carriage sidings or major modification to the station and track at Bedford St Johns representing a saving on the Cost Drivers Briefing paper as set out in section 3.3.6.

This is a preliminary design only and has room for refinement but nevertheless achieves the primary objectives of providing a second platform face at Bedford St Johns, and a route through the sidings that does not require remodelling of the sidings or impinge on operations (and may even improve them), as well as a more cost-effective route design north of Bedford. We describe some of our preliminary work by section of the route below.

3.3.2Bedford St Johns

Figure 4 illustrates how a second track could be positioned alongside the single track section to provide the additional capacity that would be required, for minimal cost.

Figure 4: Extract from drawing of proposed alignment through Bedford St Johns



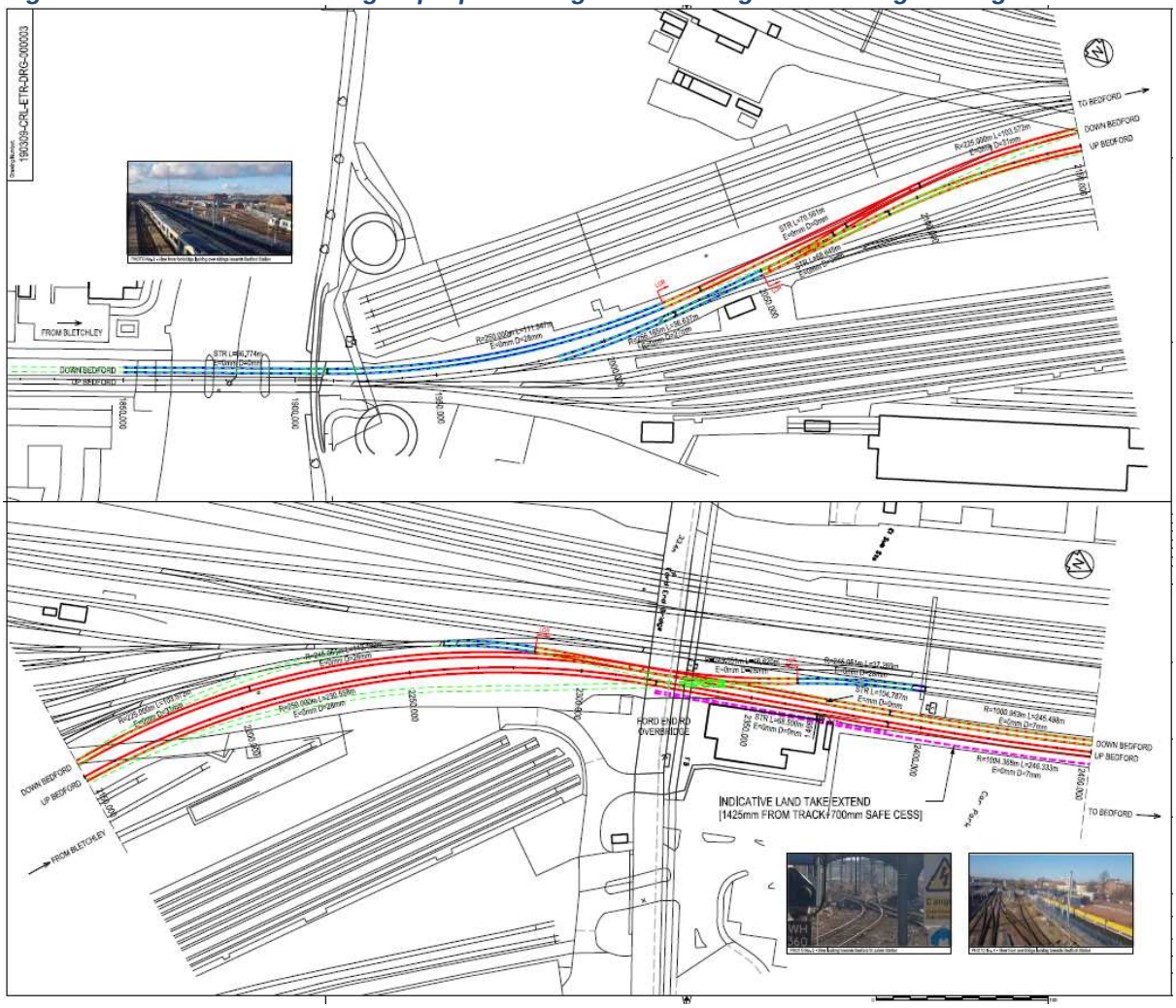
The existing turnout[1] would be removed as the second track is laid on the inside of the existing curve. The new Down platform at Bedford St Johns is shown as a straight platform 47m long, which would suffice for a typical two car unit. Even with the EWR it is unlikely that it will be necessary to provide a longer platform than this because it is unlikely that the EWR will stop at this location.

The new station will need steps to the new platform but does not need accessibility ramps as there is an accessible station (Bedford Midland) very near by[2].

3.3.3Bedford Midland Carriage sidings

Figure 5 illustrates the means by which the double track arrangement could be taken through the carriage sidings with minimal impact on the sidings and their operations.

Figure 5: Extract from drawing of proposed alignment through the carriage sidings



From the river crossing, the Down track is realigned to make room for the trailing crossover[3] connection with the new Up track that retains the existing connection with the Jowett sidings.

[1] A turnout is a piece of track infrastructure that allows a train to turn off from the main through route onto a new track
[2] Appendix B of Technical Standard for Interoperability 1300/2014 (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1300&from=EN) indicates that providing accessibility for Persons of Restricted Mobility on an upgraded station is not necessary where a fully accessible station on the same route is available within 50km.

As the two tracks continue north, the Down track is realigned to remove it from the existing connection with the sidings, reducing the use and wear on the slips that form the king points to the sidings and carriage wash. The Down track follows round the curve where it picks up the existing connection on a trailing turnout just before the Ford End Road bridge. Under the bridge, the diamond crossing is replaced with a simpler turnout arrangement that connects both to the reversible Up Slow line into platform 1 and onwards to a new extended through platform 1a.

The Up track simply follows the Down track in parallel all the way to a new through 'platform 1b' (terminology to be decided in due course). Just north of the bridge, there is a possible conflict with the railway building to the North East of the bridge. BBC does not know what the functionality of this building is, but if the impact is significant, the proposed safe cess would be removed on the grounds that under normal circumstances, staff would not be permitted to walk in this area without possession anyway (even if a safe cess were provided).

This arrangement preserves moves from platform 1 into the Up Bedford via the crossover adjacent to the Jowett sidings. A similar move is possible from the new platform 1a. Turnback functionality from the carriage wash and EMU sidings into platform 1a is retained through the junction arrangements, and if necessary a turnout from the Down line into platform 1b would also be possible within the straight section on the platform approach.

If the tracks were modified in this way, there is an opportunity to introduce further infrastructure changes for operational flexibility (but separate to the EWR project and hence not at cost to EWRCo or BBC) to provide direct access from the Down Bedford line to platform 2, and from the Down Slow to platform 1a (a functionality that does not currently exist). We have not shown this for clarity but would be happy to discuss how this might be achieved. These modifications would further increase operational flexibility to turn back trains in different platforms at Bedford, or increase throughput and service resilience at Bedford station.

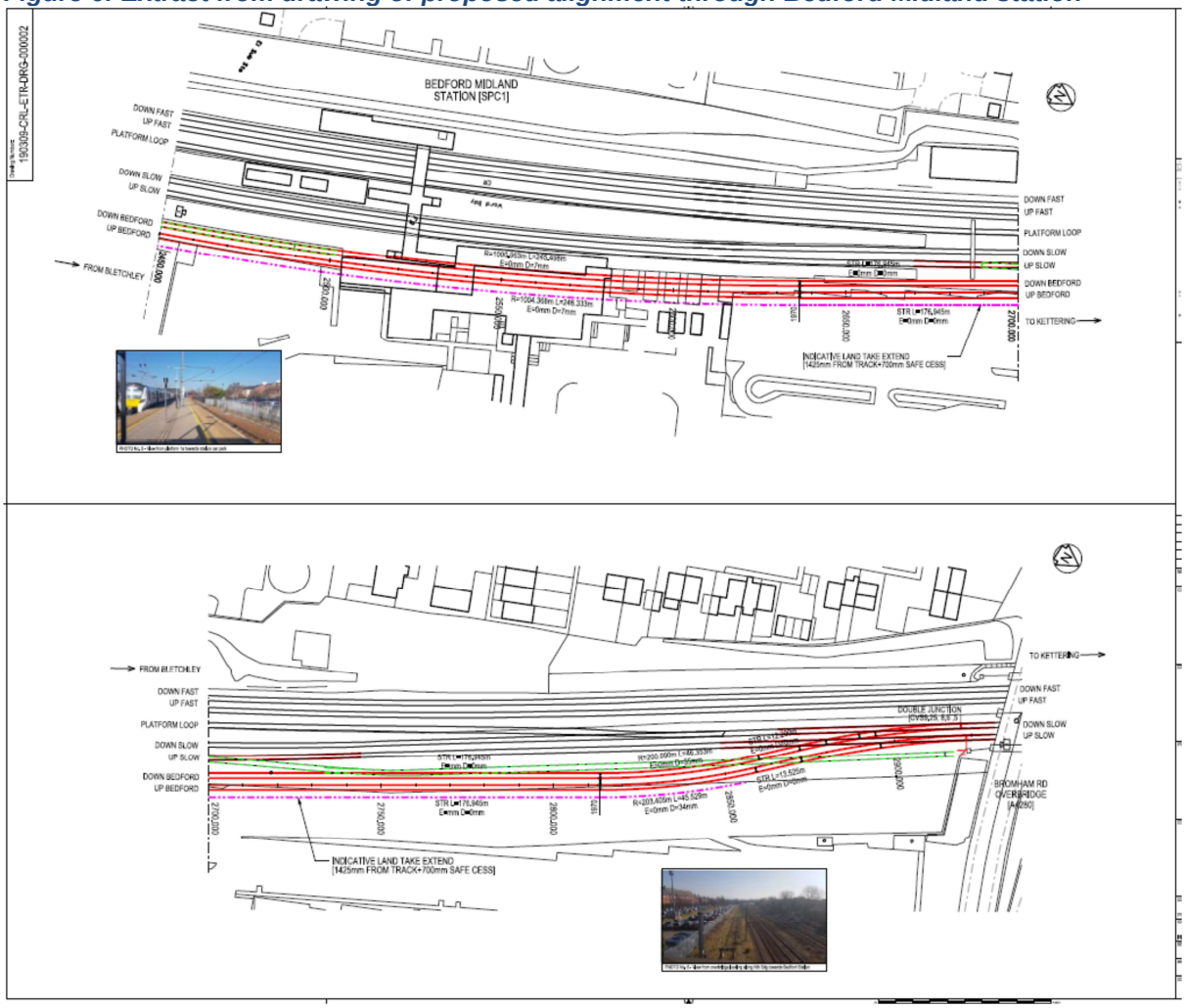
The arrangement above requires modification to the tracks in the vicinity of the level crossing, but does not create additional tracks. The increased use of the level crossing will change the risk profile and require assessment with possible closure (which would require an alternate access) or upgrade of the crossing.

3.3.4Bedford Midland station area

Figure 6 illustrates the alignment of the two new tracks in relation to the existing station. We have assumed that they would come through on a 1000m radius curve, requiring the demolition and reconstruction of the station building and local forecourt.

[3] A crossover is a pair of turnouts with a connecting piece of track between them that allows a train to cross over from one track onto another track that is usually parallel to the first one

Figure 6: Extract from drawing of proposed alignment through Bedford Midland station



To the north of the platform, the tracks straighten up to run alongside the Slow lines on the bed of the existing turnback siding before reconnecting with the Slow lines with a double junction just beyond the Down Slow connection with the Platform Loop and just south of Bromham Road bridge. This avoids modifying the platform loop connection and creates space for services to speed up / slow down on the departure / approach to the station, minimising the time blocking the Slow lines.

It may also be possible to reconnect the Up Slow to Down Bedford line to provide the northern turnback siding functionality, though at the meeting with EWRCo on 1 March 2019 it was stated that in the scenario of two new platforms, this functionality would not be required.

The additional track and station building reconstruction will impact on the existing car parking provision at the station which would need to be reconfigured not simply to recover the loss of spaces but also to cater for increased demand. One approach would be to introduce multi-storey car parking to provide greater density of car parking, and if necessary, some of the existing car parking space could be sold off for development to pay for this.

The construction of a new station building and new platforms at grade within railway-owned land that is already identified for development as part of BBC's masterplanning means that there is an opportunity for harmonisation of purpose and efficiency of construction.

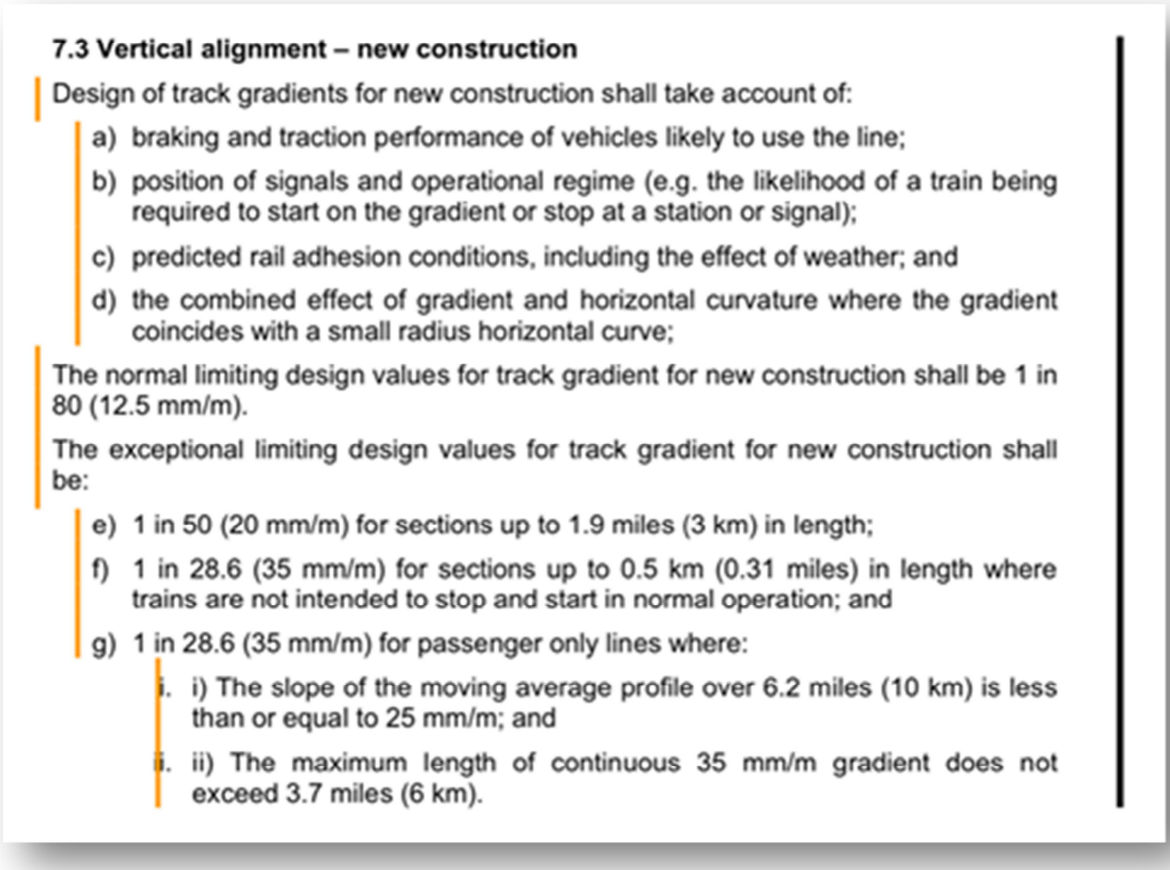
3.3.5North of Bedford

North of Bromham Road bridge the EWR route would use the Slow lines for approximately 800m until after Bedford north junction where a single turnout would take the EWR lines off east as a single lead immediately followed by a change back to double track. This does present an operational pinch point, but is cost effective given the cost of modifying Bedford North Junction to create room for an EWR double junction. A flyover to connect to/from the MML is not expected to be worth considering because of the limited benefit and significant cost.

From the MML connection, BBC has considered potential means of reducing costs of the alignment, particularly as it crosses the A6. The objective here is to avoid lengthy viaduct sections while recognising the constraints of the Great Ouse river flood plain and taking into account planned developments, and the existing highway infrastructure. A preliminary design that is compliant with current track alignment standards has been developed and estimated as shown in 3.3.6.

Following a review of the mapping and a visit to site, it is suggested that the railway might come off the MML at grade and follow the existing ground level to pass through the southernmost span of the A6 and then the southern embankment of the river. This strategy would avoid most of the flood storage impacts of EWRCo's current approach as well as negating the need to modify the A6.

Figure 7: Extract from NR/L2/TRK/2102 in relation to vertical alignment



7.3 Vertical alignment – new construction

Design of track gradients for new construction shall take account of:

a) braking and traction performance of vehicles likely to use the line;

b) position of signals and operational regime (e.g. the likelihood of a train being required to start on the gradient or stop at a station or signal);

c) predicted rail adhesion conditions, including the effect of weather; and

d) the combined effect of gradient and horizontal curvature where the gradient coincides with a small radius horizontal curve;

The normal limiting design values for track gradient for new construction shall be 1 in 80 (12.5 mm/m).

The exceptional limiting design values for track gradient for new construction shall be:

e) 1 in 50 (20 mm/m) for sections up to 1.9 miles (3 km) in length;

f) 1 in 28.6 (35 mm/m) for sections up to 0.5 km (0.31 miles) in length where trains are not intended to stop and start in normal operation; and

g) 1 in 28.6 (35 mm/m) for passenger only lines where:

i. i) The slope of the moving average profile over 6.2 miles (10 km) is less than or equal to 25 mm/m; and

ii. ii) The maximum length of continuous 35 mm/m gradient does not exceed 3.7 miles (6 km).

From the A6, all Bedford north routes would rise up to ascend the hill using maximum gradients within the standards. The EWRCo cost drivers report indicated that it had assumed a 1:125 (0.8%) gradient to allow for freight, or potentially 1:80 (1.25%) if freight provision were not necessary. The Network Rail standard NR/L2/TRK/2102 suggests that 1:80 might be acceptable, and even steeper for limited sections (Figure 7), recognising that only paragraph 7.3 g) makes a distinction between passenger and freight.

There is room to refine the design to optimise cut and fill, gradients, and interfaces with the local highway layout, but BBC has been able to demonstrate within the very limited time available that a viable solution exists that does not require very long and high viaducts, or embankments in the flood plain, or realignment of the A6, all of which reduces the costs in comparison to the EWRCo position.

3.3.6Cost drivers analysis

In response to the Cost Drivers Briefing Paper provided by Network Rail on behalf of EWRCo, BBC has carried out its own assessment of costs for the Bedford Midland arrangements proposed above, adopting the rates provided in the Briefing Paper where declared and adopting the same assumptions on risk etc. wherever possible. The outcomes are as summarised in Table 1 and are based on new construction route lengths from BBC's own version of Route A and Route E as described below, resulting in only 0.7km increase in new construction for Route E over Route A;

Route A (BBC comparator): 17.4km from the Marston Vale Line just north of Stewartby to the ECML just south of Sandy

Route E (BBC alternative): Total 18.1km new build, made up of:

- 0.6km Bedford & St Johns double tracking
- 0.9km Carriage sidings and new station track length
- 16.6km from MML north of Bedford to ECML at Tempsford

Table 1: Review of Cost Differentials compared with Route A

	EWR Route A Cost	Add EWR Route E Differential Cost	Add EWR Route E Total	BBC Route E Alternative Total	Delta	
	V	W	X = V+W	Y	Z = Y-X	
Route Length Bedford to ECML	£345 m	£30 m	£375 m	£332 m	(£43 m)	Alternative utilises existing track which requires no work or modifications are estimated for separately.
Bedford Station	£78 m	£26 m	£104 m	£89 m	(£15 m)	Alternative = Separate review of requirements and costs.
Route Length Marston Vale line to Bedford Midland		£60 m	£60 m	£18 m	(£42 m)	Alternative = Shorter double tracking at Bedford St Johns.
Impact on Depots South of Bedford Midland		£240 m	£240 m	£31 m	(£209 m)	Alternative = Alignment through the depot/sidings rather than relocation.
Civils works: Viaducts etc from MML across the River Great Ouse.		£240 m	£240 m	£186 m	(£54 m)	Alternative = Realignment of Great Ouse Way, Paula Radcliffe Way underpass, Graze Hill viaduct.
Topography North of Bedford		£100 m	£100 m	£100 m	£0 m	Alternative assumes higher level topography cost to account for extra civil engineering.
Total	£423 m	£696 m	£1,119 m	£756 m	(£363 m)	

On the basis of the revised proposals and costs above, it appears there are some significant savings in the order of £363m (1/3rd) against the EWRCo sample route and assumed costs. These reduce the differential cost between Route E and Route A by some 48% and the ratio of Route E to Route A of 2.65:1 to 1.79:1. This saving would significantly improve the financial case for Route E and therefore BBC considers that EWRCo's appraisal should take into account this proposed route strategy and related costs instead. This is without considering any additional costs for the complexity of route A in the area south of Bedford.

3.3.7 Bedford Midland options summary

In the short time available to it, BBC has been able to demonstrate:

- The double tracking through Bedford St Johns does not need to be as complex or expensive as intimated by EWRCo in its report and at the meeting
- The double track connection through the carriage sidings does not need to significantly disrupt the existing sidings, and indeed leads to reduced use of the 'king points' for the EMU sidings and potentially greater operational flexibility in the use of the existing platforms

- The extension of two new tracks through Bedford Midlands station is viable and may act as a trigger for remodelling of the station area in accordance with BBC's master planning programme

- There is likely to be a cost-efficient means of breaking off the MML and crossing the A6 that significantly reduces the assumed EWRCo costs for this section

- The limiting gradients proposed by EWRCo are too low and provision exists in the standards to go steeper and thus reduce costs of managing the more varied topography north of Bedford

- The cost of the proposed alternate Route E is significantly less than the rather pessimistic assessment by EWRCo, and BBC suggests that EWRCo re-visits its design for this section with support from BBC in order to maximise route value

4 Options commentary

4.1 Introduction

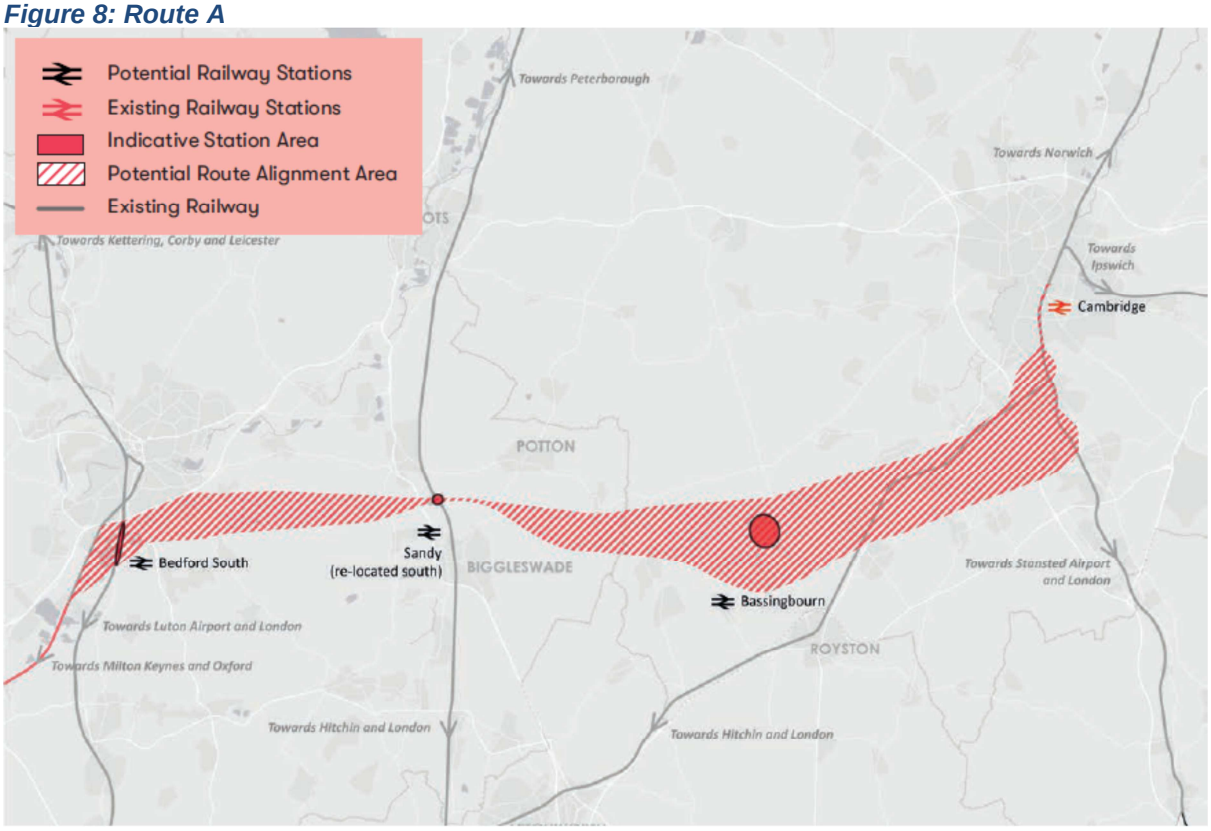
In this section, we cover each of the shortlisted options defined by EWRCo, using its terminology and the images extracted from its report. For Routes A, B and C, we have assumed a grade-separated interchange at the Wixams (re-named 'Bedford South'), and for Routes D and E we have assumed that the connection uses the existing platforms at Bedford Midland.

We have considered each route as far as the East Coast Main Line (ECML) since the remainder of the route and its stations are a function of where the connection between the MML and ECML falls in relation to Sandy.

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

Route A (Figure 8) runs from the Marston Vale line across the MML via a new interchange station at Bedford South, and then run across broadly open fields to arrive at or just south of Sandy station on a grade-separated interchange. Thereafter it runs via Bassingbourn into Cambridge from the south.

Figure 8: Route A



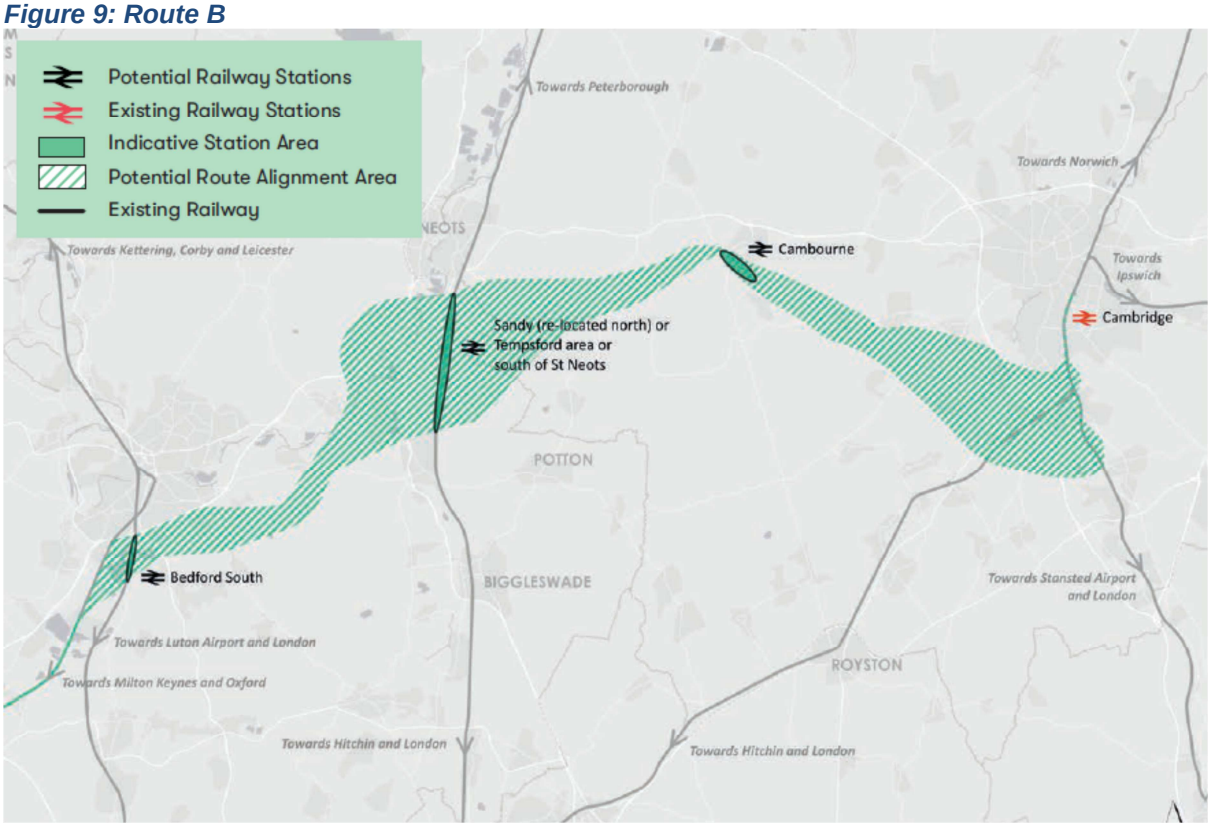
The major advantage this route has for EWRCo is that it is relatively direct, simple and unobstructed (apart from the area around the Wixams), which reduces the length and difficulty of the route and supports reduced EWR journey times.

As the least expensive route proposed, it is undoubtedly attractive to EWRCo, but the lack of political support for a new development at Bassingbourn and limited new demand from the Wixams and Sandy areas means that benefits are likely to be limited.

Since this option does not meet BBC's goal of providing an EWR station 'in the centre of Bedford' in order to achieve the economic benefits that result as set out in BBC's previous submission to EWRCo it does not have the support of BBC.

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

Figure 9: Route B



Route B (Figure 9) runs from the Marston Vale line across the MML via a new Bedford South interchange station and then runs across broadly open fields to arrive at the ECML north of Sandy at a new station which is likely to become an interchange with the ECML. To the east of the ECML, the route accesses Cambridge from the south via Cambourne.

In most respects the constraints and impacts are the same for Bedford South as were identified for Route A. Where this route differs from Route A is its direction to connect with the ECML north of Sandy. The upper edge to the alignment area follows an unexpected path due north before approaching the ECML from Wyboston (Figure 9), though it is not immediately apparent why this should be worth doing. Otherwise, the route area is broadly dictated by the intent to demonstrate connectivity with a new station roughly at Tempsford to the north of Sandy.

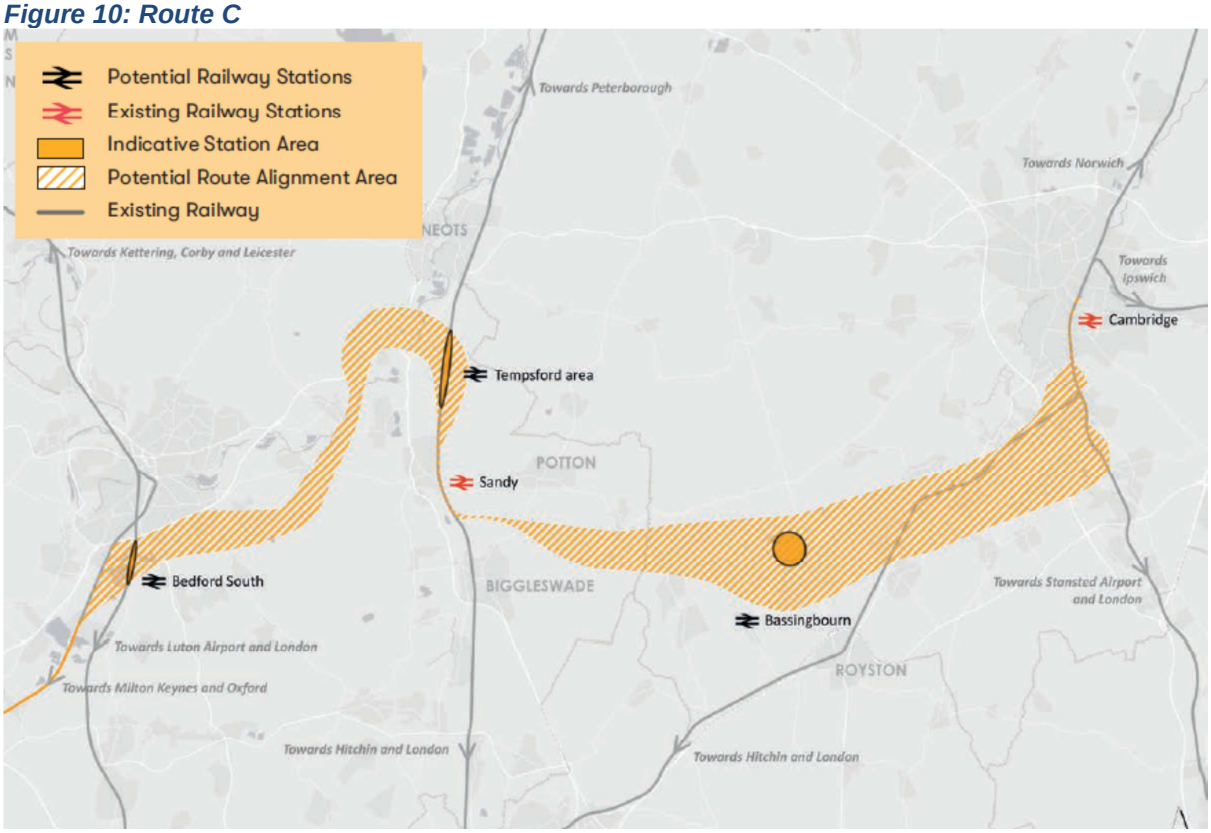
It seems unlikely (though not currently tested) that the ECML timetable would support both station stops at Tempsford and Sandy, in which case it is possible that services to Sandy might in due course be significantly reduced or even eventually be terminated.

What this route holds in its favour is that it stimulates development at Tempsford and Cambourne, which has the support of most local authorities. The additional benefit may offset the additional distance over Route A. However, its use of a Bedford South connection to the MML incurs the same constraints and impacts as Route A, as described above.

Since this option does not meet BBC's goal of providing an EWR station 'in the centre of Bedford' in order to achieve the economic benefits that result as set out in BBC's previous submission to EWRCo, it does not have the support of BBC.

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

Figure 10: Route C



Route C shown in Figure 10 adopts a similar starting configuration from the Marston Vale line across the MML and is similar to Route B except that this seems to be designed with the intent of running alongside ECML for a mile or so before breaking off again towards Bassingbourn.

This is an extremely unusual approach because it will cost more in both capex and opex terms with very little benefit other than connecting both Tempsford and Sandy stations to the EWR route. It is therefore assumed that the route would include a double track flyover to cross the ECML before running alongside the east side of the ECML. If the route were to connect onto the ECML, this would probably add significant signalling costs, as well as an operational constraint onto the ECML so this variation has not been considered in detail.

Although this route picks up existing demand at Sandy and future demand at Tempsford, every passenger not wishing to get off at Sandy or Tempsford would suffer a significant journey time disbenefit of circa ten minutes, with dwell times and a diversion of approximately 13km.

For the benefit of serving the relatively small populations of Sandy and a future expanded population Tempsford, the journey time penalties for the majority of customers, plus the additional capex of a double track flyover and associated track are likely to make this option very unattractive to almost everyone other than residents at Sandy.

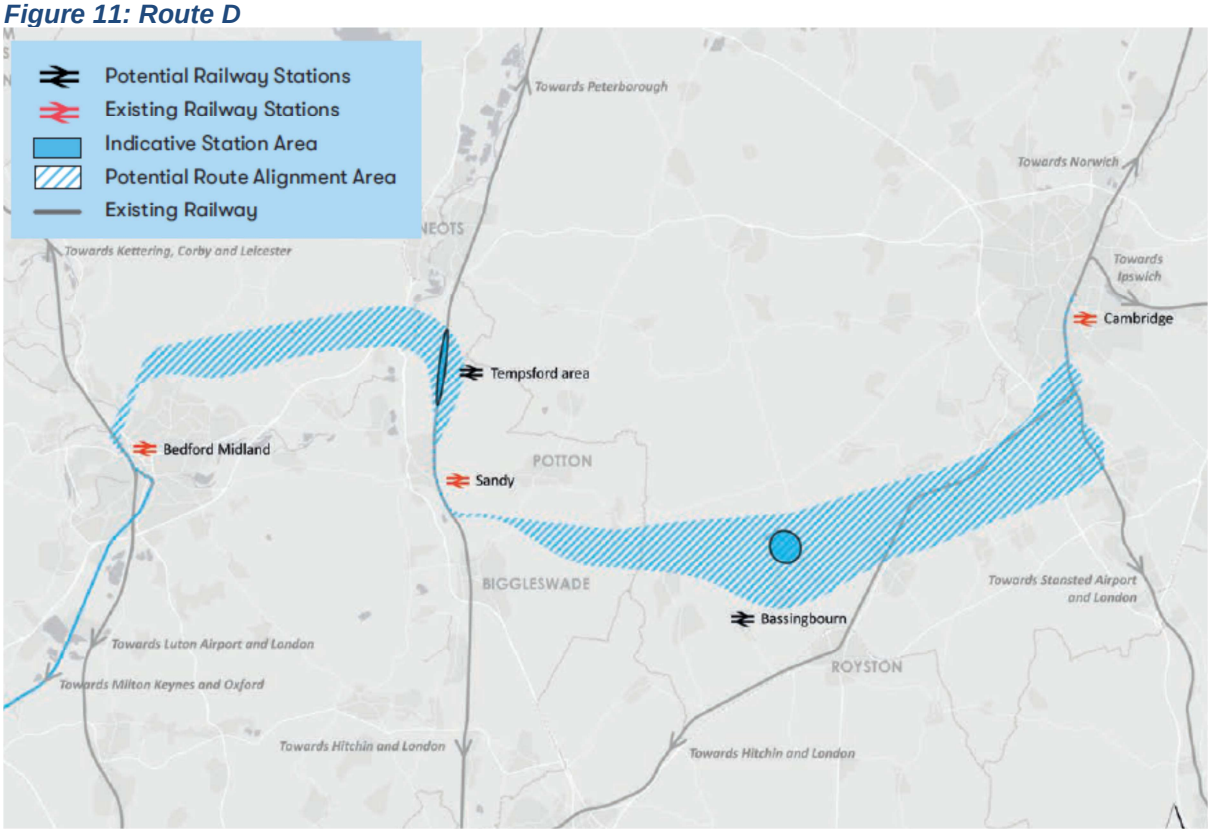
It seems likely that either Tempsford or Sandy would become the interchange point for the ECML, but not both. Adoption of one is likely to lead to a watered-down or non-existent ECML service to the other, with the EWR service providing the connection between the two. The added journey time for this connection is likely to reduce the benefits that accrue from this arrangement.

The lack of political support for a new development at Bassingbourn and limited demand from the Wixams means that benefits are likely to be limited to those gained at Tempsford and Sandy. Its use of a Bedford South connection to the MML incurs the same constraints and impacts as Route A, as described above.

Since this option does not meet BBC's goal of providing an EWR station 'in the centre of Bedford' in order to achieve the economic benefits that result as set out in BBC's previous submission to EWRCo, it does not have the support of BBC.

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

Figure 11: Route D



Route D in Figure 11 does stop at Bedford Midland before passing to the north of Bedford and then East towards Tempsford and then a similar route profile to Route C. Where it differs from Route C is that the connection between Bedford and Tempsford is more direct and hence presents better value in terms of connecting with additional demand for the cost of construction and operation.

If Tempsford does not have sufficient future demand to justify the journey time and cost of stopping there, a variation on this theme would be to connect more directly between the top of Bedford and a new grade-separated interchange station slightly south of Sandy which would save on route miles. However, the current distance of Route D between Bedford Midland and Cambridge is slightly less than Bedfrod South to Cambridge in Route B.

As for Route C it is assumed that the route would include a double track flyover to cross the ECML before running alongside the east side of the ECML. If the route were to connect onto the ECML, this would probably add significant signalling costs, as well as an operational constraint onto the ECML so this variation has not been considered in detail.

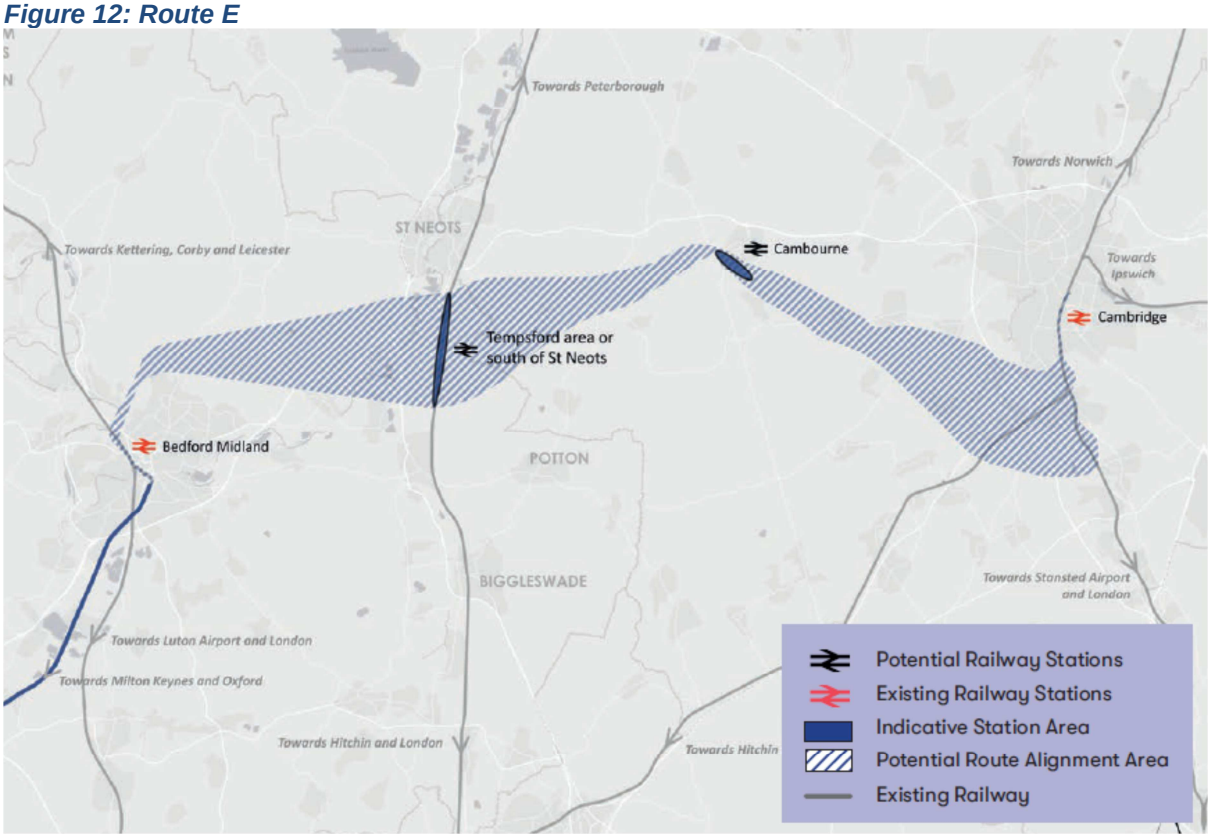
Similarly, it seems likely that either Tempsford or Sandy would become the interchange point for the ECML, but not both. Adoption of one is likely to lead to a watered-down or non-existent ECML service to the other, with the EWR service providing the connection between the two. The added journey time for this connection is likely to reduce the benefits that accrue from this arrangement.

The comparative benefit of Route D is that it accesses increased demand at Bedford Midland and additional demand at Tempsford.

Since this route passes through ‘the centre of Bedford’ via Bedford Midland and thus achieves the economic benefits that result as set out in BBC’s previous submission to EWRCo, it has support in principle from several local authorities, including BBC. However, because it connects with Bassingbourne which enjoys much less political support as a future area for development, BBC supports this route less than Route E.

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

Figure 12: Route E



Route E in Figure 12 stops at Bedford Midland and passes over the north of Bedford before heading East across largely open fields towards a new station at Tempsford on the ECML and on towards another new station at Cambourne. From there, the route accesses Cambridge from the south. This route presents a relatively direct route between the north of Bedford and Cambridge, picking up two new areas of development reasonably efficiently.

It is anticipated that the new station at Tempsford would be grade separated, crossing the ECML but creating a new interchange. As described for Route B, it is unlikely (though not currently tested) that the ECML timetable would support both station stops at Tempsford and Sandy, in which case it is possible that ECML services to Sandy might in due course be significantly reduced.

By connecting with Bedford Midland, Tempsford and Cambourne, this route targets the three main locations that have Local Authority support in a reasonably direct manner leading to overall distance and journey times that are comparable with Route B. Unlike Route B, it connects with the MML at Bedford Midland and avoids the constraints and impacts of the Bedford South routes. Unlike Route D, it targets Cambourne which is the locally preferred development area rather than Bassingbourn and has a slightly shorter route length, which will result in slightly lower comparable costs.

Therefore, since it achieves BBC's aim of connecting the centre of Bedford and the targeted development sites of Tempsford and Cambourne, this route would benefit from strong local authority support, including BBC.

4.7 Summary of EWR proposed routes

The consultation Routes proposed by EWRCo generally fall into two groups from the perspective of BBC – those that pass via a new Bedford South station (Routes A, B and C), and those that go via Bedford Midland station (Routes D and E). Since the fundamental approach near Bedford for each group is the same for each of the routes within their groups, there are effectively only two Bedford station options proposed.

We have investigated different ways in which both Bedford South and Bedford Midlands connections might be made. We have concluded that if a Bedford south option were selected, it would most likely involve a grade-separated interchange at the Wixams passing over the MML at high level. We have also concluded that if a Bedford Midland station option were selected, the likely solution is to provide two through platforms to the east of the existing station. These two solutions have then been adopted in our assessment of the five Routes presented by EWRCo which has focussed on the sections between the Marston Vale line and the ECML.

The Bedford South options are highly dependent on finding a connection from the Marston Vale lines to the MML and eastwards through a range of significant physical and development constraints that are not easily avoided. BBC is not confident that EWRCo has fully considered these constraints and accounted for them in its analysis of costs and impacts. None of the Bedford South routes achieves BBC's objective of an EWR connecting with 'the centre of Bedford' to capture the economic benefits that result as set out in BBC's previous submission to EWRCo, and therefore none of them has BBC's support.

The Bedford Midland options achieve the BBC's core aim of connecting with the centre of Bedford and provide greatly enhanced interchange opportunities. In the brief time available, BBC has developed viable and cost-effective solutions to reduce the anticipated costs suggested by EWRCo in its cost drivers paper. BBC would welcome the opportunity to work with EWRCo on developing these ideas further to reduce costs and increase the operational value they provide in recognition that the extra construction cost and journey times of slightly longer routes using Bedford Midland will need to fully capture the greater benefits that are expected for this route.

Of the two Bedford Midland schemes, Route E has the strongest case because it has the shortest route and accesses the three preferred station locations. BBC's Route E version is more than 30% cheaper than the EWRCo Route E with a length of new build construction only 0.7km longer than Route A..

Having looked at the whole route and having considered alongside Huntingdonshire District Council, South Cambs District Council and Cambridge City Council, Route E provides the best connectivity to suit the requirements of all these councils and BBC. Therefore BBC's preferred Route is its own version of Route E.

5 Conclusions

BBC has a clear commitment to supporting EWRCo with a route that connects with 'the centre of Bedford' because of the economic benefits that are to be gained by doing so, as set out in BBC's previous submission to EWRCo. This goal is only achieved with EWR Routes D and E because routes A, B and C bypass Bedford to the south via a new 'Bedford South' station, likely to be located at the Wixams. The Wixams station location is highly constrained and will be in place before EWR will have started construction.

BBC is concerned that EWRCo does not appear to have fully considered the complexities of accessing a Bedford South station south of the A421 given the considerable constraints posed by committed planning for residential and commercial development, as well as existing land use that would make it very difficult to construct in this area. In addition, BBC is very concerned about the likely negative impact of this station on services to Bedford Midland and potentially the Wixams station as well if a Bedford South does not interchange at the Wixams.

Of the two Bedford Midlands routes, Option E is BBC's preferred route, because it maintains a reasonably direct route to Cambridge after passing to the north of Bedford and therefore provides the shortest length and best journey times for the Bedford Midland routes.

Route E directly accesses the largest local population at Bedford, and two new development areas at south of St Neots and Cambourne which will be critical to supporting the business case for this option. Likewise, the financial and business case will be improved by reducing the cost of the route and to this end BBC has developed some practical solutions that significantly reduce the costs and impacts of the EWRCo proposals for the section between Bedford St Johns and the north of Bedford.

BBC would welcome the opportunity to continue to work with EWRCo to reduce the costs and risks of Route E in order to build a stronger financial and business case and lead to the development of a scheme that can win wide political support and stimulate wide economic benefits for the region.

Appendix A

Documents received from EWRCo

Table 2: List of documents received from EWR

Date	Title
30/1/19	EWRCo consultation document
30/1/19	EWRCo technical report
30/1/19	Route options map
26/2/19	EWRCS – Bedford Midland cost drivers 0.9 BBC version
13/3/19	EWRCS – Bedford Midland cost drivers 0.11 BBC version