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CAMBRIDGE-HAVERHILL CORRIDOR STUDY

DRAFT RAIL VIABILITY TECHNICAL NOTE

PUBLIC

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WSP | PARSONS BRINCKERHOFF

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Cambridgeshire County Council

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1.1 INTRODUCTION

1.1.1 This technical note has been produced to assess the viability of reopening the former Cambridge to Haverhill railway line. It is an initial assessment only, undertaken as part of the A1307 Haverhill to Cambridge Corridor Study commissioned by Cambridgeshire County Council. The objective of this technical note is to assist the Greater Cambridge City Deal in determining whether the reopening should move forward to a more detailed study, either within the present Cambridge-Haverhill corridor study or as a separate exercise.

1.2 TECHNICAL NOTE SCOPE

1.2.1 The scope of the assessment undertaken for this technical note included:

- Identifying the strategic rationale for rail;
- A desk assessment of aerial images and OS Mastermap, supplemented by targeted site visits to key areas, to identify at a high level, the current physical status of the former alignment;
- Where the corridor is physically blocked, identifying (at a high level) a potential solution, which may involve relocating the existing use or diverting the railway away from the former alignment;
- Identifying potential station locations along the alignment at each of Haverhill, Linton, Granta Park, and Babraham/Sawston amongst others. This has included identifying the scope for park-and-ride at each of these;
- Identifying (again at a high level) an assumed service/stopping pattern, along with the passenger capacity it may provide, broad journey times, the diagram(s) and loop(s) likely to be required, and the potential operating arrangements;
- Estimating the capital cost on an order-of-magnitude basis; and
- Carrying out a high level economic appraisal, including indicative estimates of demand and revenue.

1.2.2 The economic appraisal also included appraisal of a bus rapid transit (BRT) alternative on the disused rail corridor. This is also included in the technical note, for ease of reference.

2 RATIONALE, SERVICE PATTERN AND OPERATING ARRANGEMENTS

2.1 RATIONALE

2.1.1 In the context of the Cambridge-Haverhill corridor study, within which this technical note has been commissioned, the key reasons for considering the Cambridge-Haverhill reopening are seen as:

- Providing rail access from Haverhill and other locations along the corridor to employment, public services and leisure in Cambridge. This notably includes the Biomedical Campus at Addenbrooke's, the city centre and the Cambridge Science Park; and
- Providing access to employment along the reopened branch, principally at Granta Park but potentially also at Babraham Research Campus and in Haverhill. This includes reverse-commuting by Cambridge residents.

2.1.2 In both of these cases, the rail line would support growth in the Cambridge city region by:

- Increasing the amount of capacity available on the corridor, both overall and (if modal shift is secured) by creating capacity 'headroom' on the A1307;
- Providing users with an alternative to road or bus;
- Potentially offering improved journey times and reliability compared to existing alternatives; and
- Improved interchange opportunities for public transport.

2.1.3 Other potential benefits include:

- Improved access to other key destinations such as Peterborough, and indeed to the wider national rail network;
- Improved rail access to London – although existing stations, particularly Whittlesford Parkway and Audley End, already serve this need to some extent;
- Additional park-and-ride access to Cambridge - although the existing Babraham Road park-and-ride already serves this need along the corridor;
- Improved service levels at Shelford, Cambridge North (proposed) and/or Addenbrooke's (proposed); and
- Providing (at Haverhill) a railhead for residents of west Suffolk, particularly those along the A143, A1092 and A1017 (east of Haverhill) corridors.

2.2 POTENTIAL FOR EXTENSION TO SUDBURY AND BEYOND

2.2.1 A Cambridge-Haverhill railway line could also ultimately form part of a more strategic rail link from Cambridge to Colchester, via Haverhill and Sudbury, including the existing Sudbury to Marks Tey branch. However, this strategic option is beyond the scope of this technical note and the current study.

2.3 ASSUMED SERVICE PATTERN

2.3.1 Based on the rationale described previously in this chapter, the required service pattern is assumed to be half-hourly all day between Haverhill and Cambridge, calling (at a minimum) at intermediate stations at Linton, Granta Park, Sawston and Babraham.

2.3.2 The ideal location for Haverhill station in catchment terms is in the town centre. Due to physical constraints along the former railway corridor route through Haverhill (see further within this technical note), an alternative terminus at 'Haverhill North Gateway' station is also considered.

2.3.3 Services may call at, or omit, Shelford. This is not seen as a key issue at this stage. For journey time purposes, it is conservatively assumed that they do call at Shelford. The ultimate decision would depend mainly on:

- operational and timetabling feasibility;
- the potential market for changing at Shelford for points south to London Liverpool Street;
- the journey time penalty for through passengers; and
- the ridership and revenue benefit from additional services at Shelford (the current service there is broadly half-hourly at peak periods, hourly at other times).

2.3.4 Services may call at the proposed Addenbrooke's Hospital station if a future station was provided there. Again, for journey time purposes, it is conservatively assumed that they do call there. The ultimate decision would depend mainly on:

- operational and timetabling feasibility;
- the role of Addenbrooke's Hospital as a demand generator;
- the journey time penalty for through passengers; and
- the potential market for changing at Addenbrooke's Hospital for points south to London King's Cross, compared to changing at Cambridge.

2.3.5 An extension to Cambridge North (the proposed station formerly known as Cambridge Science Park or Chesterton) is desirable if operationally feasible and convenient, as this would connect the Haverhill line to Cambridge Science Park.

2.3.6 An extension beyond Cambridge North is also assumed to be desirable if operationally feasible and convenient. It may result from interworking with other routes (see below).

2.3.7 For the purposes of this assessment, there are assumed to be no requirements for charter or freight services. However, opportunities to support those services could be considered at a later stage of assessment.

2.4 ASSUMED CAPACITY

2.4.1 Table 1 shows the potential capacity provided by this service pattern. This is based on typical existing rolling stock operating locally, but the actual capacity would depend on the rolling stock available at the time of opening. The table assumes single-unit formations, but additional capacity could be provided through additional units per train if necessary.

Table 1: Potential capacity

Option	Nominal rolling stock *	Seats per unit	Trains per hour	Total seats per hour †
DMU – 2-car	2-car 170/2 (eg by extending Ipswich-Cambridge service)	119	2	238
DMU – 3-car	3-car 170/2 (eg by extending Norwich-Cambridge service)	180	2	360
EMU – 4-car	317/6	268	2	536
EMU – 4-car	379	209	2	418

** For purposes of estimating capacity, based on existing local fleets. Actual rolling stock used would depend on available fleets at the time.*

† Additional capacity, if required, could be provided by using one or more additional units per train, subject to infrastructure and operational feasibility

Source for seating numbers: British Railways Locomotives & Coaching Stock 2015, Platform 5 Publishing

2.4.2 For the purposes of this assessment, capacity is assumed to be seated capacity in first and standard accommodation, with no allowance for standing.

2.5 ESTIMATED JOURNEY TIMES

2.5.1 At this initial stage, the journey time estimates are generic and do not relate to specific rolling stock. The estimates are made for an all-stations run between Cambridge North and Haverhill (town centre or North Gateway), but the relevant elements are also applicable to Cambridge-Haverhill alone. No allowance at this stage is made for potential waits at crossing loops (if any are required on the reinstated branch) or any other pathing requirements.

2.5.2 The estimates assume stations at Haverhill (town centre or North Gateway), Linton, Granta Park, and Sawston & Babraham, with trains then calling at Shelford, Addenbrooke's, Cambridge and (if required) Cambridge North.

2.5.3 Journey times were estimated on the following basis:

- Cambridge North to/from Coldham's Lane Junction (pass): Estimated based on the distance run and the potential allowances/adjustments needed;
- Coldham's Lane Junction (pass) to Shelford: Existing Sectional Running Times (SRTs) exist for a range of relevant DMU and EMU timing loads. Nominal SRTs have been assumed based on the slowest of these. Dwell times have also been assumed, based on existing Timetable Planning Rules (TPRs). The time penalty for calls at the proposed Addenbrooke's station has been estimated and overlaid onto this;
- Shelford to the new Shelford Junction (pass): Estimated based on the distance run; and
- Shelford Junction (pass) to Haverhill: Estimated based on a conservatively assumed 70mph typical linespeed, typical time penalties for calling at stations, and the potential allowances/adjustments needed.

2.5.4 The estimates for Cambridge-Haverhill were then benchmarked against a range of comparable journeys in the region and elsewhere, to confirm their reasonableness.

2.5.5 Table 2 summarises the estimated journey times, assuming a Haverhill Town Centre station. These are based on working times, but rounded up to whole minutes as an approximation to advertised times.

Table 2: Estimated journey times (minutes) (assuming Haverhill Town Centre station)

Up (to Haverhill)

From (below) to (right)	Cambridge	Addenbrooke's	Shelford	Sawston & Babraham	Granta Park	Linton	Haverhill Town Centre
Cambridge North	6	10	14	19	22	26	37
Cambridge		3	7	12	15	19	30
Addenbrooke's			4	8	12	16	27
Shelford				4	8	12	23
Sawston & Babraham					3	7	18
Granta Park						4	15
Linton							11

Down (from Haverhill)

From (below) to (right)	Linton	Granta Park	Sawston & Babraham	Shelford	Addenbrooke's	Cambridge	Cambridge North
Haverhill	9	13	16	21	25	29	37
Linton		4	7	12	16	20	28
Addenbrooke's			3	8	12	16	24
Granta Park				4	9	12	21
Sawston & Babraham					4	8	16
Shelford						3	12
Cambridge							7

2.5.6 Table 3 summarises the alternative estimate assuming a station at Haverhill Northern Gateway, instead of the town centre. The journey times to/from Haverhill would be 1-2 minutes less in this case.

Table 3: Estimated journey times (minutes) (assuming Haverhill Northern Gateway station)

Up (to Haverhill)

From (below) to (right)	Cambridge	Addenbrooke's	Shelford	Sawston & Babraham	Granta Park	Linton	Haverhill North Gateway
Cambridge North	6	10	14	19	22	26	35
Cambridge		3	7	12	15	19	28
Addenbrooke's			4	8	12	16	25
Shelford				4	8	12	21
Sawston & Babraham					3	7	16
Granta Park						4	13
Linton							9

Down (from Haverhill)

From (below) to (right)	Linton	Granta Park	Sawston & Babraham	Shelford	Addenbrooke's	Cambridge	Cambridge North
Haverhill	7	11	15	19	24	27	36
Linton		4	7	12	16	20	29
Addenbrooke's			3	8	12	16	25
Granta Park				4	9	12	21
Sawston & Babraham					4	8	17
Shelford						3	12
Cambridge							8

Note: Certain down journey times to Cambridge North may appear as slightly longer in this scenario than in the Haverhill Town Centre scenario (Table 2). This is for technical reasons related to TPRs and the rounding-up process applied. There is no substantive difference between the two scenarios north of Linton.

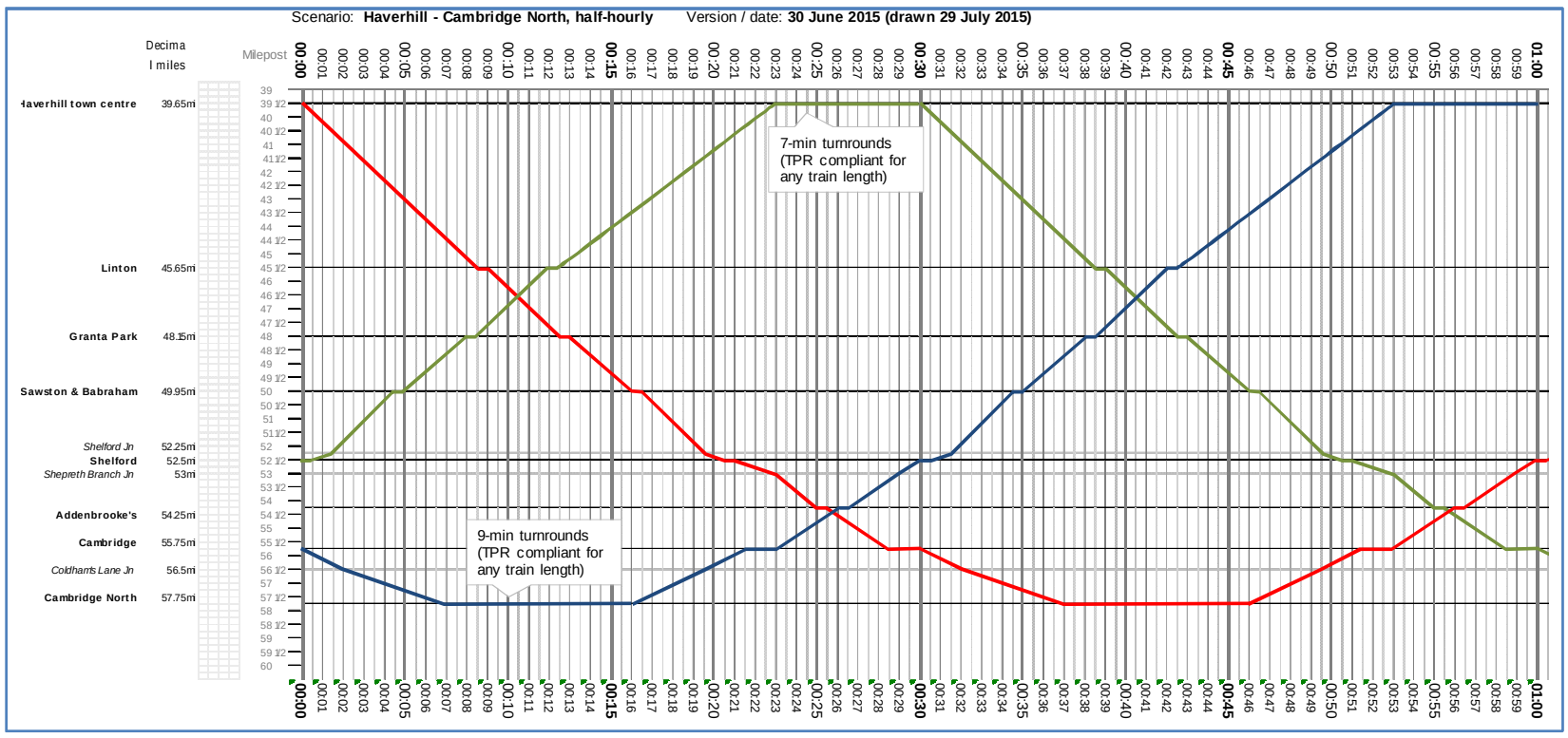
2.6 ROLLING STOCK AND INFRASTRUCTURE REQUIREMENTS

2.6.1 The timetabling exercise described below is solely for the purpose of understanding the main rolling stock and infrastructure requirements. A full timetabling exercise, reflecting other services on the network, is beyond the scope of this study and indeed would not be appropriate at this very early stage. It must be stressed that if the reopening is taken forward, a more detailed exercise, including consideration of pathing along the main line and performance implications, would be required at a later stage to confirm feasibility.

HAVERHILL-CAMBRIDGE NORTH (2TPH, EVEN INTERVALS)

2.6.2 Figure 1 shows a standard hour timetable graph based on the journey times described above, assuming a Haverhill Town Centre terminus and a self-contained 2tph even-interval Haverhill - Cambridge North service. The ‘minutes past the hour’ are arbitrary and the entire pattern could be rotated around the hour as required.

Figure 1: Timetable graph



For ease of calculation and reference, mileages along the branch are extended back from the existing BGK mileage trail on the main line, and do not correspond to any historic mileage trail along the branch.

In relation to existing Sectional Running Times (SRTs), this graph contains information of Network Rail Infrastructure Limited licensed under the following licence: www.networkrail.co.uk/data-feeds/terms-and-conditions

2.6.3 The graph shows that:

- This service pattern can be accommodated with three diagrams (90-minute cycle);
- The turnround times are reasonable at each end (totalling 18% of the 90-minute cycle);
- Trains on the branch itself would cross between Linton and Granta Park. This in turn suggests that the branch could be built, at least initially, as single-track with a mid-point passing loop;
- The timings shown would imply a dynamic loop between Linton and Granta Park. However, other permutations, such as a static loop at one or other of those stations, could arise from further timetable development; and
- While it would be desirable for Haverhill trains to pass the new Shelford Junction in parallel, this is not feasible on this service pattern.

2.6.4 A more frequent, 4tph even-interval service can be assessed by interpolation between the trains shown. Such a service would require trains to additionally cross on the branch between Shelford Junction and Sawston, and also between Linton and Haverhill. While this could in theory be accommodated with additional loops in these locations, performance considerations may require the branch to be built as double-track between Shelford Junction and Sawston, and potentially as double-track for all but the last section into Haverhill.

HAVERHILL-CAMBRIDGE (EXISTING CAMBRIDGE STATION ONLY) (2TPH, EVEN INTERVALS)

2.6.5 The graph also helps to understand how a 2tph service running only Haverhill–Cambridge (i.e. the existing Cambridge station) could operate. On the journey time assumptions used (approximately 30 minutes end-to-end), it would require three diagrams (90-minute cycle) with relatively inefficient rolling stock usage. It is possible that a more detailed engineering study, changing the assumed stopping pattern or rolling stock, and/or changing the assumed Haverhill station location could identify ways to reduce this to two diagrams and thus be more cost-effective.

INTERWORKING WITH NORWICH/IPSWICH SERVICES

2.6.6 The timings shown here for the Haverhill route are indicative, and existing services would alter over time[1], so only the broad potential for interworking can be identified at this stage.

2.6.7 The timetable graph shows 8.5 minutes between a Cambridge arrival from the north and a Cambridge departure to the north. This can be compared to the existing turnround times (based on standard off-peak hours) of 13 minutes for Norwich services and 5 minutes for Ipswich services. There may be potential for interworking if these timings can be made to match and if the Haverhill service can pivot around the hour to suit the service it interworks with.

2.6.8 If this becomes feasible, then the diagramming needs to be considered. An arrival from Norwich or Ipswich currently terminating at Cambridge could continue to Haverhill, and return to form a down (northbound) departure from Cambridge just over an hour later. This provides one of the two trains per hour to/from Haverhill, at the cost of one diagram. The other Haverhill train would need to be provided by one of the following options:

- → Another interworking service (30 minutes away from the first). Unfortunately the existing Norwich and Ipswich services are not evenly spaced from each other, so it is not possible for both of these to interwork to Haverhill to provide an evenly spaced service ;and
- → A self-contained shuttle. This would require two diagrams (plus the additional diagram on the interworking service) and the shuttle diagrams would have long turnround times, in some cases nearly an hour. This would counteract the advantages of interworking.

2.6.9 If either of the existing Norwich or Ipswich services were to be enhanced to half-hourly in the future, that service could interwork to Haverhill, requiring two additional diagrams, if the timings were compatible as noted above.

CONCLUSION

2.6.10 For the purposes of this study, it is assumed that a self-contained Haverhill-Cambridge North service would operate. This would be 2tph and require three diagrams. The assumed minimum infrastructure is a single track with a dynamic loop between Linton and Granta Park.

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[1] As an illustration of this, since the timetabling analysis was undertaken, it has been announced that the Norwich-Cambridge services are to be extended to Stansted Airport from 2018, in part replacing the existing Cambridge-Stansted Airport service. This reinforces the fact that only the broad potential for interworking can be identified at this early stage.

2.7 OPERATING ARRANGEMENTS

2.7.1 It is assumed that a Haverhill service would be operated by Greater Anglia or any relevant successor franchise. Traincrew, cleaning, stabling and maintenance are all assumed to be provided from existing locations. The following operational arrangements have been assumed:

- Traincrew and cleaning staff would be based at Cambridge;
- Trains would be part of the existing Ilford (EMU) or Norwich Crown Point (DMU) fleet, with appropriate interworking and/or ECS moves to take units to/from the depot; and
- Stabling is available at Cambridge. Units could also be stabled overnight at Haverhill but stabling at unstaffed locations is discouraged because of potential vandalism.

2.7.2 For the purposes of this study, it is assumed that only incremental operating and maintenance costs would be incurred. However, at a more detailed stage it would be necessary to confirm whether any additional facilities (e.g. new maintenance capacity or additional stabling sidings) would be required.

3 PHYSICAL CONSTRAINTS

3.1 OVERVIEW

3.1.1 Figure 2 summarises the current status of, and physical constraints along, each section of the corridor, giving a red/amber/green status to each segment. The RAG status can be summarised as follows, whilst considering that the railway corridor is not merely disused in most parts, it is physically not there or has been appropriated for another use:

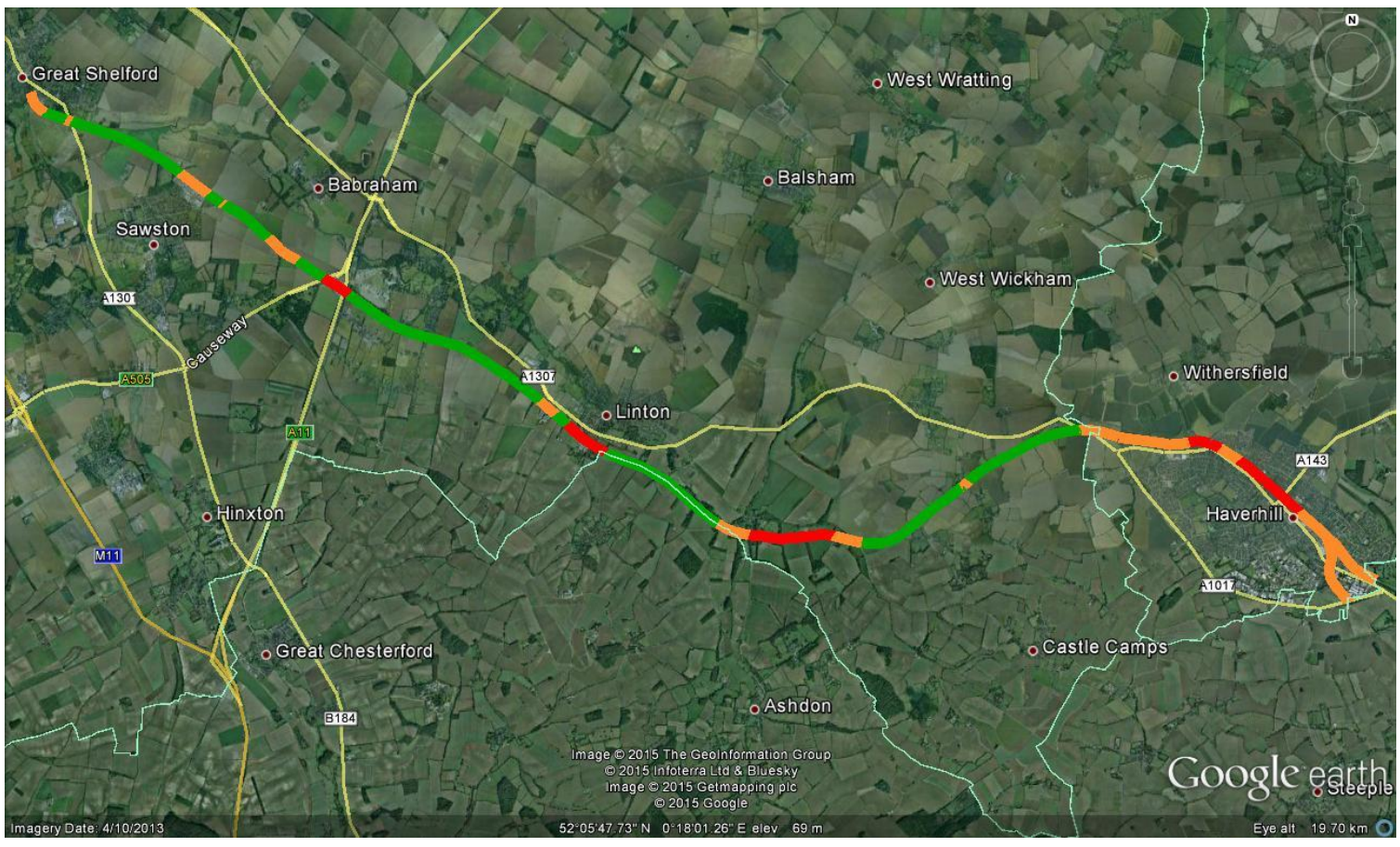
- → Red – significant issue and/or risk which would most likely require a significant piece of infrastructure / significant solution including realignment (where the original alignment cannot be achieved);
- → Amber – major issue and/or risk which may require additional consideration including realignment; and
- → Green – generally no major physical constraints but further review is required.

3.1.2 This assessment of the physical constraints is based upon an initial desk study plus a limited site visit at targeted sites where needed, and would need to be developed further if the rail option is taken forward. Appendix A includes a detailed description of each segment shown in Figure 2.

3.1.3 The following sections pick out the key areas of physical constraint, particularly those that are likely to require decisions about route alignment and extent. Where potential realignments are suggested, these are to indicate the level of realignment that might be required and the resulting impacts; their feasibility would need to be tested. There is no presumption at this stage that any of those options are desirable or deliverable.

3.1.4 Historical mapping and photographs suggest that the line was originally single-track except at stations. It was grade-separated at main highways but not necessarily at farm accesses and footpath crossings.

Figure 2: Rail RAG status



3.2 SAWSTON

3.2.1 Figure 3 shows the former alignment at Sawston. Part of the old alignment is now an industrial estate. The route could be adjusted slightly away from the old alignment to use adjacent fields instead. The industrial estate is also one option for a station serving Sawston and Babraham.

Figure 3: Sawston

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations.

3.3 A505 / A11 AND GRANTA PARK

3.3.1 Figure 4 shows the former alignment at Granta Park. The old alignment, including the former Pampisford station site (A), is blocked by the A11, A505, A505 slip roads, and development. The potential options for resolving this are:

- Re-use the old alignment. Some or all of the business premises, and what appears to be a private residence (B), would be required. New viaduct(s) over the highways would be required;
- Re-route south of the old alignment, avoiding (but with impacts on) most of the existing development. New viaduct(s) over the highways would be required. The Lodge (at the north-east corner of the Pampisford Hall grounds (C)) would be affected. Visual intrusion for Pampisford Hall grounds and New Road properties (D) might also constrain this option; and
- Re-route to the north of the old alignment, avoiding (but with impacts on) the existing development. New viaduct(s) over the highways would be required. This alignment should pass to the north of the A505 slip roads (E). The bridge work will inevitably be extensive.

3.3.2 In addition to land-take and environmental factors, other key factors affecting the decision would be:

- buildability (worksite access and minimising highway disruption during construction);

- the need to accommodate the horizontal and vertical geometry requirements for Granta Park station, assumed to be east of the A11 close to Pampisford Road and the southern pedestrian access to Granta Park (F); and
- the potential need for a dynamic loop to start at this location (see Section 2.6 previously).

Figure 4: A505 / A11 and Granta Park

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations

3.4 LINTON

3.4.1 Figure 5 shows the former alignment at Linton.

FORMER STATION SITE

3.4.2 The former station site is now commercial premises, with the station building in commercial use and a new building across the former trackbed (A). The former station approach road (Station Road) (Figure 6) displays a ‘no intention to dedicate’ notice (Highways Act 1980 Section 31) in the name of Network Rail, suggesting that Station Road might remain in Network Rail ownership, although this would be an unusual arrangement so far away from an operational railway.

3.4.3 To avoid the need to purchase the former station site, the route could be adjusted onto adjacent fields to the south (B) (Figure 7), if this can be tied in to the required alignment at The Grip / Hadstock Road (see below) (C).

3.4.4 The station could be placed on this adjusted alignment, close to the original site. Adjoining areas to the north are commercial or undeveloped and offer scope for station access and car parking. Road access would logically be from the A1307, but given the existing highway congestion concerns here, this would need to be carefully assessed.

3.4.5 However, this is not necessarily the only option for a station location. Future patterns of development and site allocations may influence, or be influenced by, the choice of station location in Linton.

THE GRIP / HADSTOCK ROAD

3.4.6 Either side of The Grip / Hadstock Road, the alignment is broadly undeveloped but has closely adjacent commercial and residential premises (C). This includes residential properties (D) west of The Grip and immediately north of the former alignment, where the embankment remains in situ.

Figure 5: Linton

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations

Figure 6: Station Road, Linton

Left: view north along Station Road towards A1307. Right: Section 31 notice in the name of Network Rail.

Figure 7: Field adjoining former station site, Linton

Left: view to west. Former station site on right behind vegetation. Right: view to east. Former station site on left behind vegetation. Photos taken from public footpath.

3.5 BARTLOW

3.5.1 Figure 8 shows the former alignment at Bartlow.

FORMER STATION

3.5.2 The former station building and platforms are now a private residence (A). The abutments, but not the deck, of the adjoining rail-over-road bridge (B) still exist (Figure 9).

BARTLOW HILLS

3.5.3 Bartlow Hills Roman barrow cemetery (C), a Scheduled Monument, is bisected by the former alignment. MAGIC mapping suggests the railway formation is not part of the Scheduled Monument, but it may still be a significant constraint in terms of impacts and construction access.

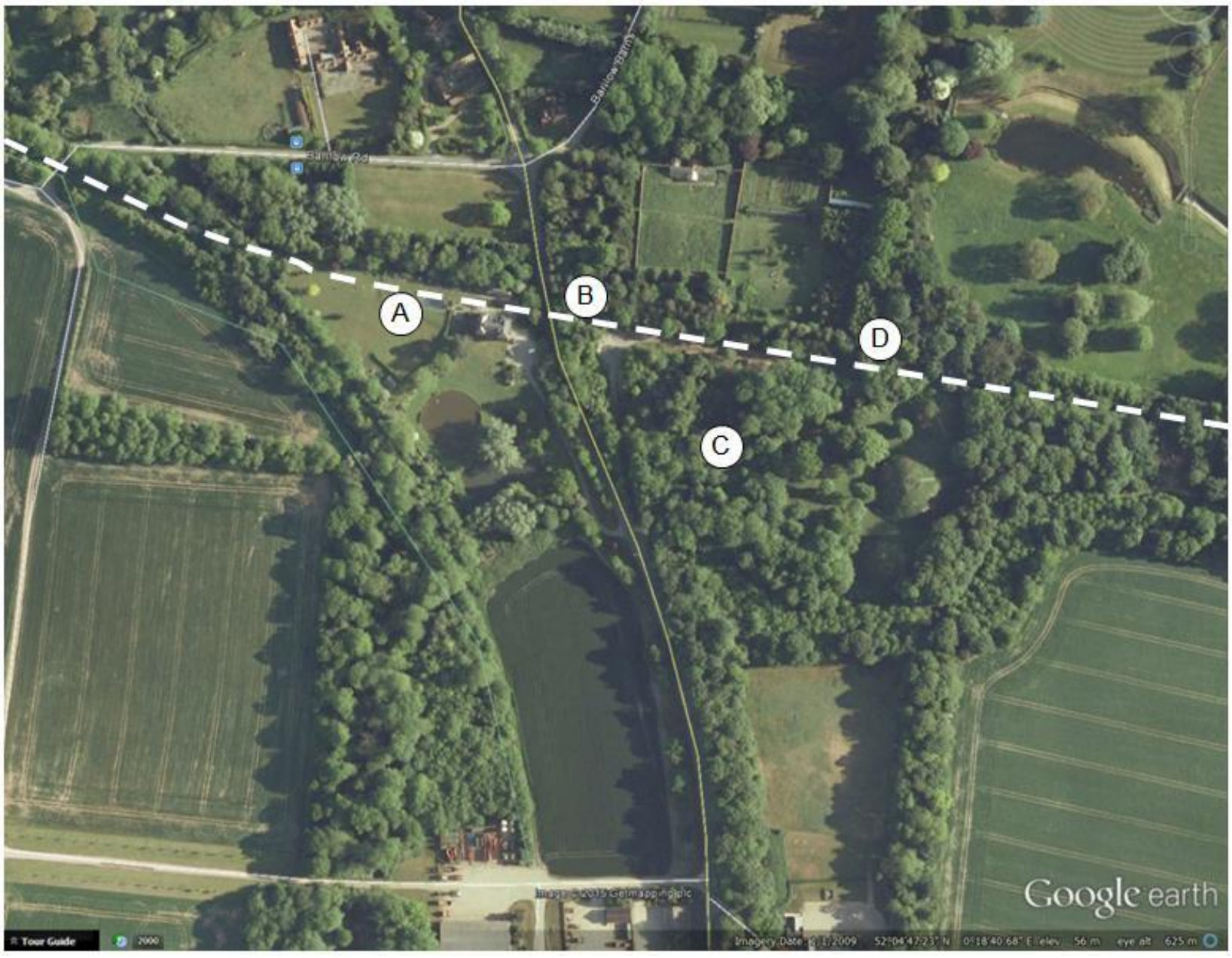
3.5.4 An interpretation board on site (Figure 10, left) states that the Bartlow Hills are owned by Cambridgeshire County Council. The ownership of the former railway alignment is not clear.

3.5.5 A site visit and review of historical maps and photographs have established that the formation at this point is mainly in a cutting. There is a short section of retained cut, with a footbridge over the railway, still in existence (D) (Figure 10, right), which takes the formation narrowly between two of the tumuli[2]. Most of the formation through Bartlow, either side of the footbridge, included a loop or siding and therefore originally had two or more tracks. However, only a single track went under the footbridge, which appears to have been built to single-track width. It is possible that the original design intent was to minimise interference with the tumuli, within the given broad alignment.

[2] See http://maps.nls.uk/geo/explore/#zoom=18&lat=52.0799&lon=0.3115&layers=176

3.5.6 It should be assumed that, if the railway were to be reinstated on the original alignment, double track could not realistically be provided alongside Bartlow Hills. The timetabling analysis above suggested that a single track would be acceptable on this part of the route in the context of a Cambridge-Haverhill service as assumed for this study. However, the issue would need to be reconsidered if the goal were to reopen Cambridge-Sudbury in its entirety as a strategic and broadly double-track route. There are examples elsewhere of short sections of single track on otherwise double-track routes, but they represent an operating constraint.

Figure 8: Bartlow



Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations. Former alignment of Bartlow-Saffron Walden route (not part of this study) omitted for clarity.

Figure 9: Bartlow

View south-west, showing abutments

Figure 10: Bartlow Hills

Bartlow Hills. Left: Interpretation board. Right: Former railway cutting, looking south-east towards footbridge.

ALTERNATIVE ALIGNMENTS

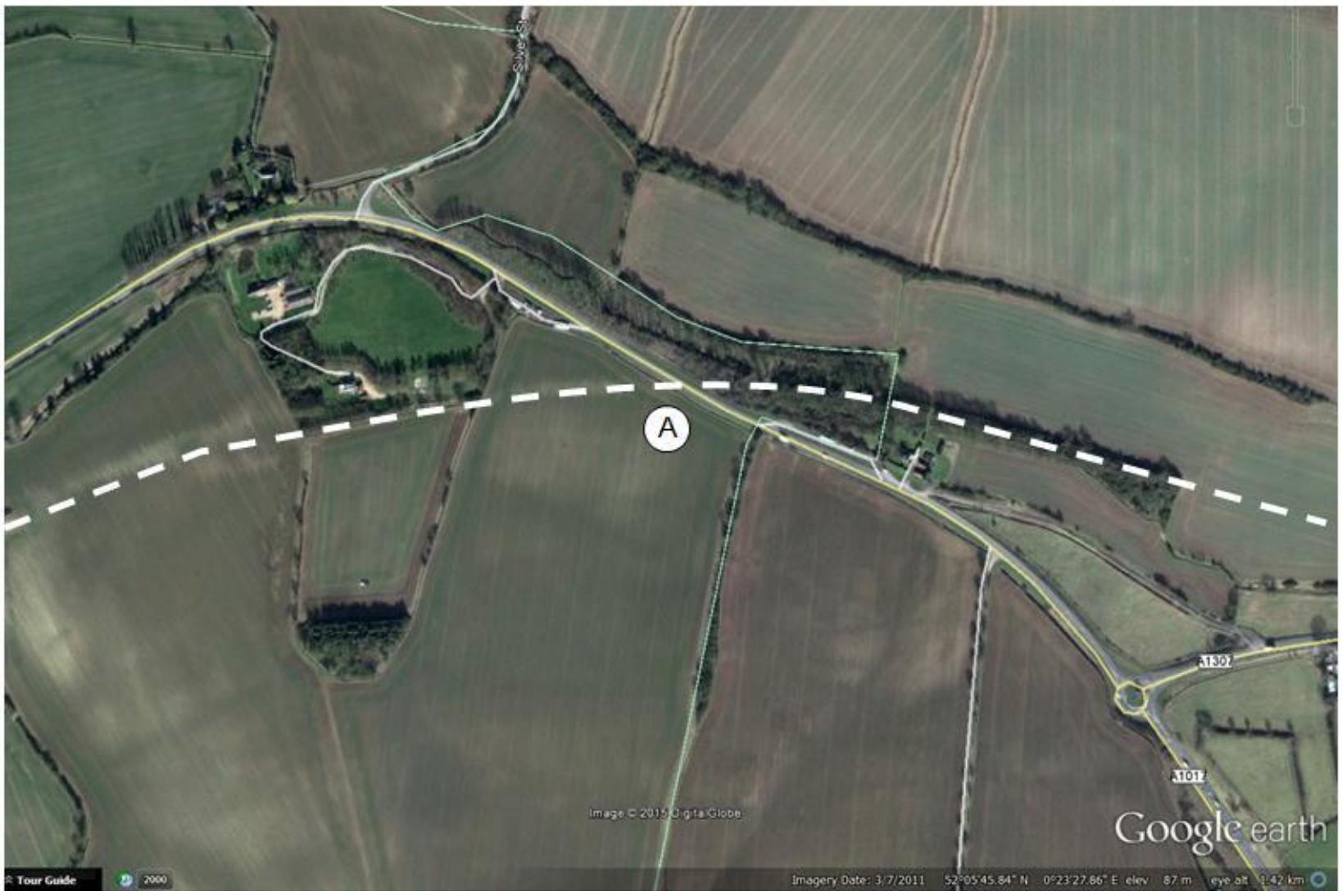
3.5.7 If the two constraints described above are unresolvable, a new alignment could be considered. This would probably be to the south of the village, leaving the former alignment west of the former station site, and passing between Bartlow Hills and Hills Farm. Options for re-joining the former alignment are:

- West of Westoe Farm. This would be a relatively short realignment, but (even if feasible) would create reverse curvature that might limit linespeeds (further design and performance simulation would be required to confirm whether this would be the case); and
- Between Westoe Farm and Shudy Camps, having passed to the north of Main Street. This would be a longer realignment and would probably require significant amounts of both cut and fill. However, if feasible, it might present opportunities for higher linespeeds.

3.6 A1307 WEST OF HAVERHILL

3.6.1 Figure 11 shows the former alignment where it crosses the A1307 west of Haverhill. A new bridge over the A1307 would be required (A), possibly with the A1307 realigned to minimise skew.

Figure 11: A1307 west of Haverhill



Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations.

3.7 HAVERHILL (HANCHET END TO WITHERSFIELD ROAD)

3.7.1 Figure 12 shows the former alignment from Hanchet End to Withersfield Road.

3.7.2 The former alignment has been breached by Meldham Washland (A) and by gardens of dwellings on Withersfield Road that are immediately alongside the old alignment (B). The main options for reinstating this part of the railway are:

- Replicate the former alignment, with significant residential property take and with new construction over Meldham Washland; and
- A new alignment, immediately north of the A1307 (perhaps forming a widened or additional southern embankment of Meldham Washland), continuing over Withersfield Road roundabout to re-join the former alignment near Alderton Close. There would be consequential commercial land take and business relocation required west of the roundabout. Residential and/or open space land take is likely to be required east of the roundabout, depending on the geometric requirements (which would need to be tested).

3.7.3 In addition to cost, both options could raise flood management, noise and/or visual intrusion issues. Given these and other constraints in Haverhill, Section 3.10 below reviews alternative options.

Figure 12: Haverhill (Hanchet End to Withersfield Road)

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations.

3.8 HAVERHILL (WITHERSFIELD ROAD TO WRATTING ROAD)

3.8.1 Figure 13 shows the former alignment from Withersfield Road to A143 Wratting Road.

3.8.2 Much of this section is now a Local Nature Reserve and a key off-road pedestrian route through the town. If this land-take were acceptable, exchange land would probably be required as compensation. A number of highways and footpaths cross or feed into the route. The vertical alignment would need to be reviewed in detail to identify a preferred approach. There would be noise and visual impacts on adjoining properties. It may be possible to retain a footpath alongside a reinstated single-track railway along all or part of the corridor, but this would need to be examined further and in any case the character of the route as a nature reserve would be highly compromised.

3.8.3 The impacts associated with a station on the former station site south of Wratting Road (see Section 3.9 below) could be avoided if the line terminated at a station north of Wratting Road. This would require a suitable site with vehicular access to be found. It would be less convenient for the town centre and bus station and would have closely adjacent residential properties.

Figure 13: Haverhill (Withersfield Road)

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations

3.9 HAVERHILL (TOWN CENTRE)

3.9.1 Figure 14 shows the former alignment south of A143 Wratting Road.

3.9.2 The former station site south of Wratting Road is now a superstore and car park. It may be possible to thread a single-track terminus into this area (and accommodate station parking and drop-off requirements) by using part of the car park. The site is adjacent to residential property, a school and a playground, with potential impacts accordingly. The pedestrian route on the former trackbed links in with several pedestrian connections to adjoining residential areas and the town centre, and these connections would need to be replicated (passing over, under or around the railway) to avoid or minimise severance. As with the section north of Wratting Road, the amenity value of what is effectively a 'greenway' route would also be compromised even if a parallel pedestrian route can be retained.

Figure 14: Haverhill (Town Centre)

Former alignment shown in white. This is for ease of reference and does not necessarily imply that a reopened railway would follow that alignment in all locations

Figure 15: Haverhill (near Tesco) photographs

(a) (Left) View north-west along footpath behind Tesco, looking towards Wratting Lane. Residential properties on right.

(b) (Right) Near photo 'a', showing residential properties adjoining.

(c) (Left) View north from footpath towards Jaywick Road. This is one of several pedestrian links that would need to be altered if the railway were reinstated here.

(d) (Right) Near photo 'c', looking west towards Tesco.

(e)View east from footpath towards playing field and Ingham Road. Tesco car park is out of view to right.

(f) View west from a similar location to 'e'. Tesco car park on left.

3.10 ALTERNATIVE HAVERHILL OPTIONS

3.10.1 As described previously, the route through Haverhill to the town centre presents multiple constraints. Two alternative options for serving Haverhill have therefore been identified. In addition to the engineering feasibility and impacts, the demand issues associated with these options would need to be considered further if they were taken forward.

NORTHERN GATEWAY

3.10.2 The route could terminate at a ‘gateway’ station on the north-west edge of the town, close to the Haverhill Science Park. This is likely to reduce construction costs, compared to continuing into the town centre. However, it would be less convenient for much of the residential area, the town centre and the bus station. This would act to reduce rail demand, although the opportunity to provide a station with convenient road access might recover some of this reduction. Potential variations on this option are described as part of Table 4 below.

WESTERN GATEWAY

3.10.3 A further option would be to create a new alignment to the west of the A1017 Haverhill by-pass, terminating at a station near Hazel Stub. As with the northern gateway option, it would act as a parkway station with convenient road access, rather than directly serving the town centre.

3.10.4 This option could allow passive provision for a later continuation south of Haverhill alongside the bypass, towards Sturmer, as part of a reopened through route to Sudbury and beyond. It might also allow opportunities for rail freight access to the industrial areas of southern Haverhill. Consideration of these further opportunities is beyond the scope of this study.

4 STATIONS

4.1.1 Table 4 summarises the potential options for station locations that have been identified during this assessment. These are based on an initial desktop study with limited confirmation on site, and there is no presumption that any of these options are desirable or deliverable. They should be seen as a long-list input to any further phase of study if appropriate.

Table 4: Station options

Note: The proposed Addenbrooke's Hospital station is a separate project, and is therefore not assessed as part of this study.

Station	Option	Comments	Scope for park and ride
Sawston & Babraham	East Way	Within or adjoining industrial estate	Some potential
	Sawston Rd	Greenfield site. Served by off-carriageway cycle route to Babraham.	Some potential
	High St	Greenfield site. Although relatively close to the A505, road access is less suitable here than at Sawston Rd for significant traffic volumes	Some potential
Granta Park	Pampisford Rd	Between the A11 and Cutting Road, with access from Pampisford Road and linking in to the pedestrian entrance to Granta Park. See comments in main text regarding the interaction with the A11/A505 bridges.	High potential, given the location close to main roads from several directions, if local highway access and impacts are acceptable.
Linton	Station Rd	At, or immediately to the south of, the former station site. See main text.	Some potential, but would need to avoid adding to existing congestion in this area
	The Grip / Hadstock Rd (B1052)	Taking account of the adjoining occupiers, a location east of The Grip would be preferable to a location west of The Grip	Some potential, but would need to avoid adding to existing congestion in this area
Haverhill	North Gateway	See main text. Could be an alternative to, or in addition to, a town centre station.	High potential
	North-West Roundabout	A similar concept to the North Gateway site, but using a new alignment west of the A1307 to a greenfield station site accessed from the roundabout. Not compatible with a town centre station.	High potential
	Sainsbury	Similar to the North Gateway site, but further east, close to the superstore. Would be closer to residential areas but would have impacts on the washes. Could be an alternative to, or in addition to, a town centre station. Site constraints may lead to parking and drop-off being less conveniently sited than for other options	Some potential but site constraints may limit this

Station	Option	Comments	Scope for park and ride
	Western Gateway	See main text. Not compatible with a town centre station.	High potential
	Withersfield Road	This option represents a search area for a site that would provide a terminus near the town centre while avoiding the impacts associated with continuing the line beyond Wratting Road.	Limited potential
	Town Centre – Tesco car park	See main text	Some potential, if traffic impact and parking management arrangements are satisfactory
	Town Centre – south of Tesco car park	This is a relatively open-ended option that would provide a station to the south of the Tesco car park, possibly associated with a wider reconfiguration of adjoining sites to the west if that were considered desirable.	Some potential, if traffic impact and parking management arrangements are satisfactory

5 DEMAND FORECAST AND ECONOMIC APPRAISAL

5.1 INTRODUCTION

5.1.1 This section summarises the economic appraisal assessment of the rail option, along with a similar appraisal of an alternative BRT option. This is an indicative assessment only based upon the information available.

5.1.2 The methodology, key assumptions, and appraisal results are all detailed as well as the risks and further data required to undertake a more detailed assessment.

5.1.3 The structure of this section is as follows:

- Methodology;
- Demand Forecast;
- Costs;
- Benefits;
- Appraisal results; and
- Risks

5.2 METHODOLOGY

5.2.1 The economic appraisal methodologies are compliant with DfT WebTAG, the appraisal guidance for transport related schemes, as well as the Green Book. The appraisal has assessed three Base Case vs Do Something options, with a Benefit Cost Ratio (BCR) determined for each.

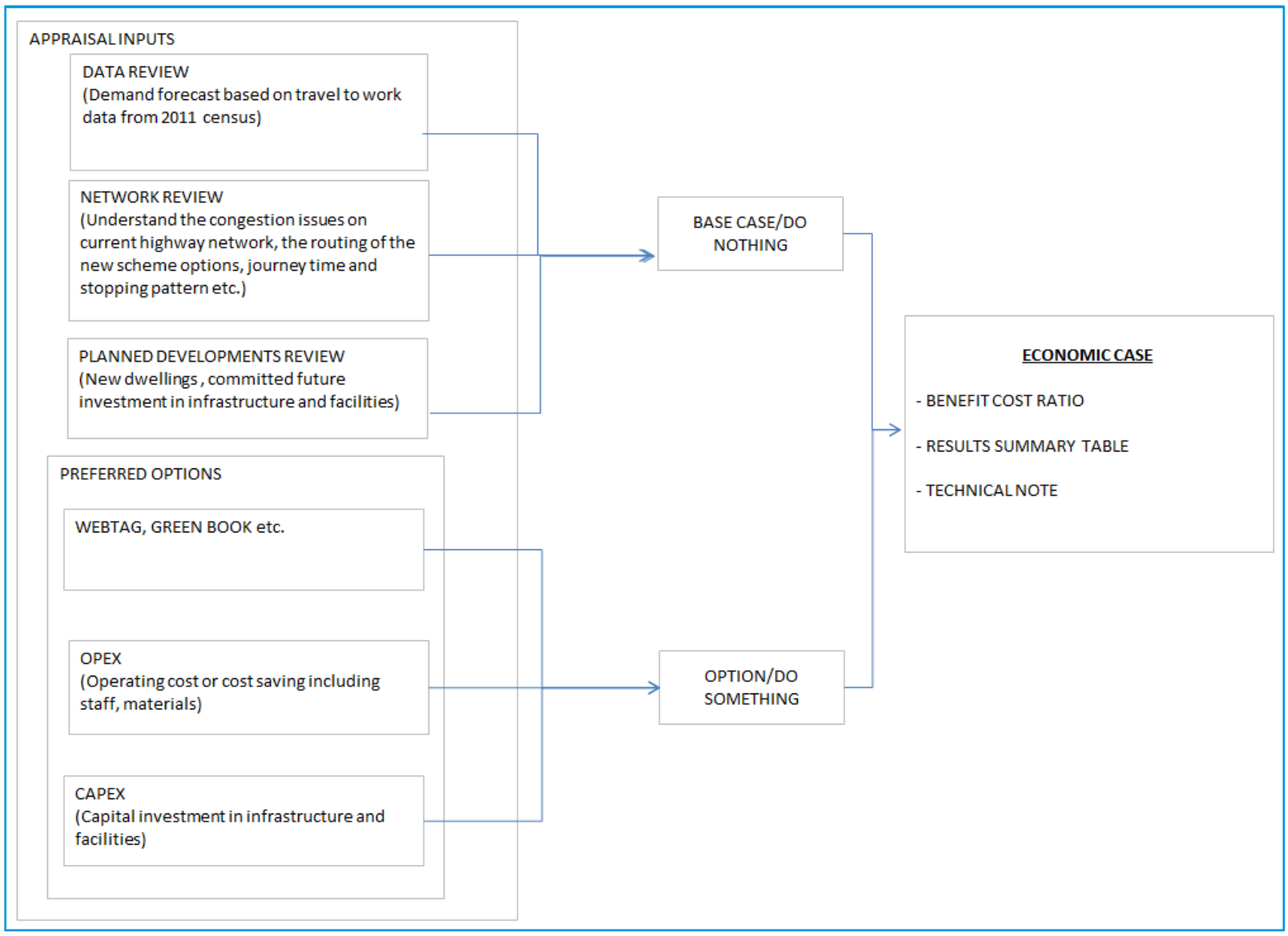
5.2.2 The Base Case is the do nothing case, which is the same as today's scenario, without any further transport intervention at the Haverhill to Cambridge corridor, but with planned development at Haverhill.

5.2.3 Three option scenarios have been assessed as follows:

- Option1: Reopen the rail line between Haverhill and Cambridge, double track option;
- Option2: Reopen the rail line between Haverhill and Cambridge, single tack option; and
- Option3: New BRT route

5.2.4 We have previously developed appraisal models in spreadsheet template consistent with DfT's WebTAG approach. The template has been adapted to assess the business case for this specific study. The process is shown in Figure 16.

Figure 16: Appraisal approach



5.2.5 The key parameters, assumptions such as the Value of Time (VoT), discounting rate, optimism bias etc. are in line with the most up to date WebTAG values from November 2014. The key modelling assumptions have been listed in Table 5 below.

Table 5: Key Appraisal Parameters

Criterion	Assumption	Source
Discount Rate	3.5%	WebTAG
Opening Year	2025	General assumption
Base Year	2010	DfT Base Year
Appraisal years	60 years	Based on asset life
Forecast Year	2084	60 years from the opening
Value of time	Commuting: £ 6.81 / hr	WebTAG Nov 2014 update
Capital cost	Option 1: £651m Option 2: £388m Option 3: £224m	Rail Schemes Project cost estimation; Includes 60% optimism bias and 60% risk contingency. BRT Project costs estimation based on assumed cost of £10m per km which includes risk and contingency.
Capital expenditure	100% in 2024	General assumption
Average fare	£5.00 per trip	General assumption with reference to similar studies

5.3 DEMAND FORECAST

RAIL

BASE DEMAND

5.3.1 2011 census travel to work data along the Haverhill to Cambridge corridor was used to identify how many people lived and worked within the corridor.

5.3.2 This was undertaken by selecting output area catchments at each potential station location identified and using that area as a place of residence, determining the number of people travelling to another catchment area around each other station location for work. This produced the following origin-destination (O-D) demand matrix for work trips (see Table 6).

Table 6: O-D Matrix for all commuters living and travelling within Corridor

	Cambridge	Sawston & Babraham	Granta Park	Linton	Haverhill	Total
Cambridge	-	985	411	132	109	1,637
Sawston & Babraham	1,256	-	95	30	23	1,404
Granta Park	166	41	-	12	10	229
Linton	641	91	67	-	73	872
Haverhill	1,708	276	148	311	-	2,443
Total	3,771	1,393	721	485	215	6,585

5.3.3 A rail mode share was also determined using 2011 census travel to work data for similar proxy routes as a useful comparator. Two routes were selected:

- Royston - Cambridge (2 trains/hr); and
- Baldock - Cambridge (2.2 trains/hr).

5.3.4 The mode share was derived in both directions, and the average used to determine a mode share for this analysis. This was determined as follows:

- Haverhill to Cambridge: 28% of total demand travel by rail; and
- Cambridge to Haverhill: 20% of total demand travel by rail.

5.3.5 It was considered unlikely that commuters travelling short distances between intermediate stops would use rail as a means of travel when it would be more efficient to travel by bicycle or car. The current congestion levels along the A1307 between Linton and Haverhill suggest that car travel may continue to be the primary mode of choice between these stations.

5.3.6 Rail demand between the O-Ds identified, matching the criteria above, was assumed to be negligible.

5.3.7 Table 7 below shows the calculated daily demand, based on the stated assumptions and analysis.

Table 7: Base Demand O-D Matrix

O\D	Cambridge	Sawston & Babraham	Granta Park	Linton	Haverhill	Total
Cambridge	-	198	83	27	22	330
Sawston & Babraham	351	-	-	-	5	356
Granta Park	46	-	-	-	2	48
Linton	179	-	-	-	-	179
Haverhill	478	77	41	-	-	596
Total	1,054	276	124	27	29	1,509

5.3.8 This demand was annualised using an assumed factor of 255 work days per annum.

5.3.9 Analysis of the Office of Rail and Road Annual Station Count showed stations in the surrounding area of this corridor to have a similar split of Leisure trips and Season trips. Therefore, Leisure base demand was assumed to be the same as Season demand.

5.3.10 Assuming all people on the system would make return trips, the annual base demand has been estimated at 1,540,000 trips.

DEMAND ON OPENING OF SCHEME – 2025

SCHEMES

5.3.11 The proposed Haverhill Research Park, located just outside of Haverhill is to provide 47,613sqm of B1 development, 150 homes, a hotel and public houses/restaurants. Using the assumption of 2.5 persons per dwelling and 1 job per 210sqm, an estimate of 375 residents and 2,400 jobs has been assumed. This has been assumed to be delivered by 2025.

5.3.12 Consultation has taken place for 3,500 homes to the North West and North East of Haverhill. Using the same dwelling occupancy assumption, this would add 8,750 residents to Haverhill. This has also been assumed to be delivered by 2025.

DEMAND

5.3.13 Analysis of the census 2011 journey to work data shows that around 3% of commuters living in Cambridge, Sawston & Babraham, Linton or Granta Park work in Haverhill. Applying this percentage to the estimated future working population gives a future increase of 72 people who would use the rail link to commute to Haverhill.

5.3.14 Assuming 70% of this future population are of working age and 70% are employed, the proposed residential dwellings give a future working population of 4,471.

5.3.15 The census 2011 journey to work data shows that around 20% of the current Haverhill population work in Cambridge, Sawston & Babraham, Linton or Granta Park. Applying this percentage to the estimated future working population gives a future increase of 894 people who would use the rail link to commute to work from Haverhill.

5.3.16 Using the same mode split assumptions and split of demand between O-D pairs, Table 8 below shows the 2025 future rail demand along the Corridor.

Table 8: 2025 O-D Demand Matrix

O\D	Cambridge	Sawston & Babraham	Granta Park	Linton	Haverhill	Total
Cambridge		198	83	27	29	337
Sawston & Babraham	351				6	357
Granta Park	46				3	49
Linton	179					179
Haverhill	652	105	57			814
Total	1,229	304	139	27	38	1,737

5.3.17 Using the same work days, Leisure trips and return trips assumption, the 2025 scheme opening demand has been estimated at 1,770,000 trips per annum.

FUTURE DEMAND – 2031

5.3.18 The Haverhill Vision 2031 states a need for 4,260 open market and affordable homes. Taking into consideration the schemes listed above, this means a further 610 houses would be built within Haverhill, which under the same assumptions for occupancy, working age, employment and travel behaviour, gives a future increase of 149 people who would use the rail link to commute to work from Haverhill.

5.3.19 Using the same mode split assumptions and split of demand between O-D pairs, Table 9 below shows the 2031 future rail demand along the Corridor.

Table 9: 2031 O-D Demand Matrix

O\D	Cambridge	Sawston & Babraham	Granta Park	Linton	Haverhill	Total
Cambridge		198	83	27	29	337
Sawston & Babraham	351				6	357
Granta Park	46				3	49
Linton	179					179
Haverhill	682	110	59			851
Total	1,259	309	142	27	38	1,774

5.3.20 Using the same work days, Leisure trips and return trips assumption, a 2031 demand has been estimated at 1,810,000 trips per annum.

BUS RAPID TRANSIT

BASE DEMAND

5.3.21 The appraisal assumptions underpinning the BRT scheme are identical to the rail scheme. Therefore, its demand has been assessed assuming it would provide the same conditions as the rail scheme, albeit with a longer journey time.

5.3.22 A journey time of approximately 30 minutes between Haverhill – Cambridge centre has been identified for the rail schemes.

5.3.23 BRT demand has been estimated based on the impact of increased journey time on demand compared to the rail scheme. Two key factors have been taken into consideration for the BRT journey time:

- The assumed top speed of the BRT system would be lower than that of the rail scheme; and
- Buses would likely have to use the existing road infrastructure for stops/stations between Great Shelford and Cambridge.

5.3.24 A journey time of 40 minutes has therefore been assumed, and a factored annual base demand of 1,188,000 was calculated for the BRT system based on the journey time difference between rail and BRT.

DEMAND ON OPENING OF SCHEME – 2025

5.3.25 Under the same assumptions used to calculate annual base demand, a factored annual base demand of 1,1368,000 has been calculated for the BRT system.

FUTURE DEMAND – 2031

5.3.26 Under the same assumptions used to calculate annual base demand, a factored annual base demand of 1,1397,000 has been calculated for the BRT system.

5.4 COSTS

CAPITAL AND OPERATING COSTS

5.4.1 Rail capital costs have been estimated at high level via a bill of quantities on the basis of 21 route-km. Single-track and double-track options were estimated. The estimates are for construction costs only, with no allowances for ecological or land surveys, land purchase, design fees and consents. BRT capital costs were estimated at high level based on costs of existing BRT projects.

5.4.2 All three schemes have had a contingency of 60% of capital costs and an optimism bias of 60% of capital costs applied. Operating costs have been assumed annually as 1% of the full capital costs.

5.4.3 Table 10 below gives the estimated costs for each scheme. Appendix C contains

Table 10: Estimated Capital and Operating Costs by Scheme

Scheme	Capital Costs (£m)	Annual Operating Costs (£m)
Rail – Double Track	£652.6m	£6.5m
Rail – Single Track	£388.7m	£3.9m
Bus Rapid Transit	£224.0m	£2.2m

INDIRECT TAXATION

5.4.4 Indirect Taxation is calculated as the loss in revenue from fuel taxation as a result of removed car km through new users of the rail system.

5.5 BENEFITS

REVENUE

5.5.1 Direct Revenue Benefits were calculated using assuming an average fare of £5 per trip on each system based on similar studies.

IN VEHICLE JOURNEY TIME BENEFITS

5.5.2 In vehicle journey time benefits were assumed for Season/commuter trips only i.e. 50% of demand using the standard WebTAG commuting value of time of £6.81 per/hr. The analysis assumes that all users of the scheme would be new users, split by 50% cars and 50% bus users. Comparative journey times for existing bus and car journeys were estimated using live travel information.

NON USER BENEFITS

5.5.3 Non user benefits arise from the impact of car miles removed from the road network as a result of the proposed scheme. This assesses the reduction in congestion, accidents, noise and air pollution as well as climate change and increased life of infrastructure.

5.6 APPRAISAL RESULTS

5.6.1 Table 11 below provides the 60 year socio-economic Benefit Cost Ratio for each scheme based on all of the above.

Table 11: Estimated Capital and Operating Costs by Scheme (£m)

	Rail - Double	Rail - Single	Bus Rapid Transit
Benefits			
Revenue	268.8	268.8	207.5
Journey Time	31.2	31.2	16.1
Non User	32.3	32.3	24.9
Total Benefits (a)	**332.2**	**332.2**	**248.4**
Costs			
Capital	438.0	261.3	150.6
Operating	115.2	68.7	39.6
Indirect Taxation	6.34	6.34	4.89
Total Costs (b)	**559.6**	**336.3**	**195.1**
Net Present Value (a-b)			
Net Present Value	**-227.3**	**-4.1**	**53.4**
Benefit Cost Ratio (a/b)			
Benefit Cost Ratio	**0.59**	**0.99**	**1.27**

5.6.2 The table shows that both rail schemes achieve a BCR of less than 1.0, and are therefore considered to represent Poor Value for Money under DfT guidelines.

5.6.3 The BRT option achieves a BCR value of 1.27, which is considered to represent Low Value for Money.

5.6.4 A scheme is considered to be financially viable if it achieves a BCR of 2.0 and above. Based on this high level economic appraisal, no scheme assessed represents High Value for Money.

5.7 RISKS

This appraisal has been undertaken at a high level, and several refinements could be undertaken in the future to look at more detailed costs or benefits:

- More detailed capital cost (subject to production of a feasibility design) and operating cost estimation;
- Multi modal travel data for the study area may be incorporated to inform a more accurate demand forecast and modal split;
- A detailed assessment of future infrastructure renewal costs; and
- Detailed multi modal journey time, fare, station access as well as well as local origin and destination travel data by journey purpose to inform a more accurate generalised journey time (GJT) analysis.

6 CONCLUSIONS & NEXT STEPS

6.1 CONCLUSIONS

6.1.1 This high level technical note of the rail viability of the disused rail corridor between Haverhill and Cambridge has made the following key conclusions:

- The initial high level assessment shows that both rail schemes would achieve a BCR of less than 1.0. This represents Poor Value for Money under DfT guidelines. The BRT scheme would achieve a BCR of 1.27, representing Low Value for Money. Substantial further work would be required to refine the economic assessment in more detail;
- The indicative capital cost of the options presented for Rail (and alternative BRT option), based upon our assessment, are substantial and cannot be funded within the current City Deal allocation;
- In any case, the reopening of the disused railway corridor could not take place within the current timescale (through to 2020) allowed for tranche 1 of the City Deal funding; and
- Extensive land acquisition and one or more deviations from the historic alignment are likely to be required along with significant new structures and refurbishment of disused / existing structures.

6.2 NEXT STEPS

6.2.1 Although the reopening of the disused rail line is not judged to be viable as part of the current A1307 Haverhill to Cambridge corridor study, a Cambridge-Haverhill railway line could ultimately form part of a more strategic rail link from Cambridge to Colchester, via Haverhill and Sudbury, including the existing Sudbury to Marks Tey branch.

6.2.2 It may be appropriate for further work to be undertaken by the relevant local authorities and central government to determine the wider viability of the railway through other decision and funding mechanisms.

Appendix A

RAG ASSESSMENT

Sequence no.	Length (m)	Grid ref start	Grid ref end	Original formation	Original use (if not plain line)	Ownership (if known)	Existing use / buildings	Adjoining use / buildings to north	Adjoining use / buildings to south	Environmental and planning constraints	Earthworks and structures - original	Earthworks and structures - extant	Existing access across or along	Corridor width (if constrained)	Commentary	RAG status
001	140	TL 46561 51772	TL 46783 51472	Single track			Industrial	Industrial/warehousing	Cambridge mainline	Situated in a green belt	Small bridge over narrow River Granta	Runs close to industrial buildings; crossing over River Granta appears to have been removed			This section runs through the back of an industrial area (including a car park) and merges with the existing West Anglia main line	
002	248	TL 46783 51472	TL 46783 51472	Single track			Field	Appears to be farm storage buildings	Agriculture	Situated in a green belt		There is a ditch on the southern edge of the alignment	Access to farm buildings near old track path	Roughly 20m between ditch/trench and stream	The section appears to have previously crossed at narrow section of the River Granta; this part of the river appears to have been diverted.	
003	370	TL 46783 51472	TL 47138 51363	Single track			Field - trees	Agriculture with nearby stream	Agriculture	Trees/shrubs along old track path; Situated in a green belt	Embankment	There is a ditch on the southern edge of the alignment		Roughly 15m between ditch/trench and stream		
004	91	TL 47138 51363	TL 47225 51339	Single track			Road - A1301	Crosses A1301	Crosses A1301	Situated in a green belt	Embankment; Passed beneath bridge on A1301	Crosses beneath bridge on A1301	Footway/cycleway adjacent to A1301	This is likely to be constrained by the narrow width of the existing bridge, although it is not possible to measure exact width from aerial mapping	Crosses A1301 Cambridge Road and foot/cycleway	
005	450	TL 47225 51339	TL 47657 51211	Single track			Field	Agriculture	Agriculture	Situated in a green belt	Embankment, with small section of cutting	None			Original embankment appears to have been filled in	
006	1534	TL 47657 51211	TL 49030 50557	Single track			Field boundary - trees	Agriculture	Agriculture	Trees/shrubs along old track path; Situated in a green belt	Embankment	Embankment likely still present, although this cannot be seen from the aerial imagery	Access from the A1301 Cambridge Road, via Sawston Waste Water Treatment Plant, towards fields			
007	577	TL 49030 50557	TL 49502 50225	Single track		Dales Manor Business Park	Industrial	Agriculture	Industrial	Situated in a green belt		Warehousing and storage for industries	Access throughout industrial site, including West Way and East Way		The industrial estate provides an option for a potential station site. The route could potentially be adjusted slightly away from the old alignment to use adjacent fields.	
008	264	TL 49502 50225	TL 49724 50084	Single track			Edge of field	Agriculture	Agriculture	Situated in a green belt						
009	48	TL 49724 50084	TL 49764 50061	Single track			Road - Babraham/Sawston Road	Crosses Babraham/Sawston Road	Crosses Babraham/Sawston Road	Situated in a green belt	Bridge over the rail line on the Babraham/Sawston Road	None - the bridge has been removed and the road straightened				
010	912	TL 49764 50061	TL 50510 49546	Single track			Edge of field	Agriculture	Agriculture	Situated in a green belt						
011	625	TL 50510 49546	TL 51003 49191	Single track			Field boundary - trees; High Street road	Agriculture	Agriculture	Trees/shrubs along old track path; Situated in a green belt	Embankment	Embankment likely still present, although this cannot be seen from the aerial imagery	High Street previously ran over the railway, and currently runs across the old lines path		A crossing at High Street would need to be provided	
012	505	TL 51003 49191	TL 51430 48921	Single track			Field boundary	Agriculture	Agriculture	Trees/shrubs along old track path; Situated in a green belt	Cutting	Cutting possibly still present, although this cannot be seen from the aerial imagery				
013	501	TL 51430 48921	TL 51858 48661	Single track; double track with sidings at Pampisford Station	Pampisford Station	Industrial park includes Solopark plc and Ridgeons	Major junction between the A505 and A11, and an industrial site	Major road and industrial site	Major road, industrial site and a private dwelling	Situated in a green belt	Pampisford Station; Embankments	Industrial site, major junction, private dwelling	Access into both the industrial site and private dwelling		Land-take and environmental factors would need to be overcome, The viability and buildability of any option to cross the road junction would also need to be seriously considered.	
014	2056	TL 51858 48661	TL 53724 47859	Single track			Field boundary - trees	Agriculture; Granta Industrial Park about 80m north; Old path comes close to the Pampisford Road; A number of private dwellings	Agriculture; Some private dwellings / farm buildings	The cottage to the west of Newhouse farmhouse and the South Lodge are Grade 2 listed buildings	Embankment, with small section of cutting	Embankment likely still present, although this cannot be seen from the aerial imagery	Cutting Road and Chalky Road			
015	1546	TL 53724 47859	TL 55028 47033	Single track			Field boundary - trees	Agriculture; Private dwelling	Agriculture		Embankment, with small section of cutting	Embankment likely still present, although this cannot be seen from the aerial imagery	Access route off of Pampisford Road			
016	335	TL 55028 47033	TL 55286 46821	Single track		Camgrain Stores	Boundary	Agriculture; Access route	Industrial - Camgrain Stores		Embankment	Embankment	Access to Camgrain Stores on Little Linton Road		Access would need to be provided into the Camgrain Stores	

Sequence no.	Length (m)	Grid ref start	Grid ref end	Original formation	Original use (if not plain line)	Ownership (if known)	Existing use / buildings	Adjoining use / buildings to north	Adjoining use / buildings to south	Environmental and planning constraints	Earthworks and structures - original	Earthworks and structures - extant	Existing access across or along	Corridor width (if constrained)	Commentary	RAG status
017	250	TL 55286 46821	TL 55479 46666	Single track			Field boundary	Agriculture	Agriculture		Cutting; Goods sheds	Cutting likely still present, although this cannot be seen from the aerial imagery	Linton Zoo Path; access to what appears to be a scrap yard			
018	791	TL 55479 46666	TL 56135 46227	Single track; with railways sidings at Linton Station	Buildings, including Linton Station, goods sheds and a railway siding	Signage indicates that Station Road may be under Network Rail ownership	Gap between buildings, and crosses the Hadstock Road	Buildings making up the southern side of Linton, including residential and commercial	Buildings making up the southern side of Linton, including residential and an industrial park	There are a large number of listed buildings in close proximity in Linton - the nearest being Ditches Close (Grad 2) and the barn to the south south east of Grip Farmhouse (Grade 2). Visual and noise impacts on residences adjacent to the rail would need to be considered.	Embankment; Some buildings, including Linton Station and goods sheds	Multiple structures, including an industrial park and private dwellings	Crosses Hadstock Road	Width of roughly 30m between back of industrial park buildings and a private dwelling	The route could be slightly realigned onto fields to the south to avoid the need to purchase the former station site.	
019	2194	TL 56135 46227	TL 58008 45121	Single track			Through fields and along field boundaries	Agriculture	Agriculture	The Grade 2 listed Windmill is in close proximity	Cutting; There seems to have previously been a crossing beneath Chalky Road	Cutting likely still present in some areas, although this cannot be seen from the aerial imagery	The former Chalky Road appears to now form part of a trail			
020	527	TL 58008 45121	TL 58505 44962	Sidings at Bartlow Station; junction with the Saffron Walden branch, with double track at places	Bartlow Station and former Bartlow junction		Field boundary and private property to the side of a residential dwelling	Property of residents of Bartlow	Property of residences of Bartlow and fields	There are a large number of listed buildings in close proximity in Bartlow - the nearest being the Forge and the two adjoining cottages (Grade 2)	Bartlow station	Bartlow station (which is now a private dwelling)	Crosses the Bartlow Road at two locations			
021	1388	TL 58505 44962	TL 59884 44989	Single track			Field boundary	Agriculture	Agriculture	There are a large number of listed buildings in close proximity in Bartlow - the nearest being the the west walled garden bartlow park including teak glass house, potting shed, boiler room, tunnel and bunker (Grade 2); The old track runs through Bartlow Hills Roman barrow cemetery, which is a scheduled monument	Embankment; Original footbridge (which still exists) provides width for a single track.		Access to fields		A new alignment could be considered although these could involve long realignments or large curvatures, which could impact line speed, journey time and construction cost.	
022	465	TL 59884 44989	TL 60340 44899	Single track			Field boundary	Agriculture	Agriculture		Embankment; Bridge over River Granta and road	Embankment	Crosses Camps Road			
023	1491	TL 60340 44899	TL 61597 45581	Single track			Field boundary	Agriculture	Agriculture	Trees/shrubs along old track path	Embankment	Embankment likely still present in some areas, although this cannot be seen from the aerial imagery	Multiple access routes into fields, and some private dwellings			
024	452	TL 61597 45581	TL 62672 46384	Single track			Field boundary	Agriculture	Agriculture	Trees/shrubs along old track path	Cutting	Cutting possibly still present in some areas, although this cannot be seen from the aerial imagery				
025	130	TL 62672 46384	TL 60340 44899	Single track			Road - Mill Green Road	Crosses Mill Green Road	Private dwelling; Crosses Mill Green Road		Cutting; Farmyard	Alongside a private dwelling	Mill Green Road		Old mapping shows a moat roughly 100m north of the former rail path, although it is not clear whether this is still here	
026	762	TL 60340 44899	TL 62672 46384	Single track			Field boundary	Agriculture	Agriculture	Trees/shrubs along old track path	Cutting	Cutting possibly still present in some areas, although this cannot be seen from the aerial imagery				
027	1272	TL 62672 46384	TL 63846 46838	Single track and Withersfield siding	Withersfield Siding		Field boundary and through fields	Agriculture	Agriculture; Runs approx 30m from a private dwelling		Cutting with small section of embankment; Siding		Access paths between fields			
028	639	TL 63846 46838	TL 64472 46736	Single track			Road - A1307; Field boundary	Crosses A1307; Agriculture	Crosses A1307; Agriculture; Runs approx 20m from Spring Grove Farm	Trees/shrubs along old track path	Embankment	Embankment possibly still present in some areas, although this cannot be seen from the aerial imagery	A1307			

Sequence no.	Length (m)	Grid ref start	Grid ref end	Original formation	Original use (if not plain line)	Ownership (if known)	Existing use / buildings	Adjoining use / buildings to north	Adjoining use / buildings to south	Environmental and planning constraints	Earthworks and structures - original	Earthworks and structures - extant	Existing access across or along	Corridor width (if constrained)	Commentary	RAG status
029	1147	TL 64472 46736	TL 65612 46694	Single track			Through fields	Agriculure; Lake; Roman Road	Agriculture	Site where human remains, spear heads and urns found in A.D. 1757-58; Crosses the 'supposed site' of the old Roman Road; There is a floodplain with a small lake along this section of the old route	Small section of cutting		'Supposed site' of the old Roman Road			
030	150	TL 65612 46694	TL 65758 46724	Single track		Partially private	Road, Stour Brook (stream) and private dwellings	Private dwelling; Road	Private land	Trees/shrubs along old track path		Private dwelling	Existing road	Approx. 35m wall to wall (approx. 15m from fence to fence)	This would need to cross Stour Brook (stream) and Queen Street, as well as run through the back gardens of private dwellings	
031	190	TL 65758 46724	TL 65944 46688	Single track		Private	Back gardens of private dwellings	Agriculture	Private land	Trees/shrubs along old track path		Private dwelling				
032	200	TL 65944 46688	TL 66131 46614	Single track			Back of a private dwelling; Hales Barn Road and Stour Brook (stream)	Close proximity to a housing estate and playground	Stour Brook (stream) and back garden of a private dwelling	Trees/shrubs along old track path		Private dwellings	Hales Barn Road which provides access to the housing estate	Approx 35m between Stour Brook (stream) and houses in estate (approx. 25m from stream to fence)		
033	335	TL 66131 46614	TL 66437 46432	Single track			Haverhill railway walk	Fields near housing estates	Stour Brook (stream) and a private dwelling	The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve		Private dwelling				
034	485	TL 66437 46432	TL 66827 46144	Single track			Mixture; Mostly private,or backing onto private land	Private dwellings	Stour Brook (stream); Green space; Close to some dwellings	The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment		Access to residential dwellings via Howe Road and Waters Edge	Approx 30m between Stour Brook (stream) and houses in estate (approx. 25m from fence to fence)		
035	391	TL 66827 46144	TL 67128 45896	Double track with sidings at the station			Haverhill railway walk between private dwellings	Private dwellings	Private dwellings	The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment		Approx 25m wall to wall between private dwellings (approx. 20m from fence to fence)		
036	429	TL 67128 45896	TL 67455 45617	Double track		Possibly Tesco	Haverhill railway walk between private dwellings and Tesco; Pedestrian crossing over the A143	Private dwellings	Tesco superstore and car park	The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment; pedestrian bridge	A143 and a pedestrian bridge over the A143	Approx 20m wall to wall between private dwellings and Tesco (approx. 15m from fence to fence)		
037	593	TL 67455 45617	TL 67909 45235	Double track			Haverhill railway walk between private dwellings and leisure facilities	Private dwellings	Haverhill leisure centre, football pitch, tennis courts, car park, cricket pitch and garden plots	Trees/shrubs along old track path; The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment; pedestrian bridge	A143 and a pedestrian bridge over the A143	Approx 45m wall to wall between private dwellings and leisure centre (approx. 35m from fence to fence)		
038	463	TL 67909 45235	TL 67982 44792	Single track	Adjacent to sewage plant		Haverhill railway walk between industrial land and sewage plant	Sewage plant	Industrial	Trees/shrubs along old track path; The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment		Approx 40m wall to wall between industrial building and sewage plant (approx. 30m from fence to fence)		
039	716	TL 67982 44792	TL 68293 44185	Single track			Haverhill railway walk between industrial land, housing and fields	Industrial	Private dwellings and green fields	Trees/shrubs along old track path; The Sturmer Arches are a Grad 2 listed building; The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment; pedestrian bridge	A143 Sturmer Road and a pedestrian bridge over the A143	Approx 45m wall to wall betweeen private dwellings and industrial buildings (approx. 40m from fence to fence)		
040	587	TL 67909 45235	TL 68309 44808	Single track	Adjacent to sewage plant		Haverhill railway walk between sewage plant, housing and fields	Fields with some private dwellings	Sewage plant	The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Cutting; crossing at what is now Coupals Close; sewage plant	Sewage plant; some private dwellings	Old railway corridor runs across Chalkstone Way			
041	498	TL 68309 44808	TL 68733 44555	Single track			Haverhill railway walk between fields, a football pitch and some private dwellings	Fields	Football pitches and the backyard of some private dwellings	Trees/shrubs along old track path; The Haverhill Railway Walks along the disused railway line for part of a Local Nature Reserve	Embankment	Embankment				

Appendix B

OPTION AREAS AND POTENTIAL REALIGNMENTS

Cambridge North station (under construction)

Cambridge station (existing)

Addenbrooke's station (proposed – separate scheme)

Shelford station (existing)

Former alignment now part of industrial estate. Potential realignment shown indicatively.

Former alignment now interrupted by A505, A11 and development. Potential alternative new alignments shown indicatively.

Sawston & Babraham station (options)

Site of former Pampisford station (not proposed for re-opening)

Former alignment now interrupted by commercial building. Former station now in commercial use. Potential realignment to avoid these, shown indicatively.

Granta Park station

Linton station (options)

Site of former Barlow station (not proposed for re-opening)

Former Bartlow – Saffron Walden – Audley End route

Haverhill Gateway station (options) (station may be omitted if line reopens to town centre)

Former alignment bisects Bartlow Hills tumuli (ancient monument). Former station now a private residence. Potential alternative new alignments are shown indicatively.

Former alignment through Haverhill now a combination of washland, residential and Local Nature Reserve. Potential realignment to reduce impacts, and/or reach some options for a Haverhill Gateway terminus, is shown indicatively.

Haverhill Town Centre station (options)

Former routes, beyond the scope of this study

LEGEND

- Former railway – core section for potential re-opening under this study
- Former railway – option for potential re-opening
- Other former routes – outside scope of this study
- Potential realignment (shown indicatively only)
- Station options
- Former station, assumed not to reopen

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Appendix C

INDICATIVE CAPITAL COST SUMMARY

Cambridge County Council

Project Nr 70012014 : Cambridge-Haverhill Corridor Study

Shelford to Haverhill Gateway

Ref.Nr	Description	Quantity	Unit	Unit Rate	Total Amount
	FOR SINGLE (ONE-WAY) TRACK				
	Temporary Works				
	Temporary Access Roads				£3,569,613.60
	Permament Works				
1	**Class D : Demolition and Site Clearance**				
	General Clearance				£518,086.93
2	**Class E : Excavation**				
	General Excavation & Excavation Ancillaries.				£9,273,851.49
3	**Class S : Rail Track**				
	Track Foundations				£10,813,685.40
	Lifting, Packing and Slewing				£2,951,676.00
	Standard Guage Railtrack : Supply and Laying				£38,032,321.22
4	**Building Works In Connection with Rail Works**				
	Sub - Total : Stations (Platforms & Facilities, Car Parking).				£10,044,030.00
5	**Bridges, Viaducts, Underpasses, etc**				£52,590,800.00
6	**Overhead Power Lines**				
	All works In Connection with OHL Including : -				
	Twin Lines, Support Gantries, Etc				£6,644,600.88
7	**Underground Cabling**				
	All works In Connection with UG Cabling Including : -				
	High Power, Earthing, Etc.				£2,988,639.58
8	**Miscellaneous Electrical**				
	All Misc Works Including : -				
	Lighting, Earthing & small power to Car parks and Stations				£675,000.00
9	**Control and Instrumentation**				
	All works in connectioh with signalling, traffic control, road crossings, etc	Prov Sum			£10,000,000.00
	Sub - Total *1				**£148,102,305.09**
	Contractor's Preliminaries : 25.0 %				£37,025,576.27
	Fee : 7.5 %				£13,884,591.10
	Prep Costs: 20%				£29,620,461.02
	Contingency : 20% (of cost excluding risk)				£45,726,586.70
	Risk: 40% (of cost excluding contingency)				£114,316,466.74
					£388,675,986.92
			Per Km Track		£18,508,380.33

Assumptions And Caveats

1 The budget costs are for total costs, excluding VAT
2 The budget costs includes 2% tender price inflation to allow for works being carried out in 2016
3 An allowance has been made for Design Team or Engineer's Fees, GIS, Ecological or Land Surveys
4 No allowance has been made for any abnormals or the removal of ACMs
5 An allowance has been included for obtaining Planning Permission or Building Control Approval
6 No specific allowance has been included for land purchase costs although a contingency is available

Cambridge County Council				
Project Nr 70012014 : Cambridge-Haverhill Corridor Study				
Shelford to Haverhill Gateway				
Ref.Nr	**Description**	**Quantity**	**Unit**	**Unit Rate**	**Total Amount**
	FOR DOUBLE (TWO-WAY) TRACK				
	Temporary Works				
	Temporary Access Roads				£4,035,738.00
	Permament Works				
1	**Class D : Demolition and Site Clearance**				
	General Clearance				£556,261.71
2	**Class E : Excavation**				
	General Excavation & Excavation Ancillaries.				£13,094,952.74
3	**Class S : Rail Track**				
	Track Foundations				£19,044,543.00
	Lifting, Packing and Slewing				£5,903,352.00
	Standard Guage Railtrack : Supply and Laying				£76,064,642.44
4	**Building Works In Connection with Rail Works**				
	Sub - Total : Stations (Platforms & Facilities, Car Parking).				£13,716,930.00
5	**Bridges, Viaducts, Underpasses, etc**				£96,612,480.00
6	**Overhead Power Lines**				
	All works In Connection with OHL Including : -				
	Twin Lines, Support Gantries, Etc				£12,922,084.58
7	**Underground Cabling**				
	All works In Connection with UG Cabling Including : -				
	High Power, Earthing, Etc.				£2,988,639.58
8	**Miscellaneous Electrical**				
	All Misc Works Including : -				
	Lighting, Earthing & small power to Car parks and Stations				£675,000.00
9	**Control and Instrumentation**				
	All works in connectioh with signalling, traffic control, road crossings, etc	Prov Sum			£10,000,000.00
	Sub - Total *1				**£255,614,624.05**
	Contractors Preliminaries : 25.0 %				£63,903,656.01
	Fee : 7.5 %				£23,963,871.00
	Prep Costs : 20%				£51,122,924.81
	Contingency : 30% (of cost excluding risk)				£118,381,522.76
	Risk: 50% (of cost excluding contingency)				£128,685,987.29
					£651,672,585.93
			Per Km Track		£31,032,027.90

Assumptions And Caveats

1 The budget costs are for costs excluding VAT
2 The budget costs includes 2% tender price inflation to allow for works being carrid out in 2016
3 An allowance has been made for Design Team or Engineer's Fees, GIS, Ecological or Land Surveys
4 No allowance has been made for any abnormals or the removal of ACMs
5 An allowance has been included for obtaining Planning Permission or Building Control Approval
6 An allowance has been assumed for land purchase costs in contingency
7 Additional risk & contingency has been allowed for due to the requirement for double tracking on a previously single tracked line