# A428 Black Cat to Caxton Gibbet improvements

TR010044

Volume 6

6.1 Environmental Statement

Chapter 3: Assessment of Alternatives

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

26 February 2021

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009**

# A428 Black Cat to Caxton Gibbet improvements

Development Consent Order 202[ ]

## Chapter 3: Assessment of Alternatives

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| **Regulation Reference:** | Regulation 5(2)(a) |
| **Planning Inspectorate Scheme Reference** | TR010044 |
| **Application Document Reference** | TR010044/APP/6.1 |
| **Author** | A428 Black Cat to Caxton Gibbet improvements Project Team, Highways England |

| Version | Date | Status of Version |
|---|---|---|
| Rev 1 | 26 February 2021 | DCO Application |

# Table of contents



## Table of Tables

# 3 Assessment of alternatives

## 3.1 Assessment methodology

3.1.1 The Scheme has been subject to a process of staged development following identification of the need case in 2014. This has involved the identification, appraisal and evaluation of different options, which have led to the preliminary design submitted as part of the Development Consent Order (DCO) application in 2021.

3.1.2 In summary, the main development stages have been:

a. Identification of the need case (2014).

b. Initial options identification and assessment (2014).

c. Options development, shortlisting and assessment (2015 – 2016).

d. Non-statutory consultation (2017).

e. Option selection and development following non-statutory consultation (2017 – 2019).

f. Preferred route announcement and Statutory Consultation (2019).

g. Design changes following Statutory Consultation leading to the preliminary design (2019 – 2021).

3.1.3 The approach taken in each of the development stages is described further in Sections 3.2 to 3.4.

3.1.4 Key factors considered during the design-development of the Scheme have included:

a. The long-term effectiveness that design solutions would have in meeting the Scheme objectives (see **Chapter 2, The Scheme** of the Environmental Statement **[TR010044/APP/6.1]**).

b. The extent to which design solutions could impact the natural and built environment, and the ability to incorporate measures into the design to prevent, avoid, reduce or compensate for any adverse environmental effects on these environments.

c. Securing opportunities to include measures within the design to deliver environmental enhancement, where feasible and appropriate to do so.

d. The safety, deliverability, viability, practicality and cost of constructing, operating and maintaining design solutions.

3.1.5 The design-development process has been informed by the requirements of the *National Policy Statement for National Networks* (NPSNN) (Ref 3-1), consultation with stakeholders, and iterative environmental assessment. These have collectively influenced:

a. The identification and evaluation of different options for the Scheme.

b. The selection of a preferred option and its subsequent refinement to optimise the design and reduce, where practicable, the likely significant environmental effects of the Scheme.

c. The planned approach to the construction, delivery, maintenance and long-term management of the Scheme.

## 3.2 Reasonable alternatives studied

**Background**

3.2.1 The *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017* (Ref 3-2) require the Environmental Statement to contain a description of the reasonable alternatives studied by the applicant and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.

3.2.2 The determination of what constituted a reasonable alternative (and the level of assessment undertaken of each) directly related to their practicality and deliverability, and the benefits they would provide in comparison to other feasible solutions.

3.2.3 In evaluating the relative advantages and disadvantages of each, not all alternatives have been explored to an equal level of detail. For example, some options have been appraised and eliminated from further consideration early in the design-development process, whereas other options have been retained to a much later stage in the process, having been subject to repeated analysis and refinement.

3.2.4 Comparisons have been made with the Do-Minimum and Do-Nothing scenarios as part of the evaluation process, where necessary.

3.2.5 The following sections detail the Scheme's development timeline and the reasonable alternatives studied by Highways England during each stage of the design-development process.

**Identification of the need case (2014)**

3.2.6 Following the *2013 Spending Round* (Ref 3-3), the government announced its plans for the biggest ever upgrade of the strategic road network (SRN) in England.

3.2.7 In April 2014, the Highways Agency (now Highways England) published evidence reports for 18 Route Based Strategies (RBS) (Ref 3-4) which collectively covered the SRN. These were developed as part of Highways Agency's work on the identification of route strategies for England's motorways and trunk roads, and set out the key future challenges, opportunities and priorities for the SRN.

3.2.8 The *Felixstowe to the Midlands Route Strategy Evidence Report* (Ref 3-5) comprised one of the 18 identified RBSs. This identified that the route is a key corridor for international freight and is a focus for substantial growth in locations including Bedford, St. Neots and Cambridge.

3.2.9 Following the outcomes of the RBSs, several problem areas on the SRN were identified by the Highways Agency as needing improvement. These included the existing A428 route corridor between the existing Black Cat and Caxton Gibbet roundabouts.

3.2.10 Highways Agency undertook a high-level options identification and assessment (Ref 3-6) for possible improvements to this section of the SRN in 2014, having determined that the existing A428 between these two roundabouts had the following problems and issues:

a. The existing Black Cat roundabout, Wyboston junction, Barford Road, Cambridge Road and the existing Caxton Gibbet roundabout were identified as having capacity issues.

b. The route as a whole was identified as having safety and maintenance issues.

c. The existing A428 between Wyboston and Caxton was identified as having peak hour speeds of less than 40mph with link delays in the top 20% nationally.

d. The existing A428 was identified as one of the least reliable journey time sections nationally.

e. The existing Black Cat roundabout was identified as having a safety problem.

f. The existing A428 between Wyboston and Caxton was identified as being within the top 25% of highway links nationally for casualties per billion vehicle miles.

g. Flooding issues along the A1 between the existing Black Cat roundabout and Wyboston.

3.2.11 The high-level options identification and assessment also concluded that:

a. Forecast growth associated with key development sites in the area surrounding the existing A428 would likely exacerbate the identified problems and issues.

b. A number of constraints along the existing A428 including the East Coast Main Line, commercial and residential property, Wyboston Lakes (near St Neots), and flood plain associated with the River Great Ouse.

c. Opportunities existed for the improvements to remove traffic away from sensitive areas and residential properties, and to resolve long standing community severance issues.

d. Local planning policy supported the case for improvements to be made to the existing A428.

3.2.12 The evidence informed the publication of the *Felixstowe to Midlands Route Strategy* (Ref 3-6) by Highways England in April 2015, which established outline operational and investment priorities for the period April 2015 to March 2020.

3.2.13 The RBS (Ref 3-4) recorded that a number of roads and junctions on this part of the SRN are frequently congested, many of which are expected to experience increased traffic demand in the future. Specific reference was made to congestion and capacity problems experienced on the existing A428 between its junction with the A1 (just north of the existing Black Cat roundabout) and the A1198 (the existing Caxton Gibbet roundabout).

3.2.14 The content of these reports (Ref 3-4; Ref 3-5; Ref 3-6) identified the need for intervention on this particular section of the network, and subsequently led to a scheme of improvements being included within the *Road Investment Strategy for the 2015/16 to 2019/20 road period* (Ref 3-7) (RIS1), published by the Department for Transport (DfT) in March 2015.

3.2.15 *RIS1* (Ref 3-7) outlines a long-term programme for England's motorways and major roads. This announced a scheme referred to as "A428 Black Cat to Caxton Gibbet" and presented a case for *"…improvement of the A428 near St Neots, linking the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge, creating an Expressway standard link between the two cities via Bedford. The scheme is expected to include significant improvements to the Black Cat roundabout, where the A1 currently meets the A421."*

**Initial options identification and assessment (2014)**

3.2.16 Following the DfT's commitment to deliver the scheme of improvements presented in *RIS1* (Ref 3-7), Highways England explored a number of potential opportunities to improve the existing A428 route corridor between the existing Black Cat roundabout and the existing Caxton Gibbet roundabout.

3.2.17 The options identification and assessment work undertaken by the Highways Agency in 2014 (Ref 3-8) was updated by Highways England during 2015 and 2016, and then reported within the *A428 Black Cat to Caxton Gibbet Options Appraisal Report* (Ref 3-9) (OAR). Work was also undertaken by Highways England to establish the business case for the improvements.

3.2.18 The *OAR* (Ref 3-9) comprised a route-based study and analysis of possible options for improving the following problems associated with the route:

a. Inadequate public transport options along the corridor, with limited bus services and no parallel rail service provision.

b. A lack of viable alternative east-west routes between Cambridge and other economic centres such as Milton Keynes, Northampton and Bedford.

c. Poor provision for walkers, cyclists and horse riders.

d. Junctions along the corridor operating close to, or at, capacity.

e. Speeds on the single carriageway sections being significantly lower than those that are dualled, and peak hour speeds being significantly lower than the rest of the day.

f. Low resilience against accidents and incidents on the single carriageway section of the corridor, resulting in one of the least reliable journey time sections nationally.

g. Safety and maintenance issues, including a lack of driver information.

h. Flooding issues along the A1 between Black Cat and Wyboston.

3.2.19 A geographical area of impact was identified to inform the identification and development of options, broadly extending from the west of Bedford to the east of Cambridge, and from north of Huntingdon to the south of Biggleswade.

3.2.20 Workshops were also held to generate a long list of possible options, informed by the consideration of relevant policy and strategy documents, previous studies, analysis of available data, and engagement with stakeholders undertaken during the RBS process.

3.2.21 A total of 50 options were initially identified within the *OAR* (Ref 3-9). These included improvements to the existing A428, the construction of a new road and junctions, public transport improvements, and improvements for walkers, cyclists and horse riders. Some of these options involved packages (combinations) of these improvements.

3.2.22 Each of the 50 options was assessed using a two-stage sifting tool to evaluate their performance against the identified problems, the route objectives, deliverability and feasibility.

3.2.23 Following assessment, a total of 16 options were taken forward for further evaluation, these being solutions that were likely to be feasible and deliverable.

3.2.24 The 16 options were assessed to evaluate the strategic, economic, management, financial and commercial cases of each. The outcomes of this assessment concluded that the following eight options warranted further consideration:

a. **Option C1** – A428 full offline dualling with grade separation of the existing Black Cat roundabout and grade separation of the existing Caxton Gibbet roundabout.

b. **Option C2** – A428 full offline dualling with grade separation of the existing Black Cat roundabout and signalisation of the existing Caxton Gibbet roundabout.

c. **Option C5** – A428 bypass to Cambridge Road junction with grade separation at the existing Black Cat roundabout, and grade separation at the existing Caxton Gibbet roundabout.

d. **Option C6** – A428 bypass to Cambridge Road roundabout with grade separation at the existing Black Cat roundabout, and signalisation at the existing Caxton Gibbet roundabout.

e. **Option C7** – A428 single lane carriageway bypass to Cambridge Road roundabout with online dualling between Cambridge Road roundabout and Caxton Gibbet roundabout, grade separation at the existing Black Cat roundabout and grade separation at the existing Caxton Gibbet roundabout.

f. **Option C10** – Local junction widening with channelisation at existing A428 junctions, grade separation at the existing Caxton Gibbet roundabout, grade separation at the existing Black Cat roundabout and upgrades to existing A1 junctions.

g. **Option C11** – Local junction widening with channelisation at existing A428 junctions, signalisation at the existing Caxton Gibbet roundabout, grade separation at the existing Black Cat roundabout and upgrade to existing A1 junctions.

h. **Option C16** – A428 dual carriageway bypass to Cambridge Road roundabout with online dualling between Cambridge Road roundabout and the existing Caxton Gibbet roundabout, grade separation at the existing Black Cat roundabout and grade separation at the existing Caxton Gibbet roundabout.

**Options development, shortlisting and assessment (2015 – 2016)**

3.2.25 The eight shortlisted options were then assessed against criteria relating to: strategic fit; value for money; financial and delivery.

3.2.26 From a strategic perspective, Option C1 was considered to be the best performing option for a number of reasons including its fit with government policy, its impact on the problems and issues affecting the existing A428, and its greater likelihood of public acceptability.

3.2.27 The options were subsequently consolidated and renamed into the following options:

a. **Option 1 (C1/C2)** – Full offline dualling between Black Cat and Caxton Gibbet with a grade separated junction at Cambridge Road. Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

b. **Option 2 (C10/C11)** – Minor junction improvements along the existing A428 at Wyboston, Cambridge Road, Croxton and Eltisley. Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

c. **Option 3 (C5/C6)** – A428 bypass between Black Cat and Cambridge Road roundabouts. No widening between Cambridge Road and Caxton Gibbet. Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

d. **Option 4 (C7/C16)** – Offline dual carriageway bypass between Black Cat and Cambridge Road and online widening between Cambridge Road and Caxton Gibbet. Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

3.2.28 Following analysis of Options 1 to 4, two additional offline options to the south of the existing A428 (Options 5 and 6), and two lower cost options (Options 7 and 8) were developed:

a. **Option 5** – Full offline dualling between Black Cat and Caxton Gibbet with no connection to the Cambridge Road roundabout. The alignment lay to the north of Abbotsley. Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

b. **Option 6** – Full offline dualling between Black Cat and Caxton Gibbet with no connection to the Cambridge Road roundabouts. The alignment lay to the south of Abbotsley. Grade separation of both the Black Cat and Caxton Gibbet roundabouts.

c. **Option 7** – Dualling between Wyboston and the River Great Ouse crossing, and a new roundabout at Wyboston. Minor junction improvements at Barford Road and Cambridge Road. Grade separation at the existing Black Cat roundabout and a signalised junction at Caxton Gibbet.

d. **Option 8** – Grade separation of both the existing Black Cat and Caxton Gibbet roundabouts.

3.2.29 In addition, the following options for Black Cat junction were identified and considered:

a. **Option 1A** – Dumbbell roundabouts on Roxton Road with merge and diverge slips from A428 and A1 connecting to the two roundabouts.

b. **Option 1B** – Dumbbell roundabouts near the existing Black Cat roundabout with merge and diverge slips from A428 and A1 connecting to the two roundabouts.

c. **Option 1C** – Similar to Option 1B with merge and diverge on the A428 located further away from the mainline carriageway.

d. **Option 1D** – Dumbbell roundabouts on Roxton Road with merge and diverge slips from A428 connecting to the two roundabouts. New roundabouts on the A1 with merge and diverge slips from A1 connecting to the new roundabout, with a side road connecting the roundabout on the A1 and southern roundabout at Roxton.

e. **Option 1E** – Dumbbell roundabouts on Roxton Road and A1 with merge and diverge slips from A428 and A1 connecting to the two dumbbell roundabouts.

f. **Option 2A** – Dumbbell roundabouts on Roxton Road with diverge and merge from A428 connecting to the roundabouts. Another dumbbell to the east of A1 with diverge and merge from A428 connecting to these roundabouts with southbound diverge and merge on A1 connecting to east roundabout and link roads connecting east and west roundabouts.

g. **Option 2B** – One roundabout on Roxton Road with diverge and merge from A428 connecting to the roundabout. Another roundabout to the east of A1 with diverge and merge from A428 connecting to this roundabout with southbound diverge, merge on A1 and link roads connecting this roundabout.

h. **Option 3A** – One roundabout at the existing Black Cat roundabout with merge and diverge slip roads from A428 and A1 connecting the roundabout.

i. **Option 3B** – Similar to Option 3A with merge and diverge on the A428 moved further away from the mainline carriageway.

j. **Option 4** – Junction with slip roads and interchange links for all directions. Loop slip roads between A1 northbound and A428 eastbound as well as A1 southbound and A428 westbound.

k. **Option 5** – Eastbound diverge slip and westbound link from A428 connecting to A1 northbound and southbound respectively. Southbound diverge loop from A1 connecting to A428 westbound.

l. **Option 6** – Eastbound diverge link road from A428 connecting to A1 northbound and diverge slip connecting to the existing Black Cat roundabout. Southbound diverge link road from A1 connecting to A428 westbound, and westbound merge slip on A428 connecting from the existing Black Cat roundabout.

**Non-statutory consultation (2017)**

*Route options*

3.2.30 Following assessment against a number of criteria including environment, safety, constructability and accessibility, Options 1, 5 and 6 were identified as the best performing route options as they would meet the majority of the Scheme objectives and would provide the most significant benefits with the lowest potential environmental impact. It was concluded that these three route options should be taken forward for further development and assessment.

3.2.31 To inform the process of assessment, Options 1, 5 and 6 were renamed and described as follows, the designs of which are illustrated on **Figure 3.1** of the Environmental Statement **[TR010044/APP/6.2]**:

a. **Orange (Option 1)** – This route option comprised an offline solution between the existing Black Cat roundabout and the existing Caxton Gibbet roundabout (with associated tie-in works to the existing A421 and A428), whilst also providing a grade separated junction at Cambridge Road. The route was approximately 18.9 kilometres (11.7 miles) in length and a dual two lane all-purpose carriageway, with both the existing Black Cat roundabout and the existing Caxton Gibbet roundabout being grade separated. After the route crossed the East Coast Main Line railway, the alignment changed to a north direction for approximately 2.5 kilometres (1.6 miles), heading towards the existing A428 and B1046/St Neots Road and an improved grade separated Cambridge Road junction. The route then ran broadly parallel, and to the north of the existing A428 for approximately 9 kilometres (5.6 miles). The route crossed Toseland Road and B1040/St Neots Road, and passed through an improved grade separated Caxton Gibbet junction.

b. **Purple (Option 5)** – This route option comprised a wholly offline dual all-purpose carriageway running from Black Cat junction to Caxton Gibbet junction (with associated tie-in works to the existing A421 and A428), approximately 18.4 kilometres (11.4 miles) in length. From Black Cat to Caxton Gibbet, the route was aligned east towards Abbotsley for approximately 5 kilometres (3.1 miles). The alignment then changed to a north east direction, bypassing north of Abbotsley for approximately 2 kilometres (1.2 miles). Past Abbotsley, the route continued east for approximately 5 kilometres (3.1 miles), passing north-west of Great Gransden. The alignment then changed to a north direction passing Eltisley to the south and joining the existing Caxton Gibbet roundabout.

c. **Pink (Option 6)** – This route option comprised a wholly offline dual all-purpose carriageway running from the existing Black Cat roundabout to the existing Caxton Gibbet roundabout (with associated tie-in works to the existing A421 and A428), approximately 18.4 kilometres (11.4 miles) in length. From Black Cat to Caxton Gibbet, the route was aligned directly east towards Little Gransden for approximately 7 kilometres (4.3 miles). The alignment changed to a north east direction when it reached southern Abbotsley. The route bypassed Abbotsley to the south and continued in a north east direction for approximately 5.5 kilometres (3.4 miles) towards the mid-point between Eltisley and Great Gransden, where it continued in a northerly direction towards the existing Caxton Gibbet roundabout.

3.2.32 The routes of the Orange, Purple and Pink options are illustrated on **Figure 3.1** of the Environmental Statement **[TR010044/APP/6.2]**. These three route options were assessed to identify and compare their relative advantages and disadvantages, prior to being presented as part of a non-statutory consultation exercise (Ref 3-10) in Spring 2017. The main outcomes of this assessment are summarised in **Table 3-1**.

## Table 3-1: Summary of the assessment of the orange, purple and pink route options

| Aspect | Orange Option | Purple Option | Pink Option |
|---|---|---|---|
| Length | Approximately 18.9km | Approximately 18.4km | Approximately 18.4km |
| Traffic | Provides a connection for St Neots which could mean a greater amount of traffic use the new route.<br>Encourages additional traffic to travel through St Neots to access the new route.<br>Leads to more traffic using the B645, B660 to the west of the A1, as well as Ermine Street North. | Helps to remove traffic from local roads and near St Neots town centre.<br>Cuts traffic on the B1042 and B1046.<br>Leads to more traffic using Ermine Street North (towards Papworth Everard) and Ermine Street South (towards Caxton).<br>Potential for traffic to increase during evening peak periods on some local roads to the west of the A1. | Encourages traffic to shift from other strategic routes going east or west and so would cut traffic on the B1042 and B1046.<br>Leads to more traffic using Ermine Street North (towards Papworth Everard) and Ermine Street South (towards Caxton). |
| | Removes traffic from the existing A428 and reduces traffic through Barford Road, Great Gransden and Little Gransden.<br>Helps shift traffic away from local roads by encouraging drivers to use the existing dual carriageways of the A421 and A428. | | |
| Air Quality | Traffic along the existing A428 would reduce and therefore there could be air quality benefits to the communities along the existing A428. There is also an AQMA in the centre of St Neots. | | |
| Cultural Heritage | Potential to impact the setting of two deserted medieval villages at Weald and Wintringham, as well as the setting of a scheduled monument near the junction with the A1198 and a Grade II listed building to the east of Cambridge Road.<br>Reduces traffic noise and emissions around Croxton Park leading to improved noise and air quality impacts. | Potential to impact a scheduled monument near the junction with the A1198 as well as nine Grade II listed buildings.<br>This route option also passes within 500m of Abbotsley Conservation Area. | Potential to impact a scheduled monument near the junction with the A1198 as well as nine Grade II listed buildings.<br>The route would be further away from the Abbotsley Conservation Area than the Purple Option. |
| | There is the potential for unknown archaeological remains. | | |

| Aspect | Orange Option | Purple Option | Pink Option |
|---|---|---|---|
| Visual Impact | Visual impact where junction improvements are proposed at Black Cat junction, Cambridge Road junction and Caxton Gibbet junction.<br>Some rural properties may be affected as well as public rights of way to the east of St Neots. | Visual impact where junction improvements are proposed at Black Cat junction and Caxton Gibbet junction.<br>To the east of the River Great Ouse, visual impacts could potentially be experienced by rural properties on the northern edge of Abbotsley and southeast edge of Eltisley, as well as people using Abbotsley Golf Course. | Visual impact where junction improvements are proposed at Black Cat junction and Caxton Gibbet junction.<br>Potential visual impact to the east of the River Great Ouse, particularly for rural properties where the route is close to a number of farmsteads. |
| Ecology and Nature Conservation | Habitats which could be affected in the area include broadleaved woodland, lowland fen and floodplain grazing marshland. | Located within 5km of five Sites of Special Scientific Interest (SSSI) to the south of the route, and within 10km of the Eversden and Wimpole Woods Special Area of Conservation (SAC).<br>Habitats which could be affected in the area include woodland and floodplain grazing pasture. | Located within 1km of Weaveley and Sand Woods SSSI. It is also within 5km of five SSSIs. This is closer than the Purple Option and therefore more likely to have an impact. At this distance, impacts associated with air quality change, disturbance or habitat degradation could arise.<br>Located within 10km of Eversden and Wimpole Woods SAC.<br>Deciduous woodland would be directly affected. |
| | Located next to the River Great Ouse County Wildlife Site with the potential for impacts due to direct habitat loss, habitat degradation, changes in air/water quality, noise/light disturbance, and severance.<br>Presence of protected species including bats, [redacted], great crested newts and reptiles. | | |
| Geology and Soils | Temporary and permanent loss of best and most versatile agricultural land. | | |
| Noise and Vibration | Properties in and to the east/south east of Little Barford and north of the existing A428 may experience an increase in noise. | Properties on the northern side of Abbotsley are likely to experience increases in traffic noise. | Properties on the southern side of Abbotsley are likely to experience increases in traffic noise. |

| Aspect | Orange Option | Purple Option | Pink Option |
|---|---|---|---|
| | Reduced noise at residential properties along the A1 and south of St Neots. Residents in Croxton and Eltisley are likely to also experience a reduction in noise. | | |
| Rights of Way | Crosses public rights of way and requires safe crossings, diversions, or closures. Opportunities to improve access for walkers, cyclists and horse riders along the existing A428. | | |
| Water | Requires a new crossing over the River Great Ouse. Could alter existing flood risk patterns as a result of construction within the floodplain. | | |
| Climate Change | Designed to be more resilient to climate change, including potential for increasing capacity of drainage systems and providing surfacing more resistant to extreme weather conditions. | | |
| Sustainable Travel | Opportunities to improve access for walkers, cyclists and horse riders along the existing A428 with the potential for a positive effect on human health. | | |

*Black Cat junction options*

3.2.33 The 12 identified Black Cat junction options were assessed based on their constructability, safety, traffic flow and cost. This concluded that the following three options for Black Cat junction could be incorporated into the design of the route options, and should be taken forward to the non-statutory consultation (Ref 3-10):

a. **Option A** – Forming a combination of Options 1A and 1C, this comprised a three-tiered roundabout, removing the existing Black Cat roundabout, and involved the construction of two roundabouts to the west of the existing roundabout. A new free-flow continuous link from the A421 eastbound towards the A1 northbound would be created along with slip roads to and from the A421, the A1 and the A428. With this option the A1 would become a free-flow continuous road going under the slip roads.

b. **Option B** – Based on Option 6, this involved the construction of three main connector roads based on the most significant traffic flows. It comprised a two-tiered roundabout, retaining the existing Black Cat roundabout and would create a new free-flow continuous link from the A421 eastbound towards the A1 northbound. The addition of slip roads would provide a free-flow link, bypassing traffic moving southbound onto the A421, with the A1 remaining the same.

c. **Option C** – Based on Option 3B, this comprised a three-tiered junction, enlarging the existing Black Cat roundabout and creating a new free-flow continuous link from the A421 eastbound towards the A1 northbound. Slip roads would be built from the A421 to the A1, and the A428 and the A1 would become continuous free-flow roads through the widened Black Cat roundabout.

3.2.34 The three junction options were assessed to identify and compare their relative advantages and disadvantages, prior to being presented as part of the non-

statutory consultation exercise (Ref 3-10). The main outcomes of this assessment are summarised in **Table 3-2**.

**Table 3-2: Summary of the assessment of the Black Cat junction options**

| Aspect | Option A | Option B | Option C |
|---|---|---|---|
| Air quality | Air quality may improve slightly in the short term as traffic reduces at Black Cat junction. Until the route is built, there could be increased congestion around Wyboston which could have an impact on air quality. It will also be important to consider air quality at the Air Quality Management Area in St Neots. | | |
| Cultural heritage | Works to Tempsford Bridge could impact on the setting of the nearby scheduled monument. May affect the setting of the listed building to the north of Black Cat junction. | May result in the removal of the Grade II Listed building to the north of Black Cat junction. | |
| Archaeology | Potential to affect unknown buried archaeology. Affects areas of known archaeology, including cropmarks, and requires further archaeological investigation. | | |
| Ecology and nature conservation | May impact habitats and species within the River Great Ouse corridor. The area is a habitat enhancement area. | | |
| Geology and soils | Affects two minerals sites. Would need to take into account the programme for mineral extraction. | Has a large area within a minerals site. Would need to take into account the programme for mineral extraction. | Has a small area within a minerals site. Least likely to be affected by the programme for mineral extraction. |
| Noise and vibration | May improve noise levels slightly in the short term to properties around the existing Black Cat roundabout as well as improve noise levels in the Noise Improvement Area to the north of the existing Black Cat roundabout. Until the route is built, there is likely to be increased congestion at Wyboston which could temporarily impact on noise levels in this area. | | |
| Water | Has an area within the River Great Ouse floodplain and would require floodplain mitigation. | Has the largest area within the River Great Ouse floodplain compared to Options A and C and would likely have the greatest impact on flood risk. Requires floodplain mitigation. | Has the smallest area within the River Great Ouse floodplain compared to Options A and B. Requires some floodplain mitigation. |

## 3.3 Justification for chosen option

**Option selection and development following non-statutory consultation (2017 – 2019)**

*Option selection*

3.3.1 Feedback obtained from the non-statutory consultation (Ref 3-10) demonstrated widespread support for the Orange route option, and for Option C for the Black Cat junction, these being the most popular solutions from the options presented.

3.3.2 The feedback identified that the Orange route option:

a. Was close to the existing road.

b. Provided additional connectivity to St Neots by the Cambridge Road junction.

c. Improved traffic and congestion.

d. Was seen to be the most beneficial to the local economy.

e. Had the least environmental impact on ecology, designated sites, the visual environment, agriculture, heritage sites and the local community.

3.3.3 The feedback identified that Option C for the Black Cat junction:

a. Created free-flowing traffic at the junction.

b. Had the least overall impact on the local environment and the surrounding area.

c. Had the least landtake.

d. Improved traffic and congestion.

e. Was seen to be the most practical option, having the greatest capacity and flexibility to cope with any future increases in traffic.

3.3.4 The assessments demonstrated that the Orange route option and Option C for the Black Cat junction presented the best value for money, had the least overall impact on the environment, and provided the greatest economic return compared to the other options.

3.3.5 It was determined from the assessments that, whilst all three route options improved journey times, the Orange route option provided a new junction at Cambridge Road, thereby giving greater access for more drivers travelling to and from St Neots and providing better connections into the town and the train station. The Orange route option was also identified as removing the largest number of vehicles from the existing A428 and local roads, with the new dual carriageway reducing rat-running on smaller local roads in surrounding villages and removing long distance traffic using these roads as a diversion route.

*Development of the design following non-statutory consultation*

3.3.6 Based on the feedback from the non-statutory consultation (Ref 3-10) and the assessment of the route options, the design of the Orange route option was refined and developed further to take account of the following:

a. Future traffic growth on the road network and possible growth around St Neots.

b. Issues and constraints relating to landfill sites and overhead power lines.

c. Responses received from local communities and landowner discussions.

d. The emerging findings of the environmental impact assessment (EIA), traffic modelling and economic appraisal.

e. The outcomes of project team design review workshops.

f. Information obtained through intrusive and non-intrusive investigations, surveys, sampling and modelling undertaken as part of the design-development and EIA processes.

g. Engagement with statutory organisations and other stakeholders regarding the form and location of the Scheme, and environmental mitigation requirements.

3.3.7 Based on the feedback from the non-statutory consultation (Ref 3-10) and the assessment of the options for Black Cat junction, the height and visual impact of Option C was reduced by lowering the A1 under the junction.

**Preferred route announcement and Statutory Consultation (2019)**

3.3.8 Highways England published its *Preferred route announcement* (Ref 3-11) in February 2019, which confirmed the selection of the Orange route option and Black Cat junction Option C as the preferred options for the Scheme.

3.3.9 Statutory Consultation (Ref 3-12) on the preferred route for the Scheme was undertaken by Highways England in June 2019. This presented details of the main features and components of the preferred route, including information on:

a. The detailed alignment of the route and the design of junctions.

b. Provisions for walkers, cyclists and horse riders incorporated into the design.

c. Preliminary information on the likely environmental and traffic impacts of the Scheme.

d. Information on construction.

e. Environmental mitigation.

**Design changes post Statutory Consultation leading to the preliminary design (2019 – 2021)**

3.3.10 Following the Statutory Consultation (Ref 3-12), further development of the preferred route was undertaken in accordance with the criteria for ‘good design’, outlined in the *NPSNN* (Ref 3-1). This also took into account the feedback gathered from the Statutory Consultation (Ref 3-12).

3.3.11 Based on this feedback, refinements were made to:

a. The engineering design of the Scheme.

b. The planned methods of construction.

c. The use and extent of the land required to construct, operate and maintain the Scheme.

3.3.12 The changes were made to help maximise the Scheme's environmental benefits and minimise impacts on people and the environment through outcomes including a reduction of construction traffic and measures to improve access for local businesses and landowners.

3.3.13 The changes made to the design were consulted as part of a non-statutory supplementary consultation exercise (Ref 3-13) held between 24 June 2020 and 28 July 2020[1], the outcomes of which were used to inform the preliminary design of the Scheme.

*Preliminary design*

3.3.14 A description of the preliminary design of the Scheme, and the Development Consent Order Limits on which the EIA has been undertaken, is presented in **Chapter 2, The Scheme,** of the Environmental Statement **[TR010044/APP/6.1]**.

3.3.15 The adoption of the preliminary design has enabled the EIA to identify, and be based on, a 'worst case' design, including limits of deviation, the details of which are presented in **Chapter 4, Environmental Assessment Methodology** of the Environmental Statement **[TR010044/APP/6.1]**.

3.3.16 Further details of the outcomes of consultation and how these have influenced the design of the Scheme are presented in the Consultation Report **[TR010044/APP/5.1]**.

## 3.4 Main alternatives considered following preferred route announcement

3.4.1 Since the *Preferred route announcement* (Ref 3-11), collaboration between the Scheme's environmental assessors, highway design engineers and drainage specialist has been an integral part of the design development process.

3.4.2 This collaboration has been undertaken with the aim of avoiding environmental constraints where possible, mitigating the Scheme's environmental effects and taking account of consultation responses and feedback.

3.4.3 Key alternatives that have been considered during the design development of the Scheme are summarised below:

a. The design of the footbridge at Wintringham Brook.

b. Road design options and mitigation considered for the Grade II listed Brook Cottages.

c. Options considered for the location of borrow pits.

[1] This consultation period was extended for some people who had delayed access to the necessary information, to give them the full time to respond. This extended period ended on 15 September 2020.

d. Location of floodplain compensation areas.

e. Options considered for bat mitigation.

f. The inclusion of noise bunds at Roxton and Potton Road.

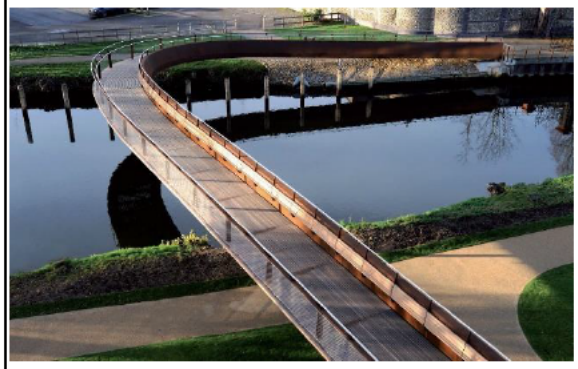
g. Locations considered for construction compounds.

3.4.4 **Table 3-3** to **Table 3-8** present the alternatives and options considered for each of the above, and the main outcomes of the appraisal and design processes.

## Table 3-3: The design of the footbridge at Wintringham Brook

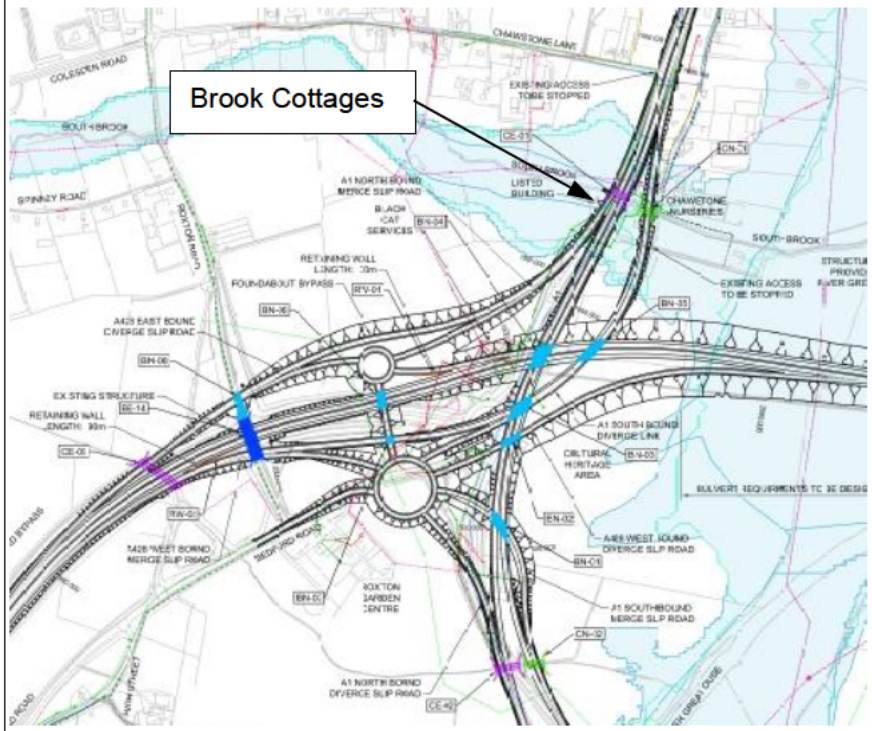
| Alternatives considered | Appraisal and design |
|---|---|
| **Date of decision: June 2018**<br>1. Suspension bridge<br>2. Bow arch bridge<br>3. Cable stayed bridge<br>4. Single span steel girder bridge with cantilever edges<br>5. Horizontally curved superstructure bridge<br>**Example of option 1: Suspension bridge**<br>  <br>**Examples of option 2: Bow arch bridge - Option 2.A**<br>  | The key drivers from a landscape and visual impacts perspective were to reduce the overhead elements of the structure which would negatively affect the open countryside, and to integrate the structure into the landscape setting by ensuring a low profile with structural support from beneath.<br>The objective was to provide an unobtrusive structure that integrated with surrounding features in line with the Highways England document *The Road to Good Design* (Ref 3-14) and principles for good road design including: "fits in context" and "is restrained".<br>As the location of the bridge is at a prominent point in the surrounding landscape, at approximately 1km to the east of the settled fringes of St Neots, progressing with a structure which achieved this objective would reduce the visual impact upon a large number of sensitive views in the surrounding context.<br>**Option 1: Suspension bridge**<br>This option was considered less preferable than other options as the location of the footbridge at Wintringham Brook would not have vegetation to screen the cantilevers (as shown in the example). Consequently, the overhead elements of this structure would be more imposing. This option was also considered less preferable as a bespoke form of structure such as this would be more expensive to design and construct, take longer to deliver, and its complexity and unusual nature could result in it having greater safety issues than other options. |

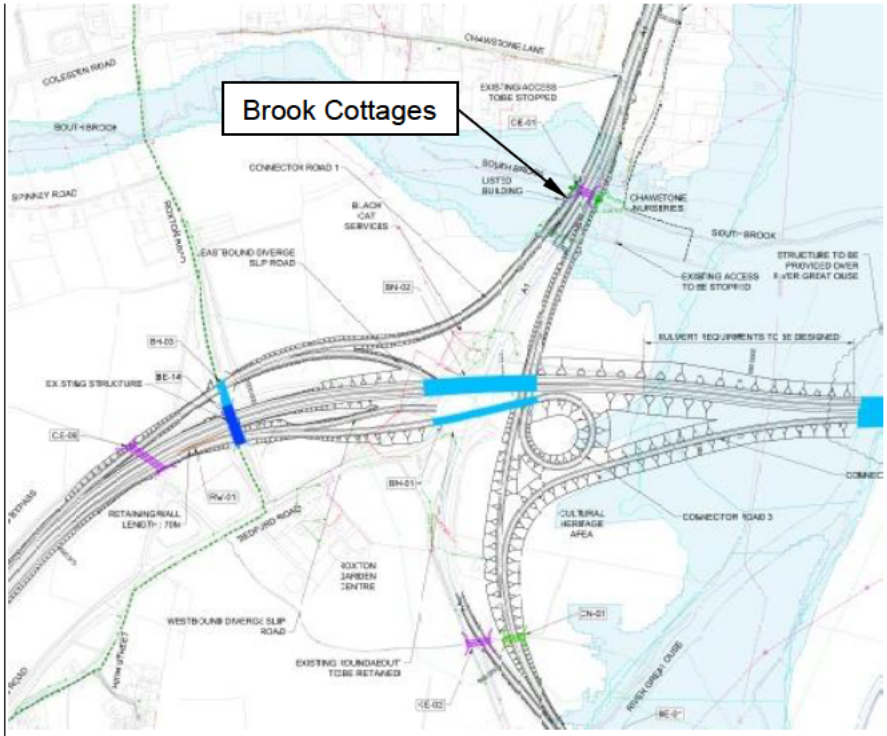
| Alternatives considered | Appraisal and design |
|---|---|
| **Examples of option 2: Bow arch bridge - Option 2.B**<br>  <br>**Example of option 3: Cable stay bridge**<br>  | **Option 2: Bow arch bridge**<br>Option 2A: The overhead elements of this bridge type are relatively prominent and would not have integrated well with the surrounding landforms. Subsequently, Option 2.B was proposed with a timber structure and a lower arch. Timber would have been more in context in the setting of the open (rural) countryside directly to the east of St Neots and the lowered arch would have greatly reduced the overhead elements and imposing nature of the structure. However, timber was not considered to be a suitable material for a bridge over the trunk road network, as it has inferior durability compared to steel and concrete, and an increased susceptibility to malicious dismantling, and the potential for items being dropped on to the road below.<br>**Option 3: Cable stay bridge**<br>This option was considered slightly preferable over the designs for Option 2; however, the overhead elements of this bridge would still be visually prominent. Also, this bridge design would not meet the requirements for durability and resilience. |

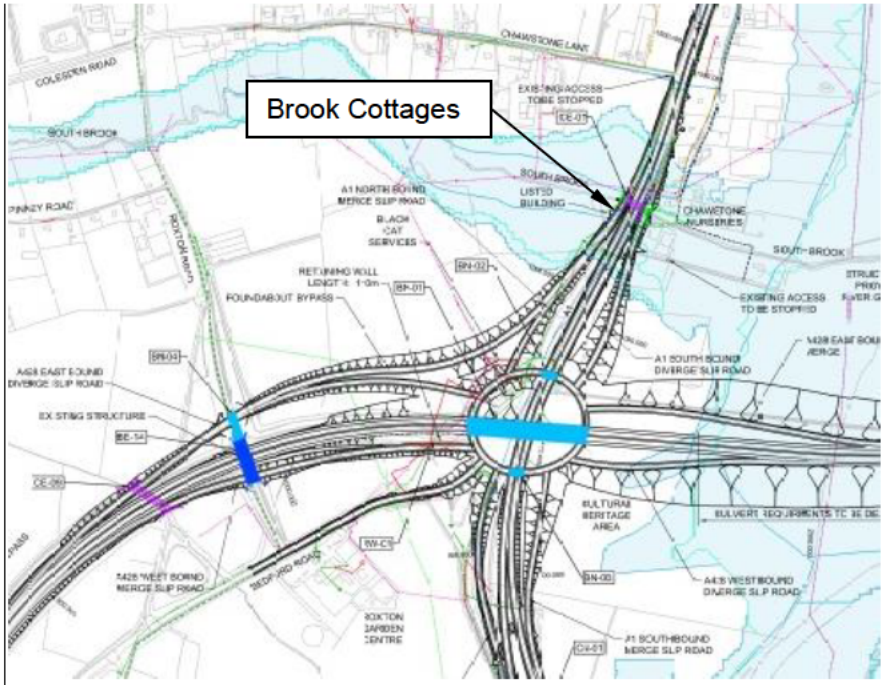
| Alternatives considered | Appraisal and design |
|---|---|
| **Examples of option 4: Single-span steel girder bridge - Option 4.A**<br>  <br>**Example of option 5: Horizontally curved superstructure bridge**<br>  | **Option 4: Single span girder bridge**<br>This type of bridge was considered preferable over the other options as it has the least obtrusive overhead elements allowing better integration with the surrounding landscape. It would also be less expensive than other options, and would meet the criteria for durability and resilience that was not met by Option 2.B and Option 3.<br>**Option 5: Horizontally curved superstructure bridge**<br>Option 5 was considered a preferable option from a visual perspective as it has a shallow profile, an elegant design and no large supporting structures. However, the horizontal curve of the bridge would mean that such a design would be complex to construct, would require a longer span and more complex foundations than a straight bridge, increase maintenance requirements and cost significantly more than other options and, subsequently, it was not deemed to be a viable option.<br>**Decision**<br>A single span steel girder bridge with cantilever edges was selected as the other options which met the cost and safety criteria would have resulted in greater landscape and visual impact. A 'statement' bridge such as Option 2.A or Option 3 was considered but a low-profile option was chosen instead to fit with the landscape setting and the surrounding sensitive views. |

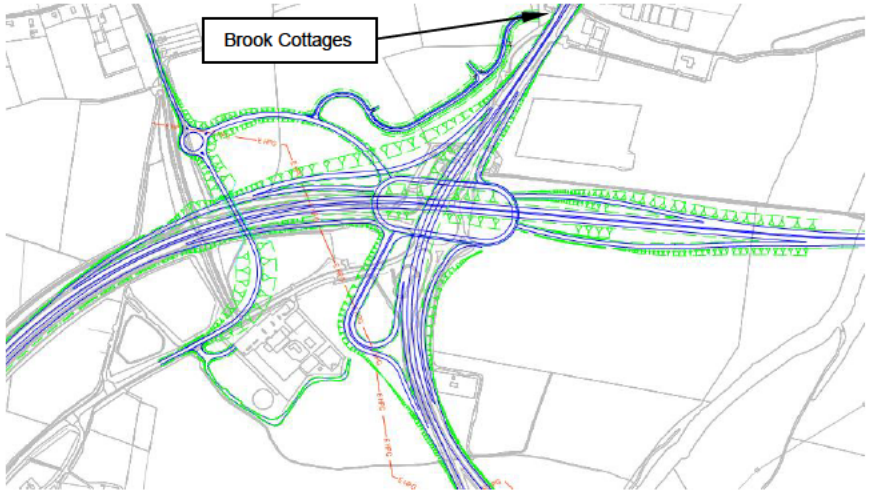
## Table 3-4: Brook Cottages Grade II listed building (Historic England list entry no. 1311862)

| Alternatives considered | Appraisal and design |
|---|---|
| **Design Options**<br><br>The Grade II listed Brook Cottages has been an ongoing consideration throughout the design process for the Scheme, due to its proximity to the proposed Black Cat junction. The Black Cat Junction Design Options report **[TR010044/APP/7.7]** sets out how the design of the Black Cat junction has developed and the reasons why demolition of Brook Cottages is necessary in order to deliver the Scheme and therefore to provide the substantial public benefits which will be realised from the Scheme's delivery.<br><br>The design of the new junction at Black Cat evolved over time and was informed by the *RIS1* (Ref 3-7) and the Road Investment Strategy 2:2020–2025 (Ref 3-15) (RIS2). *RIS2* (Ref 3-15). In order to meet the requirements of the *RIS1* (Ref 3-7), *RIS2* (Ref 3-7) and the Scheme objectives, the design had to deliver the following:<br><br>a. Compliance with highway design and safety standards contained in the *Design Manual for Roads and Bridges* (Ref 3-16), in order to meet the Scheme objective of improving safety.<br><br>b. Provision of a new three tier grade-separated all movement junction in order to deliver a free-flowing network as set out in the *RIS2* (Ref 3-15). This includes a free flow link for the A421 to the new dual carriageway and a free flow link for the A1 through traffic.<br><br>c. Provision of a free flow link from the A421 eastbound carriageway to the A1 northbound carriageway.<br><br>d. Maintaining access from Bedford Road as this comprises a key link of the local road network between Bedford and the existing Black Cat Junction.<br><br>e. The ability for vehicles on the A1 to exit and re-join at the junction in order to avoid the area below the new Black Cat junction if it is not | Options A, B and C were presented during non-statutory consultation (Ref 3-10) in March 2017.<br><br>Of the 4189 responses to the consultation that were received, 3718 responded to having a preference to the Black Cat junction options and 2538 respondents expressed a preference for one of the three junction options.<br><br>Option C received the most support from respondents with 1533 of the 2538 (60%) expressing it as their preferred option. Reasons for supporting Option C included:<br><br>a. The creation of free-flowing traffic at Black Cat junction.<br><br>b. The least amount of landtake required.<br><br>c. The greatest capacity to cope with future increases in traffic.<br><br>In addition, to receiving the most support during consultation, Option C also scored the highest when evaluated against the Scheme objectives<br><br>Following the decision to proceed with Option C, a variation of the Option was developed with the primary objective of enabling Brook Cottages to be retained in its existing location; this Option was referred to as Option C+. |

| Alternatives considered | Appraisal and design |
|---|---|
| passable in the event of an incident. This meets the Scheme objective of improving resilience.<br><br>Twelve potential junction layouts were considered for the Black Cat junction. Of these twelve options, the following three were taken forward:<br><br>  <br><br>**Option A** – Option A consisted of a three-tier grade separated junction with a dumbbell roundabout located between Roxton Road and the existing Black Cat roundabout. This option required removal of Brook Cottages. | |

| Alternatives considered | Appraisal and design |
|---|---|
|  <br>**Option B** – Option B involved the construction of three main connector roads in the vicinity of the A428 and the A1 based on the most significant traffic flows. This option required removal of Brook Cottages. | |

| Alternatives considered | Appraisal and design |
|---|---|
|  <br>**Option C** - Option C consisted of a three-tier grade separated junction with the A1 as the lowest tier, the existing Black Cat roundabout as the second tier and the new dual carriageway as the third tier. This option required removal of Brook Cottages. | |
| **Option C+**<br><br>Option C+ was a development of the Option C design with modification/relocation of the northbound on-slip road to a looped arrangement south of the junction to retain Brook Cottages. | In developing the Option C design, Highways England sought to develop a variation of the design that would enable Brook Cottages to be retained, whilst still delivering the Scheme objectives. The arrangement that was developed was referred to as Option C+. |

| Alternatives considered | Appraisal and design |
|---|---|
|  | Option C+ is described in detail in the Black Cat Design Options report **[TR010044/APP/7.7]**.<br><br>It was determined that although Option C+ did not require the demolition of Brook Cottages, it presented unacceptable technical and safety issues. In summary, Option C+:<br><br>a. Would result in an unacceptable impact on safety due to likelihood of queuing on the slip road. This was due to the design of the taper merge arrangement being insufficient to cope with predicted traffic flows. This is the only merge arrangement that could be accommodated in order to meet the objective of retaining Brook Cottages. As such, Option C+ did not meet the Scheme objectives relating to 'Connectivity' and 'Safety'.<br><br>b. Was significantly more expensive than Option C due to additional land being required, complex utility diversions, complex structures and additional traffic management.<br><br>c. Increased the scale of engineering works and resulted in a junction layout which would be difficult to understand for road users which could lead to an increase in accidents and a less safe design.<br><br>d. Had poor operational resilience if the A1 northbound were to become blocked due to an incident or flooding, and therefore did not meet the Scheme objective relating to 'Resilience'.<br><br>Based on the above, it was concluded that Option C+ was not a safe design solution and that it would not meet technical requirements or the need or objectives for the Scheme.<br><br>Accordingly, further design work was undertaken to develop an alternative, known as Refined Option C. This option is comparable to the arrangement presented at the non-statutory consultation (Ref 3-10). Importantly, Refined Option C allows for the safe movement of strategic and local traffic. |

| Alternatives considered | Appraisal and design |
|---|---|
| **Brook Cottages demolition: outcome options**<br><br>Brook Cottages, a Grade II listed building, has been identified for demolition as part of the Scheme. | The requirement to demolish Brook Cottages is demonstrated in the Black Cat Junction Design Options report **[TR010044/APP/7.7]**, which explains that there is no suitable alternative design for the Black Cat junction which would avoid demolition of the property.<br><br>In evaluating options for the building post-demolition, Highways England has considered the following alternatives:<br><br>a. Option 1: Relocating Brook Cottages to a museum.<br><br>b. Option 2: Relocating Brook Cottages to a nearby site for habitation.<br><br>c. Option 3: Demolition of Brook Cottages without relocation.<br><br>**Option 1:**<br><br>A number of museums have been contacted to establish the viability of reconstructing the building at a museum, with a positive response received from the Museum of East Anglian Life (Ref 3-17) who has confirmed that, in principle, it is willing to accept the building; however, this is subject to detailed discussions and terms yet to be agreed. This option also relies on intrusive surveys being undertaken to confirm that the structure is in a suitable condition to allow relocation.<br><br>**Option 2:**<br><br>This option would result in structural elements of Brook Cottages being relocated to a suitable nearby site, with elements replaced to bring it up to current housing standards for habitable use.<br><br>Although relocating Brook Cottages and retaining its existing residential use would retain elements of the historic fabric, it is considered that the extent of works required to make it habitable and viable for residential use would erode its historic interest to such an extent that it would not meet the criteria for listing, resulting in a loss of heritage significance. |

| Alternatives considered | Appraisal and design |
|---|---|
| | **Option 3:**<br><br>Should the intrusive surveys conclude that the structure of Brook Cottages is not of a condition that allows relocation, the building would be demolished. In this event, the building would be dismantled in a sympathetic manner to enable thorough recording prior to its loss.<br><br>**Appraisal**<br><br>As detailed in the Brook Cottages Statement within Appendix E of the Case for the Scheme **[TR010044/APP/7.1],** due to the requirement to complete intrusive surveys, no final decision has been made on the outcome of Brook Cottages.<br><br>In light of this, the EIA has been based on the worst-case assumption of Option 3 being the outcome for the building i.e. that the building is demolished and cannot feasibly be relocated elsewhere.<br><br>Notwithstanding this, Highways England's commitment to relocate the building to a museum, subject to the survey confirming capability for reconstruction, is secured through Requirement 16 in the DCO **[TR010044/APP/3.1].** |

## Table 3-5: Locations of borrow pits

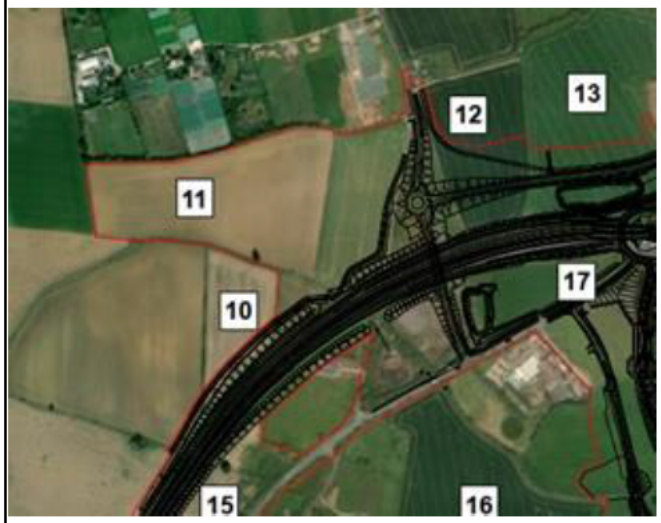
| Alternatives considered | Appraisal and design |
|---|---|
| **Date of decision: 2019 - 2020**<br><br>A significant lack of suitable earthworks material for re-use (approximately 500,000m$^3$ of Class 1 / Class 2 material) was identified during a buildability study in August 2019. The earthworks deficit was a result of key decisions made regarding junction layouts and construction strategy, and the decision to negate the need for pumped surface water drainage systems at several locations along the route of the new dual carriageway, including the Cambridge Road junction and Caxton Gibbet junction, by avoiding lowering the road level (to purposely increase excavation volumes) the result of which would have created low points in the road that would require pumped drainage systems and increase the operational risk of the new dual carriageway flooding in the event of pump or power failure.<br><br>This deficit in materials led to three possible strategic buildability options being presented:<br><br>a. Option A – to import all deficit material and off-site disposal of Class 4 materials.<br><br>b. Option B – incorporation of borrow pits (at the existing Black Cat roundabout and the existing Caxton Gibbet roundabout) and mitigation bunds.<br><br>c. Option C – include eastern borrow pits (at the existing Caxton Gibbet roundabout) but not western borrow pits (at the existing Black Cat roundabout).<br><br>Full details of the Borrow Pit locations selection process can be found in the Borrow Pits Optioneering Report **[TR010044/APP/7.6].** | Option B was selected by the project team as the borrow pits would save approximately 125,000 lorry movements (which would be required to import the shortfall of acceptable fill material) on the local road network resulting in reductions in: traffic, overall cost of the Scheme, length of the construction phase, and in carbon emissions due to the reduced distance over which the material would need to be transported.<br><br>Material was identified to be required at four primary Scheme locations including:<br><br>a. The new Roxton Road link and the new Roxton Road bridge embankments.<br><br>b. The embankment for the new dual carriageway on the approach to the River Great Ouse.<br><br>c. The embankment west of the new Caxton Gibbet junction.<br><br>d. The embankment east of the new Caxton Gibbet junction. |
| **Initial sifting of borrow pit locations** | A high-level environmental appraisal was undertaken on each site. This focused on the presence of trees and hedgerows, and whether |

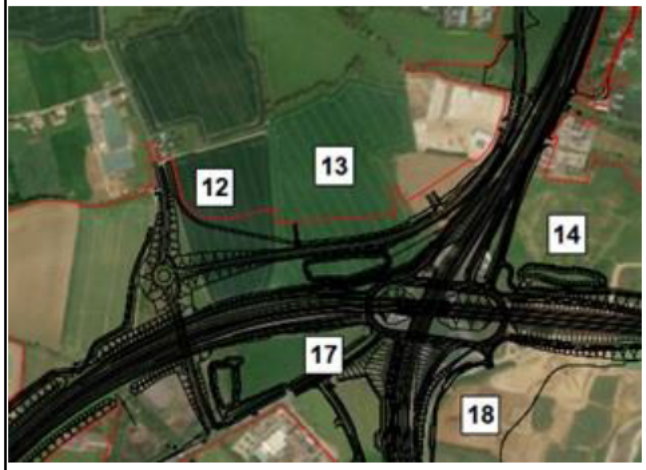
| Alternatives considered | Appraisal and design |
|---|---|
| A total of 20 sites were selected for the initial long list of sites:<br>  <br>**Figure 1: Long list of borrow pit sites in proximity to the existing Caxton Gibbet roundabout**<br>  <br>**Figure 2: Long List of borrow pit sites in proximity to the existing Black Cat roundabout and Roxton Road** | any of the sites had been identified as having archaeological potential.<br><br>The sites on the long list were then assessed for suitability based on the following criteria: the size of the site, the depth required to obtain the material required, and the distance from the site to where the material would be required. This appraisal resulted in seven sites: 3, 4, 5, 11, 13, 14 and 19, being shortlisted for further assessment. Three near to the Caxton Gibbet junction and four near to the Black Cat junction.<br><br>The following secondary environmental criteria were identified as potential site differentiators in the appraisal for environment, and are described in more detail below:<br><br>a. Noise and vibration.<br><br>b. Landscape and visual.<br><br>c. Ecology.<br><br>d. Cultural heritage.<br><br>e. Hydrology.<br><br>f. Public access.<br><br>A number of environmental topics were discounted as secondary criteria for the appraisal for the following reasons:<br><br>g. Air quality – it was assumed that best practice mitigation measures would be applied at all borrow pit sites where close to sensitive receptors, therefore this topic was not seen as a differentiator between borrow pit sites.<br><br>h. Geology and soils – All shortlisted sites at Black Cat and Caxton Gibbet respectively are located on agricultural land of the same Agricultural Land Classification grade (Ref 3-18), so this would not be a differentiator in the options appraisal. In terms of |

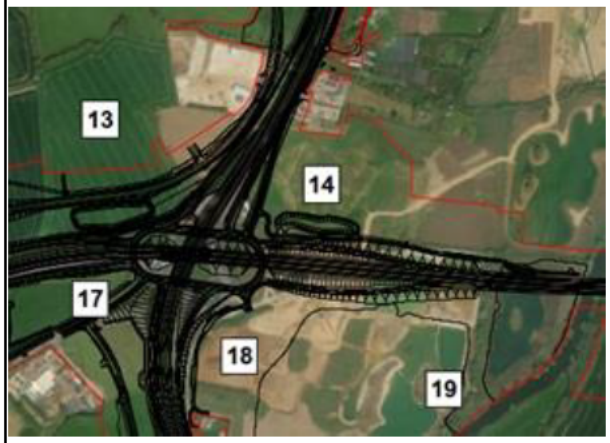
| Alternatives considered | Appraisal and design |
|---|---|
| | groundwater, none of the sites are located within a Source Protection Zone, and groundwater vulnerability mapping shows that all sites are either medium to low or low vulnerability. The geology and soils topic was therefore not seen as a differentiator between borrow pit sites.<br>i. Climate – this topic was not seen as a differentiator between borrow pit options as it was not expected that there would be a material difference in the appraisal.<br>Sites 1, 2, 10, 12, 15 and 17 were considered not large enough (in terms of the size of land available to extract the required quantities of fill material) and were therefore discounted. Smaller sites such as these would also mean deeper borrow pits which has the potential to impact the water table and surrounding groundwater.<br>Site 18 was discounted due to the fact that the site has been identified as a construction compound location. |
| **Caxton Gibbet Borrow Pit Locations Considered**<br>**Site 3**<br>  | **Appraisal**<br>Site three was a suitable size for the fill material required and had good access to the location where it would be needed. Additionally, it would not be necessary for construction plant using the site to cross any main roads to place the fill material, reducing potential safety and traffic issues.<br>Human receptors at Iway Inn Hotel and nearby farms, including a residential property, and businesses (to the south) could experience adverse noise and visual effects due to the proximity and potential visibility of construction plant, machinery and vehicles. The Iway Inn Hotel is approximately 50m east of the site, and the farm buildings are more than 200m to the west.<br>With the implementation of appropriate mitigation measures such as controlled working hours and installation of temporary hoarding |

| Alternatives considered | Appraisal and design |
|---|---|
| | fences at specific locations, the potential temporary noise impacts to these receptors are unlikely to result in significant adverse effects. Temporary hoarding fences would also reduce the impacts to visual amenity as far as practicable. |
| **Site 4**<br>  <br> | **Appraisal**<br>Site four was a suitable size for the fill material required and had good access to the location where it would be needed. Additionally, it would not be necessary for construction plant using the site to cross any main roads to place the fill material, reducing potential safety and traffic issues. The location was not shown to be near to any areas of archeological interest.<br>Human receptors at Iway Inn Hotel, a nearby farm and a cycleway would be likely to experience adverse noise and visual effects if the site was chosen due to the proximity and potential visibility of construction plant, machinery and vehicles. The Iway Inn Hotel is approximately 10m west of the site, the farm buildings are approximately 150m to the east, and the cycleway is approximately 100m to the south.<br>The predicted adverse noise and visual effects would be mitigated with the implementation of measures such as controlled working hours and installation of temporary hoarding fences. Subsequently, the potential temporary noise impacts to these less sensitive and transient receptors are unlikely to result in significant adverse effects. |
| | **Appraisal**<br>Site five was a suitable size for the fill material required and had good access to the location where it would be needed. It would not be necessary for construction plant using the site to cross any main roads to place the fill material, reducing potential safety and traffic issues. A Grade II listed building located approximately 100m to the |

| Alternatives considered | Appraisal and design |
|---|---|
| **Site 5**<br>  <br> | south would have the potential to be affected by the construction works at the site, e.g. effects on the setting of this asset.<br><br>There is a Noise Important Area approximately 100m south of this site which includes residential properties.<br><br>Human receptors at nearby farms, residential buildings and a cycleway are likely to experience adverse noise and visual effects due to the proximity and potential visibility of construction plant, machinery and vehicles. The farms and residential properties are approximately 20m to the north of the site, and the cycleway is directly to the south. It was predicted that the residential properties could potentially experience a large increase in noise due to their proximity to the site.<br><br>Given the proximity of the identified noise receptors to the site, even with the implementation of mitigation measures, the activities and processes associated with the abstraction of fill material are likely to generate significant temporary adverse effects at one of the residential properties (Common Farm Cottages).<br><br>Taking the above into consideration, the site would have no long term adverse environmental effects, but because of the potential for significant environmental effects, it is considered to perform less well than Sites 3 and 4.<br><br>**Caxton Gibbet Borrow Pit Decision**<br><br>Sites 3 and 4 were selected as the preferred borrow pit sites near Caxton Gibbet junction.<br><br>Site 3 performed well, and Site 4 performed better than Site 5 due to the lower magnitude of potential environmental impacts, for example significant temporary adverse noise and visual effects are anticipated at Common Farm Cottages (Site 5). |

| Alternatives considered | Appraisal and design |
|---|---|
| | Consequently, Sites 3 and 4 were selected as the preferred borrow pit sites at Caxton Gibbet junction. |
| **Black Cat junction potential borrow pit sites - Site 11**<br>  <br> | **Appraisal**<br>Site 11 is a suitable size for the fill material required and has direct access to the Northern Roxton Road Bridge embankment; where the fill material would be deposited. Additionally, it would not be necessary to cross any main roads to place the fill material, reducing potential safety and traffic issues.<br>Human receptors at nearby residential buildings, businesses and farm buildings along Spinney Road may experience adverse noise and visual amenity effects due to the proximity and potential visibility of construction plant, machinery and vehicles. The identified sensitive receptors would be approximately 70m to 200m from the borrow pit.<br>A small watercourse, Rockham Ditch, is immediately adjacent to the south of the site and South Brook (a tributary of the River Great Ouse) is located approximately 300m to the northern Order Limits.<br>A public footpath dissects the western part of the site and runs alongside the southern Order Limits of the site adjacent to Rockham Ditch. The footpath would need to be diverted to a route where the visual amenity effects on human receptors using it would be less prominent.<br>By implementing mitigation measures such as the use of controlled working hours, diversion of the footpath and the installation of temporary hoarding fences, it is predicted that the site would experience no long term adverse environmental effects. |
| | **Appraisal** |

| Alternatives considered | Appraisal and design |
|---|---|
| **Site 13**<br>  <br> | Site 13 is a suitable size for the fill material required, it is located on the same side of the highway as the proposed new Roxton Road link; however, a side road crossing would be required for Roxton Road bridge embankment fill.<br><br>There are two Noise Important Areas within 300m of this site along the A1 (Great North Road).<br><br>The nearest human receptors include Gleneden Plant Sales construction equipment supplier immediately to the east. Isolated residential properties are located approximately 150m to the west. Residential properties to the north of the site are also within the study area. It is possible that these receptors may experience changes in noise levels or to visual amenity. However, with the implementation of appropriate mitigation measures such as controlled working hours and installation of temporary hoarding fences at specific locations, visual amenity impacts would be reduced as far as practicable and noise impacts are unlikely to result in significant effects.<br><br>There are a number of Grade II listed buildings within 300m of this site, particularly to the north in Chawston which could experience a temporary change in setting.<br><br>South Brook (a tributary of the River Great Ouse) is located approximately 50m to the north of the site. Additionally, the northern extent of the site falls within Flood Zone 2.<br><br>Public footpaths run approximately north to south adjacent to the western and eastern boundaries of the site. The footpaths would experience some indirect effects from noise and visual intrusion; however, severance or diversion would not be required.<br><br>By implementing mitigation measures such as the use of controlled working hours, retention of existing hedges and trees, and the installation of bunds and temporary hoarding fences, it is predicted |

| Alternatives considered | Appraisal and design |
|---|---|
| | that the site would experience no long term adverse environmental effects. |
| **Site 14**<br>  <br> | **Appraisal**<br>Site 14 is a suitable size for the fill material required and the fill material could be placed directly into the east coast embankment of the Black Cat junction reducing the disruption caused by road movements which would otherwise be required. Additionally, it would not be necessary to cross any main roads to place the fill material, reducing potential safety and traffic issues.<br>Human receptors at nearby businesses, farm buildings and a residential property may experience adverse noise and visual effects due to the potential visibility of construction plant, machinery and vehicles. In the event they are still in-situ, there is the potential for a temporary change in setting for a Grade II listed building (Brook Cottages) located approximately 100m to the north-west of the site. However, Brook Cottages would be demolished as a result of constructing the Scheme, in which case no change in setting arising from the borrow pits would occur.<br>The identified sensitive receptors would be approximately 50 – 100m from the borrow pit. Overall, this site has a relatively high number of human receptors in proximity that would potentially be affected by the construction works from a noise and visual perspective.<br>There are two Noise Important Areas close to the site, approximately 50m to the west, and 150m to the north of the site.<br>The eastern extent of the site is within Flood Zone 2 and 3; however, it is likely that with additional development, these areas can be removed from the Order Limits.<br>By implementing mitigation measures such as the use of controlled working hours and the installation of temporary hoarding fences at affected receptors it is predicted that the site would have no long |

| Alternatives considered | Appraisal and design |
|---|---|
| | term adverse environmental effects, and the potential environmental impacts associated with the site can be suitably mitigated with the implementation of standard best practice. |
| **Site 19**<br>  <br> | **Appraisal**<br>Site 19 is a suitable size for the fill material required and the fill material could be placed directly into the east coast embankment of the Black Cat junction – reducing the disruption caused by road movements which would otherwise be required. Additionally, it would not be necessary to cross any main roads to place the fill material, reducing potential safety and traffic issues.<br>The nearest human receptors include the Black Cat Quarry immediately to the west of the site and a residential property within 200m to the west. It is expected that the noise effects and visual amenity effects from the site would be relatively minor due to the relative distance to this property.<br>There is a County Wildlife Site (CWS) within 25m of this site and there is potential for ecological species within this designated site to be affected by the works due to its proximity.<br>The majority of the borrow pit site is within Flood Zone 3 (River Great Ouse), so there is a 1 in 100 or greater annual probability of river flooding at this site.<br>By implementing mitigation measures such as the use of controlled working hours and the installation of temporary hoarding fences at specific locations, the potential temporary noise impacts to these receptors are unlikely to result in significant adverse effects. The use of temporary hoarding fences and the retention of existing hedges and trees, where possible, would reduce the temporary visual amenity impact as far as practicable. |

| Alternatives considered | Appraisal and design |
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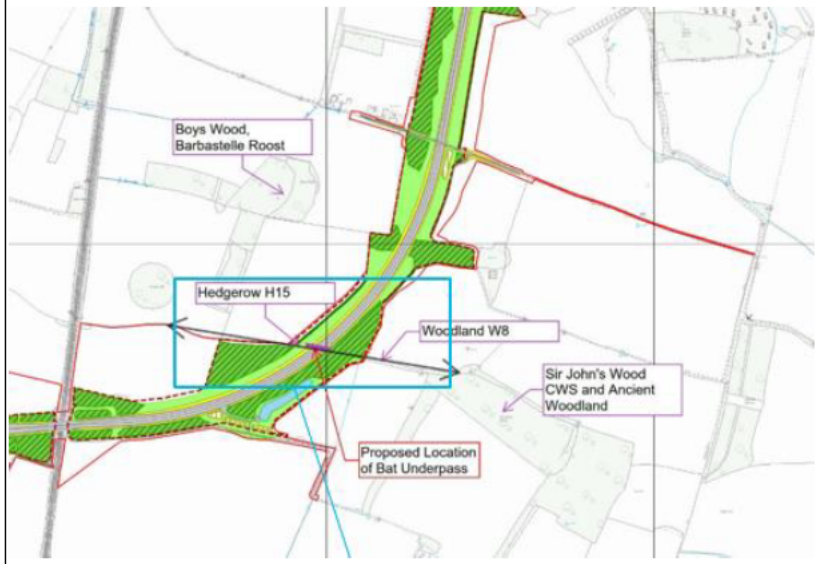
| | It would be difficult to fully mitigate the noise effects from this site for potential protected ecological species at the CWS within 25m, even with the noise control measures mentioned above. Additionally, substantial mitigation e.g. flood defences, would be required to mitigate use of a site situated within Flood Zone 2 and 3.<br><br>In summary, the main environmental concerns for this site would be the ability to mitigate potential ecological impacts and flooding impacts associated with the River Great Ouse. As such, this site is considered less favourable. |
| | **Black Cat borrow pit decision**<br><br>Based on the considerations summarised above, Sites 11 and 14 were selected as the preferred sites for borrow pits at the Black Cat junction.<br><br>Site 11 was assessed against Site 13, and Site 14 was assessed against Site 19 due to the relative proximity to where the materials would be needed (and for avoidance of unnecessary crossing of highways) for construction of the new Roxton Road link and the new Roxton Road bridge embankments; and the embankment for the new dual carriageway on the approach to the River Great Ouse.<br><br>Sites 11 and 14 were selected as the preferred sites for borrow pits near the existing Black Cat roundabout.<br><br>It is considered overall that the impacts at Site 11 and Site 13 are not too dissimilar, but Site 11 is preferred as it performs slightly better than Site 13 due to potential cultural heritage related impacts at Site 13.<br><br>Site 14 was chosen over Site 19 mainly due to the fact that the siting of Site 19 would be less favourable from a flooding and ecological perspective due to the close proximity to the River Great Ouse. Site 19 presents potential for temporary significant adverse ecological |

| Alternatives considered | Appraisal and design |
|---|---|
| | effects, and the current land is occupied by ponds and wetlands which further reduces its suitability. |

## Table 3-6: Bat mitigation options

| Alternatives considered | Appraisal and design |
|---|---|
| **1. Do nothing** – this assessment scenario would result in no mitigation being proposed to mitigate the significant adverse effect which would result from the Scheme.<br><br>**2. Re-routing the flightline along H15** – this assessment scenario would result in the existing H15 hedgeline being rerouted along the western edge of the new dual carriageway and linking into an agricultural overpass proposed to the north of H15.<br><br>**3. Green Bridge across the new dual carriageway at H15** – this assessment scenario would result in a green bridge being constructed to allow bats and other wildlife to safely cross the new dual carriageway.<br><br>**4. Building an underpass under the new dual carriageway** – this assessment scenario would result in an underpass under the new dual carriageway at H15, allowing bats and other wildlife to safely cross the new dual carriageway. | **Baseline and predicted impacts**<br><br>During surveys, hedgerow H15 was identified as having a relatively high level and diversity of foraging and commuting bats and the presence of nearby roosts, including a rare species of bat, barbastelle (*Barbastella barbastellus*) in addition to several other species.<br><br>  <br><br><br>The potential impacts predicted to occur as a result of the Scheme included: habitat loss, species mortality due to construction activities, species mortality due to vehicle collisions, and disturbance to species due to light and noise intrusion. With the inclusion of the mitigation measures set out in **Chapter 8, Biodiversity** of the Environmental Statement **[TR010044/APP/6.1]**, the assessment concluded that a significant moderate adverse effect on bat populations on the area would remain. |

| Alternatives considered | Appraisal and design |
|---|---|
| | **1. Do nothing**<br><br>The absence of mitigation would result in unsafe bat crossings causing bat collisions with vehicles and an absence of habitat connectivity. Based on the relatively high numbers of bats recorded at this location, and absence of alternative safe crossing locations nearby, this would have likely resulted in major adverse effects to bat populations and nearby roosts.<br><br>**2. Re-routing**<br><br>The *Roads and Wildlife Manual* (Ref 3-19), which provides guidance on road mitigation measures for bats, states in relation to re-routing flightlines:<br><br>*"The construction of hedgerows, treelines and screens seems to have some potential as a mitigating measure, either to change the flight paths of bats, to redirect bats to safe crossing points or to keep bats from crossing the road at the site of the barrier. However, there is no evidence proving that these measures can be efficient for 90% of the bats attempting to cross a given road. As a consequence, this measure should not be used without thorough monitoring, as well as adjustments to the mitigation design if necessary."*<br><br>Re-routing the flightline at this location would result in a substantial diversion from H15 to a potential safe crossing point located 800m to the south-west at the railway. The nearest features to the north providing potential safe crossing points are a proposed farm access bridge approximately 800m and a proposed underpass >3km from H15 at Hen Brook. Subsequently, attempting to re-route the flightline at this location would have resulted in a substantial diversion from the bat's normal flightpath and would be unlikely to be effective.<br><br>**3. Green Bridge**<br><br>A green bridge at this location did not meet current guidance in relation to the design criteria and therefore would have been unlikely to be effective in providing a safe crossing point for 90% of bats. As the Scheme would be located on an 9.2m embankment a green bridge over the A428 at H15 would result in commuting bats needing to significantly change their flightpath to safely cross the road height. In addition to this, green bridges have been found to be most successful when constructed with a width/length ratio of over 0.8:1 (Ref 3-20; Ref 3-21), the span of the green bridge at this location would need to be approximately 163m (including embankments) and if the bridge was constructed as 30m wide, the ratio would only be 0.18:1. |

| Alternatives considered | Appraisal and design |
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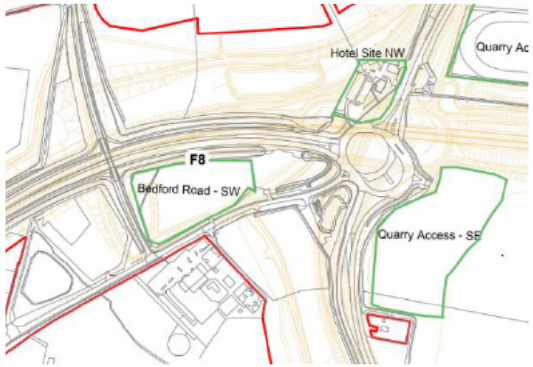
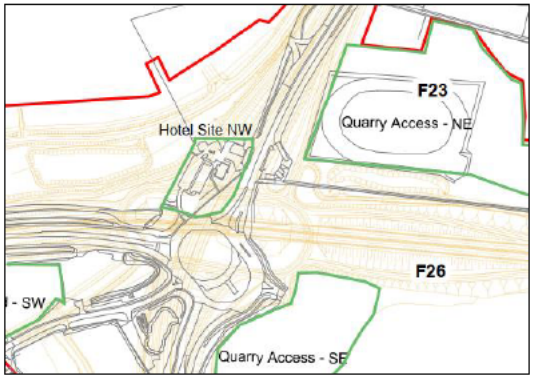
| | Due to the reasons outlined above, a green bridge was not considered to be a suitable mitigation option.<br><br>**4. Underpass**<br><br>As the Scheme would be on an 9.2m embankment in proximity to hedgerow H15, it would be possible to construct an underpass which allows bats to pass freely along H15 from either side of the Scheme and under the new dual carriageway without having to change their flight path, as recommended in the *Roads and Wildlife Manual* (Ref 3-19).<br><br>Surveys revealed that common and soprano pipistrelle, Daubenton's bat, brown long-eared and barbastelle bats were the species which would be particularly at risk from collision. Taking into account the average flightpath of the identified species it was determined that the underpass structure would need to be a minimum of 4.5m high and 5m wide. Depending on the exact orientation of the final design in relation to the Scheme, this would be an underpass length of between approximately 63m and 83m. The underpass, including the entrances and adjacent habitats, would be unlit, free from disturbance at night and free from obstructions.<br><br>**Appraisal**<br><br>The Do-nothing option was not considered a suitable option due to the high-level and diversity of bats in the area surrounding H15 which would be directly and indirectly affected by the Scheme. Furthermore, re-routing has been found to be largely ineffective, and the distance to a safe crossing point would require too great a diversion for the bats to follow. Subsequently, the mitigation options were reduced to either a green bridge or an underpass but due to the high embankment of the Scheme in proximity to H15, a green bridge would require a substantial change in the flightpath and could not be built in the recommended length to width ratio. The underpass option was selected as it would allow bats to pass freely along H15 from either side of the Scheme without altering their flight path. |

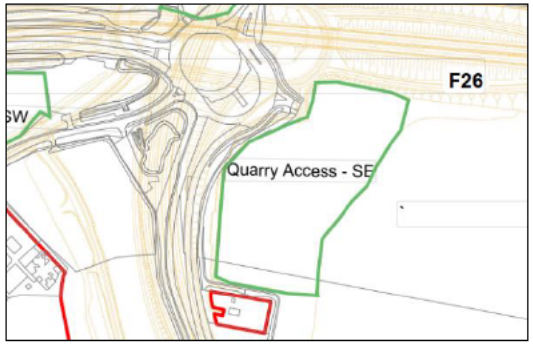
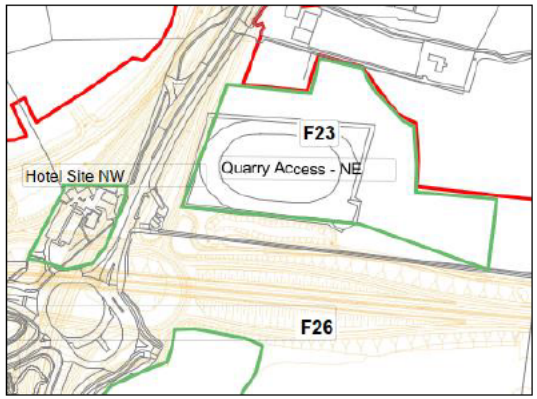
## Table 3-7: Noise bunds at Roxton and Potton Road

| Alternatives considered | Appraisal and design |
|---|---|
| **Nov 2019**<br><br>**Introduction of noise bunds at Roxton**<br><br>Prior to statutory consultation (Ref 3-12), no noise mitigation measures were proposed in this area. However, during statutory consultation it emerged that Roxton residents had been experiencing noise effects due to road traffic from the A1 and were concerned that the alterations proposed for the Scheme would increase the existing adverse effects.<br><br>The location of the noise bunds can be seen on the Environmental Masterplan (see **Figure 2.4** of the Environmental Statement **[TR010044/APP/6.2]**). | **Roxton**<br><br>Significant concerns regarding historic noise issues and landscape and visual impacts which would be introduced as a result of the Scheme were raised by Roxton residents during statutory consultation. Subsequently, the provision of a 3m high false cutting (or noise bund) along the section between the start of the Scheme and to the extent of the woodland to the west of Roxton Road bridge was presented as a possible mitigation measure.<br><br>Although creating the noise bund in this location required extra land to be taken for the Scheme, doing so would reduce noise and the visual impact of the road and traffic on nearby properties and have the added benefit of reducing the requirement for the export of surplus material as it would be possible to construct the bund using materials from within the Scheme.<br><br>Since the bund was introduced into the Scheme, the design has been modified slightly to allow a drainage pond to be installed and to allow the ditches at the location to accommodate the noise bund. |

| Alternatives considered | Appraisal and design |
|---|---|
| **Introduction of noise bunds at Potton Road**<br><br>Additional noise modelling was completed after the statutory consultation (Ref 3-12) which indicated that noise bunds would help reduce the significant noise effects predicted at properties in the vicinity of Potton Road. | **Potton Road**<br><br>The noise modelling predicted that significant effects would occur at the properties in the vicinity of Potton Road due to the introduction of a new noise source in very close proximity to those properties.<br><br>Initially, the proposed mitigation to address this was to introduce a 3m noise bund on top of the engineering cutting already proposed. Although this was predicted to substantially reduce the significant effect, the residual noise impact was still predicted to be significant. Subsequently, combining the noise bund with very low noise road surfacing was proposed.<br><br>Although creating the noise bund in this location required extra land to be taken for the Scheme, doing so would reduce noise and the visual impact of the road and traffic on nearby properties and have the added benefit of reducing the requirement for the export of surplus material as it would be possible to construct the bund using materials from within the Scheme. |

## Table 3-8: Location of construction compounds

| Alternatives considered | Appraisal and design |
|---|---|
| **Black Cat compound location – Satellite compound**<br>a. Option 1: Bedford Road (South West) – Field F8<br>  <br>b. Option 2: Hotel Site (North West)<br>  | Due to the significant and complex works which would be required at the Black Cat junction and the River Great Ouse crossing, a compound in proximity to the junction is necessary. It would need to incorporate the following facilities:<br>a. Offices.<br>b. Welfare.<br>c. Stores.<br>d. Parking.<br>e. CCTV.<br>f. Recovery concrete plant.<br>**Option 1 Bedford Road (SW)**<br>This option is located adjacent to the existing Black Cat roundabout and would be accessed directly from the roundabout. There is one residential receptor within 200m of the site a property located named 'The Bungalow' located within the Roxton Garden Centre, it is located approximately 100m from the compound location.<br>Establishing a compound in this location could cause disruption to road users as all construction traffic for the Ouse Viaduct and the central section of the new Black Cat junction would have to cross the Black Cat junction Circulatory.<br>**Option 2 Hotel Site (NW)**<br>This option is located adjacent to the existing Black Cat roundabout and would be accessed directly from the existing hotel access. The closest residential receptor is approximately 80m east from the site. As the Hotel site is within the Order Limits required to construct the |

| Alternatives considered | Appraisal and design |
|---|---|
| c. Option 3: Quarry Access (South East)<br>  <br><br>d. Option 4: Quarry Access (North East)<br>  <br> | Scheme, it would not be possible to utilise this site for the duration of the Scheme construction.<br><br>Similar to Option 1, use of this site would also require some construction traffic to cross the Black Cat junction Circulatory which could result in disruption to road users.<br><br>**Option 3 Quarry Access (SE)**<br><br>A site to the east of Black Cat junction was considered preferable as it would allow construction traffic access to key construction areas without the need to cross the Black Cat junction Circulatory, reducing disruption to road users. Additionally, this option could remain operational throughout construction of the Scheme, with only minimal alterations required to the access, to accommodate the new Black Cat junction.<br><br>The boundary of this site was located to avoid the flood risk area of the Great River Ouse; as this would require additional flood compensation and possibly additional mitigation measures or restrictions within the compound.<br><br>The closest residential property (Greenacres, Great North Road, Roxton) is adjacent to the site boundary to the south, and it is predicted that the property would experience significant adverse noise effects as a result of the location of the compound.<br><br>**Option 4 Quarry Access (NE)**<br><br>A site to the east of Black Cat junction was considered preferable as it would allow construction traffic access to key construction areas without the need to cross the Black Cat junction Circulatory, reducing disruption to road users.<br><br>Because of the proximity of the site to the embankment which would be constructed as part of the Black Cat junction, it would not be possible to have one continuous access point throughout construction of the Scheme. Upon completion of the embankment, |

| Alternatives considered | Appraisal and design |
|---|---|
| | a new access would be required either directly onto the gyratory or via the eastern local link road. This could result in disruption to road users and could increase the duration of the construction programme.<br><br>The closest residential property is adjacent to the site at the north and it is likely that the property would experience negative adverse visual and noise effects.<br><br>**Appraisal**<br><br>Option 1 and 2 were discounted from the selection process because of the potential disruption to road users, and increase in the duration of the construction programme which would be caused by construction traffic having to cross the Black Cat junction Circulatory, to access key areas of construction.<br><br>Both Option 3 and 4 would allow easier access to the key construction areas without construction traffic having to cross the Black Cat junction Circulatory. Additionally, both Option 3 and 4 could cause adverse noise and visual effects on adjacent properties without further mitigation. Option 4 was less preferable than Option 3 as a new access would be required upon completion of the embankment.<br><br>Consequently, Option 3 was chosen, as the site could be used for the duration of the Scheme construction without adjustments being made to the access route allowing for uninterrupted use and minimal disruption to road users and the construction programme. |

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