CSET Phase 2
Shelford Railway Alignment

Design Development and Feasibility Assessment

May 2020

Mott MacDonald
22 Station Road
Cambridge CB1 2JD
United Kingdom

T +44 (0)1223 463500
mottmac.com

Greater Cambridge
Partnership
Shire Hall,
Cambridge
CB3 0AP

CSET Phase 2
Shelford Railway Alignment

Design Development and Feasibility Assessment

May 2020

Mott MacDonald Limited. Registered in
England and Wales no. 1243967.
Registered office: Mott MacDonald House,
8-10 Sydenham Road, Croydon CR0 2EE,
United Kingdom

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	30/03/20	C Harwood G Goble H Diggins	M Payne M Ring J Montgomery A Hewitt	J Saldanha	Draft for client review
B	18/05/20	C Harwood	M Ring	M Payne	Issued for approval

Document reference: 403394 | 403394-MMD-TRA-00-RP-TA-0279 | B

Information class: Standard

Contents

Executive Summary

CSET Phase 2 proposes a new public transport route between Cambridge Biomedical Campus and a new Travel Hub site near the A11. The shortlisted options all follow a consistent route to Sawston and run to the east of Great Shelford and Stapleford. They then diverge to serve one of three different Travel Hub sites. Consideration has previously been given to a route via the former Cambridge-Haverhill railway line at Great Shelford and Stapleford, although this was not progressed to the longlisting of options on the basis it was not deemed to be viable. This report provides details of further design development and assessment work that has been undertaken in response to public consultation feedback in autumn 2019.

Outline designs based on a similar cross section to the rest of the CSET route were produced and used for the basis of initial assessment by rail and environmental specialists. The feedback from this assessment was then reflected in the development of feasibility design drawings. This was in order to produce an alignment which followed the applicable standards as closely as possible but at the same time ensure that appropriate mitigation (for example amendments to the route alignment) is incorporated where feasible. This is intended to provide a fair basis for comparison with the shortlisted options and mean that the railway route alignment is not unfairly disadvantaged in the subsequent assessment.

A demand assessment has been undertaken to estimate what impact the alternative alignment could have on demand, both from within the villages and on demand originating from the Travel Hub. This exercise indicates that there would be expected to be some additional demand from Shelford; however, this would not be expected to be substantial. Indeed, this is forecast to be outweighed by reduced patronage overall as a result of increases in journey time and decreases in journey time reliability that the railway route would introduce.

The alternative alignment would be expected to cost an additional £29.1m compared to the preferred option.

An assessment exercise has been undertaken using the same criteria which were used to assess the shortlisted options. This is intended to provide an indication of how the shortlisted options would have performed were they to follow the former railway alignment. This shows that the amended alignments following the railway alignment score less well in the assessment than the equivalent shortlisted option. It should also be noted that based on gateway criteria applied at the longlisting stage, the alignments following the railway would have not made it to this stage of the assessment, primarily because of the impact on residential and commercial property.

Whilst the potential for the route to provide better accessibility for Shelford residents is acknowledged, it is concluded that an alternative railway alignment would not be expected to have the same benefits as the shortlisted route alignments. In addition, a number of significant barriers would need to be overcome to construct the route which question its viability as an alternative to the shortlisted routes as currently proposed.

1 Introduction

Mott MacDonald has been commissioned by Greater Cambridge Partnership (GCP) to provide consultancy support for the Cambridge South East Transport (CSET) Phase 2 project. This note documents further design development and feasibility assessment for an alternative alignment via the former Haverhill-Cambridge railway at Great Shelford and Stapleford.

1.1 Introduction to Proposal and Shortlisted Alignments

CSET Phase 2 proposes a new public transport route between the Cambridge Biomedical Campus and a new Travel Hub near the A11. In the longer-term, it is intended that this will form part of the Cambridge Autonomous Metro (CAM) network and be used by rubber-tyred articulated vehicles. In the interim, it is planned that the route will be used by high-quality buses, with an aspiration for these to be electric. The proposal was subject to a public consultation in autumn 2019 where five options were presented. These were identified following longlisting and shortlisting exercises, which are documented within the Options Appraisal Report (reference 403394-MMD-BCA-00-RE-BC-0024).

1.2 Alternative Alignment

The shortlisted options all follow a consistent route to Sawston and run to the east of Great Shelford and Stapleford. They then diverge to serve one of three different Travel Hub sites.

The alternative route from the Travel Hub (shown in Figure 1.1 overleaf) would diverge from the alignment of the shortlisted route options to continue following the old railway line, crossing under the A1301 south of Stapleford, reaching the former junction of the Haverhill branch line with the existing main line railway between Cambridge and London Liverpool Street. It would follow the existing railway corridor through Great Shelford, passing to the east of Shelford Station and crossing Granham's Road to the east of the existing level crossing. It would then follow the route of the shortlisted options into the Cambridge Biomedical Campus.

1.3 Previous Work

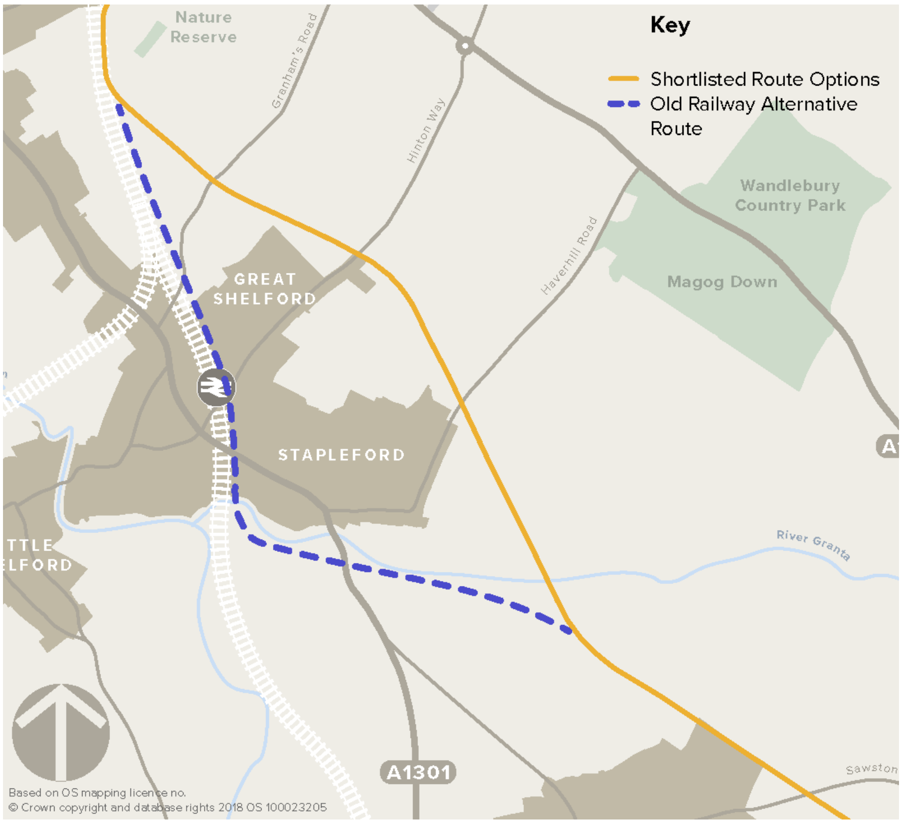
It is recognised that a route through the centre of the villages has the potential to improve accessibility to the proposed public transport service. The alternative alignment was first considered as part of WSP's work on the Strategic Outline Business Case[1]; however, it was concluded that "this is not viable for a road based public transport system given the lack of available space alongside the existing Cambridge-Liverpool St main line railway, particularly at Shelford Station that is located centrally within the village and surrounded by residential and commercial development that precludes taking a new route that by-passes the station and platforms that abut the railway".

Consequently, the alignment was not considered further at the longlisting stage completed for the Outline Business Case. Mott MacDonald did however undertake a further review of the feasibility of the route which is documented in report reference 403394-MMD-TRA-00-TN-TA-0142. This included:

- A walk-through of alternative alignment corridor;
- High-level assessment of technical constraints;
- Identification of environmental constraints; and
- High-level estimate of additional costs.

[1] WSP (2018) REF: 70012014-TN-010 Strategy 1 Route Assessment Technical Note

Figure 1.1: Location of Shortlisted Options and Alternative Railway Route



1.4 Purpose of Further Work

A number of respondents to the public consultation stated that the proposed public transport service should be routed via the centre of the villages with the most common reasons being cited that this would provide better accessibility for residents to the new service and avoid the need for development in the green belt to the east of the villages.

The responses to the public consultation favouring the alternative railway alignment are acknowledged by GCP who have therefore commissioned further feasibility work. It should be noted that, as outlined above, appropriate consideration has already been given to the alternative alignment option and this additional work is beyond what would typically be expected for an option discarded prior to or during the longlisting process. However, it is intended to provide reassurance that the alternative alignment has been properly considered and provide a level of assessment comparable to that for the shortlisted options. As such, the remainder of this report covers the following:

- Details of initial alignment design;
- Further review of constraints;
- Summary of design development and response to constraints;
- Forecast of potential change in user demand;
- Scheme costings;
- Assessment of the refined design; and
- Conclusions and recommendations.

This work is not intended to repeat the previous work undertaken and the latter should be referred to for a high-level description of the alternative routing, including site walk-through.

2 Assessment of Constraints

This chapter provides an overview of the constraints posed by the existing railway, together with a consideration of Network Rail standards to be applied in further design development. The chapter also considers structural requirements and provides an initial assessment of environmental constraints.

2.1 Initial Alignment Design

In order to inform the initial assessment of options and consultation with rail and environmental specialists, plans showing the route of the proposed alignment were produced. These have been issued separately as drawing references 403394-MMD-HWA-00-DR-HW-0237, 403394-MMD-HWA-00-DR-HW-0242, 403394-MMD-HWA-00-DR-HW-0243, 403394-MMD-HWA-00-DR-HW-0244 and 403394-MMD-HWA-00-DR-HW-0245 are provided at Appendix A.

These show a footprint consistent with designs for the shortlisted alignment with the same cross-section, including a 7.3m public transport route, 1.5m verge and 3.5m Non-Motorised User (NMU) route.

2.2 Rail Interface

Network Rail were consulted on the proposed alternative alignment in 2019; however, at the time of writing no response had been received. The advice of Mott MacDonald's rail specialists has therefore been sought and is summarised below for each aspect of rail infrastructure. This is intended to provide high-level guidance to inform the development and assessment of this alternative alignment and it is recommended that further specialist guidance be sought were this alternative alignment to be progressed further.

2.2.1 Track

- Network Rail Standard NR/L3/TRK/2049/MOD07 (Gauging) indicates that a minimum of 1625mm should be allowed from the running edge (edge of the rail) to the nearest face of any structure or mast.
- The above dimension should be further increased by a minimum of 300mm to provide a cess (the area at a lower level alongside the railway tracks) walkway for railway staff, although a walkway width of at least 700mm would be recommended in accordance with Network Rail Standard NR/SP/OHS/069 (Lineside Facilities for Personal Safety).
- The above values would be applicable to straight and level track only. Additional horizontal distances are required as a result of the effects of track curvature and cant (the crossfall or difference in elevation between each railway track). In this instance, an allowance of 32mm is estimated to be required for overthrow of rolling stock and allowance of 260mm is required for the effects of cant.
- Therefore, the final dimension is 2620mm (rounded up). It should be noted that other railway infrastructure could be potentially located in the cess (e.g. masts, signal posts, cabinets etc.). The location of this equipment could increase the dimension from the running edge to the Network Rail boundary fence. This value does not include any electrical clearances/touch potential requirements between live overhead contact equipment and the boundary fence line which is considered further below.
- Track drainage along the corridor would need to be assessed as the alternative route alignment interfaces with multiple under track culverts.

2.2.2 Vehicle Containment

- Network Rail Standard NR/L3/CIV/00012 (Road Vehicle Incursions: Risk assessment of public and non-public bridge and adjacent sites) contains a Vehicle Incursion Risk Assessment (VIRA), which is a tool to identify appropriate containment for highways adjacent to railways.

2.2.3 Overhead Lines

- The public transport route should be a sufficient distance away from Overhead Line Equipment (OLE) so that a person standing on a bus emergency exit footplate is further than 3.5m away from the live components to comply with NR/L2/ELP/27715/MOD04 (Overhead Contact System Design Specification: Module 4 Electrical and Mechanical Clearances and Separation).
- Proximity to multiple OLE structures along the route will require a generalised exclusion zone for excavation away from foundations unless each instant is reviewed.
- Fencing will need to be installed where the railway becomes accessible to the public and is currently separated by private gardens.

2.2.4 Signals and Telecoms

- According to Network Rail standard NR/GN/TEL/30139 (Survey & Design of Telecoms Cable & Route), the minimum required distance of new telecoms route to the tracks is 4.5m or 1m away from the access road or path. There is no standard covering the distance needed between the telecoms route and Network Rail boundaries or external public roads.
- Signals are commonly installed at 2.5m away from the running rail and may be installed further if required. Indeed, the boundary with Network Rail infrastructure should be at least 3m from the nearest running rail where possible.
- There is the potential that signalling assets are not placed in close proximity to the running rails and may be present in land beside the tracks which is within the railway boundary. This would require further investigation as it would be an essential requirement that no signalling assets are physically affected by any CSET works.
- Train drivers rely on good sighting of signal aspects and signage and the proximity of road traffic could affect a train driver's ability to correctly identify and act upon these. A Sighting Assessment (In accordance with NR/L2/SIG/10157, NR/L2/SIG/10158 and RIS-0737-CCS) would be required to ensure that the alternative alignment and traffic will not lead to an unacceptable risk of drivers misreading signals.

2.2.5 Level Crossing

- There may be a risk that traffic stopping at the junction with the public transport route could block back onto the level crossings, at Hinton Way (Figure 2.1) and Granham's Road. This is particularly so with the latter where the alignment shows greater separation.
- Similarly, confusion may be caused by having two sets of lights in close proximity meaning drivers ignore or miss the first set, which, depending on the direction of travel, may be either the railway crossing or the signalised junction with the public transport route.
- An alternative layout could be to run the public transport route directly adjacent to the rail corridor and incorporate the level crossing into a signal-controlled junction with the transport corridor. An example is David Lane level crossing in Nottingham (Figure 2.2) where the level crossing barriers and traffic signals associated with a dedicated tram crossing are integrated. When a train needs to traverse the crossing, the railway crossing barriers descend and the traffic lights turn red. When a tram needs to traverse the crossing, the barriers do not descend, but the traffic lights show a red aspect. It also incorporates a parallel road on the opposite side to the tramway.

- The proximity of several crossings and running lanes in close proximity is also likely to adversely affect routes for pedestrians or may lead to more risky behaviour at the level crossing.
- In addition, to the above operational considerations, construction of the public transport route parallel to the level crossings would impact opportunities for future grade separation, were the risk level of the level crossing to change.

Figure 2.1: Hinton Way Level Crossing

Source: Rail-View

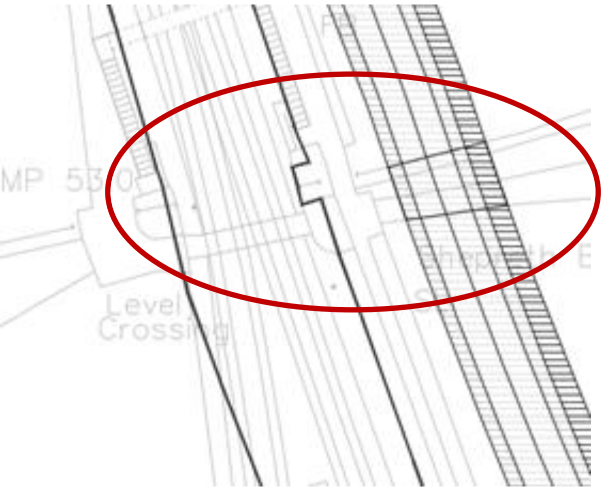
Figure 2.2: David Lane Nottingham

The rail level crossing is shown in the centre with a signalised tram crossing to the left and a parallel road to the right, the junction of which is also incorporated into the signals.
Source: Mott MacDonald

2.2.6 Network Rail Access

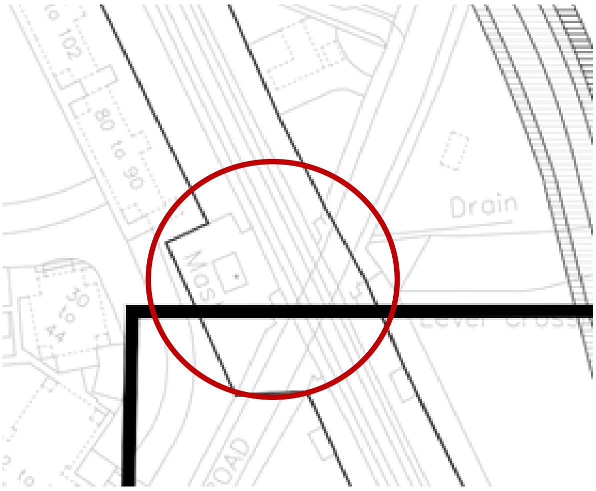
- The alternative alignment is adjacent to three Network Rail access points. Consultation and agreement with Network Rail would be required to determine whether to divert or maintain pedestrian access points as shown in Figures 2.3, 2.4 and 2.5.
- Figure 2.3 shows the access road required by Network Rail to service the junction would be crossed by the CSET route and provision for continued access would need to be incorporated.
- The other locations are unlikely to be affected or could be accommodated within the CSET design.

Figure 2.3: Websters User UWCT (User Worked Crossing with Telephone) pedestrian access



Extract from 403394-MMD-HWA-00-DR-HW-0243-P1

Figure 2.4: Granham's Road Level Crossing CCTV authorised access point



Extract from 403394-MMD-HWA-00-DR-HW-0243-P1

Figure 2.5: Hinton Way, Track and Equipment Access Point

Extract from 403394-MMD-HWA-00-DR-HW-0244-P1

2.2.7 Future Rail Infrastructure

- The route reduces the existing railway corridor width for approximately 430m from Wedd Joinery building to Shelford Station. This therefore impacts on future proofing and reduces opportunities for potentially upgrading rail infrastructure in future.

2.2.8 Approvals and Construction Requirements

- Although possible, it is not certain that signalling equipment could be moved to cater for the alternative route. It would require the approval of Network Rail and the Office of Rail and Road.
- The lengthy development process would require a significant level of scheme design and detailed design as per the Governance for Railway Investment Projects (GRIP) process outlined in NR/L2/INI/P3M/101.

- Construction of a public transport route in close proximity to the rail line would be expected to result in significant disruption to rail infrastructure. In addition, potentially restricting CSET works to weekends or overnight alongside track closures would be expected to have significant implications for the duration and cost of works.

2.2.9 Cambridgeshire Guided Busway Departure from Standard

It is noted that the existing guided busway runs in close proximity to the railway (Figures 2.6 and 2.7) south of Cambridge Station and that the standards referred to above appear to have been relaxed. It is understood that this is owing to a number of constraints in this particular location and this was considered to be the most suitable design solution mutually agreed between Network Rail and the Guided Busway promoters. It is noted that the alternative alignment through Great Shelford would require a departure from standard over a much greater length if reduced clearances as applied alongside the Guided Busway could be replicated.

Figure 2.6: Busway, South of Cambridge Station

Figure 2.7: Busway, South of Cambridge Station

Source: Mott MacDonald

2.3 Structures

The following structures would be affected along the alternative route:

- London Road (A1301) overbridge shown in Figure 2.8 (Network Rail Structure Number 543); and
- The former rail bridge further south on Cambridge Road shown in Figure 2.9.

In addition, a structure would be required across the River Granta; however, the same would be the case for the alignment of the shortlisted route options.

Figure 2.8: London Road (A1301) Rail Bridge

Source: Rail-View

Figure 2.9: Cambridge Road (A1301) Former Rail Bridge

Source: Mott MacDonald

In order to develop any designs, both the London Road and Cambridge Road bridges would require detailed topographical surveys in order to establish and confirm the site topography and levels as well as the gauges of the structures, as well as identifying any adjacent plant and equipment. In particular this would need to include the railway tracks, Overhead Line Equipment (OLE) and any signalling and telecoms equipment adjacent to the London Road Bridge. Condition surveys would also be required for both structures.

Depending on the height of the vehicles using the public transport route and the distance from ground to soffit level of the structures, it may be necessary to increase the effective headroom.

For the Cambridge Road bridge, it is impractical to raise the level of the masonry arch, instead it would be possible to lower the level for the carriageway so that it can run through the centre of the span. Masonry bridges of this type were typically constructed with relatively shallow foundations using mass brickwork; therefore, any excavation would carry a risk of undermining the foundations so the bridge abutments would likely require underpinning in order to strengthen them. The exact requirements would require Ground Investigation and a Structural Assessment of the arch to be undertaken in order to inform the design. Consideration would also need to be given to the drainage of the carriageway as lowering it would potentially give rise to flooding beneath the arch.

The London Road bridge spans the Cambridge to London railway line. The bridge appears to have been a replacement structure, most likely being constructed when the line was electrified in order to give the required clearance to the OLE. The bridge comprises of two spans, the west side spanning the up and down tracks, while the east side is currently unused, though it is possible that this previously carried another track or tracks. It is through the east span that it would be intended to bring the CSET public transport facility if routing via this alternative alignment. On the north side of the bridge, there is a separate foot / cycle bridge also crossing the railway line. At this stage, the actual length and span of the bridge is not known, nor the form of construction for the abutments and pier.

As noted in Section 2.2, the clearance required to live components of the OLE is typically 3.5m; however, it may be possible to reduce this to 3m on agreement and by a process of risk assessment. The normal height of a railway bridge with OLE is 4.78m; however, for “free running” OLE and the construction of new bridges, the clearance is 5.1m. For new highway bridges, the required clearance is 5.3m.

Should the existing clearance be insufficient, then the options for consideration would be:

- Replace the existing bridge; or
- Lower the level of the public transport route.

Replacement of the A1301 London Road bridge would have a significant impact on the adjacent properties, as well as require the closure of the A1301. Re-use and modification of the existing pier and abutments would be recommended in order to minimise the construction programme for any structure, with consideration being given to the use of modular bridges rather than in-situ construction of concrete or steel and concrete composite structures. This will be subject to the agreement of the local Highway Authority, as these solutions are in some cases seen as temporary rather than preferred solutions when compared to traditional in-situ construction.

Demolition of the existing railway bridge and re-construction will have a significant negative impact on both the operation of the railway, and the A1301 and surrounding properties. Any re-construction will also have to consider the presence of existing utilities which may need to be diverted or have separate temporary supports.

In principle, lowering the proposed public transport route is an easier option to consider, compared to raising or re-constructing the existing bridge. The key considerations will be the depth of excavation required as this will need to allow for the required carriageway to structure clearance, but also the additional excavation required for the road construction. Retaining walls will be needed alongside the existing railway line, in order to ensure that the track bed does not move, and similarly the supports for the OLE. It may also be necessary to construct retaining walls along the east side of the route, in order to both support the embankment once the existing vegetation is removed and to enable the corridor to be widened.

Further key considerations will be:

- Drainage – Because of the reduced levels, it is possible that a gravity drainage system will not be possible, and therefore a pumped system with sumps may need to be considered. Any design will need to ensure that the drainage of the tracks is not affected as this will affect the stability of the track bed.
- Existing Network Rail Infrastructure – Any proposals will need to ensure that the existing OLE and any signalling and telecoms equipment is not affected.
- Safety Barriers and Fencing – Any designs for the public transport route will need to include for containment barriers and fencing to ensure that the route and the railway are securely segregated.
- Traffic Signals and Vehicles – When designing the public transport route, specific care would be needed when considering the location of any traffic signals and also the lighting on the vehicles, as the presence of red, amber and green lights could potentially cause confusion with the railway signalling.

2.4 Environmental Considerations

A high-level environmental assessment has been undertaken for the alternative railway alignment using a desk-based approach and supported by an environmental walkover of the route. The main findings of this assessment under each environmental aspect are detailed below.

2.4.1 Air Quality

Defra background concentrations and local authority monitoring data available from Cambridge City Council and South Cambridgeshire District Council indicate that there are no air quality objectives being exceeded along or close to the alternative alignment. The highest concentration predicted by the Defra background maps for NO_2 in 2019 is 10.4 µg/m^3; for PM_{10} the concentration is 16.6 µg/m^3 and $PM_{2.5}$ is 9.9 µg/m^3.

It is not expected that the use of the railway corridor would lead to a significant air quality change within Great Shelford. This is because the number of public transport vehicle movements on the route would be low (approximately 16 services an hour) and the aspiration is for public transport vehicles to be electric, or at least Euro VI if diesel.

The use of the railway corridor may lead to the scheme being more accessible than the proposed alignment for the residents of Great Shelford. If this were to promote greater modal shift, this could have air quality benefits; however, as outlined in Chapter 4, demand is overall forecast to decrease for the rail alignment.

Considering the concentrations reported within Defra's Pollution Climate Mapping (PCM) model it is considered unlikely that the alternative alignment would result in exceedances of air quality objectives or limit values. This is the same conclusion as for the shortlisted options.

2.4.2 Biodiversity

The proposed route crosses the River Granta County Wildlife Site (CWS) and runs adjacent to it in places.

The proposed route partially runs along the old railway which is located adjacent to the existing railway route from Cambridge to London Liverpool Street. Along the Genome cycle path, there is species poor semi-improved grassland either side of the cycle path and immature trees have been planted on the opposite side from the railway line. Figure 2.10 shows the existing cycle path alongside the railway line, close to where the alternative railway alignment would join the route of the shortlisted options. During the environmental walkover, it was noted that the grassland on the railway side could have the potential to support reptiles, with one unidentified mammal hole also identified (Figure 2.11). If this alignment was to be progressed further, a preliminary ecological appraisal would be required in order to ascertain species.

Figure 2.10: Existing Cycle path from Addenbrookes to Great Shelford

Figure 2.11: Hole found along existing cycle route

Source: Mott MacDonald

The cycle path and alternative public transport alignment crosses over a small stream (Figure 2.12) which is culverted under the existing railway. The stream is considered to have good water quality with a moderate flow.

The alternative route then passes through the village of Great Shelford, adjacent to the existing railway. In Great Shelford, the existing railway is mostly screened with hedgerows and scattered mature trees. In some locations, there are large conifer trees. Figure 2.13 shows where the alternative alignment would run alongside the existing railway at Chaston Road. Were the public transport route to be fully segregated, as it is elsewhere in accordance with CAM requirements, the hedges that run alongside the existing railway route at this location would be lost.

Figure 2.12: Stream under cycle way and railway

Source: Mott MacDonald

Figure 2.13: Hedgerow at Chaston Road

The alternative CSET route then deviates from the existing railway line south of Great Shelford where it crosses the River Granta and continues east through the countryside following the old railway alignment. This area could not be accessed; however, from aerial photos this section of the route looks to sever hedgerows and directly impact mature trees. The crossing point of the River Granta could also not be accessed but a photo from River View to this area can be seen in Figure 2.14. This habitat may be suitable for otters, water voles and white clawed crayfish and further surveys, indeed, otter surveys of the River Granta, nearer the A11, have found evidence of their presence. The habitats along the alternative alignment are likely to support badgers, bats, reptiles, great crested newts (if there are ponds within 500m) and nesting birds.

Figure 2.14: River Granta from River View

Source: Mott MacDonald

A preliminary ecological appraisal (PEA) to determine the value of the habitats and assess the potential for protected species present along the alternative route, has not been undertaken at this stage but would be required if this was taken further in development.

Overall, there is the potential for this route to have a moderate adverse impact on biodiversity, due to the expected habitat loss along the proposed route and the fragmentation of habitats used by badgers, bats, great crested newts and reptiles. The main habitats expected to be lost are trees, hedgerows and grassland. There is potential for habitat loss to be mitigated through the planting of new vegetation elsewhere.

2.4.3 Historic Environment

Historic environment assets within the vicinity of the alternative alignment include:

- Site revealed by aerial photography west of White Hill Farm - Scheduled Monument (List Entry 1006891)

  This designated asset marks the northern portion of a cropmark site that comprises archaeological remains of Iron Age and Roman settlement. The wider site, southeast of the designated boundary continues south into the footprint of the proposed option. Whilst the footprint of the proposed option does not infringe into the boundary of the scheduled monument, there is potential for associated non-designated archaeological remains to hold moderate heritage value. However, the truncation at this location from the construction of both the railway and the cycle path is likely to have damaged any archaeological remains.
- Great Shelford Conservation Area – Conservation Area

  This conservation area is to the west of the main railway line which forms a hard boundary between the conservation area and the potential alignment through Stapleford and Great Shelford. The focus of the conservation area is the historic core of Great Shelford, which is to the west of the alternative alignment. There are no key views which are informed by the proposed option. As a result, there will be no impact on the Conservation Area due to the proposed option.
- Middlefield and Garden Wall – Listed Building, Grade II* (List Entry 1317370)

  The proposed option passes approximately 1.8km to the south east of this asset through an area which forms part of a key designed vista, across the rural landscape towards the River Cam/Granta. There is a potential impact on the key designed vista if the proposed route option requires trees along the former railway to be felled.
- Dovecote at Granham's Farm – Listed Building, Grade II (List Entry 1331068)

  This designated former dovecote, dated from the early 19th century, is set within the context of Granham's Farm, which is enclosed within grounds to the east of Granham's Road, east of the proposed option. The setting of this asset is largely informed by its proximity to and association with Granham's Farm. There will be no impact to this asset as a result of the proposed option.
- 32-38 Granham's Road – Listed Building, Grade II (List Entry 1317912)

  This designated row of five 19th century cottages is situated on the east side of Granham's Road. They are of simple local vernacular architectural style reflecting their likely use as farm workers' residences. The setting of this group includes the road and surrounding rural hinterland to nearby Great Shelford. The rural setting of this group will be reduced with the infringement of the proposed option at this location.
- Moated Site at Granham's Farm – Non designated heritage asset

  This site is the former moated manor house and associated large enclosure. This setting has been changed through the introduction of the railway to the west; however, the belt of agricultural land between the asset and railway remains. Further reduction of this setting will likely have a negative impact on the asset's heritage value.
- The Shephard's Cottage, 26 Granham's Road – Non designated heritage asset

  This is a residential property set within its own private grounds on the edge of Great Shelford, located along Granham's Road, which positively contributes to the asset's heritage value. The proposed option would have a high level of impact on this asset as a result of the route passing directly adjacent to it, changing the asset's setting. There would also be potential for damage through disturbance of the building's foundations during construction and operation.
- Former Cambridge to Haverhill & Melford Railway – Non designated heritage asset

  The proposed option will re-use the route of this former railway. The route was constructed in the mid-19th century and closed/dismantled in the mid- to late-20th century. The route is still evident through areas of linear tree lines, truncated fields/boundaries, and overbridge for the A1301 south of Stapleford.

Any residual archaeological material from the former railway line is likely to hold negligible to low heritage value.

Overall, there is potential for this route to have an adverse impact upon the historic environment as a result of the change of heritage setting to a number of assets. This impact is largely focused at the location of where the route crosses Granham's Road, where it diverts east from the current mainline and impacts on the setting of heritage assets along this road. The greatest impact would be to the Shephard's Cottage as the route skirts directly next to this asset, truncating its setting and potentially damaging the structural integrity of the historic building both through the route's construction and operation. There is also potential for additional impacts elsewhere along the route as a result of change to the setting and designed views to the south of the Grade II* listed Middlefield and Garden Wall towards the River Cam/Granta.

2.4.4 Landscape and Visual

A detailed baseline assessment of local landscape character was undertaken for the CSET Phase 2 scheme through a combination of desk study and field surveys. The former railway option runs through two landscape character areas (LCA), which are outlined below:

- River Granta Valley and Low-Lying Farmland LCA

  The Granta Valley and Low-Lying Farmland LCA, south and south-east of Cambridge, has the low-lying, gentle topography typical of river valleys. Key to its character are the tree-lined river, woodland belts and the arable fields, pastures and water meadows on the fertile soils of the valley. Road and rail infrastructure are already prominent in the LCA and noise and activity generated by traffic on the A1307, the A10, the A11, the railways and the villages in the Granta Valley detract from the otherwise rural character of the area and reduce tranquillity.

  Since transport infrastructure is already present in the LCA, the alternative railway alignment would not introduce uncharacteristic features into the landscape. The former railway line is treelined and adverse landscape effects would result from the loss of trees along the route. To minimise these effects, it would be better to run the former railway option alignment parallel to the former railway line rather than along on the line itself.

- River Granta Valley Nucleated Villages LCA

  This area includes the villages of Great Shelford, Stapleford and Sawston. They are all situated on low-lying land along branches of the River Granta. Each village has a historic core, designated as conservation areas. Great Shelford and Sawston have been developed substantially since the Second World War in a mixture of often contrasting architectural styles and building materials. Stapleford is less developed. Expansion has been gradual, with small estates or groups of houses arranged around narrow, residential roads and cul-de-sacs. The village streets and back gardens are tree-lined and the overall feeling of the residential areas away from main roads is verdant and secluded. Community resources in the villages include shops, schools, recreational green spaces and public houses. Tranquillity is reduced in Great Shelford by the noise and activity generated by traffic on the A1301 and the railway line and station. The wider landscape is largely screened from view by planting on the village edges, although there are more open views from the eastern edge of Stapleford and the northern edge of Great Shelford.

  Since transport infrastructure is already present in the LCA, the routing via the former railway would not introduce uncharacteristic features into the landscape, but adverse landscape effects would result from the loss of trees and garden vegetation along the route.

Overall, the impact upon the whole landscape character of the area would be limited, as the route runs along existing transport infrastructure. Albeit, adverse landscape effects would result from the loss of trees and garden vegetation along the route.

Views of the CSET route would be limited by the screening effects of topography, built form and woodland to a fairly narrow corridor of land within approximately 1000m of the scheme.

Views of the scheme between Cambridge Biomedical Campus and Granham's Road would be possible from the south eastern edge of Cambridge. However, the route would generally be at the same level as current ground levels and would be seen in the context of existing railway infrastructure. It would, therefore, be largely unobtrusive in all but close views and would not be an uncharacteristic addition to the view.

Where the scheme passes through Great Shelford, it largely continues alongside the route of the existing railway line and views are limited by existing built form and vegetation. However, the route is likely to result in the removal of residential buildings and the reduction in the size of rear gardens to a number of additional properties. Views from residential properties would be foreshortened and more open due to loss of vegetation but the scheme would be seen in the context of the existing railway line.

From Welchs Crescent, Great Shelford, to the northwest of Sawston, where the scheme meets the shortlisted routes, close filtered views to the south from Welchs Crescent would be possible. Where the route passes beneath the A1301 Cambridge Road, it would form a dominant part of the view. From footpath 196/2, to the south of the scheme, the majority of views would be screened by intervening vegetation and topography, though glimpsed views of the scheme are likely. These will not be notable as the route would generally be at current ground levels.

South of Great Shelford and Stapleford, vehicles moving across the rural landscape and through the River Granta valley would introduce uncharacteristic movements into views from residential properties, roads and PRoW that cross the landscape (particularly across the low-lying valley associated with the river) to the southeast of Stapleford. However, northwest of Great Shelford, these views would be seen in the context of the existing railway line.

2.4.5 Noise

There are approximately 150 noise sensitive receptors located within 50m of the proposed route. The nearest Noise Important Areas to the scheme route are located at distances greater than 600m in Abington (on the A1307) and in Trumpington (on Hauxton Road). Sections of the route alignment are located in the primarily rural setting south of Stapleford, although it bounds existing residential properties through Great Shelford.

Ambient noise levels from major road traffic and rail noise sources during daytime periods are typically less than 55 dB $L_{Aeq,16hr}$ for the majority of residential properties located within Great Shelford. Ambient noise levels at properties which immediately bound the railway line through Great Shelford are likely to be higher and typically between 55-60dB $L_{Aeq,16hr}$.

Traffic noise at source is a function of gradient, road surface, traffic volume, speed and percentage HGVs. Traffic noise is typically assessed over an 18-hour period (06:00 – 24:00) and the index conventionally used to calculate it is the $L_{A10,18hr}$. In order to achieve an increase of 1dB, in broad terms, a traffic increase of 25% would be necessary. Similarly, in order to achieve an increase of 3dB, existing traffic would have to be doubled. Alternatively, noise changes could also occur as a result of significant changes in flow parameters such as speed and percentage HGV.

This alternative alignment is unlikely to result in significant changes in traffic and associated noise using the existing road network. Noise effects are more likely to be apparent in the rural areas where existing ambient noise levels are low and in areas where the route runs in close proximity to existing residential properties. Existing noise sources such as the railway line through Great Shelford are likely to predominate for receptors in these locations and significant impacts are unlikely to result.

Where the alternative route passes noise sensitive receptors, such as those within Stapleford, Great Shelford and Sawston, noise from public transport is expected to be audible at the nearest properties. Noise from public transport vehicles using the route could be reduced through design and inclusion of mitigation where necessary. A preliminary review indicates that there is limited scope to provide mitigation in the form of acoustic barrier fences or earth bunds to reduce noise effects from new noise sources along the route.

Overall, there is the potential for this route to have an adverse noise impact, expected to be worse than the shortlisted options due to the number of receptors in close proximity. Adverse noise effects will likely occur at several isolated receptors in rural areas where existing ambient noise levels are typically low and at those bounding the route through Great Shelford.

2.5 Further Constraints

Further constraints identified are as follows:

- Significant loss of private gardens and up to four residential dwellings;
- The route would restrict access to a number of commercial premises and remove parking associated with them. Based on a footprint including a parallel Non-Motorised User (NMU) route, this would also require demolition of commercial premises at Mill Court;
- The provision of equivalent stop infrastructure as proposed for the shortlisted route alignment, including drop-off and disabled parking may not be possible owing to the accessibility of the alternative alignment from the existing highway network and available space;
- Potential conflict with residential traffic at Chaston Road; and
- Loss of car parking at Chaston Road.

2.6 Summary

This chapter has outlined key constraints associated with the railway, structures, environmental and other considerations. These have been considered within the design development of the railway alignment which is detailed within the following chapter.

3 Design Development

The route designs have been developed to feasibility design level (RIBA 1) in order to allow the alternative alignment to be more accurately costed. In developing the designs, the constraints identified and guidance provided as a result of the initial assessment in the previous chapter have been reflected and the ways in which the design has been developed in response to the main issues are outlined below. The intent has been to provide a workable design, which can also be assessed fairly against the shortlisted options by incorporating appropriate mitigation against the constraints.

3.1 Design Drawings

Alignment drawings (reference 403394-MMD-HWA-XX-DR-HW-0346, 403394-MMD-HWA-XX-DR-HW-0347, 403394-MMD-HWA-XX-DR-HW-0348, 403394-MMD-HWA-XX-DR-HW-0349, 403394-MMD-HWA-XX-DR-HW-0350) are provided in Appendix B.

3.2 Railway Constraints

The alignment has been adjusted to run a minimum of 3.5m from overhead cable structures and this space would be used to accommodate any vehicle restraint measures. A refuge area would be required for people to exit a public transport vehicle which stops unexpectedly along the route, for example, in the event of a breakdown. This would be additional to the 3.5m as the standards advise that the 3.5m should not be used for this purpose.

It is noted that there are departures from standards, including the example identified locally with the Busway (see Section 2.2.19). However, this is localised and it is not expected that approval would be granted for locating the public transport running lanes closer to the railway tracks and electrical equipment for the entire length of the route through Great Shelford.

3.3 Mitigating Loss of Dwellings and Commercial Premises

The alignment has been adjusted through Mill Court to minimise the impact on commercial premises. The impact could be reduced further by directing the NMU route elsewhere, which is considered further below.

The initial design intention was to provide a segregated route alongside Chaston Road (Figure 2.13) in order to comply with CAM design principles and allow public transport vehicles to run at a greater speed unimpeded by other traffic. However, in this case it would be possible to split the road into two cul-de-sacs so that the central section can be used by public transport vehicles only without the needed for a parallel route. The northern section of Chaston Road would need a parallel route if segregation were to be achieved; however, this section of the road serves a relatively small number of houses with very light traffic flows. A section shared between public transport vehicles and general traffic has therefore been incorporated in order to minimise the impact on the railway and residential premises. However, given that the road is a residential cul-de-sac, it is recommended that the design speed would need to reduce 20 mph, which would impact upon the CSET service.

3.4 Environmental Constraints

The alignment has been adjusted south of Stapleford so it runs to the south of the former railway rather than along it. This is a similar principle applied to the shortlisted options further south where it is deemed that there would be a greater environmental impact of running on the former railway than there would be on land adjacent to it. There would also be an opportunity to enhance and expand the existing dedicated County Wildlife Site.

3.5 Junction Design

The design drawings incorporate junctions consistent with those for the shortlisted alignments. The NMU route has been shown to the east of the public transport route to avoid it being bounded by the railway on one side and the public transport route on the other. It would however be necessary for NMUs to cross in order to join existing and proposed facilities to the north and south, including the Genome path into Cambridge Biomedical Campus. The junction at Granham's Road has therefore been designed to incorporate a diagonal crossing movement by NMUs.

To the south, there would not be sufficient space for an NMU route to cross the A1301 Cambridge Road adjacent to the former railway route. Therefore, the designs show the NMU route diverting to join the existing facility on the A1301, as shown on drawing 403394-MMD-HWA-XX-DR-HW-0349, with a new toucan crossing proposed on Cambridge Road.

The existing facility would also need to cross the public transport route at this point. This would be subject to further design development; however, inter-visibility for NMUs and public transport vehicles would need to be considered as this would be obstructed by the A1301 road bridge, which public transport vehicles would pass beneath. Therefore, a reduction in public transport vehicle speeds may be necessary over this section.

3.6 Structures

Based on the assessment provided in Section 2.3, it has been assumed that the A1301 Cambridge Road bridge can be retained and that lowering of the carriageway through this section and reinforcement of the abutments will be possible.

For the A1301 London Road bridge, two options have been allowed for. The preference would be for a lower cost option of lowering the public transport route and incorporating retaining structures for the railway and embankment. As it cannot be determined at this stage whether this would be possible, the replacement of the bridge has also been considered. Depending on the exact span arrangement of the bridge, pre-stressed concrete bridge beams could potentially be utilised to support a 0.2m thick in-situ concrete deck slab, with 0.125m of surfacing. The type and size of the beams depends on the span and support arrangements. If a shallower bridge construction depth is required, in order to avoid having to make significant changes to the levels of the A1301, then a steel and concrete composite deck could be considered. The steel beams can have a span to depth ration of up to 30 to 1 with a 0.25m thick concrete deck slab and 0.125m surfacing.

Potentially, one-way operation with a signalised section may be possible for both locations but this would have negative impacts on journey times. For these sections, it will also be impractical to continue the NMU within the transport corridor without the full replacement of both structures. This is considered further in the following section.

3.7 Alternative NMU Route

The proposed CSET route has provision for NMUs. The specification of this is likely to vary along the route and is to be confirmed; however, a width of 3.5m has been assumed, alongside a verge of 1.5m on the opposite side of the public transport route which, could be used by equestrians. The purpose of the route is to provide connectivity for NMUs as well as public transport users. Generally, along the shortlisted routes, there would not be desirable or direct alternatives to a parallel NMU facility alongside the public transport route. However, through the villages of Great Shelford and Stapleford, it would be possible for NMUs to leave the public transport route and travel on existing roads. This would potentially reduce the footprint of the CSET route through the villages and address some of the constraints of providing a public transport facility via this route. The below considers the alternative NMU routes and the quality of these in comparison to a parallel route. It then considers the extent to which removing the NMU facility from the main CSET alignment will improve the feasibility of routing the latter via Great Shelford and Stapleford.

The alternative routes identified are shown on drawing 403394-MMD-HWA-00-DR-HW-0271 provided in Appendix C. It is noted that the Sawston Greenway proposals included two alternatives to this section with one being a dedicated cycle route between Shelford Station and the A1301 (along a similar alignment to the former railway option being considered here) and the second being an upgraded route running on roads through Stapleford.

In order to assess the quality of existing provision, the Department for Transport's (DfT) cycling Route Selection Tool (RST) has been used. This has been introduced by the DfT as part of the Local Cycling and Walking Infrastructure Plan (LCWIP) process and is intended to allow a high-level assessment against a number of criteria. The outputs can then be used to highlight where improvements could be made and/or inform a choice of alternative route options for investment and decision-making[2].

The RST considers the quality of cycle routes on a six-point scale (5 being the highest and 0 the lowest) against directness, gradient, safety, connectivity and comfort. In addition, it considers the number of 'critical junctions' on the route, which have characteristics that present a particular hazard for cyclists, such as high traffic volumes and a lack of segregation. The DfT's LCWIP Tools Guidance states that the aim should be to select routes where a minimum score of three can be achieved and where no junctions meeting the definition of 'critical' are present.

This RST has been completed for the alternative routes as existing and then assesses these with improvements to cycle infrastructure introduced to provide a fair comparison with a dedicated NMU facility that would be provided alongside the CSET public transport route, whether via the route currently proposed or via the alternative alignment. The results are summarised in Table 3.1.

The following design upgrades have been assumed:

- Improved shared use facilities on A1301 from Bury Road;
- Reduced speed limit on Aylesford Way, Station Road and Granham's Road to 20mph;
- Improved junctions at Aylesford Road with London Road, Mingle Lane with Hinton Way and Granham's Road;
- Early release signals for cyclists at junction of Station Road and London Road; and
- Shared use facilities between Maris Green and Granham's Road.

Table 3.1: Summary of RST Assessment

Route	Directness[3]		Gradient		Safety		Connectivity		Comfort		Total		Critical Junctions	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Via proposed CSET public transport alignment	N/A	5	N/A	5	N/A	5	N/A	1	N/A	5	N/A	21	N/A	5
Via alternative public transport alignment via Shelford	N/A	5	N/A	5	N/A	5	N/A	1	N/A	5	N/A	21	N/A	0
Alternative Route 1a (via Aylesford Way to Station Road)	4	4	5	5	1.6	2.4	4.1	4.1	1.2	1.4	15.9	16.9	2	0
Alternative Route 1b (via A1301 to Station Road)	4	4	5	5	2.0	2.1	4.5	4.5	0.4	1.2	15.8	16.8	1	0

[2] DfT (2017) Walking and Cycling Infrastructure Plans Technical Guidance

[3] Compared to CSET public transport route as opposed to alternative route as existing

Route	Directness[3]		Gradient		Safety		Connectivity		Comfort		Total		Critical Junctions	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Alternative Route 2a (via A1301 to Chaston Road)	4	4	5	5	3.0	3.0	4.5	4.5	0.9	1.7	17.4	18.2	3	1
Alternative Route 2b (via Aylesford Way to Chaston Road)	3	3	5	5	2.7	2.9	4.3	4.3	0.7	0.7	15.7	15.9	3	1
Alternative Route 3a (via Aylesford Way to Granham's Road)	N/A	5	N/A	5	N/A	5	N/A	1	N/A	5	N/A	21	N/A	5
Alternative Route 3b (via A1301 to Granham's Road)	N/A	5	N/A	5	N/A	5	N/A	1	N/A	5	N/A	21	N/A	0

An NMU route via the former railway would be expected to score similarly to a route via the shortlisted CSET routes as proposed. However, the above assessment indicates that alternative routes away from the public transport route would provide a less desirable NMU facility than were it to be provided via the public transport routes. The current design, assessment and costing has assumed that the NMU route would be provided via the railway.

3.8 Stops

In order to provide consistency with the shortlisted route alignments, two stops have been incorporated within the designs. One would be an interchange at Shelford station which would replace the proposed Hinton Way stop, although a replacement stop for Haverhill Road at Stapleford is more of a challenge as the railway corridor is not generally accessible from the highway network to the south or west of Stapleford. The latter would also mean the stop is relatively close to a stop at Shelford station and not provide accessibility improvements for the village as a whole. A stop has therefore been located at the crossing with Cambridge Road, although further consideration would be required as to how this is accessed from the public highway network owing to constrained visibility on the A1301 at this point. If parking and drop-off is to be provided as with the other stops, it is likely that an extended access road will be required. For the purpose of costings, the estimate for the proposed stop at Haverhill Road has been applied; however, it is likely the cost of providing a stop off Cambridge Road will be higher.

3.9 Summary

This chapter has provided a summary of the design development undertaken for the former railway alignment. The following chapters provide assessment of this design and compare this to the shortlisted route options.

4 Demand Assessment

This chapter provides a summary of the initial demand assessment for the alternative alignment via the former railway. An assessment has been carried out to simulate how this alignment compares to the shortlisted Brown option in terms of potential passenger demand. The Brown option has been selected for comparison purposes as this is emerging preferred option, although, at the time of writing, this is subject to approval by GCP.

4.1 Methodology

The assessment considers the key demand responses for the identified Local Corridor Catchment Area (LCCA):

- Sawston,
- Stapleford and
- Great Shelford

In addition, the assessment considers the potential implications on the demand from Travel Hub Site B, based on the increased travel time into Cambridge. The rail alignment is slightly longer and experiences increased vehicle interactions within Great Shelford and therefore is determined to operate at a slightly slower speed. The demand for the public transport service is based on the Brown option.

The assessment will focus on the change in potential patronage generated by the alternative alignment through Great Shelford and the associated impacts for the LCCA and Travel Hub site. At this stage, a spreadsheet model has been developed whereby the LCCA is split into demand areas based on the stops along the route namely Great Shelford, Stapleford, Sawston and the Travel Hub site.

In order to analyse the comparability to the preferred Brown option, the assessment is based on the modelled patronage demand from the Brown option Cambridge Sub-Regional Model (CSRM) modelling, rather than on existing observed data, which was not available.

The demand patronage from the LCCA was excluded from the optioneering stage of the CSET Phase 2 assessment, due to all shortlisted options following a consistent route along this section. The option assessment showed there was minimal variance in the demand between 2036 and 2026 in the Foundation Case (FC) forecast. Based on this, the analysis presented in this report focuses on 2026 in isolation.

For each demand area, forecast demand for the rail alignment has been calculated based on modelled forecast demand for the Brown option and the change in Perceived Journey Time (PJT) to and from Cambridge between the Brown option as shortlisted and an alternative alignment via the railway. This includes the reduced access/egress times for the railway alignment based on improved accessibility within the LCCA.

An elasticity approach has been adopted to simulate the potential change in the demand following change in the PJT. However, in the case of the rail alignment, PJT is increased to the Travel Hub site, resulting in a potential reduction in Travel Hub demand.

In summary, the assessment is based on the following stages:

- **Baseline CSET Phase 2 Brown Option** - establish modelled forecast demand for each stop within the LCCA based on the public transport model;
- **Rail Alignment** - simulate the impact of providing a direct service through the LCCA;
- **Results** – analysis of differences between the alternative alignments.

The assessment approach is based on a spreadsheet model and a series of assumptions as outlined within the following analysis section.

4.2 Sensitivity Testing

Based on the simplified approach adopted for the assessment, a range of sensitivity tests have been undertaken within the assessment to establish a range of potential outcomes, including:

1. Demand uplifts for the LCCA demand areas: using 10%, 20% and 30%;
2. Varied travel time elasticities: using 0.1 and 0.5 (compared to the 0.3 assumed for the main analysis);
3. Variations in the underlying demand information such as the exclusion of rail demand (Great Shelford).

The outcome from the sensitivity testing is presented in Section 4.4.

4.3 Analysis

4.3.1 Baseline Do-Something (DS) Option 2026 Brown

The baseline demand for this assessment is represented by the CSET Phase 2 Brown option for 2026. Table 4.1 shows the LCCA person demand by demand area and time period extracted from the modelling results for the Brown option for the Foundation Case (FC) forecast for 2026.

The baseline demand analysis demonstrates that much of the demand is associated with the Travel Hub site at over 80%. Within the LCCA itself, Great Shelford represents the peak in demand, which followed by the Sawston stop. Stapleford demand is substantially lower in comparison to other stop locations within the LCCA.

In the absence of comparison observed data, the demand volumes are presented as a factual output from the model. However, the evidence to justify these volumes is currently limited.

Table 4.1: Baseline Passenger Demand Brown Option 2026 (Foundation Case)

Direction	Stop Location	AM (07-10)	IP (10-16)	PM (16-19)	12hr (07-19)	%
Inbound	Travel Hub Site	1,241	1,316	508	3,065	83%
Inbound	Sawston	82	100	68	251	7%
Inbound	Stapleford	15	14	4	33	1%
Inbound	Great Shelford	164	141	42	347	9%
	Totals	**1,503**	**1,571**	**622**	**3,696**	**100%**
Outbound	Great Shelford	28	176	131	336	11%
Outbound	Stapleford	3	17	11	31	1%
Outbound	Sawston	39	141	58	238	8%
Outbound	Travel Hub Site	47	972	1,305	2,324	79%
	Totals	**117**	**1,306**	**1,506**	**2,929**	**100%**
Two-way	LCCA	331	589	314	1,236	19%
Two-way	Travel Hub Site	1,288	2,288	1,813	5,389	81%
	Totals	**1,619**	**2,877**	**2,127**	**6,625**	**100%**

For the Brown option, the Perceived Journey Time (PJT) was calculated by including the access/egress time to the stops, origin wait time and in vehicle time. Cost coefficients based on TAG guidance M3-2 section 3.1

have been applied to ensure the relative importance of each component perceived by passengers is reflected. This approach allows for the access/egress and wait time to be "weighted" within the assessment, which is reflective of the key requirement to consider improved accessibility within the LCCA.

Table 4.2: Cost Coefficients

Type	Coefficient
Walk time	**1.5**
Wait time	**1.5**
IVT (In-Vehicle Time)	**1.0**

Source: TAG guidance M3-2 section 3.1

The access time to the public transport stops has been calculated based on a walk speed of 4.5km/hr and the distances as shown in the table below.

The access time for the Travel Hub has been considered zero as this does not differ between the Brown option and alternative railway alignment.

Table 4.3: Brown Option Access Times

Location	Walk length (km)	Walk time (mm:ss)
Sawston	1.65	22:00
Stapleford	0.98	13:06
Great Shelford	1.23	16:24

The service frequency is based on 8 services per hour resulting in an origin wait time of 7.5 minutes.

The In-Vehicle time (IVT) has been extracted from the CSRM model.

The following table provides a summary of the travel time components for each of the identified journeys to and from Cambridge by time period including:

- In-Vehicle Time (IVT);
- Walk Time;
- Other Wait Transfer & Access Time (OWTA); and
- Perceived Journey Time (PJT).

Table 4.4: Perceived Journey Times (PJT) – Brown Option (rounded in minutes)

		In-Vehicle Time			Walk Time	OWTA	Weighted PJT Brown		
Direction	**Stop location**	**AM**	**IP**	**PM**	**All**	**All**	**AM**	**IP**	**PM**
Inbound	Travel Hub Site	23	23	24	0	4	28	28	29
Inbound	Sawston	19	19	20	22	4	58	58	59
Inbound	Stapleford	14	14	15	13	4	40	40	40
Inbound	Great Shelford	13	13	13	16	4	43	43	43
Outbound	Great Shelford	14	13	14	16	4	44	43	44
Outbound	Stapleford	16	15	16	13	4	41	40	41
Outbound	Sawston	21	19	21	22	4	60	58	60
Outbound	Travel Hub Site	25	23	25	0	4	30	28	30

4.3.2 Rail Alignment

Similarly, to the Brown option, the PJT was calculated for the railway alignment using the same cost coefficients as shown in Table 4.2 and assuming the same service frequency.

The origin walk times for the Brown option have been adjusted for the reduced distances for Stapleford and Great Shelford, while the Sawston stop remains the same. The assessment identifies a substantial reduction of approximately 10 minutes for journeys from/to Great Shelford, based on a reduction in access distance of 700m.

Table 4.5: Rail Option Access Times

	Railway Alignment		DS Brown Option	Difference (Rail – Brown)	
Location	**Walk length (km)**	**Walk time (mins)**	**Walk time (mm:ss)**	**Walk length (km)**	**Walk time (mm:ss)**
Sawston	1.65	22:00	22:00	0	00:00
Stapleford	0.84	11:12	13:06	-0.14	-01:54
Great Shelford	0.5	06:42	16:24	-0.73	-09:42

The analysis indicates that based on the location of the proposed Sawston stop, the overall weighted PJT is approximately 1hr, based primarily on the Walk Time. This accessibility is unchanged under the railway alignment; therefore, the level of demand for this stop is potentially reflective of its overall accessibility and location.

The in-vehicle time (IVT) has been adjusted based on the additional distance of about 500m for the railway alignment and additional delays expected. The total in vehicle time is estimated to increase therefore by about 3 minutes between Great Shelford and Cambridge City Centre.

The assumed 3-minute increase in travel time consists of:

- 1 minute – based on additional 500m route; and
- 2 minutes – based on the assumed reduced speed through Great Shelford and increased interactions with the existing level crossings at Hinton Way and Graham's Road.

This is considered a conservative estimate of the impact on journey times as there is potential for journey times to be reduced substantially through the urban area as a result of the lower speeds that will be necessary in this environment, routing alongside general traffic at Chaston Road, and the potential need for alternate working at constrained bridge locations.

Based on the above, application of this additional 3 minutes is dependent on the location of the CSET stop in relation to the locations of the additional time. The following table provides a summary of the potential travel times and components for the identified journey and potential change between the Brown option and railway alignment.

The changes in the PJT resulting from a railway alignment are summarised as follows:

- Travel Hub Site – 3-minute additional travel;
- Sawston – 3-minute additional travel;
- Stapleford – no net saving, as access travel time is off-set by increase IVT for rail alignment;
- Great Shelford – 12-minute travel time saving based on weighted reduction in access time, which is partly off-set by increased in-vehicle time.

Table 4.6: Perceived Journey Times – Rail Alignment and Difference to Brown (rounded in minutes)

		In-Vehicle Time			Walk Time	OWTA	Weighted PJT Rail Option			Weighted PJT Difference (Rail – Brown)		
Direction	**Stop location**	**AM**	**IP**	**PM**	**All**	**All**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Inbound	Travel Hub Site	25	25	26	0	4	31	31	32	3	3	3
Inbound	Sawston	22	22	23	22	4	61	61	62	3	3	3
Inbound	Stapleford	17	17	18	11	4	40	40	40	0	0	0
Inbound	Great Shelford	16	16	16	7	4	31	31	32	-12	-12	-11
Outbound	Great Shelford	17	16	17	7	4	32	31	32	-12	-12	-12
Outbound	Stapleford	19	17	19	11	4	41	40	41	0	0	0
Outbound	Sawston	24	22	24	22	4	63	61	63	3	3	3
Outbound	Travel Hub Site	28	25	28	0	4	33	31	33	3	3	3

Based on the differences in PJT, the change in demand is calculated using an elasticity approach, whereby a 100% change of travel time results in a corresponding change in demand.

Using an elasticity factor of 0.3 results in a 30% increase in demand, if the travel time was reduced by 100% and vice versa. The calculated demand for a railway alignment is shown below.

The analysis indicates that this provides improved accessibility for Great Shelford, which potentially results in an uplift on patronage by 8%. Within the combined LCCA, Stapleford remains unchanged based on the consistent PJT and Sawston minor demand is further reduced by the increased travel time.

Overall, the demand throughout the LCCA is shown to increase by 4%, based purely on the increase in Great Shelford.

However, when considered in the wider context, the Travel Hub demand is forecast to represent over 80% of the service patronage. The PJT analysis indicates the additional travel time of 3 minutes equates to an increase in PJT circa 10%. This increase generates a noticeable reduction of 160 daily passenger journeys (-3%).

The combination of the LCCA demand and Travel Hub demand indicates that despite the increase in demand within the LCCA (i.e. Great Shelford), the overall patronage is reduced by approximately 2%, due to reduction in demand for the Travel Hub site.

Table 4.7: Rail Alignment Passenger Demand (Foundation Case)

		Rail Alignment Demand				Demand Difference (Rail– Brown)				
		2026 DS				2026 DS				%
Direction	**Stop location**	**AM**	**IP**	**PM**	**12hr**	**AM**	**IP**	**PM**	**12hr**	**12hr**
Inbound	Travel Hub Site	1,203	1,276	493	2,972	-38	-40	-15	-92	-3%
Inbound	Sawston	81	99	67	247	-1	-1	-1	-4	-2%
Inbound	Stapleford	15	14	4	33	0	0	0	0	0%
Inbound	Great Shelford	178	153	45	375	13	12	3	28	8%
	Totals	**1,477**	**1,542**	**609**	**3,628**	**-25**	**-30**	**-13**	**-68**	**-2%**
Outbound	Great Shelford	30	191	142	363	2	14	10	27	8%
Outbound	Stapleford	3	17	11	31	0	0	0	0	0%
Outbound	Sawston	38	139	57	235	-1	-2	-1	-4	-1%
Outbound	Travel Hub Site	46	942	1,267	2,256	-1	-29	-38	-68	-3%
	Totals	**118**	**1,289**	**1,478**	**2,885**	**0**	**-17**	**-28**	**-45**	**-2%**
Two-way	LCCA	345	613	326	1,284	13	23	11	47	4%
Two-way	Travel Hub Site	1,249	2,218	1,760	5,228	-39	-69	-53	-160	-3%
	Totals	**1,594**	**2,831**	**2,086**	**6,512**	**-26**	**-46**	**-42**	**-113**	**-2%**

4.3.3 Rail Alignment Summary

The assessment has identified the potential demand for an alignment via the railway at Shelford compared to the Brown option as proposed, which can be summarised as follows:

- Great Shelford demand increases due to improved accessibility (8%);
- Sawston and Stapleford show a small reduction or no change in demand;
- Travel demand reduces (-3%).

The overall demand within the LCCA is forecast to increase marginally for Great Shelford. However, the additional travel time is forecast to reduce demand for the Travel Hub site, resulting in a net reduction in demand of 2%.

4.4 Sensitivity Testing

In order to demonstrate the dependencies within the assessment, the approach adopted at this stage is a simplistic approach. Therefore, a range of sensitivity tests have been undertaken to establish a range of potential outcomes, including:

1. Demand uplifts for the LCCA demand areas: using 10%, 20% and 30%;
2. Varied travel time elasticities: using 0.1 and 0.5 (compared to the 0.3 assumed for the main analysis); and
3. Variations in the underlying demand information such as the exclusion of rail demand (Great Shelford).

In the case of sensitivity test three, the assessment includes the assumption that the underlying demand for the Great Shelford Rail Station is included within the total patronage for CSET service. This essentially assumes that all Public Transport demand transfers directly to the CSET service.

The rail station passengers demand volumes are based on the 2015 Base Year model, as presented in the table below:

Table 4.8: Great Shelford Mainline Rail Station Modelled Passenger Demand

	Great Shelford 2015 Rail Demand			
Direction	**AM**	**IP**	**PM**	**12hr**
Inbound	128	110	32	1,144
Outbound	22	138	103	1,199
Two-way	**150**	**248**	**135**	**2,343**

Overall sensitivity test results presented in the following tables demonstrate that if the demand assumptions in this are underestimated, the difference to the overall results are reasonably small with all scenarios generating a net reduction in demand.

In all cases, the demand reduction forecast at the Travel Hub site outweighs the additional demand at the LCCA. All total results predict slightly less demand with the railway alignment overall when compared to the Brown option.

The sensitivity passenger results can be summarised as follows:

1. Demand uplifts LCCA demand:
   - 10% (2% increase, net reduction -107 passengers)
   - 20% (4% increase net reduction -102 passengers)
   - 30% (6% increase net reduction remaining circa -100 passengers)
2. Varied travel time elasticities:
   - 0.1 (1% increase, net reduction -38 passengers)
   - 0.5 (1% reduction, net reduction -188 passengers)
3. Inclusion of rail demand (Great Shelford)
   - Rail demand (9% increase, net reduction -68 passengers)

The 12-hour demand for the LCCA and the Travel Hub site are shown below as well as the difference to the core scenario calculated in the previous section.

Table 4.9: Sensitivity Test - Set 1 – Demand Uplift – 12-hour (Foundation Case – FC)

Direction	Location	Demand +10%	Difference (with *FC)	Demand +20%	Difference (with *FC)	Demand +30%	Difference (with *FC)
Inbound	LCCA	721	27	787	30	853	32
	Travel Hub	2,972	-92	2,972	-92	2,972	-92
	Total	**3,694**	**-65**	**3,759**	**-63**	**3,825**	**-60**
Outbound	LCCA	691	26	754	28	817	31
	Travel Hub	2,256	-68	2,256	-68	2,256	-68
	Total	**2,947**	**-43**	**3,010**	**-40**	**3,073**	**-38**
Two-way	LCCA	1,412	53	1,541	58	1,670	63
	Travel Hub	5,228	-160	5,228	-160	5,228	-160
	Total	**6,640**	**-107**	**6,769**	**-102**	**6,898**	**-97**
% Difference from Reference		**2%**	**128**	**4%**	**257**	**6%**	**386**

Table 4.10: Sensitivity Test - Set 2 – Elasticity Variation and Rail Demand – 12-hour

Direction	Location	0.1 elasticity	Difference (with *FC)	0.5 elasticity	Difference (with *FC)	Demand +Rail	Difference (with *FC)
Inbound	LCCA	639	8	672	41	949	47
	Travel Hub	3,034	-31	2,911	-154	2,972	-92
	Total	**3,673**	**-23**	**3,583**	**-113**	**3,921**	**-46**
Outbound	LCCA	613	8	644	39	912	45
	Travel Hub	2,301	-23	2,210	-114	2,256	-68
	Total	**2,914**	**-15**	**2,855**	**-75**	**3,168**	**-24**
Two-way	LCCA	1,252	16	1,316	80	1,861	92
	Travel Hub	5,335	-54	5,121	-268	5,228	-160
	Total	**6,587**	**-38**	**6,437**	**-188**	**7,089**	**-68**
% Difference from Reference		**1%**	**75**	**-1%**	**-75**	**9%**	**577**

4.5 Summary

The demand assessment has considered the alternative railway alignment compared to the Brown option as proposed. The assessment has considered the potential demand responses for improved connectivity within the Local Corridor Catchment Area (LCCA), as provided by the Rail Option.

The assessment approach chosen at this stage was a spreadsheet model, including the following:

- Passenger demand extracted from the Brown option CSRM modelling results;
- In-Vehicle Time (IVT) extracted from the Brown option CSRM modelling results and adjusted for the railway alignment based on distance and topography;
- Perceived Journey Time (PJT) changes based on the access times for each stop; and
- Elasticity approach using an elasticity of 0.3 to calculate demand.

The results have indicated that an alternative alignment via the railway potentially generates the following responses:

- Great Shelford demand increases due to improved accessibility and reduction in overall PJT;
- Sawston and Stapleford show small or no changes in demand; and
- Travel Hub demand reduces more significantly than the demand increases across the LCCA.

Several sensitivity tests have been carried out which showed that even with a change in underlying demand the outcome remains consistent.

In conclusion, it is acknowledged that the route alignment of the Rail Option through Great Shelford would be expected to lead to increased demand for the service from the village itself. However, the demand reduction at the Travel Hub site outweighs this extra demand.

5 Costing

This chapter provides details of the cost estimating exercise undertaken for the alternative railway alignment and compares this to the estimated cost for the preferred option.

5.1 Railway Alignment

The total base capital costs for the infrastructure needed to deliver the alternative railway alignment, exclusive of any risk allowance, amount to approximately £127.3 million. This is based on the level of design to date and would be subject to change and potential additional costs were it to be progressed further. An additional amount of £31.8 million (25% of base costs) has been estimated to cover risks at the P80 level and excludes optimism bias. The estimated total capital infrastructure cost of the scheme, inclusive of risk, is £159.1 million as shown in Table 5.1.

The funding ask for the railway alignment would be £161.4 million, constituted by the total capital infrastructure cost of £159.1 million plus prior year scheme development costs of £2.4 million.

5.2 Comparison to Preferred Option

The total base capital costs for the infrastructure needed to deliver the preferred option, exclusive of any risk allowance, amount to an estimated £103.9 million. An additional amount of £26.0 million (25% of base costs) has been estimated to cover risks at the P80 level and excludes optimism bias. The estimated total capital infrastructure cost of the scheme, inclusive of risk is £129.9 million as shown in Table 5.1.

The funding ask for the project is £132.3 million, constituted by the total capital infrastructure cost of the preferred scheme option of £129.9 million plus prior year scheme development costs of £2.4 million.

Therefore, the railway alignment is expected to cost approximately £29.1m more than the preferred option. The most significant factors contributing to the cost difference are the higher land costs for the Railway Option (£15.0 million), followed by higher construction costs (£8.1 million).

The reason for the greater forecast land costs is because of the need to acquire land within the urban area of higher value, which in some case includes property such as residential dwellings. Construction costs are forecast to be higher for reasons such as the additional complications of constructing adjacent to the railway, the need for a vehicle containment barrier and alterations to two additional bridges which would not be necessary were the route to pass around the edge of the villages.

Table 5.1: Capital Costs – Infrastructure Adjusted for P80 Risk (Outturn Prices)

	Preferred Option	Railway Option
Cost Item	**Cost (£ million)**	**Cost (£ million)**
Construction	68.7	76.8
Design	9.5	10.7
Project Management	12.6	14.5
Environmental Mitigation	2.9	3.1
Statutory undertakings	12.5	12.5
Land Costs	11.5	26.5
Inflation	12.2	15.0
TOTAL	**129.9**	**159.1**

6 Option Assessment

The chapter provides a multi-criteria assessment of the alternative rail alignment and compares this to the shortlisted options.

6.1 INSET Scoring Summary

The long and shortlisted options for CSET Phase 2 were assessed using Mott MacDonald's Investment Sifting and Evaluation Tool (INSET). As noted in Chapter 1, an alignment following the former railway was discounted prior to this and therefore was not previously included in this process. However, the subsequent design development presented in Chapter 3 allows a level of assessment comparable to that for the shortlisted options. The INSET scoring has therefore been repeated for the five shortlisted options, assuming that each would run via the former railway.

It should be noted that the former railway alignment applies to one section of the route only and as such does not have a bearing on the scoring of all sub-criteria, for example, criteria relating to the Travel Hub. Likewise, fundamental difficulties that arise under certain criteria are reflected only in part by the INSET scoring and the wider feasibility work needs to be considered alongside this. For example, criteria around deliverability are critical to the scheme's progression whereas the loss of residential and commercial property would have meant that the option would have been excluded at the gateway assessment stage. This is detailed further in the Options Appraisal Report (403394-MMD-BCA-00-RE-BC-0024) and was designed to exclude those options not considered workable or would not be consistent with commitments made by GCP.

The following summarises by theme where there are differences between the scoring of sub-criteria as a result of the alternative alignment and any assumptions made.

Transport User Benefits

- Criteria relating to reliability, segregation and compatibility with CAM receive less positive scores because full segregation is not achieved.
- For the purposes of the assessment, it has been assumed that a direct NMU route can be provided and therefore, scores have not been reduced compared to the shortlisted options. As outlined in Chapter 3, it is likely the NMU facility would need to be rerouted and lower quality provision provided. The assumption that an equivalent quality route could be provided therefore provides a robust assessment for comparison purposes.
- The alternative alignment would cross the A1301 NMU route so has scored less well in this respect.

Environment

- It is expected to have a greater impact on noise owing to the close proximity to residential properties (see Section 2.4.5 above).

Deliverability

- Scheme costs are expected to be greater, which results in a more negative score; however, this is option dependent with the blue and black options already scoring more negatively.
- Engineering feasibility scores more negatively against a number of sub-criteria on the basis that the alignment would be far more complex.

- The alternative alignment would have a greater impact on residential properties and require some demolition so receives a more negative score.
- There would be less dissection of field boundaries meaning the option scores more positively in this respect but is offset by additional complexity elsewhere.
- There would be expected to be greater disruption during construction for existing transport networks, including likely part-closure of the A1301 and closure of the Cambridge-Liverpool Street mainline railway.
- The need for Network Rail approvals and significant impact on railway land identified adds to the complexity of the alignment with a significant risk that concerns cannot be addressed for the reasons outlined in Section 2.2.

Social Impacts

- It is evident that there has been a concentration of NMU accidents in Great Shelford (19 between 2014 and 2018). It is expected that the introduction of a segregated NMU route will remove some of these users from the network in this area, improving NMU accident safety. Therefore, this option has received a more positive score.
- The impact on residential and commercial property from the alternative alignment is more negative.

Wider Economic Benefits

- The alternative alignment is not deemed to have benefits above the shortlisted alignment and therefore the scores remain unchanged. This is because it is considered to have an equally positive impact on the commercial sites previously identified and is not expected to significantly alter the labour market catchment.

Alignment with Objectives

- The alternative alignment is generally equally compatible with objectives but scores less well against the themes of high quality public transport on the basis of that it is not fully segregated and is likely to have less reliable journey times.

Policy Alignment

- There is considered to be no difference in the alternative railway alignment’s compatibility with policy compared to the shortlisted options.

6.2 Comparison of Proposed and Alternative Alignments

Table 6.1 presents a summary of the results by theme for the shortlisted options and alternative alignment for each option with the full scores by criteria provided in Appendix D. It can be seen that all shortlisted options received higher assessment scores were they to run via the currently proposed alignment to the east of the villages than an equivalent option running via the former railway.

Table 6.1: Summary of INSET Scoring

Rank	Scheme	Transport Benefits	Environment	Deliverability	Social Impacts (Quality of Life)	Wider Economic Benefits	Alignment with Objectives	Policy Alignment	Total Score
1	Brown route from Travel Hub Site B	1.52	-1.25	-0.57	0.88	3.00	1.75	2.20	1.08
3	Brown route from Travel Hub Site B (Shelford Rail)	1.05	-1.38	-0.93	0.76	3.00	1.70	2.20	0.92
2	Pink route from Travel Hub Site B	1.50	-1.25	-0.64	0.88	3.00	1.75	2.20	1.06
5	Pink route from Travel Hub Site B (Shelford Rail)	1.02	-1.38	-1.00	0.76	3.00	1.70	2.20	0.90
4	Blue route from Travel Hub Site C	1.33	-1.25	-1.10	0.58	3.00	1.65	2.20	0.92
8	Blue route from Travel Hub Site C (Shelford Rail)	0.90	-1.38	-1.26	0.56	3.00	1.60	2.20	0.80
6	Purple route from Travel Hub Site A	1.31	-1.25	-0.29	0.71	2.00	1.68	2.20	0.91
10	Purple route from Travel Hub Site A (Shelford Rail)	0.83	-1.38	-0.79	0.60	2.00	1.60	2.20	0.72
7	Black route from Travel Hub Site C	1.33	-1.25	-1.38	0.58	3.00	1.65	2.20	0.88
9	Black route from Travel Hub Site C (Shelford Rail)	0.90	-1.38	-1.48	0.56	3.00	1.60	2.20	0.77

7 Conclusion

This report has detailed the design development and further assessment undertaken for an alternative alignment for the CSET route via the former Cambridge-Haverhill railway into Great Shelford.

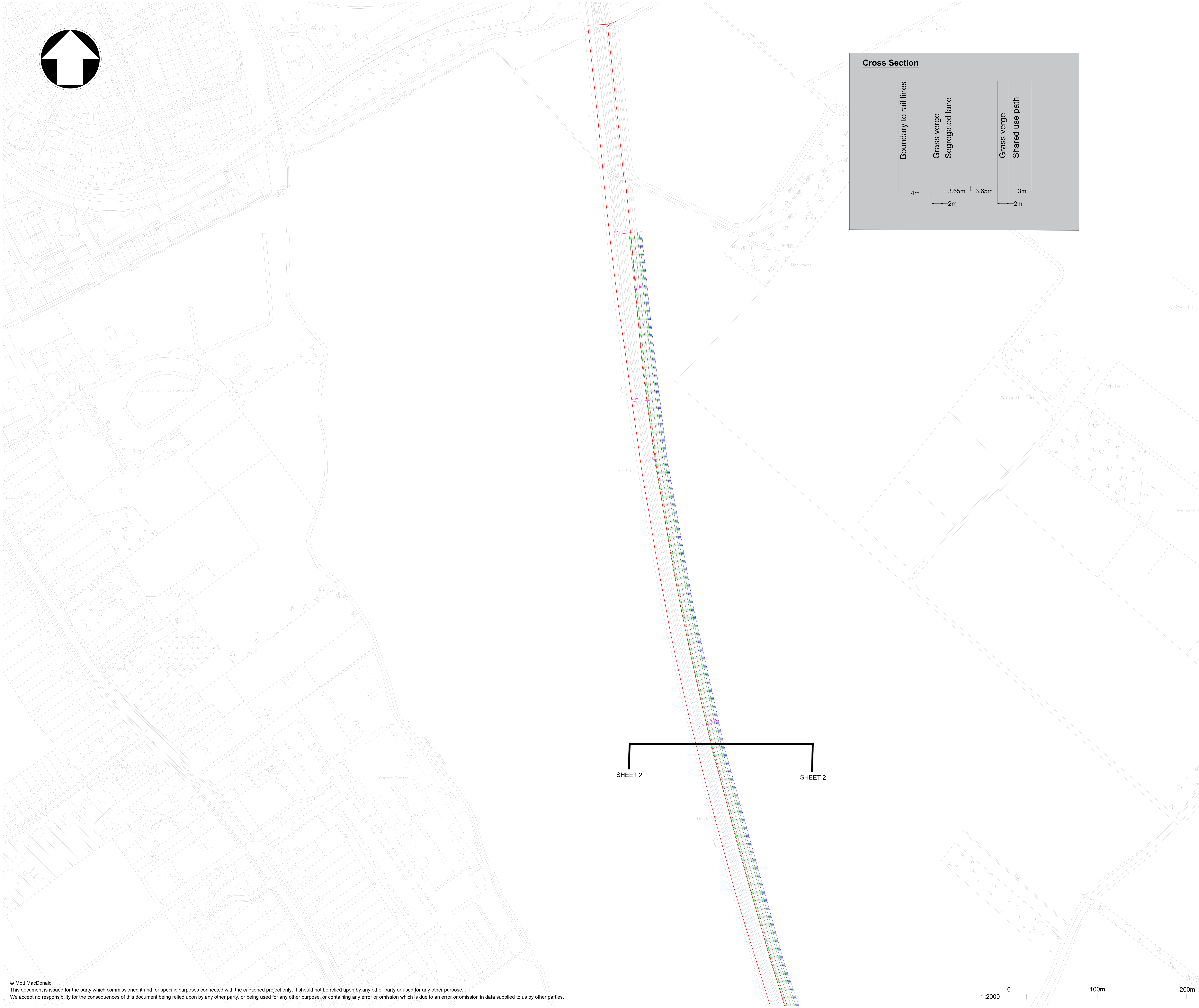
Were the option to have been carried forward to the longlisting assessment, it would have been excluded as a result of gateway criteria relating to the loss of residential dwellings and private property. The design development has shown this would not be avoidable in full; however, a comparative assessment with the shortlisted options has nonetheless been undertaken. This clearly indicates that the amended options incorporating the former railway alignment would be less desirable than those which do not. The reasons for this include:

- A number of residential and commercial properties would need to be acquired;
- The alignment would not provide full segregation meaning reliability and compatibility with CAM requirements are reduced compared to the shortlisted options;
- Journey times from the Travel Hub would be expected to increase and overall patronage of the route forecast to decrease;
- The route would be expected to have a greater noise impacts owing to the close proximity to residential properties; and
- Scheme costs at outturn prices are expected to be approximately £29.1m greater.

It should also be noted that the railway alignment presents a number of practical challenges which would be expected to seriously impact on the deliverability of this option. This includes the potential for significant disruption to the A1301 and the Cambridge-Liverpool Street railway, with an associated need for Network Rail approvals and substantial cost and programme implications.

For these reasons, the conclusions of previous work indicating that the alternative alignment via the former Haverhill railway through Shelford would not be a viable alternative are supported by the further feasibility work that has been undertaken.

A. Initial Alignment Footprint Drawings



Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205

Key to symbols

- Shared Use Path
- Public Transport Route
- Verge
- Indicative Network Rail Land Boundary

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	16/01/20	TO	First issue	MR	MP

MOTT MACDONALD

Mott MacDonald
22 Station Road
Cambridge, CB1 2JD
United Kingdom

T +44 (0)1223 463 500
F +44 (0)1223 461 007
W mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

CSET Phase 2
Former Rail Line Alignment
Indicative Route
Sheet 1 of 4

Designed	T O'Dwyer	TO	Eng check	M Ring	MR
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	M.Ring	MR	Approved	M.Payne	MP

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-00-DR-HW-0242

P:\Croydon\VOY\ITL\396909 Cambridge Phase 2 (TEMP)\Old Railway Alignment\Cambridge_Park and Ride System_Final Deliverable.dwg Jan 23, 2020 - 4:52PM ODW90582

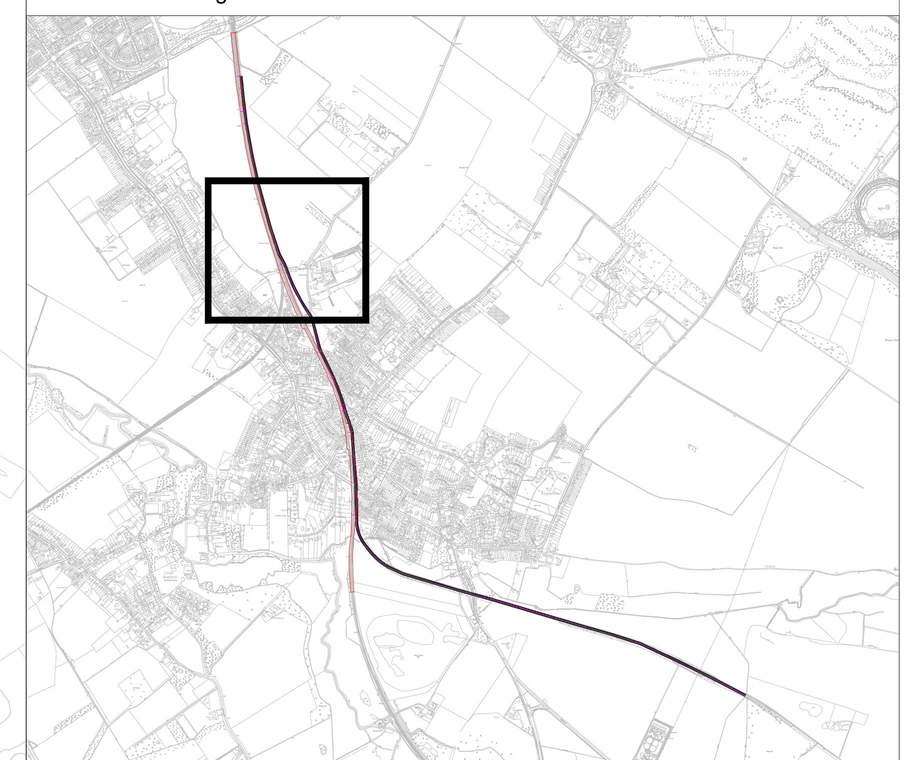
Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205

Key to symbols

- Shared Use Path
- Public Transport Route
- Verge
- Indicative Network Rail Land Boundary

Reference drawings



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	16/01/20	TO	First issue	MR	MP

MOTT MACDONALD
Mott MacDonald
22 Station Road
Cambridge CB1 2JD
United Kingdom

T +44 (0)1223 463 500
F +44 (0)1223 461 007
W mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

CSET Phase 2
Former Rail Line Alignment
Indicative Route
Sheet 2 of 4

Designed	T O'Dwyer	TO	Eng check	M Ring	MR
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	M.Ring	MR	Approved	M.Payne	MP

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-00-DR-HW-0243

P:\Croydon\VOY\ITL\396909 Cambridge Phase 2 (TEMP)\Old Railway Alignment\Cambridge_Park and Ride System_Final Deliverable.dwg Jan 23, 2020 - 4:56PM ODW90582

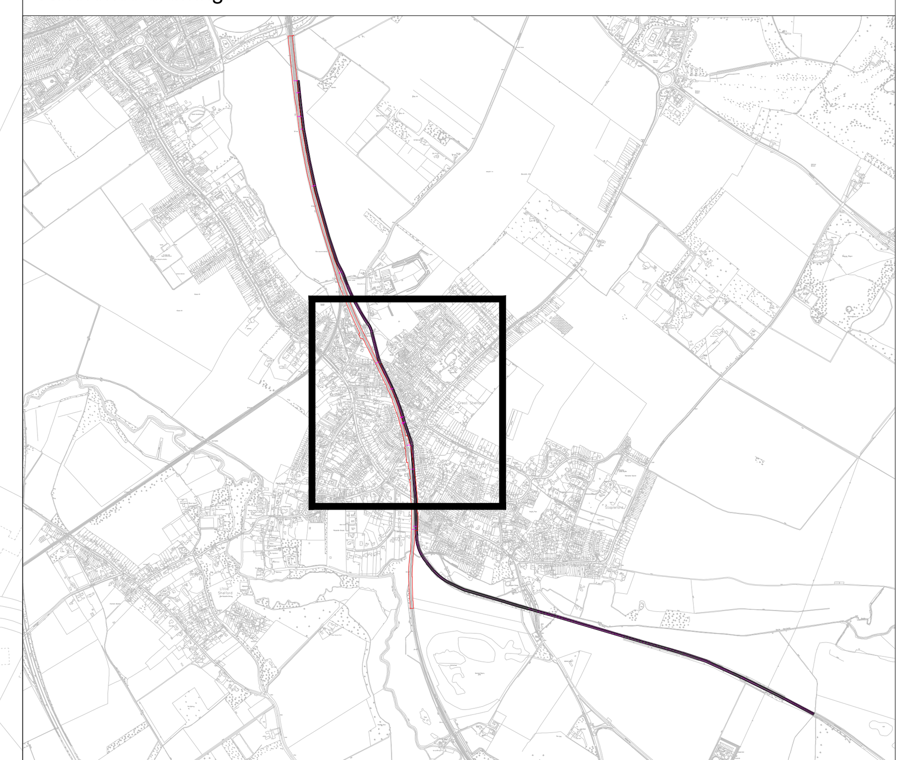
Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205

Key to symbols

- Shared Use Path
- Public Transport Route
- Verge
- Indicative Network Rail Land Boundary

Reference drawings



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	16/01/20	TO	First issue	MR	MP

MOTT MACDONALD

Mott MacDonald
22 Station Road
Cambridge, CB1 2JD
United Kingdom

T +44 (0)1223 462 500
F +44 (0)1223 461 007
W mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

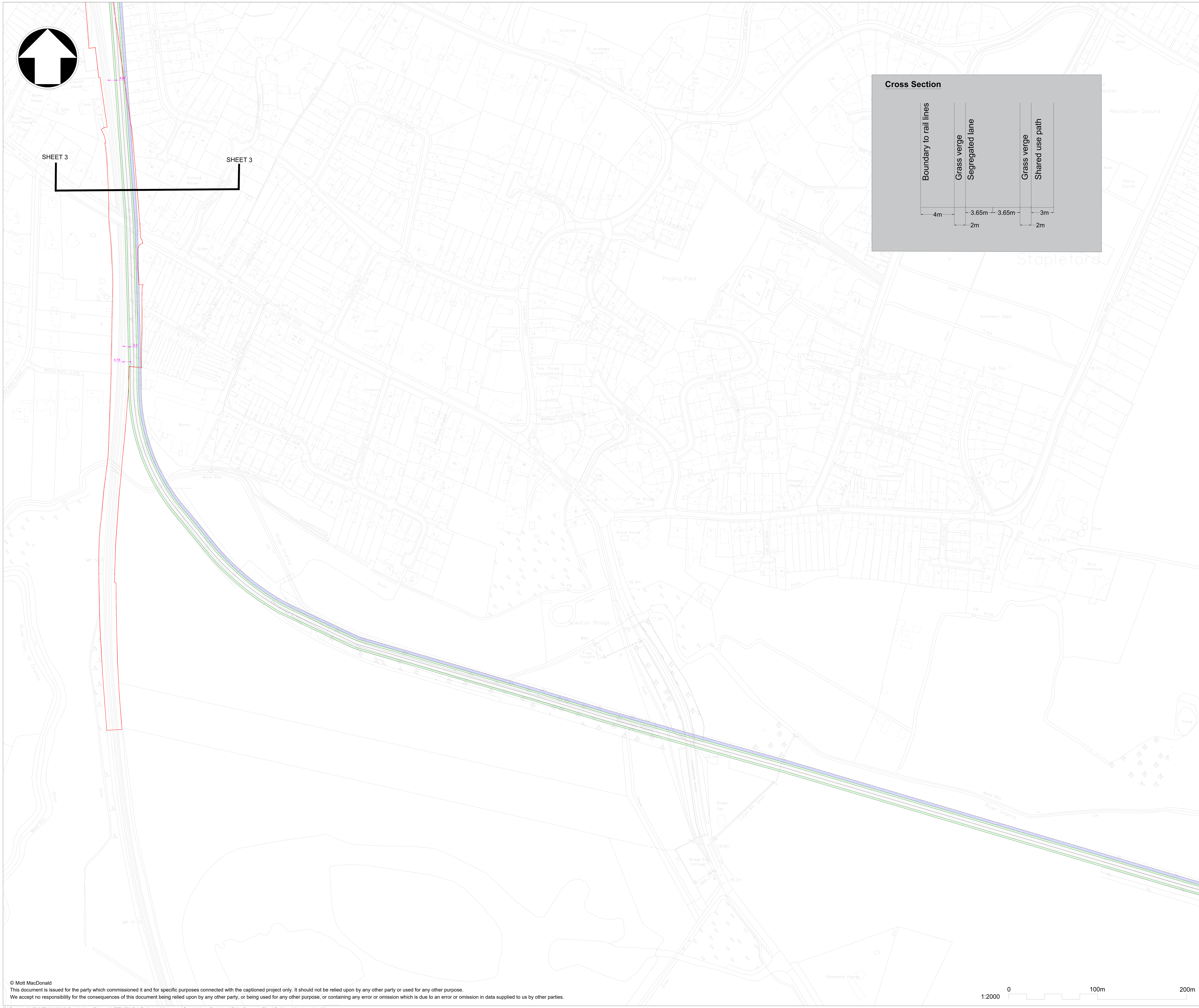
Title

CSET Phase 2
Former Rail Line Alignment
Indicative Route
Sheet 3 of 4

Designed	T O'Dwyer	TO	Eng check	M Ring	MR
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	M.Ring	MR	Approved	M.Payne	MP

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-00-DR-HW-0244



P:\Croydon\VOY\ITL\396909 Cambridge Phase 2 (TEMP)\Old Railway Alignment\Cambridge_Park and Ride System_Final Deliverable.dwg Jan 23, 2020 - 4:57PM ODW90582

Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205

Key to symbols

- Shared Use Path
- Public Transport Route
- Verge
- Indicative Network Rail Land Boundary

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	16/01/20	TO	First issue	MR	MP

MOTT MACDONALD
Mott MacDonald
22 Station Road
Cambridge, CB1 2JD
United Kingdom
T +44 (0)1223 463 500
F +44 (0)1223 461 007
W mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

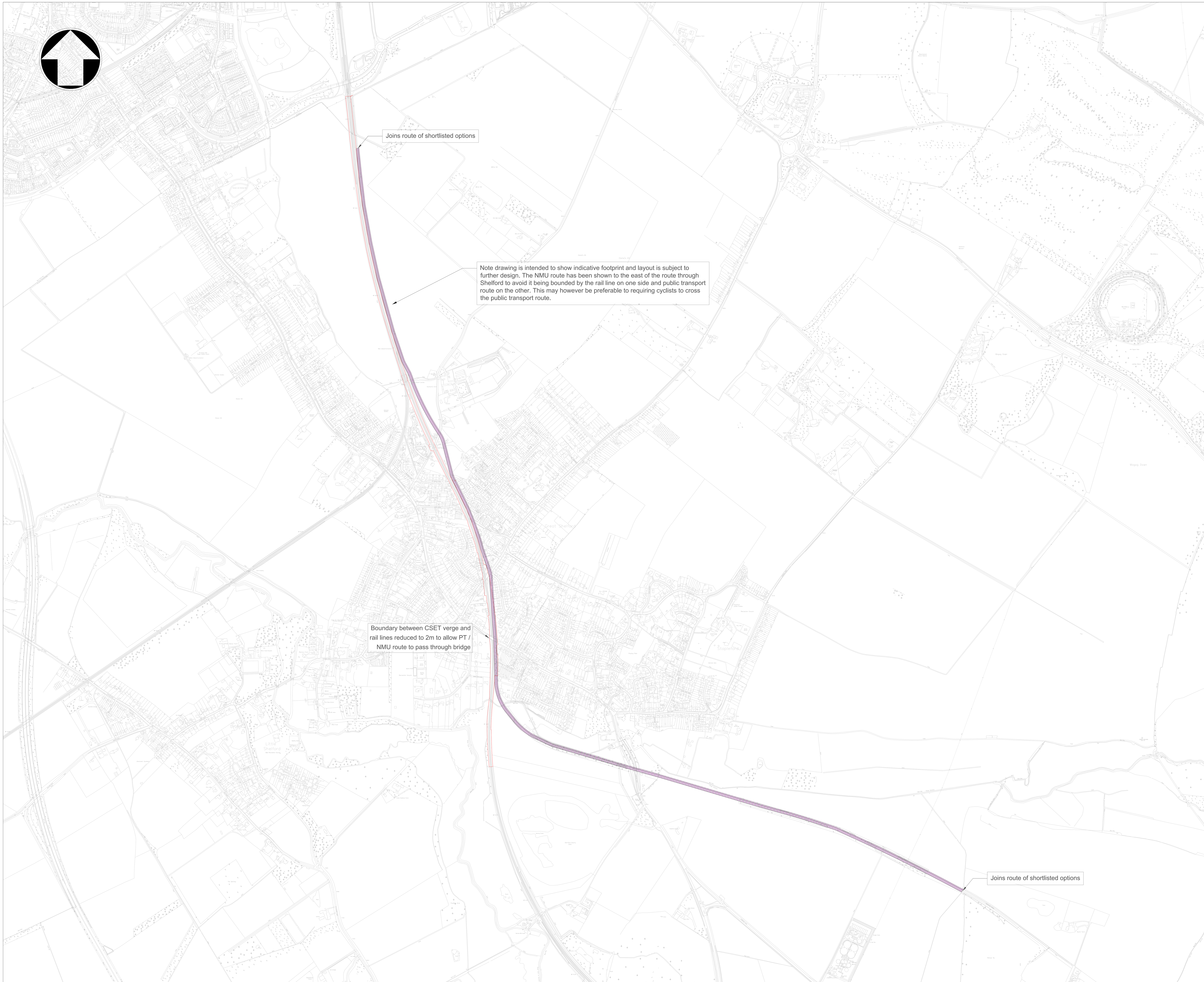
CSET Phase 2 Former Rail Line Alignment Indicative Route Sheet 4 of 4

Designed	T O'Dwyer	TO	Eng check	M Ring	MR
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	M.Ring	MR	Approved	M.Payne	MP

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number

403394-MMD-HWA-00-DR-HW-0245



P:\Croydon\VOY\ITL\396909 Cambridge Phase 2 (TEMP)\Old Railway Alignment\Cambridge_Park and Ride System_Final Deliverable.dwg Jan 24, 2020 - 10:56AM ODW90582

Notes

1. Routes options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	15/01/19	TO	First issue	MR	MP

MOTT MACDONALD

Mott MacDonald
22 Station Road
Cambridge, CB1 2JD
United Kingdom

T +44 (0)1223 463 500
F +44 (0)1223 461 007
W mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

CSET Phase 2
Former Rail Line Alignment
Indicitive Route
Overview

Designed	T O'Dwyer	TO	Eng check	M Ring	MR
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	M.Ring	MR	Approved	M.Payne	MP

Scale at A1	Status	Rev	Security
1:8000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-00-DR-HW-0237

B. Developed (Feasibility) Design Drawings

Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2020 OS 100023205

Key to symbols

- Indicative NMU Route
- Indicative Public Transport Route
- Indicative Grass Verge
- Indicative Network Rail Land Boundary

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	18/03/20	TOD	First issue	MR	JS

MOTT MACDONALD
22 Station Road
Cambridge
CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
W www.mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

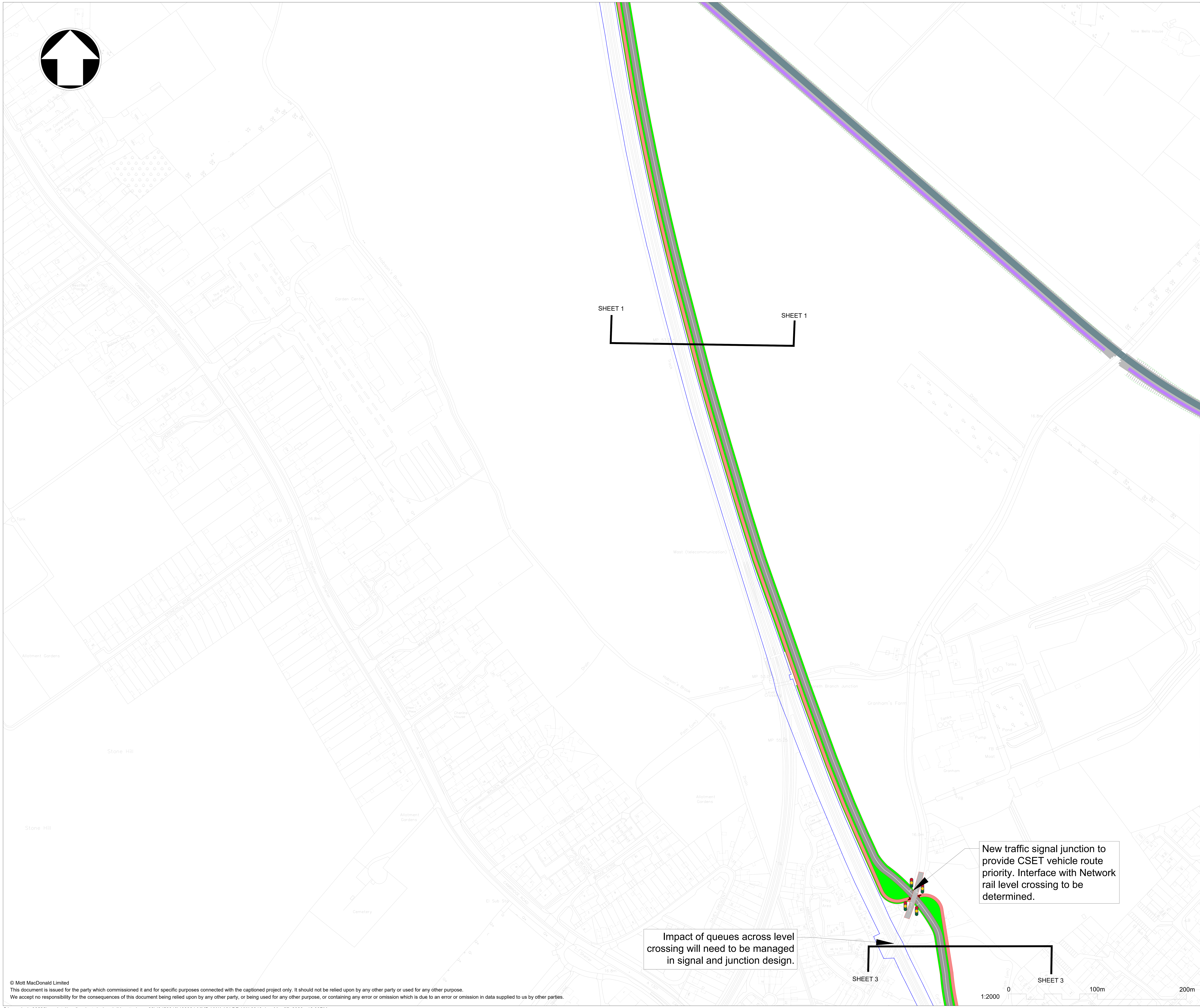
Title

Alternate Old Railway Alignment Option General Arrangement Sheet 1 of 5

Designed	T.O'Dwyer	TOD	Eng check	M.Ring	MR
Drawn	T.O'Dwyer	TOD	Coordination	J.Man	JM
Dwg check	J.Man	JM	Approved	J. Saldanha	JS

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-XX-DR-HW-0346



C:\users\odw90582\appdata\local\projectwise\workdir\mott-gb-pw-03\d0170913\403394-MMD-HWA-XX-DR-HW-0346.dwg Mar 27, 2020 - 12:03PM
ODW90582

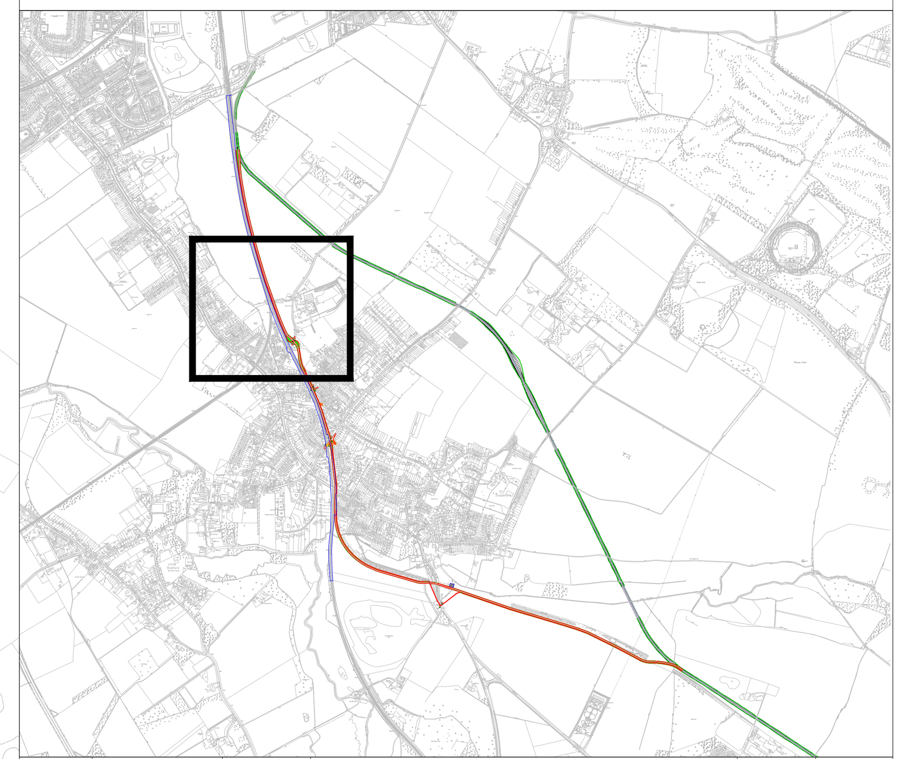
Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2020 OS 100023205

Key to symbols

- Indicative NMU Route
- Indicative Public Transport Route
- Indicative Grass Verge
- Indicative Network Rail Land Boundary
- Proposed Tactile Paving
- Existing Carriageway
- Proposed Traffic lights

Reference drawings



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	18/03/20	TOD	First issue	MR	JS

MOTT MACDONALD
22 Station Road
Cambridge
CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
W www.mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

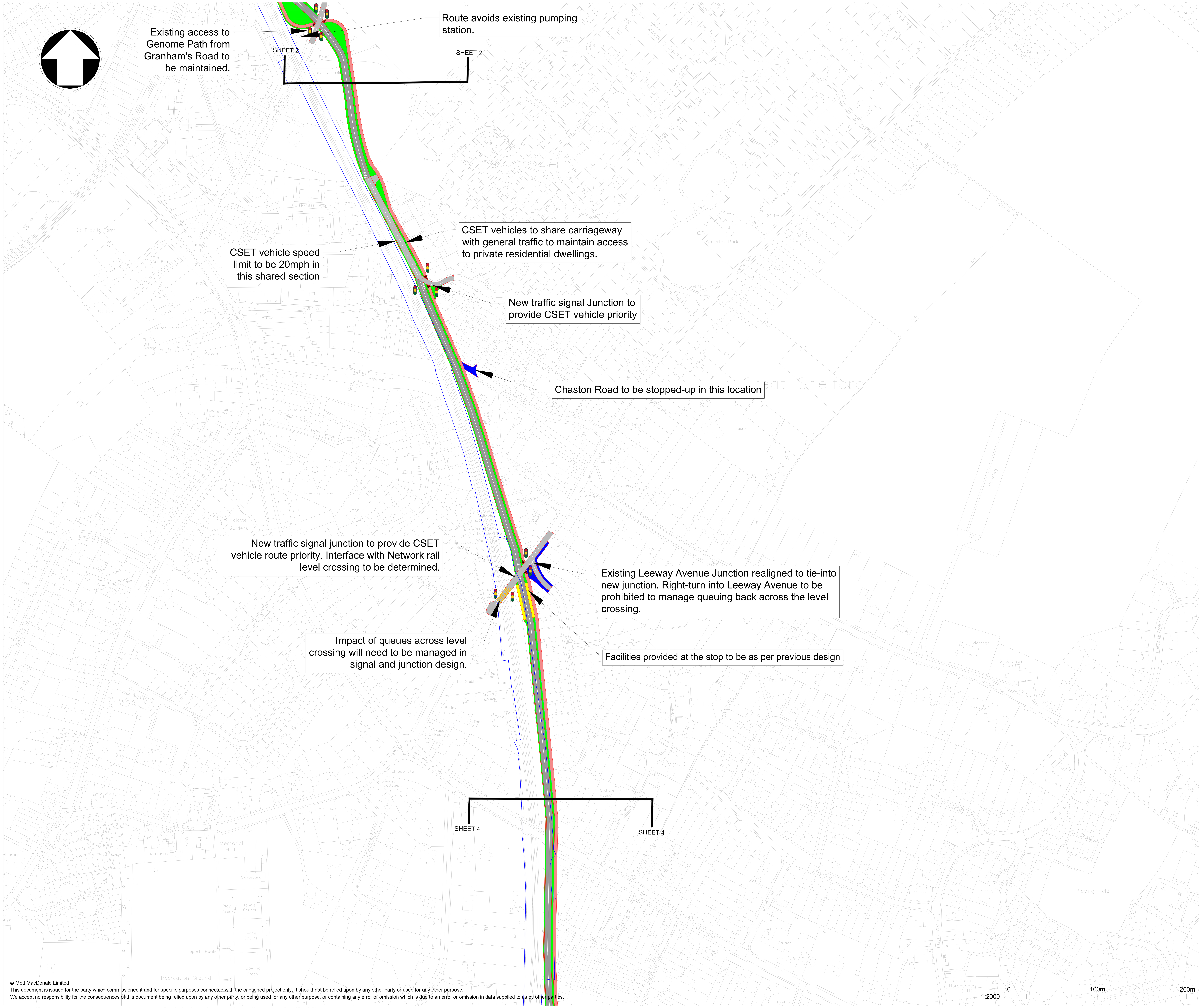
Title

Alternate Old Railway Alignment Option
General Arrangement
Sheet 2 of 5

Designed	T.O'Dwyer	TOD	Eng check	M.Ring	MR
Drawn	T.O'Dwyer	TOD	Coordination	J.Man	JM
Dwg check	J.Man	JM	Approved	J. Saldanha	JS

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-XX-DR-HW-0347



C:\users\odw90582\appdata\local\projectwise\workdir\mott-gb-pw-03\d0170913\403394-MMD-HWA-XX-DR-HW-0346.dwg Mar 31, 2020 - 9:32AM
ODW90582

Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2020 OS 100023205

Key to symbols

- Indicative NMU route
- Indicative public transport route
- Indicative grass verge
- Indicative network rail land boundary
- Vehicle shared use path
- Proposed closed road/ Proposed footway
- Proposed tactile paving
- Indicative public transport vehicle stop
- Proposed traffic lights

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	18/03/20	TOD	First issue	MR	JS

MOTT MACDONALD
22 Station Road
Cambridge
CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
W www.mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

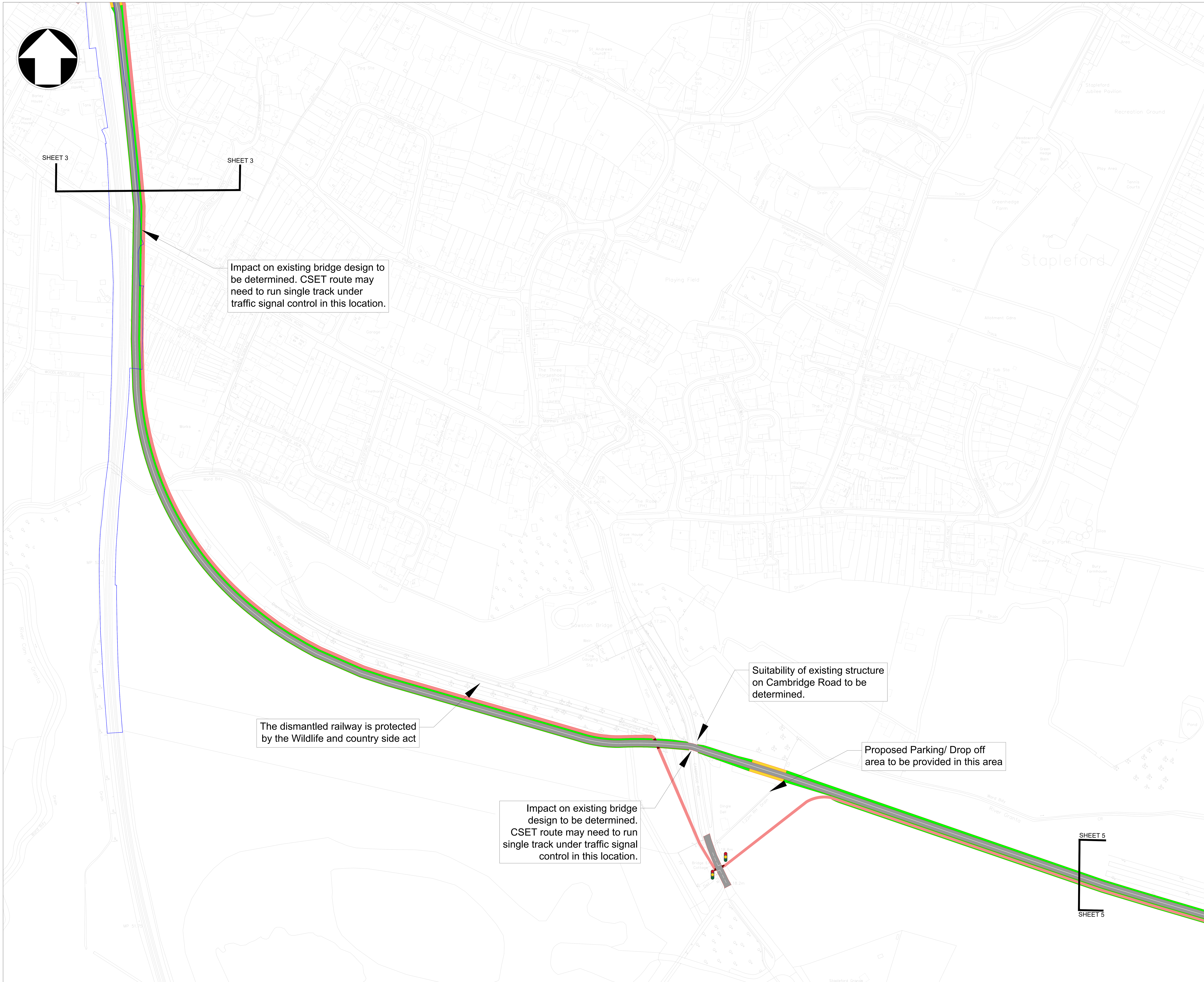
Title

Alternate Old Railway Alignment Option General Arrangement Sheet 3 of 5

Designed	T.O'Dwyer	TOD	Eng check	M.Ring	MR
Drawn	T.O'Dwyer	TOD	Coordination	J.Man	JM
Dwg check	J.Man	JM	Approved	J.Saldanha	JS

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-XX-DR-HW-0348



C:\users\man76127\appdata\local\projectwise\workdir\mott-gb-pw-03\d0170913\403394-MMD-HWA-XX-DR-HW-0346.dwg Mar 30, 2020 - 4:01PM
MAN76127

Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2020 OS 100023205

Key to symbols

- Indicative NMU route
- Indicative public transport route
- Indicative grass verge
- Indicative network rail land boundary
- Proposed tactile paving
- Proposed parking/drop off area
- Proposed public transport vehicle stop

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	18/03/20	TOD	First issue	MR	JS

MOTT MACDONALD
22 Station Road
Cambridge
CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
W www.mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

Alternate Old Railway Alignment Option
General Arrangement
Sheet 4 of 5

Designed	T.O'Dwyer	TOD	Eng check	M.Ring	MR
Drawn	T.O'Dwyer	TOD	Coordination	J.Man	JM
Dwg check	J.Man	JM	Approved	J.Saldanha	JS

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-XX-DR-HW-0349

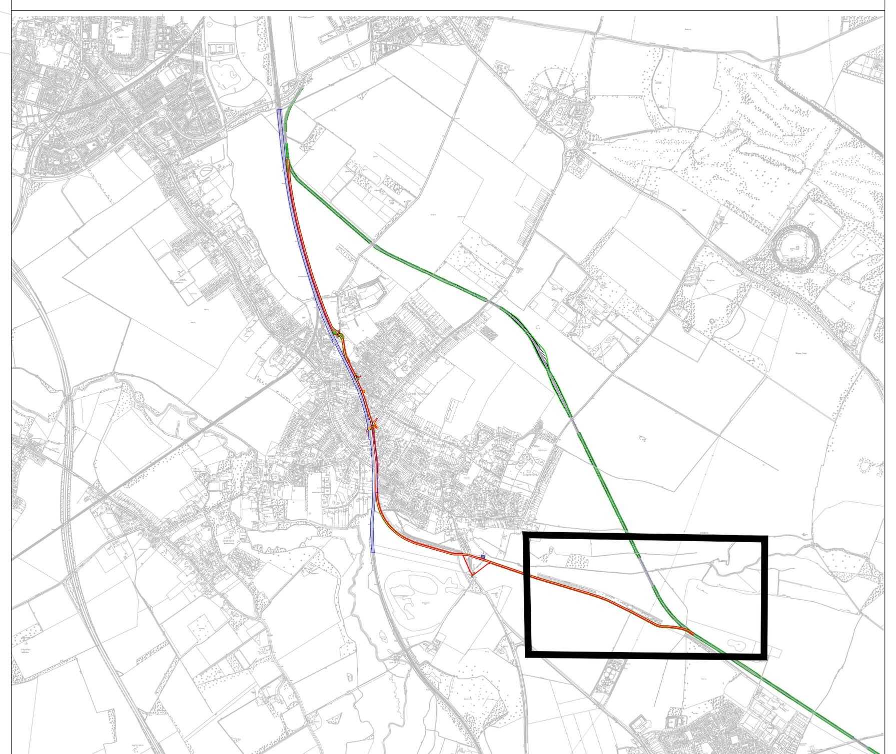
Notes

1. Route options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2020 OS 100023205

Key to symbols

- Indicative NMU Route
- Indicative Public Transport Route
- Indicative Grass Verge
- Indicative Network Rail Land Boundary

Reference drawings



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	18/03/20	TOD	First issue	MR	JS

MOTT MACDONALD

22 Station Road
Cambridge
CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
W www.mottmac.com

Client

GREATER CAMBRIDGE PARTNERSHIP

Title

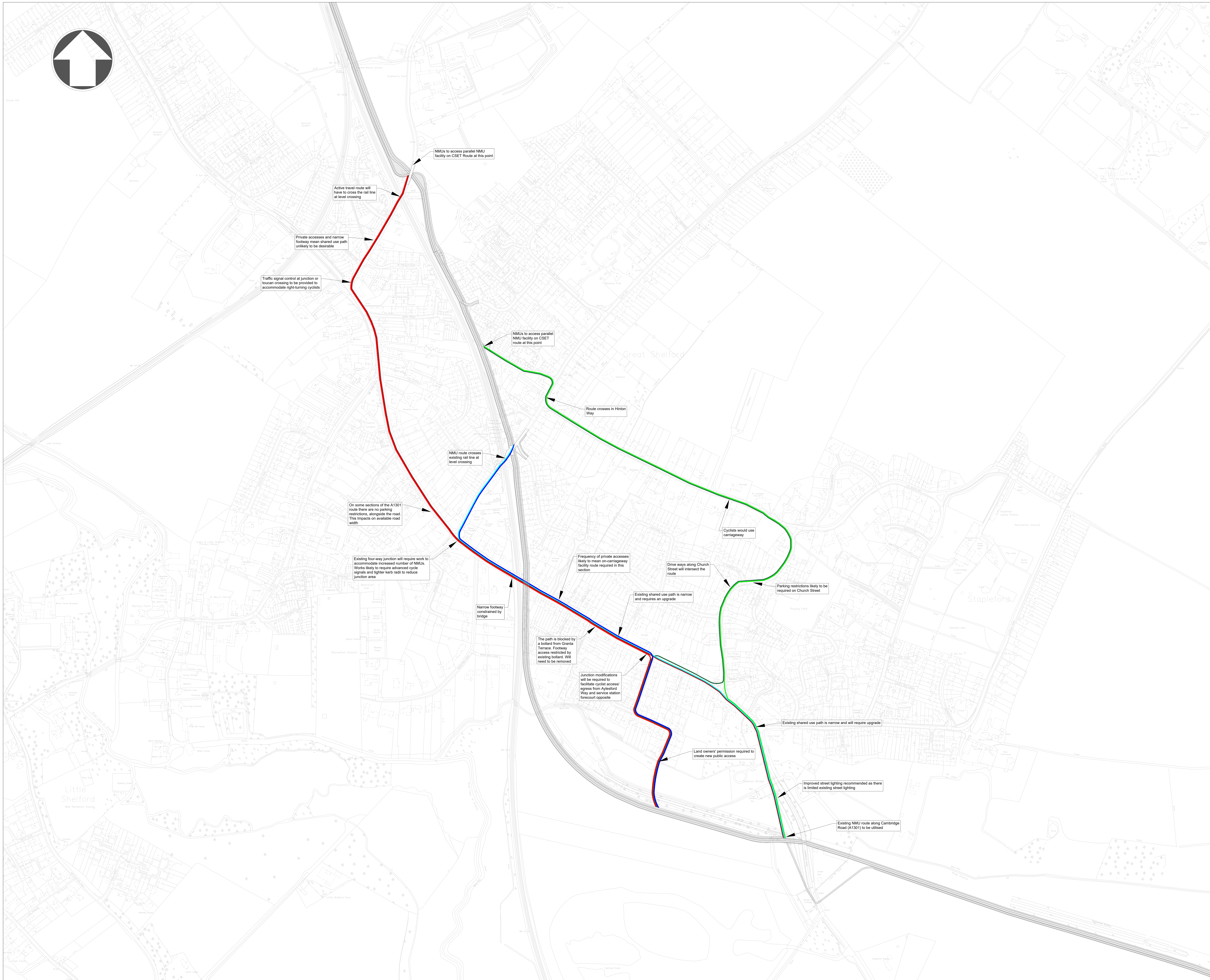
Alternate Old Railway Alignment Option General Arrangement Sheet 5 of 5

Designed	T.O'Dwyer	TOD	Eng check	M.Ring	MR
Drawn	T.O'Dwyer	TOD	Coordination	J.Man	JM
Dwg check	J.Man	JM	Approved	J.Saldanha	JS

Scale at A1	Status	Rev	Security
1:2000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-XX-DR-HW-0350

C. Alternative NMU Routes



C:\users\man76127\appdata\local\projectwise\workdir\mott-gb-pw-03\d0170913\403394-MMD-HWA-00-DR-HW-0271.dwg Mar 30, 2020 - 2:43PM
MAN76127

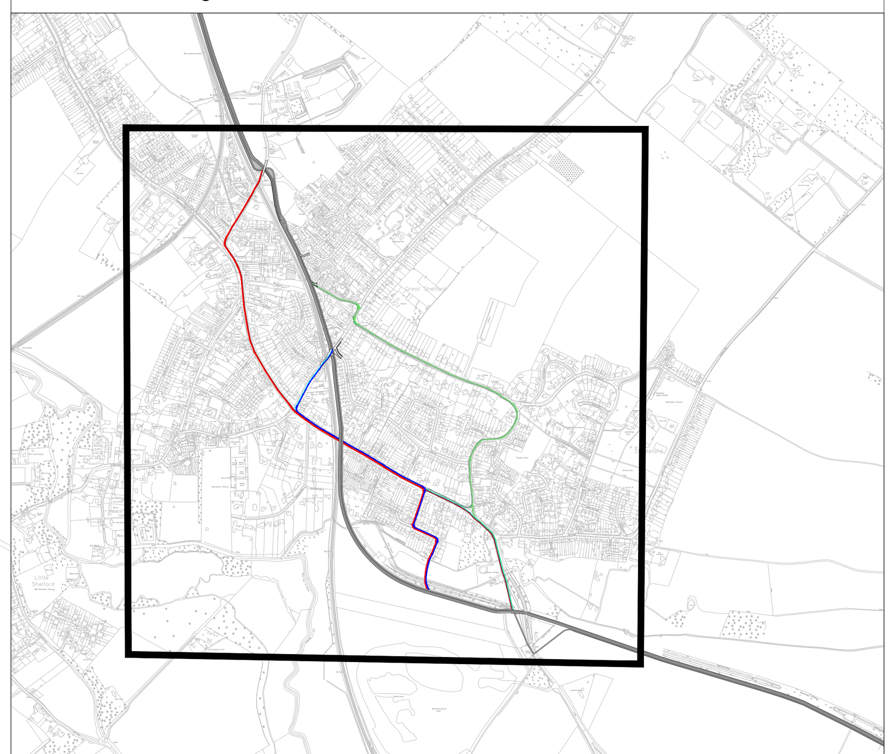
Notes

1. Routes options shown indicatively and subject to further design.
2. Based on OS mapping licence no. © Crown copyright and database rights 2018 OS 100023205.

Key to symbols

- Alternative CSET Alignment (indicative)
- Route Option 1a Via Aylesford Way to Station Road
- Route Option 1b alternate route- Via A1301 to Station Road
- Route Option 2a- Via A1301 to Chaston Road
- Route Option 2b alternate route- Via Aylesford Way to Chaston Road
- Route Option 3a- Via Aylesford Way to Granham's Road
- Route Option 3b alternate route- Via the A1301 to Granham's Road

Reference drawings



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	20/03/20	TO	First issue	CH	JS

MOTT MACDONALD
Mott MacDonald
22 Station Road
Cambridge, CB1 2JD
United Kingdom

T +44 (0)1223 463 500
F +44 (0)1223 461 007
W mottmac.com

Client
GREATER CAMBRIDGE PARTNERSHIP

Title
CSET Phase 2 Former Rail Line Alignment Alternative Non-Motorised User (NMU) Routes

Designed	T O'Dwyer	TO	Eng check	C. Harwood	CH
Drawn	T O'Dwyer	TO	Coordination	C.Harwood	CH
Dwg check	C. Harwood	CH	Approved	J.Saldanha	JS

Scale at A1	Status	Rev	Security
1:8000	PRE	P1	STD

Drawing Number
403394-MMD-HWA-00-DR-HW-0271

D. INSET Assessment

MOTT MACDONALD

CSET Phase 2

Railway Alignment INSET Scoring

Contents

Tables

1 INSET Score Tables by Theme and Criteria

1.1 Introduction

7 themes were used as part of the INSET process. These are:

- Transport User Benefits;
- Environment;
- Deliverability;
- Social Impacts (Quality of Life);
- Wider Economic Impacts;
- Alignment with Objectives; and
- Policy Alignment.

Each theme had multiple main criteria against which options were assessed. The main criteria within the themes of: Transport User Benefits; Deliverability; Social Impacts (Quality of Life); and Alignment with Objectives also had sub-criteria to help appraise each option. This assessment was either qualitative or quantitative depending on the criteria or sub-criteria. Options were assessed against the criteria or sub-criteria using INSET and a scoring range of -3 to +3 applied, where -3 is a very large negative and +3 is a very large positive.

The Options Appraisal Report, Document Reference 403394-MMD-BCA-00-RP-BC-0024, details how options were assessed against the criteria and (where applicable) sub-criteria and also explains the rationale and the parameters as to how INSET scores were assigned.

Sections 1.2 to 0 detail the INSET scores assigned to assessment criteria and sub criteria on a theme by theme basis.

1.2 Transport User Benefits Theme

This theme had 7 main criteria against which options were assessed. They are:

- Journey Reliability;
- Journey Time (User Benefits);
- Route Flexibility;
- Impact on Existing Traffic;
- Degree of Route Segregation;
- Walking and Cycling Connectivity; and
- Suitability of Travel Hub Facility.

1.2.1 Journey Reliability Criteria

Journey Reliability had two sub-criteria, as shown in Table 1.1

Table 1.1: Journey Reliability Criteria

	INSET Scores	
Option	Dedicated public transport routes	Degree of priority at junctions
Brown	+2	+2
Blue	+2	+2
Black	+2	+2
Pink	+2	+2
Purple	+2	+2
Brown route from Travel Hub Site B (Shelford Rail)	+1	+1
Blue route from Travel Hub Site C (Shelford Rail)	+1	+1
Black route from Travel Hub Site C (Shelford Rail)	+1	+1
Pink route from Travel Hub Site B (Shelford Rail)	+1	+1
Purple route from Travel Hub Site A (Shelford Rail)	+1	+1

1.2.2 Journey Time (User Benefits) Criteria

Journey Time (User Benefits) had two sub-criteria, as shown in **Error! Reference source not f ound.**.

Table 1.2: Journey Time (User Benefits) Criteria

	INSET Scores	
Option	Frequency of public transport stops	Directness of route and extent of dedicated infrastructure
Brown	0	+2
Blue	0	+2
Black	0	+2
Pink	0	+2
Purple	0	+3
Brown route from Travel Hub Site B (Shelford Rail)	0	+1
Blue route from Travel Hub Site C (Shelford Rail)	0	+1
Black route from Travel Hub Site C (Shelford Rail)	0	+1
Pink route from Travel Hub Site B (Shelford Rail)	0	+1
Purple route from Travel Hub Site A (Shelford Rail)	0	+2

1.2.3 Route Flexibility Criteria

Route Flexibility had three sub-criteria, as shown in Table 1.3.

Table 1.3: Route Flexibility Criteria

	INSET Scores		
Option	**Ability to be used by CAM vehicles**	**Compatibility with CAM alignments**	**Opportunities for benefits for users of existing public transport routes**
Brown	+2	+3	+2
Blue	+2	+3	+2
Black	+2	+3	+2
Pink	+2	+3	+2
Purple	+2	+3	0
Brown route from Travel Hub Site B (Shelford Rail)	-1	+3	+2
Blue route from Travel Hub Site C (Shelford Rail)	-1	+3	+2
Black route from Travel Hub Site C (Shelford Rail)	-1	+3	+2
Pink route from Travel Hub Site B (Shelford Rail)	-1	+3	+2
Purple route from Travel Hub Site A (Shelford Rail)	-1	+3	0

1.2.4 Impact on Existing Traffic Criteria

Impact on Existing Traffic had three sub-criteria, as shown in Table 1.4.

Table 1.4: Impact on Existing Traffic Criteria

	INSET Scores		
Option	**Loss of general traffic capacity along main alignment**	**Loss of capacity/priority at junctions**	**Impact of delay caused by additional junctions**
Brown	0	0	0
Blue	0	0	0
Black	0	0	0
Pink	0	0	0
Purple	0	0	0
Brown route from Travel Hub Site B (Shelford Rail)	0	0	0
Blue route from Travel Hub Site C (Shelford Rail)	0	0	0
Black route from Travel Hub Site C (Shelford Rail)	0	0	0
Pink route from Travel Hub Site B (Shelford Rail)	0	0	0
Purple route from Travel Hub Site A (Shelford Rail)	0	0	0

1.2.5 Degree of Route Segregation Criteria

Degree of Route Segregation had two sub-criteria as shown in Table 1.5.

Table 1.5: Degree of Route Segregation Criteria

	INSET Scores	
Option	**Junctions**	**General alignment**
Brown	+2	+3
Blue	+1	+3
Black	+1	+3
Pink	+2	+3
Purple	+2	+3
Brown route from Travel Hub Site B (Shelford Rail)	+3	+2
Blue route from Travel Hub Site C (Shelford Rail)	+3	+2
Black route from Travel Hub Site C (Shelford Rail)	+3	+2
Pink route from Travel Hub Site B (Shelford Rail)	+3	+2
Purple route from Travel Hub Site A (Shelford Rail)	+3	+2

1.2.6 Walking and Cycling Connectivity Criteria

Walking and Cycling Connectivity had three sub-criteria as shown in Table 1.6.

Table 1.6: Walking and Cycling Connectivity Criteria (Qualitative Assessment)

	INSET Scores		
Option	**Quality and directness of NMU route**	**Catchment of NMU route**	**Severance of existing routes**
Brown	+2	+2	-2
Blue	+2	+2	-3
Black	+2	+2	-3
Pink	+2	+2	-2
Purple	+2	+1	-2
Brown route from Travel Hub Site B (Shelford Rail)	+2	+2	-3
Blue route from Travel Hub Site C (Shelford Rail)	+2	+2	-3
Black route from Travel Hub Site C (Shelford Rail)	+2	+2	-3
Pink route from Travel Hub Site B (Shelford Rail)	+2	+2	-3
Purple route from Travel Hub Site A (Shelford Rail)	+2	+1	-3

1.2.7 Suitability of Travel Hub Facility Criteria

Suitability of Travel Hub Facility Criteria has six sub-criteria as shown in Table 1.7.

Table 1.7: Suitability of Travel Hub Facility

	INSET Scores					
Option	Site parking duration or restrictions	Site deliverability – on site quality/provision for buses	Site accessibility and permeability for public transport	Site visibility from the A1307, A505 and A11	Travel Hub Capacity	Site access from the A1307, A505 and A11
Brown	+3	+2	+3	+2	+3	0
Blue	+3	+3	+3	+1	0	0
Black	+3	+3	+3	+1	0	0
Pink	+3	+2	+3	+2	+2	0
Purple	+3	+2	+3	-1	0	0
Brown route from Travel Hub Site B (Shelford Rail)	+3	+2	+3	+2	+3	0
Blue route from Travel Hub Site C (Shelford Rail)	+3	+3	+3	+1	0	0
Black route from Travel Hub Site C (Shelford Rail)	+3	+3	+3	+1	0	0
Pink route from Travel Hub Site B (Shelford Rail)	+3	+2	+3	+2	+2	0
Purple route from Travel Hub Site A (Shelford Rail)	+3	+2	+3	-1	0	0

1.3 Environment Theme

This theme had 8 main criteria against which options were assessed. These were:

- Visual Impact;
- Noise;
- Air Quality;
- Water;
- Biodiversity;
- Heritage;
- Impact on Greenbelt; and
- Greenhouse Gases.

Table 1.8: Environmental Criteria

	INSET Scores							
Option	Visual Impact	Noise	Air Quality	Water	Biodiversity	Heritage	Impact on Greenbelt	Greenhouse Gases
Brown	-2	-1	0	0	-2	-3	-2	0
Blue	-2	-1	0	0	-2	-3	-2	0
Black	-2	-1	0	0	-2	-3	-2	0
Pink	-2	-1	0	0	-2	-3	-2	0
Purple	-3	-1	0	0	-2	-3	-2	0
Brown route from Travel Hub Site B (Shelford Rail)	-2	-2	0	0	-2	-3	-2	0
Blue route from Travel Hub Site C (Shelford Rail)	-2	-2	0	0	-2	-3	-2	0
Black route from Travel Hub Site C (Shelford Rail)	-2	-2	0	0	-2	-3	-2	0
Pink route from Travel Hub Site B (Shelford Rail)	-2	-2	0	0	-2	-3	-2	0
Purple route from Travel Hub Site A (Shelford Rail)	-2	-2	0	0	-2	-3	-2	0

1.4 Deliverability Theme

This theme had 7 main criteria against which options were assessed. They are:

- Degree of Objection Expected;
- Option Costs;
- Engineering Feasibility;
- Land Acquisition Required;
- Impact on Transport Networks During Construction;
- Future Proofing; and
- Risks to Delivery.

1.4.1 Degree of Objection Expected Criteria

Degree of Objection Expected had three sub-criteria, as shown in Table 1.9.

Table 1.9: Degree of Objection Expected Criteria

	INSET Scores		
Option	**Loss of environmentally sensitive areas**	**Impact on existing residential dwellings**	**Impact on general traffic**
Brown	-2	-1	0
Blue	-1	-1	0
Black	-1	-1	0
Pink	-2	-1	0
Purple	-2	-1	0
Brown route from Travel Hub Site B (Shelford Rail)	-2	-3	0
Blue route from Travel Hub Site C (Shelford Rail)	-1	-3	0
Black route from Travel Hub Site C (Shelford Rail)	-1	-3	0
Pink route from Travel Hub Site B (Shelford Rail)	-2	-3	0
Purple route from Travel Hub Site A (Shelford Rail)	-2	-3	0

1.4.2 Option Costs Criteria

Option Costs had three sub-criteria, as shown in Table 1.10.

Table 1.10: Option Costs Criteria

Option	INSET Scores		
	Capital costs	Annual operating costs	Potential annual subsidy
Brown	-3	-1	0
Blue	-3	-2	0
Black	-3	-2	0
Pink	-3	-1	0
Purple	-1	-1	0
Brown route from Travel Hub Site B (Shelford Rail)	-3	-1	0
Blue route from Travel Hub Site C (Shelford Rail)	-3	-2	0
Black route from Travel Hub Site C (Shelford Rail)	-3	-2	0
Pink route from Travel Hub Site B (Shelford Rail)	-3	-1	0
Purple route from Travel Hub Site A (Shelford Rail)	+3	-1	0

1.4.3 Engineering Feasibility Criteria

Engineering Feasibility had three sub-criteria, as seen in Table 1.11.

Table 1.11: Engineering Feasibility Criteria

Option	INSET Scores		
	Accessibility to site during construction	Complexity of junctions	Structural complexity
Brown	-2	-1	-2
Blue	-2	-1	-3
Black	-2	-1	-3
Pink	-2	-1	-2
Purple	-3	-2	+1
Brown route from Travel Hub Site B (Shelford Rail)	+3	-2	-2
Blue route from Travel Hub Site C (Shelford Rail)	+3	-2	-3
Black route from Travel Hub Site C (Shelford Rail)	+3	-2	-3
Pink route from Travel Hub Site B (Shelford Rail)	+3	-2	-2
Purple route from Travel Hub Site A (Shelford Rail)	-3	-2	-2

1.4.4 Land Acquisition Required Criteria

Land Acquisition Required had two sub-criteria, as seen in Table 1.12.

Table 1.12: Land Acquisition Required Criteria

	INSET Scores	
Option	**Quantity of land required**	**Division of field boundaries**
Brown	+1	-1
Blue	0	-2
Black	-3	-3
Pink	0	-1
Purple	+3	-1
Brown route from Travel Hub Site B (Shelford Rail)	+1	-1
Blue route from Travel Hub Site C (Shelford Rail)	0	-1
Black route from Travel Hub Site C (Shelford Rail)	-3	-1
Pink route from Travel Hub Site B (Shelford Rail)	0	-1
Purple route from Travel Hub Site A (Shelford Rail)	+3	-1

1.4.5 Impact on Transport Networks During Construction Criteria

Impact on Transport Networks During Construction had three sub-criteria, as shown in Table 1.13.

Table 1.13: Impact on Transport Networks During Construction Criteria

	INSET Scores		
Option	**Impact on road network**	**Impact on rail network**	**Impact on NMU's**
Brown	-2	0	-1
Blue	-3	0	-1
Black	-3	0	-1
Pink	-2	0	-1
Purple	-2	0	-1
Brown route from Travel Hub Site B (Shelford Rail)	-3	-3	-2
Blue route from Travel Hub Site C (Shelford Rail)	-3	-3	-2
Black route from Travel Hub Site C (Shelford Rail)	-3	-3	-2
Pink route from Travel Hub Site B (Shelford Rail)	-3	-3	-2
Purple route from Travel Hub Site A (Shelford Rail)	-3	-3	-2

1.4.6 Future Proofing Criteria

Future Proofing had two sub-criteria, as seen in Table 1.14.

Table 1.14: Future Proofing Criteria

	INSET Scores	
Option	Range of vehicle usability	Extension to Haverhill
Brown	+2	+3
Blue	+2	0
Black	+2	0
Pink	+2	+3
Purple	+2	+3
Brown route from Travel Hub Site B (Shelford Rail)	+2	+3
Blue route from Travel Hub Site C (Shelford Rail)	+2	0
Black route from Travel Hub Site C (Shelford Rail)	+2	0
Pink route from Travel Hub Site B (Shelford Rail)	+2	+3
Purple route from Travel Hub Site A (Shelford Rail)	+2	+3

1.4.7 Risks to Delivery Criteria

Risks to Delivery had two sub-criteria, as seen in Table 1.15.

Table 1.15: Risks to Delivery Criteria

	INSET Scores	
Option	Consents	Complexity
Brown	-2	-1
Blue	-2	-2
Black	-2	-2
Pink	-2	-1
Purple	-2	-1
Brown route from Travel Hub Site B (Shelford Rail)	-3	-3
Blue route from Travel Hub Site C (Shelford Rail)	-3	-3
Black route from Travel Hub Site C (Shelford Rail)	-3	-3
Pink route from Travel Hub Site B (Shelford Rail)	-3	-3
Purple route from Travel Hub Site A (Shelford Rail)	-3	-3

1.5 Social Impacts (Quality of Life) Theme

This theme had 6 main criteria against which options were assessed. They are:

- Safety;
- Access to Cambridge Biomedical Campus;
- Access to Babraham Research Campus;
- Access to Granta Park;
- Loss of Homes or Property; and
- Improvements to Physical Wellbeing.

1.5.1 Safety Criteria

Safety had three sub-criteria, as shown in Table 1.16

Table 1.16: Safety Criteria

Option	INSET Scores		
	Changes to personal safety	Changes to vehicular accident rates	Changes to NMU accident rates
Brown	+2	+1	
Blue	+2	+1	0
Black	+2	+1	0
Pink	+2	+1	0
Purple	+2	+1	0
Brown route from Travel Hub Site B (Shelford Rail)	+2	+1	+1
Blue route from Travel Hub Site C (Shelford Rail)	+2	+1	+1
Black route from Travel Hub Site C (Shelford Rail)	+2	+1	+1
Pink route from Travel Hub Site B (Shelford Rail)	+2	+1	+1
Purple route from Travel Hub Site A (Shelford Rail)	+2	+1	+1

1.5.2 Access to Cambridge Biomedical Campus Criteria

Access to Cambridge Biomedical Campus had four sub-criteria, as seen in Table 1.17.

Table 1.17: Access to Cambridge Biomedical Campus Criteria

Option	INSET Scores			
	Compatibility with masterplan proposals	Landowner support	Degree to which campus is served	Directness of route
Brown	+2	+2	+3	+3
Blue	+2	+2	+3	+2
Black	+2	+2	+3	+2
Pink	+2	+2	+3	+3
Purple	+2	+2	+3	+3
Brown route from Travel Hub Site B (Shelford Rail)	+2	+2	+3	+3
Blue route from Travel Hub Site C (Shelford Rail)	+2	+2	+3	+2
Black route from Travel Hub Site C (Shelford Rail)	+2	+2	+3	+2
Pink route from Travel Hub Site B (Shelford Rail)	+2	+2	+3	+3
Purple route from Travel Hub Site A (Shelford Rail)	+2	+2	+3	+3

1.5.3 Access to Babraham Research Campus Criteria

Access to Babraham Research Campus had four sub-criteria, as seen in Table 1.18.

Table 1.18: Access to Babraham Research Campus Criteria

	INSET Scores			
Option	**Compatibility with masterplan proposals**	**Landowner support**	**Degree to which campus is served**	**Directness of route**
Brown	+1	+2	-3	0
Blue	+1	0	-3	0
Black	+1	0	-3	0
Pink	+1	+2	-3	0
Purple	+1	0	-3	0
Brown route from Travel Hub Site B (Shelford Rail)	+1	+2	-3	0
Blue route from Travel Hub Site C (Shelford Rail)	+1	0	-3	0
Black route from Travel Hub Site C (Shelford Rail)	+1	0	-3	0
Pink route from Travel Hub Site B (Shelford Rail)	+1	+2	-3	0
Purple route from Travel Hub Site A (Shelford Rail)	+1	0	-3	0

1.5.4 Access to Granta Park Criteria

Access to Granta Park had four sub-criteria, as seen in Table 1.19.

Table 1.19: Access to Granta Park Criteria

	INSET Scores			
Option	**Compatibility with masterplan proposals**	**Landowner support**	**Degree to which campus is served**	**Directness of route**
Brown	+1	+2	+2	+2
Blue	+1	0	+2	+2
Black	+1	0	+2	+2
Pink	+1	+2	+2	+2
Purple	+1	0	+2	+2
Brown route from Travel Hub Site B (Shelford Rail)	+1	+2	+2	+2
Blue route from Travel Hub Site C (Shelford Rail)	+1	0	+2	+2
Black route from Travel Hub Site C (Shelford Rail)	+1	0	+2	+2
Pink route from Travel Hub Site B (Shelford Rail)	+1	+2	+2	+2
Purple route from Travel Hub Site A (Shelford Rail)	+1	0	+2	+2

1.5.5 Loss of Homes or Property Criteria

Loss of Homes or Property had two sub-criteria, as seen in Table 1.20.

Table 1.20: Loss of Homes or Property Criteria

	INSET Scores	
Option	Loss of commercial property	Loss of residential property
Brown	0	0
Blue	-1	0
Black	-1	0
Pink	0	0
Purple	0	0
Brown route from Travel Hub Site B (Shelford Rail)	-1	-1
Blue route from Travel Hub Site C (Shelford Rail)	-1	-1
Black route from Travel Hub Site C (Shelford Rail)	-1	-1
Pink route from Travel Hub Site B (Shelford Rail)	-1	-1
Purple route from Travel Hub Site A (Shelford Rail)	-1	-1

1.5.6 Improvements to Physical Wellbeing Criteria

Improvements to Physical Wellbeing had two sub-criteria, as seen in Table 1.21.

Table 1.21: Improvements to Physical Wellbeing Criteria

	INSET Scores	
Option	Increase in cycling uptake	Increase in walking uptake
Brown	0	0
Blue	0	0
Black	0	0
Pink	0	0
Purple	0	0
Brown route from Travel Hub Site B (Shelford Rail)	0	0
Blue route from Travel Hub Site C (Shelford Rail)	0	0
Black route from Travel Hub Site C (Shelford Rail)	0	0
Pink route from Travel Hub Site B (Shelford Rail)	0	0
Purple route from Travel Hub Site A (Shelford Rail)	0	0

1.6 Wider Economic Impacts Theme

This theme had 6 main criteria against which options were assessed. They are:

- Supporting the development of employment sites;
- Number of new housing sites supported;
- Number of new jobs created;
- GVA uplift;
- Land value uplift; and
- Increase in job catchment area.

1.6.1 Wider Economic Benefits Criteria

Table 1.22: Wider Economic Benefits Criteria

	INSET Scores					
Option	**Supporting the development of employment sites**	**Number of new housing sites supported**	**Number of new jobs created**	**GVA uplift**	**Land value uplift**	**Increase in job catchment area**
Brown	+3	+3	+3	+3	+3	+3
Blue	+3	+3	+3	+3	+3	+3
Black	+3	+3	+3	+3	+3	+3
Pink	+3	+3	+3	+3	+3	+3
Purple	+3	+3	+3	+3	+3	-3
Brown route from Travel Hub Site B (Shelford Rail)	+3	+3	+3	+3	+3	+3
Blue route from Travel Hub Site C (Shelford Rail)	+3	+3	+3	+3	+3	+3
Black route from Travel Hub Site C (Shelford Rail)	+3	+3	+3	+3	+3	+3
Pink route from Travel Hub Site B (Shelford Rail)	+3	+3	+3	+3	+3	+3
Purple route from Travel Hub Site A (Shelford Rail)	+3	+3	+3	+3	+3	-3

1.7 Alignment with Objectives Theme

This theme had 5 main criteria against which options were assessed. They are:

- Support Growth of Local Economy;
- Relieve Congestion and Improve Air Quality;
- Improve Active Travel Infrastructure and Public Transport Provision;
- Improve Road Safety; and
- Improve Connectivity to Employment Sites.

1.7.1 Support Growth of Local Economy Criteria

Support Growth of Local Economy had three sub-criteria, as shown in Table 1.23.

Table 1.23: Support Growth of Local Economy Criteria

	INSET Scores		
Option	Deliver journey time savings to jobs	Improve journey time reliability for public transport users	Infrastructure necessary to sustain economic growth
Brown	+2	+2	+3
Blue	+2	+2	+3
Black	+2	+2	+3
Pink	+2	+2	+3
Purple	+2	+2	+3
Brown route from Travel Hub Site B (Shelford Rail)	+2	+2	+3
Blue route from Travel Hub Site C (Shelford Rail)	+2	+2	+3
Black route from Travel Hub Site C (Shelford Rail)	+2	+2	+3
Pink route from Travel Hub Site B (Shelford Rail)	+2	+2	+3
Purple route from Travel Hub Site A (Shelford Rail)	+2	+2	+3

1.7.2 Relieve Congestion and Improve Air Quality Criteria

Relieve Congestion and Improve Air Quality had three sub-criteria, as seen in Table 1.24.

Table 1.24: Relieve Congestion and Improve Air Quality Criteria

	INSET Scores		
Option	**Encourage use of sustainable transport modes**	**Enhance quality of life**	**Relieve pressure at network pinch points**
Brown	+2	+2	0
Blue	+2	+2	0
Black	+2	+2	0
Pink	+2	+2	0
Purple	+2	+1	0
Brown route from Travel Hub Site B (Shelford Rail)	+2	+2	0
Blue route from Travel Hub Site C (Shelford Rail)	+2	+2	0
Black route from Travel Hub Site C (Shelford Rail)	+2	+2	0
Pink route from Travel Hub Site B (Shelford Rail)	+2	+2	0
Purple route from Travel Hub Site A (Shelford Rail)	+2	+2	0

1.7.3 Improve Active Travel Infrastructure and Public Transport Provision Criteria

Improve Active Travel Infrastructure and Public Transport Provision Criteria had four sub-criteria, as seen in Table 1.25.

Table 1.25: Improve Active Travel Infrastructure and Public Transport Provision Criteria

	INSET Scores			
Option	Deliver high quality public transport	Increase frequency of public transport during peaks	Reduce severance for pedestrians, cyclists and equestrians	Increase uptake of active travel modes for commuter journeys
Brown	+2	+3	+2	0
Blue	+2	+3	+2	0
Black	+2	+3	+2	0
Pink	+2	+3	+2	0
Purple	+2	+3	+2	0
Brown route from Travel Hub Site B (Shelford Rail)	+1	+3	+2	0
Blue route from Travel Hub Site C (Shelford Rail)	+1	+3	+2	0
Black route from Travel Hub Site C (Shelford Rail)	+1	+3	+2	0
Pink route from Travel Hub Site B (Shelford Rail)	+1	+3	+2	0
Purple route from Travel Hub Site A (Shelford Rail)	+1	+3	+2	0

1.7.4 Improve Road Safety Criteria

Improve Road Safety had three sub-criteria, as seen in Table 1.26.

Table 1.26: Improve Road Safety Criteria

	INSET Scores		
Option	Reduce number of accidents	Reduce number of speed related incidents	Improve safety of crossing movements for pedestrians, cyclists and equestrians
Brown	0	+1	0
Blue	0	+1	0
Black	0	+1	0
Pink	0	+1	0
Purple	0	+1	0
Brown route from Travel Hub Site B (Shelford Rail)	0	+1	0
Blue route from Travel Hub Site C (Shelford Rail)	0	+1	0
Black route from Travel Hub Site C (Shelford Rail)	0	+1	0
Pink route from Travel Hub Site B (Shelford Rail)	0	+1	0
Purple route from Travel Hub Site A (Shelford Rail)	0	+1	0

1.7.5 Improve Connectivity to Employment Sites Criteria

Improve Connectivity to Employment Sites had two sub-criteria, as seen in Table 1.27.

Table 1.27: Improve Connectivity to Employment Sites Criteria

	INSET Scores	
Option	**Improve access to CBC and Granta Park**	**Increase modal options for commuters travelling to CBC and Granta Park**
Brown	+3	+3
Blue	+2	+3
Black	+2	+3
Pink	+3	+3
Purple	+3	+3
Brown route from Travel Hub Site B (Shelford Rail)	+3	+3
Blue route from Travel Hub Site C (Shelford Rail)	+2	+3
Black route from Travel Hub Site C (Shelford Rail)	+2	+3
Pink route from Travel Hub Site B (Shelford Rail)	+3	+3
Purple route from Travel Hub Site A (Shelford Rail)	+2	+3

1.8 Policy Alignment Theme

This theme had 5 main criteria against which options were assessed. These are:

- Alignment with Mayoral Interim Transport Strategy Statement;
- Alignment with Cambridgeshire LTP3;
- Alignment with Transport Strategy for Cambridge City and South Cambridgeshire;
- Alignment with Cambridgeshire Long Term Transport Strategy;
- Level to which the option would permit City Access Plan (CAP).

Table 1.28: Policy Alignment Criteria

	INSET Scores				
Option	Alignment with Mayoral Interim Transport Strategy Statement	Alignment with Cambridgeshire LTP3	Alignment with Transport Strategy for Cambridge City and South Cambridgeshire	Alignment with Cambridgeshire Long Term Transport Strategy	Level to which the option would permit City Access Plan (CAP)
Brown	+3	+2	+3	+2	+1
Blue	+3	+2	+3	+2	+1
Black	+3	+2	+3	+2	+1
Pink	+3	+2	+3	+2	+1
Purple	+3	+2	+3	+2	+1
Brown route from Travel Hub Site B (Shelford Rail)	+3	+2	+3	+2	+1
Blue route from Travel Hub Site C (Shelford Rail)	+3	+2	+3	+2	+1
Black route from Travel Hub Site C (Shelford Rail)	+3	+2	+3	+2	+1
Pink route from Travel Hub Site B (Shelford Rail)	+3	+2	+3	+2	+1
Purple route from Travel Hub Site A (Shelford Rail)	+3	+2	+3	+2	+1

mottmac.com