A428 Black Cat to Caxton Gibbet improvements

TR010044

Volume 9

9.26 Scheme Design Approach and Design Principles

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Rule 8(1)(k)

Infrastructure Planning (Examination Procedure) Rules 2010

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Development Consent Order 202[ ]

9.26 Scheme Design Approach and Design Principles

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1. Introduction

1.1.1 Good design of the Scheme has been an integral consideration from the outset, in accordance with the criteria set out in the National Policy Statement for National Networks (NPSNN) [REF 1]. This document sets out the design approach for the preliminary design and the Design Vision and principles which will guide the development of the detailed design post consent. It is intended to be read alongside other documents in the Application, in particular:

a. Landscape Strategy set out in Annex L of the First Iteration Environmental Management Plan **[APP-234]**.

b. General Arrangement Plans **[APP-011]**.

c. Environmental Masterplan **[APP-091]**.

d. Engineering Sections (Part 3 - Structures General Arrangements) **[APP-019]**.

e. Landscape cross-sections **[APP-138]**.

f. Black Cat design options **[APP-247]**.

1.1.2 This document is an initial draft for comment and will be developed through the course of the examination.

1.1.3 As well as setting out the design approach, vision and principles in Section 3, this document also provides details on the design of each principal structure. Reference should be made to Appendix C, which explains how each structure has been designed to address alignment and positioning, scale, height and massing, materials and finishes and landscape integration. Computer-generated illustrations of the three main junctions (Black Cat, Cambridge Road and Caxton Gibbet) are provided in Appendix D to further assist in understanding how would appear in their landscape setting. These illustrations present the key design features of the Scheme, but are not verifiable and should be read with the other visual material set out in the Application.

1.1.4 It is important to note that the design of the Scheme is already well advanced, as can be seen in the Application documents listed above. The Applicant expects limited further design progression within the parameters and principles set out here and in the other Application documents, provided that the relevant consultees are satisfied that concerns regarding wildlife corridors, non-motorised users and appearance have been satisfactorily addressed. Sections 4 and 5 of this document explain the scope of further engagement on the detailed design.

Commented [EL1]: Though it should be accepted that this is the first document on which the local authorities and other statutory and non-statutory consultees have had sight of the intended design of structures and other features, therefore some room for revision should be built into the scheme to ensure high quality design that responds well to its context, as well as proper functionality of the multi-use structures is achieved.

1.2 Securing commitments

1.2.1 It is anticipated that the design principles set out in this document will be incorporated into the First Iteration Environmental Management Plan **[APP-234]** in order that the commitments made can be secured through the Development Consent Order (DCO) process. The First Iteration Environmental Management Plan **[APP-234]** is a certified document as set out in Schedule 10 of the updated draft DCO **[REP1-003]**.

1.2.2 Requirement 3 of the updated draft DCO **[REP1-003]** sets out that relevant local planning and highway authorities are consulted on the Second Iteration Environmental Management Plan before it is submitted to the Secretary of State for Transport for discharge. However, as the design principles would remain the same in all iterations of the Environmental Management Plan, it is not intended that comments would be made on the principles set out at that stage. Instead, the design principles contained herein are being made available during the examination process to enable comments to be provided on them before the final design principles are incorporated into the First Iteration Environmental Management Plan. It is anticipated that further consultation will be required at the detailed design stage to ensure the following is achieved:

1. The correct alignment and design of connections for mammals (crossings and wildlife corridors), which is informed by full survey and technical information,
2. The design of features intended for use by non-motorised users are fully inclusive, safe and encouraging of modal shift, and
3. The design fits into context and contributes to place making.

That the above requirements have been met should be agreed with the relevant local and county officers.

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Commented [EL2]: Whilst the overarching "design principles" may be agreed on in this document, provided a responsive consultation process, issues of "detailed design" should be consulted upon at later stages.
The importance of this is threefold:
1. To ensure the proper design is in place to provide necessary connections for mammals
2. To ensure proper design is in place to provide an inclusive and safe environment for all NMU users - including in hours of darkness
3. To ensure the design fits into context and contributes to place making.

And that any value engineering activities do not compromise these three essential components for this scheme.

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2. Good design

2.1 Policy context

2.1.1 The term “design” has broad meaning. It can be both the way in which something is planned and made, or the product of that process, such as documents showing how something is to be made and how it will work and look.

2.1.2 NPSNN explains that applying “good design” to national network projects should “*produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction, matched by an appearance that demonstrates good aesthetics as far as possible*” (paragraph 4.29).

2.1.3 Paragraph 4.30 qualifies this by acknowledging “*that given the nature of much national network infrastructure development… there may be a limit on the extent to which it can contribute to the enhancement of the quality of the area.*”

2.1.4 The National Planning Policy Framework (NPPF) was updated in July 2021. Good design is described in paragraph 126. It explains that “*the creation of high quality, beautiful and sustainable buildings and places is fundamental to what the planning and development process should achieve. Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities*.”

2.1.5 Alongside the NPSNN and NPPF, reference has also been made to other guidance, including the Landscape Institute’s Infrastructure Technical Guidance Note 04/20 [REF 2]. This explains that “*the design of major infrastructure is inherently multi-disciplinary, requiring the involvement of specialists drawn from across a broad range of professions and stakeholders. Achieving good design therefore requires a collaborative approach, where all planning and design elements of the project are integrated. This requires a common vision and purpose and a culture of openness to new ideas and perspectives*.” These concepts have been applied to the design of the Scheme since the outset, through co-ordinated, close working between disciplines and engagement with stakeholders.

2.1.6 Consideration has been given to meeting the challenges of climate change within the design, in line with the requirements contained in the NPSNN [REF 1], and where relevant the Overarching National Policy Statement for Energy (EN-1) [REF-2], and the National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) [REF 3]. This has involved reviewing future UK climate predictions and taking account of the projected impacts of climate change when planning the location and design of the Scheme, including how it will be constructed, operated and maintained, to ensure it is resilient to future climatic conditions specific to the local area and the surrounding environs. A summary explaining how the Scheme is in compliance with the policy requirements contained within EN-1 and EN-4 is provided in Appendix B of the Case for the Scheme **[APP-240]**.

2.1.7 The design of the Scheme has been developed to sufficient detail to support the Application, applying the principles of good design set out in the NPSNN. The Applicant acknowledges that the design process will continue post-consent and that these principles of good design will apply throughout. Appendix A provides a detailed summary of how the design of the Scheme complies with the relevant policies on good design in the NPSNN.

Local policy and guidance

2.1.8 Relevant local design related policies and guidance are set out in Appendix 7.1 of the Environmental Statement **[APP-179]**. The way that the design of the Scheme has been developed to respond to these policies and guidance is set out in various documents within the Application, including:

a. Section 7.8 of Chapter 7 of the Environmental Statement (Landscape and Visual Effects) **[APP-076]**.

b. Appendix 7.3 of the Environmental Statement (Landscape Baseline and Assessment) **[APP-181]**.

c. Annex L of the First Iteration Environmental Management Plan **[APP-234]**, including Appendix A: Landscape Character Areas – design considerations.

2.1.9 These documents explain that the design has followed a landscape-led approach, as set out in the Landscape Institute's Infrastructure Technical Guidance Note 04/20 [REF 4]. The Applicant has studied these policies and the published landscape character assessments in detail and carried out extensive fieldwork to understand and describe the character of the study area at the local level. This information, including for example the Landscape Character Areas and key issues identified in the Huntingdonshire Landscape and Townscape Assessment SPD [REF 5], has informed the baseline, including the definition of Local Landscape Character Areas (LLCA). This in turn has informed the design principles set out in Annex L of the First Iteration Environmental Management Plan **[APP-234]** and in this document.

2.2 Overarching design principles

National Infrastructure Commission: Design Principles for National Infrastructure

2.2.2 The National Infrastructure Commission is an executive agency which provides the UK government with impartial, expert advice on major, long term infrastructure challenges. In February 2020 it published Design Principles for National Infrastructure, which are intended to guide the planning and delivery of major projects.

2.2.3 Organisations and sectors are encouraged to build upon this approach by developing their own design vision, ambition and plan that embraces all the principles—climate, people, places and value. For National Highways, this is addressed in their document, The Road to Good Design.

National Highways: The Road to Good Design

2.2.4 The Roads Investment Strategy 1 (RIS 1) includes the government's vision to *"…see the Strategic Road Network working more harmoniously with its surroundings, impacting less on local communities and the environment*" [REF 6].

2.2.5 National Highways is required as part of their operating licence to have due regard to the principles of good design. In 2018 it published 'The Road to Good Design', outlining its key design principles. The purpose of the document is to challenge thinking about the design and quality of the Strategic Road Network. It enshrines National Highway's vision, which is:

"to put people at the heart of our work by designing an inclusive, resilient and sustainable road network; appreciated for its usefulness but also its elegance, reflecting in its design the beauty of the natural, built and historic environment through which it passes, and enhancing it where possible."

2.2.6 The Road to Good Design sets out ten overarching design principles, which relate broadly to those set out by the National Infrastructure Commission.

Connecting people

- Makes roads safe and useful.
- Is inclusive.
- Makes roads understandable.

Connecting places

- Fits in context.
- Is restrained.
- Is environmentally sustainable.

Connecting processes

- Is thorough.
- Is innovative.
- Is collaborative.
- Is long-lasting.

2.2.7 These design principles are also set out in National Highway's Standard GG103: Introduction and general requirements for sustainable development and design, which forms part of the Design Manual for Roads and Bridges (DMRB). The Scheme specific design vision and principles are underpinned by these ten principles, which collectively have encouraged better design and helped provide a basis for the Scheme to be objectively reviewed at key stages of its development. Appendix B of this document explains how the design of the Scheme has been developed to respond to these overarching principles.

3. Design vision and principles for the Scheme

3.1 Introduction

3.1.1 Paragraph 2.4 of DMRB standard LD 117: Landscape Design states that "*a project's design strategy shall establish a landscape strategy (design vision) and/or a set of defined landscape objectives for the project early on in the development of motorway and all purpose trunk road projects as an essential part of the design process*". The Design Vision for the Scheme is for the best possible integration with the surrounding landscape. This will be delivered through application of the design principles to:

a. Ensure a holistic approach to the design of the whole Scheme.

b. Guide the detailed design stages of the Scheme.

c. Provide an aspiration and driver for exemplary design from the appointed contractor.

d. Provide a point of reference for the design review process.

e. Demonstrate how the detailed design will continue to take account of the criteria for good design as set out in the National Policy Statement for National Networks (see paragraphs 4.28-4.35).

3.1.2 The design principles distil the overarching aims which have informed the development of the design to date. They have formed the commitments set out in the First Iteration Environmental Management Plan **[APP-234]**.

3.1.3 The design-development process has also been influenced by:

a. A recognition that good design is a process, which started at the point of Scheme inception and continues through the different stages of Scheme development, through to its eventual construction and operation.

b. Establishing a thorough understanding of the geographic, environmental, economic and social context of the area in which the Scheme would be developed, including any associated constraints.

c. Proactively designing-out potential environmental effects through avoidance and prevention, where possible, and reducing the need for environmental mitigation measures.

d. Designing in a manner that aims to make a difference to the experience of road users and the communities through which the Scheme would pass, including through the design of structures and consideration of visual appearance.

e. Delivering the goals of sustainable development throughout the Scheme's design lifecycle.

f. Aiming to achieve an earthworks balance where possible, in order to minimise the need to import or export earthworks materials. Where this has not been possible, the design has sought to acquire suitable construction materials from borrow pits close to where this material is needed for construction of embankments, rather than from off-site sources. The borrow pits are located within the Order Limits.

g. Minimising the need for roadside features, for example lighting, to reduce the potential for visual impacts whilst remaining consistent with safety requirements.

h. Identifying construction methods and operations to ensure that construction can be undertaken in phases as safely as possible, whilst minimising potential disruption to residents, businesses, landowners and users of the public rights of way (PRoW) and road networks.

i. Consideration of future maintenance operations and requirements to make the Scheme more understandable and safer for road users and operatives during these works, and to minimise disruption.

3.2 Design standards, guidance and good practice

3.2.1 The design has been developed to comply with current standards and with reference to relevant guidance and good practice.

3.2.2 In relation to the engineering components of the Scheme, for example structures, infrastructure for walkers, cyclists and horse riders (WCH), and highways drainage, other prevailing DMRB standards and guidance have been applied during the design development process. These include, but are not limited to:

a. CD 109 Highway link design [REF 7].

b. CD 116 Geometric design of roundabouts [REF 8].

c. CD 122 Geometric design of grade separated junctions [REF 9]

d. CD 127 Cross-sections and headrooms [REF 10]

e. CD 143 Designing for walking, cycling and horse-riding [REF 11]

f. CD 350 The design of highways structures [REF 12]

g. CD 351 The design and appearance of highway structures [REF 13].

h. CD 529 Design of outfall and culvert details [REF 14].

i. CG 501 Design of highway drainage systems [REF 15].

j. TD 501 Road lighting design [REF 16].

3.2.3 Good design practice contained within the Manual for Streets [REF 17] and the aesthetic quality of the new roads have also been considered during the design development of the Scheme. For example, the Roxton Road Link has been designed with a reduced carriageway width (without hard strips) for speed control and to reflect the rural character of the area.

3.2.4 In relation to the environmental components of the Scheme, for example planting and biodiversity measures, the following DMRB standards have been applied when designing the Scheme:

a. GG 103 Introduction and general requirements for sustainable development and design [REF 18].
b. LD 117 Landscape design [REF 19].
c. LD 118 Biodiversity design [REF 20].
d. LD 119 Roadside environmental mitigation and enhancement [REF 21].
e. LA 113 Road drainage and the water environment [REF 22].

3.3 Scheme design

Design principles

3.3.2 This section sets out the scheme-specific design principles, which have been applied to the preliminary design and will inform the detailed design. They are structured as follows:

a. General design principles
b. Engineering design principles
c. Environmental design principles

3.3.3 The scheme-specific Design Principles describe the common, general, overall goal or objective, pursuant to the Design Vision, but are not intended to prescribe the precise means of achieving it. They address, as appropriate, the scale, height, massing, alignment and materials of the Scheme and the design of landscaping (for example, screen planting) proposed. Together with the illustrative material in the Application, these design principles provide ~~clarity on~~ an indication on the visual appearance of the Scheme.

3.3.4 The Design Principles will guide development of the detailed design, to give confidence of a robust process that will be followed through from DCO examination into detailed design and delivery.

3.3.5 General design principles specific to the Scheme are set out in section 1.8 of Annex L of the First Iteration Environmental Management Plan. They are summarised here and should be read alongside Appendix C of Annex L of the First Iteration Environmental Management Plan **[APP-234]**.

a. Integration with rural landscapes.
b. Crossing the grain/landform and alignment.
c. Crossing valleys – rural viaduct and valley.
d. Retention of significant features.
e. Junctions.
f. Integration with urban fringe landscape.

Commented [FT3]: Reference should be included to the relevant local policies set out in the Authorities' response to Q1.10.1.2 of FWQ [REP1-051] to ensure that they also inform the detailed design.

Commented [EL4]: It is considered by the local authorities that we have not been involved in the decision making process for arriving at these design principles.
It is unclear how the design of the features can be influenced by statutory consultees.
It is unclear how acceptable alignments and compositions of features for multiple functions (mammal crossings as well as NMU uses) have been achieved, if indeed they have been achieved at all. It is unclear when the local authorities will have the opportunity to ensure both needs have been met.

g. Temporary landscape.

h. Integrated design.

i. Bridges and structures.

3.3.6 These principles recognise that there is a logical order to the design process in terms of avoiding or minimising the adverse impacts of the Scheme on the environment and maximising opportunities for integration:

a. **Need, alignment and positioning**. For example, seeking to use~~using~~ a single structure toprovide more than one function, such as the Hen Brook underpass, which could provide~~s~~ for the watercourse, public right of way and connect~~s~~ habitats across the route (subject to the capacity of the structure to accommodate the technical requirements of the co-uses). Positioning and aligning structures, such as the bridleway bridge north of Wintringham to make use of existing vegetation and physicalconnections.

b. **Scale, height and massing**. For example, reducing the height of the Black Cat junction by accommodating the A1 in a cutting below grade and the design of the footbridge east of St. Neots to minimise impacts on the skyline and create a welcoming approach to the crossing.

c. **Materials and finishes**. For example, ensuring that materials respond well to their use and individual context, reflecting where possible local characteristics such as the Bedfordshire brick-making industry and vernacular architecture, and using clear design language to communicate their function. ~~For example, using a common palette of materials across all structures to reinforce sense of place and Scheme identity.~~

d. **Landscaping**. For example, integrating the elevated East Coast Mainline bridge into the landscape at a point of transition between the vale landscape to the west and the elevated landscape of Alington Hill to the east.

3.3.7 Visualisations have been prepared to assist in understanding the composition and visual appearance of elements of the key structures of the Scheme. These are included in Appendix D of this document and are based on a 3-dimensional model of the preliminary design and the existing landscape. Reference should also be made to the verifiable photomontages included in **[APP-123]** to **[APP-137]** and the landscape cross-sections in **[APP-138]**.

3.3.8 The following sections summarise the Scheme specific design principles by discipline, which are guided by the general design principles referred to above.

Engineering design principles

Earthworks and drainage

3.3.9 Earthworks cuttings and embankments have been designed to minimise environmental impact, and to achieve the desired levels to connect into the existing road network. The scale, height and slopes of earthworks vary to accommodate the profile of the new dual carriageway and in response to the topography of the local landscape. Where possible, the tops of cuttings have been rounded off to create a smooth earthworks profile to maximise integration.

Commented [EL5]: Amend as suggested

Commented [EL6]: It is not considered that a basic palette of commonplace materials (such as the proposed concrete and weathering steel) help to reinforce the sense of place of Cambridgeshire, nor the scheme identity. Furthermore, an overarching principle on materiality and form does not necessarily assist in "avoiding or minimising the adverse impacts of the Scheme on the environment and maximising opportunities for integration"

This should read:
c. For example, ensuring that materials respond well to their use and individual context, reflecting where possible local character and vernacular, and using clear design language to communicate their function.

Examples of this approach include the land between the River Great Ouse and the realigned Barford Road and through Alington Hill.

3.3.10 Drainage and pollution control systems have been designed using the Highways England Water Risk Assessment Tool (HEWRAT) contained in LA 113 [REF 23]. Surface water drainage would comprise of a combination of measures including dry basins, swales, ditches, kerbs and gullies to capture, direct and attenuate flows to maintain the current rates of discharge into existing watercourses.

Structures

3.3.11 The design process of highway structures was multi-disciplinary and included consideration of aspects that affect the aesthetic quality of the completed structure, its position in the landscape and its impact on social, cultural and heritage sensitivities within the community. These aspects include:

a. Proportion and integration of structure scale within the landscape.
b. Options for contrast/harmony with surrounding environment.
c. Proportions of spans/length and height.
d. Symmetry/rhythm/line/order of principal elements.
e. Materials and finishes.
f. Parapets and other elements that contribute to rhythm.
g. Lighting and signage.
h. Managing the effects of water and weathering.
i. Structure curtilage.
j. Minimise embodied carbon.
k. Viewpoints from and to the structure.
l. Potential for developing a family of structures along the route, for example similar to other existing structures along the A421 corridor.

3.3.12 Structures include bridges and culverts in locations where the new dual carriageway would cross the River Great Ouse and other existing watercourses, the East Coast Mainline (ECML) railway and the existing road network. They have been designed in accordance with DMRB standards and in line with current best practice. Design principles specific to individual structures are set out in Appendix C of this document.

3.3.13 The design of structures has been informed by their location and the Environmental Impact Assessment to avoid or minimise impacts on the environment. For example:

a. The overall height of the Black Cat junction and structures have been designed to minimise the visual effects on nearby communities of Roxton, Chawston and Wyboston.
b. The B1046 Potton Road bridge and footbridge are located where the main carriageway is in cutting, which reduces the overall height of these new structures above existing ground level to minimise the visual impact of structures.

3.3.14 The structures design was also influenced by other existing local features and characteristics, for example existing utilities and other infrastructure, topography and ground conditions. Proportions and structural form are among the visual characteristics of good footbridge design as well as sensitivity to its context and its environmental and social impact.

3.3.15 ~~Structures have been designed as a family, with common design details, materials and structures. This approach has been taken to reinforce sense of place, create a memorable journey and maximise efficiency and buildability. It is important to note that there is flexibility in this approach. As set out in Appendix C, each principal structure has been designed to respond to its setting within these general rules. The pallete of materials is small, with structural elements being concrete or weathering steel. The application of these materials and finishes varies according to contex~~t. "Structures should be designed to respond appropriately to their individual settings, to accommodate the needs of all users and, where appropriate, facilitate the movement of wildlife. A range of design approaches have been employed to help create a memorable journey. The strategy enables locales to be recognisable not only by the character of the landscape, but by subtle changes in the materiality of structures, through which the structures are linked to the local vernacular. Moments along the journey should be marked by specific interventions, such as public art or the unique materiality/rendering of key structures.

3.3.16 The design of the structures also sought to promote durability and sustainability whilst reducing the need and frequency for maintenance in order to minimise whole life costs. Early contractor involvement (ECI) for buildability advice was key to selecting the forms of structure and materials for some of the bridges that were regarded as the safest and the quickest to build, thereby minimising disruption to the travelling public during construction of the Scheme.

3.3.17 Local authorities and other key stakeholders, such as Network Rail, were consulted to get their feedback, so that the design proposals met their particular requirements. The bridge design was multi-disciplinary and iterative. It was co-ordinated with input from other design disciplines during the course of the development of the Scheme design and review process.

Gantries, signage and lighting

3.3.18 The form and visual appearance of gantries, lighting and signage proposed within the Scheme is largely defined by function using commercially available products that comply with appropriate standards. The design process has firstly focused on minimising the need for these structures.

3.3.19 In the case of gantries, four are proposed on the approaches to the Black Cat junction. Three of these would be located on the existing A421 and A1. The fourth gantry would be located east of the East Coast Mainline bridge adjacent to the new route. It is necessary for these structures to be placed in positions where they are clearly visible to the road user in compliance with relevant technical standards. They have been positioned as far as possible to minimise additional visual impacts by siting them close to existing infrastructure such as overbridges and vegetation.

Commented [EL7]: APPEARANCE

We do not consider that the proposed elements create a memorable journey, or that the proposed materials/forms relate in any particularly to Cambridgeshire. They do not contribute to place making.

This should be amended to state that the materials are to be used as the general basis for structures, however variation has been built in to respond appropriately to context (for example brick cladding would respond much more strongly to the Cambridgeshire vernacular that concrete and weathering steel, public art unique interventions to different structures might help to mark a point on a journey and could convey elements specific to their locale, and colour and lighting, for example to provide bright welcoming environments for NMUs.

CONFLICTS BETWEEN NMUs and WILDLIFE

It may also be that due to the specific alignments required by bats, or the conflicting requirements between NMUs and wildlife (specifically lighting) that it is simply not appropriate to accommodate both purposes in one structure, or that a green bridge is the only means by which both uses can be accommodated.

3.3.20 In relation to signage, the size and position is largely defined by standards. The detailed design will:

a. Give consideration to the size of signs at key locations and the visual impact.

b. Will be coordinated with the landscaping/ planting design to ensure the required clear visibility distance is achieved and maintained for every sign.

c. Will be developed to reduce confusing and unnecessary sign clutter.

3.3.21 The first design principle for lighting of the Scheme at these locations has been determined on the basis of increasing safety for all road users, including all NMUs. Lighting of new and improved sections of highway within the Scheme has been confined to locations where road safety is a priority, in order to minimise the potential for lightspill in night time views across the landscape. The lighting design has sought to minimise the potential for adverse effects on the following:

a. Nocturnal species (for example bats, noting that human and wildlife needs~~uses~~ are not always compatible and as such separate structures to accommodate the two may be necessary).

~~a.~~b. Terrestrial invertebrates

~~b.~~c. The existing landscape and night-time views of residential receptors.

d. The setting of features associated with the historic environment (for example listed buildings).

With regards to the above local authorities will be consulted at detailed design stage to demonstrate how the lighting scheme principles have been updated to reflect the outcomes of the bat surveys and mitigation (currently under discussion with Natural England/Local Authorities).

The above minimisation of harm is to be achieved whilst ensuring adequate lighting of pedestrian and other non-motorised user routes to promote sustainable travel in line with the scheme aspirations. This will include consideration of lighting in underpasses, some of which are approximately 30m long and located near to major housing sites, and will not receive adequate natural light even in daylight hours, and therefore may require lighting wells as well as artificial lighting.

3.3.22 The design of lighting columns and luminaires will be addressed at the detailed design stage, within these parameters.

Active travel provision

3.3.23 The key design principles for active travel on the Scheme are as follows:

a. Improving safety for users, for example, through provision of segregated footways, cycleways and relocating the combined access between School Lane and The Lane away from the Black Cat grade separated junction, also connecting to National Cycle Network Route 12.

b. Enabling more sustainable travel choices.

c. Maintaining and improving existing connectivity between PRoW, local roads and communities with facilities comprising new bridges; underpasses; footpath and bridleway diversions; crossings; and new provisions for pedestrians andcyclists at junctions.

d. Maintaining and, where possible, enhancing accessibility, including through the provision of appropriate parapets for all users (including equestrians) and

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Commented [DA8]: The lighting design hasn't been designed with adequate baseline ecology information for light-sensitive species - the bat survey work / mitigation has not been concluded and there was no survey / consideration of light-sensitive terrestrial invertebrates.

We require:
- principles for lighting design to minimise impact to terrestrial invertebrates (this is an outstanding SoCG issue, applicant has agreed to do this, but we haven't seen any information)
- how the lighting scheme principles will be updated to reflect the outcomes of the bat mitigation (currently under discussions with Natural England / Local Authorities)

Commented [RP9R8]: Equally with the length of the underpasses being over 30 metres long, lighting (or light wells) will be needed to ensure sufficient safe lighting during daytime.

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lighting to encourage sustainable travel and increased healthy lifestyles even during the darker winter months.

Environmental design principles

3.3.24 The following measures have been incorporated into the design of the Scheme to mitigate its likely environmental effects and maximise opportunities for integration.

Air quality

3.3.25 Route selection was informed by the need to consider the proximity of sensitive receptors (such as residential properties and ecologically designated sites) to the alignment of the new dual carriageway, given that this could potentially change traffic flows and associated vehicle emissions into areas where local air quality is already good (and therefore reduce this), or where air quality is already a problem (and therefore exacerbate this). The following design principles have been applied to the Scheme for the purpose of minimising effects on air quality:

a. Maintaining or increasing the distances between properties and traffic, where possible, thus reducing the risks of air quality impacts.

b. Maintaining traffic flows on the A1 and A421 through Black Cat Junction and the surrounding road network.

c. Removing traffic from the existing A428 onto the new dual carriageway.

Cultural heritage

3.3.26 Due to the type, location, significance, value and number of known and potential cultural heritage assets in the area of the Scheme, avoidance of impacts on buried archaeology, designated sites and historic buildings was a key consideration in the design development and optioneering processes.

3.3.27 Based on the review of the geophysical surveys and archaeological evaluation undertaken as part of the cultural heritage assessment, the following design principles were applied to avoid potential impacts on buried archaeology and preserve features of potential interest:

a. Reducing the extent of land required to divert existing utilities infrastructure.

b. Moving the position of borrow pits and construction compounds, including modifying their layouts and extents.

c. Fencing off areas within the construction compounds and borrow pits to protect known archaeology/sites.

3.3.28 The following design principles have been applied to minimise effects on cultural heritage:

a. Limiting landtake to minimise disturbance to buried archaeology.

b. Confining road lighting to new and improved sections of road where road safety is a priority, to reduce the potential for light spill to intrude into the setting of heritage assets.

c. Planting to visually screen elements of the Scheme and reduce adverse effects on the setting of heritage assets.

3.3.29 In developing design options for the Black Cat junction, the Applicant identified a potential option (Option C+) that would enable Brook Cottages – a Grade II listed building – to be retained. Following review of Option C+, the Applicant concluded that this design could not be taken forward as it did not present a safe design solution for the junction, nor would it meet the technical requirements or the need or objectives of the Scheme. Further information on this option, and the reasons for its discounting, are summarised in the Black Cat Junction Design Options **[APP-247]** report.

3.3.30 In addition:

a. A commitment has been made to explore potential relocation options for Brook Cottages, subject to a building survey confirming the property can be taken down and moved to an alternative site (with a willing receptor host, i.e. a museum).

b. Three Grade II listed milestone and mileposts affected by the Scheme will be removed, stored and reinstated as close as possible to their original location post-construction, in order to preserve their historic interest and the accuracy of the information presented on them.

c. Tempsford Bridge, part of the A1 crossing the River Great Ouse south of the Black Cat junction is a scheduled monument. The design of the A1 realignment and Black Cat Junction have been developed to tie in to the north of this bridge to avoid impacts on the structure.

Landscape, views and visual appearance

3.3.31 The Scheme has been designed, as far as possible, to avoid adverse effects on the local landscape and existing views through option identification, appraisal, selection and refinement, as the area contains a number of local landscape character areas and visual receptors that could experience temporary and permanent changes as a result of the Scheme.

3.3.32 Modifications made to the design of the Scheme to avoid effects include:

a. Limiting the extent of temporary and permanent landtake within the Order Limits, where possible, to retain established vegetation and features that contribute to landscape character and visual amenity.

b. Modifying the horizontal alignment of the new dual carriageway to avoid impacts on valued landscape features, for example a veteran Elm tree located to the north of Hen Brook and Croxton Park RPG.

3.3.33 The following design principles have been applied to minimise effects on landscape character and visual amenity and enhance visual appearance:

a. Optimising the horizontal and vertical alignment of the new dual carriageway in a way that seeks to minimise impacts associated with crossing valleys and landform within the landscape.

b. Reducing the levels of the three-tier Black Cat junction, thereby reducing its visual impacts.

c. Positioning sections of the new dual carriageway in cuttings and between blocks of existing vegetation to visually contain much of the road infrastructure and traffic movements from existing views by receptors in close range and more distant views.

d. Designing earthwork slopes to gradients that soften their appearance and achieve good integration with the rural landscape.

e. Confining lighting on new and improved sections of road within the Scheme to locations where road safety is a priority, to minimise the potential for light spill in night-time views.

f. Designing permanent structures, such as footbridges, in a way that minimises their visual impact.

g. Optimising zones within construction compounds to minimise their temporary impact on the landscape and views, including at night.

h. Returning and reinstating land used temporarily to its former condition and profiles, where appropriate.

3.3.34 The Scheme includes a comprehensive landscape strategy (see Annex L of the First Iteration Environmental Management Plan **[APP-234]**), the overall objective of which is to integrate the Scheme into its landscape setting and eliminate or minimise adverse landscape and visual effects as far as practicable. The design has accordingly sought:

a. Integration of the Scheme into the existing landscape pattern as far as possible by retaining and following existing features, including vegetation, where practicable.

b. Replacement of existing vegetation removed during construction of the Scheme through the introduction of areas of new planting.

c. Filtering and screening more prominent components of the Scheme in views from visual receptors.

d. Providing visual interest to people travelling along the Scheme and the existing network of local roads and PRoW.

e. Applying Green Infrastructure principles to reinforce existing networks and increase resilience to climate change.

3.3.35 The landscape design has been developed collaboratively to achieve a holistic design solution that not only addresses landscape and visual effects, but also provides mitigation and enhancement opportunities for the topics of Biodiversity and Road Drainage and the Water Environment.

Biodiversity

3.3.36 The Scheme has been designed to avoid and reduce impacts and effects on biodiversity features through the process of design-development. A number of features were avoided through changes to the design of the Scheme, as follows:

a. Moving the carriageway north away from Croxton Park to avoid a County Wildlife Site.

b. Avoiding direct impacts on a number of woodlands (for example Pillar Plantation).

c. Realigning the carriageway to avoid damaging a veteran elm tree.

d. Measures to avoid three badger setts and four field ponds.

e. Incorporation of two waterbodies with Great Crested Newts into the drainage strategy to sustain them as waterbodies.

3.3.37 As construction of the Scheme has the potential to impact on protected species (such as breeding and wintering birds, great crested newts, bats and badgers and upon a range of designated and non-designated sites), the following measures have accordingly been incorporated into the design:

a. The use of planting along the carriageway to minimise the risk of mortality to Barn Owl from traffic collisions.

b. The creation of grassland habitats on earthwork slopes and within severed or redundant land parcels, to mitigate for the loss of habitat to the Scheme.

c. Mitigating effects on existing ecological networks and habitats through the planting of hedgerows, trees and scrub, woodland and grassland, and creation of ponds and wetland at locations across the Scheme.

d. Restoration of lengths of watercourses.

~~e. The use of planting along the carriageway to minimise the risk of mortality to Barn Owl from traffic collisions.~~

Commented [DA10]: duplication of bullet point a.

~~f.~~e. Treatment measures to mitigate pollution and assist in mitigating any effects on aquatic and riparian species and habitats, including the River Great Ouse and its tributaries (brooks).

~~g.~~f. Mammal underpasses (and associated guide fencing) installed to facilitate crossing of the road by bats, other mammals and other animals, to mitigate the risks of collisions with vehicles and the risks to both animals and drivers/vehicles.

~~h.~~g. Bat boxes sited on retained trees to provide alternative roosting opportunitiesfor the local bat population.

3.3.38 Collectively these measures have been designed to provide replacement habitats, re-establish and create habitat corridors, and improve connectivity.

3.3.39 Biodiversity enhancement opportunities have also been identified through the design-development process.

Geology and soils

3.3.40 As the need to protect agricultural soils was identified during the design development process, efforts were made during the selection and refinement of options to avoid, where possible, routeing the new dual carriageway through areas known to contain high grade (best and most versatile) soils.

3.3.41 Other factors evaluated during the design development phase included the consideration of potential slope erosion, avoidance of contaminated land, and the potential for groundwater interception.

3.3.42 The following design-based measures have accordingly been incorporated into the Scheme:

a. The extent of land required to construct, operate and maintain the Scheme has been minimised to reduce the loss of high grade soils.

b. The horizontal alignment of the new dual carriageway has been designed to minimise the potential for interaction with known contaminated land, to reduce the likelihood of disturbance.

c. The susceptibility of cut/embankment slopes to erosion has been reduced by incorporating appropriate drainage and by grading slopes to a maximum 1 in 3 gradient.

d. The design of pile foundations and other structures requiring deep excavation such as cuttings and borrow pits to avoid the interception of potentially pressurised groundwater.

Construction, operation and maintenance

3.3.43 The Scheme is planned to be constructed from December 2022, with works likely to be undertaken in phases to reduce disruption to road users and local communities. Three main construction compounds would be established to provide equipment and materials storage, welfare facilities and parking for staff, with additional satellite compounds formed at locations across the Scheme

3.3.44 Construction and restoration works would be carried out in line with the measures and techniques presented within the First Iteration Environmental Management Plan **[APP-234]**. Unless otherwise agreed with the landowner and any other relevant stakeholder, areas of land used temporarily during construction would be restored to their required condition and use, upon completion of the works.

3.3.45 Following completion of all construction works, the Scheme is planned to be open to traffic in March 2026.

3.3.46 The Scheme has been designed in a way that minimises the frequency of future maintenance events through the use of low maintenance equipment and features that would reduce the number of repairs required. Periodic maintenance operations would be carried out on highway verge equipment, structures, and on landscaping, drainage and carriageway features.

4. Engagement on design matters

4.1 Introduction

4.1.1 As outlined below, various design team meetings and workshops have been held during development of the preliminary design, the outcomes of which have been integral to the design-development process.

4.1.2 Key engagement has involved participation at, and discussions with, the following:

a. A 'Road to Good Design' workshop, held on 27 June 2018 and facilitated by National Highways.

b. Presentations by the Applicant's landscape architects to the engineering teams on Landscape Design in July 2018 and design materials and finishes in January 2019 (see images below).

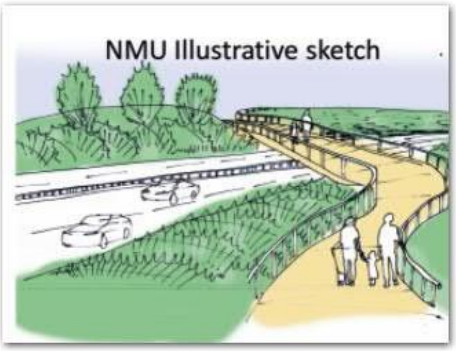
c. Consultation with Highways England's Safety, Engineering and Standards teams (SES) in relation to environmental assessment and design, road geometry, structures, geotechnical factors and departures from standards.

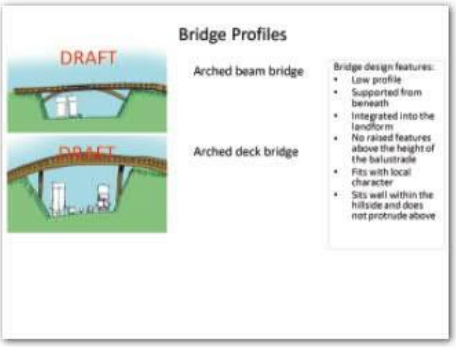
d. Presentations on the Preliminary Design made to the National Highways' Operations Technical Leadership Group and the Safety Control Review Group to demonstrate an efficient, safe design that meets the requirements of the appropriate standards and aligns and contributes to best practice and to agree matters to be addressed as part of the detailed design phase. The Preliminary Design has received endorsement that the Scheme can be safely constructed, operated, and maintained.

e. Departments including the Lands and Property team, Orders team and Statutory Process team on matters relating to the acquisition of land required for the Scheme.

f. Buildability partners.

Commented [EL11]: It would be useful to know who the invitees and attendees were to these meetings.





4.1.3 Engagement at Technical Working Groups with the host authorities, statutory bodies and non-statutory bodies has also influenced the design development process, and the form and extent of the measures embedded into the Scheme to mitigate its environmental and socio-economic effects.

4.1.4 The public were also consulted on the preliminary design. This included the Statutory Consultation carried out in the summer of 2019. Table 5-16 of the Consultation Report **[APP-033]** sets out the changes that were made to the Scheme as a result of statutory consultation and ongoing engagement. Changes included the addition of bunds to reduce noise effects and enhance landscape integration, improvements to facilities for walkers, cyclists and horse-riders and reducing land take. The design was further review and updated following the Supplementary Consultation carried out in the summer of 2020. Table 8-15 of the Consultation Report **[APP-033]** sets out the changes that were made to the Scheme as a result of supplementary consultation and ongoing engagement. This included changes to field accesses, changes to the boundary of a borrow pit and changes in rights.

5. Development of the detailed design

5.1 Introduction

5.1.1 The level of design development and consultation undertaken during preliminary design is advanced, such that minimal further design development is anticipated, once the contents of this documents has been agreed with the relevant authorities and other consultees, and it is agreed that all relevant survey information has been incorporated into the document.Combined with the nature of the Scheme, this means that the type of changes anticipated during detailed design will be limited to design development for the purpose of engineering efficiency, the correct alignment of features (subject to further survey data) and generation of information for construction.

5.1.2 The detailed design will be developed in line with the Design Vision and design principles set out above and in Appendix C. Where design changes are proposed they will go through a two-step process.

5.1.3 **Step 1 - Initial assessment:** National Highways will evaluate each change to assess suitability for implementation and whether the change results in an impact to aspects of the preliminary design with regards to the design principles. An example of such a change could be omitting piers from a bridge structure to create a single-span structure. If the change is deemed to impact the design principles, then step 2 will be initiated.

5.1.4 **Steps 2 - Engagement:** This process will identify the stakeholders that need to be engaged regarding the change in order to understand any potential impact and also ensure that the change is in accordance with the principles set out in this document. To initiate this process, National Highways will ask the following questions:

a. Who will be engaged?

b. What those bodies will be engaged on?

c. How they will be engaged?

d. When they will be engaged?

e. How the Applicant demonstrates its consideration of that engagement?

~~e.~~ Particular weight will be given to any changes that alter appearance or accessibility, lighting, the alignment or design of wildlife features or carriageway design. Changes to these matters would automatically trigger a consultation of the relevant local and county authorities.

5.1.5 The detailed design will also be presented through exhibitions to provide visibility to the solution being delivered.

Commented [EL12]: We request that the local authorities are consulted again at the detailed design stage to ensure that efficiency engineering does not have a negative impact on design.

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Commented [EL13]: The detailed design will be consulted upon through exhibitions to ensure stake-holder comments are responded to.

6. References

REF 1 National Policy Statement for National Networks. Department for Transport (2014).

REF 2 Overarching National Policy Statement for Energy (EN-1). Department of Energy & Climate Change (2011).

REF 3 National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). Department of Energy & Climate Change (2011).

REF 4 Guidelines for Landscape and Visual Impact Assessment 3rd Edition. Landscape Institute and the Institute of Environmental Management and Assessment (2013).

REF 5 Huntingdonshire's Local Plan to 2036. Huntingdonshire District Council (2021).

REF 6 Road Investment Strategy: for the 2015/16 – 2020/21 Road Period. Department for Transport (2015).

REF 7 Road Layout Design CD 109 Highways Link Design. Highways England (2020).

REF 8 Road Layout Design CD116 Geometric design of roundabouts. Highways England

REF 9 Road Layout Design CD 112 Geometric design of grade separated junction. Highways England (2020).

REF 10 Road Layout Design CD 127 Cross-sections and headrooms. Highways England (2021).

REF 11 Road Layout Design CD 143 Designing for walking, cycling and horse-riding. Highways England (2020).

REF 12 Highways Structures and Bridges Design CD 350 The design of highways structures. Highways England (2020).

REF 13 Highways Structures and Bridges CD 351 the design and appearance of highways structures. Highways England (2020).

REF 14 Drainage Design CD 529 Design of outfall and culvert details. Highways England (2020).

REF 15 Drainage General Information CG 501 Design of highway drainage systems. Highways England (2020).

REF 16 Road Lighting Design TD 501 Road lighting design. Highways England (2020).

REF 17 Manual for Streets. Department for Transport (2007).

REF 18 General Principles and Scheme Governance General Information GG 103 Introduction and general requirements for sustainable development and design. Highways England (2019).

REF 19 Sustainable and Environment Design LD 117 Landscape design. Highways England (2020).

REF 20 Sustainability and Environment Design LD 118 Biodiversity design. Highways England (2020). [redacted]

REF 21 Sustainability and Environment Design LD 119 Roadside environmental mitigation and enhancement. Highways England (2020). [redacted]

REF 22 Sustainability and Environment Appraisal LA 113 Road drainage and the water Environment. Highways England (2020). [redacted]

REF 23 Sustainability and Environmental Appraisal LA 113 Road Drainage and the water environment. Highways England (2020). [redacted]

REF 24 Equality Act (2010). [redacted]

REF 25 Road Investment Strategy 2 (RIS2): 2020 to 2025 (2020). [redacted]

Appendix A: Compliance with NPSNN in Relation to Matters of "Good Design"

National Policy Statement – National Networks	Scheme Accordance
Paragraph 4.28 Applicants should include design as an integral consideration from the outset of a proposal. Paragraph 4.29 Visual appearance should be a key factor in considering the design of new infrastructure, as well as functionality, fitness for purpose, sustainability and cost. Applying "good design" to national network projects should therefore produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction, matched by an appearance that demonstrates good aesthetics as far as possible.	The Scheme has been the subject of an iterative design process, informed by analysis of landscape and visual constraints, iterative impact assessments and mitigation proposals, and taking account of stakeholder input. Design, mitigation and enhancement measures incorporated into the Scheme design and planned construction are described in detail in Chapter 2, The Scheme **[APP-071]** and Section 7.8 in Chapter 7 Landscape and Visual Effects **[APP-076]** of the Environmental Statement (ES). The Environmental Masterplan which is included in the application as Figure 2.4 **[APP-091]** of the ES shows how the commitments to Scheme design are being implemented to minimise environmental impacts. The above documents demonstrate that the Scheme has been designed, as far as possible, to avoid and minimise impacts and effects on landscape character and visual receptors. This includes landform modelling such as cuttings and planting of woodland, trees and shrubs along the route corridor to filter views and integrate the Scheme with the landscape. In particular, measures that have been integrated into the Scheme to minimise effects on landscape character and visual amenity include the features listed below. 1. Optimising the horizontal and vertical alignment of the new dual carriageway in a way that seeks to minimise impacts associated with crossing valleys and landforms within the landscape. 2. The positioning of sections of the new dual carriageway in earthwork cuttings to visually contain much of the carriageway and its associated infrastructure and traffic movements from existing views available from receptors in close range and more distant views. 3. Designing earthwork slopes to gradients that soften their appearance and achieve good integration with the rural landscape. 4. Confining lighting on new and improved sections of road within the Scheme to locations where road safety is a priority, to minimise the potential for light spill in night time views.

National Policy Statement – National Networks	Scheme Accordance
	5. Optimising the proposed internal layouts of construction compounds to minimise their temporary impact in the landscape and in available views. 6. The designing of permanent structures, such as footbridges, in a way that minimises their visual impact in the landscape. In addition, the height of the proposed three-tier Black Cat junction has been minimised in the design process by lowering the level of the A1, which will form the bottom tier of the junction, to 12.5m below existing ground level. Chapter 2, The Scheme of the ES **[APP-071]** explains that the Scheme has been designed in accordance with the prevailing standards and good design practice as set out in Design Manual for Roads and Bridges (DMRB). Compliance with the relevant standards will ensure that the Scheme is fit for purpose and is functional. In addition to this, the Scheme has been developed so that it complies with National Highways safety governance procedures in order to ensure operational risks were identified and mitigated In addition, Chapter 2, The Scheme **[APP-071]** of the Environmental Statement also explains that design-development of the Scheme and approach to Scheme construction has been informed by the ten principles for good road design as set out in Highways England's guide, The Road to Good Design. For instance, the Scheme aims to achieve an earthworks balance where possible, in order to minimise importing or exporting earthworks materials. Where this has not been possible, the design has sought to acquire construction materials from identified borrow pits adjacent to the Scheme rather than offsite sources. Consideration has also been given to the construction methods and operations of the Scheme to ensure that construction can be undertaken in phases as safely as possible, whilst recognising potential disruption to residents, businesses, landowners and users of PRoW and road networks. Further information on the principles through which the Scheme has been developed are set out in Chapter 2, The Scheme **[APP-071]** of the Environmental Statement. The approach described above which demonstrates how design has been an integral consideration in development of the Scheme was put in place from the outset of the proposal. The design process included various options for the Scheme which were considered and assessed against certain criteria to ensure the most sustainable outcome. These criteria included the engineering impact,

National Policy Statement – National Networks	Scheme Accordance
	environmental impact, buildability impact and traffic impact. Chapter 3, Assessment of Alternatives **[APP-072]** of the Environmental Statement describes the design- based alternatives considered as part of the design-development process, including considerations relating to the visual/aesthetic appearance of the Scheme in views, and its potential noise impacts at noise sensitive locations. The process resulted in some impacts being avoided or reduced through the application of good design principles.
Paragraph 4.30 It is acknowledged however, that given the nature of much national network infrastructure development, particularly SRFIs, there may be a limit on the extent to which it can contribute to the enhancement of the quality of the area.	This point is recognised in paragraph 4.1.3 of the main report (above).
Paragraph 4.31 A good design should meet the principal objectives of the scheme by eliminating or substantially mitigating the identified problems by improving operational conditions and simultaneously minimising adverse impacts. It should also mitigate any existing adverse impacts wherever possible, for example, in relation to safety or the environment. A good design will also be one that sustains the improvements to operational efficiency for as many years as is practicable,	The Environmental Statement Chapter 2, The Scheme **[APP-071]** of the Environmental Statement explains that the identified key problems associated with the existing A428 include: a. There is a lack of viable alternative east-west routes between Cambridge and other economic centres such as Milton Keynes, Northampton and Bedford. b. There is poor non-motorised user provision along the corridor. c. A number of junctions along the corridor operate close to, or at capacity. d. Peak hour speeds along the corridor are significantly slower than the rest of the day. e. Speeds on the single carriageway sections of the corridor are significantly lower than those that are dualled. f. There is a high degree of journey time variability along the corridor, making it difficult for users to plan their journey with confidence.

National Policy Statement – National Networks	Scheme Accordance
taking into account capital cost, economics and environmental impacts.	g. Safety and maintenance issues along the corridor. h. There is low resilience against accidents and incidents. i. There is a lack of driver information along the corridor. j. 'Rat-running' on local roads through villages (resulting from drivers seeking alternative routes to avoid the existing A428). k. The above problems constrain economic growth along the corridor. Chapter 2, The Scheme **[APP-071]** of the Environmental Statement, paragraph 2.2.1 explains that the purpose of the Scheme is to address the problems of congestion, poor journey time reliability and poor resilience against incidents between the Black Cat and Caxton Gibbet roundabouts. The Scheme has been designed in order to minimise environmental effects, through embedding mitigation measures that have influenced and/or been incorporated into, the preliminary design for the purpose for avoiding, preventing, and reducing the environmental effects. Table 2-1 in Chapter 2, The Scheme **[APP-071]** of the Environmental Statement provides details of the embedded mitigation. In addition, a full schedule of mitigation is provided **[APP-235]**. This includes measures included in relation to both safety and the environment. In terms of the Scheme sustaining operational efficiency for many years it should be noted that the Scheme has been designed to be resilient to climate change taking into account future climate change scenarios with consideration for flood risk, drainage design and use of materials for construction. As set out in Chapter 2, The Scheme **[APP-071]**, future maintenance would be undertaken on a routine basis and following any major incidents or extreme weather events. Periodic maintenance operations, similar to those being undertaken elsewhere on the strategic and local road networks, would also be carried out. The Scheme and its elements have been designed to ensure minimal future maintenance requirements. This will be achieved through the use of low maintenance equipment and features that would reduce the number of repairs required.

<table>
<tr><th>National Policy Statement – National Networks</th><th>Scheme Accordance</th></tr>
<tr><td></td><td>Many of the structures within the Scheme have been designed to achieve a 120 year life span, in accordance with relevant DMRB design standards. By incorporating low maintenance equipment and features that reduce the number of repairs required, and the co-location of equipment to facilitate access for routine inspections, the frequency of future interventions has been reduced. As such, no significant maintenance activities are likely to be required within the first five years of the Scheme being operational.

Repair activities would be required as part of any unplanned, emergency works, for example to repair damage following road traffic incidents.</td></tr>
<tr><td>Paragraph 4.32

Scheme design will be a material consideration in decision making. The Secretary of State needs to be satisfied that national networks infrastructure projects are sustainable and as aesthetically sensitive, durable, adaptable and resilient as they can reasonably be (having regard to regulatory and other constraints and including accounting for natural hazards such as flooding).</td><td>The table in Appendix B of this document sets out the Scheme response to the principles in the Road to Good Design and the ways in which the Scheme is sustainable, aesthetically sensitive, durable, adaptable and resilient. See the table below for relevant principles from the Road to Good Design in relation to these factors and see Appendix B for further information.
<table>
<tr><th>Factor</th><th>Road to Good Design Principle</th></tr>
<tr><td>Sustainable</td><td>5. Good road design is restrained
6. Good road design is environmentally sustainable
9. Good road design is collaborative</td></tr>
<tr><td>Aesthetically sensitive</td><td>4. good road design fits in context
5. good road design is restrained</td></tr>
<tr><td>Durable</td><td>7. Good road design is thorough
10. Good road design is long lasting</td></tr>
<tr><td>Adaptable</td><td>8. Good road design is innovative</td></tr>
</table>
</td></tr>
</table>

National Policy Statement – National Networks	Scheme Accordance
	<table><tr><td>Resilient</td><td>1. Good road design makes roads safe and useful 2. Good road design is inclusive 3.Good road design makes roads understandable</td></tr></table> In relation to natural hazards such as flooding, a Flood Risk Assessment (FRA) has been carried out in respect of the Scheme and is included as Appendix 13.4 **[APP-220]** of the Environmental Statement. The methodology and findings of the FRA are also presented in Chapter 13, Road Drainage and the Water Environment **[APP-082]** of the Environmental Statement. The FRA identifies and assesses the risks from all forms of flooding to and from the Scheme and demonstrates how these will be managed, taking account of climate change. The FRA concludes that that there is no detrimental impact on flooding to or from the Scheme. The Scheme is considered by the Applicant to be a necessary development and subject to the Exception Test. The Scheme underwent a detailed optioneering process in order to identify the most appropriate option. The Scheme is required to provide a dual carriageway road link between the existing Black Cat and Caxton Gibbet roundabouts. There is no potential route between these points that would avoid the need to cross the River Great Ouse, its associated floodplain and other water courses. Flood modelling and flood risk assessments have been undertaken for each of the watercourses affected to demonstrate the potential impacts of the Scheme and identify and design appropriate mitigation measures to ensure that flood risk to people and property would be managed satisfactorily. Parts of the Scheme cross Flood Zones 2 and 3, including where it crosses the River Great Ouse and Hen Brook, although the majority of the Scheme is within Flood Zone 1. The Sequential Test has been applied to the Scheme. The development cannot be directed to an area with lowest probability of flooding and is classed as ‘Critical Infrastructure’. The Scheme is therefore subject to the Exception Test. The Scheme ensures that flood risk to people and property is not increased. Flood risk mitigation measures have been developed as part of the EIA and are described within Chapter 13, Road Drainage and the Water Environment **[APP-082]** of the

<table>
<tr><th>National Policy Statement – National Networks</th><th>Scheme Accordance</th></tr>
<tr><td></td><td>Environmental Statement, the Schedule of Mitigation [APP-235], and in the FRA included within Appendix 13.4 [APP-220] of the Environmental Statement.

Drainage features incorporated into the design of the Scheme include ponds, reedbeds and swales.

The Drainage Strategy Report provided in Appendix 13.3 [APP-219] of the Environmental Statement identifies that the drainage has been designed according to national SuDS best practice. These include the principles of DEFRA (2015) Sustainable Drainage Systems, Non-statutory technical standards for SuDS and the DMRB. The Environmental Masterplan which is included in the application as Figure 2.4 [APP-091] of the Environmental Statement shows attenuation basins that will also form marsh and wet grassland, contributing to wetland enhancement, as reported in Section 8.8 of Chapter 8, Biodiversity [APP-077] of the Environmental Statement.</td></tr>
<tr><td>Paragraph 4.33

The applicant should therefore take into account, as far as possible, both functionality (including fitness for purpose and sustainability) and aesthetics (including the scheme’s contribution to the quality of the area in which it would be located). Applicants will want to consider the role of technology in delivering new national networks projects. The use of professional, independent advice on the design aspects of a proposal should be considered, to ensure good design principles are embedded into infrastructure proposals.</td><td>Functional requirements of the Scheme, as a highways infrastructure project, are led by technical documents setting out parameters for new road design, such as DMRB and supporting Highway Design Standards for infrastructure. Compliance with these requirements will ensure the Scheme is fit for purpose.

The table in Appendix B of this document sets out the Scheme response to the principles in the Road to Good Design and the ways in which the Scheme is sustainable and contributes to the quality of the area in which it is located. See the table below for relevant principles from the Road to Good Design in relation to these factors and see Appendix B for further information.
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</td></tr>
</table>

National Policy Statement – National Networks	Scheme Accordance
	<table><tr><td>Aesthetically sensitive</td><td>4. Good road design fits in context 5. Good road design is restrained</td></tr></table> The Scheme proposals include the use of technological equipment including Closed Circuit Television (CCTV) coverage to monitor Black Cat, Cambridge Road and Caxton Gibbet junctions and emergency telephones installed at several lay-bys along the new dual carriageway. Variable message signs to provide information to drivers may also be included although it should be noted that subsequent to their inclusion in the Scheme and their assessment within the environmental impact assessment, the ongoing development and review of the design has yet to conclude that they would be required as part of the Scheme. An independent design review of the Scheme has not been undertaken. However, a comprehensive design development process has been undertaken, taking into account the principles set out in the Design Manual for Roads and Bridges and notably the National Highways publication “Road to Good Design”. This has also included feedback from consultation which led to design changes such as the lowering of the A1 below the Black Cat Junction to reduce visual impact.
Paragraph 4.34 Whilst the applicant may only have limited choice in the physical appearance of some national networks infrastructure, there may be opportunities for the applicant to demonstrate good design in terms of siting and design measures relative to existing landscape and historical character and function, landscape permeability, landform and vegetation.	Chapter 2, The Scheme **[APP-071]** of the Environmental Statement and the Schedule of Mitigation **[APP-235]** identify and describe the key features of embedded mitigation that have been incorporated into the design of the Scheme to avoid adverse environmental impacts. The Scheme has also been subject to an iterative process of design development, as described by Chapter 3, Assessment of Alternatives **[APP-072]** of the Environmental Statement, with account taken of the views of stakeholders throughout this process. Sections 4 and 5 of the Consultation Report **[APP-033]** identifies comments made by stakeholders at statutory consultation and how these have been taken account of during the process of design development. Section 6 and 7 of the Consultation Report **[APP-033]** summarises the responses to the non-statutory supplementary consultation and how the Applicant has had regard to the matters raised in the responses and incorporated these into the Scheme design.

National Policy Statement – National Networks	Scheme Accordance
	In terms of siting and design measures in relation to landscape, as explained in the table in Appendix B of this document, the Scheme has been designed to minimise its impact on the landscape and to preserve the historic character of the landscape where possible. A number of environmental and design measures have been incorporated to ensure this, including: development of a comprehensive planting strategy, including aligning the Scheme to make use of existing vegetation to help integrate the new dual carriageway into the landscape and maintain historic patterns; positioning of sections of the new dual carriageway below existing ground level within earthwork cuttings to screen views of the new infrastructure; and limiting the land required to construct, operate and maintain the Scheme to avoid unnecessary disturbance to buried archaeology.
Paragraph 4.35 Applicants should be able to demonstrate in their application how the design process was conducted and how the proposed design evolved. Where a number of different designs were considered, applicants should set out the reasons why the favoured choice has been selected. The Examining Authority and Secretary of State should take into account the ultimate purpose of the infrastructure and bear in mind the operational, safety and security requirements which the design has to satisfy.	Chapter 3, Assessment of Alternatives **[APP-072]** of the Environmental Statement provides an overview of how the design for the Scheme developed, the options that were considered and the reasons for selecting the design that is the subject of this DCO application. In addition, the Black Cat Junction Design Options report **[APP-247]** sets out how the design of the proposed Black Cat Junction, an integral element of the Scheme, has developed over time. The Scheme has been designed in accordance with the technical standards specified in the DMRB. The evolution in the design from a series of options down to the Scheme as proposed has been determined based on guidance specified by the Department for Transport's Transport Analysis Guidance criteria, through the EIA process, through stakeholder engagement, and taking account of relevant design standards. The Applicant's Case for the Scheme **[APP-240]**, Appendix A, rows 4.60 to 4.65 explain, in summary, how the Scheme addresses safety issues. For example, row 4.64 explains that the Scheme was designed in accordance with technical documents produced by the Department for Transport (DfT) and National Highways which include the DMRB and Manual for Contract of Highway Works (MCHW). Compliance with Highways England's safety governance procedures including consultation with Operations Technical Leadership group and production of Operational Safety documents was a mandatory aspect of the Scheme design management process to ensure operational risks were identified and mitigated.

National Policy Statement – National Networks	Scheme Accordance
	The Construction, Design and Management (CDM) regulations 2015 require due consideration for health and safety of all stakeholders through the project life which has been applied to the Scheme development process. The Case for the Scheme [APP-240], Appendix A, Row 4.62 also explains: A Stage 1 Road Safety Audit (RSA) has been carried out for the Scheme. This is described in Section 7.2 of the Transport Assessment **[APP-241]**. Additional Road Safety Audits will be conducted in accordance with DfT and National Highways guidance as the design progresses. Further road safety audits will be carried out after stage 5 (construction) of the Scheme, as soon as reasonably practicable after the Scheme opens to traffic in order to observe road user behaviour. The Case for the Scheme **[APP-240]**, Appendix A, row 4.76-4.77 explains that no national security implications have been identified for the Scheme.

Appendix B: Scheme response to the Road to Good Design

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
1. Good road design makes roads safe and useful	Various workshops and assessments have been undertaken to ensure that safety has been integral to the design-development and final operation of the Scheme. The Scheme has been designed and planned in accordance with relevant design standards, where possible, and considers the needs and impacts on stakeholders, the community and the surrounding environment. The Scheme forms part of the National Highways strategy to improve connectivity, ease congestion and improve safety within the area and the wider road network. Safety measures include the removal of unsafe accesses and side roads onto the A1, use of appropriate lighting, clear readable signage and safety barriers. Different approaches to safety have been incorporated into the design for different Scheme elements, for example the new Roxton Road link would be constructed to connect Wyboston and Chawston and provide safer access to Bedford Road and the A1. The Scheme will support and facilitate planned growth in residential housing, employment and commercial development within the host authorities, as identified within their Development Plan documents. Through the delivery of improvements to the strategic road network, and associated accessibility improvements for local communities and users, the Scheme will improve the quality of the network by addressing congestion, connectivity, reliability, accessibility, safety, resilience and capacity issues on the existing A428 between St Neots and Caxton Gibbet.	Embedded into the preliminary design of the Scheme through the process of design-development.
2. Good road design is inclusive	The Scheme has been designed using an inter-disciplinary approach which considered the needs and impacts on all users and the community. This included active travel, as well as other groups and communities that may be impacted by the Scheme.	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	The following assessments and consultations have been undertaken to understand the needs and requirements and potential impacts on local people and communities to inform design-development: • Stakeholder and community meetings. • Public exhibitions during statutory consultations. • Equality Impact Assessment (EqIA) **[APP-245]**. • Population and human health assessment **[APP-081].** • Various design hazard, risk and safety assessments and workshops. Examples of a feature included within the Scheme design that compliments this design principle include the following: • The requirements of the *Equality Act 2010* (REF 24) have been considered during the design-development of the Scheme by incorporating a combined Kelpie Marina access track and public footpath over the A1 and alongside the northbound carriageway, to provide a segregated and safe means of access to Kelpie Marina. • Increasing the headroom of a culvert structure at Pillar Plantation from 2.7 metres to 3.7 metres in height, which will enable a bridleway to pass beneath the new dual carriageway so that horse riders can use it as an underpass without having to dismount. Mitigation measures have been included within the design of the Scheme to maintain and, where feasible, improve local routes to ensure continued connectivity between communities. Examples include: • The stopping up and re-routing of existing routes away from the new dual carriageway.	

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• The introduction of new combined footpaths and cycleways, some of which will be shared and combined with private means of access, and installed in road verges. • Inclusion of pedestrian underpasses beneath, and bridges above, the new dual carriageway to allow safe passage for users.	
3. Good road design makes roads understandable	The new dual carriageway would provide a free-flowing continuous link from the Black Cat junction to Caxton Gibbet junction, thereby reducing the need to navigate numerous roundabouts and providing a simpler, more intuitive route from Milton Keynes to Cambridge. A factor in the selection of options, as reported in the Black Cat Junction Design Options **[APP-247]**, was the ability for users to navigate the junction safely and correctly. The grade separated Black Cat junction is a typical 3-level interchange, avoiding complex loop arrangements. New road signage and markings would be installed across the Scheme to ensure route legibility for road users travelling on new and improved roads, and to support the Scheme objectives of cutting congestion and improving safety. An initial review has been undertaken to identify where existing signage will need to be altered to accommodate changes introduced by the Scheme. Where existing signs do not conform to new or modified road layouts within the Scheme, these will be removed and replaced with new signage containing updated information. Key sections of road identified at this stage include the existing A428 between Girton and Caxton (which will be renamed as the A421). A signage audit will be undertaken at the detailed design stage of the project to eliminate confusing and unnecessary sign clutter. A commitment has been made to relocate historic milestone/milepost markers to appropriate locations as part of the Scheme to preserve these features and ensure they remain representative of the distances they demarcate. Additionally, the existing Black	Embedded into the preliminary design of the Scheme through the process of design-development.

Commented [CR14]: These should be fully-inclusive NMU routes i.e. equestrian as well as per the Councils' requests.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	Cat metal sign currently located at the Black Cat roundabout will be retained and repositioned within the design of the new Black Cat junction.	
4. Good road design fits in context	The Scheme has been designed to minimise its impact on the landscape and to preserve the historic character of the landscape where possible. For example, the horizontal and vertical alignment of the new dual carriageway has been optimsed in a way that seeks to minimise impacts associated with crossing valleys and landform within the landscape and avoid impacts on valued landscape features such as a veteran Elm tree located to the north of Hen Brook. A number of environmental and design measures have been incorporated to ensure this, including: development of a comprehensive planting strategy to help integrate the new dual carriageway into the landscape; positioning of sections of the new dual carriageway below existing ground level within earthwork cuttings to screen views of the new infrastructure; and limiting the land required to construct, operate and maintain the Scheme to avoid unnecessary disturbance to buried archaeology. In relation to engineering components, the Scheme design has sought to use common materials where possible to ensure elements appear consistently – for example weathering steel girders are proposed for the bridges within the Black Cat junction that provide comparable finishes. Opportunities taken within the design include having a visually elegant footbridge as opposed to a more utilitarian and economical structure, to reduce its visual impact within the sensitive landscape and in available views from the new Wintringham development. Post and rail fences are proposed as boundary treatments along the new dual carriageway to reduce the appearance of a hard boundary within the local landscape. The illustrative landscape design presented as part of the Environmental Masterplan **[APP-091]**, figure 2-4 of the Environmental Statement has been developed in line with *LD 117* (REF 19), and presents the different types of planting proposed. The development of the landscape design commenced with the identification and	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	establishment of the following design principles relevant to the landscape and visual environment: • A strategic, green infrastructure approach to design which considers the multiple benefits that the Scheme can deliver. • The sensitive design of earthworks, attenuation basins and other drainage features to fit with surrounding landform and land cover patterns. • As far as practicable, the sensitive location of signage to limit visual intrusion. • Lighting of new and improved sections of highway within the Scheme has been confined to locations where road safety is a priority, in order to minimise the potential for light spill in night time views across the landscape. • Where practicable, the application of recommendations contained within relevant landscape guidelines. • The use of a range of plant species to reflect the distinctive local character, protect against the effects of climate change, and reinforce biosecurity. • Areas of species rich grassland at locations where conditions are suitable for their establishment, to provide seasonal interest and to provide valuable habitats that increase local biodiversity. • The use of different types of native tree and shrub planting on and adjacent to highway earthworks to create woodlands, copses and shelterbelts to fit with the surrounding landscape character patterns, help to break up the scale of the new dual carriageway, and screen structures, traffic and lighting. • Retention of views to local landmarks through breaks in proposed planting, to help create a sense of place and interest for road users where possible.	

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• Rounding of the crests and toes of embankments and cuttings to achieve better integration with the surrounding landform, where space and materials are available. • The use of hedgerows along the highway boundary, where appropriate, to link into existing field boundaries, provide screening and integration into the local pattern, and to connect and extend existing wildlife corridors. No acoustic fences are included in the design due to the secondary landscape and visual effects they can often cause. Where noise attenuation is required, earth bunds have been incorporated into the design of the new dual carriageway (which also offer longer-term maintenance benefits). The landscape design aims to retain as much existing vegetation within the Order Limits as possible, as retention has biodiversity benefits and allows areas of screening vegetation to be maintained, thereby minimising the need for planting. Green corridors alongside PRoW and new links and connections between these PRoW to the east of St Neots have been included in the design, the purpose being to improve the opportunities for biodiversity. The design has also sought to expand the physical pattern of landscape features surrounding the village of Eltisley to improve the visual connectivity of the historic village enclosures, and the sense of arrival to the village.	
5. Good road design is restrained	Features included within the Scheme design that compliment this design principle include: • The landscape design has sought to express local characteristics, taking opportunities to enhance local environments where appropriate. • The use of plant species that are present within the surrounding area.	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• Parts of the new dual carriageway would be set in earthworks cuttings to reduce its visual impact, its impact on the historic landscape character and impacts on the noise environment. • Earth bunds have been designed to minimise visual intrusion and contain road traffic noise, where required. A key aim relating to design restraint has been to balance the need to deliver a safe junction at Black Cat that does not fundamentally compromise the existing environmental and socio-economic conditions along the A1. For example, it was noted that construction of parts of the junction to current design standards would have resulted in the need to demolish existing properties on the A1. Accordingly, the design at this location includes a number of departures from standards to maintain the character of the A1. The strategy for the Black Cat junction sought to reduce the visual prominence of the new three-tier junction by designing it to position the A1 beneath the gyratory, which is at ground level. As noted in Design Principle No.3, elements of the historic environment and those that contribute to sense of place (the existing Black Cat metal sign, mileposts, milestones and signage) will be retained within the design of the Scheme. Parts of the existing A428 will be retained in the Scheme and de-trunked.	
6. Good road design is environmentally sustainable	The form and nature of the landscape design has been developed to assimilate the Scheme into the surrounding landscape. Through the design-development process, there have been many examples of good road design. For example, a previous iteration of the proposed alignment of the new dual carriageway was in close proximity to a veteran elm tree which would have impacted on the tree's root protection zone. A decision was taken to horizontally realign the new dual	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	carriageway to ensure that the highway boundary is outside of the tree's root protection area. Some sections of the new dual carriageway would be positioned in cutting to reduce the significance of its effects on local landscape character and visual amenity, the setting of heritage assets (cultural heritage), and to reduce impacts associated with road traffic noise. The lighting design has sought to minimise the potential for adverse effects on nocturnal species, the existing landscape and night-time views within it, and the setting of features associated with the historic environment. Where possible, the Scheme has been designed to provide similar, natural catchment areas to minimise the impacts of flooding, and to be resilient to climate change – for example through the incorporation of sustainable drainage systems into the design to avoid surcharge for a 1 in 1 year return period and no flooding in a 1 in 5 year return period (including for a 40% increase in rainfall intensity). The design of the Scheme has also responded to climate change through the inclusion of flood storage areas, the retention of existing highways infrastructure where possible to reduce greenhouse gas emissions associated with demolition and transportation activities, and the reuse of construction materials within the design. Moreover, the Scheme has been designed to achieve a cut and fill balance as far as practicable, to reduce the need to import and export material. A number of borrow pits have been incorporated into the design to reduce the need to import material, and thereby reduce the associated traffic movements that could result in greenhouse gas emissions.	
7. Good road design is thorough	The Scheme forms part of the Department for Transport's *RIS2* (REF 25), the design of which has followed Highways England's relevant standards and guidance.	Applied during the design-development of the Scheme through the application of, and

Commented [CR15]: But it needs to also address human needs on all NMU routes, including the underpasses. Consideration needs to be given as to whether it is feasible to combine provision for human and ecological needs or whether they need to be separated.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	The design-development process has been iterative, robust and comprehensive, and has given consideration to road users and its potential environmental and socio-economic impacts. This has, for example, identified and evaluated different route alignments for the new dual carriageway and alternative junction designs, details of which are described in Chapter 3, Assessment of Alternatives **[APP-072]** of the Environmental Statement**.** Development of the Scheme design has been informed by a detailed understanding of the existing conditions of the receiving environment. These conditions have been established through targeted surveys and data collection to obtain site-specific information, thereby allowing the design to be responsive to existing features, constraints, sensitivities and opportunities. Surveys undertaken include: geotechnical and ground condition investigations; soil and water surveys; archaeological site investigations; arboricultural, landscape and visual surveys; noise surveys; WCH surveys; and ecological surveys. The design has also responded to stakeholder comments and feedback received during statutory and non-statutory consultation (described in Design Principle No. 9), in order to improve the design and intercept issues of concern to local residents and statutory consultees. This iterative process enabled continuous design refinements and improvements to be made, which collectively achieved the following benefits: • Route alignment adjustments which allowed impacts upon residential properties and visual receptors to be minimised as far as reasonably practicable. • Reductions in overall costs for the Scheme. • Rejection of design proposals deemed to be less safe than other alternative solutions.	adherence to, the requirements of Highways England's standards.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• Proceeding with a design that includes elements that were favoured during public consultation. • A design that delivers the best benefits for the users of the strategic and local road network in terms of reduced journey times and less congestion. As part of the Scheme, parts of the existing A428 would be de-trunked. It has been agreed with the relevant local authorities that: • The existing A428 between Cambridge Road (St Neots) and Caxton Gibbet would be re-classified as a B class road with number B1428 – a continuation of the number of Cambridge Road. • The existing A428 between Wyboston and Cambridge Road (the St Neots bypass) would remain an A-class road because of the volume of traffic forecast near Little Barford roundabout and would be re-numbered as the A1428. The identification of borrow pit locations within the Scheme was informed by a comprehensive site selection and optioneering exercise, in which potential locations were evaluated against a series of criteria, and lessons learned from previous projects incorporating these features. The criteria included selecting sites that avoided areas of environmental interest and value, for example buried archaeology, where possible. Their design has also identified potential haul routes and access arrangements between the sites and construction areas requiring material. The proposals for restoration of the borrow pits would be completed at the detailed design phase; however, it is envisaged that progressive restoration of the borrow pits to agricultural use would be undertaken. The borrow pits would be restored through backfilling with subsoil material unsuitable for construction and topsoil. One of the borrow pits would be restored to 1m below existing ground due to a request from a landowner and all others would be brought back to existing ground level. .	

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
8. Good road design is innovative	Various design layouts and options were considered at the options appraisal stage for the new dual carriageway. The preferred route captured opportunities for betterment and was selected as it: • Was close to the existing A428. • Provided additional connectivity to St Neots. • Improved traffic and congestion. • Was seen to be the most beneficial to the local economy. • Had the least environmental impact on ecology, designated sites, the visual environment, agriculture, heritage sites and the local community. The preferred design option for the Black Cat junction was selected as it: • Created free-flowing traffic at the junction. • Had the least overall impact on the local environment and the surrounding area. • Had the least landtake. • Improved traffic flows and congestion. • Was seen to be the most practical option, having the greatest capacity and flexibility to cope with any future increases in traffic. Following selection of the preferred route alignment and junction design options, collaboration between the Scheme's environmental assessors, highway design engineers and drainage specialist continued to be an integral part of the design-development process, the aim being to avoid environmental constraints where possible, mitigate the Scheme's environmental effects, and take account of consultation responses and feedback.	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	Key alternatives that have been considered include: • The design of the footbridge at Wintringham Brook. • Road design options and mitigation solutions for the Grade II listed Brook Cottages. • Options for the location of borrow pits to be used during construction of the Scheme. • The number and location of floodplain compensation areas. • Options to mitigate the Scheme's effects on local bat populations. • The form and extent of noise bunds at Roxton and Potton Road. • The number and location of main and satellite construction compounds. • The sequencing and timing of works to be undertaken during construction of the Scheme. Details of the alternatives considered and the reasons for the selection or discounting are presented in Chapter 3, Assessment of Alternatives **[APP-072]** of the Environmental Statement**.** Innovative measures incorporated into the design of the Scheme and the approach to its construction include the following: • An ~~dedicated~~ underpass structure to allow bats to pass freely beneath the new dual carriageway along an existing hedgerow either side of the new road, without havingto change their flight path, combined with NMU provision. An innovative approach will be taken to ensure that both human and ecological needs can be successfully met within the one structure. • Undertaking and completing a comprehensive archaeological geophysical survey and evaluation trenching across the Scheme to confirm the form, nature and extent of buried archaeology in advance of submission of the DCO application, in order to de-risk the potential for construction delays and establish a robust baseline against which to assess the Scheme's impacts and effects on archaeological resources.	

Commented [CR16]: As noted above, this structure is also currently set out for NMUs but at 30m long they need lightning to meet basic human needs and modal shift policy requirements. Therefore this needs to recognise the human need and accurately reflect those differing needs.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• The identification and inclusion of borrow pits at either end of the Scheme, in order to source materials locally to the Scheme and reduce the need for the importation and removal of materials and waste off-site (thereby reducing the associated environmental effects of road traffic emissions and network disruption to users). • Harnessing opportunities for culvert structures installed on watercourses to provide other functions, such as pedestrian and mammal access beneath the new dual carriageway. The design of the Scheme also offers opportunities for offsite construction of elements, for example the design of culvert structures is modular and could therefore be brought to site. Similarly, the viaduct across the River Great Ouse and the central bridge of the Black Cat junction could include modular components that could be precast and brought to site. Such opportunities will be evaluated during the detailed design stage.	
9. Good road design is collaborative	The design has considered the needs of, and impacts on, local communities and road users. This has involved a review of existing WCH movements to establish journey patterns on existing roads and PRoW, and establishing the type and frequency of journeys made between communities. Additionally, traffic forecasts were generated to establish future flows on the network both with and without the Scheme in place. Various groups and organisations were contacted and invited to participate in the non-statutory consultation and provide their views on the Scheme. The groups and organisations included: • People who live and work in the vicinity of the Scheme. • Elected representatives. • Statutory consultees. • Other organisations including businesses and local interest groups.	Embedded into the preliminary design of the Scheme through the process of design-development.

Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• Landowners i.e. land interests potentially affected by the route options. Public exhibitions, consultations and stakeholder and community meetings have been undertaken regularly to inform design-development for the Scheme, the details of which are set out in the Consultation Report **[APP-033]**. To support effective consultation, the following innovative techniques were employed to enable the public to interpret the emerging Scheme designs and obtain constructive feedback: • Scheme web pages – to enable people to access the range of consultation materials • The A428 app – made available via tablets at the consultation events which enabled users to view the proposed Black Cat junction in augmented reality. • Scheme fly-through video – including drive-through visualisations giving a driver's eye view of the Scheme. • VISSIM traffic model – this microsimulation was produced using software which modelled traffic behaviour to show at this early stage how National Highways envisaged it would keep traffic moving through Black Cat roundabout during construction of the Scheme. • Minecraft – an innovative tool to engage with a younger audience and broaden the reach of the consultation. The Scheme was built in Minecraft, a virtual land where players can create and build using 3D building blocks. In response to collaboration with the host authorities, statutory bodies and non-statutory bodies on design matters, a number of modifications and refinements were made during the design-development process in relation to the engineering design, the planned methods of construction, and the use and extent of land required to build, operate and maintain the Scheme. Examples of how and where consultation influenced the design include the following:	

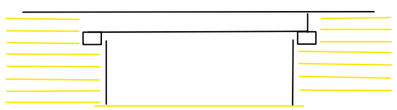
Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	• Reducing the height of the Black Cat junction by lowering the A1 under the junction, in response to concerns over visual impact. • Inclusion of earth bunds to attenuate road traffic noise, in response to concerns raised by residents in Roxton. • Providing improved access to and from properties onto The Lane, Chawston. • Inclusion of a roadside enclosure for horses to help bridleway users cross the existing A428 (located at Bridleway 1/18). • Realignment of a WCH route through the Black Cat junction to provide safer crossing opportunities.	
10. Good road design is long-lasting	As stated under Design Principle No. 6, the Scheme has been designed to be resilient to climate change taking into account future climate change scenarios with consideration for flood risk, drainage design and use of materials for construction. Future maintenance would be undertaken on a routine basis and following any major incidents or extreme weather events. Design should also, where possible, future-proof to enable modal shift through the provision of all-inclusive NMU routes adjacent to carriageways and infrastructure such as bridleway parapets that will enable delivery of upgraded status of NMU routes in the longer term at minimal capital cost. Periodic maintenance operations, similar to those being undertaken elsewhere on the strategic and local road networks, would be carried out on the following equipment and features: • Highway verge equipment – such as barriers, lighting and roadside technology. • Structures – such as road bridges and viaducts. • Landscaping – such as woodland and grassland. • Drainage features – such as ponds and culverts. • Carriageway features – such as road markings and road studs.	Embedded into the preliminary design of the Scheme through the process of design-development.

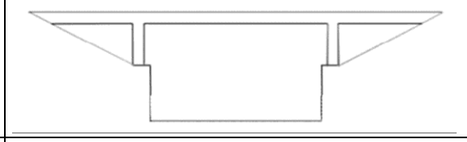
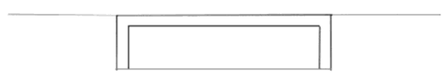
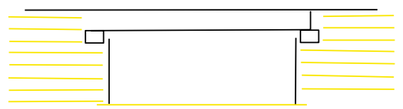
	The Scheme and its elements have been designed to ensure minimal future maintenance requirements. This will be achieved through the use of low maintenance	

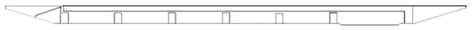
Road to Good Design principle	Consideration and application with the Scheme design	Securing mechanism
	equipment and features that would reduce the number of repairs required. Examples include: • The use of concrete barriers within the central reserve, which require minimal maintenance and are more resilient to damage if struck by a moving vehicle. • The use of 'integral' bridges, where feasible, which are designed to be free of mechanical bearings and movement joint components, which typically require replacement during the service life of the bridge. • Integrating watercourse culverts within underpasses where feasible, to reduce the number of structures requiring maintenance within the Scheme. • The use of weathering steel on some bridges, which requires little or no maintenance during the service life of the bridge. Avoiding such maintenance works brings with it benefits of reducing health and safety risks and limiting any associated disruption to the travelling public. Many of the structures within the Scheme have been designed to achieve a 120 year life span, in accordance with relevant DMRB design standards. By incorporating low maintenance equipment and features that reduce the number of repairs required, and the co-location of equipment to facilitate access for routine inspections, the frequency of future interventions has been reduced. As such, no significant maintenance activities are likely to be required within the first five years of the Scheme being operational. Repair activities would be required as part of any unplanned, emergency works, for example to repair damage following road traffic incidents.	

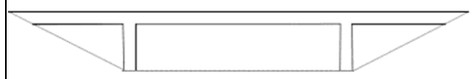
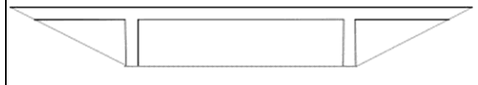
Appendix C: Design principles and features for specific structures

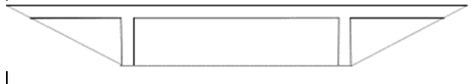
Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
S2 – Roxton Road Bridge	Overbridge	Five span weathering steel-concrete composite bridge with reinforced concrete bank seats on top of sloping earth embankments and reinforced concrete intermediate leaf piers. **Alignment and positioning**: Mirror alignment and positioned approximately 25m west of the existing bridge to enhance buildability and minimise visual impact. **Scale, height and massing**: Match the massing of the existing bridge as closely as possible. Scale increased to accommodate slip roads but with abutments aligned with bunds to enhance integration. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: Planting proposed to embankments and around abutments to integrate the structure and match existing.	Yes	Vertical Alignment of Roxton Road, alignment of new slip roads, visibility sight lines constrain the position of the piers, sequence and buildability of Black Cat junction	Yes, footway/cycleway in verge over the structure.		Width between parapets: 13.5m Span Lengths: 14m ; 21m ; 23m ; 30m ; 14m	9.5m above existing ground level
Black Cat junction		**Alignment and positioning**: Aligned to integrate with the A1 north and south and A421 to the west to minimise length of tie-ins. Positioned over and predominantly west of the existing Black Cat roundabout and across land currently mostly occupied by highway						

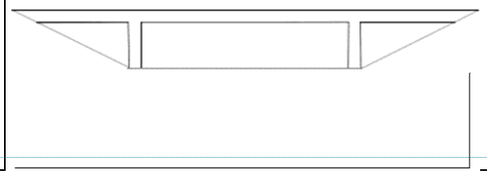
Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		infrastructure and roadside services. **Scale, height and massing**: Originally conceived as a three-tier junction above existing ground level. Scale and height minimised by incorporating the A1 in a cutting beneath the junction with the A421/A428 on an overbridge above the roundabout at grade. Massing of structures minimised by using a composite deck and embankments to break up structures across the centre. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: Substantial planting proposed around the junction to maximise landscape integration and visual screening, including on the embankments at the centre.						
S3 – Black Cat West Bridge	Underbridge	Single span portal with weathering steel-concrete composite deck supported on reinforced concrete bank seats on top of reinforced soil abutments.	No	Vertical alignment of A428 mainline, horizontal alignment of Black Cat circulatory (visibility sightlines), sequence and buildability of Black Cat junction	No, WCH routes moved to Roxton Road to avoid Black Cat Junction		Width between parapets: 28.4m Span Length: 36m	9.5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
S5 -Black Cat Central Bridge	Underbridge	Three span weathering steel-concrete composite bridge with reinforced concrete bank seats on top of sloping earth embankments and reinforced concrete intermediate leaf piers.	Yes	Fully integral construction for a long overall length of bridge, sequence and buildability of Black Cat junction	No, WCH routes moved to Roxton Road to avoid Black Cat Junction		Width between parapets: 27.7m Span Lengths: 24m, 36m, 25m	10.5m above existing ground level
S6 - Black Cat Roundabout North Bridge	Underbridge	Single Span Integral with weathering Steel-concrete composite bridge spanning between reinforced concrete Contiguous Bored Pile Retaining Wall Abutments	No	Vertical alignment of A1 channel below ground level. Horizontal alignment of Black Cat circulatory, sequence and buildability of Black Cat junction	No, WCH routes moved to Roxton Road to avoid Black Cat Junction		Width between parapets: 15.5m Span Length: 37m	2m above existing ground level
S7 - Black Cat Roundabout South Bridge	Underbridge	Single Span Integral with weathering Steel-concrete composite bridge spanning between reinforced concrete Contiguous Bored Pile Retaining Wall Abutments	No	Vertical alignment of A1 channel below ground level. Horizontal alignment of Black Cat circulatory, sequence and buildability of Black Cat junction	No, WCH routes moved to Roxton Road to avoid Black Cat Junction		Width between parapets: 15.5m Span Length: 37m	2m above existing ground level
S8 – Black Cat East Bridge	Underbridge	Single span portal with weathering steel-concrete composite deck supported on reinforced concrete bank seats on top of reinforced soil abutments	No	Vertical alignment of A428 mainline, horizontal alignment of Black Cat circulatory (visibility sightlines), sequence and buildability of Black Cat junction	No, WCH routes moved to Roxton Road to avoid Black Cat Junction		Width between parapets: 26.1m Span Length: 36m	11.5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
S9 -River Great Ouse Viaduct	Underbridge	Six span weathering steel-concrete composite bridge supported on piled reinforced concrete abutments and reinforced concrete intermediate piers. **Alignment and positioning**: Aligned to cross the River Great Ouse perpendicular to the channel. Positioned at a low point in the landscape, using land on the western side currently being restored from a quarry. **Scale, height and massing**: Scale and mass minimised by using a low profile structure on piers across the flood plain. Height below existing vegetation retained along the river. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: On the western side the landscape will be restored in line with the quarry restoration plan, avoiding planting in the floodplain that could impede flow. On the eastern side additional planting is proposed to reinforce connections along the river and to connect the landscape between the River Great Ouse viaduct and Barford Road bridge.	No	Crossing of River Great Ouse and floodplain. Navigable waterway	No, NMUs to avoid A428 mainline		Width between parapets: 26.1m Span Lengths: 35m, 42m, 42m, 42m, 42m, 56m	10.5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
S10 - Barford Road Bridge	Overbridge	Three span integral pre-cast concrete bridge supported on reinforced concrete bank seats on top of non-reinforced embankments and reinforced concrete intermediate leaf piers. **Alignment and positioning**: Sited at a point of higher ground to make use of existing topography to conceal the mainline in cutting beneath. Aligned closely with the existing Barford Road to maintain visual connections across the landscape and enhance buildability. **Scale, height and massing**: The scale and height have been minimised by siting the bridge on higher ground. Supported by two piers. **Materials and finishes**: Precast concrete beams and metal parapet. **Landscaping**: Planting proposed along Barford Road to reflect the existing rural character and provide visual screening.	Yes	Vertical alignment of Barford Road, and A428 mainline	No		Width between parapets: 11.6m Span Lengths: 20m, 30m, 20m	4.5m above existing ground level
S13 - East Coast Mainline Railway Bridge	Underbridge	Three span weathering steel-concrete composite bridge with reinforced concrete bank seats on top of sloping earth embankments and reinforced concrete intermediate leaf piers.	Yes	Vertical alignment of A428 mainline, OLE clearance, lateral clearance from outermost running rail, HP gas main, accommodation tracks Wynne Estate	No, NMUs to avoid A428 mainline		Width between parapets: 26.9m Span Lengths: 22m, 32m, 22m	12.5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Positioned at a point of transition in the landscape between the generally flat vale to the west and elevated land of Alington Hill to the east. Aligned close to existing hedgerows and woodland to enhance integration. **Scale, height and massing**: The scale and massing of the structure has been minimised by using steel plate girders supported by two piers and tied into embankments at each end. The height is determined by standards for crossing the railway line. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: Extensive woodland planting is proposed on the embankments to assist in integrating the structure and providing visual screening, particularly from Tempsford to the south west.						
S14 - Top Farm Bridge	Overbridge	Three span integral prestressed pre-cast concrete bridge supported on reinforced concrete bank seats on top of non-reinforced embankments and reinforced concrete intermediate leaf piers.	Yes	Vertical alignment of A428 mainline. Span over mainline in deep cutting avoiding piers in central reserve	No		Width between parapets: 5.7m Span Lengths: 17m, 34m, 21m	3.5m above existing ground level

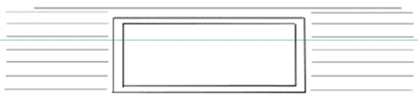
Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned with the existing farm access track. Positioned to retain as much existing vegetation as possible. **Scale, height and massing**: Positioned across the cutting such that minimal earthworks are required to provide necessary clearances to the mainline carriageway beneath. **Materials and finishes**: Precast concrete beams and metal parapet. **Landscaping**: Substantial woodland proposed to integrate the structure into the landscape.						
S17 - B1046 Bridge	Overbridge	~~Three span integral prestressed pre-cast concrete bridge supported on reinforced concrete bank seats on top of non-reinforced embankments and reinforced concrete intermediate leaf piers.~~ Please see comment.	Yes	Horizontal alignment of B1046 Potton Road	No		Width between parapets: 12m Span Lengths: 17m, 30m, 17m	3.5m above existing ground level

Commented [EL17]: Identify local vernacular references and where these could be incorporated into the structures. The series of structures surrounding Wintringham Park (S17, S19, and S25) should be identifiable as a "set" and respond to the vernacular buff tones and buff brickwork.

The overarching principle for these features should read:

"A common palette has been employed to identify the features relating to Wintringham Park. These include materials in buff tones and buff brickwork to reflect the local vernacular"

In S17 this should be demonstrated through the incorporation of buff brick or stone facing to the reinforced concrete bank and/or piers.

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Close to the alignment of the existing road to maximise landscape fit and buildability. Positioned at a point of transition where the land begins to slope down into the valley of Hen Brook with the mainline in cutting. **Scale, height and massing**: Scale and height mimimised by positioning the bridge over the cutting on low embankments and two piers. **Materials and finishes**: ~~Precast concrete beams and metal parapet.~~ Please see comment. **Landscaping**: Substantial woodland proposed to integrate the structure into the landscape and provide visual screening for residents of Eynesbury and Potton Road and users of PRoW.						
S19 - New Hen Brook Culvert and Underpass	Underbridge	~~Pre-cast segmental concrete box culvert.~~Please see comments.	No	Combining a watercourse culvert ~~,and~~ NMU underpass and a bat and other mammals tunnel into one structure. ~~,~~ The alignment and flood level of Hen Brook, the existing flight paths of bats, and buildability of structure within existing watercourse. Providing natural light as a minimum	Yes, footway/cycleway and ~~equatrian~~equestrian under the structure		Width between parapets: 31.1m Span Length: 7m	7m above existing ground level

Commented [EL18]: This should be an oval shaped underpass. The structure should be "welcoming" through the incorporation of an appropriate entrance feature, and should relate to the "Wintringham Park Series" of features through the inclusion of an appropriate entrance feature material within splayed wingwalls, such as buff brick. As this is a very long underpass, this may also be a good location to incorporate public art.

There are safety concerns over the bend in the footpath immediately after the tunnel as this reduces visibility for NMUs.

A lighting well as well as night-time lighting is requested to enable person-to-person facial recognition, encourage modal shift and enable non-motorised use at different times of day/year. A light well will also enable air flow.

It needs to be recognised that humans, bats, and other mammals have different needs, and both those needs must be met without compromising the standards needed for the other. The compatibility of this structure with existing bat flight paths also needs to be ensured. If it is not possible to achieve these aims within one feature, an alternative tunnel may be required to align with the existing bat flight path.

				within such a long tunnel and ensuring an adequately dark tunnel for bats.				

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned to minimise the realignment of Hen Brook, tie in with existing bat flight path, andto integrate the adjacent PRoW. Positioned where the mainline will be on embankment. If it is not possible to find a suitable alignment that accommodates all three uses a separate feature for the ~~bat~~ mammal underpass ~~tunnel~~ needs to be sought. **Scale, height and massing**: The structure will be integrated into the embankment with a slim cross-section to mi~~m~~nimise itsscale in elevation whilst providing the necessary flood functions. **Materials and finishes**: ~~Precast concrete to facilitate safe construction.~~ Please see comments. **Landscaping**: Substantial planting proposed to adjacent embankments to integrate the structure into the landscape and provide visual screening from St. Neots to the west and PRoW to the east.						
S25 – Cambridge Road Bridge	Overbridge	~~Three span integral pre-cast concrete bridge supported on reinforced concrete bank seats on top of non-reinforced embankments and reinforced concrete intermediate leaf piers~~.Please see comment.	Yes	Layout / arrangement of Cambridge Road junction, horizontal alignment of Cambridge Road overbridge, vertical alignment of A428 mainline	Yes, footway/cycleway in verge over the structure.		Width between parapets: 27.6m Span Lengths: 20m ; 33m ; 20m	4m above existing ground level

Commented [GB19]: It is essential that the mammal tunnels tie in with the existing flight lines for bats, otherwise the tunnels will not be used by bats. Evidence from Berthinussen & Altringham (2012) shows that 96% of bats flew through underpasses along the original commuting route.

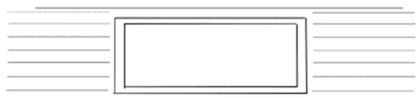
Commented [EL20]: This structure is the last in the "Wintringham Park" series of structures, and should, as the others, contain buff brick or stone details/retaining walls to help identify place.

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned to retain the existing Cambridge Road roundabout and to position the mainline in cutting to maximise visual screening. Positioned the northern roundabout across the existing A428. **Scale, height and massing**: Scale and height minimised by siting the bridge across the cutting supported on two piers. **Materials and finishes**: ~~Precast concrete beams and metal parapet.~~Please see comment **Landscaping**: Planting limited within the junction to enhance sense of place and integrate the structure. More substantial belts of trees and shrubs and hedgerows proposed to enclose the junction and provide visual screening from Wintringham and PRoW east of St. Neots.						
S28 - Fox Brook Bridge	Overbridge	Single span portal with weathering steel-concrete composite deck supported on square reinforced concrete columns.	No	Vertical alignment of accommodation track and approaches, proximity to O/H electricity cables, single span to avoid intermediate pier in central reserve	Yes, bridleway crossing over the structure		Width between parapets: 6m Span Length: 34m	11.5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned to sit between existing blocks of woodland north of Wintringham on the route of the historic byway. **Scale, height and massing**: Single span with abutments integrated with earthworks to minimise scale. Approach roads designed to accommodate safe access across the structure and minimise land take. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: Substantial woodland planting proposed to link with existing woodland blocks within the constraints of utilities and drainage.						
S31 – Toseland Road Bridge	Overbridge	~~Two span weathering steel – concrete composite bridge with reinforced concrete bank seats on top of sloping earth embankments and reinforced concrete intermediate leaf piers.~~ Please see comment linked to “materials”.	Yes	Crossing Gallow Brook and A428 mainline, maintenance access track, re-use of existing Toseland Road, vertical alignment of proposed Toseland Road	Yes, footway/cycleway/equestrian route in verge over the structure.		Width between parapets: 12.5m Span Lengths: 46m ; 46m	10.5m above existing ground level

Commented [EL22]: All structures should be all inclusive and include equestrian users. The only change needed would be to increase parapet height and change signage.

Commented [EL21]: A protected species crossing has been shown on the environmental master plan. Please clarify. How are these species going to be accommodated?

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned closely with the existing Toseland Road to maintain sense of place and maximise buildability. Positioned at a low point in the landscape adjacent to Gallow Brook. **Scale, height and massing**: Scale and massing minimised by steel girders and a single central pier. **Materials and finishes**: ~~Weathering steel to blend with natural, muted tones of the surrounding landscape.~~Please see comment **Landscaping**: Substantial woodland planting proposed to embankments and along the mainline to reinforce landscape integration and visual screening.						
S37 - Pillar Plantation Culvert and underpass	Underbridge	Pre-cast concrete box culvert segments.	No	Combining a watercourse culvert, bat flight path and NMU underpassinto one structure, vertical alignment of A428 mainline, headroom for mounted horse riders, alignment and flood level of West Brook Tributary, buildability of structure within existing watercourse	Yes, bridleway crossing under the structure with mounting blocks at each end		Width between parapets: 37.5m Span Length: 7m	2.5m above existing ground level

Commented [EL23]: Given the distinctly wooded character of this part of the journey an alternative material is required to help soften the feature into it's setting and assist with good place making such as timber cladding or a green bridge.

Commented [EL24]: This should be an oval shaped underpass. The structure should be "welcoming" through the incorporation of an appropriate entrance feature that reflects the vernacular of the area.

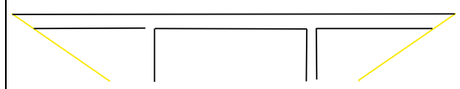
The structure/entrance feature should relate to the Western Claylands character area (LLCA 14 as identified in the Landscape and Visual Impact Assessment [APP-076]) through the incorporation of materials that reflect the local vernacular, such as buff brick or stonework.

The same materiality should be incorporated in structures S38, S40 and S45.

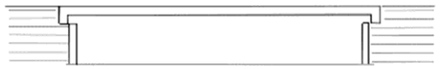
This may also be a good location to incorporate public art.

A lighting well as well as night-time lighting is requested to enable facial recognition, encourage modal shift and enable non-motorised use at different times of day/year. A light well will also enable air flow.

It needs to be recognised that bats and humans have different needs, and both those needs must be met without compromising the standards needed for the other. The compatibility of this structure with existing bat flight paths also needs to be ensured. If it is not possible to achieve these aims within one feature, an alternative tunnel may be required to align with the existing bat flight path.

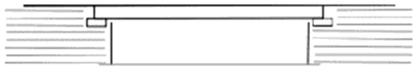
Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned to minimise the realignment of the West Brook tributary and to integrate the adjacent PRoW. Positioned where the mainline will be on embankment. **Scale, height and massing**: The structure will be integrated into the embankment with a slim cross-section to mimimise its scale in elevation. **Materials and finishes**: Precast concrete to facilitate safe construction. **Landscaping**: Substantial planting proposed to adjacent embankments to integrate the structure into the landscape and provide visual screening from Eltisley to the south and Yelling to the north.						
S38 - St Ives Road Bridge	Overbridge	Three span integral prestressed pre-cast concrete bridge supported on reinforced concrete bank seats on top of non-reinforced embankments and reinforced concrete intermediate leaf piers.	Yes	Vertical alignment of A428, layout/horizontal alignment of B1040 St Ives Road	Yes, footway/cycleway in verge over the structure.		Width between parapets: 13.8m Span Lengths: 15m, 31m, 16m	5m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Positioned east of the existing B1040 where the mainline will be in cutting. **Scale, height and massing**: Height minimised by low embankments above the cutting. Scale and massing locating the two piers within the cutting. **Materials and finishes**: Precast concrete beams and metal parapet. **Landscaping**: Substantial belts of trees and shrubs and woodland planting proposed to integrate the embankments and structure and providing visual screening in longer distance views from Papworth to the north-east in particular.						
S40 – Caxton Gibbet Bridge	Underbridge	Three span weathering steel-concrete composite bridge with reinforced concrete bank seats on top of sloping earth embankments and reinforced concrete intermediate leaf piers.	Yes	High Load Route headroom provision, vertical alignment of A428 mainline, buildability over existing A1198 carriageway, visibility sightline along A428 mainline and through Caxton Gibbet junction	Yes, footway/cycleway in verge under the structure		Width between parapets: 35m Span Lengths: 18m ; 28m ; 18m	11m above existing ground level

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Positioned north of the existing Caxton Gibbet roundabout, which will be retained as the southern interchange. Aligned parallel to the existing A428 to the north. **Scale, height and massing**: Single bridge structure proposed on two piers joined by embankments to minimise height and footprint. Slip roads broadly at grade or on low embankments. **Materials and finishes**: Precast concrete beams and metal parapet. **Landscaping**: Substantial belts of trees and shrubs and woodland planting proposed to integrate the embankments and structure and providing visual screening in longer distance views from Papworth to the north in particular.						
S45 – PROW 1/16-1/17-51 NMU Overbridge	Overbridge	~~Single Span fabricated painted steel box girder supported on reinforced concrete Bank seats on top of reinforced earth abutments.~~See comment.	No	Vertical alignment of A428 mainline, reduction of height of approach embankments and profile of superstructure, layout of footpath approaches	Yes, footbridge		Width between parapets: 2.6m Span Length: 35m	8.5m above existing ground level

Commented [CR25]: assume this refers to FP St Neots 51. That path has actually been extinguished as it was a dead-end path meeting the railway. It would be better for this bridge to refer to existing paths that the bridge is accommodating e.g. Abbotsley FP 1/16 - 1/17.

Commented [EL26]: This structure should be a part of the "Wintringham Park Series" of structures and incorporate a suitable material detail to visually connect with the other structures in the area and the local vernacular. Please see comments for S17, S19 and S25.

Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Positioned where the mainline is in cutting and aligned to coincide with an existing hedge line to maximise integration. Facilitates new circular walking routes from St. Neots to the east. **Scale, height and massing**: Scale, height and massing minimised with a single span supported by a box girder. **Materials and finishes**: Detailing to the parapet provides rhythm and visual interest and distinguishes the function from other structures on the Scheme. **Landscaping**: Mosaic of woodland and grassland to create an inviting setting and approach to the bridge and provide landscape integration.						
S88 - Kelpie Marina Access Track Culvert	Underbridge	Single span portal with weathering steel-concrete composite deck supported on reinforced concrete bank seats on top of reinforced soil abutments.	No	Limited space for approach ramps within Kelpie Marina, avoid various buried utilities.	Yes, albeit share the carriageway over the structure		Width between parapets: 4.7m Span Length: 21m	8m above existing ground level

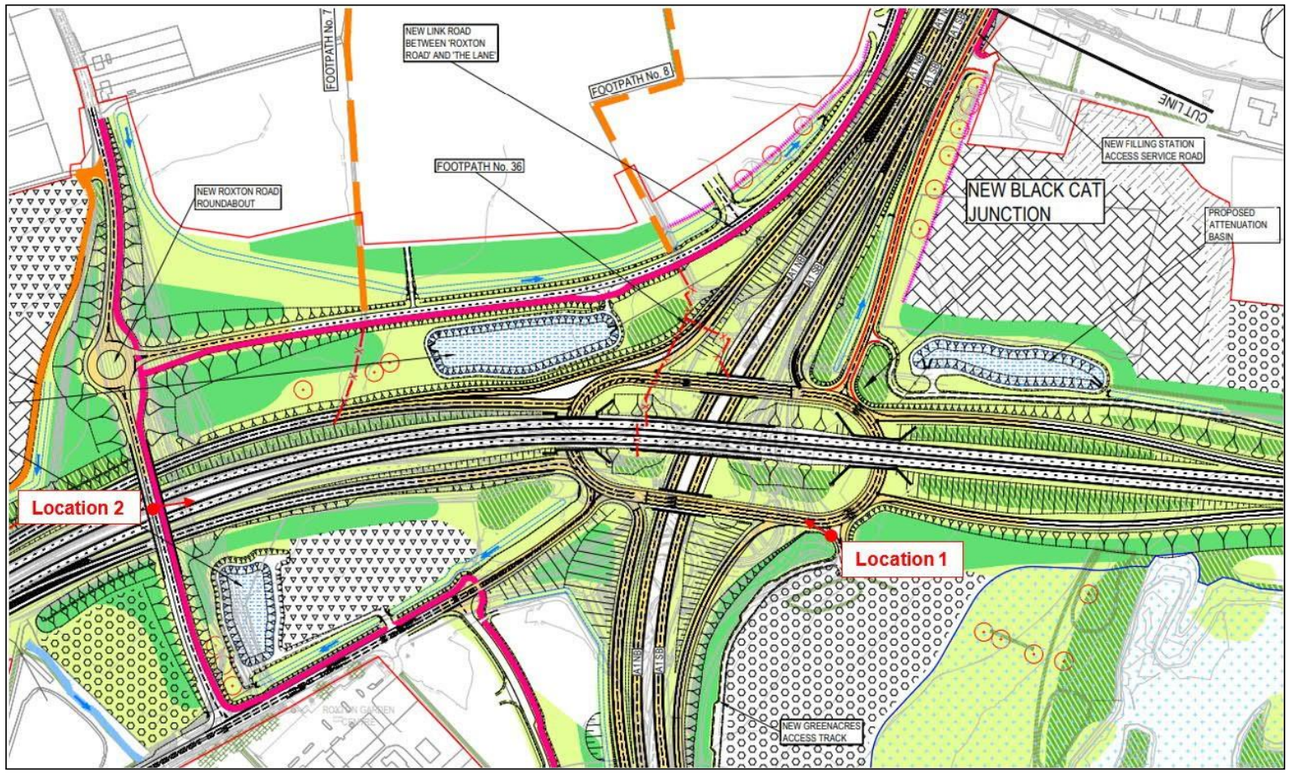
Structure	Under / Overbridge	Design principles	Open Side Spans	Key Constraints on Structures Design	Active Travel Provision	Thumbnail Sketch of Preliminary Design	Preliminary Design Bridge width and span lengths	Approx. Height above Existing Ground Level of Preliminary Design
		Alignment and positioning: Aligned to minimise landtake and provide a safe and welcoming entrance to the marina. **Scale, height and massing**: The structure will sit above the surrounding landscape. The scale of the bridge has been minimised by aligning it close to perpendicular across the north bound carriageway of the A1 within the space constraints on the eastern side, which determine the alignment of access ramps. **Materials and finishes**: Weathering steel to blend with natural, muted tones of the surrounding landscape. **Landscaping**: Linear belts of trees and shrubs are proposed to integrate the structure into the landscape setting and assist in screening the bridge and traffic, particularly from Roxton to the west.						

Appendix D: Visualisations

The visualisations presented below are illustrative and are intended to give an indication of how the Proposed Development fits into the existing landscape. The visualisations are not be used to measure or scale. The locations for which the visualisations depict are set out in the text and figures below.

Black Cat junction

1. View from Black Cat junction circulatory looking north-west towards the flyover
2. View from Roxton Road bridge looking east towards the proposed Black Cat junction

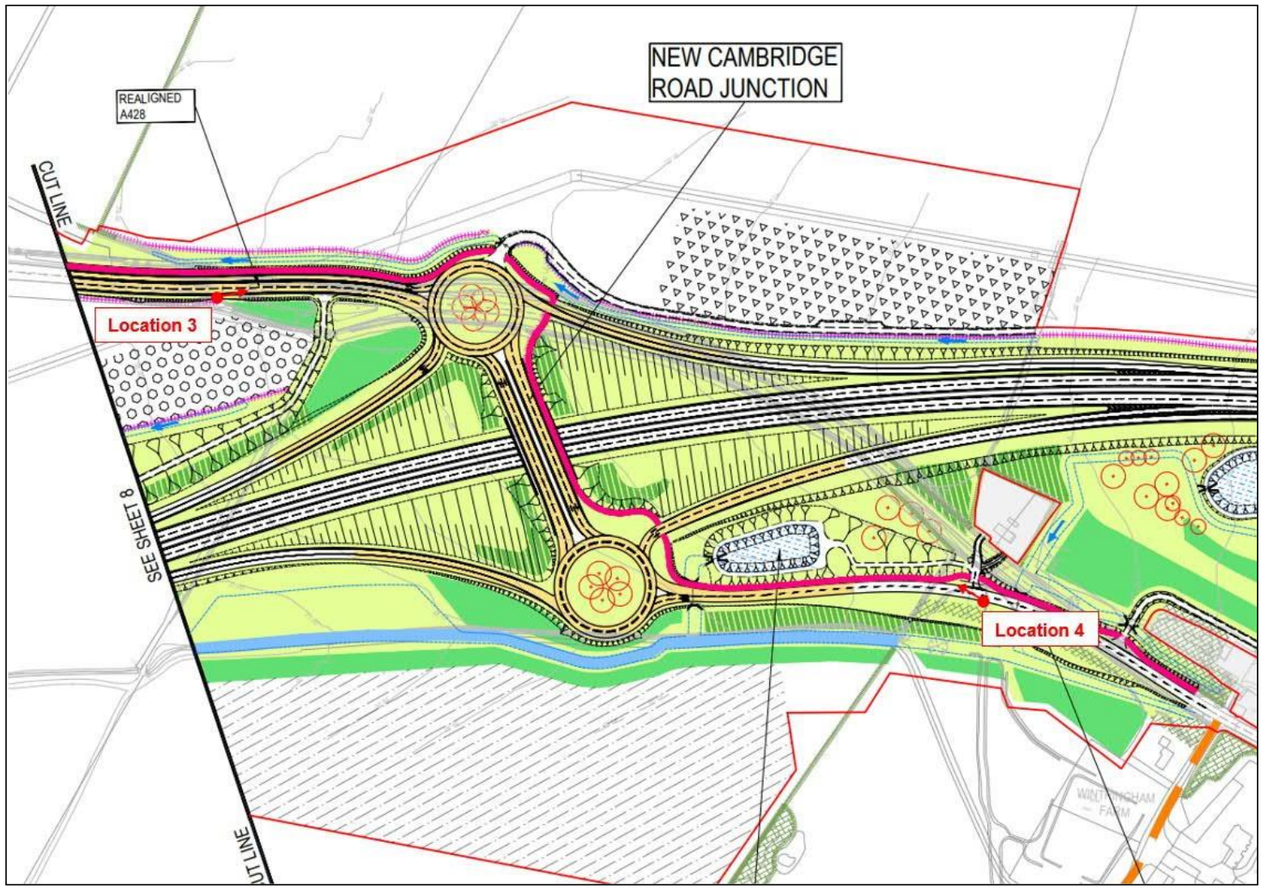


Visualisation – Location 1

Visualisation – Location 2

Cambridge Road junction

3. Realigned A428 on the approach to the proposed Cambridge Road junction north roundabout, looking east
4. Realigned A428 on the approach to the proposed Cambridge Road junction south roundabout, looking north-west

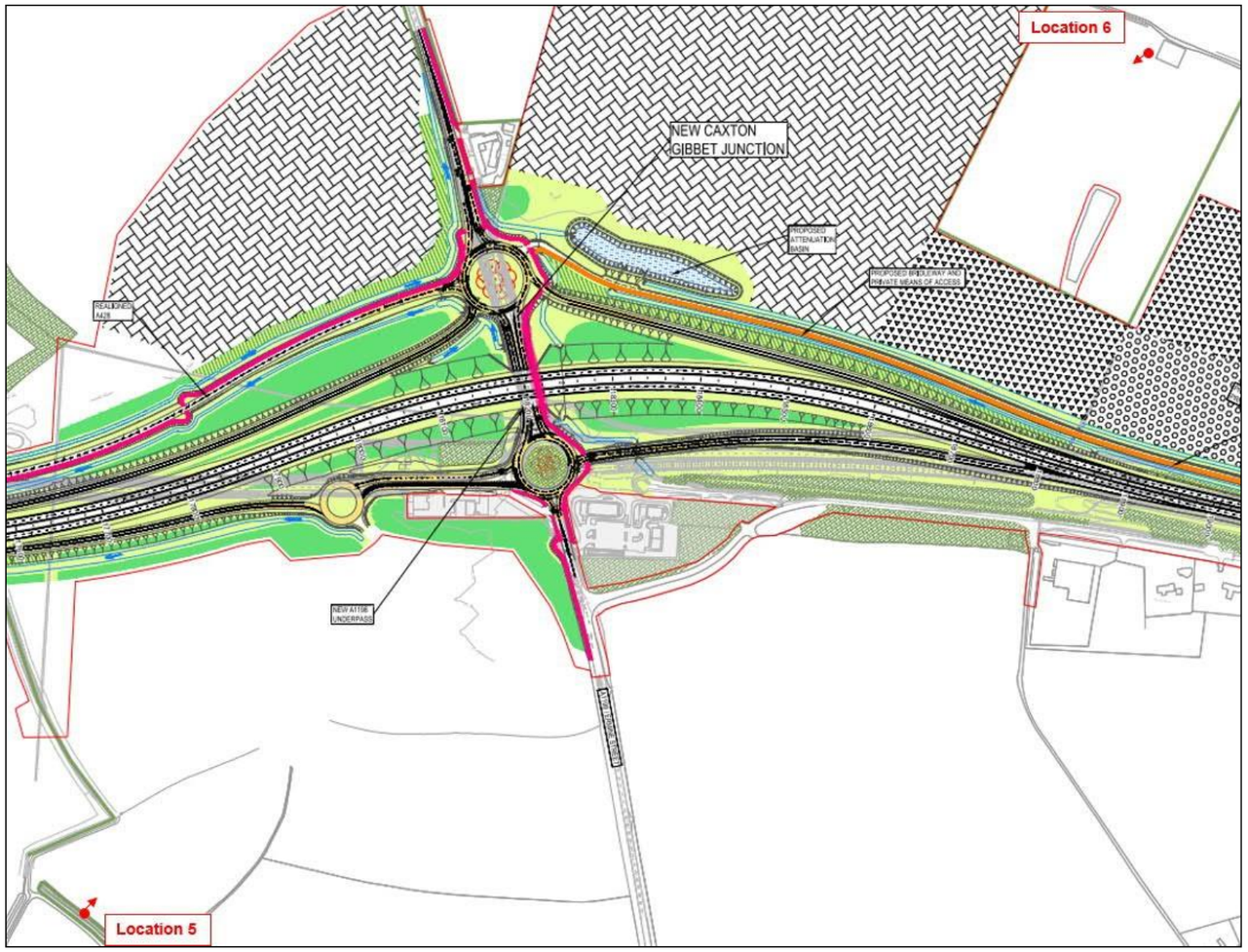


Visualisation – Location 3

Visualisation – Location 4

Caxton Gibbet junction

5. View looking north-east towards the proposed Caxton Gibbet junction, which lies approximately at the centre of the view
6. View looking-south-west towards the proposed Caxton Gibbet junction, which lies approximately at the centre of the view



Visualisation – Location 5

Visualisation – Location 6